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EVALUATION

Rural Works Project

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## I. Background

USAID's first approach to assist the Cape Verde Islands is noted in a letter to the High Commissioner of Cape Verde from the U.S. Ambassador Frank C. Carlucci, on April 22, 1975. The Ambassador stated that he was notified that an AID Team was prepared to continue discussions already begun in Washington on March 6, 1975, with the Minister for Economics and Coordination and Labor, Amaro de Luz. An attached memorandum from AID confirmed that in Fiscal Year 1975, an appropriation of 5 million dollars in Grant and Loan funds for use in Cape Verde under the Foreign Assistance Act were available and to be committed prior to June 30, 1975.

The GOCV had developed a plan for economic assistance to Cape Verde prior to the AID Team's visit in May, 1975. The plan enumerated the critical problems of soil and water conservation, including Torrent control, erosion and desertification. The immediate objective of the plan was to develop a project aimed at giving useful work to an estimated 60% of the rural workers who were unemployed.

By June 30, 1975, a USAID Project Paper (PP) entitled "Agricultural Sector Support (Rural Works)" was prepared and approved. The two main components of the PP were Soil and Water Conservation and Farm to Market Roads. A loan of US \$3,000,000 was first made to facilitate the programming process. The loan was forgiven and given a grant status in March, 1977. In addition, a project revision completed in May, 1977 added \$400,000 for the purchase of additional equipment.

The administration of the grant was placed with the AID Regional Economic Development Service Organization (REDSO/WA) in Ivory Coast. A USAID Agricultural Development Officer assigned to Cape Verde October 23, 1977 has monitored the project.

### A. Overall Project Goal:

The purpose of the soil and water conservation works is to improve and increase effectively soil and water resources available for crop production.

### Short Term Objectives:

The immediate objective of the project was to provide employment to approximately 10,000 workers who would have otherwise been unemployed. These workers were to: build dikes in valley areas to catch alluvial soils washed down from the mountain side during the sporadic, torrential downpours; construct retaining walls

that prevent further erosion of soils and; to provide irrigation and clear areas of rocks to develop pasture and promote crop production.

B. Long Term Objectives:

- slow the erosion and desertification of the islands;
- increase the productivity of the land;
- increase the infiltration of the water into the soil;
- increase the land area to be used, and
- improve the lives of the population.

Farmers have had to cultivate more marginal land on higher slopes, thereby increasing erosion. Animals, mainly goats, continue to wander freely and eat the vegetation. As a result and with the devastating drought that begun in 1967, the land can not support the population's basic needs. Moreover, 70 per cent of the active population is unemployed. In analyzing the situation, the GOCV determined that labor intensive projects directed at the urgent need to conserve soil and water could provide employment while controlling erosion and developing more irrigated agricultural land.

The \$3,000,000 loan was designed to cover foreign exchange costs and provide local financing to support rural work projects, including land clearing and the construction of access roads, conservation works and small-scale irrigation facilities. The Project activities were to be arranged and carried out by Ministry of Economic Coordination and Labor. Responsibility for project management was later given to the Ministry of Rural Development. The beginning of the project is detailed in an Implementation Letter dated August 21, 1975 from REDSO/WA (AID Loan 655-Z-0001). The letter explains that the GOCV will present to USAID a proposal to divide project activities under "sub-projects" which will identify the location, objectives, an estimation of work to be performed, a budget, and the date the work effort is to start and end.

The project areas are originally described in the Project Paper as "primarily on the Island of Santo Antao, but also on Sao Vicente, Fogo, Brava and Santiago". The documents relating to the project do not state when the decision was made to give emphasis to Santiago Island, but on the basis of the projects submitted to REDSO/WA only sub-projects located on Santiago have been initiated. Approximately 10 kilometers of access roads have been constructed to work on Soil Conservation Projects, but no specific projects to build farm to market roads have yet been undertaken.

When the AID Loan Agreement was signed, the Cape Verde Islands were suffering a seven year drought. Because of the drought, agriculture's relative share of GDP has been decreasing steadily from 41 per cent in 1967 to about 16 per cent in 1973. The yield of corn had slumped from .8 tons per hectare to .2 in 1975, making the economy totally dependent on imported food for subsistence. The three million dollar loan basically provided funds for work projects that have employed the majority of the rural population living in the project area. In accordance with the implementation letter, the Ministry of Rural Development established three sub-projects which were funded by the loan. In addition, one project, Number 4, was presented and approved for locally generated funds from the sale of AID PL-480 cereals.

