EMERGENCY WATERSHED PROTECTION REPORT

Spring and Summer 1983

Manti-LaSal National Forest

Carbon, Emery, Grand, Juab, Sanpete,
and Utah Counties, Utah

EMERGENCY WATERSHED PROTECTION REPORT

Spring and Summer 1983

Manti-LaSal National Forest

Carbon, Emery, Grand, Juab, Sanpete,
and Utah Counties, Utah

United States Department of Agriculture | Forest Service | Manti-LaSal N.F.

Reply to: 2510 Watershed Surveys and Plans | Date: August 23, 1983

Subject: Amendments to Flood Damage Report and Funding Request - 1983

Regional Forester

Changes that have been made to the Emergency Watershed Protection Report also require a few amendments to the Flood Damage Report. Please make the following pen and ink changes to the Flood Damage Report:

1. Within the Recommended Treatments with Section 403 funds, where ever the term "gabion and channel structure" is used, change to riprap.

2. Within the Recommended Treatments with Section 403 funds, where ever the term "channel modification" is used, change to "streambank reshaping and revegetating."

3. Page 32, delete the third to the last line which reads "slope retention, Structure 1, $56,000/ea., $56,000."

4. Page 32, change the total to $112,435.

5. Page 50, delete two structures for $100,000.

6. Page 50, change total to $53,545.

7. Page 51, add under Treatment: 2 structures for $156,000.

The above changes require adjustment of tables on pages 123, 124, 125, 126, 127, and 128, which is not attempted.

Lee Foster

for
REED C. CHRISTENSEN
Forest Supervisor

cc: R.O. - S&WM
D-1
D-2
D-3
D-4
R. Thompson
E. Carlson
J. Duncan
R. Ottesen
D. Kelly (4 copies)
S.O. File Copy

EMERGENCY WATERSHED PROTECTION REPORT

Spring and Summer 1983

Manti-LaSal National Forest

Carbon, Emery, Grand, Juab, Sanpete, and Utah Counties, Utah

This report appraises the Emergency Watershed Protection needs on the Manti-LaSal National Forest and is a request for funds to do work that will protect life and high value property in accordance with Section 403 of the Agriculture Credit Act of 1978. The funds requested are $785,213.

The four District Conservationists of the counties have generally reviewed the damaged areas and discussed the proposed treatments. At least three of these District Conservationists agree that the treatments we are proposing are reasonable and within the conditions of Section 403. **This request was reviewed on August 8, 1983, by Ralph Mashburn and Dave Johnson of the Soil Conservation Service Portland Technical Center, Harold Brown SCS Assistant State Conservationist, Pete Stender Forest Service Regional Hydrologist, and Cliff Benoit Forest Service Region 4 Emergency Coordinator of the watershed staff. Dave Johnson conducted a further on-the-ground review of the disaster and structural recommendations on August 11, 1983. This report has been modified to incorporate the recommendations of these reviewers.**

**Added and Amended August 15, 1983.

This request is recommended for approval by:

Reed C Christensen Date 8/18/83

Reed C. Christensen, Forest Supervisor,
Manti-LaSal National Forest

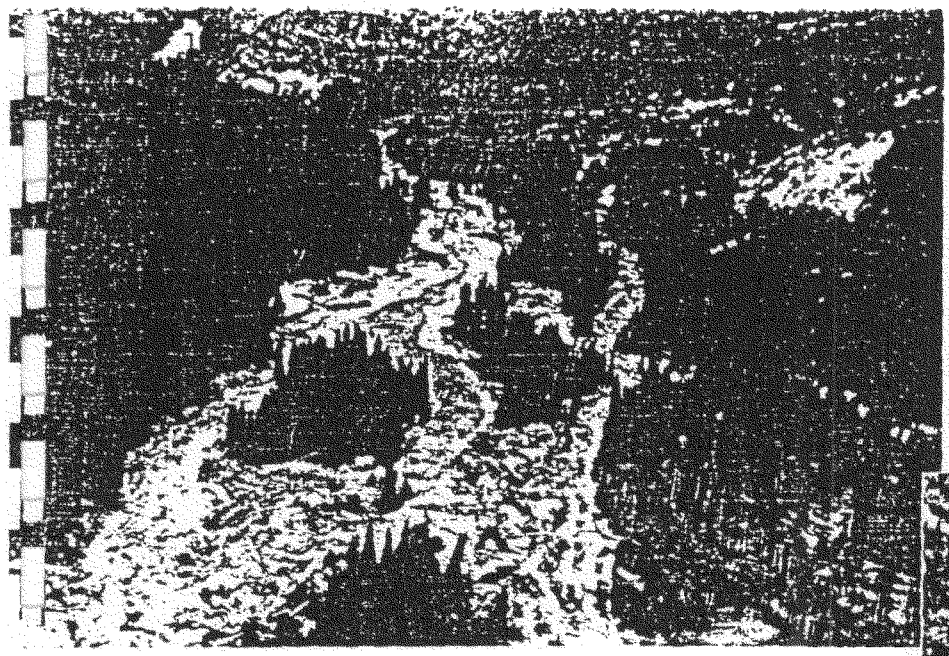
and endorsed by:

_____ Date _____

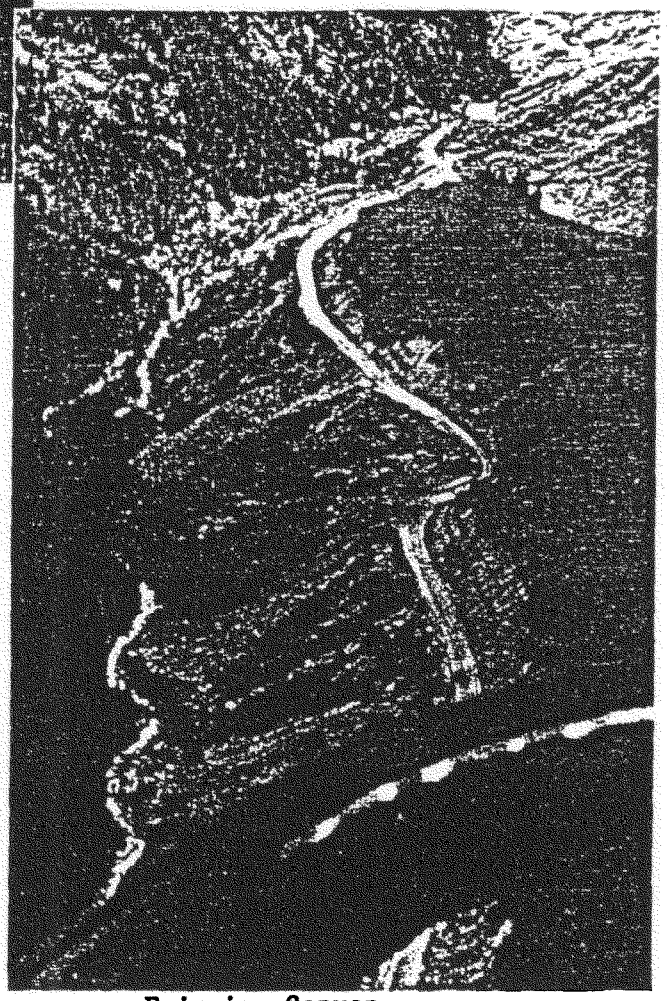
J.S. Tixier, Regional Forester, R-4, Forest Service

_____ Date _____

Francis T. Holt, State Conservationist, Utah SCS



Mudflow - Twelve Mile Canyon



Fairview Canyon

Fish Creek

Abstract

Major areas on the Manti-LaSal National Forest have received severe damages 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. 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.

