

SOM 10

UNITED NATIONS DEVELOPMENT PROGRAM
(SPECIAL FUND)

PROJECT FOR THE WATER CONTROL AND
MANAGEMENT OF THE SHEBELLI RIVER
SOMALIA

EXECUTING AGENCY
FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS

VOLUME IIA

THE BALAD FLOOD IRRIGATION PROJECT
FEASIBILITY STUDY
TECHNICAL ANNEX

NOVEMBER 1969

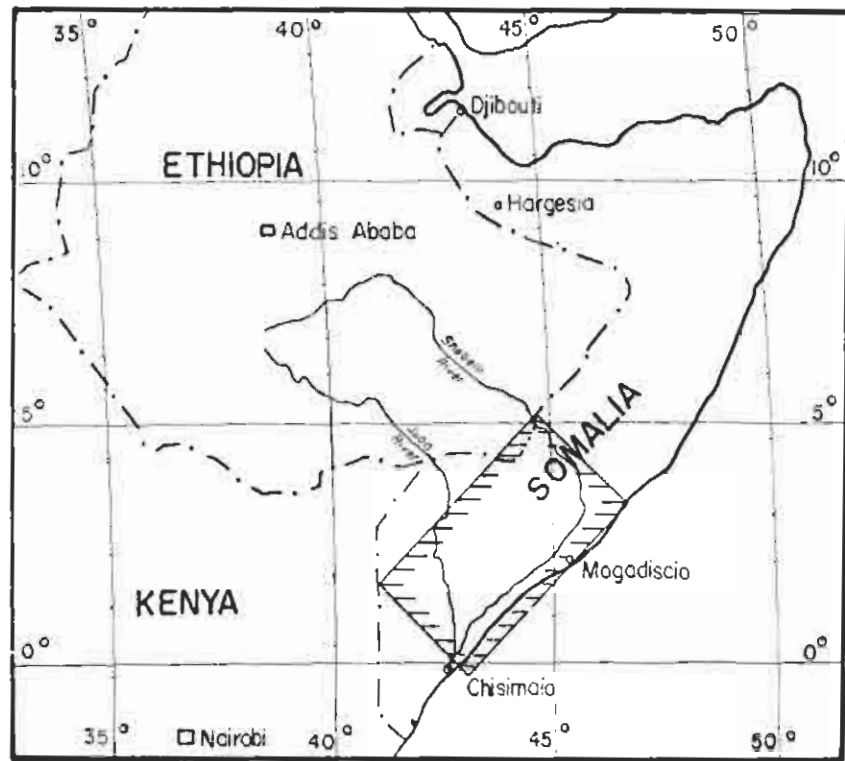


HUNTING TECHNICAL SERVICES LTD
LAND USE & AGRICULTURAL CONSULTANTS
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HERTS, ENGLAND