## II. Description of the Four Rural Works Sub-Projects:

Developed for Santiago Island, these projects were submitted to REDSO/WA. All have similar objectives:

1. to provide income and employment for rural workers;
2. to construct permanent stream-slope reduction structures;
3. to prevent soil erosion, especially by constructing check dams on the gullies;
4. to improve the conditions for recharging the level of underground water; to create flat beds with the deposit of solid transport; and to promote as much as possible the storage of rainwater in the stream beds.

Title: Sub-Project #1: Soil and Water Conservation Project in Ribeira SECA

Location: See map #1 for location on Santiago Island. The population density equals 163 per square km. in 72 kms. square.

The project was planned for a twelve month period starting November, 1975. Estimated cost for the period - \$1,100,000 (29.7 million escudos @ 27 escudos = US \$1.00).

Title: Sub-Project #2: Soil and Water Conservation in Ribeira Dos PICOS

Location: Shown on map #1.

The project was planned for a twelve month period starting December, 1975. Estimated costs for 940 check dams and 2,800

MAP No. 1.

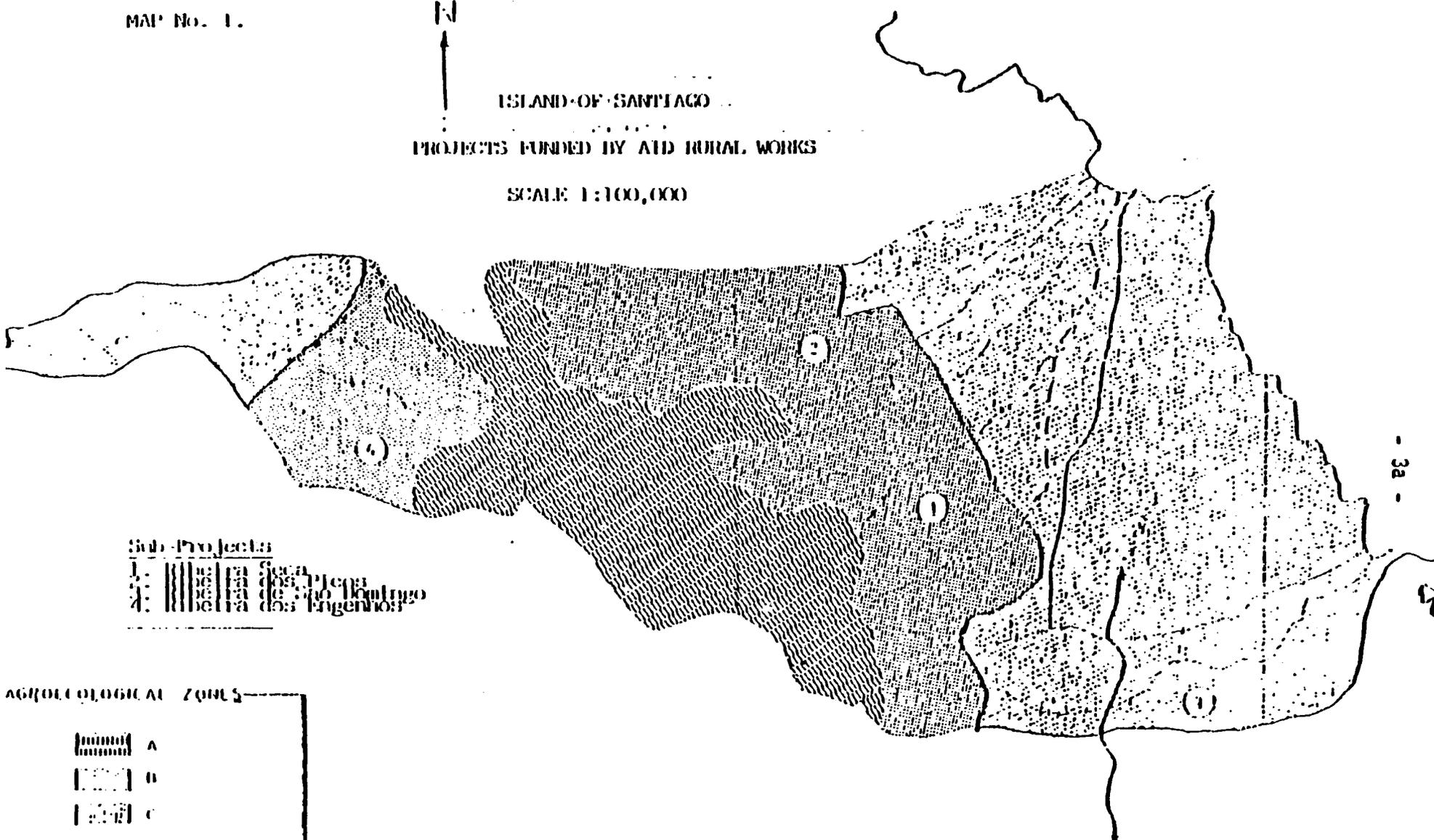
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ISLAND OF SANTIAGO

