Flood Damage Report and Funding Request to Repair or Ameliorate the Damages caused by the Snowmelt, Highwater, Landslides, and Mudflows of the Spring and Summer 1983

Mudflow - Twelve Mile Canyon

Fairview Canyon

Fish Creek

Abstract

Major areas on the Manti-LaSal National Forest have received severe damage from landslides, mudflows, and abnormally high water runoff during the spring and summer of 1983. A damage survey was conducted by the Interdisciplinary Team during the period of June 28, to July 11, 1983. Damage was widespread throughout the Manti and San Pitch Divisions of the Manti-LaSal National Forest. Additional damage was reported on the Moab Ranger District of the LaSal Division. Landslides were identified on about 2,790 acres. These landslides, along with high floodwaters destroyed 169.5 miles of stream channel, 40.7 miles of Forest Development Roads, 16 major road stream crossings, 5.4 miles of Forest Trails, 20 miles of range allotment fence, all or portions of 4 campgrounds, and one public land survey corner on the National Forest boundary. To repair damages and protect remaining facilities and resources, a total of $9,256,000 is needed through various funding programs.

This natural disaster has created denuded slopes, and has deposited rock, mud, and log debris in stream channels. Thunderstorms and spring snowmelt on these denuded slopes and runoff into these impaired stream channels will mobilize a destructive flood force, which will pose an eminent hazard to life and property of downstream valley communities in the near term. To assist in relieving this eminent hazard $942,000 is requested for the Manti-LaSal National Forest under Section 403 of the Agriculture Credit Act of 1978 for Emergency Watershed Protection.

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Flood Damage Report and Funding Request to Repair or Ameliorate the Damages caused by the Snowmelt, Highwater, Landslides, and Mudflows of the Spring and Summer 1983

Manti-LaSal National Forest

I. Introduction

During the spring and summer of 1983, much of Utah received severe damage from landslides, mudflows, and abnormally high floodwaters. This damage assessment includes only the damage that occurred on the Manti-LaSal National Forest. A damage survey was conducted by the Interdisciplinary Team during the period of June 28, to July 11, 1983. Damage was widespread throughout the Manti and San Pitch Divisions of the Manti-LaSal National Forest. Additional damage was reported on the Moab Ranger District of the LaSal Division. Landslides and high floodwaters have destroyed Forest Development Roads and trails, range land and improvements, campground facilities, streams and fishery habitat, and have impaired the watershed.

The purpose of this report is to describe the Interdisciplinary Team's findings and recommendations. A general description of the flood event, contributing factors, damage sustained, recommended corrective treatments, and costs will be presented. A site specific description by incident will also be shown. Recommendations for treatment and costs will be divided into two sections: (1) Section 403 for those funds requested for Emergency Watershed Protection under the Agriculture Credit Act of 1978, and (2) Forest Management Program for those funds which will come from other sources such as ERFO funding from the Federal Highway Administration and others.

II. Flood Event

Major areas on the Manti-LaSal National Forest have received severe impacts from slides, mudflows, and abnormally high runoff.

The 1981-1982 moisture year was relatively wet in terms of snowpack and total precipitation. The heavy fall rains in 1982 left the area with unusually wet soil mantles, which were covered by record snowpacks in the winter of 1982-1983. The cool spring weather of 1983 added to these snowpacks and delayed melt. In the last two weeks of May, the weather turned warm and then hot.

The record moisture conditions, combined with dipping bedrock and historic land instability, lubricated and released numerous landslides. All of these factors created about 131 significant landslides on the west face of the Wasatch Plateau, and on northwestern exposures throughout the rest of the Manti Division. Other smaller slides have occurred on the balance of the Manti Division, the San Pitch Division, and some on the LaSal Mountains. The abnormal high spring runoff has caused additional flooding and damage.

Many of the landslides deposited directly in live stream channels and temporarily dammed streamflow before breaking loose. The failure of temporary dams caused catastrophic flow levels and debris accumulations downstream. Roads were washed out, covered by slide debris, or fell victim to fill failures because of mass movements. Stream channel degradation and channel shifting was widespread. Trees were undercut along streambanks and contributed to the debris load.

The unusual event of 1983 was an overabundance of moisture in and on the watershed. This natural disaster has created denuded slopes and has deposited rock, mud, and log debris in stream channels impairing the watershed. Thunderstorms and spring snowmelt on the impaired watershed will mobilize a destructive flood force, which will pose an eminent hazard to life and property of downstream communities in the near term.

Although flood peaks and frequencies have not yet been calculated, various descriptive phrases used by members of the Interdisciplinary Team may provide a concept of the magnitude of this event.

> "Since no evidence of earlier flood plains remain, these flows are probably the highest since the Pleistocene Geologic Epic!"
>
> "In Chicken Creek, nature did a poor job of flushing out the channel; some structures still remain intact. In Maple Canyon, nature did a superb job of flushing out the channel, everything is gone!"
>
> "In Twelve Mile Canyon, I was really pleased to get an unusual picture of an area that <u>has not</u> moved, a rarity in that canyon!"

III. Contributing Factors

A. Landslide Activity

Several factors contributed to landslide activity on the Manti (Wasatch Plateau) and San Pitch Division. The most important geologic factors on the Wasatch Plateau are geologic structure, exposure of certain rock types (bedrock), and the presence of paleo-landslides.

Geologic structure encompasses bedrock dip (angle) and fault systems. The general dip of the bedrock on the Wasatch Plateau is westerly. The bedrock dip allows ground water to flow and exit as springs on the west side of the Wasatch Plateau (Sanpete District). Fault systems allow water to accumulate at the surface as springs.

Exposure of certain rock types allows ground water to exit as springs. For example, at the contact of the Flagstaff Limestone and North Horn Formation there is a great amount of groundwater exiting as springs. The combination of melting snowpack and spring water discharge saturates the loose unconsolidated deposits to the point where multiple landslides form. Geologic structure and exposure of certain rock types allows spring water to discharge and saturate soils where a threshold is reached and multiple landslides form.

Paleo-landslides formed in late Pleistocene time when glaciers were melting and saturating the soils. Multiple flows formed and deposited in glacial carved canyons. The conditions this spring reactivated portions of the paleo-landslides.

The other factors that contribute to landslide activity are degree of slope, slope aspect, and project activities. More than 75% of the landslides mapped are on slopes greater than 35%. A high percentage of landslides were found on northwest facing slopes. Northwest facing slopes tend to have higher moisture content because of microclimatic changes and geologic structure. Project activities include construction of roads and pipelines for special uses. Occassionally, roads and pipelines have crossed unstable slopes. When this construction undercuts unstable slopes, landslide activity is often increased. Less than 10% of the landslides mapped were caused by these uses.

B. Types of Landslides

As the geologic conditions vary across the landscape, the type of landslides change.

The most common landslide is the small, shallow landslide. This type of landslide is called a flowslide by some landslide experts. These flowslides outnumbered all other slides by at least two-to-one. The flowslides are relatively shallow at the head, usually less than twelve feet deep, and are universally longer than they are wide. The flowslide

mobilizes vegetation as well as other slope materials. Some terminated into active streams, others did not. Those that terminated in the active streams were remobilized as mud-debris floods. This type of slide is common throughout the Manti and San Pitch Divisions.

The next most common landslide type is the small landslide associated with channel erosion and slope cuts. As the flow in stream channels increase, the banks and floor of the channel will erode. This process oversteepens the slope into the channel and small landslides form. When slopes are cut for roads or other purposes, the support of the slope is decreased. When water saturates these slopes, a threshold is reached and small landslides form. This type of slide is common throughout the Manti and San Pitch Divisions.

The least common, but by far the largest of the landslides in the Manti-LaSal National Forest are translational slides that developed from late Pleistocene flowslides. These landslides will continue to move for several years. A small number of these slides were mobilized in 1983; however, two of them are the fifth and sixth largest landslides in the United States that formed in this century (Earl Olsen, 1983). This type of slide is found on the Sanpete and Ferron Districts.

C. Recurring Problem

Those landslides that terminated into the active streams will move again when the streamflow reaches the threshold of mobilization of that particular slide. This will happen time and time again as long as there is landslide debris in the streams.

IV. Damages

The damage to the National Forest has been widespread on the Manti, San Pitch, and Moab Divisions, as shown on the packet map. The damages are difficult to quantify since many different resources and many different components of society and commerce have suffered. A brief description of the damages is attempted here.

Within the National Forest boundary, 131 significant areas of active landslides were identified with about 2,786 acres of known movement; 20.0 miles of fence was damaged, 169.5 miles of stream channel, 40.7 miles of roads, and 5.4 miles of trails were damaged. One campground was obliterated; 3 campgrounds were damaged. One dam failed; 2 were breached to prevent failure, 1 dam spillway was cleared just before the dam was over-topped. One 24 inch gas pipeline, and one 345 KV powerline was threatened. One public land survey corner on National Forest boundary was destroyed.

All resources have been affected. The loss of access has interrupted established resource uses of range, timber, recreation, fuelwood gathering, and mineral activities. Normal commerce and commuter traffic was interrupted or was forced to seek alternate routes. Approximately 37 range allotments were affected, with some suffering significant reductions in capacity. Fish habitats were completely destroyed in several streams.

Tables 1, 2, and 3 summarize those damages surveyed and assessed.

The reports of damages began in mid May 1983, and are continuing as new landslides become active. The widespread nature of this disaster, both in area and destruction, overwhelms all who observe it. Even a systematic progression in review of the damages tends to become a blurr of images. This particular survey began on June 28, 1983, and continued to July 11, 1983. During that time, the snowmelt continued and new landslides were reported in areas that had already been surveyed. The fast moving nature of this survey made it necessary to group damages and estimate percentages. While the projects proposed are reasonable, the project leader will need to make on-the-ground site specific analyses in order to direct the work.

Table 1: SUMMARY OF DAMAGES BY COUNTY

County	Mass Movements (# of slide areas)	Mass Movements (Acres)	Destroyed Fence (Miles)	Stream Damage (Miles)	Transportation System Damage (Miles)
Carbon	0	0	---	24.9	0.7
Emery	18	142	---	20.9	0.5
Grand	7	20	---	2.0	1.5
Juab	19	142	---	10.3	9.4
Sanpete	70	2,369	19.0	90.7	21.0
Utah	17	96	1.0	20.7	7.6
Forest Totals	131	2,786	19.5	169.5	40.7

Table 2: SUMMARY OF DAMAGES BY RANGER DISTRICT

County	Mass Movements (# of slide areas)	Mass Movements (Acres)	Destroyed Fence (Miles)	Stream Damage (Miles)	Transportation System Damage (Miles)
D-1 Sanpete	88	2,068	19.0	68.3	31.3
D-2 Ferron	8	511	---	36.0	0.2
D-3 Price	28	187	1.0	63.2	7.7
D-4 Moab	7	20	---	0	1.5
Forest Totals	131	2,786	20.0	169.5	40.7

Table 3: Estimated Repair Costs by Resource Element

Resource Element	Repair Costs ($)
Watershed	$1,082,000
Range	112,000
Fisheries	2,244,000
Transportation and Engineering	5,238,000
Recreation	580,000
TOTAL REPAIRS NEEDED	$9,256,000

Of the amount listed in Table 3, $942,000 is being requested for the Manti-LaSal National Forest under Section 403 of the Agriculture Credit Act of 1978 for Emergency Watershed Protection. The remainder of $8,314,000 will be requested funding under various programs such as ERFO and other funding programs. Within this report, these various programs will be referred to as Forest Management Programs.

Within this report, threatened downstream property values are estimated for each project and incident. These property value estimates are based on review of maps, photographs, and personal observations. The values are based on the estimates of the team members.

Downstream from the National Forest, the effects of the slides and floods damaged property and roads within 7 communities; at least 6 community water supplies, 2 U.S. Highways, 1 Interstate Highway, many acres of agricultural lands, many acres of crops, and many irrigation diversions.

Damage has occurred in 11 of the 18 designated watersheds of the Manti-LaSal National Forest. These watersheds, hydrologic unit codes, and incident numbers are listed in Table 4.

Table 4: Damaged Watersheds

Watershed Name	Hydrologic Unit Code	W/S Code	State Basin Code	Incident #
Upper Spanish Fork	16020202	001	51	3,4
Price River	14060007	002	91	3,6,7
San Pitch River	16030004	003	65	4,5,13,14, 15,16,17
Huntington Canyon	14060009	004	93	7,8,9
Straight Canyon	14060009	005	93	9,10
Ferron Canyon	14060009	006	95	11
Muddy Creek	14070002	007	95	12
Moab	14030005	008	05	18
Salt Creek	16020201	014	53	1
Fountain Green	16030004	015	65	2
Chicken Creek	16030005	016	66	1

V. Proposed Treatments and Justification

A. Control of Erosion and Sediment Production

Small denuded areas have historically generated devastating mudflows into the communities of the San Pitch River Valley. This disaster of high water and landslides has damaged much property in several of these small communities, and denuded widespread areas of the Manti and San Pitch Divisions. Many areas are barren, due to sediment deposits and mudflows that have destroyed and/or buried existing vegetation.

When the summer thunderstorms and snowmelt high water occurs, newly denuded areas will erode severely and the mobilization of sediment and debris will occur. Downstream damage will be extensive.

Landslide and Mudflow
in Fairview Canyon

Diked Channel Through Fairview Community

Sediment in the water supply adds to the cost of municipal water treatment and has been known to carry disease organisms and protect them from water treatment. Water diversions, pipelines, culverts, and bridge openings may be clogged with sediment. Cropland may be destroyed by sediment deposits.

Most of the barren and denuded areas are highly susceptible to additional erosion and sediment production. The slopes range from 5 to 100%. The area is characterized by high intensity summer thunderstorms in August and September. In Ephraim Canyon, Farmer and Fletcher report an average of more than 16 thunderstorms in August and September. (Farmer and Fletcher, 1971, Precipitation Characteristics of Summer Storms at High Elevations in Utah, Forest Service. INT 110.) The intensity at the 5 year recurrence 30 minute storm is about 1.2 inches per hour. These precipitation data are probably applicable throughout the Manti and San Pitch Divisions.

Revegetation is the best means for reducing erosion and sediment production from denuded areas. Revegetation of stream banks and flood plains will greatly reduce the potential for further erosion and downstream damage. Grass seeding, willow planting, and some channel structures are recommended for erosion and sediment control. This work is classified as MIH Code F03.

1. Grass Seeding

Immediate grass seeding is needed where the seed beds are moist and early successful germination is likely. If treatment is delayed, the areas are likely to dry out and the soil will harden and crust over. Immediate seeding will provide the earliest possible ground cover to prevent erosion and sediment yields downstream. Failure to immediately apply seed in appropriate areas will delay the establishment of vegetative ground cover at least one season. Delay will also greatly reduce the chances of any successful ground cover being established. Immediate seeding was requested on 925 acres in our 2510 correspondence of July 20, 1983.

Fall seeding is needed on areas that have already dried out and crusted. Fall rains will soften the crusts and provide a moist seed bed. Spring germination will begin the cover establishment.

Two seed mixes have been selected for erosion control. The low and mid elevation mix is for areas up to 8,000 feet elevation. The high elevation mix is for areas above 8,000 feet. Grass seeding will not be applied to active landslides. Only after the movement has subsided will they be seeded.

2. Willow Planting

The sediment deposition zones along streams are active sediment sources as discussed earlier. Willows form an effective cover, and the roots provide excellent binder for these sediments. Patches of willows provide excellent sediment retention during flood flows and tend to filter the sediments from the water.

Willow planting will advance the plant succession and greatly hasten the good ground cover needed along streambanks. The willows will act as a buffer to sediments from upslope. The willowed areas provide food and cover for aquatic species.

Good Willow Planting Area in Little Clear Creek

B. Debris Dams and Channel Clearing

This work is classed as MIH Code F03. Large quantities of logs and smaller sized wood materials have accumulated in piles that block the stream channels. This type of debris is also often deposited in other areas along streams within the seasonal high water zone without completely blocking the stream.

Debris Deposits Along the Highwater Line in Mayfield

Unless removed, these materials will be mobilized by flows from snowmelt and thunderstorms to create temporary dams and flood surges down the channel. Once mobilized, these materials have great power to damage and destroy channel crossings, structures, and facilities within the high water zone. One member of the damage assessment team has some debris clearing experience which indicates a migration of materials not only down channel, but also down slope.

Debris Poised for Movement in Fairview Canyon

Damaged Road and Over-Widened Channel in Little Clear Creek

The wood materials should be piled and burned or scattered well above the high water zone. In certain locations, it will be possible to anchor logs into banks for stabilization and/or fish habitat improvements. In other locations where raw, steep, and erodible slopes are directly above the stream channel, it may be possible to place logs above the flood plain parallel to the contour to act as sediment traps. Some of the wood debris may be used by fuelwood cutters.

