WATERSHED PLAN

AND

ENVIRONMENTAL IMPACT STATEMENT

ESPANOLA-RIO CHAMA WATERSHED

Rio Arriba and Sandoval Counties, New Mexico

Prepared under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, 68 Stat. 666, as amended, and in accordance with the National Environmental Policy Act of 1969, Section 102(2)(c), Public Law 91-190.

Prepared by:

The Espanola-Rio Chama Watershed District

The East Rio Arriba Natural Resource Conservation District

The City of Espanola, New Mexico

The County of Rio Arriba, New Mexico

With Assistance by:

U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Agriculture, Forest Service
U.S. Department of the Interior, Bureau of Land Management
U.S. Department of the Interior, Bureau of Indian Affairs

June 1976

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WATERSHED WORK PLAN AGREEMENT

Between the

Espanola-Rio Chama Watershed District
East Rio Arriba Natural Resource Conservation District

City of Espanola

County of Rio Arriba

(Hereinafter referred to as the Sponsoring Local Organization)

State of New Mexico

and the

Soil Conservation Service

United States Department of Agriculture

(Hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Espanola-Rio Chama Watershed, State of New Mexico, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress, 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Espanola-Rio Chama Watershed, State of New Mexico, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about ten years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated cost, $207,400).

2. The Sponsoring Local Organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	Sponsoring Local Organization (percent)	Service (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	6.4	93.6	0 1/

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Costs (dollars)
I All Structural Measures	0	100	$7,679,300

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Engineering Costs (dollars)
All Structural Measures	0	100	$606,700

6. The Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be $16,100 and $1,717,700 respectively.

7. The Sponsoring Local Organizations will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

8. The Sponsoring Local Organizations will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

9. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The Sponsoring Local Organizations will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

    A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this Agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The

Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

14. No member of, or delegate to Congress, or resident commissioners, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Espanola-Rio Chama
Watershed District
Local Organization

By Richard V. Cook
Title Chairman
Date 5-24-76

Box 37 Espanola NM
Address Zip Code 87532

The signing of this agreement was authorized by a resolution of the governing body of the Espanola-Rio Chama Watershed District
Local Organization
adopted at a meeting held on 21 May 76

Catherine C. Boyle
Secretary, Local Organization
Date 5-24-76

55 Boyle Drive
Address Zip Code
Hernandez NM 87537

East Rio Arriba Natural
Resource Conservation District
Local Organization

By J. Oliver Begay
Title Chairman
Date May 24/76

El Rito, NM. 87530
Address Zip Code

The signing of this agreement was authorized by a resolution of the governing body of the East Rio Arriba Natural Resource Conservation District
Local Organization
adopted at a meeting held on 20 May 76
Date

Box 933 - 87532 - [illegible]
Secretary, Local Organization
Date 5-24-76

Address Zip Code

The City of Espanola
Local Organization

By Angel Martinez
Title Mayor
Date 5-24-76

PO Box 37, ESPANOLA, NM. 87532
Address Zip Code

The signing of this agreement was authorized by a resolution of the governing body of the City of Espanola
Local Organization
adopted at a meeting held on 19 May 76
Date

Secretary, Local Organization
Date May 24 1976

PO Box 37, Espanola, N.M., 87532
Address Zip Code

Rio Arriba County, New Mexico
Local Organization

By [signature]

Title Chairman

Box 127, Tierra Amarilla, N.M. 87575
Address Zip Code

Date May 24 1976

The signing of this agreement was authorized by a resolution of the governing body of Rio Arriba County, New Mexico
Local Organization
adopted at a meeting held on May 7 1976
Date

Joe A. Branch County Clerk
Secretary, Local Organization

Tierra Amarilla N.M. 87575
Address Zip Code

~~Date~~ By: Rosalea R. Mendez, Deputy
May 24, 1976

Appropriate and careful consideration has been given to the environmental impact statement for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

[signature]
State Conservationist

5/25/76
Date

SUMMARY OF PLAN 1/

The Espanola-Rio Chama Watershed is located in the Rio Grande Valley in North Central New Mexico. It includes that part of the City of Espanola that is west of the Rio Grande and the communities of La Plaza, San Jose, and Hernandez. It is about 25 miles northwest of Santa Fe, the State Capitol. The entire watershed is within an area classified as economically depressed under the Area Redevelopment Act of 1965.

The watershed encompasses about 43 square miles (27,520 acres) of Rio Arriba and Sandoval Counties.

The sponsoring local organizations are: The Espanola-Rio Chama Watershed District, the East Rio Arriba Natural Resource Conservation District, the City of Espanola, and the County of Rio Arriba, New Mexico.

Problems in the watershed include flooding of urban areas and agricultural cropland along the Rio Grande and the Rio Chama, erosion and sediment deposition. Also on-farm irrigation water management has a low efficiency. Damaging floods were reported in 1910, 1941, 1950, 1952, 1957, 1961, 1962, 1963, 1964, 1966, 1967, 1968, 1969, and 1973. It is estimated that the 1967 flood was a two percent chance of occurrence flood.

Planned land treatment measures include practices for watershed protection, land improvement, irrigation water management, and sediment reduction. These measures will be established by land owners and operators and the administering agency on Federal lands. Emphasis will be placed on proper grazing use on rangelands and on improved water and soil management practices on irrigated cropland. These measures will be operated and maintained by the owners and operators.

Planned structural measures for the watershed are ten floodwater retarding structures with associated appurtenances. Principal spillway flows will be conveyed to the river in pipelines or existing channels.

All structures will be designed for a 100-year life span and will be protected by reinforced concrete chute emergency spillways, and/or by earth spillways. These structures will protect the croplands and cultural improvements of the area from the runoff

1/ All information estimates and data, except as otherwise noted, were collected by the Soil Conservation Service and Forest Service, U. S. Department of Agriculture.

resulting from any storm up to the one percent chance of occurrence event. The structures will control runoff from 36 square miles of upland and protect seven square miles of agricultural and urban lands, including the City of Espanola and the communities of La Plaza, San Jose, and Hernandez.

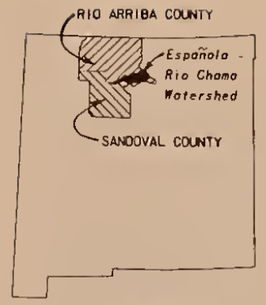
All channel modifications are on ephemeral channels. The installation, operation and maintenance of all structural measures will be the responsibility of the Espanola-Rio Chama Watershed District.

Planned Measures will reduce the estimated average annual cost of flood damages by $664,250. Redevelopment benefits are estimated at $141,580 annually. Benefits from external economies as a result of the completed project will amount to an estimated $54,950 annually.

The total average annual installation cost of the planned measures ($628,050) plus future operation and maintenance cost, ($20,000) (amortized at 6-1/8 percent for a 100-year life) is estimated to be $648,050. Total average annual benefits are estimated to be $860,780.

The total estimated installation cost of the project is $10,946,500 of which $10,248,100 will be from PL-566 funds and $698,400 from other funds. Installation of the project will occur over a ten-year period.

The upland range portion of the watershed will benefit by an increase of forage on 36 square miles. Livestock yield will increase and wildlife will benefit because of increased cover and food plant density and additional water sources such as new troughs and tanks. In the cropland area, irrigation water loss through ditch seepage will be reduced. Ditch breaks will no longer interrupt water application, thereby enabling the farmer to increase crop production without fear of loss. Employment will be created by new jobs and increased farm income. Property values will be enhanced because of the removal of the flood threat. Urban and commercial areas in Espanola will no longer have serious flood damage problems. A detailed soil survey is completed on the watershed.



LOCATION MAP

R.6E. R.7E. R.8E.

T. 21 N.

T. 20 N.

106°20' 106°10' 106°00'

36°00'

RIO ARRIBA COUNTY
SANDOVAL COUNTY

SANTA FE NATIONAL FOREST

SANTA CLARA INDIAN RESERVATION

BARTOLOME SANCHEZ GRANT

SANTA CLARA GRANT

RIO CHAMA

RIO GRANDE

Hernandez

San Jose

La Plaza

Guachupangue

Española

D.A.- 0.45
D.A.- 0.97
D.A.- 3.00
D.A.- 0.29
D.A.- 1.51
D.A.- 17.68
D.A.- 0.26
D.A.- 6.35
D.A.- 1.03
D.A.- 4.42

(11) (10) (9) (8N) (8S) (6) (5) (4) (3) (1) (2)

LEGEND

- Watershed Boundary
- Subwatershed Boundary
- Floodwater Retarding Structure
- (6) Site Number
- D.A.- 0.00 Drainage Area (Square Miles)
- Area Benefited
- Drainage Area Controlled By Structures
- Outlet Channel
- Outlet Pipeline

PROJECT MAP

ESPAÑOLA-RIO CHAMA WATERSHED

RIO ARRIBA AND SANDOVAL COUNTIES
NEW MEXICO

JANUARY 1976

0 2 MILES

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, ORE. 1976

M7-N-23570

INTRODUCTION

Part I of this document contains a brief description of the proposed project plans for land treatment and structural measures, and also the economic analysis of the project. Part II contains information on authorities, responsible local organizations, project purposes, environmental setting, water and related land resource problems, other programs, environmental impacts, and alternative plans. A more detailed description of planned measures is also found in Part II. A soils map, geology map, and project map are found in Appendix B of Part II.

PLANNED MEASURES

Land Treatment Measures

Land treatment measures will be applied throughout the watershed in combinations needed to achieve proper use and adequate treatment. It is estimated that 24,700 acres will be adequately treated during the project installation period. On private land, this will be achieved by operators developing and applying complete conservation plans with East Rio Arriba Natural Resource Conservation District. On Federal lands the administering agency will be responsible for the plans and application of the needed measures.

On irrigated cropland, this involves the installation of satisfactory irrigation systems so that high efficiency in water application can be achieved. Adequate fences and livestock water facilities are necessary on rangeland before a desirable deferred grazing system can be initiated. Needed facilities will be identified in the conservation plans. Land treatment measures that improve wildlife habitat will be encouraged on both cropland and rangeland. Improved grazing systems on rangeland will increase the amount of wildlife food. The application of the land treatment measures will improve the vegetative cover on the range, and reduce runoff and erosion. These measures will lengthen the life of the structures and improve the economic condition of the farmers and ranchers by stabilizing and increasing production.

The planned measures, applied on a voluntary basis, will be installed under specifications and standards, and with the technical assistance of the Soil Conservation Service on private and State land. Measures on Federal land will be administered by the appropriate agency.

Structural Measures

Ten single-purpose floodwater retarding structures are planned on the major drainages of the watershed. These structures will

consist of earthfill embankments with reinforced concrete appurtenances. Each structure will be designed to store the anticipated 100-year sediment volume from the drainage area above it. Temporary retarding storage and principal spillway flows at all sites will provide protection from the runoff produced by a 100-year frequency storm. Floodwater retarding structures will control about 36 sq. miles of the 43 sq. mile drainage area.

Structures at sites 1, 3, 4, 5, and 6 are evaluated as one unit and control 29.74 square miles of the drainage area. Structures at site 8S and 8N, 9, 10, and 11 are evaluated as a different unit and controls 6.22 square miles of the drainage area.

All floodwater retarding structures will have principal spillways with an inlet riser and a reinforced concrete conduit. All principal spillway conduits will be 30-inch reinforced concrete pipe installed in concrete cradles with antiseep collars. At Sites 4,6, and 9 inlet risers are planned as single-stage. On all other Sites two-stage risers are planned. At Sites 1, 3, 5, 8S and 8N, 10, and 11, the risers will be modified with orifices to reduce discharges. Principal spillway outlets consist of reinforced concrete pipelines, lined channels, stabilized earth channels, or a combination of these types. The principal spillway at Sites 1, 8S and 8N, 9, 10 and 11 discharge directly to outlet pipelines that convey flows directly to the river. At Site 3 a pipeline and lined channel is planned to convey the principal spillway discharge to the river. At site 4 a combination of pipeline, lined channel, and stabilized earthen channel is planned. At Site 6 the outlet channel is planned as a stabilized earthen channel. At Sites 4, 5, and 6 the principal spillway outlet will have a concrete structure for energy dissipation.

Various appurtenances are planned for the pipelines and for the transition from one type of conveyance to another. Appurtenances may include manholes, air vents, energy dissipators, flap gates, highway crossing, with operation and maintenance bridges at ditch crossings.

Concrete emergency spillways are planned for structures at Sites 1,4,6,9,10, and 11. These spillways will be provided with baffles for de-energizing purposes. The primary emergency spillway at Sites 3,5, and 8N is the second stage of the riser and the principal spillway pipe. An auxillary earth spillway is planned on Sites 3,5, and 8N. An earth emergency spillway is planned at Site 8S. The crest elevation of the emergency spillways will be set at the water surface of the 100-year frequency storm volume, routed through the principal spillway and starting at the sediment pool elevation. Capacity of the emergency spillways chutes is the routed Class "c" freeboard hydrograph.

All embankments will be constructed of compacted earthfill obtained at the sites. Zoned embankments are planned on all sites, except

Sites 3 and 5, where they will be homogeneous earthfill. Fill materials will consist of sandy silt, silty fine sand, low plasticity sandy clay, and silty sand with gravel. The structures will be constructed upon moderately yielding foundations. Foundation materials consist of sand with gravel overlying dense consolidated beds of sandy silt, low plasticity sandy clay, and silty sand. Depth to the consolidated bed range from the surface to more than 30 feet.

Existing utilities at the sites will be modified or rerouted to fit site conditions and planned work. Fences within the construction areas will be removed and replaced or relocated by the Espanola-Rio Chama Watershed District.

Land rights required for the project include approximately 857 acres of rangeland for the floodwater retarding structures, 34 acres of range or arroyo bottomland, and 20 acres of cropland for the principal spillway outlets.

INSTALLATION COSTS - MONETARY

The total cost of installation, including land treatment measures, is $10,946,500, with the cost of various elements included as shown below. The estimated cost of installing land treatment measures is $719,300. This includes $60,500 on Federal land, on which the Bureau of Land Management and the Forest Service have developed a management plan for their operating units. The cost of land treatment including technical assistance, will be about $658,800 on non-federal land. Of this amount, BIA will spend $58,700 on land treatment and technical assistance on Indian land. One thousand six hundred dollars in land treatment measures will be installed on state land. Cost-sharing on these lands through the Agricultural Conservation Program is available on a voluntary basis for permanent type conservation practices.

Total technical assistance portion for land treatment is estimated to be $264,900. The cost of Soil Conservation Service technical assistance provided through the East Rio Arriba Natural Resource Conservation District is $247,000. This will be used for planning and application on private and state land. The Soil Conservation Service will provide $2,600 of this amount from regularly appropriated funds for assistance to districts. The remaining $244,400 will be from PL-566 funds for additional technical assistance to farmers and ranchers within the watershed to accelerate the application of land treatment measures on private land. Estimates for technical assistance also include the Forest Service $2,400, BLM $6,700, and BIA $8,800.

The total estimated installation cost of the structural measures included in the plan is $10,227,200. This cost includes cost of construction, engineering services, land rights, and project administration. A tabulation of cost items for each structure is included in Table 2.

Construction cost estimates include a contingency allowance of 10-20 percent to provide for unforeseen costs on the structural measures. Estimated construction costs of $7,679,300 include the:

1. Clearing sites.

2. Alteration, modification, or reconstruction of existing irrigation facilities.

3. Providing needed travelways for maintenance along the principal spillway outlets.

4. The disposal of waste spoil in accordance with sound engineering design and construction principles.

5. Construction of dams and channels.

Included under engineering costs, estimated to be $606,700, are the direct costs for detailed design surveys, site investigations, design, and preparation of plans and specifications for all structural measures.

Estimated local costs for landrights included in the work plan are estimated to be $207,400. This includes $38,100 for relocation of utilities, $2,300 for relocation of roads, $21,200 for installing road crossings, $13,900 for reconstructing fences, and $123,300 for other landrights costs such as land, easements, rights-of-way, and $8,600 for legal surveys and other local costs. The cost of landrights includes the following:

1. All expenditures made in acquiring land, easements, leases, and rights-of-way. Includes costs of subordination agreements and cost of complying with any special provisions in landrights documents not needed for proper construction.

2. Changes of existing telephone, power, gas, water, sewer lines, or other utilities.

3. All changes of existing public or private roads, culverts, and other crossings.

4. All relocations and changes of roads that are to remain serviceable after project installation.

5. Relocation or reconstruction of fences damaged by construction which are not needed for the proper operation, maintenance or inspection of the works of improvement.

Project administration costs ($1,733,800) include the cost of contract administration, review costs of engineering plans prepared by others, costs for government representatives, and necessary inspection service during construction to insure that structural measures are installed according to the plans and specifications. The local cost for project administration is estimated to be $16,100. Estimated PL-566 costs for these items are $1,717,700.

Public Law 566 funds will be used for:

a. The cost of additional technical assistance needed to accelerate land treatment on private and state land.

b. The cost of construction for structural measures.

c. The cost of engineering services for measures applicable to flood prevention.

d. All Soil Conservation Service administrative costs needed for project installation.

Other funds will be used for:

a. The installation cost of land treatment measures.

b. All costs for legal surveys and other administrative costs necessary for acquiring landrights.

c. All local administrative costs.

d. All operation and maintenance costs on land treatment and structural works of improvement.

The cost of the structural measures to the Federal government and to the local sponsoring organizations will be based upon the actual quantities installed. The cost-sharing summaries shown in the work plan are the best estimates available during the planning stage of project development.

The installation priority for structural measures is as follows: Site #4, #5, #6, #1, #3, #8N, #8S, #9, #10, and #11. The schedule of obligations for the installation period covering installation of land treatment and structural measures is shown in the following tables:

ESTIMATED FUND OBLIGATIONS
By Years

Land Treatment

Year	P.L. -566 Funds	Other Funds All Other Sources
First	24,500	47,490
Second	24,500	47,490
Third	24,500	47,490
Fourth	24,500	47,490
Fifth	24,400	47,490
Sixth	24,400	47,490
Seventh	24,400	47,490
Eighth	24,400	47,490
Ninth	24,400	47,490
Tenth	24,400	47,490
TOTAL	244,400	474,900

Structural Measures

Year	P.L. 566 Funds	All Other Funds
First	520,000	38,900
Second	1,501,400	38,800
Third	966,300	16,300
Fourth	1,100,000	16,500
Fifth	1,050,000	16,400
Sixth	960,000	16,200
Seventh	910,000	20,100
Eighth	850,000	20,100
Ninth	1,190,000	20,100
Tenth	956,000	20,100
TOTAL	10,003,700	223,500

BENEFITS - MONETARY

The planned land treatment program will provide higher crop, pasture, and rangeland production, improved wildlife, reduce erosion and sediment, and permit more efficient land and water management. Land treatment will also increase income and generate employment.

Structural measures will reduce the estimated average annual flood damage from $688,200 to $23,950 with a resultant benefit of $664,250. Monetary Benefits are shown in Tables 5 and 6.

Farm income will increase as a result of the project. The decrease in risk and uncertainty as a result of flood control will increase efficiency of agricultural production.

The City of Espanola as well as the farmers and rural non-farmers will be directly benefited by the project flood reduction. Also, local businesses will benefit from increased trade as a result of the project. The quality of living will be improved because of higher farm income and the ability to constantly improve the land without periodic setbacks from flooding. The project will also reduce the health problems which occur during and after flooding.

Private land development in the floodplain will continue to occur due to the fact that there is a limited amount of private land available in the Espanola area. The floodplain of the watershed has a HUD Flood Insurance Program developed. Future benefits from not needing to floodproof homes and businesses were evaluated.

Benefits from external economies arise from the increased value of production of goods and services realized by local businesses and residents. These benefits induced by and stemming from the project were estimated to be $54,950 annually. These benefits from a national standpoint were not considered pertinent to the economic evaluation.

The watershed is in the Four Corners Development Area. Thus, redevelopment benefits from the use of underemployed and unemployed local labor resources may be used for project justification. Redevelopment benefits were estimated at $141,580 annually.

Intangible benefits will be an opportunity to shift funds from repairing damages to investing in schools, libraries, and other facilities that improve the quality of living. Local residents can also invest in upgrading their homes, quality and standard of living.

COMPARISON OF BENEFITS AND COSTS

The total average annual cost of structural measures (total installation, project administration, and operation and maintenance costs) amortized at 6- 1/8 percent for 100-year life is $648,050. Total average annual benefits, including externalities and redevelopment, are estimated to be $860,780. This results in a benefit cost ratio of 1.3:1.0 (Table 6). Average annual benefits exclusive of external benefits are $805,830 or a benefit cost ratio of 1.2:1.0.

INSTALLATION PROVISIONS

Land Treatment

Land treatment measures will be established by farmers and ranchers over about a ten-year installation period. The Soil Conservation Service will help in the planning and application of land treatment on private and state land by providing technical assistance through the East Rio Arriba Natural Resource Conservation District under on-going programs and with Public Law 566 funds for technical assistance.

The Bureau of Land Management and the U. S. Forest Service will install needed land treatment measures on Federal land during the project installation period. Proper grazing use on Federal land will be continued by lessees with assistance from the agencies. The Bureau of Land Management and the U. S. Forest Service concur with the provisions of this plan.

The Bureau of Indian Affairs will provide assistance to the Santa Clara and the San Juan Pueblos for land treatment measures planned on the pueblo grant lands.

The Extension Service will assist the Espanola-Rio Chama Watershed District with the educational phase of the project by helping conduct general informational meetings, preparing radio and press releases, and using other methods to promote understanding of the plan.

The Agricultural Stabilization and Conservation Service will assist farmers and ranchers by providing agricultural conservation program cost-sharing for application of permanent conservation measures.

Structural Measures

Structural measures will be installed during a ten-year period on a schedule controlled by availability of funds. Construction of

these measures will start when the project is approved by Congress, when all necessary land, easements, and rights-of-way have been obtained, when operation and maintenance agreements are signed, and when Federal funds are available.

The Espanola-Rio Chama Watershed District will be responsible for installing all structural measures. The District has the power of eminent domain. It will acquire and bear all costs for land rights, including land surveys, land acquisition, and easements needed for construction. The Watershed District will request the State Engineer Office to approve plans, specifications, and issue permits to construct floodwater retarding structures. The Watershed District has requested the Soil Conservation Service to administer the contracts for construction of all structural measures.

The Soil Conservation Service will provide technical assistance in making field surveys and geologic investigations, prepare plan designs and specifications, administer construction contracts, supervise construction, prepare contract payment estimates, conduct final inspection, certify completion, and other related work.

The Soil Conservation Service will provide construction funds for the installation of all floodwater retarding structures and for the principal spillway outlet systems.

The Espanola-Rio Chama Watershed District will be responsible for making necessary arrangements with the local utility companies and with the City of Espanola for modification or change in location of utilities. The District will acquire any land rights that may be needed to relocate these facilities.

OPERATION AND MAINTENANCE PROVISIONS

Land Treatment

The Forest Service and the Bureau of Land Management will maintain the land treatment measures installed on land administered by them.

Land treatment measures installed on pueblo grant lands will be maintained by the Santa Clara and San Juan Pueblos with technical assistance from the Bureau of Indian Affairs.

Land treatment measures installed on private and State land will be maintained by the owners and operators of that land with technical assistance from the Soil Conservation Service through the East Rio Arriba Natural Resource Conservation District.

Structural Measures

The operation and maintenance of all structural measures will be the responsibility of the Espanola-Rio Chama Watershed District. The average annual operation and maintenance cost for the structures is estimated to be $20,000. The Watershed District will acquire the necessary funds for the operation and maintenance by assessing the benefited landowners.

Maintenance of the structural measures shall include but not be limited to:

1. Keeping all structures in serviceable condition by making replacements and repairs as needed. Items to be considered are the condition of the principal spillways, emergency spillways, earthfill of the floodwater retarding structures, and the pipelines including all appurtenances.

2. The sponsoring local organizations will effectively and in a timely manner perform all necessary maintenance and will operate the entire project in accordance with legal permits granted for construction.

3. Damage to the structural measures caused by large storms will be repaired by the local sponsors as part of the maintenance program.

The Espanola-Rio Chama Watershed District and the Soil Conservation Service will enter into a specific operation and maintenance agreement in accordance with provisions in the Soil Conservation Service Operation and Maintenance Handbook of New Mexico prior to signing a project agreement. An Operation and Maintenance Plan will be prepared for each structural measure.

The Operation and Maintenance Agreement will include specific provisions for retention and disposal of property acquired or with PL-566 financial assistance.

FINANCING PROJECT

Costs of applying necessary land treatment measures on private and state land will be borne by landowners and operators. These owners and operators may receive cost-sharing, as applicable, through the Agricultural Conservation Program and technical assistance from the Soil Conservation Service. The cost of applying land treatment measures on Federal land will be from regular funds from on-going programs of the land administrating agency. The respective Indian pueblos will bear the cost of installing land treatment measures on their lands.

Federal assistance for fire control and suppression is available through the New Mexico State Forestry Department for state and private lands.

The Espanola-Rio Chama Watershed District will pay the sponsors' share of the project installation costs from assessments made against land within the watershed. Sponsors of the watershed project state that assessments levied against the real property within the watershed will be sufficient to meet their financial needs. They can acquire needed landrights or rights-of-way by condemnation through the use of their powers of eminent domain.

The Soil Conservation Service will provide construction funds for all floodwater retarding structures, with appurtenant structures, channels, and pipelines.

Federal financial assistance in carrying out the project will be made available to the local organizations when the necessary landrights are obtained, when the local organizations have their share of construction costs, and when Federal funds are available. Federal funds are contingent on appropriations made under Public Law 566.

Prior to entering into agreements that obligate funds of the Service, the Espanola-Rio Chama Watershed District will have a financial management system for control, accountability, and disclosure of PL-566 funds received, and for control and accountability for property and other assets purchased with PL-566 funds.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Espanola-Rio Chama Watershed, New Mexico

Installation Cost Item	Unit	Number			Estimated Cost (Dollars) 1/								
					PL-566 Funds		Other Funds						
					Non-Federal Land		Federal Land		Non-Federal Land				
		Fed. Land	Non-Fed Land	Total	SCS 3/	Total	FS 3/	BLM 3/	BIA 3/	SCS 3/	State	Total	Total
LAND TREATMENT													
Land Area 2/													
Cropland	Acres		200	200						108,500		108,500	108,500
Pastureland	to be		400	400						228,200		228,200	228,200
Rangeland	Treated	19,873	4,227	24,100			13,700	37,700	49,900	14,800	1,600	117,700	117,700
Technical Assistance					244,400	244,400	2,400	6,700	8,800	2,600		20,500	264,900
TOTAL LAND TREATMENT	X	19,873	4,827	24,700	244,400	244,400	16,100	44,400	58,700	354,100	1,600	474,900	719,300
STRUCTURAL MEASURES													
Construction													
Floodwater Retarding Struct. (Includes principal spillway outlets)	No.	2	8	10	7,679,300	7,679,300	-	-	-	-	-	-	7,679,300
Engineering Services					606,700	606,700							606,700
Project Administration													
Construction Inspection					1,026,500	1,026,500							1,026,500
Other					691,200	691,200				16,100		16,100	707,300
Subtotal - Administration	X	X	X	X	1,717,700	1,717,700	X	X	X	16,100	X	16,100	1,733,800
Other Costs													
Land Rights										207,400		207,400	207,400
TOTAL STRUCTURAL MEASURES	X	X	X	X	10,003,700	10,003,700	X	X	X	223,500	X	223,500	10,227,200
TOTAL PROJECT	X	X	X	X	10,248,100	10,248,100	16,100	44,400	58,700	577,600	1,600	698,400	10,946,500

1/ Price Base 1975.
2/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land area, not just to adequately treated areas.
3/ Federal agency responsible for assistance in installation of works of improvement.