PROJECTS FUNDED BY AID RURAL WORKS

SCALE 1:100,000



Sub-Projects

- 1: Beltra de San Pedro
- 2: Beltra de San Antonio
- 3: Beltra de San Lorenzo
- 4: Beltra de Ingenio

AGRICULTURAL ZONES

- A
- B
- C

DESCRIPTION OF THE ZONES TABLE 1  
SURFACES OF THE ZONES TABLE 2

meters of retaining walls using the dry rubble technique equals 36,335,160 escudos, or \$1,345,746 (@ 27 escudos per US \$1.00).

Title: Sub-Project #3: Soil and Water Conservation in Ribeira De Sao Domingos

Location: See map #1.

The estimated budget is 3,355,000 escudos or \$125,000 (@ 27 escudos per US \$1.00).

The project was to start in April, 1976 and continue for 21 months. An estimated 120 check dams and 600 cubic meters of retaining walls were to be constructed.

Title: Sub-Project #4: Soil and Water Conservation in Ribeira Dos Engenhos

Location: See map #1.

The project was to start in April, 1976 and continue for 45 months. An estimated budget is 41,139,000 escudos or \$1,523,670 (@ 27 escudos per US \$1.00).

An estimated 850 check dams and 40,600 cubic meter of retaining walls were to be constructed.

Sub-project #4 uses funds accumulated through the sale of AID PL 480 grains. The project is an integral part of the Rural Works effort, even though funds are provided from a different source.

The location of works that were to be accomplished by the Rural Works Project was chosen according to previous watershed techniques and knowledge. Long range planning was not possible because of the time constraints and lack of trained technicians.

Table 1 shows a comparison of the program planned and the results of the work program in the four sub-projects. The Rural Works Project will receive AID assistance until December, 1979. There are 200 work fronts presently in progress but only 88 per cent of the dikes are completed. About 56 per cent of the retaining walls are completed on target. Three hundred and six kilometers of earth terraces have been constructed as part of the sub-projects. In the case of dikes, different dimensions depend on the site conditions. A review of the Ministry of Rural Development's files indicates that only 28 per cent of the dikes

completed are long dikes, or about 15 meters long, while 62 per cent are middle size, or about 9-15 meters long, and 10 per cent of them are small dikes 7-9 meters long. Three are long dikes each over 170 meters located in the river bed.

TABLE 1:

Comparison of Program Plan with Realization Attained (March, 1978)

<u>Sub-Project</u>	<u>Initial Duration</u>	<u>Starting Date</u>	<u>Dams</u>		<u>Walls (CU.M.)</u>		<u>Expenditures</u>	
			<u>Programmed</u>	<u>Built</u>	<u>Programmed</u>	<u>Built</u>	<u>Foreseen</u>	<u>Effective</u>
<u>Ribeiras:</u>								
Seca	12 mos.	1/12/76	836	1,239	2,400	8,424	29,700,000	29,706,96
Picos	12 mos.	1/16/76	940	1,032	2,800	7,160	36,335,370	29,887,62
Domingos	21 mos.	4/16/76	120	18	1,600	2,672	3,355,000	3,970,94
Engenhos	45 mos.	2/5/76	<u>850</u>	<u>129</u>	<u>40,600</u>	<u>8,200</u>	<u>41,139,000</u>	<u>11,125,51</u>
Total			2,746	2,418	47,400	26,456	110,529,370	74,691,10

The progress reports give the masonry walls in km. whereas the calculation in cubic meters was made on a basis of 0.4 cubic meters/meter (dimensions of wall height 0.8; bottom width 0.6 meters and top width 0.4 meters).