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, **$785,213 is requested for the Manti-LaSal National Forest under Section 403 of the Agriculture Credit Act of 1978 for Emergency Watershed Protection.

*The total repairs needed are reported in the 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 of 1983. Manti-LaSal National Forest, August 1, 1983. These repairs are estimated to cost $9,255,092.00, of these repairs about **$785,213** or about **8½%** are requested for funding under Section 403.*

*Added August 10, 1983.
**Changed August 15, 1983.

Table 1: Priorities for Funding

Priority	Treatment	Incident	Project	403
1.	Road Relocation & Repair		Emergency Access	
2.	Immediate Grass Seeding		All Projects	25,500
3.	Debris Jam Removal and Channel Clearing	13	Twelve Mile/South Fork/Twin	161,000
		1	Lakes Chicken Cr./Pigeon Cr./	53,000
		5	Levan Fairview Canyon	40,750
4.	Fall Grass Seeding		All Projects	7,818
5.	Willow Planting	1,3,4,5,6,7,8,13,14,15,16, 17	All 403 Projects	122,970
6.	Debris Jam Removal and Channel Clearing	1,3,4,5,6,8,14,15,17	All Remaining Projects 403 Projects	94,375
7.	Channel Modification	1,4,13,14	All 403 Projects	32,800
8.	Riprap to Protect Roads and Campground	1,4,8,13,14	All 403 Projects	247,000

Amended and Added August 15, 1983

Total $785,213

TABLE OF CONTENTS

LIST OF MAPS

LIST OF TABLES

LIST OF PHOTOS

Emergency Watershed Protection Report
Spring and Summer 1983

Manti-LaSal National Forest
Carbon, Emery, Juab, Sanpete, and Utah Counties

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. 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 those recommendations for treatment that should be funded by Section 403 of the Agriculture Credit Act of 1978. A general description of the disaster event, contributing factors and damage sustained will be presented. A site specific description by incident, recommendations for treatment, and costs will also be shown for those areas that should qualify for 403 funding.

Table 2

TOTAL PROGRAM 403 & FOREST MANAGEMENT PROGRAM
By Incident Area

No.	Incident	403	Forest Management Program	Total
1	West San Pitch	**259,264**	1,432,836	**1,683,499**
2	East San Pitch	—	667,472	667,472
3	Lake Fork	36,350	702,098	738,448
4	Thistle Creek	**99,594**	140,500	240,094
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	Knov Mountain	24,200	145,386	169,586
18	Moab	--	235,500	235,500
	TOTAL	785,213	8,313,879	9,099,092

*Added August 10, 1983

**Added and Amended August 14, 1983

Seven hundred eighty-five thousand two hundred thirteen dollars ($785,213) is being requested for the Manti-LaSal National Forest under Section 403 of the Agriculture Credit Act of 1978 for Emergency Watershed Protection.

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.

**Amended August 15, 1983.

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 and San Pitch Division. 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 has not 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 and San Pitch 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 overtopped. One 24 inch gas pipeline, and one 345 KV powerline was threatened. One public land survey corner on the 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 and 2 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 3: 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
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	124	2,766	19.5	167.5	39.2

Table 4: SUMMARY OF DAMAGES BY RANGER DISTRICT

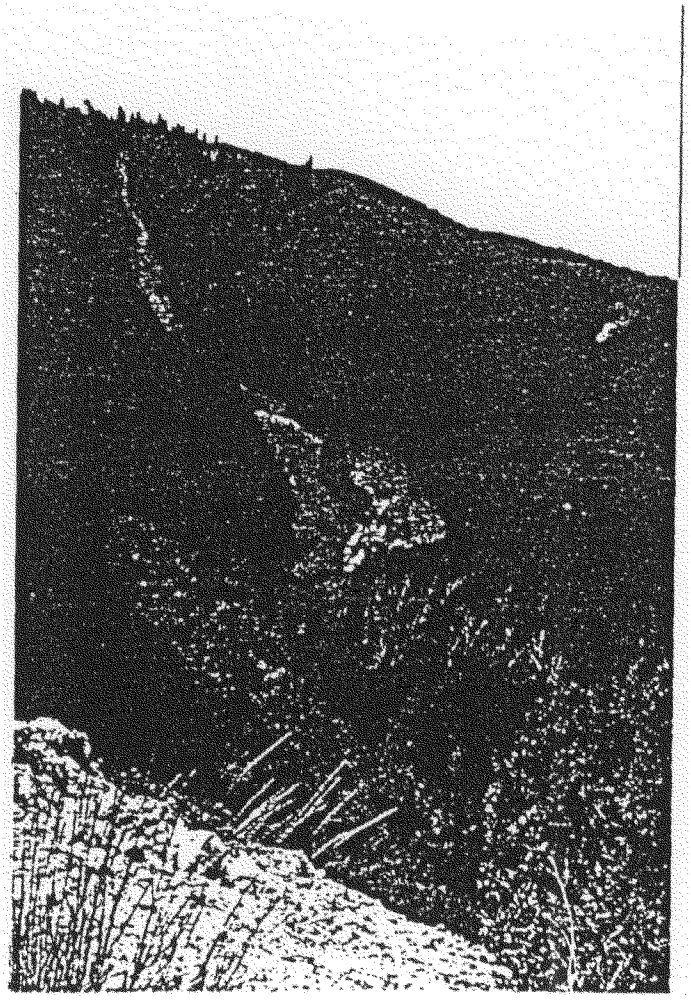
County	Mass Movements (# of slide areas)	Mass Movements (Acres)	Destroyed Fence (Miles)	Stream Damage (Miles)	Transportation System Damage (Miles)
D-1 Sanpete	88	2,068	19.0	68.3	31.3
D-2 Ferron	8	511	---	36.0	0.2
D-3 Price	28	187	1.0	63.2	7.7
Forest Totals	124	2,766	19.5	167.5	39.2

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.