June 1976

TABLE 1A - Status of Watershed Works of Improvement
(at time of work plan preparation)

ESPANOLA-RIO CHAMA WATERSHED, NEW MEXICO

Measures	Unit	Applied to Date	Total Cost (Dollars) 1/
Land Treatment			
Conservation Cropping System	Acre	100	1,000.00
Irrigation Water Management	Acre	150	1,500.00
Irrigation Land Leveling	Acre	80	20,000.00
Irrigation Ditch Lining	Feet	11,200	78,400.00
Irrigation Structures for Water Control	Number	550	110,000.00
Pasture and Hayland Management	Acre	100	2,500.00
Pasture and Hayland Planting	Acre	400	16,000.00
Proper Grazing Use Range	Acre	24,100	48,200.00
Deferred Grazing	Acre	19,873	39,746.00
Fencing	Mile	17	34,000.00
Trough and Tank	Number	5	2,500.00
Wells	Number	4	12,000.00
Stockwater Pipeline	Feet	10,560	4,224.00
Stockwater Pond	Number	4	8,000.00
Planned Grazing System	Acre	19,873	39,746.00
Brush Management	Acre	3,075	61,500.00
Range Seeding	Acre	3,175	53,975.00
Grade Stabilization Structure	Number	15	750.00
Debris Basin	Number	3	4,500.00
TOTAL			538,541.00

1/ Price Base 1975.

June 1976

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
(Dollars) 1/

Espanola-Rio Chama Watershed, New Mexico

ITEM	Installation Cost P.L. 566 Funds: Construction	Engineering	Total P.L. 566	Installation Cost Other Funds: Land Rights	Total Other Funds	Total Installation Cost
Floodwater Retarding Structures:						
Site No. 1	1,141,900	79,900	1,221,800	51,600 2/	51,600	1,273,400
3	733,600	66,000	799,600	18,700 3/	18,700	818,300
4	1,471,800	103,000	1,574,800	32,100 4/	32,100	1,606,900
5	187,600	22,500	210,100	4,200 5/	4,200	214,300
6	1,745,300	122,200	1,867,500	42,300 6/	42,300	1,909,800
8-S & 8-N	498,500	56,200	554,700	16,800 7/	16,800	571,500
9	1,019,800	71,400	1,091,200	23,700 8/	23,700	1,114,900
10	570,100	51,300	621,400	13,200 9/	13,200	634,600
11	310,700	34,200	344,900	4,800 10/	4,800	349,700
Total	7,679,300	606,700	8,286,000	207,400	207,400	8,493,400
Project Administration			1,717,700		16,100	1,733,800
GRAND TOTAL			10,003,700		223,500	10,227,200

1/ Price Base 1975.
2/ Includes $600 for reconstructing fences, $33,100 modifying utilities, $1,000 for surveys.
3/ Includes $3,000 for reconstructing fences, and $1,000 for surveys.
4/ Includes $3,000 for reconstructing fences, $3,200 for road crossing, $5,000 for relocating utilities, and $1,500 for legal surveys.
5/ Includes $500 for reconstructing fences and $500 for legal surveys.
6/ Includes $1,300 for reconstructing fences, $18,000 for road crossing, and $1,000 for legal surveys.
7/ Includes $500 for reconstructing fences, $100 for road relocation, and $1,000 for legal surveys.
8/ Includes $2,500 for reconstructing fences, $2,200 for road relocation, and $1,300 for legal surveys.
9/ Includes $2,500 for reconstructing fences and $800 for legal surveys.
10/ Includes $500 for legal surveys.

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TABLE 3 - Structural Oata

Structures With Planned Storage Capacity

Espanola-Rio Chama Watershed - New Mexico

ITEM	UNIT	SITE 1	3	4	5	6	8-S	8-N	9	10	11	Totals
Class of Structure		C	C	C	C	C	C	C	C	C	C	
Orainage Area	Sq.Mi.	4.42	1.03	6.35	0.26	17.68	1.51	0.29	3.00	0.97	0.45	35.96
Controlled												
Curve No. (1-day)(AMCII)		84	84	85	84	80	85	85	85	85	84	
Tc	Hrs.	1.2	.67	2.5	.54	3.24	.85	0.4	.93	.8	.35	
Elevation Top of Oam	Ft.	5,709.4	5,681.7	5,761.0	5,724.3	5,768.2	5,784.2	5,803.5	5,826.0	5,831.7	5,774.8	
Elevation Crest Emergency Spillway	Ft.	5,698.5	5,675.8 4/	5,749.0	5,722.3 5/	5,756.8 6/	5,775.5	5,798.0 7/	5,812.5	5,822.7	5,768.0	
Elevation Crest High Stage Inlet	Ft.	5,698.5	5,671.6	5,741.0	5,706.6	5,742.6	5,770.1	5,792.0	5,804.0	5,822.7	5,768.0	
Elevation Crest Low Stage Inlet	Ft.	5,694.5	5,669.2	-	5,703.0	-	5,762.2	5,786.0	-	5,815.0	5,765.0	
Maximum Height of Oam	Ft.	45.4	32.7	81.0	49.3	78.2	63.2	45.5	66.5	56.2	33.2	
Volume of Fill	Cu. Yds.	603,000	273,250	539,600	69,200	680,000	174,990	53,300	243,700	101,800	76,000	2,814,840
Total Capacity 2/	Ac.Ft.	1,048	193	1,058	50	1,807	232	28	430	140	77	5,063
Sediment Aerated	Ac.Ft.	730	131	749	36	1,158	151	14	270	87	53	3,379
Beneficial Use	Ac.Ft.	-	-	-								
Retarding	Ac.Ft.	318	62	309	14	649	81	14	160	53	24	1,684
Surface Area												
Sediment Pool	Acres	70	21	32.8	3.9	58	10	1.8	17.7	4.4	6.0	225.6
Beneficial Use Pool	Acres	-	-	-								
Retarding Pool	Acres	84	26.3	42.0	5.0	71	13.2	2.7	22.4	7.3	7.4	281.3
Principal Spillway												
Rainfall Volume (areal)(1 day)	In.	2.8	2.8	2.8	2.8	3.01	2.8	2.8	2.8	2.8	2.8	
Rainfall Volume (areal)(10 day)	In.	4.0	4.0	4.0	4.0	4.15	4.0	4.0	4.0	4.0	4.0	
Runoff Volume (10 day)	In.	2.09	2.37	2.09	2.37	1.88	2.31	2.31	2.24	2.46	2.37	
Capacity of Low Stage (Max.)	Cfs.	34 1/	27 1/	-	15 1/	-	45 1/	45 1/	-	90 1/	49 1/	
Capacity of High Stage (Max.)	Cfs.	138	115	143	131	158	148	128	138	151	117	
Frequency Operation - Emergency Spillway	%chance	1	1	1	1	1	1	1	1	1	1	
Size of Conduit	In.	30	30	30	30	30	30	30	30	30	30	
Emergency Spillway												
Rainfall Volume (ESH)(areal)	In.	5.45	5.8	5.3	5.8	5.0	5.8	5.8	5.8	5.8	5.8	
Runoff Volume (ESH)	In.	3.7	4.01	3.65	4.01	2.89	4.12	4.12	4.12	4.12	4.01	
Type		Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	
Bottom Width	Ft.	60	15 3/	100	15 3/	150	100	15 3/	70	40	40	
Velocity of Flow (Ve)	Ft./Sec.						5.2					
Slope of Exit Channel	Ft./Ft.						.04					
Maximum Water Surface Elevation	Ft.	5,700.9	5,675.8	5,753.5	5,709.1	5,761.7	5,777.9	5,797.1	5,817.0	5,825.7	5,769.9	
Freeboard												
Rainfall Volume (FH)(areal)	In.	15.0	16.0	14.7	16.0	13.6	16.0	16.0	16.0	16.0	16.0	
Runoff Volume (FH)	In.	13.0	13.93	12.64	13.93	11.00	14.07	14.07	14.07	14.07	13.93	
Maximum Water Surface Elevation	Ft.	5,709.4	5,681.7	5,761.0	5,724.3	5,768.2	5,784.2	5,803.5	5,826.0	5,831.7	5,774.8	
Capacity Equivalents												
Sediment Volume	In.	3.10	2.38	2.21	2.60	1.23	1.88	.91	1.69	1.68	2.21	
Retarding Volume	In.	1.35	1.13	0.91	1.01	.69	1.01	.91	1.00	1.02	1.00	

1/ Orifice controlled flows.
2/ Sediment and retarding capacity at crest of 2d stage riser and/or concrete chute spillways.
3/ Weir length of high stage in a 2-stage riser.
4/ Crest of 50' wide auxiliary earth spillway.
5/ Crest of 30' wide auxiliary earth spillway (2' below top of dam).
6/ Crest of 300' wide auxiliary earth spillway @ elev. 5762.0.
7/ Crest of 50' wide auxiliary earth emergency spillway.

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PART 4 – REQUESTER'S COPY

TABLE 3A - STRUCTURE DATA

CHANNELS

Espanola - Rio Chama Watershed New Mexico

Channel (No. or Name)	Reach From Station	Reach To Station	Drainage Area (sq.mi.) 5/	Capacity (cfs)	Hydraulic Gradient (ft/ft)	Channel Dimensions Bottom (ft)	Depth (ft)	Side slopes 1/	"N" Value Aged	"N" Value As Built	Velocities ft/sec Aged	Velocities ft/sec As Built	Excavation (cu. yds.)	Type of Work 2/	Before Project Type of Channel 3/	Before Project Flow Conditions 4/
Site 3 Outlet	9+00	45+00		PIPELINE												
	45+00	60+00		27	.001	2.0	1.9	1:1	.014	.014	3.4	3.4	-	IL	0	E
Site 4 Outlet	12+00	36+00		143	.0233	25.0	0.8	3:1	.031	.031	6.16	6.16	6,000	II	N	E
	36+00	50+00		PIPELINE												
	50+00	67+00		143	.001	2.0	4.3	1:1	.014	.014	4.3	4.3	-	IL	0	E
Site 6 Outlet	20+00	63+00		158	.017	42.0	0.7	2:1	.028	.028	5.4	5.4	13,100	II	N	E

I-18

1/ Where Excavation is not planned, show cross sectional area and wetted perimeter below hydraulic grade line.

2/ I. Establishment of new channel including necessary stabilization measures.

II. Enlargement or realignment of existing channel or stream.

III. Cleaning out natural or manmade channel (includes bar removal and major clearing and snagging operation.)

IV. Clearing and removal of loose debris within channel section.

V. Stabilization as primary purpose (by continous treatment or localized problem areas - present capacity adequate).

NOTE: A subscript "L" should be added to the Roman numeral classification to indicate an impervious lining.

3/ N - An unmodified, well defined natural channel or stream.

M() - Manmade ditch or previously modified channel (show approximate date of original major construction in parenthesis).

O - None or practically no defined channel.

4/ Pr - Parennial - flows at all times except during extreme drought.

I - Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons.

E - Ephemeral - flows only during periods of surface run-off, otherwise dry.

S - Ponded water with no noticeable flow caused by lack of outlet or high groundwater table.

5/ All flows are principal spillways only.

June 1976

TABLE 4 - ANNUAL COST

Espanola-Rio Chama Watershed, New Mexico

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost 2/	Operation and Maintenance Cost	Total
1	357,570	12,400	369,970
2	164,010	7,600	171,610
Project Administration	106,470		106,470
GRAND TOTAL	628,050	20,000	648,050

1/ Price Base 1975.

2/ 100 years @ 6-1/8 percent interest.

June 1976

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Espanola-Rio Chama Watershed, New Mexico

(Dollars) 1/ 2/

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefit
Floodwater-Agricultural			
Crop and Pasture	10,540	750	9,790
Other Agricultural	3,300	300	3,000
Interruption of Irrigation Water	2,740	0	2,740
Damage to Irrigation Facilities	7,280	0	7,280
Floodwater-Non-Agricultural			
Residential	321,030	4,160	316,870
Commercial	184,160	150	184,010
Road & Bridge	5,990	0	5,990
Subtotal	535,040	5,360	529,680
Sediment			
Agricultural	59,340	16,190	43,150
Indirect	93,820	2,400	91,420
Total	688,200	23,950	664,250

1/ Price Base 1975.

2/ Damages and benefits will accrue from floods of greater magnitude than the 1 percent chance of occurrence, but were not evaluated.

June 1976

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Espanola-Rio Chama Watershed, New Mexico

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/			Total	2/ Average Annual Cost	Benefit Cost Ratio
	Damage Reduction	Re-development	External Economies			
Unit 1	387,540	97,380	32,160	517,080	369,970	1.4:1.0
Unit 2	276,710	44,200	22,790	343,700	171,610	2.0:1.0
Project Administration					106,470	
GRAND TOTAL	664,250	141,580	54,950	860,780	648,050	1.3:1.0

1/ Price Base Agricultural - Current normalized prices; Non-agricultural - 1975

2/ From Table 4.

June 1976

PRINCIPLES AND STANDARDS

PHASE-IN ADDENDUM

C O N T E N T S

I N T R O D U C T I O N

This addendum is based on the Water Resources Council's Principles and Standards for resource planning.

The work plan for the Espanola-Rio Chama Watershed was developed using 1975 construction costs, current normalized agricultural prices, current non-agricultural prices, and 6-1/8 percent discount rate.

Effects and impacts resulting from the selected watershed plan alternative are displayed under separate accounts for National Economic Development, Environmental Quality, Regional Development, and Social Well-Being.

The abbreviated environmental quality plan has been developed by an interdisciplinary team using information and data prepared and assembled during investigations and analyses for the watershed plan. The development of the abbreviated environmental quality plan begins with a recognition of the watershed problems. Component needs to improve the environmental quality were developed, and alternatives or options to solve the needs were determined.

These options were translated into specific plan elements. The estimated preliminary cost of the environmental plan is $11,337,200. The expected environmental effects and impacts of the environmental quality plan are shown.

PART 1

DISCOUNT RATE COMPARISON

Espanola-Rio Chama Watershed, New Mexico

The work plan shows an evaluation of the project structural measures using 1975 installation costs and a discount rate of 6-1/8 percent.

Average annual costs, benefits, and the benefit-cost ratio are as follows:

1. Average annual costs are $648,050.

2. Average annual benefits:

   a. with externalities included are $860,780.

   b. without externalities included are $805,830.

3. The benefit-cost ratio:

   a. with externalities included is 1.3 to 1.0.

   b. without externalities included is 1.2 to 1.0.

PART 2
SELECTED ALTERNATIVE

ENVIRONMENTAL QUALITY ACCOUNT
Espanola-Rio Chama Watershed, New Mexico

Components	Measures of Effects
Beneficial and Adverse Effects	
A. Areas of Natural Beauty	1. Protection from flood damages will (a) promote beautification of the urban area in the Espanola planning area; (b) allow total development of the irrigated cropland area without interruption by flooding and ditch breaks, and (c) decrease sediment to the Rio Chama and Rio Grande.
	2. Rangeland treatment will increase vegetation on the upper watershed, and promote a pleasing landscape to view.
	3. Improved habitat will provide more frequent wildlife sightings.
	4. Construction will create some dust and noise and will present raw scars until embankments are revegetated.
B. Quality Consideration of Water, Land and Air Resources	1. Dust from sediment deposition areas will be lessened.
	2. Sheet erosion on upper watershed will be reduced.
	3. Runoff water will carry less sediment into the Rio Chama and Rio Grande.
	4. Better irrigation water management practices will require less water.

Components	Measures of Effects (Continued)
	5. Wind and water erosion will occur on disturbed areas until revegetation takes place.
C. Biological Resources and Selected Ecosystems	1. Rangeland treatment practices will result in more cover and feed for wildlife, reduced streambank erosion, and reduced sediment yields to the Rio Chama and Rio Grande.
	2. Good irrigation practices will produce more crops and more feed for wildlife.
	3. More water sources for domestic animals will also provide more water for wildlife.
	4. During construction and revegetation, wildlife habitats and food supply will be disrupted.
D. Historical, Archeological, and Geological Resources	1. Five archeological sites will have added protection because of erosion control measures on on rangeland.
	2. Two archeological sites will be inundated by floodwater backup behind structures.
E. Irreversible or Irretrievable Commitments	1. The dam and inundation area require 286 acres of rangeland that will be removed from full production.

SELECTED ALTERNATIVE
NATIONAL ECONOMIC DEVELOPMENT ACCOUNT
Espanola-Rio Chama Watershed, New Mexico

Components	Measures of Effects 1/ - - - Dollars - - -
Beneficial Effects:	
A. The value to users of increased outputs of goods and services	
1. Flood prevention	664,250
2. Utilization of unemployed & underemployed labor resources	141,580
Total beneficial effects	805,830

Components	Measures of Effects 1/ - - - Dollars - - -
Adverse effects:	
A. The value of resources required for a plan	
1. Floodwater retarding and diversion structures	
Project installation	521,580
Project administration	106,470
OM&R	20,000
Total adverse effects	648,050
Net beneficial effects	157,780

1/ Average annual.

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT
Espanola-Rio Chama Watershed, New Mexico

Components	Measures of Effects 1/ State of N. Mex.	Measures of Effects 1/ Rest of Nation
	- - - Dollars - - -	
Income:		
Beneficial effects:		
A. The value of increased output of goods and services to users residing in the region		
1. Flood prevention	664,250	
2. Utilization of unemployed and underemployed labor resources	141,580	
B. The value of output to users residing in the region from external economies		
1. Induced by and stemming from effects	54,950	
Total beneficial effects	860,780	
Income:		
Adverse effects:		
A. The value of resources contributed from within the region to achieve the outputs		
1. Floodwater retarding and diversion structures		
Project installation	12,740	508,840
Project administration	990	105,480
OM&R	20,000	
Total adverse effects	33,730	614,320
Net beneficial effects	827,050	-614,320

1/ Average Annual

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT (Continued)
Espanola-Rio Chama Watershed, New Mexico

Components	Measures of Effects: State of N. Mex.	Measures of Effects: Rest of Nation
Employment:		
Beneficial effects:		
A. Increase in number & types of jobs		
1. Employment for project construction	20 man-years of semi-skilled jobs over the 10-yr. installation period 245 man-years of unskilled jobs over 10-year installation period	--
2. Employment for project OM&R	0.5 permanent semi-skilled jobs	
3. Employment in service & trade activities induced by and stemming from project operation	1.5 man-years permanent semi-skilled jobs	
4. Agricultural employment	Will maintain 2.0 man-years of employment per year in agricultural production otherwise lost without project	
Total beneficial effects:	20 man-years of semi-skilled jobs over 10-year installation period 4.0 permanent semi-skilled jobs 245 unskilled jobs over 10-year installation period.	

Components	Measures of Effects: State of N. Mex.	Measures of Effects: Rest of Nation
Employment:		
Adverse effects.		
A. Decrease in number & types of jobs	0	0
Total adverse effects	0	0
Net beneficial effects	20 man-years of semi-skilled jobs over 10-yr installation period 4.0 permanent semi-skilled jobs 245 man-years of unskilled jobs over 10-year installation period	

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT (Continued)
Espanola-Rio Chama Watershed, New Mexico

Components	Measure of Effects	
	State of N. Mex.	Rest of Nation
Regional Economic Base and Stability		
Beneficial effects:	The selected project will provide flood protection from a 1 percent chance of occurrence storm to 295 homes, 47 commercial business, 3 schools, 1 church, 1 hospital, and 12 public structures and installations. Six hundred thirty-five acres of irrigated cropland and 390 acres in the urban area will be protected. Protection from interruption by flooding of irrigation water to 737 acres will lessen the number of farms which will go out of production. The project will create 20 semi-skilled jobs and 245 unskilled jobs during the installation period and 4.0 permanent semi-skilled jobs. The area has been classified by the Economic Development Administration as a Title V area because of severely depressed economic conditions. Flood protection is an integral part of the success of many programs which are underway for the economic development and improvement of the Espanola-Rio Chama Watershed.	
Adverse effects:		

SELECTED ALTERNATIVE
SOCIAL WELL-BEING ACCOUNT
Espanola-Rio Chama Watershed, New Mexico

Components	Measures of Effects
Benefical and adverse effects	1. Create 20 man-years of semi-skilled employment, 245 man-years of unskilled jobs, and 4.0 permanent semi-skilled jobs.
A. Real Income Distribution	2. Create regional 1/ income benefit distribution of $860,780 flood damage reduction benefits by income class as follows:

Income Class - Dollars -	Percentage of Adjusted Gross Income in Class	Percentage Benefits in Class
Less than 3,000	26	40
3,000-10,00	53	53
More than 10,000	21	7

3. Local cost to be borne by region totals $223,500.

B. Life, Health, and Safety

1. Provide flood protection from a one percent change of occurrence storm to 295 homes, 1 school, 1 hospital, 12 public structures, 47 business, 390-acre urban area. Future threats of loss of life and displacements during floods will be decreased. Decrease pollution from animal and domestic wastes, outhouses, and sewer backups. Prevention of flooding will reduce the need for immunizations during flood events.

1/ The realization of these flood damage reduction benefits is considered to occur in the Espanola planning area.

Part 3

ENVIRONMENTAL QUALITY PLAN
(abbreviated)

Espanola-Rio Chama Watershed
New Mexico

The GOALS for this environmental quality plan for Espanola-Rio Chama Watershed are:

1. Enhance and improve areas of natural beauty.

2. Improve and maintain the quality of the land, water, and air.

3. Preserve and enhance the biological ecosystems.

4. Preserve the historic and archeological resources.

The main environmental PROBLEMS fall into four categories:

A. Deterioration of watershed lands by water erosion.

B. Periodic flooding of bottom land and urban areas.

C. Inadequate vegetative cover on rangelands.

D. Improper disposal of refuse.

The watershed is located west of Espanola and south of Hernandez in southern Rio Arriba County. Approximately ten percent of the area is nearly level bottom land along the Rio Chama and Rio Grande where the cropland and the urban land are located. This is where the severe flood damages occur.

Ninety percent of the watershed is range and grazable woodland. This is the area subject to erosion. Vegetation ranges from Ponderosa Pine forest in the higher elevations through pinon-juniper woodlands in the middle watershed to open grasslands with scattered brush on the rangelands closer to the rivers. Predominant grasses include blue grama, sideoats grama, black grama, sand dropseed, and threeawn.

The project area provides habitat for small rodents, skunks, and rabbits. Mule deer and wild turkey occur in the upper watershed areas, while scaled quail live within the floodplains.

An archeology survey and assessment was developed by the Museum of New Mexico. Seven archeological sites were located and recorded. Two of the seven are expected to be inundated by floodwater backed up by proposed structures. The remaining five sites are located outside the areas where construction activities or floodwater will have a detrimental impact. The State Historic Preservation Officer has granted archeological clearance for the project.

COMPONENT NEEDS for solving environmental problems are as follows:

1. Areas of Natural Beauty:

    a. Reduce water erosion on rangeland.

    b. Revegetate areas of unstable soil and severe erosion.

    c. Develop a deterrent to refuse dumping by the public.

    d. Develop parks and green space areas in the urban area.

2. Quality of Water, Land and Air Resources

    a. Protect the land resource base by reducing erosion.

    b. Maintain and improve the productivity of the land resource base.

    c. Reduce flooding of agricultural lands in the watershed and non-agricultural lands adjacent to the watershed.

    d. Reduce sediment deposition on farmlands and in the live stream courses.

3. Biological resources and ecosystems.

   a. Improve rangeland vegetation for wildlife habitat.

   b. Reduce damage to existing wildlife habitat from flooding and sediment deposition.

4. Archeological Resources.

   Protect identified sites in the construction area from disturbance during construction.

The PLAN ELEMENTS for maintaining, protecting, and improving the quality of the environment include land management, land treatment, structural measures, and archeological site protection.

The estimated installation costs of these elements are:

1. Application of land treatment systems and land treatment measures on 1,110 acres of irrigated cropland and 23,000 acres of rangeland.	1,090,000
2. Installation of ten floodwater retardation structures with associated appurtenances and fences.	10,227,200
3. Construction of six pickup stations for collection of refuse.	12,000
4. Developing green, park-like areas along channel levees in the town of Espanola.	6,000
5. Protect archeological sites in the watershed area during construction period.	2,000
Estimated Total Cost for Environmental Quality Plan	$11,337,300

The environmental EFFECTS that will result from implementation of the Environmental Quality Plan are:

1. Areas of Natural Beauty

   a. Enhance and improve the appearance of the rangeland.

   b. Enhance and improve the appearance of farms, rural homes, and urban areas.

   c. Create green, park-like areas within the Town of Espanola.

d. Structure sites will present a visual contrast with the natural terrain for several years until native vegetation is reestablished.

2. Quality of Water, Land and Air Resources

a. Sediment deposition will be reduced on farmland, in irrigation canals, and in the live stream courses.

b. Rangeland productivity will be improved by erosion control measures and revegetation.

c. Wind erosion will occur on structural sites during construction and until they are revegetated.

d. Flooding of urban land will be reduced.

e. Temporary loss of 20 acres of irrigated cropland during construction.

f. Permanent loss of 286 acres of rangeland to structure location and pool areas.

3. Biological Resources and Ecosystems.

a. Wildlife habitat on rangeland and grazable woodland will be improved.

b. Plant ecosystems on rangeland will be restored.

c. Wildlife diversity and populations will increase.

d. Wildlife habitat at the structural sites will be enhanced by fencing to exclude livestock grazing.

e. Wildlife habitat will be temporarily disturbed during construction and during application of mechanical land treatment.

4. Archeologic and Historic Resources.

a. Known archeological sites will be located and will be protected from construction activities.

b. Unknown archeological sites may be destroyed during construction period.

c. Potentially important historic resources in the Town of Espanola will be protected.

5. Irreversible and Irretrievable Commitments.

Project will require the use of land, commitment of labor, money, and materials to install, operate, and maintain the planned elements.

WATERSHED PLAN - PART II

ENVIRONMENTAL IMPACT STATEMENT

FOR

ESPANOLA-RIO CHAMA WATERSHED

USDA ENVIRONMENTAL IMPACT STATEMENT

ESPANOLA -RIO CHAMA WATERSHED PROJECT

Rio Arriba and Sandoval Counties, New Mexico

Prepared in accordance with
Sec. 102(2)(C) of PL 91-190

SUMMARY

I Final

II Soil Conservation Service

III Administrative

IV Project Purposes and Action.

A project for watershed protection, and flood prevention in Rio Arriba and Sandoval Counties, New Mexico, is to be implemented under authority of the Watershed Protection and Flood Prevention Act (PL-566, 83rd Congress, 68 Stat. 666), as amended.

V. Summary of environmental impacts:

1. More efficient use of water and related land resources in the watershed.

2. Reduction of damages to agricultural and urban property by floodwater and sediment originating in the uplands.

3. Improved vegetative cover will reduce erosion, provide more forage on rangeland for livestock and wildlife.

4. Temporary ponding of floodwater from the uplands on 767 acres will be eliminated.

5. A reduction in sediment yields to the river from the present estimated 20 acre feet per year to an estimated 5 acre feet per year.

6. The proposed embankments will block an arroyo in an area of high visibility.

7. An increase of crop yields and possible change to high value cash crops.

8. There will be 265 new jobs created during construction and 1-1/2 manyears of permanent unskilled and semiskilled labor will stem from the necessary operation and maintenance.