A. Technical Appraisal of the Rural Works Project:

The surface of the agroecological zones are shown in Map 1. Watersheds of Ribeira Seca, Sao Domingos and Ribeira Engennos have common characteristics with 20-30 per cent of slopes of A Unit or 50 per cent slope; 40-50 per cent of B Unit or 20-50 per cent slope and 20-40 per cent of C Unit, or 20 per cent slope. The Watershed No. 4, Sao Domingos, is lower in altitude and is more arid, as shown in tables 2 and 3 below.

TABLE 2:

Surfaces of Agroecological Zones: Rural Works

<u>Sub-Projects</u>	<u>Density of People</u>	<u>A</u>		<u>B</u>		<u>C</u>		<u>Total h</u>
		<u>HA</u>	<u>%</u>	<u>HA</u>	<u>%</u>	<u>HA</u>	<u>%</u>	
<u>Ribeira:</u>								
Seca	163	200	28	2,870	40	2,293	32	5,363
Dos Picos	270	1,455	30	2,495	50	974	20	4,924
Domingos	191	326	11	484	16	2,244	73	3,054
Engenhos	N/A	<u>782</u>	<u>19</u>	<u>1,771</u>	<u>44</u>	<u>1,486</u>	<u>37</u>	<u>4,039</u>
Total		2,763		7,620		6,997		17,380
Average of percentage			24		40		36	

The key to the features of the agroecological zones is shown in the fold out table on the following sheet.

Description of the Erosion:

Visits to the watersheds were very short, averaging one day per each; therefore, it is not possible to present a detailed description of the erosion processes. To better understand the complete process of erosion, a longer and more careful examination should take place using aerial photos followed by field verification. The following are only general impressions.

The present erosion process is an overall run-off and erosion of the banks. In the project area, mass movements (slumping) are very rare. Because of the rains, the steep slopes, and the absence of protecting vegetation, run-off is intense and concentrated on all the numerous, but elementary, linear gullies. Extremely sub-divided gullies such as those frequently seen in Mediterranean countries are rare in Cape Verde. Instead, gullies are generally simple or sub-divided into rills at their head; this is the result of the lithology producing soils which are resistant to concentrated erosion. Consequently, the gullies are progressively becoming longer and deeper, but less sub-divided.

Bank erosion takes place generally in the main valleys and their

Features of Agroecological Zone

Unit	Climate	Altitude (meters)	Ave. Slope (%)	Soil	Agricultural Capability	Perennial Species Existing or to be Introduced	Density of Population	Erosion	Soil and Water Conservation Techniques
A.	P 400 mm; frequent clouds, fog, high air humidity.	500	50	Paraferrallitic Cambisols Andosols	Locally good for Beans, Cajanus, Mango Corn; excessive humidity	Cajanus Cajan Lantana Camara L. Gigantea Melia Azerderach Leucaena Glauca Acacia Albida (dry exposure) Cytisus Proliferus Picus up	Intermediate between B and C concentrated 1200 inhab. per km <sup>2</sup>	Torrential rivers run-off	Torrential check dams Perennial vegetation for wood, forage, food (cajanus)
B.	P 400 mm	300-500	20-50	Solomitic Sertisols	Optimum for corn good for cajanus mango	Acacia Alcide Cajanus Cajan Melia Azerderach Lantana Camara Leucaena Glaerca	Maximum of density 250/300 h/sq. km. scattered	Maximum of run-off elementary gullies erosion of banks	Slopes: walls, ditches with perennial vegetation, Perennial vegetation on steep slopes Rivers: dikes water catchment
C.	P 200 mm; Littoral	300	20	Xerosols	Grazing, Corn only in micro-saltations and rainy years. Beans excluded	Miziphus Mauretanic Camarinus Acacia (Albida and Nilobica	150 h/sq km; rather concentrated	Run-off, few gullies wild erosion	-Wind breaks -Banquettes -Water storage -Flood regulation -Reclamation of alluvial soils

tributaries. The torrential character of the rainfall concentrates enormous quantities of water, moving voluminous rocks and accumulating them at the bottom of continually decreasing slopes. Moreover, water caves the banks inward during every stream flood.