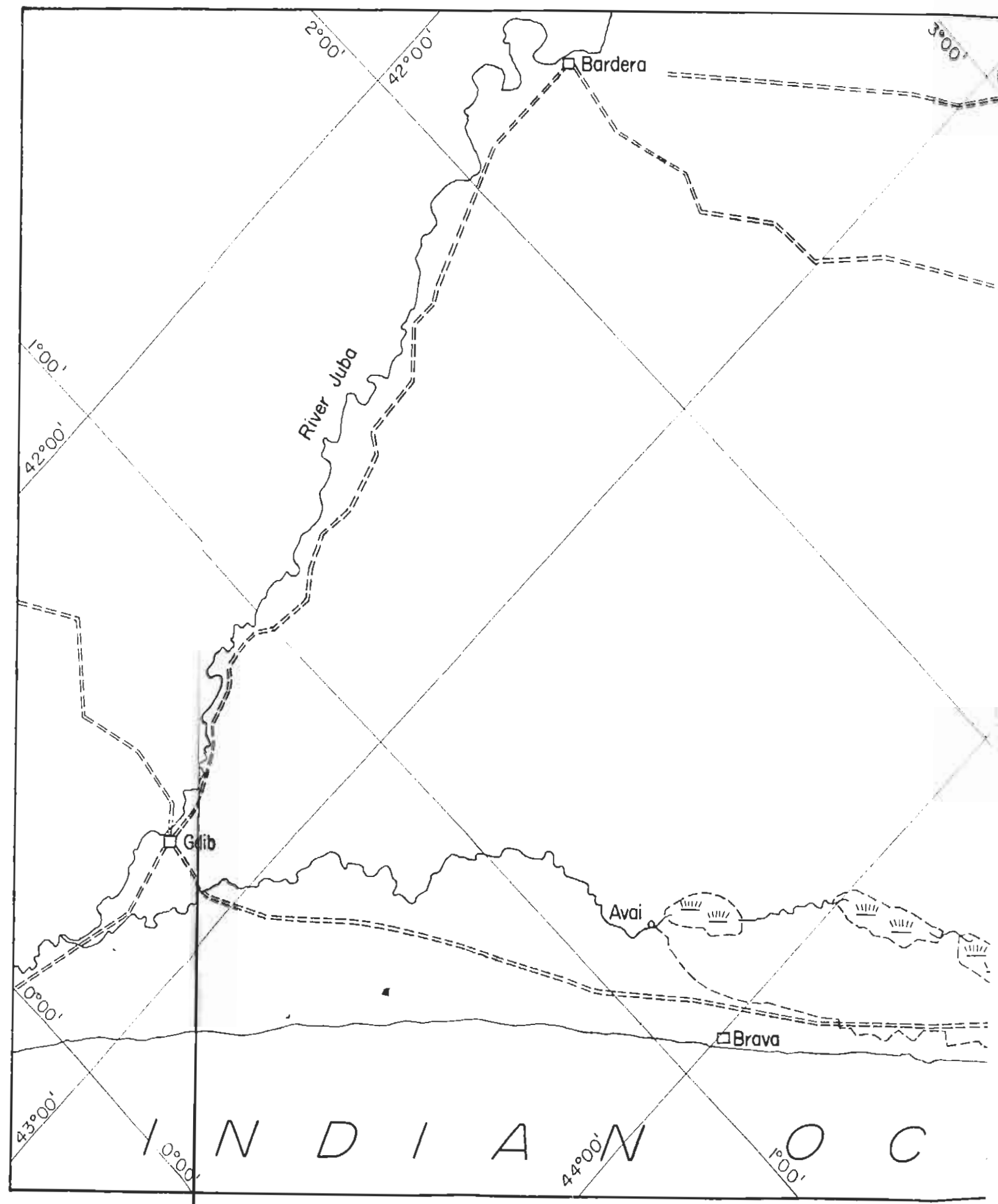
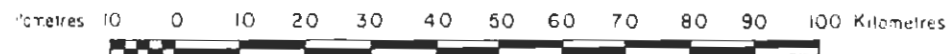
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CONSULTING ENGINEERS
HANOVER HOUSE, 73, HIGH HOLBORN
LONDON, W.C.1.