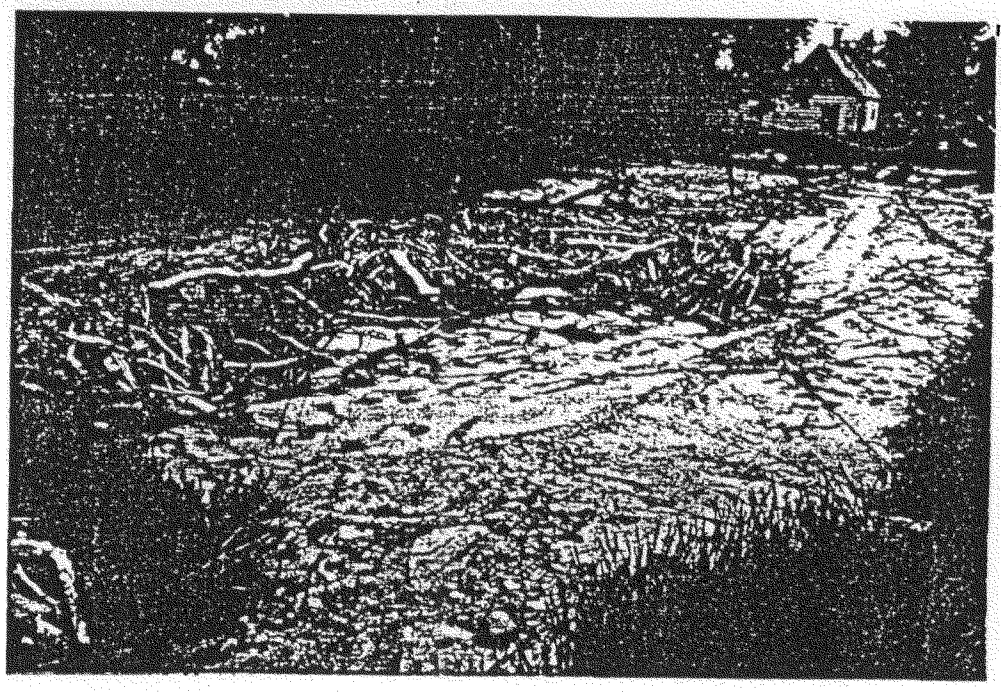
Willow planting will advance the plant succession and greatly hasten the good ground cover needed along streambanks. The willows will act as a buffer to sediments from upslope. The willowed areas provide food and cover for aquatic species.

Good Willow Planting Area in Little Clear Creek

Added August 10, 1983 (Between the arrows)

B. Debris Dams and Channel Clearing

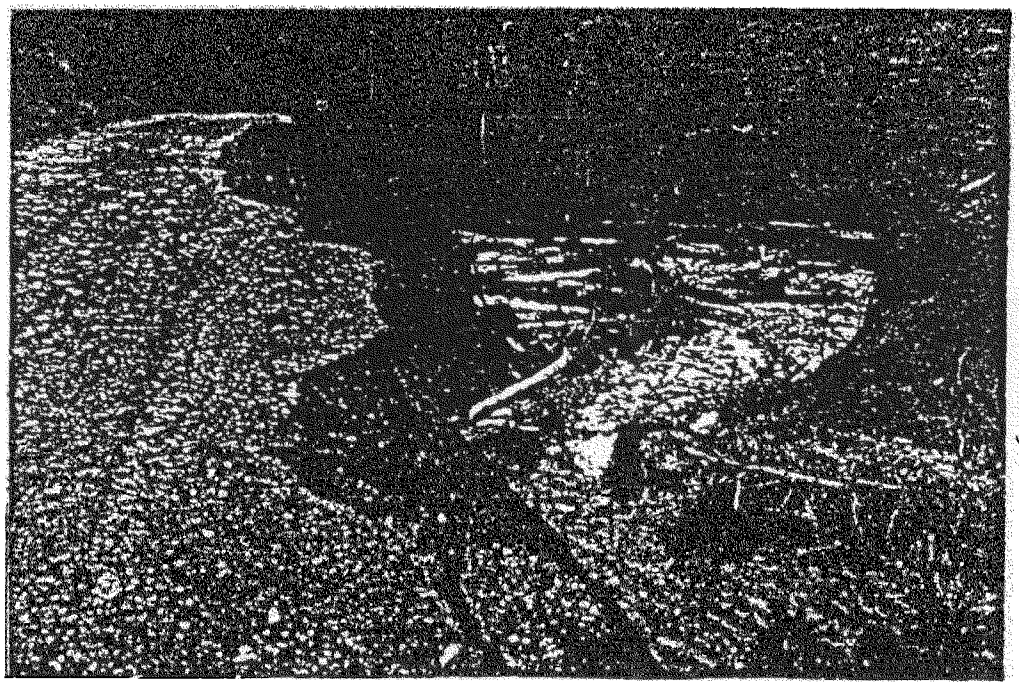
This work is classed as MIH Code F03. Large quantities of logs and smaller sized wood materials have accumulated in piles that block the stream channels. This type of debris is also often deposited in other areas along streams within the seasonal high water zone without completely blocking the stream.



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 Cleat 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. *Riprap*

This work is classed as MIH Code F03. Where streams are actively undercutting otherwise stable slopes or roads "riprap" or other channel structures may be justified. Downstream sediment damage will be reduced. Fish habitat improvement structures will also provide some of these same benefits.

D. *Bank Reshaping and Revegetation*

This work is classed as MIH Code F03. In several instances, the stream has cut new channel, 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.

**E. Slide Removal

This work is classed as MIH Code F03. In several instances small landslides have blocked small stream channels. The sediment and debris needs to be cleared from the channel to prevent a ponding, overtopping and flushing of the channel. The resulting surge of water and debris threatens downstream values.**

*Changes Added August 10, 1983
**Amended August 15, 1983

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 5. 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.