9. During construction there will be:

   Increased noise from construction equipment. Increased dust and engine exhaust in the project area. Temporary inconvenience of short detours on county or private roads for installation of pipelines, culverts or bridges.

   Temporary loss of vegetation and lag gravel cover on about 911 acres that are now partially protected from wind and water erosion.

   Temporary loss of production on or about 20 acres of cropland where the pipelines will be installed.

10. About 300 acres will be taken up by structural and sediment pools.

11. About 18 acres of available wildlife access routes between the uplands and the floodplain will be taken up by structural measures.

12. Two archeological sites will be inundated by floodwater.

VI Alternatives considered.

1. No project with a continuing, on-going land treatment program.

2. Land treatment combined with channel work and floodwater retarding structures.

3. Accelerated land treatment.

4. Land treatment with channel work to the river.

5. Land treatment with zoning, floodproofing and flood insurance.

VII Written comments have been received from the following agencies:

Federal agencies:

Department of the Interior
Department of Health, Education, and Welfare
Department of Transportation
Environmental Protection Agency
Advisory Council on Historic Preservation
N.M. State Office, ASCS
N.M. State Office, FHA

State Agencies:

N. M. State Engineer
State Planning Office
Department of Game and Fish

Information copies have been sent to the following organizations:

Natural Resource Defense Council
Friends of the Earth
Environmental Defense Fund
National Wildlife Federation
National Audubon Society
Environmental Impact Assessment Project
Sierra Club, N.M. Section

VIII Draft Statement transmitted to CEQ on March 9, 1976.

AUTHORITY

USDA SOIL CONSERVATION SERVICE

FINAL ENVIRONMENTAL IMPACT STATEMENT 1/

FOR

Espanola-Rio Chama Watershed New Mexico

Installation of this project constitutes an administrative action. Federal assistance will be provided under authority of Public Law 83-566, 83rd Congress, 68 Stat. 666, as amended.

SPONSORING LOCAL ORGANIZATIONS

An application for federal assistance under Public Law 566 was first submitted in June 1963. The 225,121 acre watershed area included all drainage to the Rio Chama and Rio Grande from the west, beginning at the City of Espanola and extending to the Divide, five miles west of the Village of Abiquiu.

Sponsors were the City of Espanola, the Abiquiu Vallecitos and the Espanola Valley Soil and Water Conservation Districts, and the County of Rio Arriba. Others expressing approval and willingness to assist in the completion of the program were: The U. S. Bureau of Land Management, the Bureau of Indian Affairs, the Abiquiu Livestock Owners Association, the U.S. Forest Service, the Bartolome-Sanchez Land Grant, the Pueblos of Santa Clara and San Juan, the New Mexico State Highway Commission, and the New Mexico Commissioner of Public Lands. In 1970, the East Rio Arriba Natural Resource Conservation District replaced the two Soil and Water Conservation Districts as co-sponsor of the project.

A favorable Preliminary Investigation Report was completed in September 1964. Planning was authorized in February 1968, and active field work was started in July of that year. Also favorable was the feasibility report included in "El Rio Arriba Sub-basin, Upper Rio Grande Basin, New Mexico, Preliminary Early Action Opportunities." This report was published by U.S. Department of Agriculture and the New Mexico State Engineer in 1969.

1/ All information estimates and data, except as otherwise noted, were collected by the Soil Conservation Service and Forest Service, U. S. Department of Agriculture.

At the initial meeting of the local people, a watershed district was organized consisting of members of the sponsoring organizations and other interested groups. District organizational and implementation meetings were regularly held, well-advertised, and favorably attended, manifesting widespread local interest. A "Flood Damage Questionnaire," for use by commercial and industrial property owners, was drafted and distributed to aid in the economic evaluation of damages.

Specialists of the West Technical Service Center, Soil Conservation Service, Portland, Oregon, as well as representatives of all interested national, state, and local agencies, were invited to participate in the initial field surveys. Their ideas are incorporated in the formulation of the plan.

In November 1968, the certification of the Espanola-Rio Chama Watershed District as a sub-division of the East Rio Arriba Soil and Water Conservation District, an entity of state government, was officially recorded.

Rescheduling of priorities by the State Watershed Committee resulted in delay in compilation of the work plan after field work was essentially complete in 1971. In 1974, the local people reevaluated the proposed watershed and in May 1975 submitted an amended application. The new application requested assistance on 43 square miles of the original area, deleting the area from Hernandez to Abiquiu from the project. The sponsors for the project at present are: The Espanola-Rio Chama Watershed District, the East Rio Arriba Natural Resource Conservation District, the City of Espanola, and the County of Rio Arriba, New Mexico.

PROJECT PURPOSES AND GOALS

Watershed protection, flood prevention and reduction of floodwater and sediment damage are the primary objectives desired by the sponsors.

The following specific objectives were agreed upon as a basis for project formulation:

1. Determine and establish on the land the needed land treatment measures which contribute directly to watershed protection, flood prevention, sediment control, and make possible the maximum proficiency in irrigation management. The objective is to apply 75 percent of the needed measures by the end of the project installation period.

2. Attain a significant reduction in average annual flood damages. A significant reduction is described as:

a. Control of the 10 percent chance of occurrence storm for the watershed area contributing floodwaters to the agricultural lands.

At a mimumum, controlling 75 percent of the watershed contributing area.

b. Control of the storm having a one percent chance of occurrence for the watershed area contributing floodwaters to urban areas.

At a minimum, controlling 75 percent of the watershed contributing area.

Formulation of land treatment and structural measures is to be within the framework of existing plans and to assist in the full development and stabilization of the economy of the area.

PLANNED PROJECT

Land Treatment Measures

Land treatment measures will be applied throughout the Watershed in combinations needed to achieve proper use and adequate treatment. It is estimated that 24,700 acres will be adequately treated during the project installation period. On private land this will be achieved by operators developing and applying complete conservation plans with the East Rio Arriba Natural Resource Conservation District. On Federal lands the administering agency will be responsible for the plans and application of the needed measures.

On irrigated cropland, this involves the installation of satisfactory irrigation systems so that high efficiency in water application can be achieved. Adequate fences and livestock water facilities are necessary on rangeland before a desirable deferred grazing system can be initiated. Needed facilities will be identified in the conservation plans. Land treatment measures that improve wildlife habitat will be encouraged on both cropland and rangeland. Improved grazing systems on rangeland will increase the amount of wildlife food. The application of the land treatment measures will improve the vegetative cover on the range, reduce runoff, and erosion. These measures will lengthen the life of the structure and improve the economic condition of the farmers and ranchers by stabilizing and increasing production.

The cost of this land treatment is estimated to be $719,300.

By the end of the installation period (10 years), 100 percent of the needed measures for adequate treatment will have been applied on the rangeland and 74 percent on the irrigated croplands.

The above planned measures, applied on a voluntary basis, will be installed under specifications and standards, and with the technical assistance of the Soil Conservation Service on private and state land. Measures on Federal land will be administered by the Forest Service, Bureau of Land Management and Bureau of Indian Affairs.

Structural Measures

Ten floodwater retarding structures will be installed on the major drainages of the watershed. These structures will have a design life of 100 years and will be earthfill embankments with reinforced concrete appurtenances. Outlets to the river for all structures will consist of pipelines, lined channels, stabilized earth channels, or a combination of these. All construction materials for the embankments will come from the immediate site area. All dams will be located at the topographic break (in the escarpment) immediately above the damage areas where each will be most effective.

The damage area has been divided into two evaluation units. Unit Number 1 will control 83 percent of the source of damaging floodwaters and sediment, and Unit Number 2 will control 17 percent. Unit 1 includes structure sites 1, 3, 4, 5, and 6 and outlets. Unit 2 includes structure sites 8S,8N,9,10, and 11 and their outlets.

All of the floodwater retarding structures will be constructed upon moderately yielding foundations. Materials of the foundations consist of sand with gravel overlying dense, consolidated beds of sandy silt, low plasticity sandy clay, and silty sand. Depth to the consolidated beds ranges from the surface to more than 30 feet. All dams will have zoned embankments, except 3 and 5, which will be constructed as homogeneous fills. Embankment construction materials will consist of sandy silt, silty fine sand, low plasticity sandy clay, and silty sand with gravel.

All principal spillways will be constructed upon moderately yielding foundations. All conduits will consist of 30-inch diameter reinforced concrete pipe bedded in concrete cradles with anti-seep collars. At Sites 1,3,5,8S,8N,10, and 11 the principal spillway inlets will be two-stage risers proportioned to fit the pipe barrel diameters. Sites 4,6, and 9 will have a single-stage riser inlet. All inlet risers will be provided with ungated openings sized to drain the flood volume produced by a 25-year, 6-hour storm in a maximum of 96 hours.

The inlets at Sites 1,3,5,8S,8N,10, and 11 will be orifice-controlled to release a predetermined discharge. All first stage riser inlet crests will be placed at the elevation of the anticipated 100-year sediment levels. The second stage of the inlet risers is set at the 100-year retarding pool elevation.

The principal spillways at all structure sites excepting Numbers 4,5, and 6 will discharge directly into a pipeline. At site 3, the pipeline and a concrete lined channel will convey the principal spillway discharge to the river. An energy dissipator and air vent will be provided at the point of entry. Pipeline outlets and all other planned outlets are further described under each site.

Concrete emergency spillways are planned for structures at sites 1,4,6,9,10, and 11. The concrete spillways will be provided with baffles for de-energizing purposes. The primary emergency spillway at Sites 3, 5, and 8N is the second stage of the riser and the principal spillway pipe. An auxiliary earth spillway is planned at these three sites. An earth emergency spillway is planned at Site 8S.

Flows through the emergency spillways will take place only after the one percent chance of occurrence storm and flood have occurred. Emergency spillway flows at all sites except Site 3 and Site 8S will be in the existing natural channel. Flows through the emergency spillways at Sites 3 and 8S will be in an existing arroyo for about 200 feet and 1,000 feet respectively, before returning to the existing natural channel. Use of these areas will be restricted to non-structural measures, such as open space, agriculture, or parks.

Retarding volume and principal spillway flows at all sites will provide, as a minimum, control from the runoff produced by a one percent chance of occurrence storm. Initially, runoff control will be greater because the volume allotted to the 100-year sediment storage will be available for retarding capacity.

Existing utilities at the sites will be modified or re-routed to fit site conditions and planned work. Existing fences within the construction areas will be removed and either replaced or relocated by the Sponsoring Local Organization.

Measures to minimize soil erosion and air and water pollution will be applied during construction. Soil erosion will be held to a minimum by the installation of culverts at road crossings; by the use of mulch and/or temporary vegetation, diversions, debris basins, and traps in borrow and excavation areas. The sprinkling of roads in the work area, wetting borrow areas, placing of mulch and the temporary seeding of borrow areas are methods that will be used to minimize air pollution. Water pollution will be kept to a minimum by installing culverts at road crossings, sediment traps, debris basins, and by use of chemical sanitary units and/or locating sanitary facilities in areas that will preclude contamination of surface and sub-surface water supplies. The water resources in

the area which will be protected during construction include domestic water wells for development outside the City of Espanola, stockwater wells, and irrigation water diverted from the Rio Grande and the Rio Chama. Noise abatement will be accomplished by requiring the contractor to work only during daylight hours. Proper maintenance of equipment and disposal of waste oil will be required of contractors during construction.

All exposed concrete appurtenances will be stained to blend with the landscape. All areas of bare earth exposed during construction will be reshaped by the contractor. Major structures will be fenced and protected from excessive erosion.

Construction contracts will make provisions for actions to be taken should significant historical or archeological values be encountered. Provisions will include instructions to all construction personnel to report such findings and to promptly avoid unnecessary destruction of artifacts and features. Provisions will also include the suspension of operations which would damage the findings until the State Historic Preservation Officer or the National Park Service Office of Archeology and Historic Preservation (as appropriate) has been notified and a decision on needed action obtained. Such action will follow procedures in P.L.-93-291. Also since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historic resources.

Site 1

The floodwater retarding structure at Site 1 will control a drainage area of 4.42 square miles. It will have a total capacity of 1,048 acre-feet, of which 730 acre-feet are for the 100-year sediment volume. A 60-foot wide concrete chute with the capacity to pass the routed Class "c" freeboard hydrograph is planned at this site. The embankment will be approximately 4,900 feet long at the top and will be zoned. Borrow materials are located just upstream from the embankment within the sediment pool area. A pipeline approximately 5,070 feet in length extending from the structure to the river will convey principal spillway discharges. Reinforced concrete pipe (24-inch and 27-inch diameter) will be used for this pipeline. A flap gate will be provided at the outlet end of the pipeline. Landrights required include about 209 acres of rangeland at the structure location and about 7 acres of existing arroyo bottomland to install the pipeline. Subordination agreements will be required from the Southern Union Gas Company, the Jemez Electric Cooperative, and the state and county highway departments.

Site 3

The floodwater retarding structure at Site 3 will control 1.03 square miles of drainage area. It will have a total capacity of

193 acre-feet, of which 131 acre-feet are for the 100-year sediment volume and 62 acre-feet for the 100-year retarding volume. The emergency spillway system will consist of a 50-foot wide earth spillway and the high stage of the inlet riser. The system has the capacity to pass the routed Class "c" freeboard hydrograph without overtopping the dam.

A homogeneous embankment approximately 4,100 feet long is planned. Borrow for the embankment will come from the sediment pool and/or the reservoir area. Principal spillway discharges will be conveyed to the river by approximately 3,646 feet of pipeline and approximately 1,400 feet of concrete-lined ditch. The pipeline will connect to the outlet end of the principal spillway conduit and will require such appurtenances as manholes, transitions, a highway crossing, and a flap gate at the outlet end. The concrete ditch begins at the outlet end of the pipeline and extends to the Rio Grande. Landrights required include 104 acres of rangeland at the structure and three acres of rangeland plus four acres of cropland for the pipeline. That part of the pipeline east of the highway will parallel an inplace sewer line. Subordination agreements will be required from the State HIghway Department , the City of Espanola, the Southern Union Gas Company, the Jemez Electric Cooperative, and the irrigation ditch owners.

Site 4

The Site 4 floodwater retarding structure will control 6.35 square miles of drainage area. It will have a total capacity of 1,058 acre-feet with 749 acre-feet available for the estimated 100-year sediment volume and approximately 309 acre-feet for the 100-year retarding volume. A 100-foot wide concrete chute is planned as the emergency spillway. It will have the capacity to pass the routed Class "c" freeboard hydrograph without overtopping the dam. A zoned embankment, approximately 3,300 feet long, is planned at this site. Borrow material is available upstream from the embankment. An outlet consisting of a stabilized open channel, a pipeline, and a concrete-lined ditch will carry the principal spillway flows to the Rio Grande. Approximate lengths are 2,400 feet for the open channel; 1,400 feet of pipeline and 1,700 feet of concrete-lined ditch. Appurtenances for the pipeline include an inlet box with trash guard, road crossing, air vents as required, and a flap gate at the outlet end. Landrights include 110 acres of rangeland at the structure, 4 acres of rangeland plus 4 acres of cropland for the outlet system. Subordination agreements will be required form the Southern Union Gas Company, the Jemez Electric Cooperative, and the state and county highway departments.

Site 5

The floodwater retarding structure at Site 5 will control 0.26 square mile of drainage area. The total capacity at emergency spillway crest is 183 acre-feet, with 36 acre-feet available for the 100-year sediment volume, 14 acre-feet for the 100-year retarding volume, and 133 acre-feet for freeboard hydrograph retarding. An auxiliary earth emergency spillway 30 feet wide with the crest two feet below top of dam elevation is planned. The structure will store the anticipated 100-year sediment volume, and retard the routed Class "c" freeboard hydrograph storm. A two-stage riser is planned at the inlet to the 30-inch diameter principal spillway conduit. The low stage will be orifice-controlled for a small discharge, and the second stage will be set at the 100-year storm routing. The outlet will be provided with an energy dissipator and will discharge into the existing channel. A homogeneous embankment approximately 550 feet long is planned. Borrow material is available in the reservoir area. Landrights are required on about 32 acres of rangeland for this structure.

Site 6

The drainage area to be controlled by Site 6 is 17.68 square miles. Total capacity below the emergency spillway crest is 1,807 acre-feet with 1,158 acre-feet available for the 100-year sediment volume and 649 acre-feet for retarding volume. The emergency spillway system will consist of a 150-foot wide concrete chute and a 300 ft. wide auxiliary earth spillway with the capacity to pass the routed Class "c" freeboard hydrograph storm without overtopping the dam. The auxiliary earth spillway crest will be at the water surface of the emergency spillway hydrograph elevation. A zoned embankment approximately 3,290 feet long, 78 feet high, with 2.5:1 side slopes is planned. Borrow materials are available in the reservoir area. A stabilized open channel with the capacity to convey the maximum principal spillway discharge to the river is planned at this site. The channel will be approximately 4,300 feet long and will have a 42-foot bottom width with 2:1 side slopes. A road crossing will be installed where the channel crosses an unimproved road. Landrights required include 198 acres of rangeland for the structure, and 11 acres of existing arroyo bottomland for the channel. Subordination agreements will be required from the Southern Union Gas Company, the Jemez Electric Cooperative, and the state and county highway departments.

Site 8

Site 8 encompasses two canyons on which embankments are planned. Both floodwater retarding structures control 1.8 square miles of drainage area with site 8-South controlling 1.51 square miles and

site 8-North controlling 0.29 square miles. Eight South has a total capacity of 232 acre-feet below crest of the high-stage of the riser with 151 acre-feet available for the expected 100-year sediment volume and 81 acre-feet available for 100-year retarding volume. Eight North has a total capacity of 28 acre-feet with 14 acre-feet for the 100-year sediment volume and 14 acre-feet available for the 100-year retarding volume.

The spillway systems for both structures consists of the high stage in the 2-stage risers and earth auxiliary emergency spillways. The south structure earth emergency spillway will be 100 feet wide, with its crest about 2.4 feet below the routed emergency spillway hydrograph water surface elevation. Excavation from this spillway will be used to construct the embankment. The auxiliary earth spillway for the north structure will be 50 feet wide with its crest planned 1.1 feet higher than the routed emergency spillway hydrograph water surface.

Zoned embankments are planned at both locations. The south embankment will be approximately 720 feet long and the north embankment will be about 410 feet long.

Outlet pipelines will convey principal spillway discharges to the Rio Chama. The outlet pipeline from the north structure will join the south pipeline at a junction box approximately 420 feet downstream from the South embankment and approximately 1492 feet from the north embankment. From the junction box they become a commom pipeline to the river. Total length of the common line is approximately 4,700 feet. Both outlet pipelines will be connected to the principal spillway conduits with manholes. Other appurtenances planned for proper pipeline functioning include road crossings, air vents, operation and maintenance ditch crossings, an energy dissipator, and a flap gate at the outlet end. Landrights required include 70 acres of rangeland for the structure sites and 6 acres for the outlet pipeline (2 acres of rangeland and 4 acres of cropland). Subordination agreements will be required from the Southern Union Gas Company, the Jemez Electric Cooperative, and the state and county highway departments.

Site 9

The floodwater retarding structure at Site 9 will control three square miles of drainage. Below the emergency spillway crest it has a total capacity of 430 acre-feet, 270 acre-feet available for the 100-year anticipated sediment volume, and 160 acre-feet of retarding volume. A 70-foot wide concrete chute emergency spillway with the capacity to pass the routed Class "c" freeboard hydrograph storm is planned at this site. The embankment will be zoned. It will be approximately 780 feet long.

Borrow material is available from the pool area upstream of the dam. A pipeline, approximately 5,500 feet is length, will convey the principal spillway discharges to the Rio Chama. The outlet pipeline will connect to the principal spillway conduit and will include appurtenances such as manholes, road and ditch crossings, energy dissipator, flap gate, and air vents. The land rights required will include approximately 75 acres of rangeland for the structure site; 7.0 acres for the outlet pipe, 5 of which are cropland. Subordination agreements are required from the Southern Union Gas Company, the Jemez Electric Cooperative, and the state and county highway departments. A ranch road located in the reservoir area will be relocated.

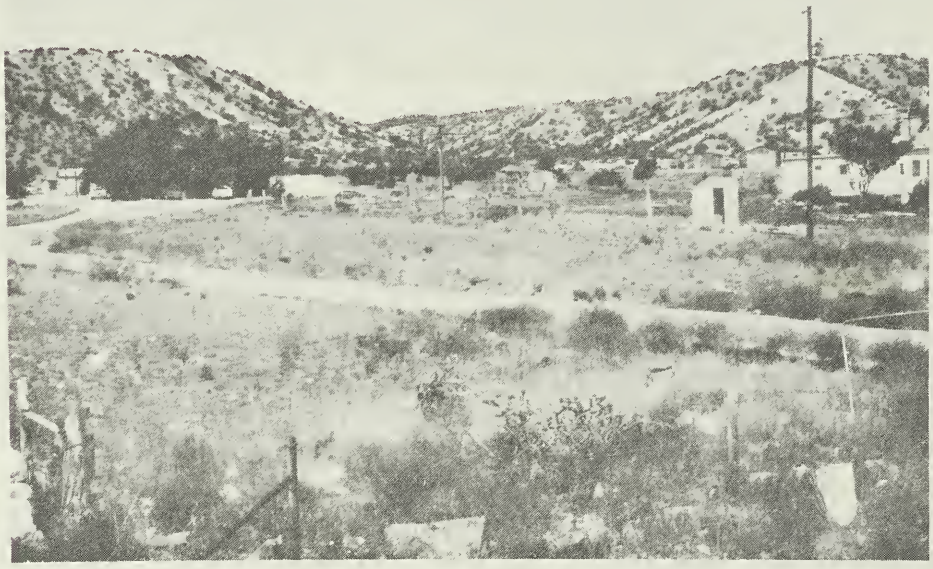
Site 10

The floodwater retarding structure at Site 10 will control 0.97 square mile of drainage area. A total of 140 acre-feet of capacity is provided below emergency spillway crest. Eighty-seven acre-feet of storage is for the 100-year sediment volume and 53 acre-feet for the floodwater retarding volume. A zoned embankment approximately 580 feet long is planned at the site. Borrow materials are available from the pool area upstream of the dam. The emergency spillway will be a 40-foot wide concrete chute with the capacity to pass the routed Class "c" freeboard hydrograph without overtopping the dam. An outlet pipeline is planned to convey the principal spillway discharge from this site and from Site 11 to the Rio Chama. The pipeline will consist of approximately 2,200 feet of 30-inch diameter concrete pipe and 2,400 feet of 48 and 42 inch diameter pipe. It will require several appurtenances, including manholes, irrigation ditch and road crossings, energy dissipator, flap gate and air vents. Land rights requirements include approximately 36 acres of rangeland for the structure and 6 acres (3 acres of which are cropland) for the pipeline right-of-way. Subordination agreements will be required from the Southern Union Gas Company, the Jemez Electric Cooperative, and the state and county highway departments.

Site 11

The floodwater retarding structure at Site 11 will control 0.45 square mile of drainage area. Capacity below the emergency spillway crest is 77 acre-feet with 53 acre-feet available for the 100-year sediment volume and 24 acre-feet for the retarding volume. A 40-foot wide concrete chute will serve as the emergency spillway. It will have the capacity to pass the routed Class "c" freeboard hydrograph. An embankment approximately 1,000 feet long, constructed with a zoned fill, is planned at this site. Borrow materials are available in the reservoir area. The principal spillway conduit will discharge into an outlet pipeline through a manhole. The pipeline will join the outlet pipeline which extends from Site 10 to the Rio Chama. This section of pipeline will be approximately

1,600 feet long. Landrights on 23 acres of rangeland are required for the structure site. Landrights on an additional two acres of rangeland are required for that section of outlet pipeline that extends from Site 11 to the Site 10 outlet pipeline. Subordination agreements will be required from the Southern Union Gas Company, the Jemez Electric Cooperative, and the state highway department.



Site 10 as viewed from
U.S.Highway 84 is a typical site.

ENVIRONMENTAL SETTING

Location

The watershed encompasses an area of 43 square miles (27,520 acres). It is located in the southeastern part of Rio Arriba County of North Central New Mexico. That part of the City of Espanola located west of the Rio Grande is in the southeast corner of the watershed. The Farming community of Hernandez, on the Rio Chama, is located in the watershed northwest of Espanola. Other small farming communities within the watershed are La Plaza and San Jose. The watershed is located 25 miles northwest of Santa Fe, capital city of New Mexico. It is in the Rio Grande Water Resource Region and the North Rio Grande Subregion (1302), as designated by the Water Resources Council, 1970.

Included in the watershed are the drainages of 11 arroyos that occasionally discharge large volumes of floodwater and sediment. Damaging runoff affects 635 acres of irrigated cropland bordering the Rio Grande and Rio Chama. Extensive damage is also sustained by irrigation facilities, urban areas, homes and farmsteads, public property, commercial and industrial establishments, roads, streets and their appurtenances, storm drains, and stream channels.

Physiography, Climate, Geology

The watershed lies within the Southern Rocky Mountain Physiographic Province. The terrain ranges from gently sloping to steeply mountainous with deeply incised arroyo-type drainage. Elevations range from 5,550 feet, mean sea level, in the Rio Grande floodplain to 10,500 feet in the upper reaches. The higher elevations lie within the Southern Rocky Mountain Land Resource Area. The irrigated lands are within the New Mexico and Arizona Plateaus and Mesas Land Resource Area. A geologic map is in Appendix D.

The watershed is in a semi-arid climatic zone. The average annual precipitation ranges from 9 inches in the valley to 30 inches in the mountains. Most of the rainfall of the valley occurs during high-intensity frontal storms in the months of July through September. The mean annual temperature, recorded at Espanola, is 51 degrees F. The extremes in temperature range from 106 degrees F. to -38 degrees F. The normal frost-free growing period is 152 days, from May 9 to October 8.

The watershed area is underlain by Tertiary and Quaternary age volcanics in the upper reaches with areas of thick colluvial deposits consisting of volcanic derived debris. Thick Tertiary-Quaternary age fan, volcanic mud-flow, and river-terrace deposits overlying Tertiary basin fill of the Santa Fe Group underlie

the mid-portion of the area. In the lower portion, the bedded and well-consolidated basin fill deposits are exposed along the scarp face of the valley border and underlie the area of the proposed structures. These deposits consist of thick to massive beds of silt, clay, sand, and gravel, and are usually horizontal in attitude. Locally, the beds are steeply dipping due to structural deformation near the basin margins. Quaternary alluvial fan and river-terrace deposits mantle slopes extending from the foot of the valley border scarp to the irrigated floodplain and low terrace area of the inner valley.

No mining development has taken place within the watershed, although many exploratory pits have been excavated in search of pumice deposits. Only small deposits of non-economic volume have been found. Several gravel and sand pits are located in the watershed but are not presently in operation.

Many domestic and stockwater wells in the alluvial fan and irrigated lands are developed in the alluvial fill. Irrigation water is diverted from the Rio Chama and Rio Grande.

Typical Rolling Mid-Upland

Typical Mountain Meadow of Higher Elevations

Soils

The soils of the irrigated area within the watershed consist of the Green River-El Rancho-Werlow association. These are deep, level to gently sloping, well-drained to somewhat poorly drained, loamy soils. Alfalfa, orchards, irrigated pasture, and vegetables are the crops most suited to these soils. Native vegetation includes black grama, sideoats grama, galleta, alkali sacaton, and Indian ricegrass; such shrubs as rabbitbrush, snakeweed, and cottonwood and willow trees.