TABLE 5.1 Land Classification for Controlled Irrigation Schemes

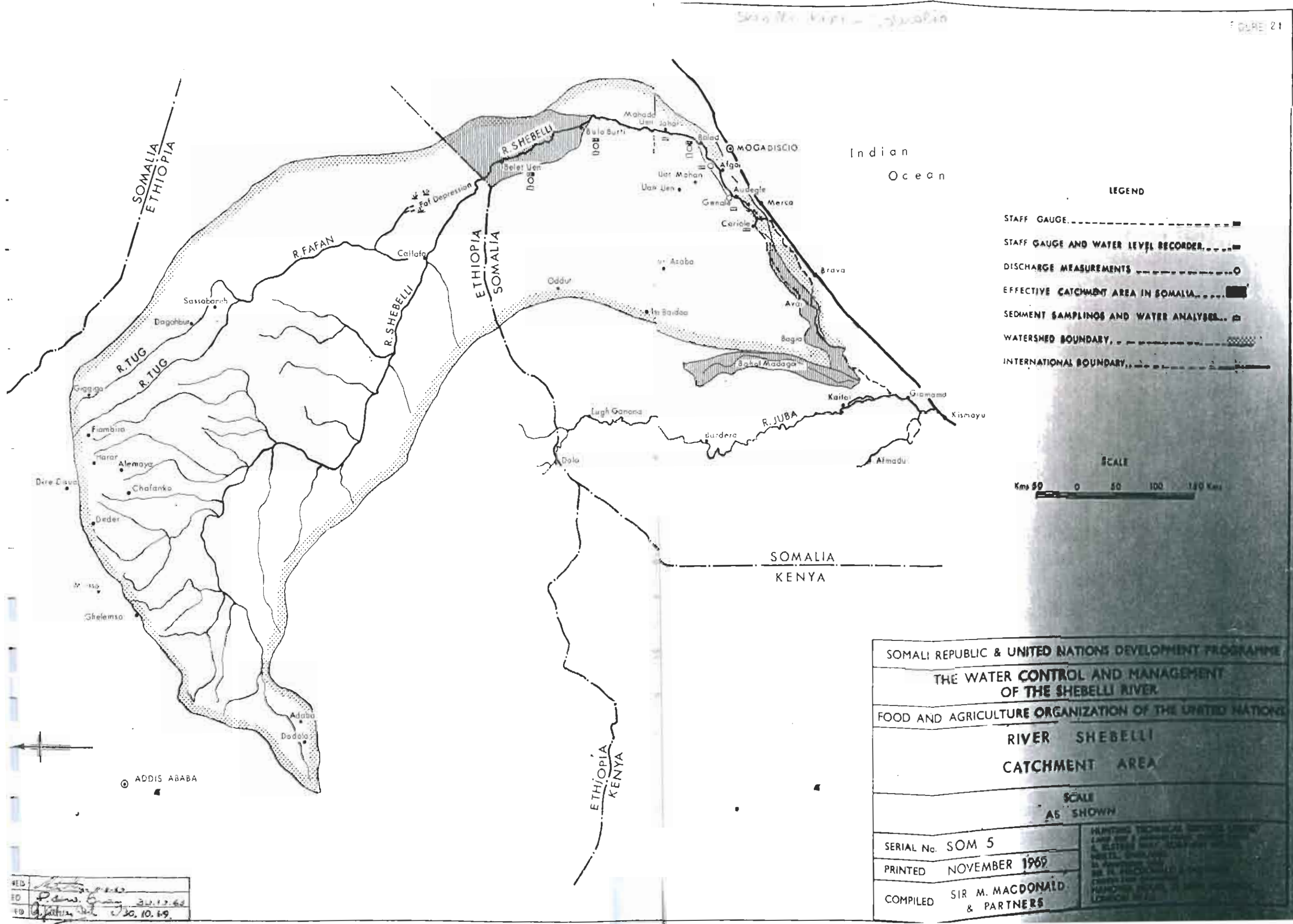
Class	1	2	3	4	6	Symbol
<u>Minimum soil depth to horizon limiting to root development (cms)</u>	100	60	60	50	50	d
<u>Salinity</u> E. C. in mmhos at fixed depths						
0-50 cm	< 4	< 4	4-8	8-12	Unlimited	s
50-100 cm	< 4	< 4	< 8	8-12	"	
100-150 cm	< 4	4-8	< 8	Unlimited	"	
<u>Alkalinity</u> E. S. P. at fixed depths						
0-50 cm	<15	<15	<15	15-25	Unlimited	a
50-100 cm	<15	<15	<15	< 25	"	
100-150 cm	<15	<15	<15	Unlimited		
<u>Texture</u>	Sandy loam to friable clay	Loamy sand to permeable clay	Loamy sand to moderately permeable clay	Loamy sand to clay	Unlimited	b= stratifications v= very coarse texture l= moderately coarse texture m= moderately fine texture h= very fine texture
<u>Topography</u>	Little gilgai formations or no restrictions	Moderate gilgai formation or no restrictions	Moderate gilgai formation or moderate restrictions	Severe gilgai or moderate restrictions	Unlimited	g= gilgai t= topography
<u>Profile Characteristics</u>	No limit to water movement or root development. Well structured.	Water movement and root development a little impeded. Well to moderately structured.	Water movement and root development restricted. Moderately structured.	Water movement and root development moderately to severely restricted. Moderately to poorly	Unlimited	p