C. Gabions and Channel Structures

This work is classed as MIH Code F03. Where streams are actively undercutting otherwise stable slopes or roads, gabions or other channel structures may be justified. Occassionally, rock check dams 10 to 15 feet high may be appropriate to trap sediment, and to stop channel downcutting. Downstream sediment damage will be reduced. Fish habitat improvement structures will also provide some of these same benefits.

D. Road Repair and Relocation

This work is classed as MIH Codes L02, L03, L04, L05, L06, L07, L08, L09, L16, L17, and L18. Many Forest Development Roads and Trails have been severely damaged. The disruption of normal Forest use and resource activities has occurred. The losses are diverse and incompletely identified because of ongoing landslides.

Detailed engineering surveys and design data to provide accurate cost estimates are progressing. However, for the purposes of this report, average costs based on limited data have been used to estimate repair costs. These estimates can be refined as better data comes available from detailed project descriptions required for ERFO funding from the Federal Highway Administration.

E. Fisheries Habitat Rehabilitation

This work is classed as MIH Code C03.. Fisheries habitat diversity should be restored to the diversity that existed prior to 1983. The rehabilitation structures are needed to create pools and riffles, slow water velocities at low flows, reduce channel downcutting, and increase revegetation success. Cost estimates are based on the stream damage classes shown on the Incident Maps and defined below. For fisheries habitats, the damage class indexes the percent of habitat lost. For stream damage, it indexes the proportion and magnitude of stream damage.

Table 5: Stream Damage Classes

Stream Damage Class	Fisheries Habitat Lost (%)	Fisheries Structure Spacing (feet)	Structures Per Mile #
1	0-20	264	20
2	21-50	198	27
3	51-80	132	40
4	81-100	66	80

F. Range Improvements

This work is classed as MIH Code D05. Those range improvements that have been damaged must be replaced. Fences need to be replaced or relocated in order to maintain livestock control.

G. Special Use Assessment

This work is classed as MIH Code J01. Numerous facilities operated under Special Use Permit have been damaged. The assessment repair and replacement of these facilities will require Forest Service review and approval.

H. Channel Modification

This work is classed as MIH Code F03. In several instances, the stream has cut new channels, downcut the channels so that the banks are steep and raw. In some of these cases, the stream channel banks should be laid back to gentler slopes and revegetated. This treatment will reduce erosion and sediment production.

I. Recreation Facilities

This work is classed as MIH Codes A05, A10, A12, L21, L22, and L24. One campground will have to be totally reconstructed to the recreation capacity and experience level that previously existed. Other campground facilities, such as water systems that are damaged, will need repair. Springs may have to be redeveloped or new sources located. Streambanks through campgrounds may have to be reinforced with gabion structures or riprap.

VI. Environmental Impact of Proposed Projects

The implementation of these proposed repairs will reduce downstream sediment, reduce downstream debris, reduce threats to downstream lives, health, and property.

On site, the impacts will vary. Through the scoping process, some activities may be determined to be categorical exclusions. Other activities or facets of activities may have sufficient issues or concerns to warrant an Environmental Assessment. The assessment will be completed using the Forest Service NEPA process.

VII. Private and State Lands

Some private and State land within the National Forest boundary have been damaged by flooding or landslide (1983). Approximately 21 acres of private land was damaged by high water floods in Lower Pigeon and Chicken Creek drainages, Sanpete Ranger District. Other private and State lands were not assessed.

To repair and put these damaged land areas back into a stable condition, both grass seeding and willow planting will be needed. Grass seeding will cost about $570.00 to treat the 21 acres damaged, and willows will be planted on about 2 miles of stream, for a cost of about $3,000.00. But before any treatment can be initiated, clearance from the private landowners is needed.

VIII. Incident Reports

A. Incident Delineation

Due to the widespread nature of the disaster, individual projects were grouped geographically into incidents. The incident boundaries and locations are shown in Maps 2, 3, and 4, and are listed in Table 6. A map of each incident was prepared that shows the damages that occurred.

Within each incident, each project is described. The projects were generally selected to include all those areas that are funnelled together by the drainage system to pose a threat to nearby communities or concentrations of values. Within the project, the necessary work to protect remaining facilities, resources, and repair resource damage is itemized.

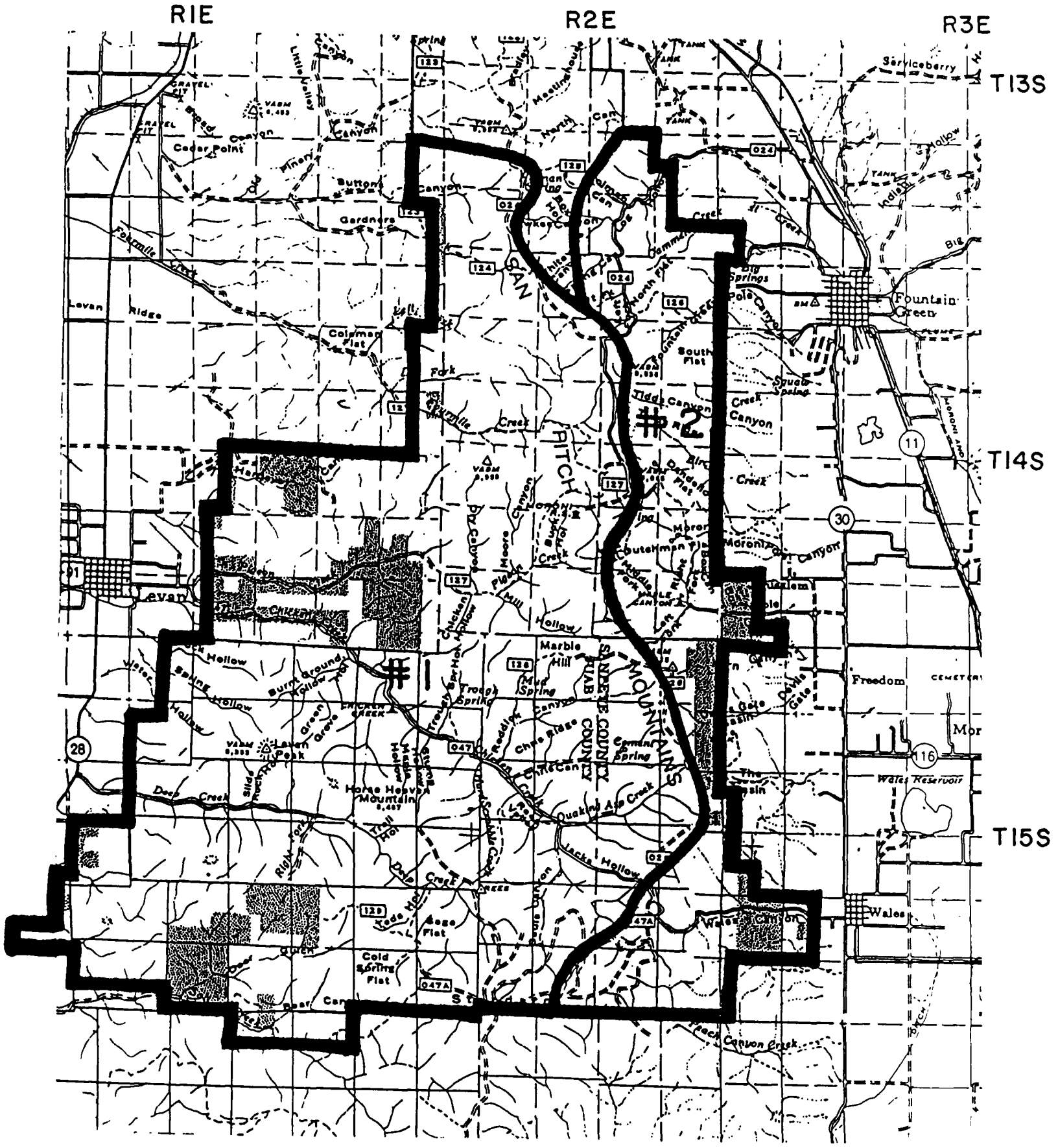
Each project is further divided into subareas identified as sites. The site boundaries are shown on the incident map. The incident maps also show stream damage classes as defined in Table 5 and landslide areas.

Table 6

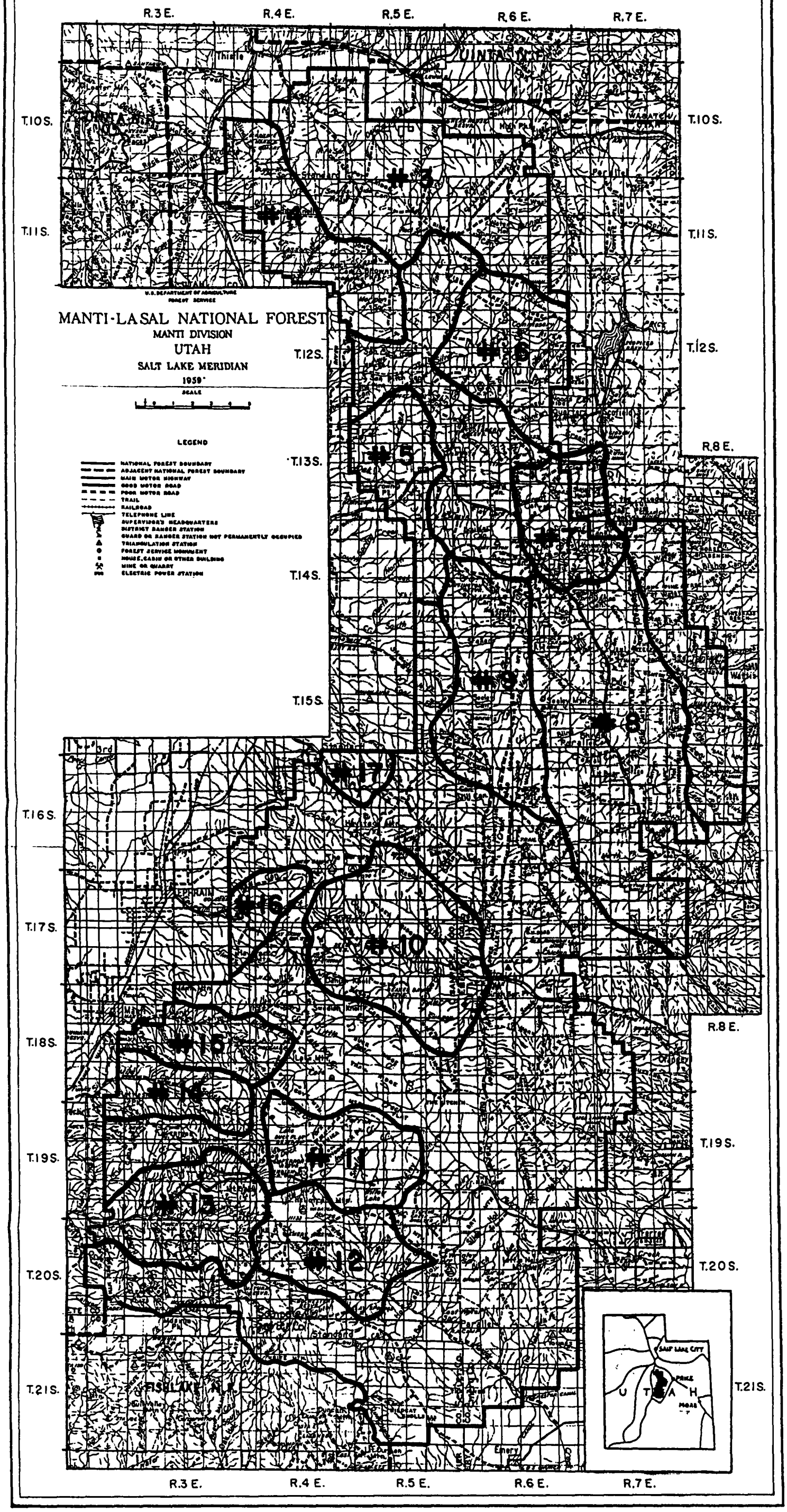
INCIDENT AND PROJECT NAMES

Incident #	Name
1.	W. San Pitch Project - Chicken/Pigeon/Levan Project - 4 Mile/Levan Project - Deep Creek/Levan Project - Sutton's Canyon
2.	E. San Pitch Project - Log Canyon Project - Birch Creek Project - Maple Canyon Project - Pole Canyon
3.	Lake Fork Project - Lake Fork Project - Dairy Fork Project - Clear Creek Project - Mill Fork
4.	Thistle Creek Project - Little Clear/Rock/Thistle Project - Dry Creek/Indianola
5.	Fairview Canyon Project - Fairview Canyon Project - Oak Creek/Dry Creek/Fairview
6.	Fish Creek Project - Woods Canyon Project - Pontown Creek Project - French Creek Project - Winter Quarters
7.	Monument Peak Project - Eccles Canyon Project - Mud Creek Project - Monument Peak
8.	Huntington Creek Project - Huntington Creek/Left Fork Project - Nuck Woodward Project - Crandall Canyon Project - Tie Fork Creek Project - Intex
9.	Scad Valley Project - Rolfson Project - Miller's Flat

Incident #	Name
10.	Seely Creek - Joe's Valley Project - Seely Canyon (Becks Creek) Project - Upper Joe's Valley
11.	Ferron Canyon Project - Wood Tick Point
12.	Muddy Creek Project - Brush Reservoir/Spinner's Reservoir
13.	Twelve Mile Creek Project - Twelve Mile/South Fork/Twin Lakes
14.	Six Mile Project - Six Mile/North Fork Project - Forbash Cove
15.	Manti Canyon
16.	Ephraim Canyon Project - Jimmy's Fork/Willow Creek Project - New Canyon/Cottonwood Creek/Ephraim
17.	Knob Mountain Project - Oak Creek/Spring City
18.	Moab



DAMAGE INCIDENT BOUNDARIES
SAN PITCH DIVISION



DAMAGE INCIDENT BOUNDARIES
MANTI DIVISION

R23E R24E R25E

T25S

T26S

T27S

T28S

DAMAGE INCIDENT BOUNDARY
MOAB RANGER DISTRICT

B. Individual Project Reports

Individual Project Reports follow in the order shown on Table 6.

R1E | R2E

R2E | R3E

T13S

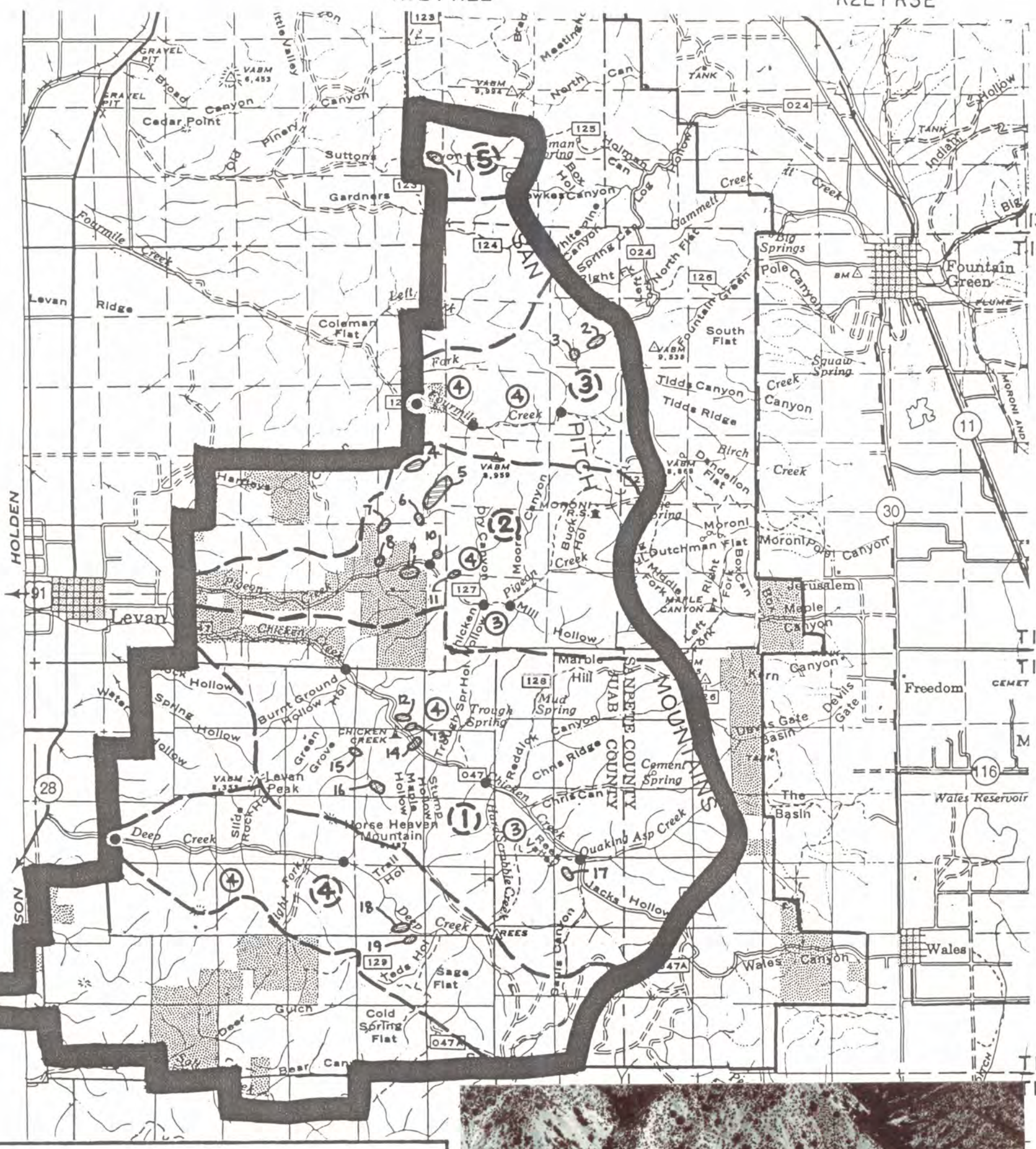
T14S

T14S

T15S

T15S

T16S



INCIDENT # 1
WEST SAN PITCH

● ③ ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

—(2)— SITE BOUNDARY

Incident #1 West San Pitch

Project: Chicken/Pigeon/Levan

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Juab

Treatment Sites

Site #1: Chicken Creek

Site #2: Pigeon Creek

Description of Impairment

Extensive flooding and landslides caused by extremely high snowpack and high runoff over a short period of time destroyed roads, water systems, and damaged downstream values, including farmlands, Interstate Highway 15, U-28, and the community of Levan. Access to a major campground and grazing lands were lost through the destruction of a major access route across the San Pitch range. In addition, the Levan City culinary water system and an irrigation reservoir were severely damaged.