The soils of the alluvial fan and scarp areas, paralleling the river and bordering the irrigated cropland, are of the Pojoaque-Rough broken land association. These are deep, gently undulating to hilly, loamy soils and hilly to steep gravelly land forms used for range. These soils support a sparse cover of juniper, snakeweed,

rabbitbrush, chamiza, and yucca. Sparse grasses found are blue grama, sideoats grama, black grama, ring muhly, sand dropseed, threeawn, and Indian ricegrass.

The mid-upland, an area of dissected low slopes and relatively flat ridge crests, consists of the Los Alamos-Bidman-Millett soils association. These are deep, loamy soils developed upon old fan, mud-flow, and river-terrace deposits. Locally, these soils are underlain by layers of pumice and volcanic ash. The soils of this area support a thin overstory of juniper and pinyon. The more common grasses and shrubs are blue grama, sideoats grama, black grama, Indian ricegrass, sand dropseed, ring muhly, threeawn, rabbitbrush, snakeweed, and several species of cacti.

The higher elevations, over 8,000 feet m.s.l., have shallow soils on steep to very steep slopes in the Nambe-Cundiyo Association. The Fernando-Basalt Rock land-Dormilon soils association is found in the mid-uplands. These soils support a native vegetation of pinyon juniper with some minor areas of Ponderosa pine. The more common grasses are Arizona fescue, bluegrass, Junegrass, little bluestem, sideoats grama, pine dropseed, mountain muhly, western wheatgrass, and blue grama. Few desirable browse plants suitable for grazing by wildlife are found.

There are several square miles of the Fernando-Basalt Rockland soils association along the north boundary in the mid to higher elevations in the watershed. These areas are interspersed with grasslands and support, in addition to the grasses and shrubs in common with the remaining mid-upland area, Apache plume, big sagebrush, and Gamble oak.

A soils map showing the general location of the predominant associations and a table of soils characteristics appear in Appendix D. Appendix F lists the dominant plant species and also suggests the potential plant species.

Landownership and Land Use

The general landownership includes:

Bureau of Land Management	10.4 square miles
Forest Service	4.2 square miles
State-controlled	1.2 square miles
Indian land	15.8 square miles
Privately-owned	11.4 square miles
Total	43.0 square miles

Of the 11.4 square miles of private lands, 1.7 square miles are irrigated croplands and orchards, and the City of Espanola occupies 1.6 square miles.

Land Use	Percent
Irrigated Cropland	4
Urban, Roads, Misc.	8
Rangeland	62
Grazeable Woodland	26
Total	100

Cropland average consists of 15.2 percent alfalfa, 5 percent corn, 5.8 percent oats, 5.8 percent garden crops, 20.3 percent apples, 21.7 percent hay, 22.2 percent pasture and 4 percent idle land.

Most land in the watershed is used for grazing livestock. Various types of wildlife also use the watershed (see Appendix F).

Drainage

Included in the watershed are eleven ephemeral stream courses that occasionally discharge large volumes of floodwater and sediment. The individual drainage area of the arroyos ranges in size from about 0.25 square miles to about 17.7 square miles. Arroyo de la Plaza Larga, with a drainage area of 17.7 square miles, is located in the central portion of the watershed and originates in the steep topography on the eastern slopes of the Jemez Mountains. It flows in an easterly direction and is tributary to the Rio Grande. The channel is unmodified and well-defined. Five smaller arroyos are located to the south, and five other smaller arroyos are located to the north of this main arroyo. Each of the smaller arroyos has an unmodified, well-defined channel in the upper portion of the watershed. They are basically parallel to the main arroyo and flow in an easterly direction to the valley. Approximately 4,000 feet west of the river, the arroyo channels, with the exception of Guachupanque Arroyo, flow onto an irrigated agricultural alluvial fan. Irrigation canals traverse the alluvial fan area on the west side at the base of a steep escarpment and intercept the arroyo flows.

Guachupanque Arroyo is the southernmost arroyo in the watershed and has a well-defined channel to the Rio Grande. The group of arroyos north of Plaza Larga flow into a common area along the Rio Chama, while the lower group, south of Plaza Larga, flows into a common area along the Rio Grande. Normal flows are heavily laden with sediment, as much as 21,000 mg/l, and flow for only a few hours or less during and immediately after air-mass thunderstorms.

Wetlands

There are 40 acres of Type 1 wetlands, lands seasonally overflowed, and 120 acres of Type 2, water-logged croplands adjacent to the Rio Chama and Rio Grande. There are no wetlands in the range or forest areas.

Economic Data

Twenty-six percent of the land in the watershed is privately-owned. Twenty-four percent is administered by the Bureau of Land Management; 10 percent by the U. S. Forest Service; 3 percent by the State of New Mexico; and 37 percent by the Pueblos of Santa Clara and San Juan. The privately-owned segment includes 1.6 square miles of urban land within the corporate limits of the City of Espanola and 1,110 acres of irrigated croplands.

The farms and ranches of the watershed are small family-size operations. The irrigated farms range in size from 0.2 acre to 41.2 acres, averaging 6.6 acres per farm. There are 79 irrigated farm operations on 3 community ditches. All of the crop-producing land lies within the damage area.

The principal crops are alfalfa, orchards, chili, truck crops, and irrigated pasture. Current yields are as follows: Alfalfa, 2.5 tons per acre; apples, 200 bushels per acre; chili, 5,900 pounds per acre. Irrigated pasture is both grazed and cut, yielding 1.5 tons per acre. Currently, upland range is valued at $50-$100 per acre. Urban land outside the City of Espanola, in the alluvial fan areas, is valued at $3,000-$5,000 per acre. Urban land within the city is $5,000-$10,000 per acre. Irrigated cropland is valued at $1,200-$1,800 per acre.

U. S. Highway 84 crosses the watershed in the alluvial fan area above the irrigated lands. Being a major highway, it provides access to markets in Espanola and Santa Fe and to rail and highway connections to larger centers such as Albuquerque.

Rio Arriba County, in which the watershed project is located, was classified as economically depressed under the Area Redevelopment Act of 1965. The work force in the county totals approximately 6,501. 1/ Of this total, 1,050 (14.6 percent) were unemployed as of June 1972. 2/ The per capita income in 1969 for the county was $1,896. In March of 1972, 11.7 percent of the county population was receiving welfare or transfer payments. Thirty-five point seven percent received food stamps and commodities. 2/

1/ Employment Security Commission.

2/ Bureau of Business Research.

Yearly farm income in the watershed area averages $800-$1,000. 1/ Many operators or family members living on small farms supplement their income by off-farm work. All farming is done on irrigated lands where floodwaters and sediment do the most damage.

The watershed is located in the Four Corners Development Region, the Northern Rio Grande Resource Conservation and Development Project Area, and the Upper Rio Grande Basin Study Area.

Fish and Wildlife Resources

Currently, the upper portion of the watershed, administered by the U.S. Forest Service and the Santa Clara Pueblo, is the habitat of such game animals as mule deer (Odocoileus heminonus) and wild turkey (Meleagris gallopavo); in the lower reaches are found mourning doves (Zemaidura macroura) and scaled quail (Callipepla squamata). 2/ Many non-game mammals, rodents, and birds reside within the watershed or use it intermittently. A listing of representative wildlife habitats and wildlife species of the project area is found in Appendix F.

There are no fish habitats within the watershed, and none are planned.

Wildlife are not dependent upon habitats within the watershed. Game animals and others presently using the area move at will into and out of the watershed. Numerous birds, small mammals, and rodents remain throughout the seasons.

Wildlife populations within the project area are lower than state averages for similar type habitats; a result of past grazing use and increased human activity within more recent years. For example, the statewide mule deer populations for the period 1967-1974 averaged 15.1 deer/section; while the area including this watershed averaged only 1.7 deer / section. 3/

There are no threatened species of wildlife, as defined by the U. S. Fish and Wildlife Service, that are resident within the watershed boundaries.

1/ Bureau of Business Research.

2/ Report of reconnaissance survey of the watershed by the U. S. Department of the Interior, Fish and Wildlife Service, and the State Department of Game and Fish, dated 11/25/68.

3/ Game Surveys; F.A. Projects W-93-9 to 17; N.M. Dept. of Game and Fish

Recreational Resources

There are no recreational resources within the watershed other than those within the City of Expanola and that afforded by undeveloped U.S. Forest Service administered land. However, Rio Arriba County has numerous sites classified as "cultural property" of the State. The City of Espanola has a number of recreational sites and facilities. The county contains 1,410,156 acres of Forest Service land that is available for recreation, and 21,156 acres of state-owned land administered by the State Department of Game and Fish. A total of 1,420,840 acres are utilized for public hunting. The following recreational facilities are available for public use in Rio Arriba County and the City of Espanola:

Recreational Facilities

	County	City		County	City
Picnic Units	144	1	Miles of Fishing Stream	246	-
Camp Units	162	-	Tennis Courts	2	2
Lakes < 50 acres	15	1	Guest Ranch	1	-
Lakes > 50 acres	2	-	Baseball Fields	-	7
Recreation Park	-	1	Basketball Areas	-	8
Playground Areas	-	7	Swimming Pool	-	1

Archeological and Historical and Unique Scenic Areas

There are no sites or structures of historical interest within the watershed, listed in the National Register of Historic Places.

An archeological survey and assessment was compiled by the Museum of New Mexico of the project area. The report states:

"LA 12306 and LA 12307 of the seven archeological sites recorded during the survey of the flood-control areas will be inundated by floodwater back-up behind the earthen structures. The remaining five archeological sites are located outside the limits of the construction zones and floodpools and probably will not receive direct impact. Indirect impact may occur as a result of visitation to the construction zones during or following construction.

"Surface collections were made where cultural debris existed, but in no case did these collections indicate a need for further archeological work, and the significance of the sites to be inundated is minimal to archeological investigation of interpretation of the area, beyond knowing they exist. None of the sites are recommended for either State or Federal historical registers, and no such

sites are known to exist in the immediate vicinity of the dam-sites. No further mitigating actions for these sites are recommended, and archeological clearance should be given in each case so that construction can proceed." A copy of the archeological survey report is found in Appendix G.

The State Historic Preservation Officer has granted archeologic clearance for the projects.

The area is located on the northeast margin of the Jemez Caldera, a site of geologic interest. The caldera and associated volcanics are of scientific interest, especially in seismic and geothermal fields. It is an area of intense geothermal investigations at the present time. A three-component seismology recording station with central control at the Los Alamos Scientific Laboratory is located within the watershed at Santa Clara Peak.

Soil, Water, and Plant Management Status

Land in this area is handed down from generation to generation according to historical custom and divided between heirs. An initially large holding is thus reduced to many small farms as several generations pass. Today there are 79 landowners of 1,110 acres of irrigated lands.

The land treatment program in the rangeland is effective, with 92 percent of current needs applied to date. In the cropland area, only 30 percent of needed practices have been applied. Irrigation facilities and equipment needs are neglected because of the poor return from too small holdings. The East Rio Arriba Natural Resource Conservation District has leadership in establishing conservation practices, with assistance by the Espanola Soil Conservation Service Field Office. There are 13 active cooperators and 23 resource conservation plans in the watershed area. Sixty-one percent of the watershed lands are covered by conservation agreements, and 49 percent of the planned practices have been applied.

The City of Espanola has, in recent years, incorporated a large tract of irrigated and developed watershed land located to the north of the old city boundary. Urban development is accelerating in this area. Planned growth of the city foresees further encroachment onto the irrigated lands of the watershed. 1/

1/ Espanola, 1972 Comprehensive Plan.

WATER AND RELATED LAND RESOURCE PROBLEMS

Floodwater Damage

All runoff-producing rainfall in the watershed results from thunderstorms of short duration and high-intensity rainfall. These generally occur during the growing season. The resulting flash-floods flow from the arroyos onto the fan areas, overtopping banks and damaging culverts, roads, farmsteads, urban and commercial properties. The arroyo channels usually end at the irrigation canals. As a result, canals are filled with sediment and overtopped, spilling floodwaters and sediment onto the irrigated lands. This interrupts normal irrigation schedules. In the urban areas of Espanola, the flows damage streets, homes, utilities, commercial properties, schools, government offices, and storm drains. Guachupangue Arroyo loses its channel capacity before reaching the river and overbank flows move northward into the business district, adding to flood damage by the arroyos directly west of the city.

These combined flows pond between the dikes along the Rio Grande and those along the lower Guachupangue Arroyo.

Flood Damage to a Home from the Guachupange Arroyo

Floodwater damages about 635 acres of irrigated cropland. Five hundred sixty-one acres are damaged by sediment. Crops such as chili, alfalfa, orchards, feed crops, truck crops, and irrigated pasture are damaged.

Flood damage to 12 Acres of Agricultural property

There are approximately 390 acres damaged in the urban area. There are approximately 295 homes, 47 business establishments, 3 public schools, a technical vocational school, 12 public utilities and governmental offices, city streets, and storm drains which are subject to flood damages. Future developments in the floodplain are estimated to be 620 homes.

Flood damage to Highway South of Espanola in the 1968 Flood

Flooding with significant damage was reported in 1910, 1941, 1950, 1952, 1957, 1961, 1962, 1963, 1964, 1966, 1967, 1968, 1969, and 1973. The August 1967 flood, estimated to have a 2 percent chance of occurrence, resulted in significant damage to the alluvial fan area north of Arroyo de la Plaza Larga (Arroyo No. 6). The first arroyo north of Plaza Larga had a measured peak flow of 2,755 c.f.s. at the crossing of the arroyo under U. S. Highway 84. This storm covered part of the watershed area north of Plaza Larga. The floodwaters fanned out through the residential area downstream of U.S. Highway 84, inundating about 100 acres up to 3.0 feet in depth. The floodwaters flowed across the irrigation canal, inundating about 275 acres of the irrigated lands to depths up to 3.0 feet.

The value of the agricultural land subject to flood damage is $1,666,500; ditch systems and other agricultural improvements, $250,000; private property, homes, and farmsteads, $5,000,000; public property, $10,000,000; and business, commercial, and industrial properties, $12,000,000. Future development both outside and within the City of Espanola will suffer similar damages without control of the arroyo flows.

Sediment and debris in the Main Street of
Espanola from the 1968 flood

Floodwater damage to crops and pastures amounts to $10,540 annually. Other agricultural damages amount to $3,300. Non-agricultural damages amount to $511,180 annually. Interruption of irrigation water and damage to irrigation facilities amount to $10,020 annually.

Erosion Damage

Erosion in the watershed is moderate, with minor areas (less than 5 acres) of erosion of as much as 12 tons/ac/year. The rate of upland erosion is 1.76 acre feet/square mile/year, or 7.02 tons/acre/year. The rate of sheet and rill erosion ranges from 0.7 to 1.5 acre feet/square mile/year, an average of about 3.8 tons/acre/year. The rate of gully and channel erosion ranges from 0.08 to 1.6 acre-feet/square mile/year, an average of 3.3 tons/acre/year. The established erosion tolerance for the upland soils ranges from 3 to 5 tons/acre/year.

The drainages of the watershed are long and narrow. Flows are confined in channels that are in deep, narrow, steep-walled valleys. Gullying, for the most part, consists of deep rilling in the steep valley walls. Streambank erosion is from the concave side of sharp meander curves where flows have cut channels in the valley bottoms.

Roadside erosion is minor and areas of critical erosion are few and small.

Erosion on the irrigated agricultural lands is estimated to be less than 0.3 acre-feet/square mile/year (1.0 ton/acre/year).

Erosion damages have not been assessed monetarily, since it has only a minor effect upon the grazing lands and the sparsely vegetated, rough, broken lands. Agricultural production in the irrigated lands is not materially affected by erosion.

Sediment Damage

Damaging sediment delivered to the agricultural land amounts to 22 acre-feet per year, or approximately 87 tons per acre of damage area per year. This sediment is delivered by flashfloods and consists of approximately 35 percent fines with the remainder consisting of sand to cobble-size particles. Where deposited in large volumes on agricultural land and urban areas, sediment has to be removed. Where deposited in minor volumes, sediment can sometimes be spread and the land releveled.

Channels 1 and 6, the only arroyo channels through to the river, are damaged by coarse sediment deposits of an estimated 2.4 acre-feet per year. The fan areas of the remaining arroyos are damaged by approximately five acre-feet of coarse sediment deposition per year.

The average annual sediment yield to the Rio Chama and Rio Grande from the watershed is about 19.8 acre-feet, or approximately 49,500 tons per year. Relative to the total water yield to the river, sediment concentration is 18,727 mg/l. The quality of the river, already heavy with sediment discharged from the Rio Chama, is not noticeably reduced. The sediment load of the Rio Chama, measured at the Chamita gage, seven miles upstream, indicates a maximum daily sediment load of 340,000 tons and a minimum of "0" tons for the period 1947-60. 1/

1/ Water Resources Data For New Mexico, Part 2 Water Quality Records 1970, U.S.D.I.(GS).

Part of this sediment is being deposited in the Rio Chama and is causing a gradual encroachment on the irrigated croplands by the adjacent river-wash lands, and a noticeable rise in the water table is taking place. The average annual sediment damage, exclusive of any indeterminate minor damage to the river or downstream facilities, is $59,340.

Irrigation

Presently, the 1,110 acres of irrigated land is serviced by three ditch systems. Two ditches divert water from the Rio Chama and one diverts from the Rio Grande immediately below the confluence with the Rio Chama. Water quality is adequate, though heavily laden with silt and clay. Quantity of water is generally adequate for present irrigation needs.

The number of irrigated acres is slowly being reduced because the City of Espanola is encroaching upon the irrigated lands as it expands northward along the river.

The present irrigation facilities have been in use for a great number of years and are in need of rehabilitation. The ditches are, for the most part, unlined, the appurtenances in need of repair or replacement. One of the irrigation dams diverting water onto the watershed lands is inadequate. It is constructed of rock and brush.

Flood damage to irrigation ditch in 1971

The soils of the irrigated lands adjacent to where the arroyos terminate at ditches are degenerating as sterile outwash is spread with each ditch break. Crops grown within the watershed are compatible with the soils and climate. However, the poor financial condition of the community and individual farmers, as well as the small size of farms, precludes maximum use of modern farming equipment and technology.

Municipal and Industrial Water

Municipal water supplies for the City of Espanola are pumped from wells which tap aquifers in the beds of the Santa Fe Group, Tertiary-Quaternary age alluvium. The supply is adequate for anticipated growth. The total capacity of the water system was over eight times greater than the average daily consumption of the 1970 population of 4,528. 1/

The fluoride content exceeds standards of the Public Health Service, 2/ however, the quality is good with total solids of 302 ppm and a hardness (CaCO3) of 25 ppm. 3/

Recreation

There are no water-oriented recreational facilities within the watershed. Existing recreational resources are enumerated under Environmental Setting.

The 1970 population of Espanola was 4,528 4/ with several hundreds more living within the watershed boundary outside of the municipality. The population growth of the county was 5 percent in the period 1970 - 73. 4/ The local people expressed high interest in new water-based recreational sites, however, none are presently feasible within the watershed.

Fish and Wildlife

The slow change from irrigated lands to urban development (less than 3 families per acre) will have little effect on the present wildlife habitat. Those few wild creatures present usually flourish

1/ Bureau of Business Research.

2/ Technical Report 29c, New Mexico State Engineer.

3/ Bureau of Business Research.

4/ Census Report.

near habitation of man. Additions of green-belts along channels and other little used areas to be seeded to wildlife food plants are desirable. The major problems of wildlife within the watershed are:

(1) Low quality and quantity of vegetative food supplies resulting from poor land use in the past, particularly overgrazing and,

(2) Illegal hunting.

There are no live streams or fish habitats within the watershed. The damage to the adjacent main stream fish habitat by sediment and nutrients eroded from watershed lands is negligible relative to that carried by them from upstream sources.

There are no endangered species, as described by the U. S. Fish and Wildlife Service, that are resident within the watershed.

Economic and Social

Farm income is limited and must be supplemented by off-farm employment in order to provide even a modest standard of living. Limited non-farm employment opportunities prevent many families from supplementing their farm income. All of the farm and ranch units are classified as low income-producing units employing less than 1-1/2 man-years of labor. Farmland traditionally is divided among all children in a family. After several generations, the units are no longer economic. The small size, floodwater and sediment damages, low production and income, and lack of investment capital are contributing factors to the poor economic condition of the farms in the watershed.

Improved management such as combining several farms into a single operation, thus making investment in modern machinery practical, would greatly increase productivity, job opportunities, and farm income. There are 79 irrigated farms in the watershed, all of which are family operated. The average farm size is 6.6 acres.

The average gross sales per farm for Rio Arriba County is approximately $8,500. 1/

Sources of employment for Rio Arriba County (total work force, 6,501) in the major industry sectors are: 2/

1/ 1969 U. S. Census of Agriculture.

2/ Employment Security Commission, 1974.

Employment	Percent
Total Work Force	100
Unemployed	20.5*
Employed	79.5
Areas of Employment	**Percent**
Manufacturing	4.2
Mining	.5
Contract Construction	4.3
Transportation & Utilities	3.3
Wholesale Retail Trade	12.6
Finance, Insurance, & Real Estate	1.9
Service & Miscellaneous	13.6
Government	23.4
Other Non-agricultural	8.8
Agricultural	6.9
Employed	79.5

*April 30, 1975, New Mexico Manpower Review shows unemployment increased to 23.6 percent.

The 1970 value of the median family income for Rio Arriba County is $5,550, as compared to $6,300 for New Mexico. New Mexico is 65 percent of the national average.

Accessibility to roads and markets from farms and ranches within the watershed is good. There are no railroads or commercial airlines serving Espanola; however, Santa Fe (25 miles south) is served by a spur line of the AT&SF Railway, Interstate Highway 25, and commercial air service. Highway U.S. 84/285 serves the community.

The county is designated as an economically depressed area by the Public Works and Economic Development Act of 1965. Approximately 26 percent of the work force earns less than $3,000 per year and 79 percent earn less than $10,000 per year. Over 60 percent are eligible to receive some type of financial assistance. Additional employment opportunities are desperately needed.

The population of both city and rural areas is increasing. Espanola's annual rate of growth from 1970 to 1975, was about 3 percent. The Espanola planning area during the 1960's had an out-migration of approximately 200 people per year; however, it gained in population (14,765 in 1960 to 16,875 in 1970). The City of Espanola increased in population from 1,976 in 1960 to 4,528 in 1970.

Chronic unemployment and underemployment are expected to be reduced by as much as 100 man-years of labor during each year of the proposed construction period. Benefits from external economies will continue to provide a low level of increased employment even after installation.

There is at present a sawmill in operation within the watershed. Additional resource-related industry, such as packing and canning plants or wood products factories are needed. Such industry would raise the standard of living and reduce unemployment and the number of people dependent on public support.

RELATIONSHIP TO LAND USE, POLICIES AND CONTROLS

The following are watershed projects by government agencies which presently affect or will affect the general area. The Santa Cruz River PL-566 Watershed Project, with seven floodwater retarding structures, is located mostly within the county and lies 10 miles to the east. It was completed in 1962.

The Sebastian Martin-Black Mesa PL-566 Watershed Project, located on the Rio Grande, is immediately adjacent to the proposed project to the northeast. Two floodwater retarding structures were constructed in 1974, and four were designed in 1975. An environmental assessment has been developed for the remaining floodwater retarding structures.

The proposed plan complements and will possibly accelerate urban development as set forth in the City of Espanola Comprehensive Plan. The plan also complies with and complements the land use policies of the government agencies and Indian pueblos that administer the major portion of the watershed land.

The Abiquiu Dam, a Corps of Engineer flood control structure on the Rio Chama, is located 27 miles upstream of the watershed. This structure, together with El Vado Irrigation Reservoir further upstream, controls floods and irrigation flows in the river. The Llano Irrigation Project, a Bureau of Reclamation effort, is in the design stage of development adjacent to the watershed in the Espanola Valley of the Rio Grande.

ENVIRONMENTAL IMPACT

Conservation Land Treatment

In the uplands, which are primarily public lands, improved management and applied land treatment measures listed under the heading "Planned Project" will result in improved cover and increased forage on rangeland. Increased livestock yields will benefit the range leaseholder as well as the agency under whose management the land is entrusted. Improved vegetative cover will be a benefit to

wildlife in the area of habitat and forage plants. Because of the nature of the climate and topography, future water and sediment runoff will be held to near acceptable rates. Installation of land treatment measures will not appreciably change flood flows and sediment yield to the damage areas.

In the irrigated croplands, the application of land treatment measures will result in a reduction in irrigation water loss through seepagee less maintenance costs and time input in ditch operation, greater production and better distribution of stock in the haylands, and better and more consistent truck-crop and orchard yields.

Nonstructural Measures

The principal spillway discharge from three sites will be into either a modified or the existing natural channel. These and the natural channels where the emergency spillway will flow will have restricted use. These areas will be restricted to uses such as open space, agriculture, or parks. By restricting the use of this area, damage to future development will not occur.
Flood insurance is available within the corporate limits of Espanola at rates made affordable through a Federal subsidy. Insurance does not prevent damage, it only attempts to mitigate local costs of replacement and repairs.

Structural Measures

The major impact of the total program will be a 96 percent reduction of damages to agricultural and urban property by floodwaters and sediment originating in the uplands. Temporary ponding on 767 acres with inherent health hazards in both rural and urban areas will be reduced to that resulting from on-site storm events.

In the irrigated lands, reduced flooding and sediment damage will improve agricultural soils on 635 acres. Wildlife habitat will improve along 11.5 miles of irrigation canals and ditches as a result of fewer cleanouts. A significant increase in clean water yield to the main streams will result because the principal spillway flows from the retarding structures will be piped to the river. A reduction in sediment yields to the river from the present estimated 20 acre-feet per year to 5 acre-feet per year will result. Seasonal ditch breaks because of arroyo flows will be eliminated. Irrigation water interruption will cease to be a crop hazard.

The proposed embankments are of necessity located in the most physically and economically feasible sites, considering the objectives of the plan. The environmental and scenic aspects are also best accommodated at the selected locations.

During construction, engine exhaust emissions, noise, and dust due to equipment movement and the use of earthen construction material, are expected. Accelerated erosion may occur on 911 acres of required construction sites. Runoff water will be polluted by excessive sediment loads. Farming operations will be temporarily suspended in 20 acres of pipelines rights-of-way while construction is in progress. There will be a permanent loss of 18 acres of channel bottom access routes presently in use by wildlife moving between the floodplain and the uplands.

Each proposed structure will block an arroyo in an area of high visibility to the general public. U.S. Highway 84/285 traverses the arroyo fan areas adjacent to and topographically lower than the valley border scarp. The structures are located to the west and south within the sharp break in slope where each arroyo cuts through onto the floodplain. New earthen structures, of the dimensions proposed, will contrast sharply with the natural brownish-gray color of the scarp face. However, the natural scarp effectively blocks the view to the south and west of the highway; therefore, the observer tends to view the scene to the north and east across the Rio Chama and Rio Grande Valleys. In a few years, the elements and natural revegetation will blend the freshly turned earthen look in with the landscape.

Economic and Social

Employment for project construction will create 265 new semi-skilled and unskilled jobs over the 10-year installation period. Employment for operation and maintenance of the completed project will create 1.5 man-years of semi-skilled and unskilled jobs per year.

The completed project will increase crop yields. Increased yields, diversification, and possible consolidation of operating units will insure better incomes and help maintain jobs in agriculture.

Farmsteads, homes, and private property in the rural and urban areas will no longer sustain periodic floodwater and sediment damage. Public and private roads, streets, highways and appurtenances, and commercial and public buildings will suffer damage only from unusual on-site storm events. No longer having to bear these damage costs, both the public and private economy will benefit. With the input of this $664,250 into the local economy annually as demands on products and services, new and additional jobs will be created.