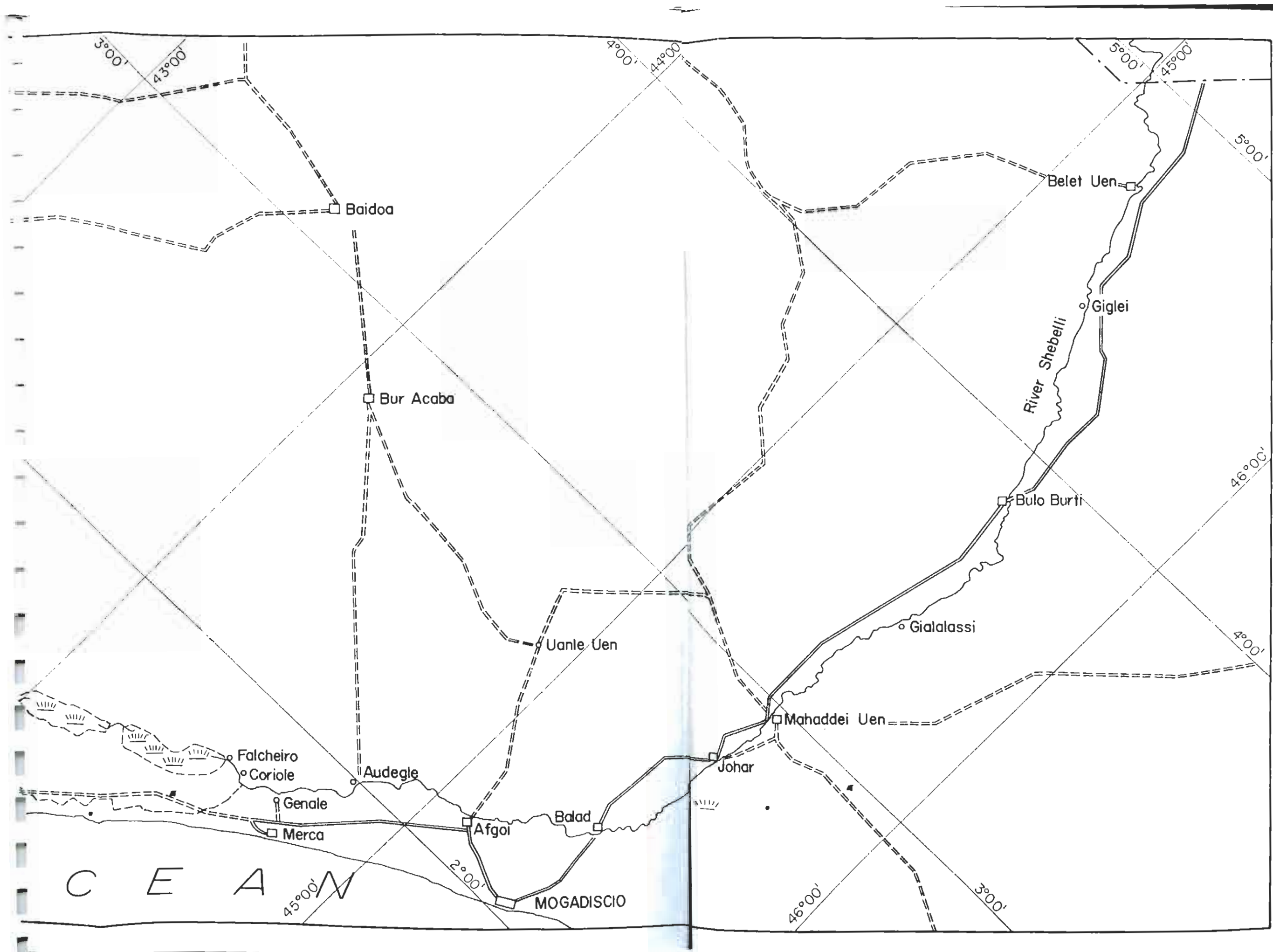
SCALE 1:1,000,000



SOMALI REPUBLIC & UNITED NATIONS DEVELOPMENT PROGRAMME	
THE WATER CONTROL AND MANAGEMENT OF THE SHEBELLI RIVER	
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS	
LOCATION MAP	
SCALE 1:1,000,000	
SERIAL No	HUNTING TECHNICAL SERVICES LIMITED LAND USE & AGRICULTURAL CONSULTANTS 6, ELSTREE WAY, BOREHAM WOOD, HERTS., ENGLAND. in Association with SIR M. MACDONALD & PARTNERS CONSULTING ENGINEERS HANDOVER HOUSE, 73 HIGH HOLBORN, LONDON W.1
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COMPILED	



RED	
ED	P. d. w. 30.12.69
ED	G. J. 30.10.69



C E A N

MOGADISCIO

Baidoa

Bur Acaba

Belet Uen

Gigei

Bulu Burti

Gialalassi

Mahaddei Uen

Johar

Uanle Uen

Audegle

Falcheiro
Coriole

Genale

Merca

Afgoi

Balad

River Shebelli

3°00'

4°30'00"

4°00'

4°40'00"

5°00'

4°50'00"

5°00'

4°00'

4°00'

4°50'00"

2°00'

4°00'

3°00'