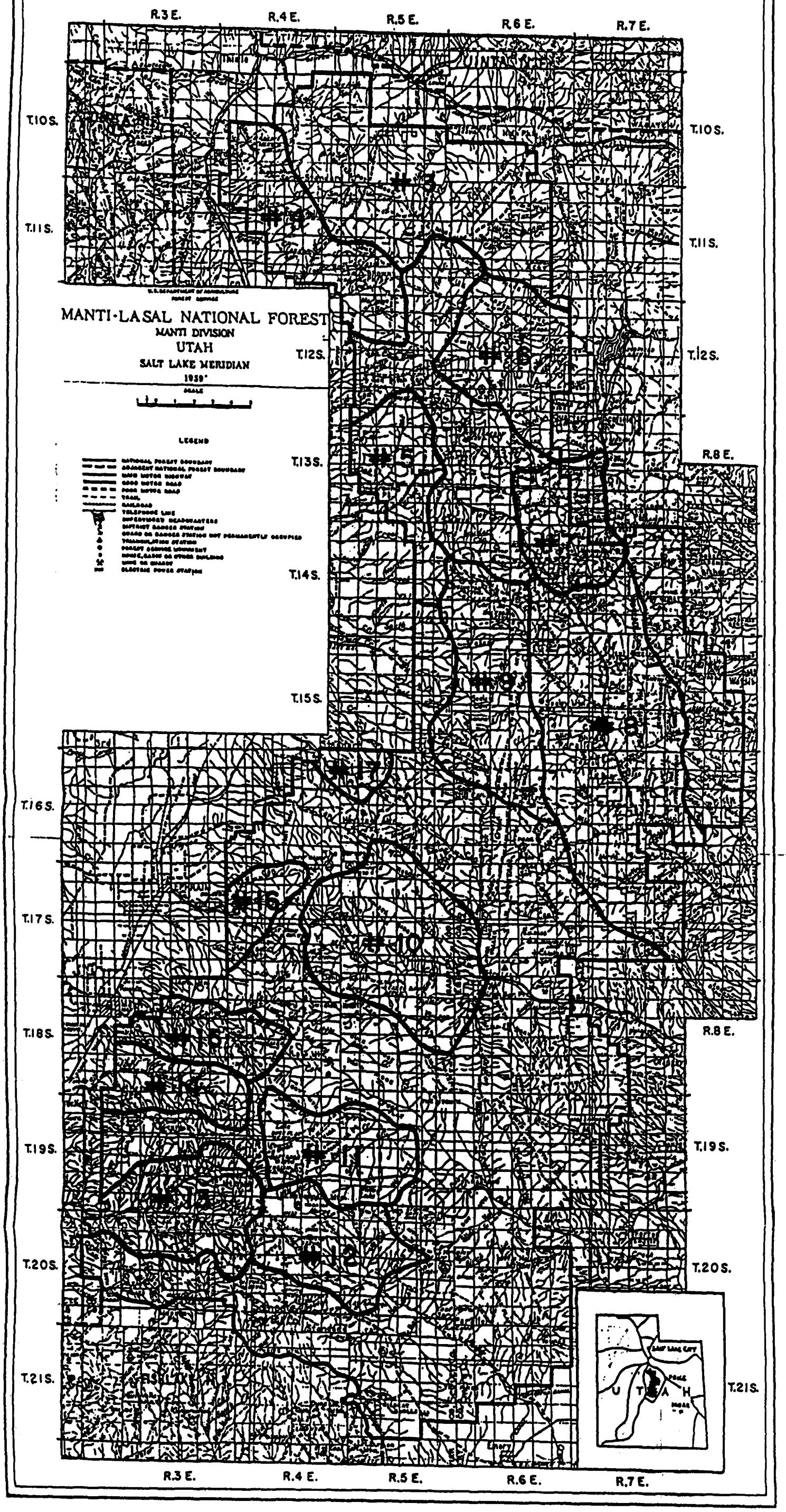
The proposed work is a reasonable attempt to reduce on-site and downstream damages. The values threatened are estimated replacement costs of the itemized values. The threat may not be a complete loss to these values. No attempt was made to estimate a percentage of loss.

*Added August 10, 1983

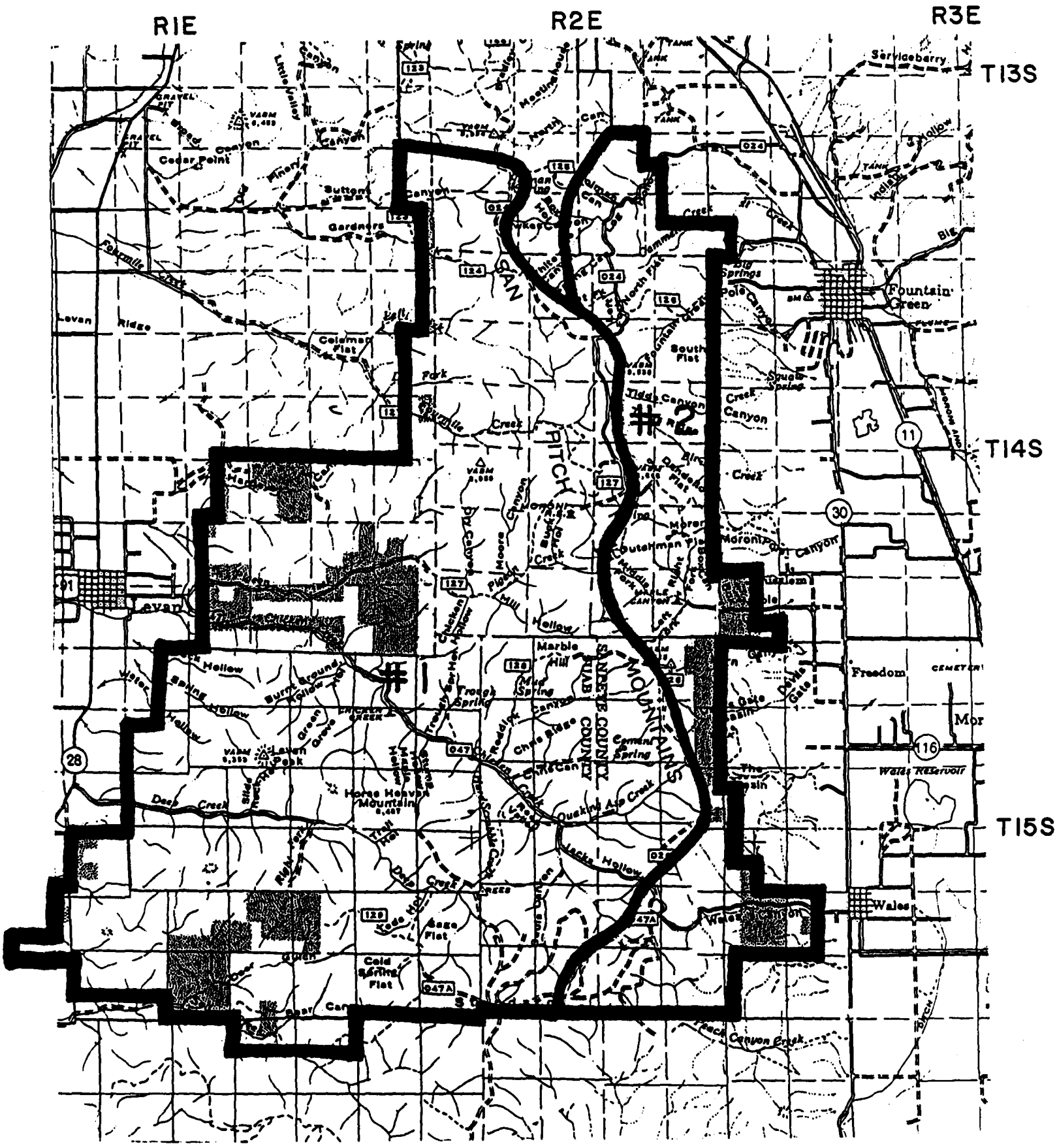
Table 5 INCIDENT AND PROJECT NAMES

Incident #	Name
1.	W. San Pitch Project - Chicken/Pigeon/Levan Project - 4 Mile/Levan Project - Deep Creek/Levan Project - Sutton's Canyon - No 403 Funds
2.	E. San Pitch - No 403 Projects
3.	Lake Fork Project - Lake Fork Project - Dairy Fork - No 403 Funds Project - Clear Creek - No 403 Funds Project - Mill Fork - No 403 Funds
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 - No 403 Funds Project - French Creek - No 403 Funds Project - Winter Quarters - No 403 Funds
7.	Monument Peak Project - Eccles Canyon Project - Mud Creek - No 403 Funds Project - Monument Peak - No 403 Funds
8.	Huntington Creek Project - Huntington Creek/Left Fork Project - Nuck Woodward - No 403 Funds Project - Crandall Canyon - No 403 Funds Project - Tie Fork Creek - No 403 Funds Project - Intex - No 403 Funds
9.	Scad Valley - No 403 Projects