The completed project will enhance values of 1,110 acres of irrigated cropland, 1,024 acres of urban business and residential property, and 563 acres of alluvial fan areas. The fan areas have commercial, industrial, and residential development potential.

Due to construction demands, housing and services will be increased. Unemployment and under-employment will be reduced and sustained at the reduced level due to benefits derived directly from the project installation. Business and urban development will accelerate because of the elimination of flood damages.

FAVORABLE ENVIRONMENTAL IMPACTS

1. A 96 percent reduction in floodwater and sediment damage to Agricultural, rural, and urban property by runoff from storms ranging up to one percent.

2. A 60 percent reduction in ponding and associated health hazards.

3. An improvement in the capability due to sediment reduction of 561 acres of irrigated soils which lies within the damage areas.

4. A change from heavily sediment-laden flows (concentration estimated at 18,727 mg/L) to relatively clean water (concentration estimated at less than 5000 mg/L) yield to the main streams.

5. A reduction from 19.8 acre-feet annual yield of sediment to the main streams, present conditions, to 4.5 acre-feet with the project.

6. More efficient use of irrigation water will result from new ditch lining and non-interruption of service to the irrigators.

7. Future erosion control on 36 square miles of upland range at or below the present acceptable rates.

8. An increase in cover density on 36 square miles of upland range due to accelerated land treatment.

9. Improved wildlife habitat on 36 square miles of upland range because of increase in cover density.

10. Reduce sedimentation and excessive cleanout that are disruptive to wildlife habitat along 11.5 miles of irrigation canals and ditches.

11. There will be 265 new jobs created during construction.

12. One and one-half man-years of permanent unskilled and semi-skilled work will stem from operation and maintenance.

ADVERSE ENVIRONMENTAL IMPACTS

1. Dust, noise, and engine exhaust emissions during the construction period.

2. Temporary inconvenience of short detours where pipelines, culverts, or bridges are being installed on county and individual access roads.

3. Temporary loss while under construction of vegetative and lag-gravel cover on 911 acres that are now partially protected from wind and water erosion.

4. Temporary loss of the productive use of 20 acres of irrigated croplands while outlet pipelines are being placed below ground surface.

5. Loss of 15 acres of flood-prone fan surfaces to permanent channel and levee construction.

6. Permanent loss of 286 acres of rangelands in the valley border scarp to embankment and pool locations.

7. Loss to some wildlife of 18 acres of available access routes between the upland and the floodplain areas via arroyo channels where dams are to be constructed.

8. Temporary contrast between freshly turned, graded earth embankments and the brownish-gray eroded face of the valley border scarp.

9. Two archeological sites will be inundated by floodwater in the reservoir in a 1 percent chance storm.

ALTERNATIVES

1. Alternative Number 1, "No Project" Ongoing Land Treatment Only. With a "No Project" alternative, the current environmental and economic problems of the watershed will remain. Some will be relatively static in their impact. Others will increase in magnitude with time.

Land Treatment

The on-going land treatment program for conservation measures to be applied in the future on the rangeland of the watershed, consists

of the following: 3,427 acres of deferred grazing, construct 2 miles of fencing, install 3 stock tanks and troughs; construct 3 stockwater wells, and install 5,000 feet of stockwater pipeline. The estimated total cost of this needed treatment is $117,700. The costs of similar measures that have been applied to date were $309,141.

On the irrigated crop and pasturelands, land treatment measures costing $229,400 have been applied to date. Needed measures in the future will cost $336,700. These needed measures are as follows: apply 100 acres of conservation cropping systems, apply 300 acres of pasture and hayland management practice and 400 acres of irrigation water management, apply 220 acres of irrigated land leveling, install 120 irrigation water control structures, and construct 65,200 feet of irrigation ditch and canal lining.

Impacts

The on-going land treatment program will maintain the present level of efficiency of the irrigation systems. The productive capabilities of the cropland soils will continue to deteriorate because of the sterile outwash from the arroyos. As a result, farm income will be further reduced which will contribute to an overall lowering of the standard of living.

The upland area of public lands will in general maintain its present level of productivity and utility by wildlife. Wildlife habitat will be reduced by urbanization of the croplands now within the city boundary. Upland habitats in the public lands will remain static.

Sediment damage to farmsteads and commercial property and the costs of removal of sediment and releveling of croplands will increase. This will result from urbanization of the arroyo fan areas. As houses in the fan areas increase in density, the flood flows are more and more restricted to confined channels. Confined channels increase flow efficiency and sediment-carrying capacity, thus delivering larger loads to the ditches and cropland areas. Sediment and floodwater damage to urban property, highways, roads, streets, storm drains, utilities, and public buildings will continue to be an expensive budget item supported by local taxes. The normal increase in value of real property will be substantially retarded. City growth and development in the recently incorporated areas will continue but at a slow pace because of the flooding hazard. Any urban growth will result in an increase in the total damages. Health problems, because of ponded water, will continue to periodically plague the lower parts of the city.

Projected net monetary benefits of $212,730 annually as a result of the installation of the planned project will be foregone.

2. Alternative Number 2, Land Treatment and Channel work Combined with Floodwater Retarding Structures

This alternative consists of land treatment and channel work resulting in delivery direct to the river by some arroyos together with floodwater retarding structures with principal spillway outlets piped to the river.

Land Treatment

Land treatment measures to be applied in the rangeland during the 10-year construction period for this alternative consist of 24,100 acres of proper grazing use, 21,929 acres of deferred grazing, 1.2 miles of fencing, 2 stock troughs and tanks, 1 stockwater well, and 19,873 acres of planned grazing systems. Those to be applied on the irrigated lands are as follows: conservation cropping systems on 60 acres, pasture and hayland management on 240 acres, irrigation water management on 330 acres, irrigation land leveling on 140 acres, 39,000 feet of irrigation ditch and canal lining, 70 irrigation water control structures, and 120 acres of pasture and hayland planting. Total cost is estimated to be $719,300.

Structural Measures

Channels 1 and 6, which now empty into the river, will be lined with concrete to increase their capacity and to establish grade at a slope where a minimum of maintenance will be necessary. The small gullies just west of the Espanola Hospital will be diverted northward into Channel Number 3. Arroyos Numbers 3 and 4, presently terminating at the Vigil and Salazar Ditches, will be concrete lined and extended to discharge into the river. These channels will afford protection to urban lands and the recently incorporated lands under development in the City of Espanola, from storm events up to the one percent chance of occurrence. The area below Arroyo Number 5 will be protected from the probable maximum precipitation storm by a floodwater retarding structure. The present channel of Arroyo Number 6 will be modified to afford protection from the one percent chance of occurrence storm event as far as the irrigated lands. From that point to the river it will protect the irrigated lands from storms up to the ten percent chance of occurrence event. The areas below Arroyos 8-11 will be protected from storm events up to the one percent chance of occurrence by floodwater retarding structures with principal spillway outlets piped directly to the river.

The concrete lined Arroyo Channels 1,3,4, and 6 will require, to some extent, dikes, grade control structures, culverts, bridges, syphons, and other appurtenances. Acquisition of permanent rights-of-way, a responsibility of the local people, will cost an estimated $144,300. These rights-of-ways may be difficult to acquire because entire farms could be in the proposed alignment.

The family farms of the area tend to be narrow, elongated strips perpendicular to the river. Construction and installation costs for this alternative are estimated to be $8,835,800. Operation and maintenance, a local responsibility, is estimated to total $15,800 annually. Monetary benefits derived from implementation of this alternative are estimated to be $840,000 annually. The average annual cost including operations and maintenance, is estimated to be $558,400. Sponsors would not accept this alternative as it would increase sediment yield to the Rio Grande.

Impacts

The major impact will be a 95 percent reduction in floodwater and sediment damage from runoff originating in the upland to agricultural, rural, and urban property. This more than meets the objectives of the local people. Removal of the flood hazard will result in improvement in productivity or change to higher revenue crops on 631 acres of damaged soils. Future erosion control, at or below the present rates, through improved range management, will result in increased cover density and greater animal production by ranchers. These effects will result in increased crop yields, insuring higher incomes and more jobs. Farmsteads, homes, and private property in the rural and urban areas will no longer sustain periodic floodwater and sediment damage. Public and private roads, streets, highways and their appurtenances, and commercial and public buildings will suffer damage only from unusual on-site storm events. Damages presently amount to $688,200 annually. No longer having to bear these damage costs, both the public and private sectors will benefit. This will create greater demands for products and services, which in turn will result in more jobs.

The completed program will enhance values of 1,110 acres of irrigated cropland; 1,024 acres of urban business, industrial, commercial, and residential property; and 563 acres of alluvial fan areas. These fan areas have commercial, industrial, and residential development potential.

During construction, 250 man-years in new jobs will be created. Demands on housing and services will increase. Unemployment and underemployment will be reduced and sustained at the reduced level because of benefits directly derived from the project installation, and the business and urban development accelerated because of the elimination of flood damages.

Implementation of this alternative will result in a 60 percent reduction in size and duration of ponding and associated health hazards and the reduction in size of unsightly, unimproved flood-

prone areas. An increase of 67 percent in the total sediment yield from the watershed to the main stream, as well as a 66 percent increase in relative concentration of sediment entering the main stream will result.

The project will result in improved wildlife habitat on upland range. In the irrigated cropland areas, flooding and excessive cleanout along 11.5 miles of ditches and canals, which is disruptive to wildlife activity, will be eliminated.

Within the corporate limits of Espanola, permanent greenbelt or open areas of 11 acres will be established along channel levees. Construction will result in improved visual esthetics along Highway 84 by 62 acres of embankment and levee protection and maintenance.

During construction, there will be a period during which dust, noise, and engine exhaust emissions will be noticeable. This will be mitigated by minimizing haul distances, proper supervised maintenance of equipment, and wetting of roads and construction areas.

The installed project will result in a permanent loss of 8 acres of agricultural lands to provide channel rights-of-way. Also lost will be 41 acres of incorporated urban lands to channel rights-of-way. In the rangeland, 61 acres of very poor areas will be permanently lost to embankment and pool locations.

To wildlife, there will be a permanent loss of 21 acres of arroyo channel bottom now utilized as access routes between the uplands and river bottomlands.

During and for several years after construction, there will be a contrast between freshly turned graded earthen embankments and the brownish-gray eroded face of the valley border scarp along U. S. Highway 84. Concrete appurtenances to these earthen embankments, where exposed to view, will be stained to blend in with natural coloring.

3. Alternative Number 3, Land Treatment

Land treatment as the primary means of solving the watershed problems will result in the following impacts.

Because of the climatic and local agricultural-oriented economy, effective land treatment measures are concentrated in the irrigated croplands. The planned measures are: apply 100 acres of conservation cropping systems, 300 acres of pasture and hayland management, 400 acres of irrigation water management, and 220 acres of irrigated land leveling; install 120 irrigation water

control structures; and construct 65,200 feet of irrigation ditch and canal lining. In the upland, planned measures are: 24,100 acres of deferred grazing, construct 2 miles of fencing, install 3 stock tanks and troughs, construct 3 stockwater wells, install 5,000 feet of stockwater pipeline, 780 miles of terraces, 30 grade stabilization structures, and 5,950 acres of range pitting.

In implementing this alternative, the crop and hayland treatment measures will be decreased by a factor of 0.64 and applied during a 10-year period. Those applied in the rangeland will be increased by a factor of 4.24 and will also be applied within a 10-year period.

Impacts

Impacts are economical for the most part. Erosion in the irrigated area is negligible. Wildlife habitat at field borders and ditches and in the river wash land is not affected.

Erosion on most of the public-owned uplands will continue to yield similar materials as at present and at similar rates. Concentrated floodwater runoff will continue to follow heavy rainfall. Seeding minor areas and intensified management practices will increase cover density, and consequently reduce sheet erosion in those areas. This may result in less volume, but cleaner water runoff. Rilling and bank erosion in the deeply incised arroyos will then accelerate, offsetting any reduction in yields.

In the long run, floodwater and sediment damage in the areas now occupied by irrigated cropland will increase. It will increase because continued urbanization in the alluvial fan areas will confine the flood flows. This confined flow, with its greatly increased efficiency, will deliver its total volume of floodwater and sediment to the cropland damage area instead of spreading across the fan areas.

Floodwaters and sediment within the urban area of Espanola will continue to cause damage similar to that which occurs at present. Current damages from floodwater and sediment amount to $779,770 annually. Increased urbanization will result in increased total damage.

Land treatment measures as planned with this alternative will cost an estimated $3,452,000. Monetary benefits to be derived from the implementation of alternative Number 3 were not evaluated.

4. Alternative Number 4, Land Treatment with Channels directly to the River

Land treatment with all the larger arroyos returned to their natural channels to empty directly into the river will require the following works.

Land Treatment

The proper land treatment program is identical to that described in Alternate 2, page II-39.

Impacts

The application of the land treatment program will result in erosion control at or below the present acceptable rates. An increase in cover density will result in more profitable stock production and an improvement in wildlife habitat. Sheet erosion in the more dense cover will lessen; however, cleaner water runoff will result in deeper rilling in the steep arroyo sides and channel banks. Because of this, sediment and floodwater yields to the damage areas will not be reduced.

Structural Measures

Arroyos Number 1 and 6, which now empty into the river, will be lined with concrete to increase their capacity and to establish grade at a slope where a minimum of maintenance will be necessary. The small gullies west of the Espanola Hospital will be diverted northward into Arroyo Number 3. Arroyo Numbers 3 and 4, presently terminating at the Vigil and Salazar Ditches, will be concrete lined and extended to the river. Arroyo Number 5, too small to warrant channel work, will be controlled by a floodwater retarding structure with principal spillway outlet which will drain into the Salazar Ditch. Arroyo Numbers 8 and 9, presently terminating at the Salazar and Hernandez Ditches, will be concrete lined channels to the river. Arroyo Numbers 10 and 11 will be concrete lined channels to a common point about U.S. Highway 84, and thence via a single concrete lined channel to the river.

All concrete channels will require to some extent, dikes or levees, grade control structures, culverts or bridges, and syphons and other appurtenances. Channel banks and levees within the incorporated area of Espanola will be established as permanent green-belt areas. Any necessary borrow areas outside of the construction zone will be shaped and naturally revegetated. All new earthen construction will be naturally revegetated.

Acquisition of permanent rights-of-way, a responsibility of the local people, will cost an estimated $128,700. These rights-of-way may be difficult to acquire because entire farms could lie within the proposed alignment. The family farms of the area tend to be narrow elongated strips perpendicular to the river. Construction and installation costs for this alternative are estimated to be $8,098,500. Operation and maintenance, a local responsibility,

is estimated to total $15,700 annually. The average annual benefit for the channel alternative is $835,000 The average annual cost, including operation and maintenance, is estimated to be $513,000. Local sponsors were not interested in this alternative as it would increase the sediment deposition into the Rio Grande.

Impacts

Channels 1 and 3 will afford protection up to the one percent chance of occurrence storm event to urban lands and the recently incorporated lands under development in the City of Espanola. The area below Channel 5 will be protected for the 100-year life of the structure from the one percent chance of occurrence storm event. Channel 6 will be modified to safely carry the one percent chance of occurrence event as far as the agricultural land. From the ditch to the river it will protect the agricultural land from damage up to the ten percent chance of occurrence storm. Channel work on Arroyos 8-11 will protect the fan areas as far as the ditch from damage by storm events up to the 100 percent chance of occurrence. Arroyos 8 and 9 and the combined flows of 10 and 11 will be in an open channel from the ditch to the river. All will protect the agricultural lands from any storm event up to the ten percent chance of occurrence.

The major impact will be a 96 percent reduction in floodwater and sediment damage from runoff originating in the upland to agricultural, rural, and urban property. This more than meets the objectives of the local people. Removal of the flood hazard will result in improvement in productivity or change to higher revenue crops on 631 acres of damaged soils. Future erosion control, at or below the present rates, through improved range management will result in increased cover density and greater animal production by ranchers. These effects will result in increased crop yields, insuring higher incomes and more jobs. Farmsteads, homes, and other property in the rural and urban areas will no longer sustain periodic floodwater and sediment damage. Public and private roads, streets, highways and their appurtenances, and commercial and public structures will suffer damage only from unusual on-site storm events. Damages presently amount to $688,200 annually. Both public and private sectors will benefit with more money to spend. This spending will create greater demands for products and services, which will in turn result in more jobs.

The completed program will result in enhancement of the value of 1,089 acres of irrigated cropland; 1,024 acres of urban, business, commercial, and residential property; and 563 acres of alluvial fan areas. The alluvial fan areas have potential for commercial, industrial, and residential development.

During construction, 275 new jobs will be created. Demands on housing and services will increase. Unemployment and underemployment will be reduced and sustained at the reduced level because of benefits directly derived from the project installation and the business and urban development accelerated because of greatly reduced flood damages.

Implementation of this alternative will result in an 82 percent reduction in size and duration of ponding and associated health hazards resulting from a storm having ten percent chance of occurrence. An increase of 95 percent in the total sediment yield from the watershed to the rivers, as well as a 95 percent increase in relative concentration of sediment entering the river, will result. A more efficient use of irrigation water will result from new lining and non-interruption of service to the irrigators.

The project will result in an increase in wildlife habitat along embankment and levee areas being fenced. Wildlife habitat on upland range will increase in cover density and be improved. Flooding and excessive cleanout along 11.5 miles of ditches and canals, which is disruptive to wildlife habitat, will be eliminated.

Within the corporate limits of the City of Espanola, 22 acres of permanent greenbelt or open space will be established along channel levees. Construction will result in improved visual esthetics along U.S. Highway 84 by 70 acres of gravel surface protection and maintenance on embankments and levees.

During construction there will be a period with excessive dust, noise, and engine exhaust emissions. This will be mitigated by minimizing haul distances, proper supervised maintenance of equipment, and wetting of roads and construction areas.

The installed project will result in a permanent loss of 21 acres of agricultural lands to provide channel rights-of-way. Also lost 41 acres of incorporated urban land to channel rights-of-way. In the rangeland, seven very poorly vegetated acres will be permanently lost to embankment and pool locations.

There will be a permanent loss to wildlife of 3 acres of arroyo channel bottom now utilized as access routes between the uplands and the river bottomlands.

During and for several years after construction there will be a contrast between the normal croplands and the freshly turned earth levees and the newly constructed channels by viewers from U. S. Highway 84. Any concrete appurtenances to the channel systems, where exposed to view, will be stained to visually blend with the landscape.

5. Alternative Number 5, Land Treatment with Zoning, Floodproofing, and Flood Insurance

Land Treatment

The accelerated land treatment program, described under alternative 2, will be implemented under this alternative. Total cost of the measures will be $719,300. No flood reduction benefits accrue to land treatment.

Floodproofing

Floodproofing of the existing 295 homes, 47 commercial and industrial, and 12 public structures and installations that are now located in flood-prone areas is estimated to have an estimated average annual cost of $160,100. Floodwaters and sediment will continue to damage roads, streets, highways and their appurtenances, croplands, and irrigation systems. Total damages currently amount to $688,200 annually. Floodproofing will alleviate $584,810 of the direct commerical and residential damages. Total benefits are estimated to be $800,000 annually.

The local sponsors reject floodproofing as it does not alleviate flood or sediment damages to their agricultural land. In addition, this alternative does not adequately alleviate the safety hazards in flooding.

Non-Structural Measures

Parts of the flooded areas are extensively developed with homes and business establishments. With this development already being damaged by floods, zoning would not be effective in reducing flood damage.

Flood insurance is available within the corporate limits of Espanola at rates made affordable through a Federal subsidy. Availability of flood insurance within the County of Rio Arriba is expected in the near future. Flood insurance for existing development does not prevent damage, it is rather a method for recovering a portion of the local cost for replacement and repairs. Flood insurance for new developments however can be effective for flood damage reduction if land use controls require floor elevations to be above flood levels.

Relocation as an alternative will cost an estimated $11 million for the 295 homes, 47 commercial and industrial, and the 12 public buildings and installations now established in flood-prone areas. With these measures, floodwater and sediment damages to croplands and cultural improvements for which costs for mitigation are excessive will continue to be a problem. Ponding and associated health hazards will continue and even be aggravated with floodproofing as some efforts may divert or block present flow routes.

SHORT-TERM VS LONG-TERM USE OF RESOURCES

The project is compatible with future land use planning as displayed in the 1972 Espanola Comprehensive Plan. The plan indicates that of the present 1,110 acres in agriculture only approximately 200 acres will remain in that use by the year 2020. The major portion of the agricultural lands will be residential with less than three families per acre.

The completed project will serve to eliminate the immediate floodwater and sediment damage problem. It will do so for the design life of the structures and possibly longer if proper maintenance and care are exercised.

Implementation of the plan will complement and accelerate the Espanola Community projected long-term planned uses of land and natural resources. Agricultural uses are projected to yield to urbanization. 1/ Rangeland, being federally controlled for the most part, will continue to be utilized for stock raising and as undeveloped recreation areas. The rangeland areas to be occupied by embankments and floodwater pools produce little, and without the project, will continue to produce little. With the project, this acreage will serve as open greenbelt areas, and the embankments will protect the lands and cultural developments of the floodplain where urbanization is planned.

The design life of the project is 100 years. It is estimated that the sediment pools of the floodwater retarding structures will be filled in that period of time. The life of the sediment pools, and therefore that of the project, can be extended indefinitely by the simple expedient of using the stored sediment as a source of earthfill. The life of the proposed outlet channels can also be extended indefinitely with proper attention to maintenance and repair.

There is one PL-566 completed project in the immediate vicinity of the proposed plan area, Santa Cruz River Watershed; the Sebastian

1/ Espanola Comprehensive Plan, 1972

Martin-Black Mesa PL-566 project has been approved for construction and is partially complete. In the remainder of the sub-region there are: one completed pilot watershed project, one PL-566 project in the construction stage, one authorized for planning, seven potential projects for which applications have been received, and two potential projects for which planning has been discontinued. To date, none of the completed or approved PL-566 projects include water storage as a purpose. All are floodwater retarding structures with appurtenant diversions, etc. Within the sub-region there are two large Corps of Engineers Projects, the Jemez and Galisteo Dams, which also provide flood protection only. Other completed projects of the Corps within the sub-region include the Abiquiu and Cochiti Reservoirs, which provide recreation storage as well as flood storage. There are several Bureau of Reclamation operated projects within the sub-region, the Herron Reservoir and the Nambe-Pojoaque Irrigation Project. The Llano irrigation project near Espanola is being designed in 1975. Also, an irrigation and recreation storage, the Santa Cruz Reservoir, owned and operated by the Santa Cruz River Irrigation District, is located in the sub-region. There are also state operated small recreation reservoirs within the sub-region.

Because of the sediment storage capacity of this project, the Santa Cruz River, and the Sebastian-Martin Watershed projects, a substantial increment will be added to the life of Cochiti Lake, located 35 miles downstream on the Rio Grande.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The dam sites and pool areas of the proposed project will permanently occupy 286 acres of rangeland. The present value of upland range varies from $50 to $100 per acre. Actual forage production on the sparsely vegetated steep arroyo sides at these locations is, for all practical purposes, nil. As access routes for nocturnal wildlife, the arroyo floors are of some minor value. However, there will be any number of small arroyos remaining to serve this purpose.

The total commitment of $10,946,500, the estimated construction costs of the project, includes labor, material, and energy fuels. The estimated annual commitment to operation and maintenance of $20,000, also includes the costs of labor, material, and energy fuels.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

An application for assistance under Public Law 566 was filed in 1963. Sponsoring the application were the East Rio Arriba Natural Resource Conservation District, the City of Espanola, and the County of Rio Arriba. The watershed was authorized for planning in February 1968.

The state and local agencies that participated in project formulation and planning include the sponsoring organizations, the New Mexico State Engineer, the New Mexico State Planning Board, the Museum of New Mexico, the New Mexico State Highway Department, the New Mexico State Game and Fish Department, the Bartolome-Sanchez Grant Board, the Pueblo of Santa Clara, the Pueblo of San Juan, and other community groups and private individuals.

The National Register of Historic places has been consulted. There are no sites or structures listed for the watershed area.

The State Historic Preservation Officer has been consulted on the project. He has reviewed the attached archeological survey report and has granted clearance for the project. The Soil Conservation Service will comply with Section 106 of PL-89-665 and with Executive Order 11,593.

Federal agencies that assisted the local sponsors in project formulation and planning include the Soil Conservation Service, the Forest Service, the U. S. Fish and Wildlife Service, the Bureau of Land Management, and the Bureau of Indian Affairs.

During the period October 1968 to November 1973, six public meetings were held for the purpose of formulating and planning the project. The attendance reflected a majority of the organizations and agencies involved. Local news media published the problems encountered, solutions, and general progress of the planning process.

In the period 1974-1975, the sponsors drafted and secured approval by the local people of an amended application that reduced the watershed area to 43 square miles. The amended application was submitted and approved.

The following agencies were requested to review and comment on the draft statement:

Federal agencies:

Department of the Army
Department of the Interior
Department of Commerce

Department of Health, Education, and Welfare
Department of Transportation
Office of Equal Opportunity
Environmental Protection Agency
Federal Power Commission
Advisory Council on Historic Preservation
N.M. State Office, ASCS
N.M. State Office, FHA

State Agencies:

Office of the Governor
N. M. State Engineer
State Planning Office
North Central Economic Development District
Natural Resource Conservation Commission
Department of Game and Fish
State Park and Recreation Commission
State Forestry Department
Environmental Improvement Agency

The following agencies did not comment on the draft environmental impact statement:

Federal agencies:

Department of the Army
Department of Commerce
Office of Equal Opportunity
Federal Power Commission
N.M. State Office, ASCS

State agencies:

Office of the Governor
North Central Economic Development District
Natural Resource Conservation Commission
State Park and Recreation Commission
State Forestry Department
Environmental Improvement Agency

DISCUSSION AND DISPOSITIONS OF EACH COMMENT

ON THE DRAFT ENVIRONMENTAL STATEMENT

DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS

Comment

"To meet objections of both Santa Clara and San Juan Pueblos, some provision must be made to insure that each Pueblo is consulted and approval given for any changes or alterations to the original priority scheduling of sites, locations, and structures."

Response

All interested parties and publics will be included in discussions of any possible needed changes.

Comment

"On Page II-85 the proposed project will occupy permanently 286 acres of rangeland with a value of $50-$100 per acre. In this proximity to the highway and city of Espanola, these site values will range from $1000 to $7000 per acre."

Response

Much of the area required for structure installation is in arroyo bottoms or on the steep slopes of the ridges. These values as listed were estimates provided by local officials.

Comment

"San Juan Pueblo will not give any consideration or discussion to the Espanola - Rio Chama Watershed Project until some construction activity has started on sites 1 and 15 of the Sabastian-Martin Watershed Project. This is a particularly touchy subject with the Pueblo and rightly so, as they were assured that site 15 would be No. 1 in priority on the Sabastian-Martin. Site 15 protects Kennedy Junior High School and several San Juan homes."

Response - Noted

Comment

"It is felt that the maintenance of the watershed project structures should be the obligation of the Espanola -Rio Chama Watershed

District and that the plan should state that neither Santa Clara Pueblo or San Juan Pueblo would be held responsible for the maintenance on the structures."

Response

The watershed plan under the heading "Operation and Maintenance Provisions," clearly states, "the operation and maintenance of all structural measures will be the responsibility of the Espanola - Rio Chama Watershed District."