Property Endangered

Protection of Highway U-28, the community of Levan, Highway I-15/U.S. 91, an irrigation system and reservoir, the Levan City culinary water system, farmlands, a major National Forest campground, and Forest Development Roads #50146 and #50101, are dependent upon flood control in the Chicken Creek and Pigeon Creek drainages.

Recommended Treatment: With Section 403 Funds

The highly unstable stream channels need to be stabilized, protected, and cleared of debris to decrease future threats and destruction downstream. Channels, in many cases over-widened by 10 times, will need to be rechanneled, reseeded or vegetated, and in some cases, constrained by gabions or rock channel structures. Exposed and unstable soils will need to be revegetated to avoid near term repeats of downstream impacts during flash flood events. Partial landslide removal from the channel will be necessary as part of channel clearing.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Sites 1&2	67	$27/ac.	$ 1,809
Willow Planting	Sites 1&2	4.5 mi.	$1,500/mi.	$ 6,750
	Sites 1&2	22.5 ac.	$690/ac.	$ 15,525
Debris Jam	Sites 1&2	17	$2,000/DJ	$ 34,000
Slide Removal	Sites 1&2	2 slides	$5,000/sl.	$ 10,000
Channel Clearing	Sites 1&2	3.6 mi.	$2,500/mi.	$ 9,000
Gabions & Channel Struc.	Sites 1&2	1,800 ft.	$50/ft.	$ 90,000
Channel Modification	Site 1	0.6 mi.	$8,000/mi.	$ 4,800
TOTAL				$171,884

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Highway I-15/U.S. 91	$ 500,000
Highway U-28	$ 250,000
Levan City Residential	$1,500,000
Levan City Culinary Water	$ 400,000
Farmlands	$ 240,000
Irrigation System and Reservoir	$ 250,000
National Forest Campground	$ 100,000
Forest Development Roads #50146 and #50101	$ 40,000
TOTAL	$3,280,000

Because Chicken and Pigeon Creeks are 5th and 6th order streams, the probability of near term damage is 80%.

The investment of $171,884 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio 15.3 : 1

Recommended Treatment: Forest Management Program

Restore transportation facilities including Forest Development Roads #50146 and #50101. Rehabilitate severely damaged fish habitat. A special use assessment will be required on the irrigation system for Pigeon Creek. Rehabilitation of severely damaged streambanks through the Chicken Creek Campground is needed. Rehabilitate the Chicken Creek Campground water system.

Treatment	Location	Quantity	Unit Cost	Total Cost
Road Repair	Sites 1&2	7 mi.	$78,000/mi.	$ 546,000
Fisheries Habitat Rehab.	Sites 1&2	5.4 mi.	$43,333/mi.	$ 233,998
Special Use Assessments	Site 2	1	$5,000/ea.	$ 5,000
Channel Clearing	Sites 1&2	3.6 mi.	$2,500/mi.	$ 9,000
Campground Rehabilitation				
1. Stream Rehab.	Site 1	1,500 ft.	$50/ft.	$ 75,000
2. Water System	Site 1	1	$10,000/ea.	$ 10,000
Repair of Watershed Improvements	Site 1			$ 5,000
TOTAL				$ 883,998

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

Incident #1 West San Pitch

Project: Four Mile/Levan

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Juab

Treatment Sites

Site #3: Four Mile Canyon

Description of Impairment

Flooding in Four Mile Canyon caused damage on Highway I-15/U.S. 91, and farmlands at the mouth of the canyon. Stream channel damage also occurred as a result of the flood event. Some landsliding and related damage occurred in the upper canyon area. In addition, flooding washed out 1 county bridge.

Property Endangered

Property values to be protected in/and below Four Mile Canyon include U.S. Highway 91/I-15, a county road, farmlands, and watershed areas.

Recommended Treatment: With Section 403 Funds

Channel clearance will need to be performed to decrease impacts of near term flood events. Flood control measures, including revegetation, are also necessary to re-establish some stability in the channel.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	60 ac.	$27/ac.	$ 1,620
Willow Planting	2 mi.	$1,500/mi.	$ 3,000
Slide Removal	1 slide	$5,000/sl.	$ 5,000
Channel Clearing	.25 mi.	$2,500/mi.	$ 625
TOTAL			$10,245

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Highway I-15/U.S. 91	$100,000
Farmlands	$ 90,000
Watershed Improvements	$ 1,500
TOTAL	$191,500

Because Four Mile Canyon is a 4th order stream, and the landslide and debris block about 70% of the channel width, the probability of near term damage is 100%.

The investment of $10,245 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 19.0 : 1

Recommended Treatment: Forest Management Program

Watershed rehabilitation and channel clearing are recommended treatments in Four Mile Basin.

Treatment	Quantity	Unit Cost	Total Cost
Watershed Rehabilitation	50 ac.	$90/ac.	$4,500
Channel Clearing	.25 mi.	$2,500/mi.	$ 625
TOTAL			$5,125

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

Incident #1 West San Pitch

Project: Deep Creek/Levan

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Juab

Treatment Sites

Site #4: Deep Creek Canyon

Description of Impairment

Major flooding occurred in the Deep Creek drainage, almost totally destroying an irrigation system, the Forest Service access road into the canyon, including 5 major stream crossings, and depositing heavy sediment deposits downstream on farmlands. In addition, a major slope retention structure suffered a major failure. Some landsliding also occurred, but was of less significance than in other areas.

Property Endangered

An irrigation system, U.S. Highway 91/I-15, Highway U-28, Forest Development Road #50149, and farmlands will continue to be impacted if flood and sediment control measures are not accomplished.

Recommended Treatment: With Section 403 Funds

Sediment control measures will need to be accomplished including re-establishment of channel and slope vegetative cover capable of stabilizing soils and reducing major sediment sources. The slope retention structure needs to be restored to avoid major channel blockage and a serious sediment source failing directly into the stream. In addition, gabion structures and channel modification will be needed to retain unstable banks and protect the road in the near term.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	5 ac.	$27/ac.	$ 135
Willow Planting	10 ac.	$690/ac.	$ 6,900
	2 mi.	$1,500/mi.	$ 3,000
Gabions and Channel Structures	2,000 ft.	$50/ft.	$100,000
Slope Retention Structure	1	$56,000/ea.	$ 56,000
Channel Modification	0.3 mi.	$8,000/mi.	$ 2,400
TOTAL			$168,435

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Irrigation System	$150,000
U.S. Highway 91/I-15	$ 70,000
Highway U-28	$ 70,000
Forest Development Road #50149	$ 94,000
Farmland	$300,000
TOTAL	$684,000

Because the Deep Creek channel is composed of 6 to 24 inch rock, and the rock comprises 50% of the streambed, the probability of near term damage is 40%.

The investment of $168,435 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 1.6 : 1

Recommended Treatment: Forest Management Program

Reconstruct damaged and lost portions of Forest Development Road #50149, including five major stream crossings. Rehabilitate damaged fish habitat resources in Deep Creek. Conduct a special use assessment on the irrigation system.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	2.4 mi.	$78,000/mi.	$187,200
Fisheries Habitat Rehab.	3 mi.	$52,000/mi.	$156,000
Bridges	5 ea.	$40,000/ea.	$200,000
Special Use Assessments	1 ea.	$ 5,000/ea.	$ 5,000
TOTAL			$548,200

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Soil loss and reduced site productivity will occur if treatment is not implemented.

Incident #1 West San Pitch

Project: Suttons Canyon

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Juab

Treatment Sites

Site #5: Suttons Canyon

Description of Impairment

Nineteen acres of soils were exposed by three small landslides in the watershed.

Recommended Treatment: Forest Management Programs

Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	19 acres	$27/ac.	$513
TOTAL			$513

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Soil loss and reduced site productivity will occur if treatment is not implemented.

R1E | R2E

R2E | R3E

T13S
T14S
T14S
T15S
T15S
T16S

INCIDENT # 2
EAST SAN PITCH

AREAS OF MASS MOVEMENT

STREAM CHANNEL DAMAGE CLASS

DAMAGED FENCES

SITE BOUNDARY

Incident #2 East San Pitch

Project: Log Canyon

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #1: Log Canyon

Description of Impairment

Flooding in Log Canyon has caused damage to the Log Canyon-Marble Hill Forest Development Road #50069. This road has experienced at least 5 slumps and a 1,000 foot section of washout. In addition, 3 to 5 culverts have washed out or been plugged.

Recommended Treatment: Forest Management Program

Slump areas need to be repaired and fill slopes riprapped or gabioned to protect the road from undercutting. The washout area should be repaired and will require a culvert to pass water out of Holman Canyon. The culverts plugged or lost will need to be repaired.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair and Protection	.8 mi.	$81,250/mi.	$65,000
TOTAL			$65,000

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. This road is classified as a minor collector route having an average daily traffic flow of 5 vehicles per day, consisting of 38% recreation, 25% oil and gas, and 23% range. In addition, this road is the appraised route for two proposed timber sales.

Incident #2 East San Pitch

Project: Birch Creek

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #2: Birch Creek

Description of Impairment

Soils were exposed on fifty-two acres of landslides in the watershed.

Recommended Treatment: Forest Management Program

Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	13 acres	$27/ac.	$351
TOTAL			$351

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Soil loss and reduced site productivity will occur if treatment is not implemented.

Incident #2 East San Pitch

Project: Maple Canyon

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #3: Maple Canyon

Description of Impairment

Flood waters inundated the entire canyon from wall to wall, taking out the entire Maple Canyon Forest Development Road #50066, for approximately 1.5 miles. In addition, soils were exposed by 50 acres of landslides in the watershed.

Recommended Treatment: Forest Management Program

Make an assessment of the feasibility and need to restore the Maple Canyon Road. To rebuild the section of road, it will most likely require a 4½ foot high gabion wall for the entire damaged length. Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair (incl. 8,000 ft. of gabions)	1.5 mi.	$401,000/mi.	$601,986
Grass Seeding	18 ac.	$27/ac.	$ 486
TOTAL			$601,986

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. This is a minor collector route having an average daily use of 13 vehicles per day. In addition, it is the main access to Maple Canyon Campground, the only campground on the east side of the San Pitch Division. An economic analysis is needed to determine the need to replace this system. Access to the campground could be accomplished by trail and/or coming down the canyon road from above. Soil loss and reduced site productivity will occur if revegetation is not implemented in disturbed soil areas.

Incident #2 East San Pitch

Project: Fountain Green/Pole Canyon

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #4: Fountain Green/Pole Canyon

Description of Impairment

Soils were exposed by 50 acres of landslides in the watershed.

Recommended Treatment: Forest Management Program

Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	5 acres	$27/ac.	$135
TOTAL			$135

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Soil loss and reduced site productivity will occur if treatment is not implemented.

R4E | R5E

R5E | R6E

T9S

T10S

T10S

T11S

T11S

T12S

INCIDENT # 3
LAKE FORK

- ● ④ ● STREAM CHANNEL DAMAGE CLASS
- AREAS OF MASS MOVEMENT
- x—x—x DAMAGED FENCES
- —③— SITE BOUNDARY

Incident #3 Lake Fork
Project: Lake Fork

Location

Manti-LaSal National Forest
Ranger District: Price
County: Carbon

Treatment Sites

Site #1: Lake Fork Canyon

Description of Impairment:

Flooding in the Lake Fork Drainage caused severe damage to Forest Development Road #50070, which has been washed out in numerous locations. Forest Development Road #50006 also suffered minor damages. U.S. Highway 89, U.S. Highway 50&6, and Rio Grande Railroad were flooded by Thistle Lake. Highway 89 will probably be relocated across the lower canyon. Debris jams and minor landslide damage are poised as hazards to downstream activities. Forest Trail #5037 was damaged.

Property Endangered

An irrigation system, farmlands, Forest Service Bridge #50070-3.6, and Forest Development Road #50070.

Recommended Treatment with Section 403 Funds

Debris jam removel and channel clearing need to be conducted throughout the Lake Fork System. Sediment control measures will need to be accomplished including re-establishment of channel and slope vegetative cover capable of stabilizing soils and reducing major sediment courses.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	50 acres	$27/ac.	$ 1,350
Willow Planting	4 miles	$1,500/mi.	$ 6,000
Debris Jam Removal	12	$2,000/D.J.	$24,000
Channel Clearing	2 miles	$2,500/mi.	$ 5,000
TOTAL			$36,300

Economic Defensibility: Section 403

Expected Values Threatened:

Irrigation System	$ 20,000
Farmlands	$100,000
F.S. Bridge #50070-3.6	$ 40,000
F.S. Road #50070	$ 78,000
TOTAL	$238,000

Because Lake Fork Creek is a 6th order stream, the probability of near term damage is 100%. Investment of $36,350 would help protect the facilities and property listed above.

403 - Benefit-Cost Ratio = 6.5:1

Recommended Treatment: Forest Management Programs

Reconstruct damaged Sections of Forest Development Road #50070. Rebuild two reaches of range unit fences. Rehabilitate damaged fish habitat resources in Lake Fork channel. Reconstruct damaged portion of Forest Trail #5037.

Treatment	Quantity	Unit Cost	Total Cost
Road Reconstruction	5.5 mi.	$78,000/mi.	$429,000
Road Bridge Construction	2	$40,000/Br.	$ 80,000 (If Needed)
Range Fence Reconstruction	1 mi.	$ 8,000/mi.	$ 8,000
Fish Habitat Rehabilitation	8.4 mi.	$17,300/mi.	$145,320
Channel Clearing	2 mi.	2,500/mi.	$ 5,000
Trail Reconstruction	0.1 mi.	$20,000/mi	$ 2,000
TOTAL			$669,320

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

Incident #3 Lake Fork
Project: Dairy Fork

Location

Manti-LaSal National Forest
Ranger District: Price
County: Utah

Treatment Sites

Site #2: Dairy Fork

Description of Impairment

Damage to the Dairy Fork Forest Development Road #50006 consisted of washed out culverts and 250 feet of road damage.

Recommended Treatment

Repair damaged culverts and remove landslide material from road.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair (Culvert)	.1 mile	$60,000/mi	$6,000
TOTAL			$6,000

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Access into and through the Dairy Fork drainage depends on the repair of the culverts and re-establishment of the road travel way. The Dairy Fork Road provides access to Indianola and the head of Lake Fork Canyon.

Incident #3 Lake Fork
Project: Clear Creek

Location

Manti-LaSal National Forest
Ranger District: Price
County: Utah

Treatment Sites

Site #3: Clear Creek

Description of Impairment

High flood waters damaged a large culvert and portions of Skyline Drive Forest Development Road #50150.