Incident #	Name
10.	Seely Creek - Joe's Valley - No 403 Projects
11.	Ferron Canyon - No 403 Projects
12.	Muddy Creek - No 403 Projects
13.	Twelve Mile Creek Project - Twelve Mile/South Fork/Twin Lakes
14.	Six Mile Project - Six Mile/North Fork Project - Forbush 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/Spri ng City
18.	Moab - No 403 Projects



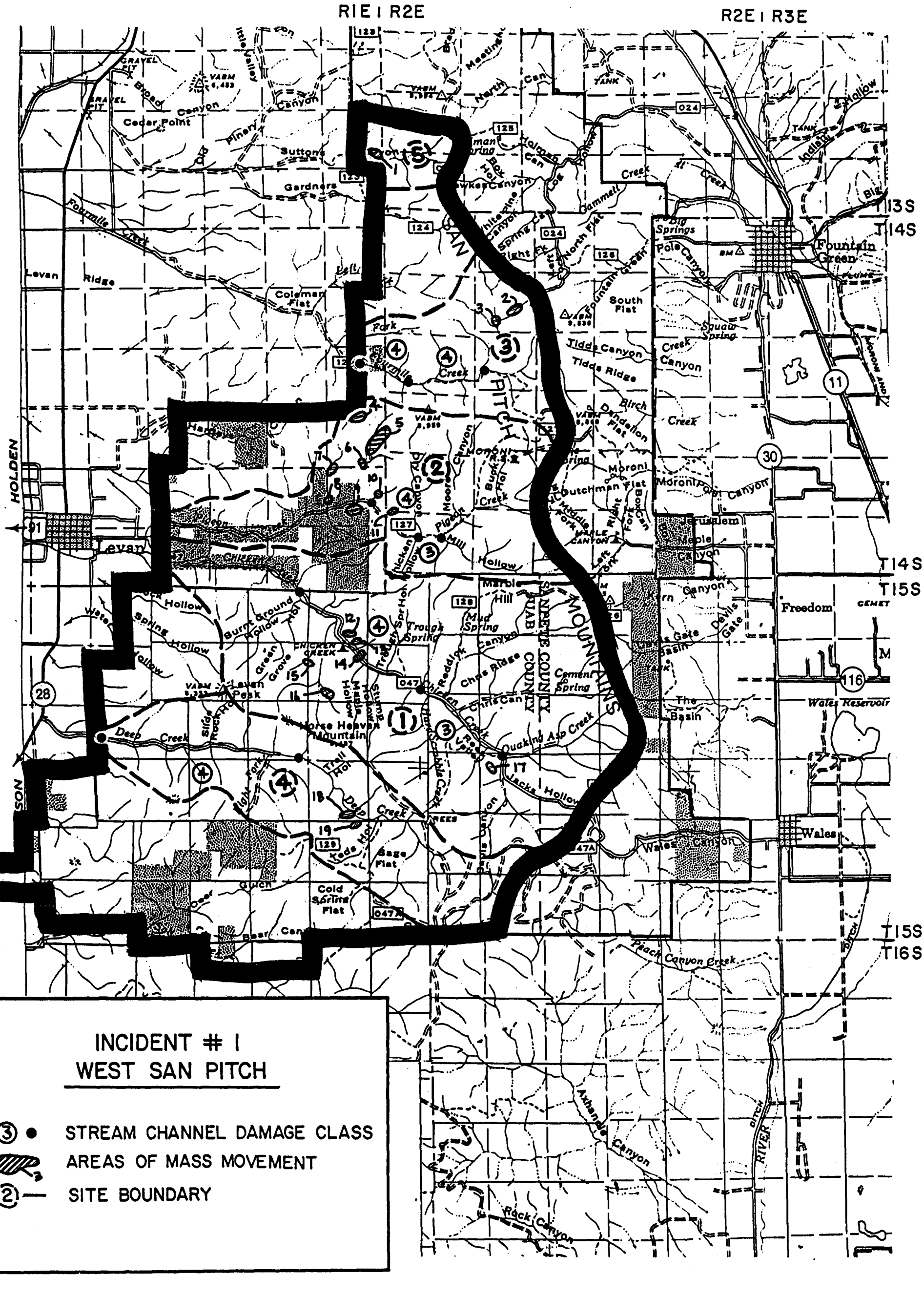
DAMAGE INCIDENT BOUNDARIES
MANTI DIVISION



DAMAGE INCIDENT BOUNDARIES
SAN PITCH DIVISION

B. Individual Project Reports

Individual Project Reports follow in the order shown on Table 5. Only those projects and incidents that contain recommendations for funding under section 403 are included.


R1E I R2E
R2E I R3E
T13S
T14S
T14S
T15S
T15S
T16S
INCIDENT # 1
WEST SAN PITCH
STREAM CHANNEL DAMAGE CLASS
AREAS OF MASS MOVEMENT
SITE BOUNDARY
SAN PITCH MOUNTAINS
SANPETE COUNTY
Gravel Pit
Broad Canyon
Cedar Point
Pinery Canyon
Sutton
Gardners
Fourmile Creek
Levan Ridge
Coleman Flat
Levan
Levan Peak
Deep Creek
Horse Heaven Mountain
Trail Hollow
Slide Rock Ridge
Burnt Ground Hollow
Spring Hollow
Green Grove
Chicken Creek
Trough Spring
Mud Spring
Marble Hill
Reddick Canyon
Chris Ridge
Cement Spring
Chris Can
Quaking Asp Creek
Jacks Hollow
Dead Creek
Sage Flat
Cold Spring Flat
Bear Canyon
Meadow Creek
North Can
Indian Hollow
Tank
Spring Can
Los Canyon
Hammell Creek
Big Springs
Pole Canyon
Fountain Green
South Flat
Squaw Spring
Tidds Canyon
Tidds Ridge
Birch Creek
Dandelion Flat
Moroni
Butchman Flat
Middle Fork
Maple Canyon
Jerusalem
Freedom
Devils Gate
The Basin
Wales Reservoir
Wales
Wales Canyon
Peach Canyon Creek
Axhandle Canyon
Rock Canyon
Sanpete River
HOLDEN
Ephraim
Manti
Mt. Pleasant
Spring City
Fairview
Wales
Gunnison
Sterling
Ephraim
Manti
Mt. Pleasant
Spring City
Fairview
Wales
Gunnison
Sterling

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 time, will need to be rechanneled, reseeded or vegetated, and in some cases, constrained by *riprap to protect the roads and campgrounds.* 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.

The removal of debris and control of erosion will reduce the threat of damage to the roads and highways, reduce the clogging of stream-road corssings, and reduce the likelihood of damaging the irrigation and culinary water collection systems.

Changes Added August 10, 1983

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
Rip Rap *	Sites 1&2	1,800 ft.	$50/ft.	$ 90,000
Bank reshaping & Revegetating. *	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.