Comment

"Santa Clara Pueblo will not participate in or approve the present locations of structures 1 and 3. The Pueblo has definite plans for both these sites and will not relinquish these locations to the Watershed Project. By relocating the structures for sites 1 and 3 approximately 3/4 to 1 mile west, the Pueblo would probably reconsider the project. By relocating further west, the present location sites can be used for homes, industry, apartments, etc., and receive flood control protection from the watershed project. Under present locations of sites 1 and 3, these structures will be a determent to the Pueblo forever and prevent any future economical use of their land."

Response

Much of the area required for the two structures is not now suitable for development because of topography and flooding. The structures are located at sites that will provide maximum protection for existing developments. The local sponsors have evaluated this condition. A letter from the Chairman of the Espanola Rio Chama Watershed District states that they will continue to work with the Santa Clara Indians with a design that will satisfy their objections.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Comment

"In regard to the extension of irrigation, it should be noted that the encephalitis mosquito, Culex tarsalis, is commonly associated with agricultural irrigation and is frequently abundant. Large numbers of this mosquito, as well as other pest species, have forced local residents in many western states to form mosquito control districts. Most of the production is associated with "poorly managed water," which is noted on Page I-2 as a descriptor of current irrigation practices in the project area.

"We are sure that some thought has been given to the design of the irrigation system. We cannot find such a plan in the statement; it would be important to determine if there is such a plan. An irrigation system, in order to operate efficiently, conserve water, and minimize the creation of mosquito producing habitats,

should be thought of as a complete system. This will involve design and construction of the main irrigation canals, the preparation of the land, the application of water to the fields, the removal of surplus water from the fields into a drain which will eventually channel the return flow into a river or stream. Does the operating agency plan to manage the system in such a manner? Are there ways and means to carry out mosquito or other control measures nessitated by the project?"

Response

The project does not propose an extension of irrigation.

The land treatment measures to be applied on irrigated cropland includes measures that will improve the efficiency of the entire irrigation system. These measures are part of a complete conservation plan for the individual farm.

These plans are for a complete system and when the measures are installed they will improve the overall efficiency of water application on irrigated cropland. These measures will be maintained by the individual land owner. There are no measures proposed in the project that will require mosquito control measures.

Comment

"Poor drainage of irrigated agricultural lands is a major source of mosquito production in the western United States. Runoff water from the fields often accumulates in roadside ditches or borrow pits not designed for drainage. Such water usually will remain there for long periods and creates a habitat that produces large numbers of C. tarsalis and other mosquito species.

"Also in the West, standing water in unleveled pastures and row crop fields provide habitats that produce mosquitoes abundantly. In much of Colorado, Wyoming, Nebraska, and New Mexico Aedes vexans, Ae. dorsalis, and Ae. melanimon are potential arbovirus vectors to man and animals and are very significant pest mosquitoes. Those species are commonly produced on unleveled irrigated pastures. Pastures and alfalfa are the major crop-types listed in the EIS."

Response

The planned project measures will not contribute to water accumulating in roadside ditches or borrow pits. The structural measures will reduce the areas of ponding water and thus reduce this health hazard. This situation is noted in the EIS under Favorable Environmental Impacts.

Comment

"In summary, the project sponsors should consider the impact upon vectors and vector-borne diseases. They should be asked to respond to a variety of related questions. (1) Have any cases of encephalitis reported from areas near the project? If so, will the project increase the risk of such diseases? (2) Which species of mosquito vectors are found there, and how numerous are they? What impact will the project have on vector populations (mosquitos and others). (3) Which pest mosquitos cause control problems in the area? (4) What steps will be taken to deal with mosquitos produced by this project? (5) What impact will the project have upon risks of encephalitis, plague, tick-fever? These questions should be answered in order to estimate the potential vector-borne disease impact for the project area. To ignore consideration of these questions and similar questions, would be an error of considerable public health importance."

Response

As stated in the plan and EIS, the structures are single purpose flood-water retarding structures and a flood volume produced by a 25 year 6 hour storm will be drained in 96 hours. One of the stated favorable environmental impacts is "a 60 percent reduction in ponding and associated health hazards." The project measures as planned will have a beneficial impact on reducing mosquitoes and other vectors. In as much as the project has no adverse impact on vectors and vector-borne diseases, the study required to respond to the questions are outside the scope of this project.

DEPARTMENT OF TRANSPORTATION

Comment

"The Department of Transportation has reviewed the material submitted. We have no comments to offer nor do we have any objection to this project."

Response - Noted

ENVIRONMENTAL PROTECTION AGENCY

Comment

"On pages 14 and 15 it is stated that water pollution will be kept to a minimum by use of chemical sanitary units and/or locating sanitary facilities in areas that will preclude contamination of surface and sub-surface water supplies. The statement would be

strengthened by including a more thorough discussion of these water resources. Additional information on this subject should be included in the final statement.

Response

The following statement added to the identified section: "The water resources in the area which will be protected during construction include domestic water wells for development outside the city of Expanola, stockwater wells, and irrigation water diverted from the Rio Grande and Rio Chama."

Comment

"This comment classifies your Draft Environmental Impact Statement as LO-1. Specifically, we have no objection to the proposed project. There is sufficient information in the statement to evaluate the environmental impacts of the project. The classification and tha date of our comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions, under Section 309 of the Clean Air Act."

Response - Noted

ADVISORY COUNCIL ON HISTORIC PRESERVATION

Comment

"...Pursuant to its responsibilities under Section 102 (2) (C) of the National Environmental Policy Act of 1969, the Advisory Council on Historic Preservation has determined that your DES and draft plan appear adequate regarding our area of expertise and we have no further comment to make at this time."

Response - Noted

NM STATE OFFICE FmHA

Comment

"We do not have any negative comments, finding the draft comprehensive and complete."

Response - Noted

NM STATE ENGINEER

Comment

"We have reviewed the work plan and note that it clarifies the points raised in my July 14, 1975 letter. We have no further comments regarding the work plan or the environmental impact statement.

"This project will afford much needed protection to the agricultural land in the Rio Chama Valley and to the developing urban area of Espanola. I support the Espanola-Rio Chama Watershed Project and urge early approval for construction."

Response - Noted

STATE PLANNING OFFICE

Comment

"We have reviewed your Draft Plan and Environmental Impact Statement for the Espanola-Rio Chama Watershed. Though the project seems to be beneficial from the material you have presented, an assessment of how much construction and operation will cost the individual landowner and what his specific benefits would be (such as the cost of concrete lining versus money saved in ditch cleaning) would give a basis for more accurate analysis."

Response

As stated in the plan, the Espanola-Rio Chama Watershed District is responsible for operation and maintenance of all structural measures. If there is a cost to the individual landowner, this cost will be determined by the district.

Benefits to measures such as concrete ditch lining include analyses of other factors in addition to saving in ditch cleaning. These include such items as decreased seepage and evaporation loss, reduced waterloged areas, and others. These benefits accrue to individual farm owners as well as to the community as a whole. For this project these benefits were not evaluated in monetary terms. However, this type of measure has been evaluated in monetary terms in other cases, and the benefits far exceed the costs.

DEPARTMENT OF GAME AND FISH

Comment

"Wildlife population in this area has been adversely affected by the many years of human activity. Proposed adjustments in the uplands by improved management and applied land treatment measures

should enhance vegetative cover and subsequently wildlife habitat. Agricultural lands that will fall under the flood control structures should provide short-term wildlife improvements but, with the anticipated development of homes, a large percentage of these lands will no longer be wildlife habitat. Overall, the proposed project should be beneficial to wildlife and wildlife habitat."

Response - Noted

PUEBLO de SANTA CLARA

Comment

"The 1967 Agreement was understood at the time to be a permission to study only, not a grant of easement."

Response

Prior to detailed investigation and construction of structural measures, the sponsoring local organizations will acquire land rights for the intended land use. A legal land rights document is required to be filed in the county records.

Comment

"The proposed sites 1 and 3 are in an area planned for commercial, residential and municipal use. Espanola's growth is serviously limited because of the shortage of usable land. The proposed sites would require 313 acres of land that could be put to a much higher and more beneficial use."

Response

Because of topography and present flooding, very little of the area at these sites is currently suited for development.

Comment

"The project as presented benefits Santa Clara very little compared to the amount of land that would be lost to other uses."

Response - Noted

Comment

"In summary, we oppose the project as presented, but would consider an alternative which would locate control structures further up on the watershed. If this is a possibility, we would like to discuss such a proposal in the field."

Response

The proposal has been reviewed in the field with Pueblo officials. The local sponsoring organizations have evaluated this condition. A letter from the chairman of the Espanola-Rio Chama Watershed states that they will continue to work with the Santa Clara Indians with a design that will satisfy their objections.

SAN JUAN PUEBLO

Comment

"Concerning the draft plan and environmental statement of the Espanola-Rio Chama Watershed Project; San Juan Pueblo has always been concerned wherever flooding and erosion of their land has occurred. We believe some provision should be made whereby our Pueblo's approval would be secured in setting the priority approval of construction, and approval of any major changes in dam site location or construction."

Response

As concerned and involved publics the views of pueblo officials will be involved in any decision of major changes of structural measure on Pueblo lands.

Comment

"Page II-85: The dam site and pool areas of the proposed project will permanently occupy (286) acres of range land with a present value of $50-$100 per acre. Acreage value of land in these particular site areas range from $1,000 to $7,000 per acre depending upon intended use and proximity to the city of Espanola and the highway."

Response

This is the same as comment #2 from the B.I.A. See that response.

Comment

"The Tribal Council of the Pueblo of San Juan has been a willing participant in the Sebastian-Martin Watershed by granting easements for surveying, planning and construction when called upon to do so. The Pueblo has always been under the impression that project site No. 15 (protection for J.F.K. Junior High School and the Housing Project on the San Juan Reservation) was at one time No. 1 in priority under the Sebastian-Martin Watershed Project. We now find that structures 5 and 6 have been completed, structures 2, 3, and 4 are ready for contract; and structure 1, (protection for Pueblo lands and situated very close to structure 2) has never been included with structures 2, 3, and 4, for contract.

"Until construction activities on structures 1 and 15 of the Sebastian-Martin Watershed Project (east of J.F.K. Junior High School) have been initiated; the San Juan Pueblo Council will not consider or approve structures 5, 6, 8S, and 8N on the Espanola-Rio Chama Watershed Project."

Response - Noted

Approved By: A W Hamelstrom 5/25/76
A. W. Hamelstrom
State Conservationist

APPENDICES

A P P E N D I X A

Espanola-Rio Chama Watershed,

New Mexico

COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Appendix – A-COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Espanola-Rio Chama Watershed, New Mexico

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/				2/ Average Annual Cost	Benefit Cost Ratio
	Damage Reduction	Re-development	Secondary	Total		
Unit 1	387,540	97,380	32,160	517,080	369,970	1.4:1.0
Unit 2	276,710	44,200	22,790	343,700	171,610	2.0:1.0
Project Administration					106,470	
GRAND TOTAL	664,250	141,580	54,950	860,780	648,050	1.3:1.0

1/ Price Base Agricultural - Current normalized prices; Nonagricultural - 1975

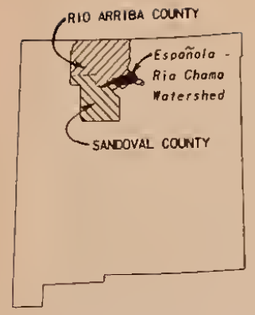
2/ From Table 4.

A P P E N D I X B

Espanola--Rio Chama Watershed

New Mexico

PROJECT MAP



LOCATION MAP

R.6E.

R.7E.

R.8E.

T. 21 N.

T. 20 N.

106°20'

106°10'

36°00'

RIO ARRIBA COUNTY

SANDOVAL COUNTY

SANTA FE NATIONAL FOREST

SANTA CLARA INDIAN RESERVATION

SANTA CLARA GRANT

SAN ILDEFONSO PUEBLO

D.A.- 0.45

D.A.- 0.97

D.A.- 3.00

D.A.- 0.29

D.A.- 1.51

D.A.- 17.68

D.A.- 0.26

D.A.- 6.35

D.A.- 1.03

D.A.- 4.42

RIO CHAMA

RIO GRANDE

Hernandez

San Jose

San Pedro

La Plaza

Gunchu

Española

Guachoangue

LEGEND

- Watershed Boundary
- Subwatershed Boundary
- Floodwater Retording Structure
- (6) Site Number
- D.A.- 0.00 Drainage Area (Square Miles)
- Areo Benefited
- Drainage Area Controlled By Structures
- Outlet Channel
- Outlet Pipeline

PROJECT MAP

ESPAÑOLA-RIO CHAMA WATERSHED

RIO ARRIBA AND SANDOVAL COUNTIES

NEW MEXICO

JANUARY 1976

1 0 1 2 MILES

M7-N-23570

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OREG. 1975

A P P E N D I X C

Espanola-Rio Chama Watershed

Letters of Comments Received
on the Draft Environmental
Impact Statement

IN REPLY REFER TO:

Land Operations

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
NORTHERN PUEBLOS AGENCY
P. O. BOX 580
SANTA FE, NEW MEXICO 87501

06 APR 1976

A. W. Homelstrom
State Conservationist
U. S. Department of Agriculture
Soil Conservation Service
P. O. Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Homelstrom:

Comments on the draft plan and draft environmental statement of the Espanola - Rio Chama Watershed Project are as follows:

1. To meet objections of both Santa Clara and San Juan Pueblos, some provision must be made to insure that each Pueblo is consulted and approval given for any changes or alterations to the original priority scheduling of sites, locations, and structures.

2. On Page II-85 the proposed project will occupy permanently 286 acres of rangeland with a value of $50-$100 per acre. In this proximity to the highway and city of Espanola, these site values will range from $1000 to $7000 per acre.

3. San Juan Pueblo will not give any consideration or discussion to the Espanola - Rio Chama Watershed Project until some construction activity has started on sites 1 and 15 of the Sabastian-Martin Watershed Project. This is a particularly touchy subject with the Pueblo and rightly so, as they were assured that site 15 would be No. 1 in priority on the Sabastian-Martin. Site 15 protects Kennedy Junior High School and several San Juan homes.

4. It is felt that the maintenance of the watershed project structures should be the obligation of the Espanola - Rio Chama Watershed District and that the plan should state that neither Santa Clara Pueblo or San Juan Pueblo would be held responsible for the maintenance on the structures.

5. Santa Clara Pueblo will not participate in or approve the present locations of structures 1 and 3. The Pueblo has definite plans for both these sites and will not relinquish these locations to the Watershed Project. By relocating the structures for sites 1 and 3 approsimately 3/4 to 1 mile-west, the Pueblo would prcbably reconsider the project. By relocating further west, the present location sites can be used for homes, industry, apartments, etc., and receive flood control protection from the watershed project. Under present locations of sites 1 and 3, these structures will be a determent to the Pueblo forever and prevent any future economical use of their land.

I believe the above comments fairly reflect the feelings of the two Pueblos and the Agency concerning the Espanola - Rio Chama Watershed Plan. Until some economical benefits can be derived by the PUeblos from the Watershed Plan, I would have to recommend that the Pueblos not participate in the program.

Sincerely,

Superintendent

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

APR 23 1976

Mr. A. W. Hamelstrom
State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Hamelstrom:

Enclosed is a copy of this Department's comments on the Draft Environmental Impact Statement concerning the Proposed Espanola-Rio Chama Watershed, Rio Arriba and Sandoval Counties, New Mexico.

Thank you for the opportunity to review the document.

Sincerely,

Charles Custard

Charles Custard
Director
Office of Environmental Affairs

Enclosure

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL

BUREAU OF LABORATORIES
VECTOR-BORNE DISEASES DIVISION
POST OFFICE BOX 2987
FORT COLLINS, COLORADO 80521

April 12, 1976

Mr. Charles Custard
Director
Office of Environmental Affairs
Department of Health, Education, and
Welfare
Room 4628 North Wing
330 Independence Avenue, S.W.
Washington, D.C. 20201

Dear Mr. Custard:

In response to your letter, we have reviewed the draft environmental impact statement (EIS) on the Espanola-Rio Chama Watershed, Rio Arriba and Sandoval Counties, New Mexico. We believe that there are some potential adverse affects on health which might result from this project.

An increase in mosquito or other vector populations and the increased risk of vector-borne diseases is not mentioned as a potential adverse impact which might result from this project. The mosquito problem could originate from two sources the floodwater detention reservoirs and the irrigation system.

In 1975, the Water Resources Branch studied mosquito production associated with several Soil Conservation Service (SCS) floodwater detention reservoirs. Our findings show that properly prepared reservoirs do not significantly contribute to mosquito problems. Such reservoir preparations include steep shoreline gradient (3:1), periodic removal of vegetation and frequent water level fluctuation. Many SCS floodwater detention reservoirs are dry most of the time, but some are maintained as recreational areas and contain water permanently. Reservoir preparation, proper maintenance, and water management for mosquito control would be essential when the water is impounded for long periods of time.

I am enclosing a CDC brochure entitled "Prevention and Control of Vector Problems Associated with Water Resources". It mentions some of the types of considerations needed to avoid the creation of vector problems when planning for the construction, operation, and management of reservoirs, impoundments, irrigation, and other types of water and related land resources development.

In regard to the extension of irrigation, it should be noted that the encephalitis mosquito, Culex tarsalis, is commonly associated with agricultural irrigation and is frequently abundant. Large numbers of this mosquito, as well as other pest species, have forced local residents in many western states to form mosquito control districts. Most of the production is associated with "poorly managed water," which is noted on Page I-2 as a descriptor of current irrigation practices in the project area.

We are sure that some thought has been given to the design of the irrigation system. We cannot find such a plan in the statement; it would be important to determine if there is such a plan. An irrigation system, in order to operate efficiently, conserve water, and minimize the creation of mosquito producing habitats, should be thought of as a complete system. This will involve design and construction of the main irrigation canals, the preparation of the land, the application of water to the fields, the removal of surplus water from the fields into a drain which will eventually channel the return flow into a river or stream. Does the operating agency plan to manage the system in such a manner? Are there ways and means to carry out mosquito or other control measures necessitated by the project?

Poor drainage of irrigated agricultural lands is a major source of mosquito production in the western United States. Runoff water from the fields often accumulates in roadside ditches or borrow pits not designed for drainage. Such water usually will remain there for long periods and creates a habitat that produces large numbers of C. tarsalis and other mosquito species.

Also in the West, standing water in unleveled pastures and row crop fields provide habitats that produce mosquitoes abundantly. In much of Colorado, Wyoming, Nebraska, and New Mexico Aedes vexans, Ae. dorsalis, and Ae. melanimon are potential arbovirus vectors to man and animals and are very significant pest mosquitoes. Those species are commonly produced on unleveled irrigated pastures. Pastures and alfalfa are the major crop-types listed in the EIS.

In summary, the project sponsors should consider the impact upon vectors and vector-borne diseases. They should be asked to respond to a variety of related questions. (1) Have any cases of encephalitis reported from areas near the project? If so, will the project increase the risk of such diseases? (2) Which species of mosquito vectors are found there, and how numerous are they? What impact will the project have on vector populations (mosquitoes and others). (3) Which pest mosquitoes cause control problems in the area? (4) What steps will be taken to deal with mosquitoes produced by this project? (5) What impact will the project have upon risks of encephalitis, plague, tick-fever? These questions should be answered in order to estimate the potential vector-borne disease impact for the project area. To ignore consideration of these questions and similar questions, would be an error of considerable public health importance.

We contacted Mr. Bryan E. Miller, Chief, General Sanitation Division, Environmental Improvement Agency, Post Office Box 2348, Santa Fe, New Mexico, 87501, and obtained some information regarding vectors and vector-borne disease in that area. He advised us that Rio Arriba County has experienced cases of mosquito-borne encephalitis over the years and has had serious vector mosquito problems. On one occasion, emergency control procedures necessitated aerial spraying of 60,000 acres acres in order to bring the vector problem under

control. Further, every year that sentinel chicken flocks have been used there to measure encephalitis virus activity, they have demonstrated serologic evidence of virus infections. All of these factors referred to by Mr. Miller are indicative of the need to design, operate, and manage the proposed project property to avoid a significant mosquito-arboviral encephalitis problem.

We are forwarding the environmental statement to Mr. Miller in New Mexico for his review and comments. He advises us that he will provide comments on the subject draft EIS to the Soil Conservation Service.

Vector-borne disease problems associated with water resources developments are frequently overlooked or ignored. We hope that this letter will focus needed attention on a potentially serious problem and that disease prevention and control measures can be instituted before the project becomes operational. Please let us know if we can furnish any further technical assistance or supply any other information.

Sincerely yours,

Richard O. Hayes

Richard O. Hayes, Ph.D., M.P.H.
Chief, Water Resources Branch

cc:
Mr. Samuel W. Hoover
Mr. Bryan E. Miller
Dr. James V. Smith

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
WASHINGTON, D.C. 20590
PHONE: (202) 426-2262

Mr. A. W. Hamelstrom
State Conservationist
Soil Conservation Service
P.O. Box 2007
Albuquerque, N. M. 87103

Dear Mr. Hamelstrom:

This is in response to your letter of 9 March 1976 addressed to Admiral Siler concerning a draft environmental impact statement for the Espanola-Rio Chama Watershed project, Rio Arriba and Sandoval Counties, New Mexico.

The Department of Transportation has reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

The opportunity to review this draft statement is appreciated.

Sincerely,

ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1600 PATTERSON, SUITE 1100
DALLAS, TEXAS 75201

April 28, 1976

OFFICE OF THE
REGIONAL ADMINISTRATOR

Mr. A. W. Hamelstrom
State Conservationist
Soil Conservation Service
Box 2007
Albuquerque, New Mexico 87103

Re: D-SCS-G36046-NM

Dear Mr. Hamelstrom:

We have reviewed the Watershed Work Plan and the Draft Environmental Impact Statement for the Espanola-Rio Chama Watershed Project, Rio Arriba and Sandoval Counties, New Mexico. The proposed project calls for the application of accelerated land treatment measures on 1,110 acres of cropland and 23,000 acres of rangeland and includes the construction of ten floodwater retarding structures on the major drainages of the watershed. The project is to provide for watershed protection, flood prevention and reduction of floodwater and sediment damage.

The following comment is for your consideration in preparing the Final Environmental Impact Statement:

On pages 14 and 15 it is stated that water pollution will be kept to a minimum by use of chemical sanitary units and/or locating sanitary facilities in areas that will preclude contamination of surface and subsurface water supplies. The statement would be strengthened by including a more thorough discussion of these water resources. Additional information on this subject should be included in the final statement.

This comment classifies your Draft Environmental Impact Statement as LO-1. Specifically, we have no objection to the proposed project. There is sufficient information in the statement to evaluate the environmental impacts of the project. The classification and the date of our comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions, under Section 309 of the Clean Air Act.

Definitions of the categories are provided on the attachment. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and on the adequacy of the impact statement at the draft stage, whenever possible.

We appreciate the opportunity to review the Draft Environmental Impact Statement and we will be happy to discuss our comment with you. Please send us two copies of the Final Environmental Impact Statement at the same time it is sent to the Council on Environmental Quality.

Sincerely yours,

John C. White
Regional Administrator

Enclosure

ENVIRONMENTAL IMPACT OF THE ACTION

LO - Lack of Objections

EPA has no objections to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER - Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to re-assess these aspects..

EU - Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

ADEQUACY OF THE IMPACT STATEMENT

Category 1 - Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2 - Insufficient Information

EPA believes the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3 - Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement. If a draft statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

Advisory Council
On Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

March 17, 1976

Mr. A. W. Hamelstrom
State Conservationist
Soil Conservation Service
Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Hamelstrom:

This is in response to your request of March 9, 1976 for comments on the draft environmental statement (DES) and draft plan for Espanola-Rio Chama Watershed, Rio Arriba and Sandoval counties, New Mexico. Pursuant to its responsibilities under Section 102 (2)(C) of the National Environmental Policy Act of 1969, the Advisory Council on Historic Preservation has determined that your DES and draft plan appear adequate regarding our area of expertise and we have no further comment to make at this time.

Your continued assistance and cooperation are appreciated.

Sincerely yours,

Louis S. Wall
Assistant Director, Office
of Review and Compliance

UNITED STATES DEPARTMENT OF AGRICULTURE
FARMERS HOME ADMINISTRATION
Room 3414 Federal Building
517 Gold Avenue, SW
Albuquerque, NM 87101

March 22, 1976

A. W. Hamelstrom, State Conservationist
Soil Conservation Service
Box 2007
Albuquerque, NM 87103

Dear Mr. Hamelstrom:

Subject: Draft Plan for Espanola-Rio Chama Watershed

Thank you for the opportunity to review this draft.

We do not have any negative comments, finding the draft comprehensive and complete.

If we can be of assistance in any way, please advise.

Sincerely,

WILLIAM H. COINMAN
Chief, Community Programs

STATE OF NEW MEXICO

STATE ENGINEER OFFICE

SANTA FE

S. E. REYNOLDS
STATE ENGINEER

BATAAN MEMORIAL BUILDING
STATE CAPITOL
SANTA FE, NEW MEXICO 87503

May 6, 1976

Mr. A. W. Hamelstrom
State Conservationist
Soil Conservation Service
Post Office Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Hamelstrom:

Your March 9, 1976 letter requests comments on the Espanola-Rio Chama Watershed Work Plan and draft environmental impact statement.

We have reviewed the work plan and note that it clarifies the points raised in my July 14, 1975 letter. We have no further comments regarding the work plan or the environmental impact statement.

This project will afford much needed protection to the agricultural land in the Rio Chama Valley and to the developing urban area of Espanola. I support the Espanola-Rio Chama Watershed Project and urge early approval for construction.

Sincerely,

S. E. Reynolds
State Engineer

by J. L. Whiteman
J. L. Whiteman, Chief
Design & Construction Section

JLW*pat

STATE OF NEW MEXICO

STATE PLANNING OFFICE

EXECUTIVE – LEGISLATIVE BUILDING
SANTA FE 87503

GRACIELA (GRACE) OLIVAREZ
STATE PLANNING OFFICER

JERRY APODACA
GOVERNOR

ROBERT S. LANDMANN
DEPUTY STATE PLANNING OFFICER

May 10, 1976

Mr. A.W. Hamelstrom
State Conservationist
Soil Conservation Service
Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Hamelstrom:

We have reviewed your Draft Plan and Environmental Impact Statement for the Espanola-Rio Chama Watershed. Though the project seems to be beneficial from the material you have presented, an assessment of how much construction and operation will cost the individual landowner and what his specific benefits would be (such as the cost of concrete lining versus money saved in ditch cleaning) would give a basis for more accurate analysis.

Thank you for the opportunity to review this project.

Sincerely,

Louis Daeuble, Planner II
Division of Natural Resources

LD:anne

State of New Mexico

DEPARTMENT OF GAME AND FISH

STATE CAPITOL
SANTA FE
87503

April 12, 1976

Mr. A. W. Hamelstrom
State Conservationist
U. S. Department of Agriculture
Soil Conservation Service
Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Hamelstrom:

We have reviewed the Draft Plan and Environmental Statement for the Espanola-Rio Chama Watershed, New Mexico, and wish to make the following comments:

Wildlife population in this area has been adversely affected by the many years of human activity. Proposed adjustments in the uplands by improved management and applied land treatment measures should enhance vegetative cover and subsequently wildlife habitat. Agricultural lands that will fall under the flood control structures should provide short-term wildlife improvements but, with the anticipated development of homes, a large percentage of these lands will no longer be wildlife habitat. Overall, the proposed project should be beneficial to wildlife and wildlife habitat.

Thank you for the opportunity to review and comment upon the plan and statement.