In conclusion, the erosion process is characterized by an intense, general run-off of the slopes which tears away a precious part of the soils and promotes further erosion of the banks.

Description of Soil and Water Conservation Structures Constructed:

The four valleys were selected because of their population density, agricultural potential and the problem of severe erosion. The project was to provide income to rural workers; prevent soil erosion by using check dams, rock retaining walls and earth contours; create new farming land by reducing the slope of the river bed with check dams and; provide with underground dams, water storage in the stream beds:

Check Dams:

These dams are constructed with a dry rubble or dry masonry techniques and vary in dimension and design to the erosion problem. They also vary in length from seven to fifteen meters in the small valleys to 185 meters in the river bed. Table 4 below gives data on check dams:

<u>Item</u>	<u>Long Dikes</u>	<u>Middle Dikes</u>	<u>Small Dikes</u>
Length (Meters)	15	9-15	7-9
Volume (cubic meters)	100-150	35-100	20-35
Transversal section (square meters)	5	3-5	3
Surface of downstream face (square meters)	32	12-32	12

The purpose of a check dam is to stabilize the valley profile of a watershed by reducing the slopes of the hillsides. By decreasing the rate of water flow the eroded material moving in the stream can settle out. This process forms productive farm land and provides an increasing opportunity for water to infiltrate into the soil. As a result an increased capacity for underground water storage is created. Torrent control dams are set on foundations dug 2-3 meters into the stream bed. Large rocks are used for the base. The dams are provided with spillways and the larger dams have rock aprons or settling basins to protect the dam against the

turbulence of the water spilling over it. Dry rubble or masonry dams are established along the valleys according to soil characteristics; they reduce the slope between the dams by 1 to 2 per cent.

Estimating the number of work days required to accomplish the construction of check dams or dikes is difficult. Distance, availability of stones and the depth of foundations vary greatly between different dikes. However, in reviewing the records of the Ministry of Rural Development, there are generally 6 categories of middle size dikes which vary in cost and work days.

Volume (Cubic Meters)	52	62	87	221	50	236
Man/days	19	112	250	934	222	1,292
Man. days per cu. meter	133	197	322	423	444	547
Cost per cu. meter (escudos)	60	89	145	190	210	246

Av. salary ..45 escudos per day

In general, the cost of transporting stones often represents 58 per cent of the total cost.

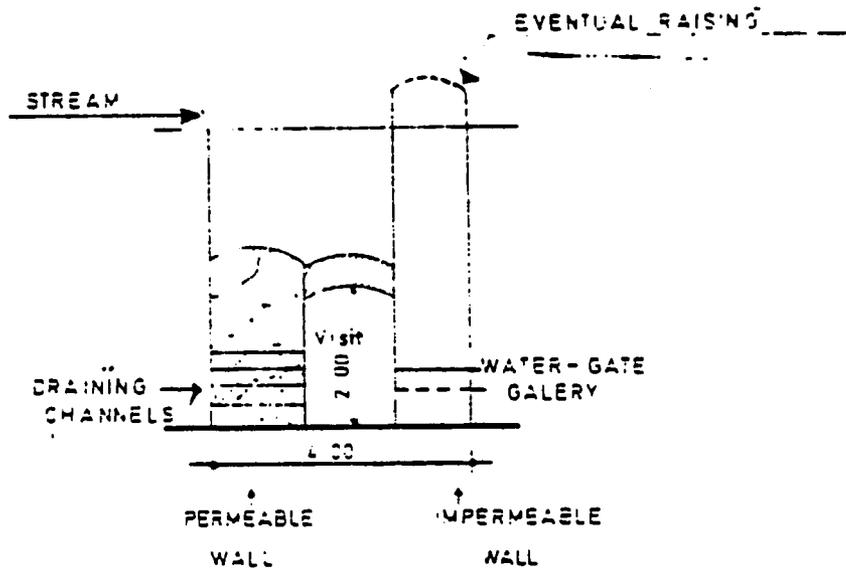
#### Gabions:

Gabions are being used extensively to build check dams. The wire enclosures (1 meter x 1 meter x 1½ meters) hold smaller rocks and provide an opportunity to employ more women who can fill the gabions with the rocks carried on their heads. Gabions have the advantage of settling with any movement in the stream bed and since they are structured in net wire, they don't crumble.