* Changes Added August 10, 1983

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.

Channel clearance will need to be performed to decrease impacts of debris that may clog and damage the highway crossing and farmlands during near term flood events. Flood and sediment control measures, including revegetation, are also necessary to re-establish some stability in the channel and to reduce the amount of sediment available to clog the highway and damage the farmlands.

Added August 10, 1983

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, rip rap and bank reshaping and revegetating will be needed to reduce sediment production 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
Rip Rap along roads *	2,000 ft.	$50/ft.	$100,000
Bank reshaping and revegetating*	0.3 mi.	$8,000/mi.	$ 2,400
TOTAL			$112,435**

*Changes Added August 10, 1983

**Amended August 14, 1983

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 $118,435 would help protect the facilities and property listed above.

R4E | R5E

R5E | R6E

T9S

T10S

T10S

T11S

T11S

T12S

INCIDENT # 3
LAKE FORK

- ④ STREAM CHANNEL DAMAGE CLASS
- AREAS OF MASS MOVEMENT
- DAMAGED FENCES

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 to reduce damage to Forest Roads and bridges.* 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. *To reduce impacts to the irrigation system and farmlands.*

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

*Changes Added August 10, 1983

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.

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
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 willow planting, and streambank reshaping and revegetating.**

**Amended August 15, 1983

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.	$ 12,750
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
Bank Shaping and Revegetation *	(Site 1)	2 mi.	$8,000/mi	$ 16,000
TOTAL				$ 53,545**

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 $ 53,545 would help protect the facilities and property listed above.

*Changes Added August 10, 1983

**Amdended August 15, 1983

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. *The debris cleared from along the channel to prevent the clogging and washing out of road crossings and the deposition of sediment on farmlands.*

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 slope 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.

*Added August 10, 1983

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. *The water surges, debris and sediment migration that could damage or destroy lives and property in and near Fairview.*

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

*Changes Added August 10, 1983

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Fairview City (Population 916)*	
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.

*Changes Added August 10, 1983

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, *which will reduce the debris and sediment that threatened the stream crossings and stream side values.*

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

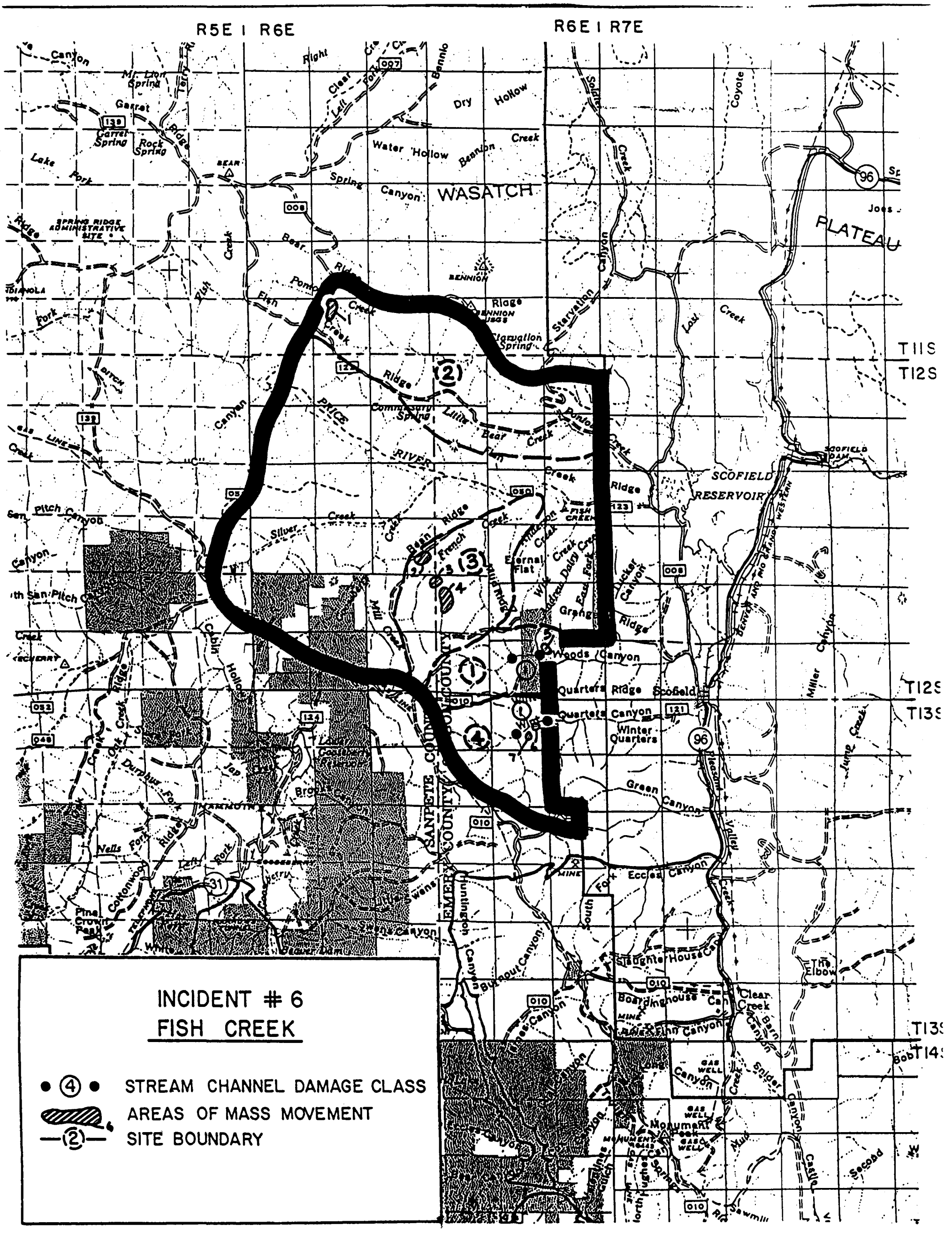
*Changes Added August 10, 1983

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 Oak Creek 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.



INCIDENT # 6
FISH CREEK

● ④ ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

—(2)— SITE BOUNDARY

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 Scofield 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 above.

R5E I R6E

R6E I R7E

R7E I 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. *The bypass culvert is about ½ mile long, 72 inches in diameter and burried over 100 feet deep. The mine portal facility on top of this fill and culvert is the 5th largest coal mine in Utah costing several million dollars to construct.* 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. *The reduction in sediment will also reduce the hazards of plugging the bypass culvert.*

Treatment	Quantity	Unit Cost	Total Cost
Grass Seeding	40 acres	$ 27/ac.	$1,080
Willow Planting	.3 miles	$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 Road	$100,000
TOTAL	$401,080

*Changes Added August 10, 1983

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.

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
- (2) 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

Riprap is 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. *Debris clearing will reduce the chance of clogging of the 7 highway crossings.*

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

*Changes Added August 10, 1983

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.