Recommended Treatment: Forest Management Program

Replace the large culvert and repair damaged portions of the above road.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair (Incl. Culvert Repair)	0.4 mi.	$66,000/mi.	$26,400
TOTAL			$26,400

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. This portion of Skyline Drive has an average daily traffic flow of 25 vehicles per day, consisting of 75% recreation, 12% mineral, 7% firewood, and 6% range. This is a major collector road and the main access to the Skyline Drive from the north end of the Forest.

Incident #3 Lake Fork
Project: Mill Fork

Location

Manti-LaSal National Forest
Ranger District: Price
County: Utah

Treatment Sites

Site #4: Mill Fork

Description of Impairment

Landslides exposed soils on 14 acres and impacted the stream channel.

Recommended Treatment: Forest Management Programs

Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	14 acres	$27/ac.	$ 378
TOTAL			$ 378

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Soil loss and reduced site productivity will occur if treatment is not implemented.

R3E. I R4E

R4E I R5E

R5E I R6E

T10S

T11S

T11S

T12S

T12S

T13S

INCIDENT # 4
THISTLE CREEK

● ④ ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

—(3)— SITE BOUNDARY

Incident #4 Thistle Creek
Project: Little Clear/Rock Creek/Thistle Creek

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Utah and Sanpete

Treatment Sites

Site #1: Little Clear Creek
Site #2: Rock Creek
Site #3: Thistle Creek

Description of Impairment

Major landslides in the upstream drainages resulted in severe degradation of these streams. Two major landslides blocked one channel creating small lakes, which upon breaching, released surges of water causing severe downcutting and over-widening of the channel. This process repeated itself several times. Subsequent impacts included undercutting Forest Development Road #50070, causing road failure into the channel. In addition, Forest Development Road #50125 has been inundated by landslides. Severe soil losses and downstream sediment deposits occurred on farmlands, fences, roads, residential sites in Indianola, National Forest Lands, stream channels, and U.S. Highway 89. Flood damage resulted to the Denver Rio Grande Railroad, Mountain Fuel Company's Gas Pipeline, and summer homes in the area.

Property Endangered

Little Clear, Rock, and Thistle Creeks merge into Thistle Creek above Indianola. Thistle Creek flood flows and channel surges from debris dam failures and other causes, threaten the community of Indianola. In addition, Thistle Creek floods directly threaten the Denver Rio Grande Railroad, U.S. Highway 89, farmlands, Forest Development Road #50070, a small reservoir, and summer homes. The Mountain Fuel Gas Pipeline crosses unstable slopes in the Thistle Creek drainage. The pipeline is currently threatened with landslides, which may rupture the line.

Recommended Treatment with Section 403 Funds

Stream channels need to be protected and debris cleaned, particularly below the major slide in Little Clear Creek, to avoid the stream headcutting through the slide reactivating and beginning subsequent landslide and flow surge cycles. A series of sediment control measures will need to be implemented including seeding, willow planting, channel modification, and sediment check dams to avoid accelerated and prolonged downstream impacts.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	(Sites 1,2,&3)	85 ac.	$27/ac.	$ 2,295
Willow Planting	(Sites 1,2,&3)	6.7 mi.	$1,500/mi.	$ 10,000
Debris Jam (DJ) & Slide Removal	(Sites 1 & 3)	4 DJ's	$2,000/DJ	$ 8,000
Channel Clearing	(Sites 1,2,&3)	5.8 mi.	$2,500/mi.	$ 14,500
Gabions & Channel Structures	(Site 1)	2 struc.	$50,000/st.	$100,000
Channel Modification (dragline)	(Site 1)	2 mi.	$8,000/mi.	$ 16,000
TOTAL				$153,545

Economic Defensibility: Section 403

Expected Values Threatened

Railroad Crossing	$ 60,000
U.S. Highway 89 crossing - 200 ft. road	$ 70,000
Forest Development Road #50070 (2 mi.)	$117,000
Damage to Indianola	$200,000
Summer Homes	$250,000
Gas Pipeline	$400,000
Farmlands	$ 20,000
Small Reservoir	$ 10,000
TOTAL	$727,000

Because Little Clear Creek, Rock Creek, and Thistle Creek are third and fourth order streams, the probability of near term damage is 100%.

Investment of $153,545 would help protect the facilities and property listed above.

Benefit-Cost Ratio = 4.7:1

Recommended Treatment: Forest Management Program

Preliminary engineering recommendations include partial relocation of Forest Development Road #50070, around the toe of two threatening landslides, and protecting road alignments adjacent to the stream channel. If reconstruction of the existing road is the only alternative, then costs will increase by a factor of 6. A special use assessment will need to be conducted on the Mountain Fuel Gas Pipeline in Thistle Creek. The Brown's Peak road will require some slide removal. Clearing channel of scattered debris is needed to avoid downstream damage.

Treatment	Location	Quantity	Unit Cost	Total Cost
Road Repair	(Sites 1&3)	1.5 mile	--	$661,000 (Alt B)
Road Relocation	(Site 1)	1.5 mile	$78,000/mi	$117,000 (Alt A)
Channel Clearing	(Sites 1,2,&3)	5.8 miles	$ 2,500/mi	$ 14,500
Special Use Assessment	(Site 3)	1 gas pipeline	$ 5,000/ea.	$ 5,000 (Eng costs only)
TOTAL	Alternate A (w/ Road Relocation)			$136,500
	Alternate B (No Road Relocation Possible)			$680,500

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

Incident #4 Thistle Creek
Project: Dry Creek/Indianola

Location

Manti-LaSal National Forest
Ranger District: Price
County: Utah

Treatment Site

Site #4: Dry Creek

Description of Impairment

High water flows and associated debris have damaged U.S. Highway 89, the Denver Rio Grande Railroad, Forest Development Road #50214, and some farmlands. Landslides have damaged portions of the stream channel and watershed areas.

Property Endangered

U.S. Highway 89, the Denver Rio Grande Railroad, Forest Development Road #50214, and some farmlands will continue to be impacted if flood and erosion control measures are not implemented.

Recommended Treatment: With Section 403 Funds

Damaged portions of the stream channel and exposed soils on landslide areas need to be revegetated.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	17 acres	$27/ac.	$ 459
Channel Clearing	.3 miles	$5,000/mi	$1,500
TOTAL			$1,959

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Farmland	$15,000
Highway 89	$20,000
Forest Development Road #50214	$10,000
Railroad	$10,000
TOTAL	$55,000

Because the landslides in Dry Creek are on slopes in excess of 80%, the probability of near term damage is 100%.

The investment of $1,959 would help protect the facilities and property listed above.

403 - Benefit-Cost Ratio - 28:1

Recommended Treatment: Forest Management Program

Some road repair is necessary to maintain access in this canyon.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	0.1 mile	$40,000/mi.	$ 4,000
TOTAL			$ 4,000

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

R4E | R5E

R5E | R6E

T12S

T13S

T13S

T14S

T14S

T15S

INCIDENT # 5
FAIRVIEW – OAK CREEK

● ④ ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

—(2)— SITE BOUNDARY

Incident #5 Fairview

Project: Fairview Canyon

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #1: Fairview Canyon

Description of Impairment

Several landslides and related floods occurred in Fairview Canyon from its origin to the confluence with San Pitch River. The landslides and floodwaters damaged and at several locations destroyed Utah Highway 31. Flood and debris flows inundated and damaged U.S. Highway 89, the Denver Rio Grande Railroad, Fairview City's culinary water supply, an irrigation system, a U.S.G.S. gaging station, several residences, and many acres of farmland. Portions of a number of city streets were destroyed in downtown Fairview. The population of Fairview is 916.

Property Endangered

Fairview City streets, residences, businesses, the city water supply, U.S. Highway 31, the Denver Rio Grande Railroad, municipal hydro-power plant, an irrigation system and reservoir, and farmlands will continue to be impacted or even destroyed if flood control measures, debris removal, and channel rehabilitation is not accomplished in the near term.

Recommended Treatment: With Section 403 Funds

A number of debris jams will need to be removed and channels cleared to decrease future threats and destruction downstream. In addition, rapid revegetation of denuded and unstable channels and slopes is needed to accelerate channel stabilization and healing processes.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	210 ac.	$27/ac.	$ 5,670
Willow Planting (channel)	3.5 mi.	$1,500/mi.	$ 5,250
(floodplain)	13 ac.	$690/ac.	$ 8,970
Debris Jam (D.J.) Removal	7 D.J.'s	$2,000/DJ	$14,000
Channel Clearing	3.9 mi.	$2,500/mi.	$ 9,750
TOTAL			$43,640

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Fairview City	
Hydro Power Plant	$ 250,000
Streets	$ 320,000
Residential	$ 830,000
Business	$ 160,000
Culinary Water Supply	$ 200,000
Irrigation System and Reservoir	$ 100,000
Farmlands	$ 30,000
Denver Rio Grande Railroad	$ 60,000
U.S. Highway 89	$ 70,000
U.S.G.S. Gaging Station	$ 10,000
TOTAL	$2,030,000

Because Cottonwood Creek in Fairview Canyon is a 4th order stream that is blocked 100% by debris jams, the probability of near term damage is 100%.

The investment of $43,640 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 46.5 : 1

Recommended Treatment: Forest Management Program

Forest Service Engineering and Environmental Assessments are needed for the repair and rehabilitation of permitted activities including: Utah Highway 31, Fairview City culinary water system, and the irrigation system. Fisheries habitat rehabilitation in Cottonwood Creek and rehabilitation in the watershed also need to be accomplished to restore and protect resource values.

Treatment	Quantity	Unit Cost	Total Costs
Special Use Assessments	3	$5,000/ea.	$ 15,000
Channel Clearing	3.4 mi.	$2,500/mi.	$ 9,750
Fish Habitat Rehabilitation	2.2 mi.	$40,970/mi.	$ 90,200
Watershed Rehabilitation	80 ac.	$90/ac.	$ 7,200
TOTAL			$122,150

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

Incident #5 Fairview Canyon

Project: Oak Creek/Dry Creek/Fairview

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #2: Oak Creek

Site #3: Dry Creek

Description of Impairment

Several landslides and flooding occurred in Oak Creek and Dry Creek. The landslides and flooding damaged or impacted stream channels and banks, watershed and range areas, fish habitats, farmlands, sections of 2 Forest trails, Highway U-91, Denver Rio Grande Railroad, and an irrigation system. Debris jams, landslides, and extensively damaged stream channels are potential hazards to downstream facilities and activities.

Property Endangered

Facilities and property threatened include Utah Highway 91, an irrigation system, the Denver Rio Grande Railroad, farmlands, and a U.S.G.S. gaging station.

Recommended Treatment: With Section 403 Funds

Debris jam removal, channel clearance, and rehabilitation of watershed areas need to be accomplished in the Oak Creek and Dry Creek drainages.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Site 1	20 ac.	$27/ac.	$ 540
Willow Planting	Sites 1&2	7.5 mi.	$1,500/mi.	$11,250
Debris Jam and Slide Removal	Site 1	6 D.J.'s	$2,000/DJ	$12,000
Channel Clearing	Site 1	2 mi.	$2,500/mi.	$ 5,000
TOTAL				$28,790

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Farmlands	$ 30,000
Irrigation System	$ 30,000
Denver Rio Grande Railroad	$ 70,000
Utah Highway 91	$ 70,000
U.S.G.S. Gaging Station	$ 10,000
TOTAL	$210,000

Because Fairview Canyon is a 4th order stream blocked by debris jams, the probability of near term damage is 100%.

The investment of $28,790 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 7.3 : 1

R6E I R7E

T12S

T13S

T12S

T13S

T14S

INCIDENT # 6
FISH CREEK

● ④ ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

—(2)— SITE BOUNDARY

Recommended Treatment: Forest Management Program

Trail repair and heavy maintenance will be necessary to reopen major stock driveways. In addition, fish habitat rehabilitation will be necessary to restore lost fish habitat. Channel clearing measures are necessary to prevent further downstream damage in the near term.

Treatment	Location	Quantity	Unit Cost	Total Cost
Fisheries Habitat Rehab.	Sites 2&3	7.9 mi.	$22,603/mi.	$210,167
Trail Repair	Sites 2&3	0.4 mi.	$20,000/mi.	$ 8,000
Channel Clearing	Site 1	2 mi.	$2,500/mi.	$ 5,000
TOTAL				$223,167

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

Incident #6 Fish Creek
Project: Woods Canyon

Location

Manti-LaSal National Forest
Ranger District: Price
County: Carbon

Treatment Sites

Site #1: Woods Canyon

Description of Impairment

Exceptionally high stream runoff and landsliding caused severe scouring, over-widening, and downcutting in the Woods Canyon channel, tributary to Scofield Reservoir. A moderate size landslide moved directly into the stream channel creating a direct and continuing sediment source.

Property Endangered

The Price, Helper, Wellington, Spring Glen, and Carbonville complex (15,000 people) depend on Scofield Reservoir for culinary water. The Scofield Reservoir tributaries, high in phosphates, when contributing high sediments can seriously threaten a major public water supply.

Recommended Treatment: With Section 403 Funds

Revegetation on exposed soils, re-establishment of stream bank willow materials, and stream channel clearing is necessary to control accelerated sedimentation into Socifield Reservoir, which will impact the Price and vicinity culinary water supply over the near term.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	10 acres	$ 27/ac.	$ 270
Willow Planting	1 mile	$1,500/mi.	$1,500
Channel Clearing	.6 mile	$2,500/mi.	$1,500
TOTAL			$3,270

Economic Defensibility: Section 403

Expected Values Threatened: Section 403	Estimated Worth
Scofield Reservoir (increased cost of water treatment)	$ 3,270
County Road Crossing	$40,000
TOTAL	$43,270

Because Woods Canyon is a 4th order stream and the debris along the channel blocks about 30% of the stream, the probability of near term damage is 80%.

The investment of $3,270 would help protect the facilities and property listed

403 Benefit-Cost Ratio = 10.6:1

Recommended Treatment: Forest Management Program

Some channel clearing and watershed rehabilitation is necessary to avoid impacts to the Scofield/Price water system complex. Fish habitat rehabilitation is necessary to restore habitat diversity to pre-1983 levels.

Treatment	Quantity	Unit Cost	Total Cost
Fisheries Habitat Rehab.	1 mile	$15,167/mi	$15,167
Watershed Rehab.	10 acres	$ 100/ac	$ 1,000
Channel Clearing	.6 mile	$ 2,500/mi	$ 1,500
TOTAL			$17,667

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

Incident #6 **Fish Creek**
Project: Pontown

Location

Manti-LaSal National Forest
Ranger District: Price
County: Carbon

Treatment Sites

Site #2: Pontown Creek

Description of Impairment

Landslides exposed soils on four acres, and impacted the stream channel.

Recommended Treatment: Forest Management Programs

Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	4 acres	$27/acre	$108
TOTAL			$108

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Pontown Creek supports a good fishery and provides rearing and spawning habitat for adult trout migrating from Scofield Reservoir. Soil loss and reduced site productivity will occur if treatment is not implemented.

Incident #6 Fish Creek
Project: French Creek

Location

Manti-LaSal National Forest
Ranger District: Price
County: Carbon and Utah

Treatment Sites

Site #3: French Creek

Description of Impairment

Soils were exposed by 45 acres of landslides in the watershed.

Recommended Treatment: Forest Management Programs

Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	10 acres	$27/ac.	$270
TOTAL			$270

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Soil loss and reduced site productivity will occur if treatment is not implemented.

Incident #6 Fish Creek
Project: Winter Quarters

Location

Manti-LaSal National Forest
Ranger District: Price
County: Carbon

Treatment Sites

Site #4 Winter Quarters Canyon

Description of Impairment

Soils were exposed by 32 acres of landslides in the watershed.

Recommended Treatment: Forest Management Programs

Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	9 acres	$27/ac.	$243
TOTAL			$243

Defensibility

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Winter Quarters Creek supports a good fishery. Soil loss and reduced site productivity will occur if treatment is not implemented.

R5E | R6E

R6E | R7E

R7E | R8E

T12S

T13S

T13S

T14S

T14S

T15S

INCIDENT # 7
MONUMENT PEAK

AREAS OF MASS MOVEMENT

SITE BOUNDARY

Incident #7 Monument Peak
Project: Eccles Canyon

Location

Manti-LaSal National Forest
Ranger District: Price
County: Carbon

Treatment Sites

Site #1: Eccles Canyon

Description of Impairment

Landslides in upper Eccles Canyon are contributing to the phosphate sediment problem of the Price City Municipal Water System. In addition, landslides are plugging two major mine site bypass culverts, which endanger the site.

Property Endangered

Scofield Reservoir, Eccles Canyon coal mine bypass culvert, an access road, and Highway U-96 are endangered by high sedimentation rates and landslides.