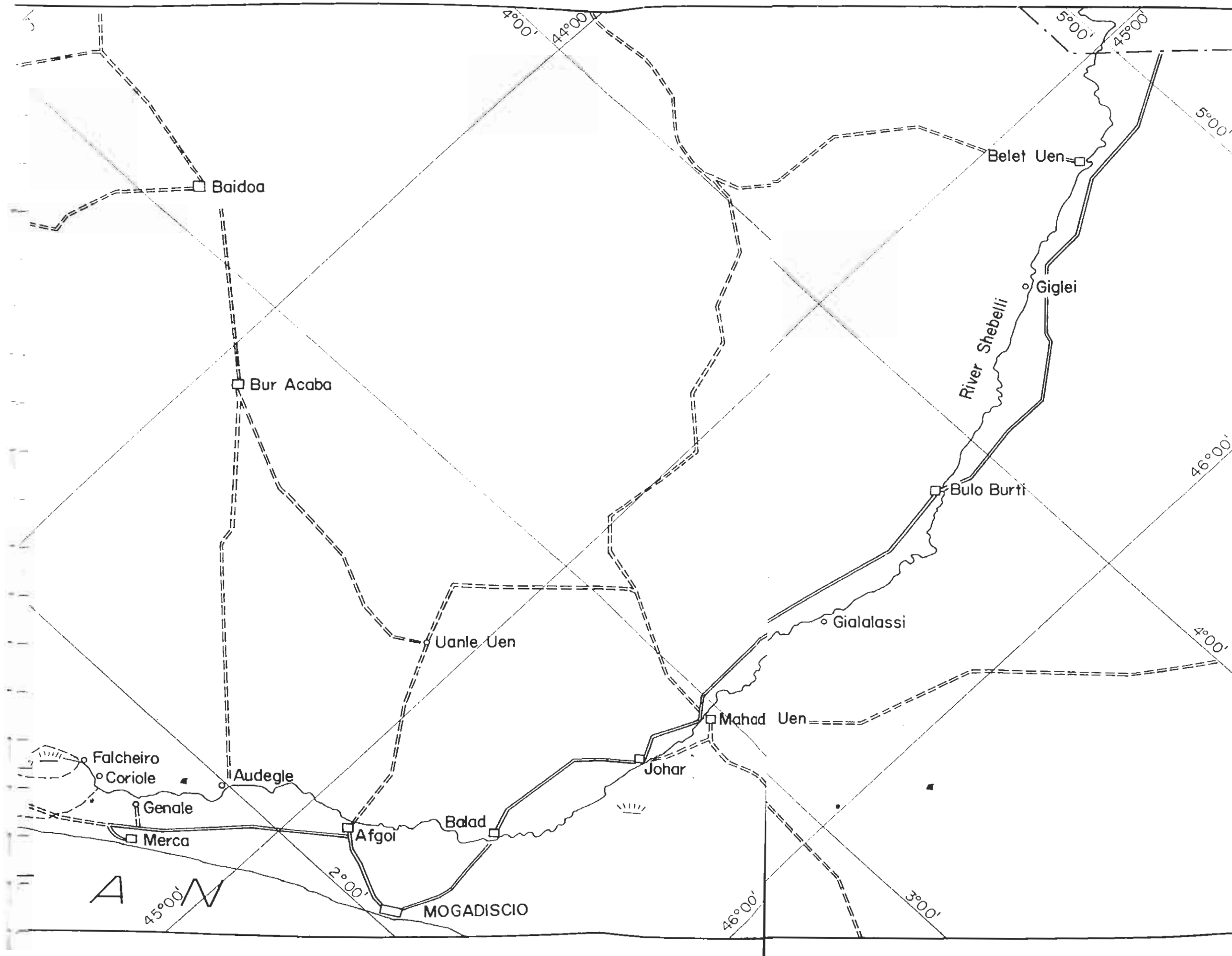
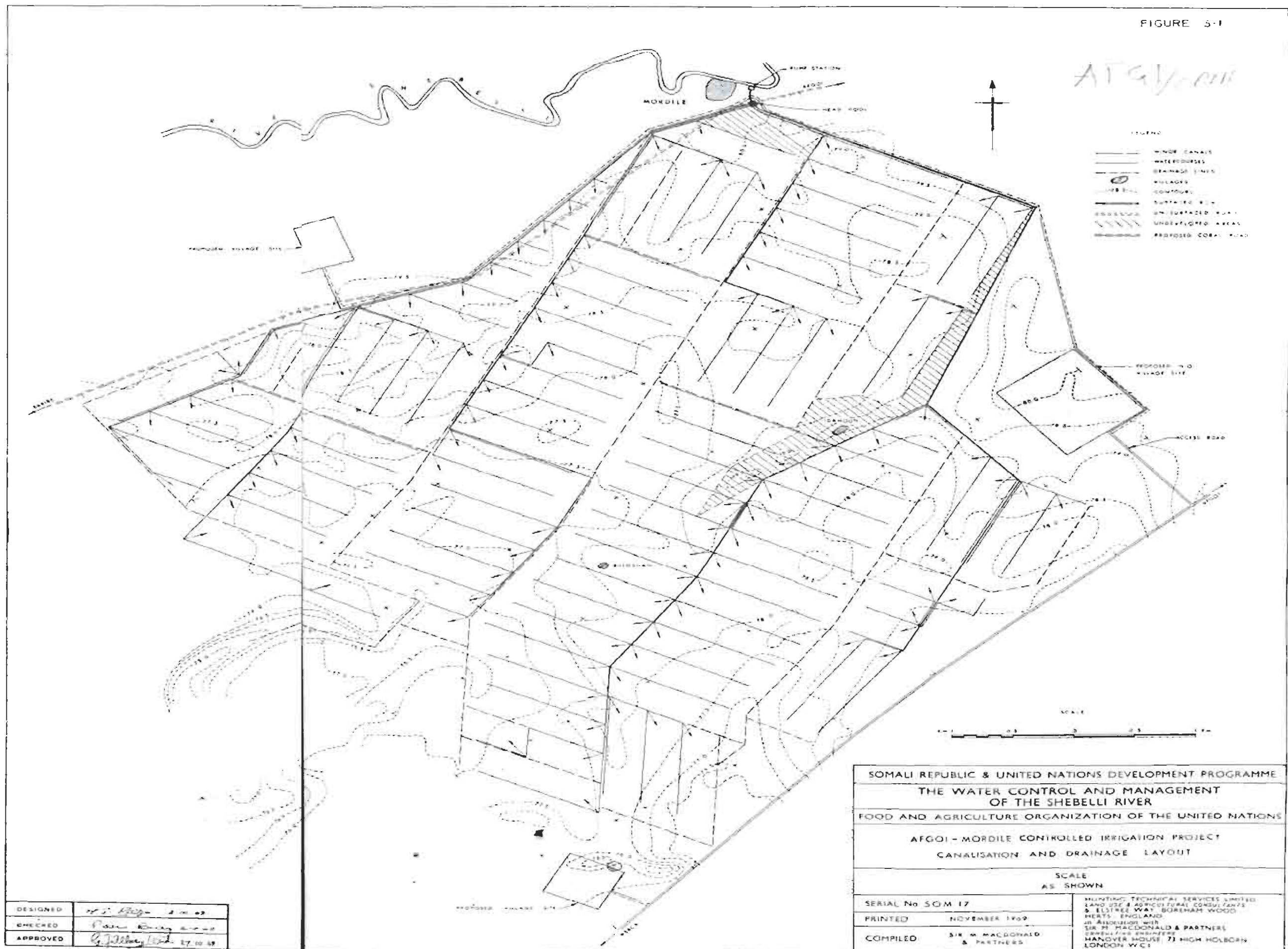