R2E | R3E

R3E | R4E

T18S
T19S
T20S
T21S
T22S

T. 19½ S.

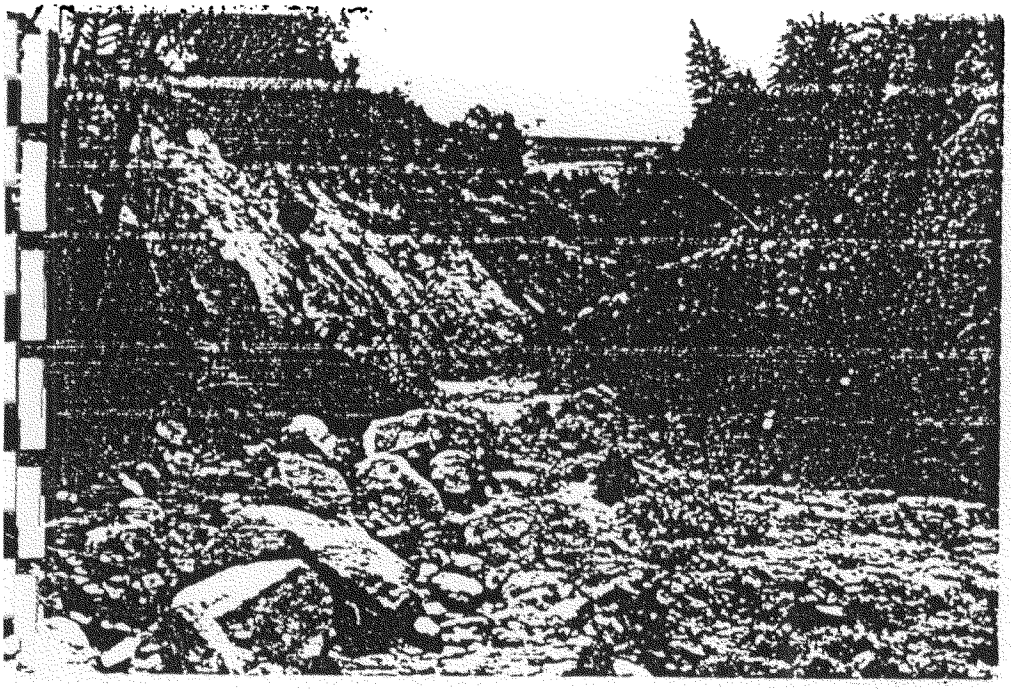
SANPETE COUNTY
SEVIER COUNTY

FOREST

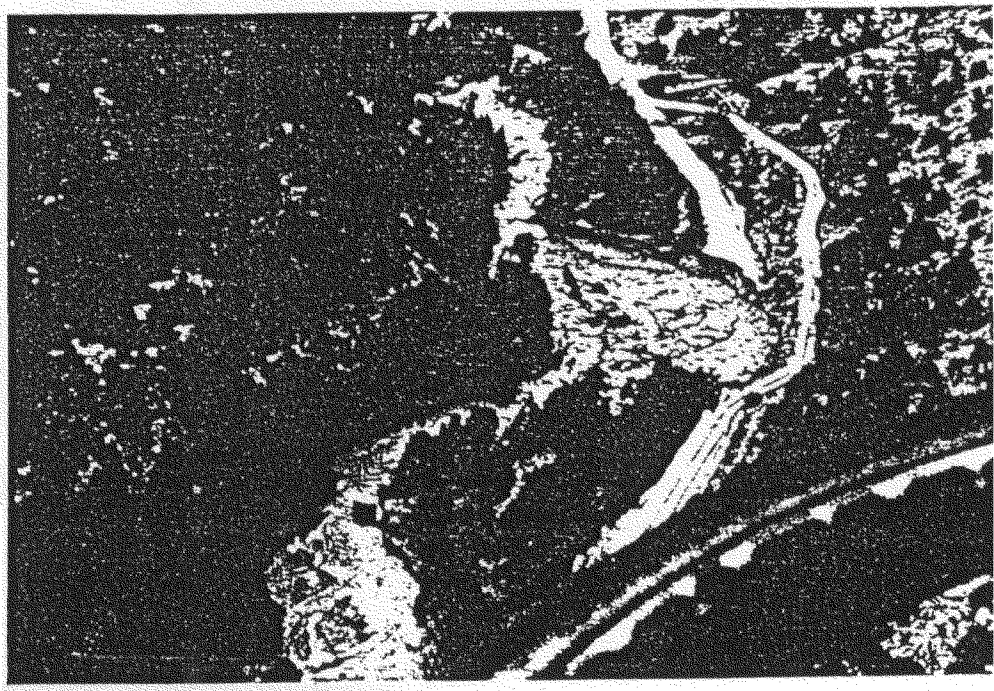
STANDARD

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 Twelve 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 *riprap. The reduced sediment will reduce future damages to the water supply, irrigation system, and the gaging station and farm field.*

Treatment	Location	Quantity	Unit Cost	Total Cost
Grass Seeding	Sites 1,2,&3	400 acres	$27/acre	$ 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	$ 20,000
Riprap	Site 1	900 feet	$50/ft.	$ 45,000
*Stream bank reshaping & reveg.	Site 2	1 mile	$8,000/mi.	$ 8,000
TOTAL				$230,800

*Changes Added August 10, 1983

Economic Defensibility: Section 403

Expected Values Threatened	Estimated Worth
Mayfield Residential (3 res.)	$ 90,000
Culinary Water System	$100,000
Irrigation System	$ 80,000
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.

R2E I R3E

R3E I R4E

T17S

T18S

T18S

T19S

T19S

T20S

INCIDENT # 14
SIX MILE

● ② ● STREAM CHANNEL DAMAGE CLASS

AREAS OF MASS MOVEMENT

SITE BOUNDARY

SANPETE COUNTY

SEVIER COUNTY

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

Riprap, stream bank reshaping, revegetating, and stream relocation will be necessary to protect the existing Forest Development #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, *and to reduce sediment damage to downstream values.*

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
*Riprap	Site 1	200 ft.	$50/ft.	$10,000
*Bank Reshaping and Revegetating	Site 1	0.2 mi.	$8,000/mi.	$ 1,600
TOTAL				$21,160

*Changes Added August 10, 1983

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.

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 blocked 30% by debris, the probability of near term damage is 40%.

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

R2E | R3E

R3E | R4E

R4E | R5E

T17S

T18S

T18S

T19S

.9S

3½S

9½S

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 *(Population 2080)*	
Residential *($35,000/house - 40 houses)*	$1,400,000
Business *($10,000/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.

*Manti Community has developed on the floodplain of Manti Creek as shown on the attached map and photo. "Initial studies indicate there are approximately 400 homes and 50 public and commercial buildings on the floodplain in and adjacent to the city. U.S. Highway 89 and the Denver Rio Grande Western Railroad are on the floodplain. Approximately 6,400 acres of land are irrigated with waters from Manti Creek." Measures for Mitigating Impacts Generated by Cottonwood Land Flow Near Manti, Utah. USDA Forest Service Intermountain Region Manti-LaSal National Forest, Utah, December 1975. page 3, 23-25.