Recommended Treatment with Section 403 Funds

Revegetation, including seeding and willow planting, are necessary to control accelerated sedimentation into Scofield Reservoir, which will impact the Price and vicinity culinary water supply over the near term.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	40 acres	$ 27/ac.	$1,080
Willow Planting	.3 mile	$1,500/mi.	$ 450
TOTAL			$1,530

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Scofield Reservoir (Increased cost of water treatment)	$ 1,080
Mine Site Bypass Culvert	$300,000
Access Raod	$100,000
TOTAL	$401,080

Because of the proximity of the landslide to the mine portal, the probability of damage is 100%. Continued movement of the slide will cause continuing damage.

The investment of $1,530 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 262 : 1

Recommended Treatment: Forest Management Program

A special use assessment is necessary for the mine access road and the mine site bypass culvert. Fish habitat rehabilitation is necessary to restore productivity to pre-1983 levels.

Treatment	Quantity	Unit Cost	Total Cost
Fisheries Habitat Rehab.	.3 mile	$26,000/mi	$7,800
Special Use Assessments	1 ea.	$ 5,000/ea.	$5,000
TOTAL			$12,800

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

Incident #7 Monument Peak
Project: Mud Creek

Location

Manti-LaSal National Forest
Ranger District: Price
County: Carbon

Treatment Sites

Site #2: Mud Creek

Description of Impairment

Mud Creek Forest Development Road #50247 was damaged by 3 small landslides and by flood waters washing out 1,500 feet of road.

Recommended Treatment: Forest Management Programs

Repair damaged section of road and remove slides.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	.6 mile	$54,600/mi.	$ 32,760
TOTAL			$ 32,760

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. The Mud Creek road is a local route which provides the only access into the Mud Creek drainage. Vehicle use is less than 1 per day.

Incident #7 Monument Peak
Project: Monument Peak

Location

Manti-LaSal National Forest
Ranger District: Price
County: Emery

Treatment Sites

Site #3: Monument Peak

Description of Impairment

A large debris jam resulted from flood waters in North Hughes Creek above a large culvert on Forest Development Road #50035. Approximately 300 feet of Forest Development Road #50018 sloughed off into the canyon. In addition, soils were exposed by 9 acres of landslides in North Hughes Canyon. A natural gas transmission pipeline was damaged by landslides.

Recommended Treatment: Forest Management Programs

The debris jams need to be removed from North Hughes Creek and 300 feet of Forest Development Road #50035 needs to be repaired. Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	.1 mile	$30,000/mi.	$ 3,000
Debris Jam Removal	1 DJ	$ 2,000/ea.	$ 2,000
Grass Seeding	9 acres	$ 27/ac.	$ 243
TOTAL			$ 5,243

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. The removal of the debris jam will prevent the destruction of a major culvert on Road #50035, which provides access to the Trough Springs area. The repair of 300 feet of Road #50018 will maintain safe access and provide continued use of the area by the public. Soil loss and reduced site productivity will occur if revegetation is not implemented.

R5E | R6E

R6E | R7E

R7E | R8E

T14S

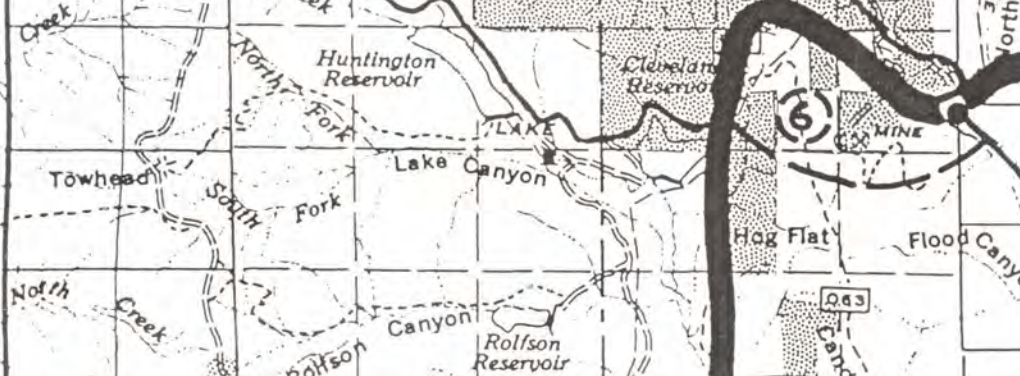
T15S

T15S

T16S

T16S

T17S



INCIDENT # 8
HUNTINGTON CANYON

- ② STREAM CHANNEL DAMAGE CLASS
- AREAS OF MASS MOVEMENT
- SITE BOUNDARY

Incident #8 Huntington Creek

Project: Huntington Creek/Left Fork

Location

Manti-LaSal National Forest
Ranger District: Price
County: Emery

Treatment Sites

Site #1: Huntington Canyon

Site #2: Left Fork Huntington (from Forks Campground to Scad Valley)

Description of Impairment

High water and landslides destroyed portions of a major National Recreation Trail (FT #5131), the water supply system for the Forks of Huntington Campground, and portions of Highway U-31. In addition, stream channels and fish habitat were damaged to a point where partial restoration will be required. The access road (FDR #50058) to the Forks of Huntington Campground was partially damaged due to undercutting by flood waters. A landslide damaged the Huntington Campground by diverting water through two camp units, and the access road.

Property Endangered

Facilities and property which will continue to be impacted if debris removal is not accomplished in the near term include, Utah Highway 31 (including 7 major bridges), a major power plant diversion facility, a culinary water system, and farmlands. Huntington Canyon is also a major recreation corridor.

Recommended Treatment: With Section 403 Funds

Gabion structures are necessary to protect the Forks of Huntington Campground from undercutting by Left Fork Huntington Creek. Debris clearing is necessary to avoid scouring and jams from further impacting downstream values. Revegetation and willow planting will be required to stabilize channels and side slopes threatened with further damage in the near term.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Site 1	10 ac.	$27/ac.	$ 270
Willow Planting	Sites 1&2	5 mi.	$1,500/mi.	$ 7,500
Channel Clearing	Site 1	.8 mi.	$2,500/mi.	$ 2,000
Gabions and Channel Structures	Site 2	40 ft.	$50/ft.	$ 2,000
TOTAL				$11,770

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Utah Highway 31 (including bridges)	$1,200,000
Diversion Facility	$ 300,000
Culinary Water System	$ 100,000
Farmlands	$ 600,000
Forks Campground	$ 130,000
TOTAL	$2,330,000

Because Left Fork of Huntington Creek is a 5th order stream, main Huntington is a 6th order stream and streamside debris blocks about 50% of the channel, the probability of near term damage is 100%.

The investment of $11,770 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 198 : 1

Recommended Treatment: Forest Management Program

A special use assessment is needed to coordinate treatment of damage to Highway U-31. Trail reconstruction is necessary on a portion of a National Recreation Trail along the Left Fork of Huntington Creek. Road repairs are necessary to re-establish access to portions of Forks of Huntington Campground and the water system needs to be relocated. Partial fish habitat rehabilitation is necessary to restore productivity in the heavily used Huntington Creek system.

Treatment	Location	Quantity	Unit Cost	Total Cost
Road Repair	Site 2	0.1 mi.	$78,000/mi.	$ 7,800
Fisheries Habitat Rehab.	Sites 1&2	18.2 mi.	$14,095/mi.	$256,529
Special Use Assessment	Site 1	1 ea.	$5,000/ea.	$ 5,000
Trail Repair	Site 2	0.1 mi.	$20,000/mi.	$ 2,000
Campground Repair	Site 2	All	$40,000/all	$ 40,000
Channel Clearing (scattered debris and slide)	Site 1	0.8 mi.	$2,500/mi.	$ 2,000
TOTAL				$313,329

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

Incident #8 Huntington Creek

Project: Intex Canyon

Location

Manti-LaSal National Forest
Ranger District: Price
County: Emery

Treatment Sites

Site #6: Intex Canyon

Description of Impairment

Landslides covered a portion of Forest Development Road #50012 severing access into Intex Canyon.

Recommended Treatment: Forest Management Program

Remove landslide from Forest Development Road #50012.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	0.1 mi.	$20,000/mi.	$2,000
TOTAL			$2,000

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. The removal of the landslide will perpetuate the access into Intex Canyon and the Larson/Rigby Mine.

Incident #8 Huntington Creek

Project: Nuck Woodward

Location

Manti-LaSal National Forest
Ranger District: Price
County: Emery

Treatment Sites

Site #3: Nuck Woodward Canyon

Description of Impairment

A landslide and flood waters have damaged Forest Development Road #50110, washing out portions of the road, 3 culverts, and inundating 150 feet under landslide debris.

Recommended Treatment: Forest Management Programs

Remove the landslide material and repair washed out portions of the road.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	.3 mi.	$37,000/mi.	$11,100
TOTAL			$11,100

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. This road is a minor collector having an average daily traffic flow of 12 vehicles per day, consisting of 33% fuelwood, 25% range, 24% recreation, 16% mineral, and 2% timber. This road also provides the principal access into Nuck Woodward Canyon.

Incident #8 Huntington Creek

Project: Crandall Canyon

Location

Manti-LaSal National Forest
Ranger District: Price
County: Emery

Treatment Sites

Site #4: Crandall Canyon

Description of Impairment

Landslides occurred in the upper drainage causing a surge of high waters and debris that damaged the channel and partially plugged a major culvert. Soils were exposed by 10 acres of landslides in the upper watershed.

Recommended Treatment: Forest Management Program

Revegetation is needed to rehabilitate disturbed soil areas. The major culvert will be maintained by Genwal Corporation.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	10 acres	$27/ac.	$ 270
TOTAL			$ 270

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Crandall Canyon Creek supports a good fishery. Soil loss and reduced site productivity will occur if treatment is not implemented.

Incident #8 Huntington Creek

Project: Tie Fork

Location

Manti-LaSal National Forest
Ranger District: Price
County: Emery

Treatment Sites

Site #5: Tie Fork

Description of Impairment

High flood waters caused bank sloughing into the stream channel and exposed approximately 200 feet of the culinary water pipeline for the Huntington City municipal supply system.

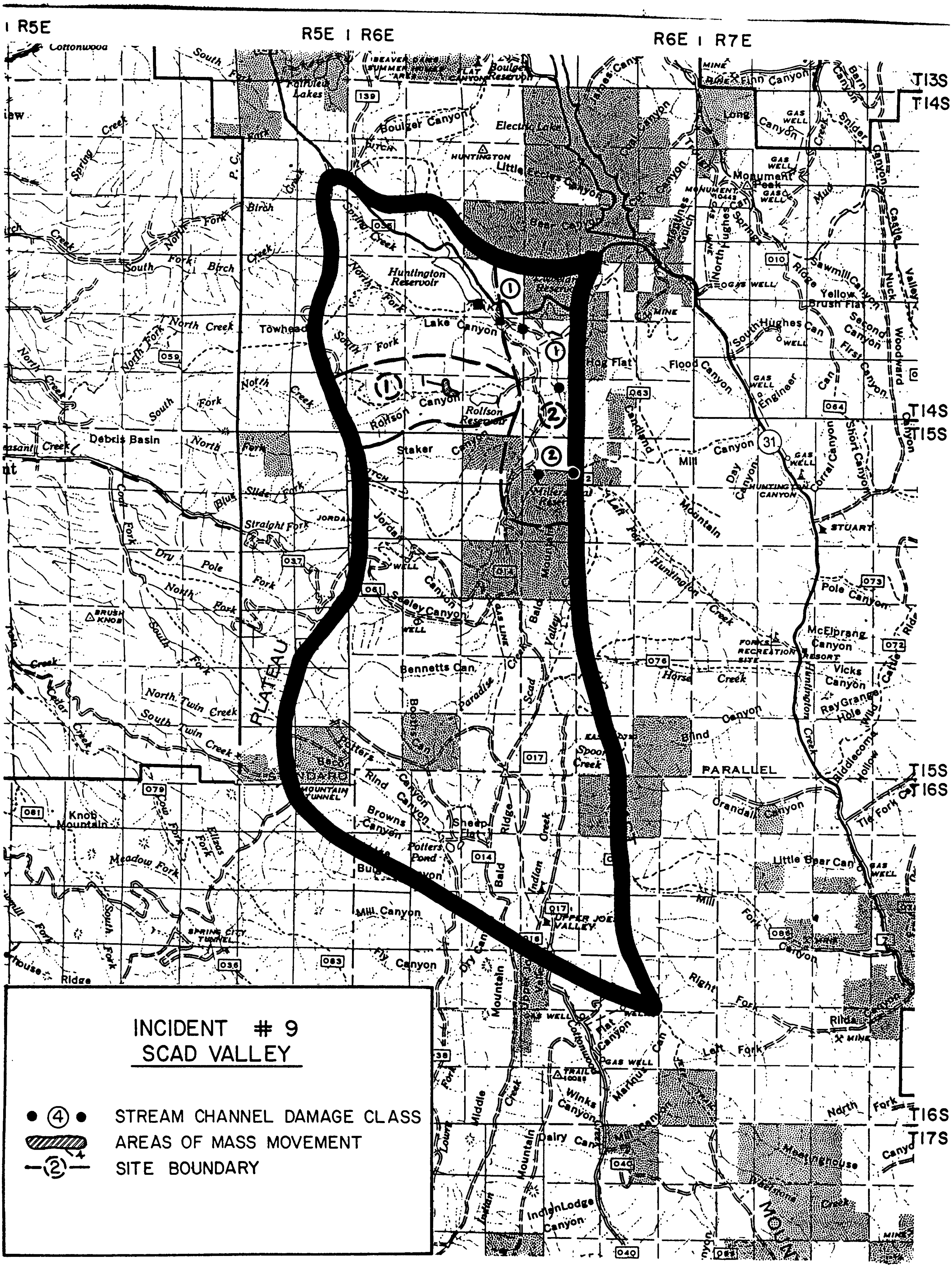
Recommended Treatment: Forest Management Program

A special use assessment is needed to coordinate actions with the city of Huntington and assure correction.

Treatment	Quantity	Unit Cost	Total Cost
Special Use Assessment	1	$5,000/ea.	$ 5,000
TOTAL			$ 5,000

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. The special use assessment will insure permittee correction of the flood damaged culinary water system and correction of the damaged stream channel.


INCIDENT # 9
SCAD VALLEY
STREAM CHANNEL DAMAGE CLASS
AREAS OF MASS MOVEMENT
SITE BOUNDARY
R5E
R5E R6E
R6E R7E
T13S
T14S
T14S
T15S
T15S
T16S
T16S
T17S
Huntington Reservoir
Lake Canyon
Towhead
Rolfson Canyon
Rolfson Reservoir
Staker Canyon
Hog Flat
Electric Lake
Little Eccles Canyon
Bear Canyon
Boulger Canyon
Boulger Reservoir
Fairview Lakes
Monument Peak
South Hughes Can
North Hughes Can
Flood Canyon
Engineer Can
Mill Canyon
Day Canyon
Corral Canyon
Short Canyon
Huntington Canyon
Stuart
Left Fork Huntington Creek
Pole Canyon
McElprang Canyon
Forks Recreation Site
Resort
Vicks Canyon
Ray Grange Hole
Horse Creek
Blind Canyon
Spoon Creek
Parallel
Crandall Canyon
Tie Fork Can
Little Bear Can
Mill Fork Canyon
Right Fork
Left Fork
Rilda Canyon
Upper Joes Valley
Bald Mountain
Scad Valley
Paradise Creek
Bennetts Can
Seeley Canyon
Jordan Canyon
Booths Can
Potters Canyon
Rind Canyon
Browns Canyon
Sheep Flat
Potters Pond
Mill Canyon
Fly Canyon
Dry Can
Flat Canyon
Cottonwood
Markus Can
Winks Canyon
Dairy Can
Indian Lodge Canyon
Meetinghouse
Whetstone Creek
Plateau
Debris Basin
Blue Slide Fork
Straight Fork
Dry Pole Fork
North Fork
South Fork
North Twin Creek
South Twin Creek
Cedar Creek
Brush Knob
Knob Mountain
Meadow Fork
Spring City Tunnel
Mountain Tunnel
Spring Creek
North Fork Birch Creek
South Fork Birch Creek
North Creek
Pleasant Creek
Cottonwood
31

Incident #9 Scad Valley
Project: Rolfson Canyon

Location

Manti-LaSal National Forest
Ranger District: Price
County: Sanpete

Treatment Sites

Site #1: Rolfson Canyon

Description of Impairment

Soils were exposed by 5 acres of landslides adjacent to Rolfson Canyon Creek. The road was inundated by landslides and portions of Forest Development Road #50269 sloughed into the canyon.