Sincerely yours,

William S. Huey
Director

PUEBLO DE SANTA CLARA

POST OFFICE BOX 580

ESPANOLA, NEW MEXICO 87532

March 29, 1976

A.W. Homelstrom, State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
P.O. Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Homelstrom:

The Council has discussed the draft Environmental Impact Statement on the Espanola-Rio Chama Watershed Project. Also, a tour was made of a portion of the watershed on Santa Clara land.

The following aspects of the proposal were discussed in the Council meeting:

1. The 1967 Agreement was understood at the time to be a permission to study only, not a grant of easement.

2. The proposed sites 1 and 3 are in an area planned for commercial, residential and municipal use. Espanola's growth is serviously limited because of the shortage of usable land. The proposed sites would require 313 acres of land that could be put to a much higher and more beneficial use.

3. The project as presented benefits Santa Clara very little compared to the amount of land that would be lost to other uses.

In summary, we oppose the project as presented, but would consider an alternative which would locate control structures further up on the watershed. If this is a possibility, we would like to discuss such a proposal in the field.

Sincerely,

Walter Dasheno

Walter Dasheno, Governor,
Santa Clara Pueblo

WD/pb

cc: Mr. Leo Wolff, Director,
Division of Economic Development, Land Operation

P. O. Box 99 1099
San Juan Pueblo, New Mexico 87566
Phone (505) 852-4400

Joseph A. Trujillo
Lt. Governor

Frank J. Cruze
Governor

Anthony S. Archuleta
2nd Lt. Governor

March 24, 1976

A.W. Hamelstrom
State Conservationist
Soil Conservation Service
Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Hamelstrom:

Concerning the draft plan and environmental statement of the Espanola-Rio Chama Watershed Project; San Juan Pueblo has always been concerned wherever flooding and erosion of their land has occurred. We believe some provision should be made whereby our Pueblo's approval would be secured in setting the priority approval of construction, and approval of any major changes in dam site location or construction.

Page II-85: The dam site and pool areas of the proposed project will permanently occupy (286) acres of range land with a present value of $50-$100 per acre. Acreage value of land in these particular site areas range from $1,000 to $7,000 per acre depending upon intended use and proximity to the city of Espanola and the highway.

The Tribal Council of the Pueblo of San Juan has been a willing participant in the Sebastian-Martin Watershed by granting easements for surveying, planning and construction when called upon to do so. The Pueblo has always been under the impression that project site No. 15 (protection for J.F.K. Junior High School and the Housing Project on the San Juan Reservation) was at one time No. 1 in priority under the Sebastian-Martin Watershed Project. We now find that structures 5 and 6 have been completed, structures 2, 3, and 4 are ready for contract; and structure 1, (protection for Pueblo lands and situated very close to structure 2) has never been included with structures 2, 3, and 4, for contract.

Until construction activities on structures 1 and 15 of the Sebastian-Martin Watershed Project (east of J.F.K. Junior High School) have been initiated; the San Juan Pueblo Council will not consider or approve structures 5, 6, 8S, and 8N on the Espanola-Rio Chama Watershed Project.

P. O. Box 95
San Juan Pueblo, New Mexico 87566
Phone (505) 852-4400

Frank J. Cruze
Governor

Joseph A. Trujillo
Lt. Governor

Anthony S. Archuleta
2nd Lt. Governor

Further more, we would appreciated if the San Juan Pueblo Council would be informed of such projects before any studies are conducted.

Sincerely,

Governor, Frank J. Cruze

Lt. Gov. Joseph A. Trujillo

FJC-JAT:ma

cc: San Juan Pueblo Council
John Caldwell, BIA
Pete Casados

A P P E N D I X D

Espanola-Rio Chama Watershed

MAPS

Soils Map with Table of General Soil Characteristics

Geology Map

Floodplain Maps

Landownership Map

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE, ALBUQUERQUE, NEW MEXICO

LOCATION MAP

LEGEND

15. Nambe-Cundiyo association: Deep, moderately steep to very steep, loamy and stony soils used for forestry and range.

19. Fernandez-Basalt rock land-Dormilom association: Deep, level to gentle, [illegible], loamy soils and steep to very steep rock outcrops used for range.

20. Los Alamos-Bidman-Millett association: Moderately deep to deep, nearly level to hilly, loamy and clayey soils used for range.

25. Pojoaque-Rough broken land association: Deep, gently undulating to hilly, loamy soils and hilly to steep, gravelly land forms used for range.

27. Green River-El Rancho-Werlow association: Deep, level to gently sloping, loamy soils used for irrigated cropland.

SOILS ASSOCIATION MAP

ESPAÑOLA-RIO CHAMA WATERSHED

RIO ARRIBA AND SANDOVAL COUNTIES

NEW MEXICO

APPROXIMATE SCALE - MILES

PROJECTION UNKNOWN

APRIL 1974 4-R-33940

4-R-33829

GENERAL SOIL CHARACTERISTICS, ESPAÑOLA-RIO CHAMA WATERSHED 1/

SOIL MAP SYMBOL AND SOIL ASSOCIATION	DOMINANT SLOPE RANGE (percent)	APPROX. PERCENT OF ASSOC.	TAXONOMIC CLASSIFICATION		SURFACE SOIL FEATURES			PERMEABILITY 4/	SOIL DEPTH (Inches)
			SUBGROUP	FAMILY	TEXTURE 2/	COLOR 3/	REACTION		
15 Nambe-Cundivo Association									
Nambe gravelly loam and stony loam	20-70	55	Typic Cryochrept	Loamy-skeletal, mixed	gl; stl	Light brown	Extremely acid to strong acid	Mod. rapid	60 or more
Cundiyo gravelly sandy loam	45-80	25	Typic Cryoboralf	Loamy-skeletal, mixed	gsl	Light brownish-gray	Slightly acid to neutral	Mod. rapid	60 or more
Other soils and land types		20							
19 Fernando-Basalt Rock Land-Dormilom Association									
Fernando loam	0-5	35	Ustollic Haplargid	Fine-silty, mixed, mesic	l	Brown	Mod. alkaline	Mod. to slow	60
Basalt rock land	25-75+	30	(A miscellaneous land type)						
Dormilon stony loam	3-15	20	Lithic Ustic Torriorthent	Loamy, mixed (calcareous), mesic	stl	Brown	Mildly to moderate alkaline	Mod. to slow	10 to 20
Other soils and land types		15							
20 Los Alamos-Bidman-Millett Association									
Los Alamos loam	2-9	20	Ustollic Haplargid	Fine-loamy, mixed, mesic	l	Brown	Mildly to strongly alkaline	Mod. to slow	20 to 50
Bidman gravelly fine sandy loam	0-6	20	Ustollic Paleargid	Fine, montmorillonitic, mesic	gfsl;	Pale brown to brown	Mildly to moderately alkaline	Mod. to slow	60 or more
Millett gravelly sandy loam	10-30	20	Ustollic Haplargid	Fine-loamy, mixed, mesic	gsl	Light brown	Neutral	Moderate	60 or more
Other soils and land types		40							
25 Pojoaque-Rough broken Land Association									
Pojoaque sandy clay loam	1-25	35	Ustic Torriorthent	Fine-loamy, mixed (calcareous), mesic	scl	Light reddish-brown	Mildly alkaline	Moderate	60 or more
Rough broken land	20-35	45	(A miscellaneous land type)						
Other soils and land types		20							
27 Green River-El Rancho-Werlow Association									
Green River soils	0-3	20	Aquic Ustifluvent	Coarse-loamy, mixed (calcareous), mesic	cl; l; fsl	Brown to grayish-brown	Mildly to moderately alkaline	Moderate	60 or more
El Rancho sandy clay loam	0-5	20	Ustic Torriorthent	Fine-loamy, mixed (calcareous), mesic	scl	Light reddish-brown	Moderately alkaline	Rapid	60 or more
Werlow loam	0-3	20	Aquic Ustifluvent	Fine-loamy, mixed (calcareous), mesic	l	Grayish-brown	Moderately alkaline	Moderate	60 or more
Other soils and land types		40							

1/ From Agricultural Experiment Station, New Mexico State University Research Report 254.

2/ Textural symbols and classes: gl-gravelly loam, gsl-gravelly sandy loam, gfsl-gravelly fine sandy loam, fsl-fine sandy loam, sl-sandy loam, cl-clay loam, l-loam, scl-sandy clay loam, stl-stony loam.

3/ Colors for dry soil.

4/ Permeability, approximate rates per hour: v. slow<0.06, slow 0.06-0.2, mod slow 0.2-0.6, moderate-0.6 to 2.0 inches, moderately rapid-2.0-6.0 inches, rapid 6.0-20.0 inches, very rapid>20 inches.

Quaternary	Qal	Alluvium	Road
	Ql	Landslide Deposits	State-US.Hwy.
	Qg	Terrace Gravels	Ephemeral Stream
	Qbt	Tshirege Mbr. Bandelier Tuff	City
			Unincorporated Community
	QTp	Puye Formation	Fault trace inferred where dashed dotted where concealed
Tertiary	Tt	Tschicoma Formation	W/S boundary - geologic contact
	Tlb	Lobato Basalt	
	Tsf	Santa Fe Formation	

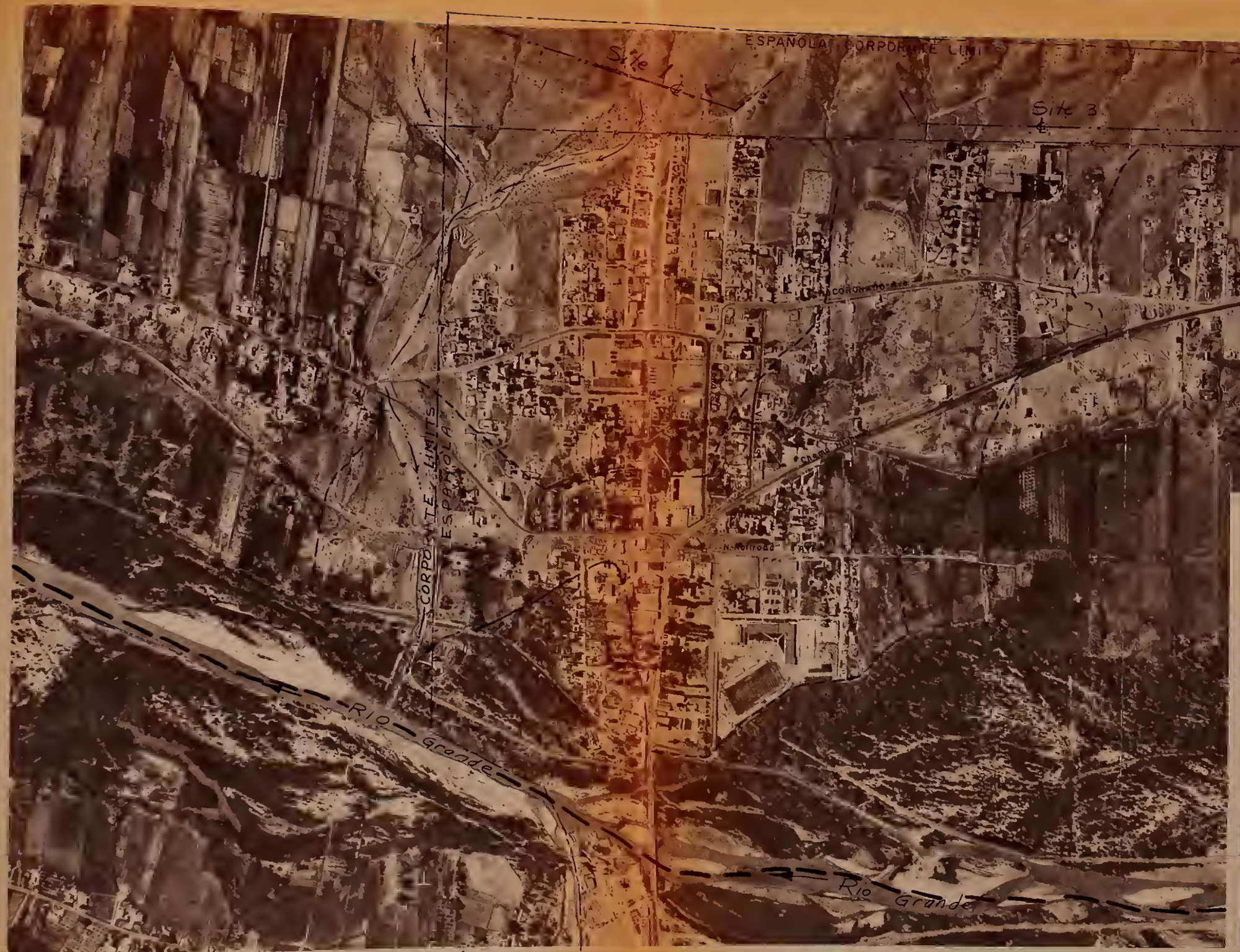
After U.S.G.S. Map I-571
Geologic Map of Jemez Mountains, New Mexico
Smith, et al., 1970

GEOLOGY
ESPANOLA - RIO CHAMA WATERSHED

Rio Arriba Co. Area 1 New Mexico

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
Drawn		Title	
Traced J.B.H.	12-75	Title	
Checked		Sheet No of	Drawing No



Scale 1" = 660'

LEGEND

- - - - 100 Year Storm Present Condition

—— —— 100 Year Storm With Project

—— —— Project Boundary

Photo dated 10/62

URBAN FLOOD PLAIN

Española - Rio Chama Watershed

Area 001

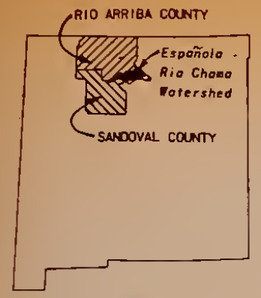
Rio Arriba & Sandoval Co. New Mexico

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

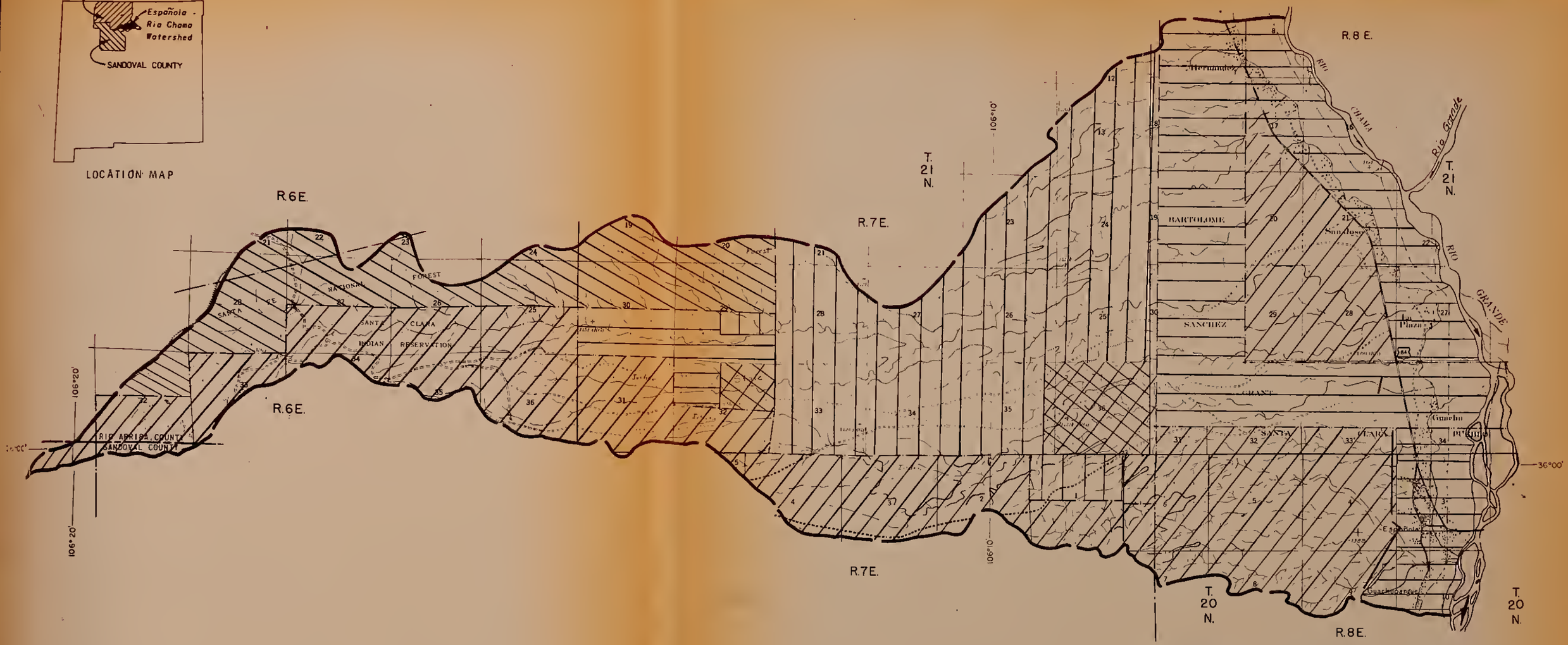
		Date	
Designed	C. Jackson	5/75	Approved by
Drawn	J. K. Martin	5/75	Title
Traced			Title
Checked			Sheet No. of / Drawing No.

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE, ALBUQUERQUE, NEW MEXICO



LOCATION MAP



LEGEND

BUREAU OF LAND MANAGEMENT	
FOREST SERVICE	
STATE	
INDIAN	
PRIVATE	

LANDOWNERSHIP

ESPAÑOLA-RIO CHAMA WATERSHED

RIO ARRIBA AND SANDOVAL COUNTIES

NEW MEXICO

APPROXIMATE SCALE - MILES

Compiled and reproduced at 1:31,680 (1 inch = .5 Miles) and reproduced at 1:63,360 (1 inch = 1 Mile).

PROJECTION UNKNOWN

APRIL 1974 4-R-33940

4-R-33829

A P P E N D I X E

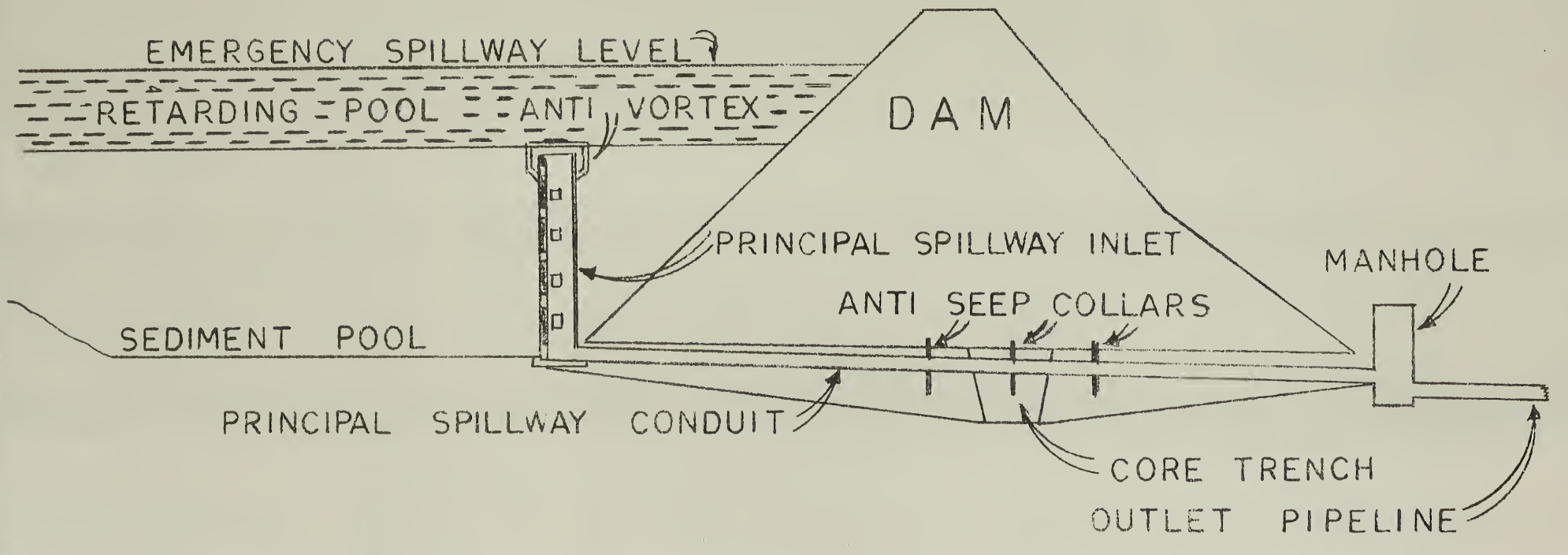
Espanola-Rio Chama Watershed

Typical Drawings of Structural Measures

Fig. 1 - Typical Cross-Section Floodwater Retarding Structure

Fig. 2 - Typical Floodwater Retarding Structure

Fig. 3 - Typical Principal Spillway OUtlet Pipeline

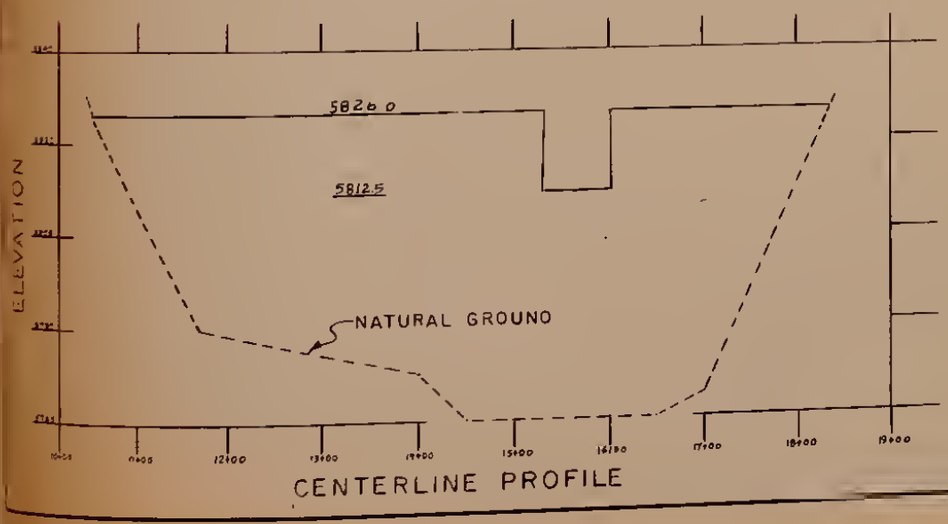


SECTION OF A TYPICAL

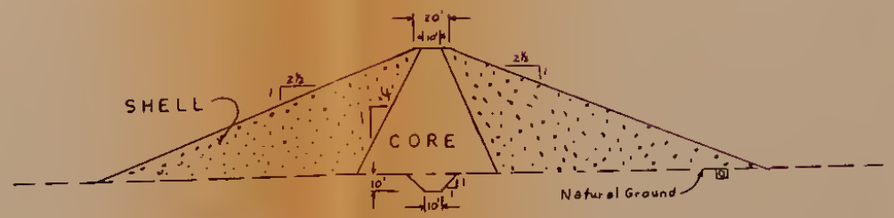
FLOODWATER RETARDING STRUCTURE

FIGURE 1

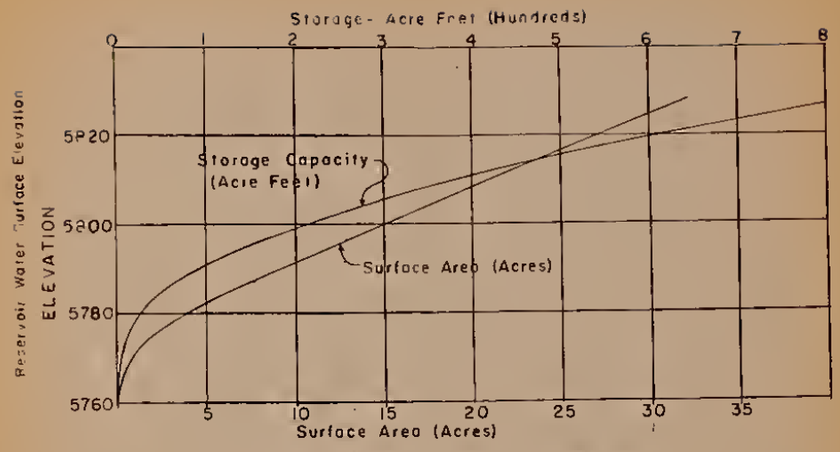
TOPOGRAPHIC MAP



CENTERLINE PROFILE



EMBANKMENT CROSS SECTION



RESERVOIR AREA — CAPACITY CURVES

EMERGENCY SPILLWAY DISCHARGE CURVE

FIGURE 2

TYPICAL FLOODWATER RETARDING STRUCTURE
ESPAÑOLA-RIO CHAMA WATERSHED

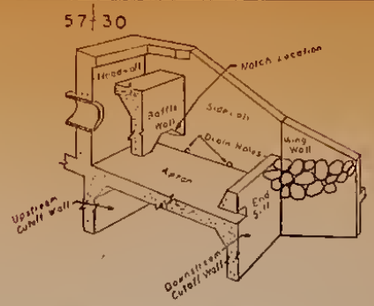
S I T E 9

RIO ARRIBA & SANDOVAL CO. NEW MEXICO

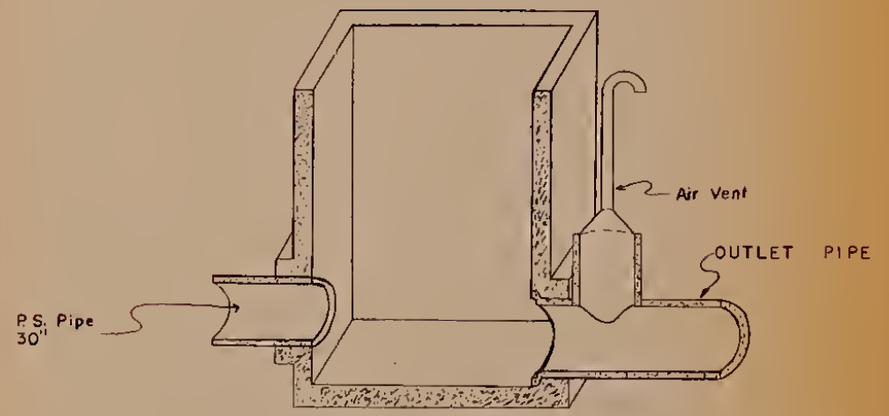
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
Designed R.A.R.	3-71	Approved by
Drawn J.K.M.	5-75	Title
Traced		Title
Checked R.A.R.	5-75	Sheet No. of / Drawing No.

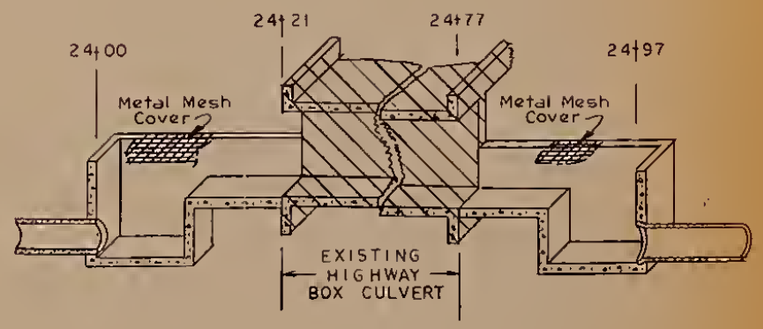
SCS-313C (9-64)



IMPACT BASIN - PERSPECTIVE VIEW
SKETCH



O. & M. MANHOLE END OF PRINCIPAL SPILLWAY PIPE STA. 7+80
SKETCH



HIGHWAY CROSSING
SKETCH

FIGURE 3

TYPICAL PRINCIPAL SPILLWAY
OUTLET PIPELINE
ESPANOLA—RIO CHAMA W/S - SITE 9

RIO ARRIBA-SANDOVAL CO. AREA 1 NEW MEXICO

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed RDA & RAR	Date 5/75	Approved by	Title
Drawn JKM	5/75		Title
Traced J.K. MARTIN	5/75	Sheet No. of	Drawing No.
Checked R.A.R.	5/75		

Form SCS-317 (November 1955)

A P P E N D I X F

Espanola-Rio Chama Watershed

Listing of Wildlife, Habitats and Wildlife Species Representative of the Watershed Area.