FIGURE 5-1

ATG/1000

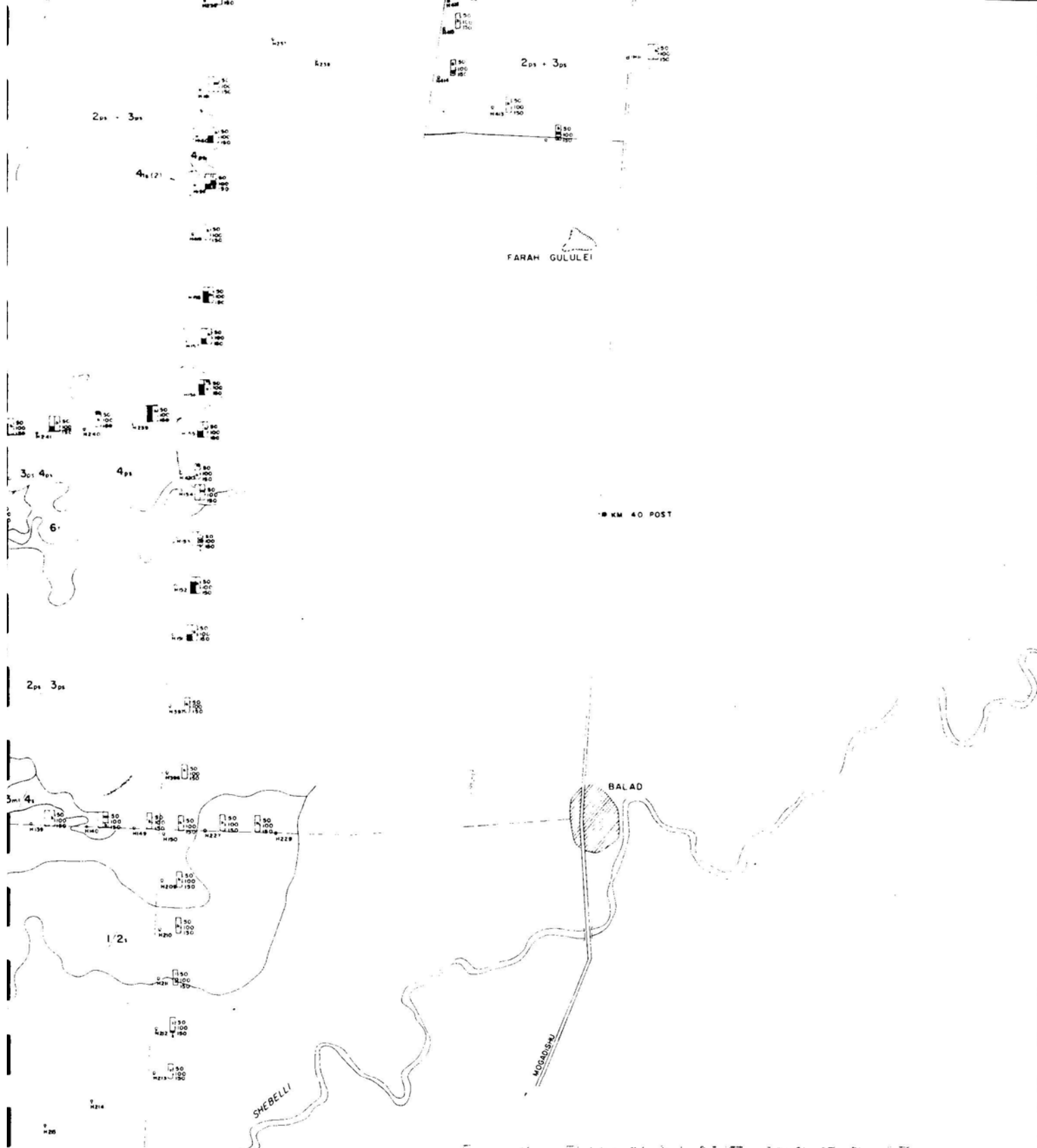


DESIGNED	<i>W. J. [unclear]</i> 2-10-62
CHECKED	<i>[unclear]</i> 2-10-62
APPROVED	<i>[unclear]</i> 27-10-62

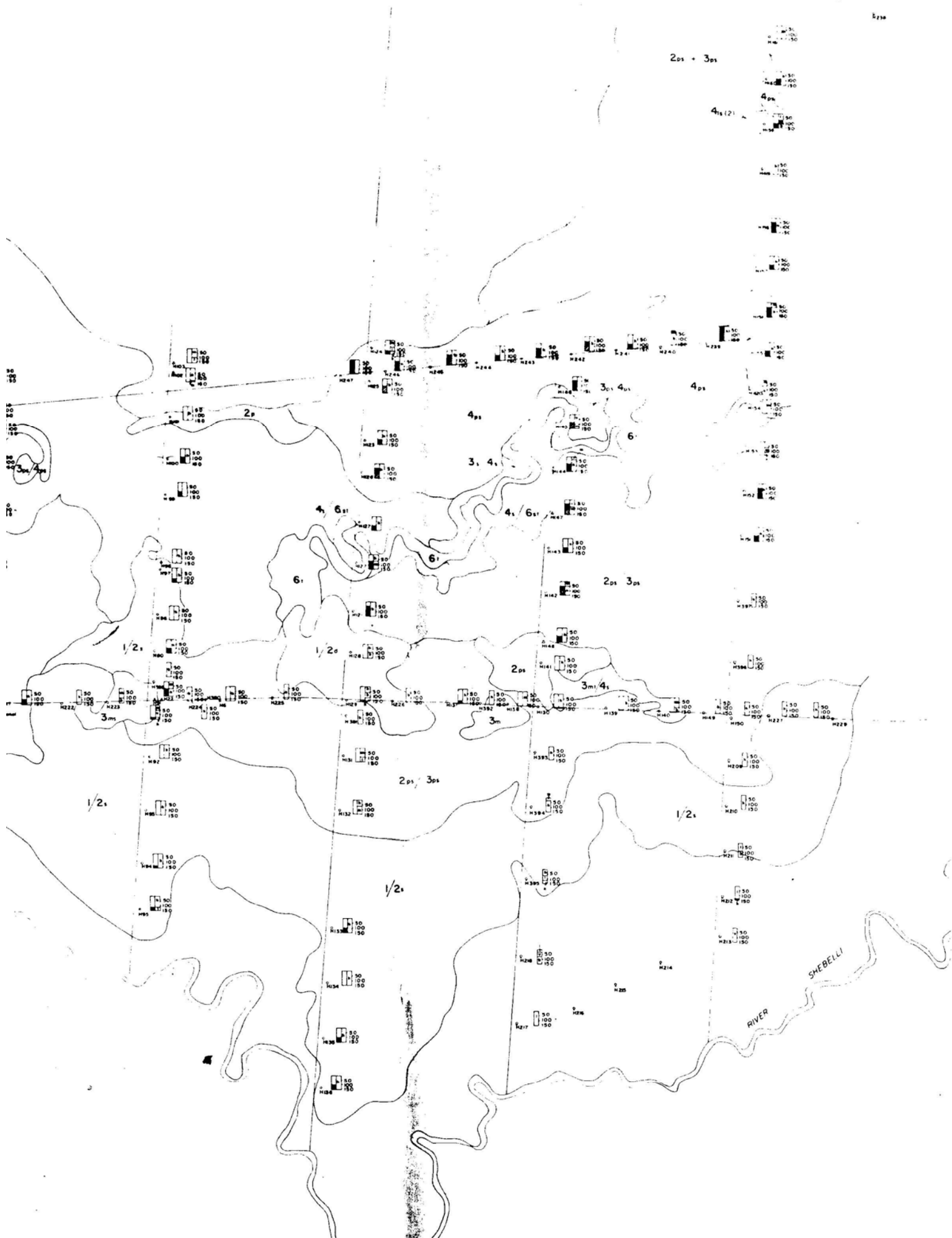
SOMALI REPUBLIC & UNITED NATIONS DEVELOPMENT PROGRAMME		
THE WATER CONTROL AND MANAGEMENT OF THE SHEBELLI RIVER		
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS		
AFGOI - MORDILE CONTROLLED IRRIGATION PROJECT		
CANALISATION AND DRAINAGE LAYOUT		
SCALE AS SHOWN		
SERIAL No SOM 17	HUNTING TECHNICAL SERVICES LIMITED LAND USE & AGRICULTURAL CONSULTANTS 5, ELSTREE WAY, BOREHAM WOOD HERTS., ENGLAND IN ASSOCIATION WITH SIR H. MACDONALD & PARTNERS CONSULTING ENGINEERS MANOVER HOUSE, 73 HIGH HOLBORN LONDON W.C.1	
PRINTED		NOVEMBER 1962
COMPILED		SIR H. MACDONALD & PARTNERS