Recommended Treatment: Forest Management Program

Revegetation is needed to rehabilitate disturbed soil areas. Remove the landslide material and repair damaged sections of road #50269.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	.3 mile	$44,000/mi.	$13,200
Grass Seeding	2 acres	$ 27/ac.	$ 54
TOTAL			$13,254

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases, benefits will be realized to other downstream resources and values. Repair of Road #50260 and removal of the landslide material from the road will restore the only access into Rolfson Canyon. Soil loss and reduced site producitivity will occur if treatment is not implemented.

Incident #9 Scad Valley
Project: Miller's Flat Canyon

Location

Manti-LaSal National Forest
Ranger District: Price
County: Sanpete

Treatment Sites

Site #2: Miller's Flat Canyon

Description of Impairment

High flood waters washed out a major culvert and a smaller culvert on Forest Development Road #50014. In addition, a section of road was damaged.

Recommended Treatment: Forest Management Programs

Repair damaged culverts and road.

Treatment	Quantity	Unit Cost	Total Cost
Large Culvert Repair	1 culvert	$20,000/cul.	$ 20,000
Road Repair	0.1 mile	$50,000/mi.	$ 5,000
TOTAL			$ 25,000

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases, benefits will be realized to other downstream resources and values. Replacement and repair of the 2 damaged culverts and road will restore access to Miller's Flat Reservoir and the surrounding area. The Miller's Flat Road #50014 has a daily traffic volume of 75 vehicles per day with 85% recreation, 3% fuelwood, 8% mineral, and 4% range.

R4E | R5E

R5E | R6E

T16S

T17S

T17S

T18S

T18S

T19S

INCIDENT #10
SEELY CREEK - JOE'S VALLEY

● ② ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

Incident #10 Seely Creek/Joe's Valley
Project: Seely Canyon/Beck's Creek

Location

Manti-LaSal National Forest
Ranger District: Ferron
County: Sanpete

Treatment Sites

Site: Seely Canyon/Beck's Creek

Description of Impairment

Additional movement of the historic Seely Creek landslide caused channel scouring and sedimentation into Seely Creek and Joe's Valley Reservoir. A landslide blocked Forest Highway #8 below the Rock Creek Crossing. Soils were exposed by 19 acres of landslides in the watershed. In addition, 2.5 miles of highly productive fish habitat were damaged.

Recommended Treatment: Forest Management Programs

Removal of landslide material from Forest Highway #8 will restore access to upper Seely Creek, and between Orangeville and Ephraim. Revegetation is needed to rehabilitate disturbed soil areas. Willow planting is needed to stabilize damaged streambanks. Fish habitat rehabilitation is needed to restore lost habitat diversity.

Treatment	Quantity	Unit Cost	Total Cost
Fisheries Habitat Rehab.	2.5 mile	$17,333/mi.	$43,333
Road Repair (Slide Removal)	0.1 mile	$50,000/mi.	$ 5,000
Grass Seeding	19 acres	$ 27/ac.	$ 513
Willow Planting	4 miles	$ 1,500/mi.	$ 6,000
TOTAL			$54,846

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Forest Highway #8 is the major east-west access route across the Forest, between Orangeville on the east and Ephraim on the west. Landslide removal will restore access for 120 vehicles daily. The rehabilitation of fish habitat will restore habitat diversity to pre-1983 levels. Revegetation and willow planting will constrain sediments from entering Seely Creek and subsequantly Joe's Valley Reservoir immediately downstream.

R3E | R4E

R4E | R5E

R5E | R6E

T18S

T19S

T19S

T20S

PARALLEL T20S T21S

SANPETE COUNTY

EMERY COUNTY

INCIDENT # 11
FERRON CANYON

AREAS OF MASS MOVEMENT

DAMAGED FENCES

Incident #11 Ferron Canyon
Project: Wood Tick Point

Location

Manti-LaSal National Forest
Ranger District: Ferron
County: Sanpete

Treatment Sites

Site: Wood Tick Point

Description of Impairment

Landslides destroyed 2 miles of range allotment boundary fence, severed access on Forest Development Road #50031, and exposed soils on 65 acres of suitable range.

Recommended Treatment: Forest Management Programs

Rebuild the 2 miles of damaged allotment boundary fence. Remove landslide material from Road #50031, and repair damaged sections of the road. Revegetation is needed to rehabilitate disturbed soil areas.

Treatment	Quantity	Unit Cost	Total Cost
Rebuild Fences	2 miles	$ 8,000/mi.	$16,000
Road Repair & Slide Removal	0.1 mile	$30,000/mi.	$ 3,000
Grass Seeding	65 acres	$ 27/ac.	$ 1,755
TOTAL			$20,755

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Range fence repair is necessary to protect the integrity of 2 separate range allotments. Road #50031 needs to be repaired to restore access to upper Ferron Creek and McEwan Flat. Soil loss and reduced site productivity of suitable livestock range will occur if grass seeding is not implemented.

R3E | R4E R4E | R5E R5E | R6E

T19S
T20S
T20S
T21S
T21S
T22S

SANPETE COUNTY
SEVIER COUNTY

PARALLEL

STANDARD

T. 19½

INCIDENT # 12
MUDDY CREEK

● ② ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

X—X—X DAMAGED FENCES

Incident #12 Muddy Creek

Project: Brush/Spinners Reservoir

Location

Manti-LaSal National Forest
Ranger District: Ferron
County: Sanpete

Treatment Sites

Site #1: Brush/Spinners Reservoir

Description of Impairment

"The whole world fell apart" around Brush Reservoir and the adjacent terrain. High instability emptied a destroyed Brush Reservoir and created threatening conditions ¼ - ½ mile below Spinners Reservoir. Two miles of range allotment boundary fence were totally destroyed. The North Fork of Muddy Creek received high water and debris scouring in the main channel. Soils were exposed in 183 acres of landslide areas.

Recommended Treatment: Forest Management Program

Abandon Brush Reservoir and monitor landslide activity immediately below Spinners Reservoir. Revegetation is necessary as an immediate and long-term measure to reduce sedimentation. Plant willows and clear the North Fork Muddy channel and floodplain from scattered debris and debris jams. Special use assessments will be necessary to determine future action regarding Brush and Spinners Reservoir. Rebuild two miles of range allotment boundary fence.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	183 acres	$27/ac.	$ 4,941
Willow Planting	3 mi.	$1,500/mi.	$ 4,500
Channel Clearance	3 mi.	$5,000/mi.	$15,000
Debris Jam (D.J.) Removal	5 D.J.'s	$2,000/DJ	$10,000
Rebuild Fence	2 mi.	$10,000/mi.	$20,000
Special Use Assessment (Brush Reservoir and Spinners Reservoir)	2 ass.	$5,000/mi.	$10,000
TOTAL			$64,441

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. The replacement or relocation of Brush Reservoir needs to be determined. The safety of Spinners Reservoir needs to be assessed because of downstream threats to facilities, resources, and property. The allotment boundary fence needs to be rebuilt to perpetuate the integrity of 2 separate range allotments. The North Fork Muddy channel needs to be cleared and revegetated to protect downstream values and fisheries habitat. Grass seeding is needed to stabilize and revegetate 183 acres of suitable rangeland.

R2E | R3E

R3E | R4E

T18S
T19S
T19S
T20S
T20S
T21S
T21S
T22S

SANPETE COUNTY
SEVIER COUNTY

INCIDENT # 13
TWELVE MILE CREEK

- ● ④ ● STREAM CHANNEL DAMAGE CLASS
- AREAS OF MASS MOVEMENT
- x—x—x DAMAGED FENCES
- —②— SITE BOUNDARY

Stream undercutting in the toe of a landslide - Twelve Mile Canyon

Stream widening and road damage - Twelve Mile Canyon

Debris jam in Twleve Mile Canyon

Incident #13 Twelve Mile Creek
Project: Twelve Mile/South Fork/Twin Lakes

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #1: Main Twelve Mile Creek
Site #2: South Fork of Twelve Mile
Site #3: Twin Lakes

Description of Impairment

Major landslides and flooding occurred throughout the entire drainage resulting in extensive damage to the transportation system, including 8 bridges, a community water supply system, a major recreation site, stream channels and banks, fish habitats, range improvements, a reservoir, at least 2 natural lakes, an irrigation system, and downstream residential areas, and farmlands. The Twelve Mile drainage sustained as severe damage as any observed throughout the Utah National Forest System complex. Several debris jams and scattered debris were left throughout miles of stream channels in the drainage basin.

Property Endangered

Twelve Mile Creek flood flows and channel surges from debris dam failures and other causes, threatened portions of the community of Mayfield, their culinary water supply, an irrigation system, a U.S.G.S. gaging station, Forest Development Road #50022, 3 major bridges, Highway U-137, and farmlands.

Recommended Treatment with Section 403 Funds

Debris jam removal and channel clearance is needed to prevent the imminent probability of future catastrophies. A series of sediment control measures will need to be accomplished, including seeding, willow planting, channel modification, and gabion structures.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Sites 1,2,&3	400 acres	$27/ac.	$ 10,800
Willow Planting	Sites 1&2	4 miles	$1,500/mi.	$ 6,000
Debris Jam Removal	Sites 1&2	63	$2,000/DJ	$126,000
Slide Removal	Sites 1&2	3	$5,000/Sl	$ 15,000
Channel Clearing	Sites 1&2	8 miles	$2,500/mi.	$ 20,000
Gabions & Channel Struc.	Site 1	900 feet	$50/ft.	$ 45,000
Channel Modification	Site 2	1 mile	$8,000/mi.	$ 8,000
TOTAL				$230,800

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Mayfield Residential (3 res.)	$ 90,000
Culinary Water System	$100,000
Irrigation System	$ 30,000
U.S.G.S. Gaging Station	$ 10,000
F.S. Road #50022 (3 miles)	$234,000
2 Major Bridges	$ 80,000
Highway U-137 (1 bridge + 200 ft. highway)	$ 70,000
Farmlands	$ 30,000
TOTAL	$644,000

Because Twelve Mile Creek and tributary creeks are 4th, 5th, and 6th order stream(s), the probability of near term damage is 100%.

The investment of $230,800 would help protect the facilities and property listed above.

Benefit-Cost Ratio = 2.8:1

Recommended Treatment: Forest Management Program

Relocate and/or reconstruct portions of Forest Development Roads #50022, #50290, #50155, #50032, #50159, and #50023. If the current alignment is reconstructed a number of bridges will need to be replaced. Four miles of range fence and 2 cattleguards will need to be replaced. Heavy maintenance is needed on approximately 10 miles of range fence. Fish habitat losses will need to be rehabilitated. Forest Trail #5125 (4.5 miles) needs to be reconstructed. A special use assessment needs to be conducted on Twin Lakes Reservoir. Reconstruction or relocation to replace the equivalent recreation capacity lost in the destruction of Pinchot Campground is necessary.

Treatment	Location	Quantity	Unit Cost	Total Cost
Road Repair	Sites 1,2,&3	.7 mile	$ 76,000/mi.	$ 53,200
Channel Clearing	Sites 1&2	8 miles	$ 2,500/mi.	$ 20,000
Fisheries Habitat Rehab.	Site 1	15.3 miles	$ 32,000/mi.	$ 489,600
Road Relocation	Sites 1&3	8.3 miles	$155,000/mi.	$1,286,500
Road Bridges	Site 1	3	$ 40,000/Br.	$ 120,000
Range Improvement Rehab.	Sites 1,2,&3	14 mi.fence	$ 4,000/mi.	$ 56,000
		2 ct. gd.	$ 2,000/c.g.	$ 4,000
Trail Reconstruction	Sites 2&3	4.5 miles	$ 20,000/mi	$ 90,000
Trail Bridges	Site 2	5	$ 15,000/Br.	$ 75,000
Spec. Use Assessment	Site 3	1	$ 5,000/ea.	$ 5,000
Campground Relocation and/ or Reconstruction	Site 2	15 units	$ 10,000/Unit	$ 150,000
TOTAL				$2,349,300

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

R2E | R3E

R3E | R4E

T17S

T18S

T18S

T19S

T19S

T20S

INCIDENT # 14
SIX MILE

● ② ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

—②— SITE BOUNDARY

Incident #14 Six Mile

Project: Six Mile/North Fork

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #1: Main Six Mile

Site #2: North Fork Six Mile

Description of Impairment

Landsliding and exceptionally high stream discharge caused extensive damage ($486,000) to Forest Development Road #50047, scoured and litered the stream channel with debris and damaged the Sterling area irrigation complex.

Property Endangered

Downstream facilities and property threatened include U.S. Highway 89, Sterling City culinary water system, farmlands, an irrigation system, and Forest Development Road #50047.

Recommended Treatment: With Section 403 Funds

Gabions, channel structures, and some channel modifications will be necessary to protect the existing Forest Development Road #50047. Channel clearance is necessary to remove scattered debris which may cause severe downstream damage over the near term. Revegetation and willow planting will be required to stabilize channels and side slopes threatened with further damage.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Sites 1&2	30 ac.	$27/ac.	$ 810
Willow Planting	Site 1	5 mi.	$1,500/mi.	$ 7,500
Channel Clearing	Site 1	.5 mi.	$2,500/mi.	$ 1,250
Gabions and Channel Structures	Site 1	200 ft.	$50/ft.	$10,000
Channel Modification	Site 1	0.2 mi.	$8,000/mi.	$ 1,600
TOTAL				$21,160

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Irrigation System	$ 30,000
Culinary Water System	$100,000
Farmlands	$ 20,000
Highway 89	$ 20,000
Forest Development Road #50047	$186,000
TOTAL	$356,000

Because Six Mile Canyon is a 4th order stream and the stream side debris blocks about 30% of the stream width, the probability of near term damage is 80%.

The investment of $21,160 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 13. : 1

Recommended Treatment: Forest Management Program

Road repair and major relocation (including 2 bridges) will be necessary to re-establish access into and through Six Mile Canyon. In addition, rehabilitation will be necessary to restore fish habitat productivity to pre-1983 conditions.

Treatment	Location	Quantity	Unit Cost	Total Cost
Road Repair	Site 1	1.4 mi.	$78,000/mi.	$109,200
Fisheries Habitat Rehab.	Site 1	9.4 mi.	$21,252/mi.	$199,769
Road Relocation	Site 1	4.2 mi.	$78,000/mi.	$327,600
Bridges	Site 1	2	$40,000/ea.	$ 80,000
Channel Clearing	Site 1	0.5 mi.	$2,500/mi.	$ 1,250
TOTAL				$717,819

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

Incident #14 Six Mile

Project: Forbush Cove

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #3: Forbush Cove

Description of Impairment

Extremely high spring runoffs caused heavy damage to the Sterling City culinary water system.

Recommended Treatment: With Section 403 Funds

Revegetation will be necessary to stabilize exposed soils. In addition, channel clearing measures need to be accomplished to protect downstream facilities in the near term.

Treatment	Quantity	Unit Cost	Total Cost
Willow Planting	0.25 mi.	$1,500/mi.	$ 375
Channel Clearing	0.25 mi.	$5,000/mi.	$1,250
TOTAL			$1,625

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Sterling Culinary Water System	$125,000
TOTAL	$125,000

Because the canyon is a 2nd order stream, and 30% of the stream width is blocked with debris, the probability of near term damage is 40%.

The investment of $1,625 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 30 ; 1

Recommended Treatment: Forest Management Program

A special use assessment will be necessary in the repair of the Sterling City culinary water system, Grass seeding will be necessary to stabilize exposed soils along the culinary pipeline.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	5 acres	$27/ac.	$ 135
Special Use Assessment	1	$5,000/ea.	$5,000
TOTAL			$5,135

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

R2E | R3E

R3E | R4E

R4E | R5E

T17S

T18S

T18S

T19S

19S

19½S

19½S

20S

INCIDENT # 15
MANTI CANYON

● ③ ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

Incident #15 Manti Canyon
Project: Manti Canyon

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site: Manti Canyon

Description of Impairment

Exceptionally high runoff and landslides caused damage to Forest Development Roads #50045 and #50046, debris jams in the main channel, and scoured channel banks and fish habitat.

Property Endangered

Facilities and property threatened include Manti City, U.S. Highway 89, the Denver Rio Grande Railroad, Manti City culinary water system, an irrigation system, a hydroelectric power plant, a U.S.G.S. gaging station, farmlands, and Forest Development Roads #50045 and #50046.

Recommended Treatment with Section 403 Funds

Streambank willow planting is necessary to stabilize 7 miles of damaged streambanks. Channel clearing and debris jams are necessary to protect downstream facilities and property from further scouring events over the near term.