Listing of Dominant Plant Life Representative of the Watershed Area.

APPENDIX F
LISTING OF WILDLIFE HABITATS AND SPECIES REPRESENTATIVE OF THE
ESPANOLA-RIO CHAMA WATERSHED

Habitats		Present Conditions Acreage of Type/ Acre Value	Estimated with Project Acreage of Type/ Acre Value
A. Openland Types			
1. Cropland, irrigated and non-irrigated	Desert cottontail (Sylvilagus auduboni) Pocket gopher (Thomomys bottae) Bullsnake (Pituophis Melanoleucus sayi) Skunk (Mephitis mephitis) Scaled quail (Callipepla squamata)	1100/880	600/480
2. Rangeland, grass	Blacktailed jack rabbit (Lepus californicus) Spotted ground squirrel (Citellus spilosoma) Coyote (Canis latrans) Mountain bluebird (Sialia curruoides) Prairie rattlesnake (Crotalus viridis viridis)	1500/500	1500/1200
3. Rangeland, grass and light juniper	Western kingbird (Tyrannus verticalis) Meadowlark (Sturnella neglecta) Blacktailed jack rabbit (Lepus californicus) Coyote (Canis latrans) Prairie rattlesnake (Crotalus viridis viridis)	7000/2800	7000/5600
4. Rangeland, pinyon-juniper, light to medium	Scrub jay (Aphelocoma coerulescens) Pinyon mouse (Peromyscus truei) Woodrat (Neotoma micropus) Loggerhead shrike (Lanius ludoricianus) Coyote (Canis latrans)	11000/5500	11000/8800

B.	Woodland Types			
1.	Bosque, lightly grazed	Mourning dove (Zenaidura macroura) Yellow warbler (Dendroica petechia) Garter snake (Thamnophis sirtalis) Gray fox (Urocyon cinereoargenteus) Raccoon (Procyon lotor)	40/32	30/24
2.	Bosque, heavily grazed, burned	Starling (Sturnus vulgaris) Mourning dove (Zenaidura macroura) Crow (Corvus brachyrhynchos) Red-shafted flicker (Volaptes cafer) Pocket gopher (Thomomys bottae)	580/290	350/175
3.	Ponderosa pine	Clark's nutcracker (Nucifraga columbiana) Stellar jay (Cyanocitta stelleri) Red squirrel (Tamiasciurus hudsonicus) Mule deer (Odocoileus hemionus) Merriam's turkey (Meleagris gallopavo)	1900/1330	1900/1330
4.	Pinyon pine, mature stands	Pinyon jay (Gymnorhinus cyanocephala) Nuthatch (Sitta carolinensis) Mountain chickadee (Patus gambeli) Rock squirrel (Citellus variegatus) Mule deer (Odocoileus hemionus)	2700/1350	2700/1350
C.	Wetland Types			
1.	Seasonally overflowed	Mallard duck (Anas plaryrhynchos) Canada goose (Branta canadensis) Great blue heron (Ardea herodias) Spotted sandpiper (Actilis macularia) Wodehouse toad (Bufo woodhousei)	40/32	40/32
2.	Waterlogged cropland	Red-winged blackbird (Agelaius phoeniceus) Long-billed dowitcher (Limnodromus scolopaceus) Robin (Turdus migratorius) Leopard frog (Rana pipiens) Tiger salamander (Ambystoma tigrinum)	120/48	60/20

Espanola-Rio Chama Watershed

DOMINANT PLANT SPECIES ON WATERSHED SOILS

Dominant Species	Potential	Range-land	Crop-land	Urban
Riverbreaks				
Grasses				
Black grama (Bouteloua eriopoda)	Black grama	x		
Blue grama (Bouteloua gracillis)	Sideoats	x		
Sideoats grama (Bouteloua curtipendula)	Little bluestem	x		
Shrubs				
Apacheplume (Fallugia paradoxa)		x		
Trees				
Pinyon (Pinus edulis)		x		
Juniper		x		x
Sandy				
Grasses				
Blue grama	Indian ricegrass (Oryzopsis hymenoides)	x		
Threeawn (Aristida spp.)	Black grama	x		
Galleta (Hilaria jamesii)	Needle-and-Thread (Stipa comata)			
Shrubs				
Rubber rabbitbrush (Chrysothamus nauseosus)		x		
Apacheplume		x		
One seed Juniper (Juniperus monosperma)		x		
Loamy				
Grasses				
Blue grama	Black grama	x		
Ring muhly (Muhlenbergia torreyi)	Sideoats grama	x		
Threeawn	Western wheat (Agropyron smithii)	x		

Dominant Species	Potential	Range-land	Crop-land	Urban
Shrubs				
Broom snakeweed (Gutierrezia sarothrae)		x		
Trees				
Pinyon		x		
Shallow				
Grasses				
Blue grama	Indian ricegrass	x		
Threeawn	Sideoats grama	x		
Ring Muhly	Black grama	x		
Shrubs				
Snakeweed		x		
Trees				
Juniper	juniper	x		

APPENDIX G

Espanola-Rio Chama Watershed Plan

Archeological Survey
and
Assessment

ARCHAEOLOGICAL SURVEY AND ASSESSMENT

ESPANOLA-RIO CHAMA WATERSHED

SANTA FE AND RIO ARRIBA COUNTIES, NEW MEXICO

CONDUCTED FOR

THE U. S. SOIL CONSERVATION SERVICE

Prepared by:

David H. Snow

Museum of New Mexico

February 1975

Laboratory of Anthropology Notes No. 115

Santa Fe

INTRODUCTION

Overlapping the Museum of New Mexico's archaeological survey of the SCS Sebastian Martin-Black Mesa Watershed area (Snow 1975), a similar reconnaisance of the Espanola-Rio Chama Watershed area was carried out at proposed flood-control dam-sites, outlet channels and appurtenant structures, and access roads, located in Santa Fe and Rio Arriba counties, in the vicinity of Espanola, Santa Clara Pueblo, and Hernandez, New Mexico. The areas surveyed, including outlet channels and access roads, comprised approximately 1150 acres, and are located as follows:

Site 1, Espanola Quadrangle (USGS 7.5'), portions of Secs. 4 & 9, T-20N., R-8E

Site 3, Espanola Quadrangle, San Juan Pueblo Quadrangle, portions of Secs. 4 & 33, T-20N., R-8E.

Site 4, San Juan Pueblo Quadrangle, portions of Sec. 33, T-21N., R-8E.

Site 5, San Juan Pueblo Quadrangle, portions of Secs. 33 & 28, T-21N., R-8E.

Site 6, San Juan Pueblo Quadrangle, portions of Sec. 28, T-21N., R-8E.

Site 8, San Juan Pueblo Quadrangle, portions of Sec. 20, T-21N., R-8E.

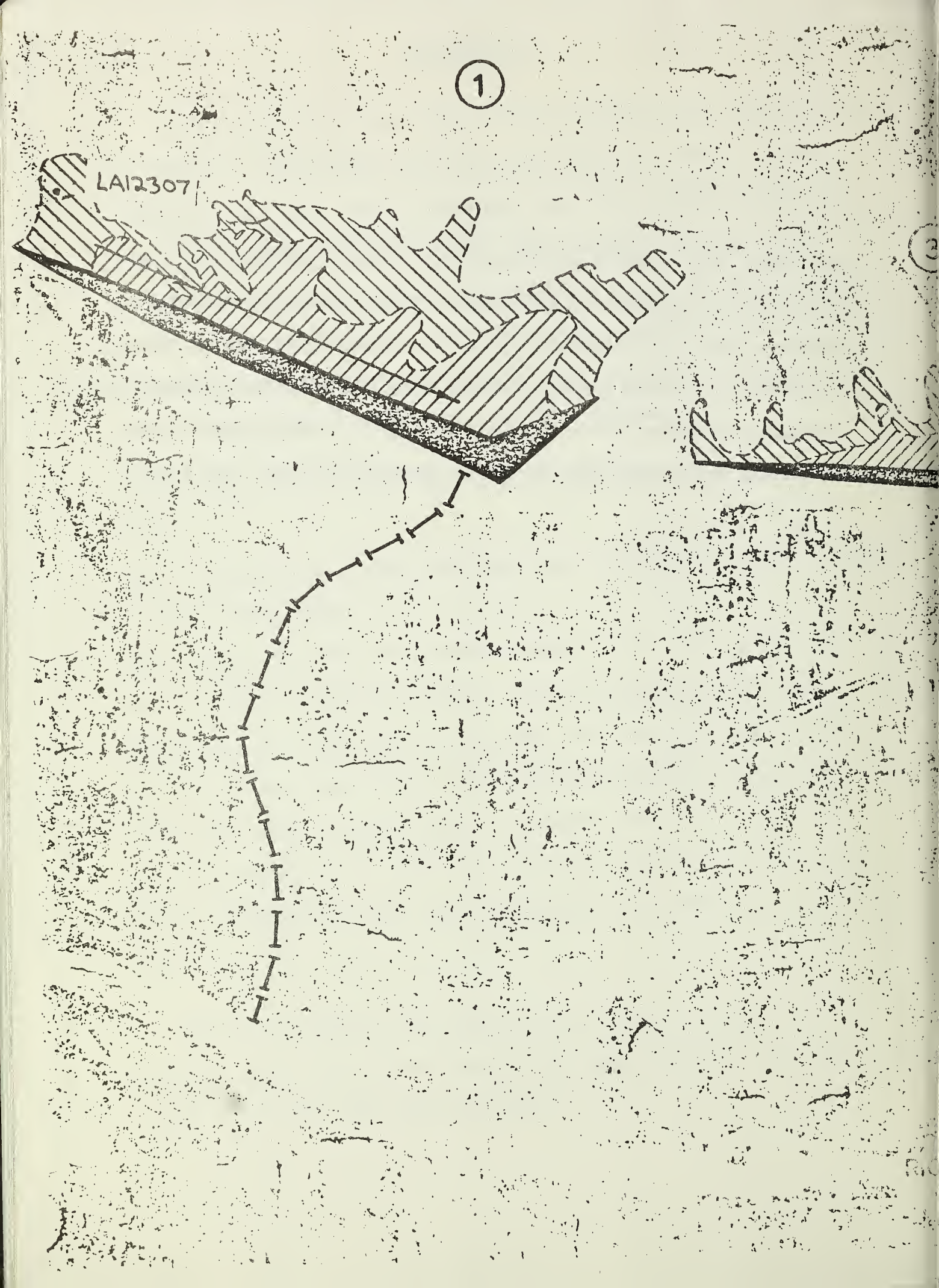
Site 9, San Juan Pueblo Quadrangle, portions of Sec. 17, T-21N., R-8E.

Site 10, San Juan Pueblo Quadrangle, portions of Sec. 17, T-21N., R-8E.

Site 11, Chili and San Juan Pueblo Quadrangle, portions of Sec. 8, T-21N., R-8E.

The brief summary of the cultural and historical background of the Sebastian Martin-Black Mesa Watershed area (Snow 1975) is applicable to the Espanola-Rio Chama area considered here.

This report is the result of archaeological survey conducted for the United States Department of Agriculture, Soil Conservation Service (Purchase Order No. 201-NM-SCS-75), by the Museum of New Mexico, within the Espanola-Rio Chama Watershed area, during the months of December, 1974, and January-February, 1975. A permit to conduct archaeological survey was granted by Governor Paul Tafoya of Santa Clara Pueblo, New Mexico.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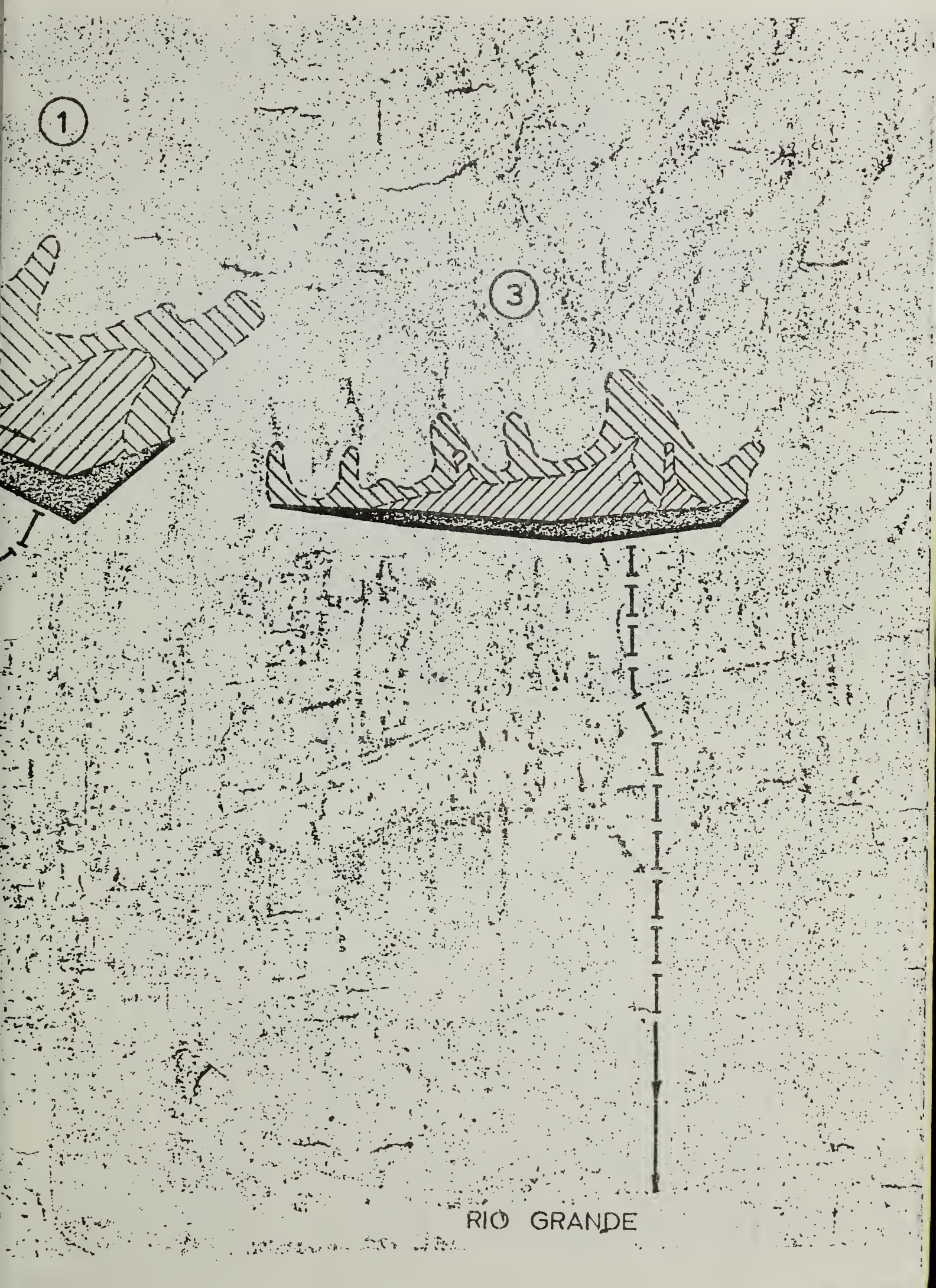
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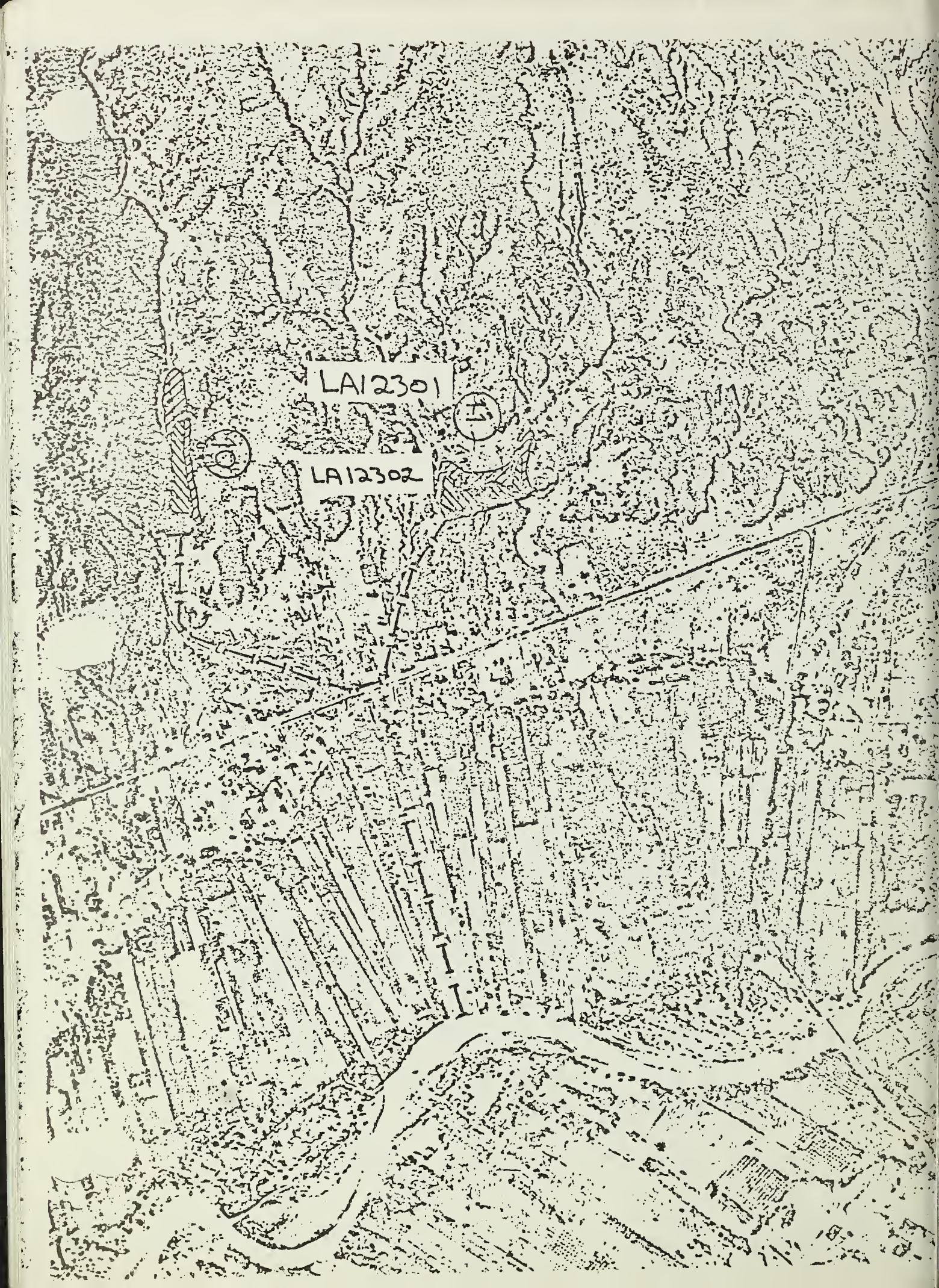
LA12301
LA12302

THE SURVEY

Survey procedures were the same as those used for the previously referred to Sebastian Martin-Black Mesa Watershed project report, and are described therein. The field crew consisted again, of Kathleen W. Fiero, Field Supervisor; and Steven A. Koczan and Lorraine Laurel Wade, Archaeological Recorders; and David H. Snow as project Supervisor.

Seven archaeological sites were located and recorded during the survey of flood-control dam-sites within the Espanola-Rio Chama Watershed area, as follows:

LA 12301 (SCS No. 11): A pottery scatter over an area of 10.0 X 10.0 m., located in the NW1/4SE1/4NE1/4SW1/4, Sec. 7, T-21N., R-7E (projected), USGS Chili Quadrangle, on a low terrace just above an arroyo bottom. The site is outside the western boundary of the structure (No. 11), and contained a small concentration of Bandelier Black-on-grey pottery sherds which date from about AD 1400-1550.

LA 12302 (SCS No. 11): A lithic scatter over an area 3.0 X 3.0 m. located in the SW1/4NE1/4SW1/4SW1/4, Sec. 7, T-21N., R-8E. (projected), USGS Chili Quadrangle, on a mesa top outside of the proposed dam area. No structures were noted and the occupation span is not known.

LA 12303 (SCS No. 9) A masonry room, measuring 2.0 X 2.0 m., located in the NW1/4NE1/4SE1/4SW1/4, Sec. 17, T-21N., R-8E., USGS San Juan Quadrangle, on top of a mesa just outside the southeastern limits of the construction site. The structure is U-shaped with 5 courses of masonry remaining in place. A large piece of metal was found on the surface outside the walls. The site was probably used as a windbreak in modern or recent times.

LA 12304 (SCS No. 9): A lithic scatter over an area 10.0 X 10.0 m. located in the NW1/4SW1/4NW1/4SW1/4, Sec. 17, T-21N., R-8E. (Projected), USGS San Juan Pueblo Quadrangle, at the western limit of the flood-pool area at Site 9. The scatter is at the confluence of 2 unnamed drainages, and consists of a concentration of cultural lithic debris of an unknown period.

LA 12305 (SCS No. 9): A small masonry room measuring 3.0 X 3.0 m. located in the NW1/4NW1/4SW1/4SW1/4, Sec. 17, T-21N., R-8E. (projected), USGS San Juan Pueblo Quadrangle, in the bottom of an arroyo leading to the pool area at Site 9. The site consists of a rectangular outline of stone foundations, but lacked cultural artifacts in association; consequently its age or use is not known.

LA 12306 (SCS No. 6): Pueblo shrine located in the NE1/4NW1/4SW1/4SE1/4, Sec. 28, T-21N., R-8E., USGS San Juan Pueblo Quadrangle, behind the structure to be constructed at Site 6, on the first bench at the junction of 2 small arroyos. The shrine consists of an outline of cobbles in square form with a "tail" pointing southwest. This particular form is reminiscent of known Pueblo shrines related to hunting, and to more esoteric varieties, although the "tail" appendage is unexplained. No cultural debris was found in association.

LA 12307 (SCS No. 1): A lithic scatter over an area 2.0 X 2.0 m. located in the NW1/4SW1/4SW1/4NE1/4, Sec. 9, T-20N., R-8E., USGS Espanola Quadrangle, on the southern boundary of the dam-site at Site 1. The cultural material is non-diagnostic and its cultural-historical affiliation, consequently, is not known.

In addition to the sites above, a circular shrine was located well away from SCS Site 3. A photo of this included in the report on the Sebastian Martin-Black Mesa survey (Fig. 8, Snow 1975).

IMPACT OF THE PROJECT AND RECOMMENDED MITIGATION FOR ARCHAEOLOGICAL SITES

LA 12306 and LA 12307, of the seven archaeological sites recorded during the survey of the flood-control areas, will be innundated by flood-water back-up behind the earthen structures. The remaining five archaeological sites are located outside the limits of the construction zones and flood-pools and probably will not receive direct impact. Indirect impact may occur as a result of visitation to the construction zones during or following construction.

Surface collections were made where cultural debris existed, but in no case did these collections indicate a need for further archaeological work, and the significance of the sites to be innundated is minimal to archaeological investigation of interpretation of the area, beyond knowing they exist. None of the sites are recommended for either State or Federal historical registers, and no such sites are known to exist in the immediate vicinity of the dam-sites. No further mitigating actions for these sites are recommended, and archaeological clearance should be given in each case so that construction can proceed.

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DEPUTY STATE PLANNING OFFICER

June 20, 1975

Mr. Jay Ramsay
Project Planning Staff Leader
oil Conservation Service
Box 2007
Albuquerque, New Mexico 87103

Dear Mr. Ramsay:

This is with reference to your letter of June 18, 1975, which enclosed copies of David H. Snow's archeological survey reports on the Sebastian Martin-Black Mesa and Espanola-Rio Chama Watersheds. I have these comments to make:

The site identified as LA 12308 should be flagged; construction personnel should be instructed to avoid it and above all to avoid driving equipment over it. Flagging should be removed when construction is complete.

Mitigation, in the form of surface collections made for the record, was carried out by the survey personnel on the Espanola-Rio Chama site where cultural debris existed. Sites were photographed. No further mitigation is called for.

Archeological clearance for these two projects is granted subject to my first stipulation. I would appreciate it if you would acknowledge this letter and your intent to avoid LA 12308.

Sincerely,

Graciela Olivarez
State Planning Officer

by: Thomas W Merlan
Thomas W. Merlan, State
Historic Preservation Officer

TWM:dm
cc: David H. Snow

A P P E N D I X H

Espanola-Rio Chama Watershed

Glossary

APPENDIX H

GLOSSARY

acre-foot	A quantity of water that will cover 1 acre 1 foot deep (43,560 cubic feet).
anti-seep collars	Projections from conduits to increase the length of the seepage path between a conduit and the embankment.
arroyo	A term applied in the Southwest U. S. to small, usually flat-floored, sand bed, ephemeral streams.
colluvial outwash	A loose heterogeneous and incoherent mass of soil material, rock and rock fragments, usually deposited by mass wasting.
conservation cropping system	A land treatment practice of crop rotation and tillage considered best suited to the soil.
control structure	A regulating structure to maintain water at a desired elevation, usually installed in gravity flow systems.
design life	The period for which a structure is designed to perform its function--such as flood protection for 100 years as proposed by this plan.
energy dissipator and de-energizing basins	A structure installed to minimize the erosive effect of water by absorbing excess energy produced by flow velocities.
flap gate	A swinging metal gate installed at the outlet end of a pipeline to keep out backwater, but permits flow through the pipeline.
flood plain	Nearly level land situated on either side of a channel which is subject to overflow flooding.
floodway	A channel, either natural or excavated, or bound by dikes and levees, used to carry excessive flood flows to reduce flooding.

hydrograph	Graphical or tabular representation of flow rate with respect to time.
incised arroyo	An entrenched arroyo.
land treatment measures	Farming practices designed to protect the land while making the best use of it.
moderately yielding foundation	A foundation in which a minimum of settlement will take place during construction and none subsequently.
one percent chance of occurrence	The probability of occurrence of a 100-year rainfall in any given year or one in 100 years or 0.01 (100-year frequency).
phreatophyte	A water-loving plant characterized by a deep root system.
probable maximum precipitation	An estimate of the physical upper limits to the amount of precipitation that can fall over a specific area in a given time, which is used to develop class "c" hydrograph.
100-year recurrence interval	The flood that is equaled or exceeded once in 100 years (one percent chance of occurrence).
2-stage riser	A principal spillway inlet structure designed to release different rates of flow at 2 different elevations in the retarding pool.
25-year, 6-hour storm	The storm that is equaled or exceeded once in 25 years. The New Mexico State Engineer has classified this storm as the limiting criteria for sizing the principal spillway in a floodwater retarding dam to drain the detention pool. The runoff collected in the detention pool must be drained within 96 hours.
Tertiary-Quaternary age	Geologic age ranging from 25 to 1 million years ago.
transitions	A structure to provide a uniform change from one size of conduit to another size.
zoned embankment	Embankments constructed of various soil materials placed in different sections or "zones" of a dam.