#### Subterranean Dams:

Subterranean dams (shown in figure 1) provide a catchment for water in stream beds. These dams are set on foundations of bed rock and made impermeable with concrete. Plans call for raising the dams as they become filled with sediment to increase the catchment basin for water or as a base for dry rubble check dams to catch soil and form temporary irrigated land, using the advantage of capillary action. The cost of building a subterranean dam varies, but in one case was recorded at \$22.50 per cubic meter.

Fig. 1 - WATER CATCHMENT

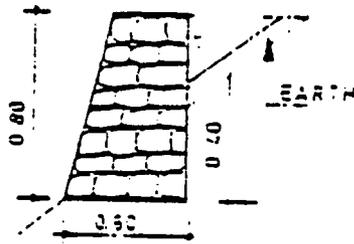


Rock Walls:

Stones are generally abundant to construct rock retaining walls using the dry masonry techniques. The foundation of an average wall is about 40 cubic meters deep x 60 cubic meters wide and 80 cubic meters high. (See figure 2) Walls are constructed on slopes up to 60 per cent. The distance between walls varies from 10-30 meters. The women who are seen in crews doing this type of work make up 30-40 per cent of the total work force. The cost of rock retaining wall is calculated at approximately 2 work days per meter or about \$2.00 - \$2.50 per meter.

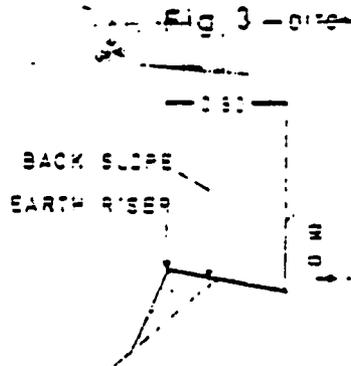
**Best Available Document**

Fig. 2 - RETAINING WALL - DRY MASONRY



Contour Ditches:

On hillsides where stones are readily available, contour ditches are dug into the hillsides. The cut is about 20-30 cubic meters deep, producing earth rises averaging 10-20 cubic meters high. (See figure 3). The work progresses at the rate of 20 meters per day per worker, or \$42.00 per kilometer.



B. Site Selection for Construction Projects:

The location of construction sites are indicated on map 2. These locations tend to approximate the concentration of people in the watershed and were chosen to accommodate areas having a larger group of employable workers. Another factor influencing the selection of sites is the Cape Verdean technician's limited background with modern methods to control erosion. In response to the more apparent and immediate needs, the objective of most construction is to catch sediment that moves with the heavy run off and place most of the construction projects in the populated valleys.

III. Progress and Constraints:

Two main constraints exist:

Technical Staff:

There is general lack of technical staff and technical training: there are only two engineers. Their duties require them to give attention to work projects on other islands as well.

The four sub-projects are monitored by four supervisors (regent Agricole) and three assistants for approximately 10,000 workers. With the additional problems caused by inadequate transportation, there is a lack of careful monitoring.

Equipment:

Big dikes of over 180 meters have been constructed by hand in the valleys of Ribeira Seca and Sao Domingos. Digging for underground dams to a depth of 25 feet is also being accomplished by hand labor. A lack of an excavator such as a backhoe or dragline to handle large boulders causes delays and creates dangerous conditions which could lead to cave ins. In addition, work must be accomplished before the rains start or previous work will be destroyed by floods.

A lack of trucks and a front end loader were obstacles in the beginning of the project. However, with arrival of the trucks, front end loader and compressors, it was possible to open more work projects and employ more workers.

Shortages of cement and of gabions were, in many cases, constraints to achieving the work as planned.

A. Technical Characteristics of the Work Accomplished:

The existing soil and water conservation structures have been constructed by hand labor. Using the dry rubble technique, check dams and retaining walls are constructed to meet the conditions of the particular site. In the case of dikes constructed in the river beds, excavations of 2-3 meters deep are made (by hand), and large rocks of one ton or more are placed forming the footings. The check dams built on the footings rise to 2-3 meters above the stream bed. The spillway is given special attention and enlarged to carry the floods equal to those of 1976 when 10 inches of rain-fell in one 24 hour period.

In many locations rocks are not available in sufficient quantities, or the rocks are too small making it necessary to haul them to the sites. The USAID has provided three 6 ton trucks, a D-4 caterpillar, a front end loader, two compressors and jack hammers for this purpose.