Treatment	Quantity	Unit Cost	Total Cost
Willow Planting	7 miles	$1,500/mi.	$10,500
Debris Jam and Slide Removal	6 DJ's	$2,000/DJ	$12,000
Channel Clearing	0.6 mile	$2,500/mi.	$ 1,500
TOTAL			$24,000

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Manti City	
Residential	$1,400,000
Business	$ 500,000
Hydro Power Plant	$ 250,000
Culinary Water System	$ 500,000
Streets	$ 375,000
U.S. Highway 89	$ 70,000
Denver Rio Grande Railroad	$ 70,000
Farmlands	$ 900,000
Forest Development Roads #50045 & #50046	$ 78,000
U.S.G.S. Gaging Station	$ 10,000
TOTAL	$4,153,000

Because Manti Canyon is a 5th order stream, blocked 100% by debris jams, the probability of near term damage is 100%.

The investment of $24,000 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 173.:1

Recommended Treatment: Forest Management Programs

Road repairs are necessary to restore use of Forest Development Roads #50045 and #50046. Channel clearing will be necessary to remove remaining channel debris. Fish habitat rehabilitation is necessary to restore habitat diversity to pre-1983 productivity levels.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	0.7 mile	$170,000/mi.	$119,000
Fisheries Habitat Rehab.	6.6 mile	$ 20,550/mi.	$135,630
Channel Clearing	.6 mile	$ 2,500/mi.	$ 1,500
TOTAL			$256,130

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

R2E | R3E R3E | R4E R4E | R5E

T16S
T17S
T17S
T18S
T18S
T19S

INCIDENT # 16
EPHRAIM CANYON

- ● ③ ● STREAM CHANNEL DAMAGE CLASS
- AREAS OF MASS MOVEMENT
- x—x—x DAMAGED FENCES
- —②— SITE BOUNDARY

Incident #16 Ephraim Canyon
Project: Jimmy's Fork/Willow Creek

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #1: Jimmy's Fork
Site #2: Willow Creek, South Fork

Description of Impairment

A landslide temporarily blocked Jimmy's Fork. When it breached, it caused a destructive debris flow down the channel, over Highway U.S. 89, through the local airport, washed out a railroad crossing, and covered Forest lands with mud. In addition, an irrigation system and range unit fence were damaged.

Property Endangered

An irrigation system, farmlands, U.S. Highway 89, Denver Rio Grande Railroad, Ephraim-Manti Airport, and county roads will continue to be impacted if sediment control measures are not accomplished.

Recommended Treatment with Section 403 Funds

The principal corrective measure available in this case is to re-establish vegetative cover which will accelerate the natural healing process.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Site 1	100 acres	$27/acre	$ 2,700
TOTAL				$ 2,700

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Irrigation Systems	$ 50,000
Farmlands	$ 75,000
U.S. Highway 89	$ 50,000
Denver Rio Grande Railroad	$100,000
Ephraim-Manti Airport	$ 20,000
County Roads	$ 60,000
TOTAL	$355,000

Because Jimmy's Fork landslides are on 30% slopes and because they are deep landslides, the probability of near term damage is 60%.

The investment of $2,700 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio - 79.:1

Recommended Treatment: Forest Management Programs

Approximately one mile of a range unit division fence will have to be relocated.

Treatment	Location	Quantity	Unit Cost	Total Cost
Range Improvement	Site #1	1 mi. fence	$8,000/mi.	$8,000
TOTAL				$8,000

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

Incident #16 Ephraim Canyon
Project: New Canyon/Cottonwood Creek/Ephraim

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #3: New Canyon
Site #4: Cottonwood Creek

Description of Impairment

Floods and related landslide events severely impacted and/or totally removed portions of Forest Development Roads #50114 and #50039, Forest Highway 8 and Trail #5096; also causing damage to a powerline, a transmountain water diversion system, Ephraim City's culinary water system, irrigation canals, farmlands, and Highway U.S. 89, and several county roads. In addition, stream channels, banks, and fish habitat were damaged. Possible damage to a ¼ corner monument and one mile of property line has occurred.

Property Endangered

Facilities and property which will continue to be impacted if flood control measures, debris removal, and channel rehabilitation is not accomplished in the near term, include Ephraim City, a culinary water system, an irrigation system, a hydroelectric power plant, Highway U.S. 89, and U-29, the Transmountain Water Diversion System, New Canyon Reservoir, Forest Highway 8, farmlands, the Denver Rio Grande Railroad, Forest Development Roads #50114 and #50039, and a U.S.G.S. gaging station.

Recommended Treatment with Section 403 Funds

Sediment control measures including grass seeding and willow planting are necessary to control accelerated sedimentation over the near term.

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Site 1	30 acres	$27/acre	$ 810
Willow Planting	Sites 1&2	3 miles	$1,500/mi.	$4,500
TOTAL				$5,310

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Ephraim City	
Residential	$ 210,000
Hydro. Power Plant	$ 250,000
Culinary Water System	$ 200,000
Streets	$ 25,000
U.S. Highway 89	$ 70,000
Utah Highway 29	$ 70,000
Denver Rio Grande Railroad	$ 70,000
Irrigation System and Reservoir	$ 500,000
Transmountain Water Diversion	$ 40,000
Forest Highway 8 & Roads #50114 & #50039	$ 39,000
Farmlands	$ 150,000
TOTAL	$1,624,000

Because the Ephraim Canyon Landslides are on 80% slopes and because they are deep landslides, the probability of near term damage is 100%.

The investment of $5,310 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 305.0:1

Recommended Treatment: Forest Management Programs

Road repairs are necessary to maintain access through the main Ephraim Canyon and New Canyon corridors. The White Ledge-Hell Hole road and trail will need partial reconstruction. Special use assessments will be necessary on the trans-mountain water diversion and Forest Highway #8. Partial rehabilitation of fish habitat will also be necessary to restore lost productivity.

Treatment	Location	Quantity	Unit Cost	Total Cost
Road Repair	Sites 1&2	2.7 miles	$130,000/mi.	$351,000
Fisheries Habitat Rehab.	Sites 1&2	5.1 miles	$ 13,000/mi.	$ 66,300
Trail Repair	Site 2	0.25 mile	$ 20,000/mi.	$ 5,000
Special Use Assessment	Site 2	2 each	$ 5,000/ea.	$ 10,000
Re-Establish ¼ Corner	Site 2	1 each	$ 5,000/ea.	$ 5,000
Re-Establish Boundary	Site 2	1 mile	$ 10,000/mi.	$ 10,000
TOTAL				$447,300

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program nor the Forest Management Programs alone will fully protect downstream values.

R4E I R5E

R5E I R6E

T15S
T16S
T16S
T17S
T17S
T18S

INCIDENT # 17
KNOB MOUNTAIN

● ④ ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

Incident #17 Knob Mountain

Project: Oak Creek/Spring City

Location

Manti-LaSal National Forest
Ranger District: Sanpete
County: Sanpete

Treatment Sites

Site #1: Oak Creek/Spring City

Description of Impairment

A landslide is blocking the main Oak Creek channel. The landslide filled the channel with debris and large rocks. In addition, highwater flow, created by landslide, caused considerable downstream damage.

Property Endangered

Streets in Spring City, an irrigation system, a culinary water system, U.S. Highway 89, Forest Development Road #50036, farmlands, the power plant aqueduct, and a U.S.G.S. gaging station will continue to be impacted if sediment control measures, channel clearing, and debris/slide removal are not accomplished.

Recommended Treatment: With Section 403 Funds

Channel clearing and debris jam/slide removal are necessary to protect downstream facilities and property from further damage in the near term. In addition, erosion control measures and revegetation are necessary.

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	100 ac.	$27/ac.	$ 2,700
Willow Planting	3.5 mi.	$1,500/mi.	$ 5,250
Debris Jam	5 D.J.'s	$2,000/D.J.	$10,000
Slide Removal	1 sl.	$5,000/sl.	$ 5,000
Channel Clearing	0.5 mi.	$2,500/mi.	$ 1,250
TOTAL			$24,200

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Irrigation System	$ 30,000
Culinary Water System, Spring City	$ 10,000
U.S. Highway 89	$ 10,000
Forest Development Road #50036	$ 40,000
Farmlands	$ 20,000
Power Plant Aqueduct	$ 10,000
Spring City Streets	$ 30,000
U.S.G.S. Gaging Station	$ 10,000
TOTAL	$160,000

Because Oak Creek is a 4th order stream, blocked 100% by debris jams, the probability of near term damage is 100%.

The investment of $24,200 would help protect the facilities and property listed above.

403 Benefit-Cost Ratio = 6.2 : 1

Recommended Treatment: Forest Management Program

Some road repair is necessary to maintain access through this canyon. Channel clearing will be necessary to remove remaining channel debris. Fish habitat rehabilitation is necessary to restore habitat diversity to pre-1983 productivity levels.

Treatment	Quantity	Unit Cost	Total Cost
Road Repair	0.1 mi.	$20,000/mi.	$ 2,000
Fisheries Habitat Rehab.	5.5 mi.	$25,843/mi.	$142,136
Channel Clearing	.5 mi.	$2,500/mi.	$ 1,250
TOTAL			$145,386

Economic Defensibility: Forest Management Program

Several of the treatments recommended under the Forest Management Program will also protect the itemized downstream values shown in the 403 program. However, many of the Forest Management Programs protect and restore only those resources and uses within the National Forest. Neither the treatments recommended under the 403 program, nor the Forest Management Programs alone will fully protect downstream values.

R23E | R24E R24E R25E

R25S
R26S
R26S
R27S
R27S
R28S
R28S
R29S

PARALLEL SOUTH

GRAND SAN JUAN

INCIDENT # 18
MOAB

④ STREAM CHANNEL DAMAGE CLASS

$_2$ AREAS OF MASS MOVEMENT

Oowah Lake Dam Nearly Overtopped

Oowah Lake Dam Spillway Damaged by Landslide

Incident #18 Moab
Project: Oowah Lake

Location

Manti-LaSal National Forest
Ranger District: Moab
County: Grand

Treatment Sites

Site #1: Oowah Lake

Description of Impairment

Several landslides, one of which moved directly on the Oowah Lake Dam, damaged the spillway. High water flows over the spillway severely damaged 1½ miles of road and the Oowah Lake campground parking area. The damaged road resulted in the campground being inaccessible. The stream channel below the dam was also severely damaged.

Property Endangered

An irrigation system diversion works is the only endangered downstream facility that could be damaged from high flows.

Recommended Treatment: Forest Management Programs

Complete road repair and replacement of large culverts is necessary to restore access into Oowah Lake Recreation Area. Channel modification is also necessary to restore the channel and the road. The campground facilities and Oowah Lake spillway will have to be repaired. A landslide will have to be removed from the top of the Oowah Lake Dam. Channel clearing of scattered debris will be necessary to prevent further downstream damage to the irrigation diversion works. The facilities at the Oowah Lake Recreation Area will have to be repaired. A special use assessment of the Oowah Lake Dam will also be necessary.

Treatment	Quantity	Unit Cost	Total Cost
Fisheries Habitat Rehab.	2 miles	$26,000/mi.	$ 52,000
Road Repair	1.5 miles	$78,000/mi.	$ 117,000
Large Culverts	3	$10,000/ea.	$ 30,000
Channel Clearing	.5 mile	$ 5,000/mi.	$ 2,500
Channel Modification	.5 mile	$ 8,000/mi.	$ 4,000
Special Use Assessment	1 Assessment	$ 5,000/ea.	$ 5,000
Campground Repair	2 units	$10,000/ea.	$ 20,000
Slide Removal	1 slide	$ 5,000/sl.	$ 5,000
TOTAL			$ 235,500

Defensibility: Forest Management Program/Resource Cost of No Action

The treatments recommended under the Forest Management Program will protect and restore most of the recent uses and activities within the National Forest. In addition, in many cases benefits will be realized to other downstream resources and values. Soil loss and reduced site productivity will occur if treatment is not implemented.

IX. SUMMARY TABLES

FOREST MANAGEMENT PROGRAM

FOREST MANAGEMENT PROGRAM

	Road Relocation		Re-establish Forest Boundary		Road Repair		Major Stream Crossing		Trails		Range Rehabilitation		Fisheries Habitat Rehabilitation		Campground Rehabilitation		Special Use Assessment		Grass Seeding		Willow Planting		Channel Clearance		Watershed Rehabilitation		
COUNTY	Miles	Cost	Miles & Corner	Cost	Miles	Cost	Quantity	Cost	Miles	Cost	Miles	Cost	Miles	Cost	Quantity	Cost	Quantity	Cost	Acres	Cost	Miles	Cost	Miles	Cost	Acres	Cost	Total Costs
Carbon	---	---	---	---	0.7	35,760	---	---	---	---	---	---	1.3	22,967	---	---	1	5,000	28	756	---	---	1.0	3,500	10	1,000	68,983
Emery	---	---	---	---	0.5	20,900	---	---	0.1	2,000	---	---	18.2	256,529	1 (Water Sys.)	40,000	2	10,000	10	270	---	---	0.8	4,000	---	---	333,699
Grand	---	---	---	---	1.5	117,000	3	30,000	---	---	---	---	2.0	52,000	1	25,000	1	5,000	---	---	---	---	0.5 (incl. channel modifi.)	6,500	---	---	235,500
Juab	---	---	---	---	9.4	733,200	5	200,000	---	---	---	---	8.4	389,998	1 (Gabion & Water Sys.)	85,000	2	10,000	19	513	---	---	3.85	9,625	50	4,500	1,432,836
Sanpete	12.5	1,614,100	1	15,000	8.5	1,327,100	6	220,000	5.15 (incl. 5 bridges)	178,000 (75,000)	19.0 (incl. 2 cat.gd.)	104,000	54.5	1,377,135	1 (Total Replace)	430,000	9	45,000	310	8,370	7.0	10,500	22.30	73,250	80	7,200	3,409,655
Utah	1.5	117,000	---	---	6.1	465,400	2	80,000	0.1	2,000	1.0	8,000	8.4	145,320	---	---	1	5,000	18	486	---	---	4.0	10,000	---	---	833,206
Totals	14.0	1,731,100	1	15,000	26.7	2,699,360	16	530,000	5.35	182,000	20.0	112,000	92.8	2,243,949	4	580,000	16	80,000	385	10,395	7.0	10,500	32.45	106,875	140	12,700	8,313,879
Ranger District																											
D-1 Sanpete	14.0	1,731,100	1	15,000	17.3	2,034,100	10	400,000	5.15 (incl. 5 bridges)	178,000 (75,000)	19.0 (incl. 2 cat.gd.)	104,000	60.4	1,723,800	2 (Total Replace, Gabions, Water Sys.)	515,000	9	45,000	60	1,620	---	---	25.15	62,875	130	11,700	6,822,195
D-2 Ferron	---	---	---	---	0.2	8,000	---	---	---	---	---	---	2.5	43,333	---	---	2	10,000	267	7,209	7.0	10,500	3.0	25,000	---	---	104,042
D-3 Price	---	---	---	---	7.7	540,260	3	100,000	0.2	4,000	1.0	8,000	27.9	424,816	1	40,000	4	20,000	58	1,566	---	---	3.8	12,500	10	1,000	1,132,142
D-4 Moab	---	---	---	---	1.5	117,000	3	30,000	---	---	---	---	2.0	52,000	1	25,000	1	5,000	---	---	---	---	0.5	6,500	---	---	235,500
Totals	14.0	1,731,100	1	15,000	26.7	2,699,360	16	530,000	5.35	182,000	20.0	112,000	92.8	2,243,949	4	580,000	16	80,000	385	10,395	7.0	10,500	32.45	106,875	140	12,700	8,313,879

FOREST MANAGEMENT PROGRAM

#	Incident	Road Relocation		Re-establish Forest Boundary		Road Repair		Major Stream Crossing		Trails		Range Rehabilitation (Fences/Cattleguards)	
		Miles	Cost	Miles	Cost	Miles	Cost	Quantity	Cost	Miles	Cost	Miles	Cost
1	West San Pitch	---	---	---	---	9.4	733,200	5	200,000	---	---	---	---
2	East San Pitch	---	---	---	---	2.3	666,500	---	---	---	---	---	---
3	Lake Fork	---	---	---	---	6.0	461,400	2	80,000	0.1	2,000	1	8,000
4	Thistle Creek	1.5	117,000	---	---	0.1	4,000	---	---	---	---	---	---
5	Fairview Canyon	---	---	---	---	---	---	---	---	0.4	8,000	---	---
6	Fish Creek	---	---	---	---	---	---	---	---	---	---	---	---
7	Monument Peak	---	---	---	---	0.7	35,760	---	---	---	---	---	---
8	Huntington Canyon	---	---	---	---	0.5	20,900	---	---	0.1	2,000	---	---
9	Scad Valley	---	---	---	---	0.4	18,200	1	20,000	---	---	---	---
10	Seely Creek/ Joe's Valley	---	---	---	---	0.1	5,000	---	---	---	---	---	---
11	Ferron Canyon	---	---	---	---	0.1	3,000	---	---	---	---	2	16,000
12	Muddy Creek	---	---	---	---	---	---	---	---	---	---	2	20,000
13	Twelve Mile Creek	8.3	1,286,500	---	---	0.7	53,200	3	120,000	4.5 (+5 bridges)	165,000	14 (+2 cat.gd.)	60,000
14	Six Mile	4.2	327,600	---	---	1.4	109,200	2	80,000	---	---	---	---
15	Manti Canyon	---	---	---	---	0.7	119,000	---	---	---	---	---	---
16	Ephraim Canyon	---	---	1	15,000	2.7	351,000	---	---	0.25	5,000	1	3,000
17	Knob Mountain	---	---	---	---	0.1	2,000	---	---	---	---	---	---
18	Moab	---	---	---	---	1.5	117,000	3	30,000	---	---	---	---
	TOTAL												