The treatment measures recommended will have the effect and purpose of reducing sediment and debris damage downstream to the buildings and farms of the community. Complete protection is not provided nor can it be. The 5-year flow is estimated at 440 CFS. The maximum flow of record is 682 CFS in 1973 which was exceeded in 1983. Total loss of these values is not expected, but not all of the values within the floodplain were listed.*

*Changes Added August 10, 1983.

From Measures for Mitigating Impacts Generated by Cottonwood Land Flow Near Manti, Utah - U.S. Department of Agriculture Forest Service, Intermountain Region, Manti-LaSal National Forest, Utah December 1975.

The real impacts need to be assessed in relation to the downstream values to be protected and additional risks incurred in providing an emergency solution. Initial studies indicate there are approximately 400 homes and 50 public and commercial buildings on the flood plain in and adjacent to the City. U.S. Highway 89 and the Denver and Rio Grande Western Railroad are on the flood plain. Approximately 6400 acres of land are irrigated with waters from Manti Creek

R2E | R3E

R3E | R4E

R4E | R5E

T16S

T17S

T17S

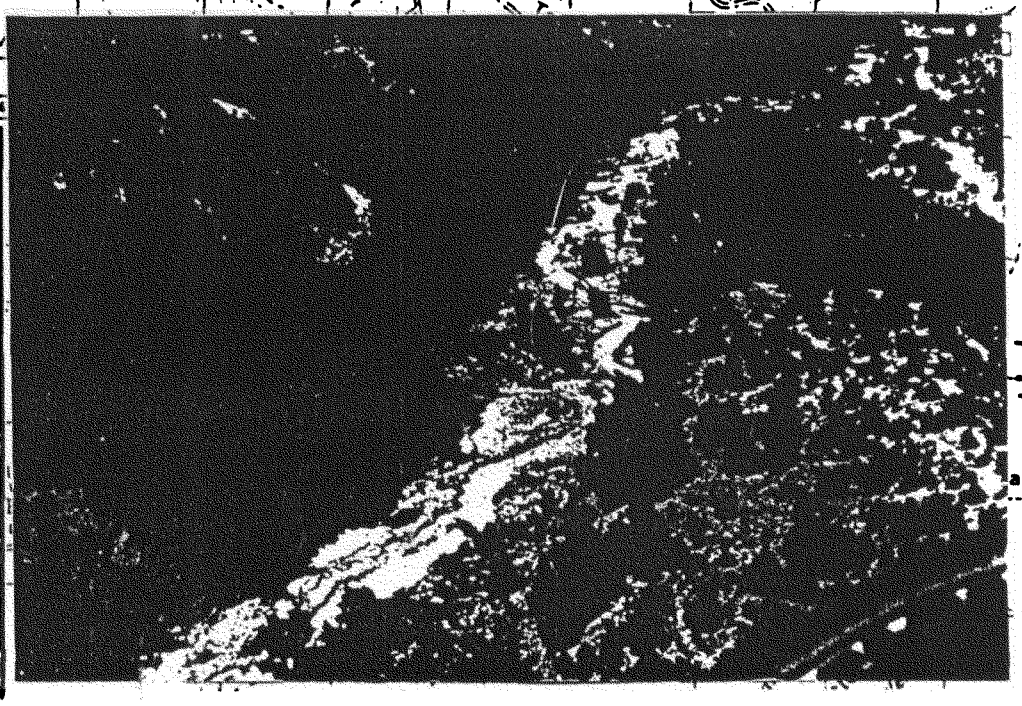
T18S

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 *and reduce sediment production.*

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

*Changes Added August 10, 1983

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.

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 will continue to be impacted. *Revegetation for sediment and flood control will reduce near term damages to* 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

*Changes Added August 10, 1983

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.

R4E | R5E

R5E | 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.

Table 6

SECTION 403

County	Willow Planting			Debris Jam/ Slide Removal			Channel Clearing		Grass Seeding		Rip Rap		Streambank Reshaping and Revegetating		TOTAL
	Qunatity Miles	Acres	Cost	Quantity D.J.'s	Slides	Cost	Miles	Cost	Acres	Cost	Feet	Cost	Miles	Cost	
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	3,800	196,000	0.9	7,200	250,564
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			2.0	16,000	73,559
TOTALS	61.05	45.5	122,970	120	7	275,000	29.1	74,125	1,234	33,318	4,940	247,000	4.1	32,800	785,213
Ranger Districts															
D-1 Sanpete	50.75	45.5	107,520	108	7	251,000	25.4	64,125	1,107	29,889	4,900	245,000	4.1	32,800	730,334
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	4,940	247,000	4.1	32,800	785,213

Table 7

SECTION 403

#	Incident	Willow Planting Quantity Miles	Willow Planting Quantity Acres	Willow Planting Cost	Debris Jam/ Slide Removal Quantity D.J.'s	Debris Jam/ Slide Removal Quantity Slides	Debris Jam/ Slide Removal Cost	Channel Clearing Miles	Channel Clearing Cost	Grass Seeding Acres	Grass Seeding Cost	Rip Rap Feet	Rip Rap Cost	Streambank Reshaping and Revegetating Miles	Streambank Reshaping and Revegetating Cost	TOTAL
1	West San Pitch	8.5	32.5	35,175	17	3	49,000	3.85	9,625	132	3,564'	3,800	196,000	0.9	7,200	294,564
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			2.0	16,000	55,504
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	4,940	247,000	4.1	32,800	785,213

Table 8: Priorities for Funding

Priority	Treatment	Incident	Project	403
1.	Road Relocation & Repair		Emergency Access	
2.	Immediate Grass Seeding		All Projects	25,500
3.	Debris Jam Removal and Channel Clearing	13	Twelve Mile/South Fork/Twin	161,000
		1	Lakes Chicken Cr./Pigeon Cr./	53,000
		5	Levan Fairview Canyon	40,750
4.	Fall Grass Seeding		All Projects	7,818
5.	Willow Planting	1,3,4,5,6,7,8,13,14,15,16, 17	All 403 Projects	122,970
6.	Debris Jam Removal and Channel Clearing	1,3,4,5,6,8,14,15,17	All Remaining Projects 403 Projects	94,375
7.	Channel Modification	1,4,13,14	All 403 Projects	32,800
8.	Riprap to Protect Roads and Campground	1,4,8,13,14	All 403 Projects	247,000
	Amended and Added August 15, 1983		Total	$785,213

XI. CONCLUSION

Major areas on the Manti-LaSal National Forest have received severe damage from landslides, mudflows, and abnormally high flood waters during the spring and summer of 1983. 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 $785,213 is requested for the Manti-LaSal National Forest under Section 403 for Emergency Watershed Protection.

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

Dennis Kelly, Team Leader, Hydrologist

Alan Galbraith, Hydrologist

Alan Gallegos, Geologist

Jim Duncan, Engineer

Ed Carlson, Engineering Technician

Ted Fitzgerald, Engineer

Al Mills, Fisheries Biologist

Bob Thompson, Range Conservationist

Kim Young, Draftsperson