Technique of Construction:

The dry masonry or dry rubble construction technique is accomplished with hand labor. Stones weighing one ton or more are rolled up logs and placed into position. USAID equipment--has made it possible to move rocks to locations where no rocks exist and to help open more work locations. In June, 1978, over 10,000 workers were employed in the USAID/GOCV Rural Works Project on over two hundred construction projects.

Slopes:

The availability of rocks has an influence in the retaining walls built on the slopes. The distance between walls is too great. The following spacing should instead be observed:

<u>Slopes</u>	<u>Distance (meters)</u>
20-30	20-25
30	15-20
40	10-15

The contour ditches around the slopes are made from earth when rock is not available. Earthen contour ditches are usually fruitless because livestock, the wind and poor farming methods destroy much of the work. Earth contours without vegetative fixations should be built with caution and be carefully maintained to prevent gullying from heavy run off which finds its way down the slope from other broken contour ditches. Preference should be to reduce the surfaces, improve the contour by digging a deeper

cut and building a higher riser.

The work accomplished is impressive. The major part of the work consists of check dams; retaining walls and earth contour ditches. The quality of the dry rubble technique is excellent. Women employed in the construction efforts represent 30-40 per cent of the total labor force, and many are advancing to positions of responsibility as chiefs of work crews, or supervisors. Where women do equal work, such as supervising crews, they receive the same pay as the men. The pay scale, however, reflects that men do receive more wages, on the average.

Supervisors.....	100	escudos per day
Foremen.....	80	escudos per day
Masons.....	60	escudos per day
Laborers--men--.....	40	escudos per day
Laborers--women--....	30	escudos per day

The Ministry of Rural Development explained however that the Ministry of Justice is in the process of proposing a new wage law which will give women equal pay for equal work.

B. Magnitude of Benefits:

Unfortunately, the drought continues into its ninth year in Cape Verde. The situation for the rural people who represent 80 per cent of the total population has grown steadily worse. No crops can be grown on the farms. The Rural Works sub-projects are planned to be completed by December, 1979. The average number of workers per day in the four sub-projects has increased from 1,800 in July, 1976 to over 10,000 in 1978. Officials from the Ministry of Rural Development estimate that most of the rural families in the four sub-projects areas have at least one person working on rural works projects. In some cases where a family has many children, more than one person is permitted to work.

Recent estimates of 15 escudos (\$.43 per day per person to provide food indicates that the \$1.00 per day for women workers, \$1.33 per day for men workers, \$2.00 - \$2.66 per day for rock masons and \$3.33 per day for supervisors is a great benefit to the family food budget. The sub-projects are the main source of work for the rural people in the four valleys.

Map 2 shows the accomplishments of work completed in the four sub-projects. Over 200 projects with separate work crews of 10-50 persons were in progress in May, 1978.

Inspired by this project, the Government of Cape Verde has made

Watershed Management and Soil Conservation a national effort and is providing funds for similar projects on other islands and in other valleys of Santiago. (A recent issue of the 1,000 escudo bank note has a picture of the soil and water conservation efforts of the GOCV).

IV. Recommendations:

1. A careful study of the watershed should precede the work. Sites should be selected after reconnaissance of the watershed and according to prior knowledge of the erosion conditions in the watershed. The present approach can lead to mistakes and wasted effort.

Methodology based on aerial photo interpretation is one possibility to carefully examine and define locations for fighting erosion. Photo interpretation has to be followed by field verification of slopes, the intensity of erosion, specific soil characteristics, vegetation and land use.

Work on the slopes should precede work in the valleys. Fortunately a major part of the Rural Works Project is now directed to work on the slopes.

2. The Rural Works Project was planned as an effort to provide jobs (about 70 per cent of the workforce is unemployed) and to improve the soil and water conservation needs of the country. The recent Agricultural Assessment Team considers that continuing work in conservation of soil and water is a high priority, with the effort leading to more irrigated land.

3. Continuation of the Rural Works Project is planned, using funds from the GOCV National Development Fund through the end of the planned project of December, 1979. As critical need for funds may begin as early as June, 1978.

4. While the records of the project appear excellent, a review by the financial control for REDSO/WA or Regional Controller/Sakar would be in order.

5. A full set of project records should be established for use in Cape Verde. A good start is to zerox the entire file of the loan project now in REDSO/WA Abidjan.