FOREST MANAGEMENT PROGRAM

#	Incident	Fisheries Habitat Rehabilitation		Campground Rehabilitation		Special Use Assessment		Grass Seeding		Willow Planting		Channel Clearance		Watershed Rehabilitation		TOTALS
		Miles	Cost	Quantity	Cost	Quantity	Cost	Acres	Cost	Miles	Cost	Miles	Cost	Acres	Cost	
1	West San Pitch	8.4	389,998	Water System + Gabion	85,000	2	10,000	19	513	---	---	3.85	9,625	50	4,500	1,432,836
2	East San Pitch	---	---	---	---	---	---	36	972	---	---	---	---	---	---	667,472
3	Lake Fork	8.4	145,320	---	---	---	---	14	378	---	---	2.0	5,000	---	---	702,098
4	Thistle Creek	---	---	---	---	1	5,000	---	---	---	---	5.8	14,500	---	---	140,500
5	Fairview Canyon	10.1	300,367	---	---	3	15,000	---	---	---	---	5.9	14,750	80	7,200	345,317
6	Fish Creek	1.0	15,167	---	---	---	---	23	621	---	---	0.6	1,500	10	1,000	18,288
7	Monument Peak	0.3	7,800	---	---	1	5,000	9	243	---	---	0.4	2,000	---	---	50,803
8	Huntington Canyon	18.2	236,529	1 Water System	40,000	2	10,000	10	270	---	---	0.8	4,000	---	---	333,699
9	Scad Valley	---	---	---	---	---	---	2	54	---	---	---	---	---	---	38,254
10	Seely Creek/ Joe's Valley	2.5	43,333	---	---	---	---	19	513	4	6,000	---	---	---	---	54,846
11	Ferron Canyon	---	---	---	---	---	---	65	1,755	---	---	---	---	---	---	20,755
12	Muddy Creek	---	---	---	---	2	10,000	183	4,941	3	4,500	3.0	25,000	---	---	64,441
13	Twelve Mile Creek	15.3	489,600	1	430,000	1	5,000	---	---	---	---	8.0	20,000	---	---	2,629,300
14	Six Mile	9.4	199,769	---	---	1	5,000	5	135	---	---	0.5	1,250	---	---	722,954
15	Manti Canyon	6.6	135,630	---	---	---	---	---	---	---	---	0.6	1,500	---	---	256,130
16	Ephraim Canyon	5.1	66,300	---	---	2	10,000	---	---	---	---	---	---	---	---	455,300
17	Knob Mountain	5.5	142,136	---	---	---	---	---	---	---	---	0.5	1,250	---	---	145,386
18	Moab	2.0	52,000	1	25,000	1	5,000	---	---	---	---	0.5	6,500	---	---	235,500
	TOTAL															8,313,879

SECTION 403

County	Willow Planting Qunatity Miles	Acres	Cost	Debris Jam/ Slide Removal Quantity D.J.'s	Slides	Cost	Channel Clearing Miles	Cost	Grass Seeding Acres	Cost	Gabions and Channel Structures Feet	Cost	Channel Modification Miles	Cost	TOTAL
Carbon	1.3	---	1,950	---	---	---	0.6	1,500	50	1,350	---	---	---	---	4,800
Emery	5.0	---	7,500	---	---	---	0.8	2,000	10	270	40	2,000	---	---	11,770
Grand	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Juab	8.5	32.5	35,175	17	3	49,000	3.85	9,625	132	3,564	4,920	246,000	0.9	7,200	350,564
Sanpete	37.75	13.0	65,595	89	4	198,000	17.85	46,000	975	26,325	1,100	55,000	1.2	9,600	400,520
Utah	8.5	---	12,750	14	---	28,000	6.0	15,000	67	1,809	(2 structures)	100,000	2.0	16,000	173,559
TOTALS	61.05	45.5	122,970	120	7	275,000	29.1	74,125	1,234	33,318	6,060 (+2 structures)	403,000	4.1	32,800	941,213
Ranger Districts															
D-1 Sanpete	50.75	45.5	107,520	108	7	251,000	25.4	64,125	1,107	29,889	6,020 (+2 structures)	401,000	4.1	32,800	886,334
D-2 Ferron	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
D-3 Price	10.3	---	15,450	12	---	24,000	3.7	10,000	127	3,429	40	2,000	---	---	54,879
D-4 Moab	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTALS	61.05	45,5	122,970	120	7	275,000	29.1	74,125	1,234	33,318	6,060 (+2 structures)	403,000	4.1	32,800	941,213

	Incident	Willow Planting Quantity Miles	Acres	Cost	Debris Jam/ Slide Removal Quantity D.J.'s	Slides	Cost	Channel Clearing Miles	Cost	Grass Seeding Acres	Cost	Gabions and Channel Structures Feet	Cost	Channel Modification Miles	Cost	TOTAL
1	West San Pitch	8.5	32.5	35,175	17	3	49,000	3.85	9,625	132	3,564	4,920	246,000	0.9	7,200	350,564
2	East San Pitch	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3	Lake Fork	4.0	---	6,000	12	---	24,000	2.0	5,000	50	1,350	---	---	---	---	36,350
4	Thistle Creek	8.5	---	12,750	4	---	8,000	6.1	16,000	102	2,754	(2 structures)	100,000	2.0	16,000	155,504
5	Fairview Canyon	11.0	13.0	25,470	13	---	26,000	5.9	14,750	230	6,210	---	---	---	---	72,430
6	Fish Creek	1.0	---	1,500	---	---	---	0.6	1,500	10	270	---	---	---	---	3,270
7	Monument Peak	0.3	---	450	---	---	---	---	---	40	1,080	---	---	---	---	1,530
8	Huntington Canyon	5.0	---	7,500	---	---	---	0.8	2,000	10	270	40	2,000	---	---	11,770
9	Scad Valley	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
10	Seely Creek	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
11	Ferron Canyon	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12	Muddy Creek	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13	Twelve Mile Creek	4.0	---	6,000	63	3	141,000	8.0	20,000	400	10,800	900	45,000	1.0	8,000	230,800
14	Six Mile	5.25	---	7,875	---	---	---	0.75	2,500	30	810	200	10,000	0.2	1,600	22,785
15	Manti Canyon	7.0	---	10,500	6	---	12,000	0.6	1,500	---	---	---	---	---	---	24,000
16	Ephraim Canyon	3.0	---	4,500	---	---	---	---	---	130	3,510	---	---	---	---	8,010
17	Knob Mountain	3.5	---	5,250	5	1	15,000	0.5	1,250	100	2,700	---	---	---	---	24,200
18	Moab	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	TOTAL	61.05	45.5	122,970	120	7	275,000	29.1	74,125	1,234	33,318	6,060 (2 structuures)	403,000	4.1	32,800	941,213

TOTAL PROGRAM 403 & FOREST MANAGEMENT PROGRAM

By County & Ranger District

County	403	Forest Management Program	Total
Carbon	4,800	68,983	73,783
Emery	11,770	333,699	345,469
Grand	--	235,500	235,500
Juab	350,564	1,432,836	1,783,400
Sanpete	400,520	5,409,655	5,810,175
Utah	173,559	833,206	9,255,092
Ranger District			
D-1 Sanpete	886,334	6,822,195	7,708,529
D-2 Ferron	--	104,042	104,042
D-3 Price	54,879	1,152,142	1,207,021
D-4 Moab	--	235,500	235,500
TOTAL	941,213	8,313,879	9,255,092

TOTAL PROGRAM 403 & FOREST MANAGEMENT PROGRAM

By Incident Area

No.	Incident	403	Forest Management Program	Total
1	West San Pitch	350,564	1,432,836	1,783,400
2	East San Pitch	--	667,472	667,472
3	Lake Fork	36,350	702,098	738,448
4	Thistle Creek	155,504	140,500	296,004
5	Fairview Canyon	72,430	345,317	417,747
6	Fish Creek	3,270	18,288	21,558
7	Monument Peak	1,530	50,803	52,333
8	Huntington Creek	11,770	333,699	345,469
9	Scad Valley	--	38,254	38,254
10	Seely Cr/Joe's Valley	--	54,846	54,846
11	Ferron Canyon	--	20,755	20,755
12	Muddy Creek	--	64,441	64,441
13	Twelve Mile Creek	230,800	2,629,300	2,860,100
14	Six Mile	22,785	722,954	745,739
15	Manti Canyon	24,000	256,130	280,130
16	Ephraim Canyon	8,010	455,300	463,310
17	Know Mountain	24,200	145,386	169,586
18	Moab	--	235,500	235,500
	TOTAL	941,213	8,313,879	9,255,092

X. Priorities

The projects have been identified as areas. Within each area, several types of treatments are recommended--both under 403 funding and under Forest Management Program funding. By area it is difficult to set priorities because it is difficult to say that life and property in Mayfield is worth more than life and property in Fairview or Levan.

An attempt to classify the areas is attached. The Damage Assessment Team rated each project under the 403 categories. The Hydrologist rated flood hazards and the potential for additional debris flows. The Geologist provided a geologic hazard rating. The ratings are incomplete.

If the treatments are rated, the debris jam removal and channel clearing provides a reduction of an immediate threat. Grass seeding provides quick cover to reduce erosion. Willow planting provides better erosion and sediment control in a relatively short time.

Since we are required to choose, the following priorities are itemized.

Table 13: Priorities for Funding

Treatment	Project	403	P&M	FR&T
Road Relocation & Repair	Emergency Access			X
Immediate Grass Seeding	All Projects	25,500		
Debris Jam Removal and Channel Clearing	Twelve Mile/South Fork/ Twin Lakes	20,000	141,000	
	Chicken Cr./Pigeon Cr./ Levan	9,000	44,000	
	Fairview Canyon	2,500	12,000	
Check Dam Construction	Little Clear Creek/Rock/ Thistle	100,000		
Fall Grass Seeding	All Projects	7,818	10,395	
Willow Planting	All 403 Projects	122,970		
Debris Jam Removal and Channel Clearing	All Remaining Projects	317,625	106,875	
Special Use Assessments	All Projects		80,000	
Range Improvements	All Projects		112,000	
Willow Planting	All Remaining Projects		10,500	
Channel Modification	All Projects	32,800		
Water System Replacement	All Projects		40,000	
Watershed Improvements Repair	All Projects		12,700	
Campgrounds & Recreation Facilities	All Projects		455,000	
Fisheries Rehabilitation	All Projects		2,243,949	
Trails	All Projects		17,000	

Table 14: Priorities for Funding: ERFO $ (Preliminary Estimate)

Emergency Access

Maple Canyon Road (FDR #50066)	$ 602,000
Chicken Creek Road (FDR #50101)	$ 308,000
Lake Fork-Indianola Road (FDR #50070)	$ 626,000
Ferron-Mayfield Road (FDR #50022)	$ 1,260,000
All Remaining Roads	$ 2,180,000
TOTAL	$ 4,976,000

XI. CONCLUSION

Major areas on the Manti-LaSal National Forest have received severe damage from landslides, mud flows, and abnormally high flood waters during the spring and summer of 1983. A total of $9,256,000 is needed through various funding programs to repair damages and protect remaining facilities and resources. The impaired watershed should be repaired or ameliorated immediately before thunderstorms and spring snowmelt can mobilize a destructive flood force on the impaired watershed. To assist in relieving this eminent hazard $942,000 is requested for the Manti-LaSal National Forest under Section 403 for Emergency Watershed Protection.

Additional Team Recommendations

Land Management

Develop standards, guidelines, and prescriptions for managing resources in landslide areas.

A program should be implemented to continue monitoring known landslides; to refine the identification of unstable slopes; to develop predictions of future landslide activity; and to identify flood hazards.

Monitoring

A monitoring program should include stream channel meandering, and streamwater quality. Monitoring programs should be implemented to followup the proposed rehabilitation treatments. The programs should include monitoring revegetation, fish habitat improvement and standing crop, and channel debris.

Studies and Research

Determine the effects landslides have on site productivity for various resources.

Develop detailed maps and analyses of the geologic conditions and processes that generated these landslides.

Determine and describe the hydrologic event. Determine the frequency of the snowpack by months, of precipitation amounts, of the delayed melts, and of flood flows.

XII. Investigation Team Members

Ben Black, District Ranger, Sanpete Ranger District

Ira Hatch, District Ranger, Price Ranger District

John Niebergall, District Ranger, Ferron Ranger District

Raymon Carling, District Ranger, Moab Ranger District

Dennis Kelly, Team Leader, Hydrologist

Alvin Galbraith, Hydrologist

Alan Gallegos, Geologist

Jim Duncan, Engineer, P.E.

Ed Carlson, Engineering Technician

Ted Fitzgerald, Engineer, P.E.

Al Mills, Fisheries Biologist

Bob Thompson, Range Conservationist

Kim Young, Draftsperson

MANTI-LASAL NATIONAL FOREST
(MANTI DIVISION)
UTAH
SALT LAKE AND UINTA SPECIAL MERIDIANS
1964

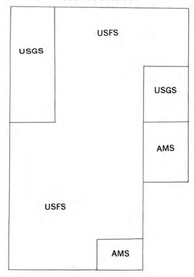
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
EDWARD P. CLIFF, CHIEF

Scale 0 ½ 1 2 3 4 5 6 Miles

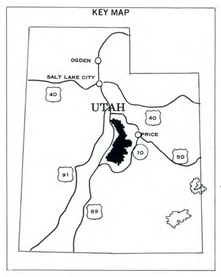
LEGEND

- National Forest Boundary
- Adjacent National Forest Boundary
- Paved Road
- All Weather Road
- Dirt Road
- Primitive Road
- 92 U.S. Highway
- 11 State Highway
- 169 Forest Route (Prefix numbers are not shown.)
- 099 Trail (Prefix numbers are not shown.)
- Mine, Quarry or Gravel Pit
- Railroad
- Power Transmission Line
- Forest Supervisors Headquarters
- District Ranger Station
- Fireman Station
- Permanent Lookout Station
- Horizontal Control Station
- Horizontal Control Station and Permanent Lookout Station
- Recreation Site
- House, Cabin, or Other Building
- National Forest Land

SOURCE DIAGRAM



KEY MAP



MOAB RANGER DISTRICT

LEGEND

- AREAS OF MASS MOVEMENT
- STREAM CHANNEL DAMAGE CLASSES 1 & 2
- STREAM CHANNEL DAMAGE CLASSES 3 & 4
- MINOR ROAD DAMAGE LESS THAN $50,000
- MODERATE ROAD DAMAGE $50,000 – $200,000
- MAJOR ROAD DAMAGE OVER $200,000
- STATE HIGHWAY DAMAGE
- PIPELINE DAMAGE WATER & GAS
- SPOT DAMAGE STATE HIGHWAY

7/22/83
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FLOODING & LANDSLIDE DAMAGES

SPRING & SUMMER 1983

FOREST SERVICE MAP CLASS C

Compiled at Regional Office, Ogden, Utah, 1964, from U.S. Forest S
U.S. Geological Survey quadrangles, and U.S. Army Map Service To

FOREST SERVICE MAP CLASS C

Compiled at Regional Office, Ogden, Utah, 1964, from U.S. Forest Service Planimetric Maps, U.S. Geological Survey quadrangles, and U.S. Army Map Service Topographic maps.

LAND LINE SYMBOLIZATION

Solid lines indicate surveyed land lines which are positioned within the limits of accuracy, for class C maps.
Long dash lines indicate surveyed land lines which may not be positioned within the limits of accuracy.
Short dash lines indicate B.L.M. protracted plan of survey in unsurveyed areas.

Polyconic Projection 1927 North American Datum

Longitude West from Greenwich

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