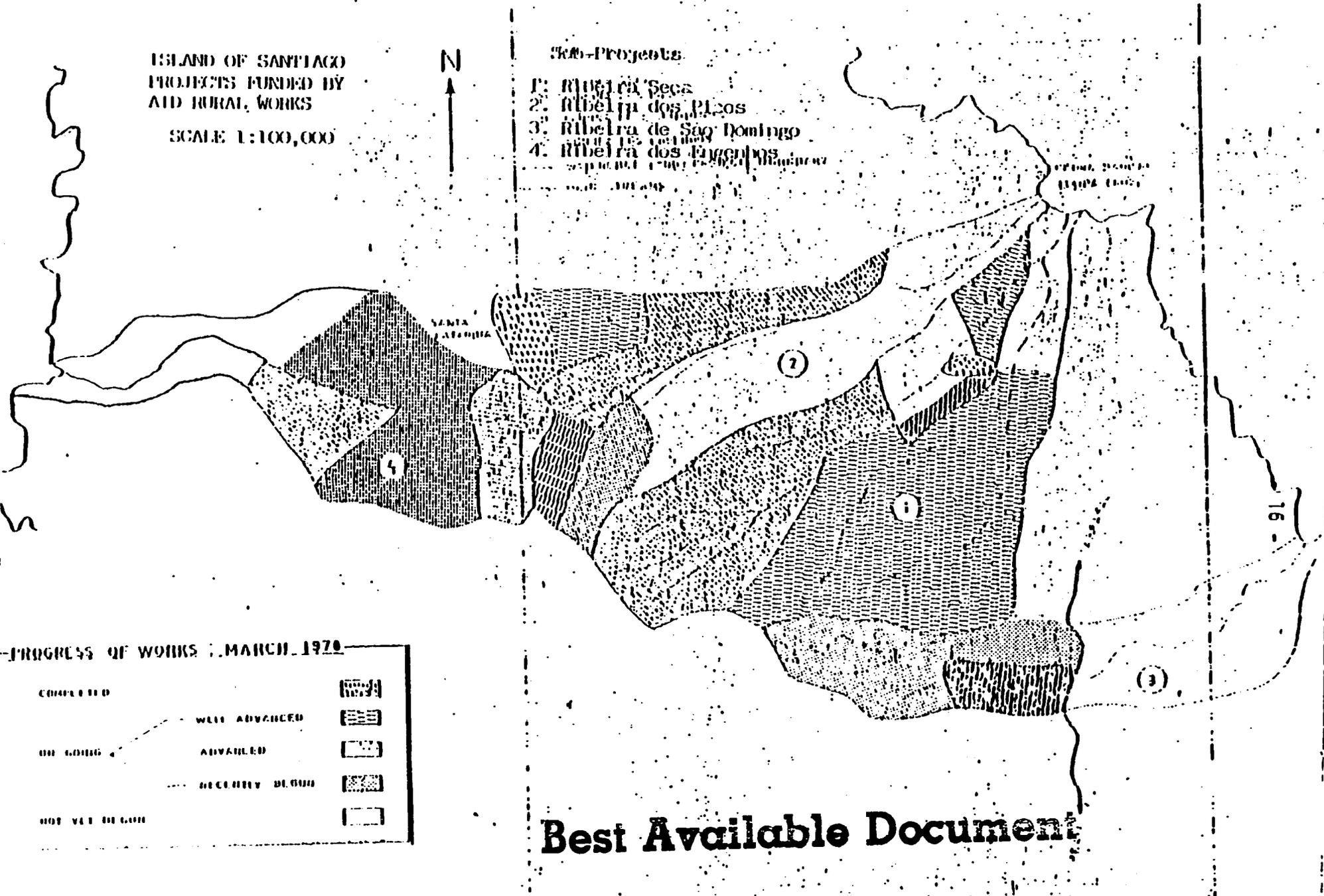
ISLAND OF SANTIAGO  
PROJECTS FUNDED BY  
AID RURAL WORKS

SCALE 1:100,000



Sub-Projects

1. Ribeira Seca
2. Ribeira dos Picos
3. Ribeira de São Domingo
4. Ribeira dos Engenheiros



PROGRESS OF WORKS : MARCH 1970

COMPLETED	
WELL ADVANCED	
ON GOING	
ADVANCED	
RECENTLY BEGUN	
NOT YET BEGUN	

Best Available Document