VOLUMES COMPRISING THE REPORT

VOLUME I	General Report
VOLUME II	The Balad Flood Irrigation Project Feasibility Study
VOLUME IIA	The Balad Flood Irrigation Project Feasibility Study Technical Annex
VOLUME III	The Afgoi-Mordile Controlled Irrigation Project Feasibility Study
VOLUME IIIA	The Afgoi-Mordile Controlled Irrigation Project Feasibility Study Technical Annex
VOLUME IV	Water Resources and Engineering
VOLUME V	Soils and Agriculture
VOLUME IV/V A	Annexes to Volumes IV and V Water Resources and Engineering Soils and Agriculture



SOMALI REPUBLIC & UNITED NATIONS DEVELOPMENT PROGRAMME	
THE WATER CONTROL AND MANAGEMENT OF THE SHEBELLI RIVER	
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS	
BALAD FLOOD IRRIGATION PROJECT	
LAND CLASSIFICATION MAP	
SCALE 1 : 50,000	
SERIAL No	HUNTING TECHNICAL SERVICES LIMITED LAND USE & AGRICULTURAL CONSULTANTS 6, ELSTREE WAY, BOREHAM WOOD, HERTS, ENGLAND. in Association with SIR M. MACDONALD & PARTNERS CONSULTING ENGINEERS HANOVER HOUSE, 73 HIGH HOLBORN, LONDON W C 1
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COMPILED	



2p + 3p

4p

4p

2p 3p

1/2

1/2

2p 3p

1/2

1/2

1/2

4 6p

4 6p

3 4

4p

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LAND CLASSIFICATION LEGEND

(Land classes in accordance with U.S. Bureau of Reclamation Standards with criteria adjusted for Somali Conditions).

ARABLE

- Class 1 Highly suitable lands
- Class 2 Moderately suitable lands
- Class 3 Moderately to marginally suitable lands

LIMITED ARABLE

- Class 4 Special Use lands

NON ARABLE

- Class 6 Soils with severe limitations

Land sub-classes are shown on the map in areas of class 2, 3, 4 & 6 by the following subscripts

- d Land downgraded due to depth limitation
- s Land downgraded due to salinity
- o Land downgraded due to alkalinity
- g Land downgraded due to gilgai formation
- r Land downgraded due to topographical limitations
- p Land downgraded due to profile limitations

Textural classes

- v Very coarse texture
- l Moderately coarse texture
- m Moderately fine texture
- h Very fine texture
- b Irrigations

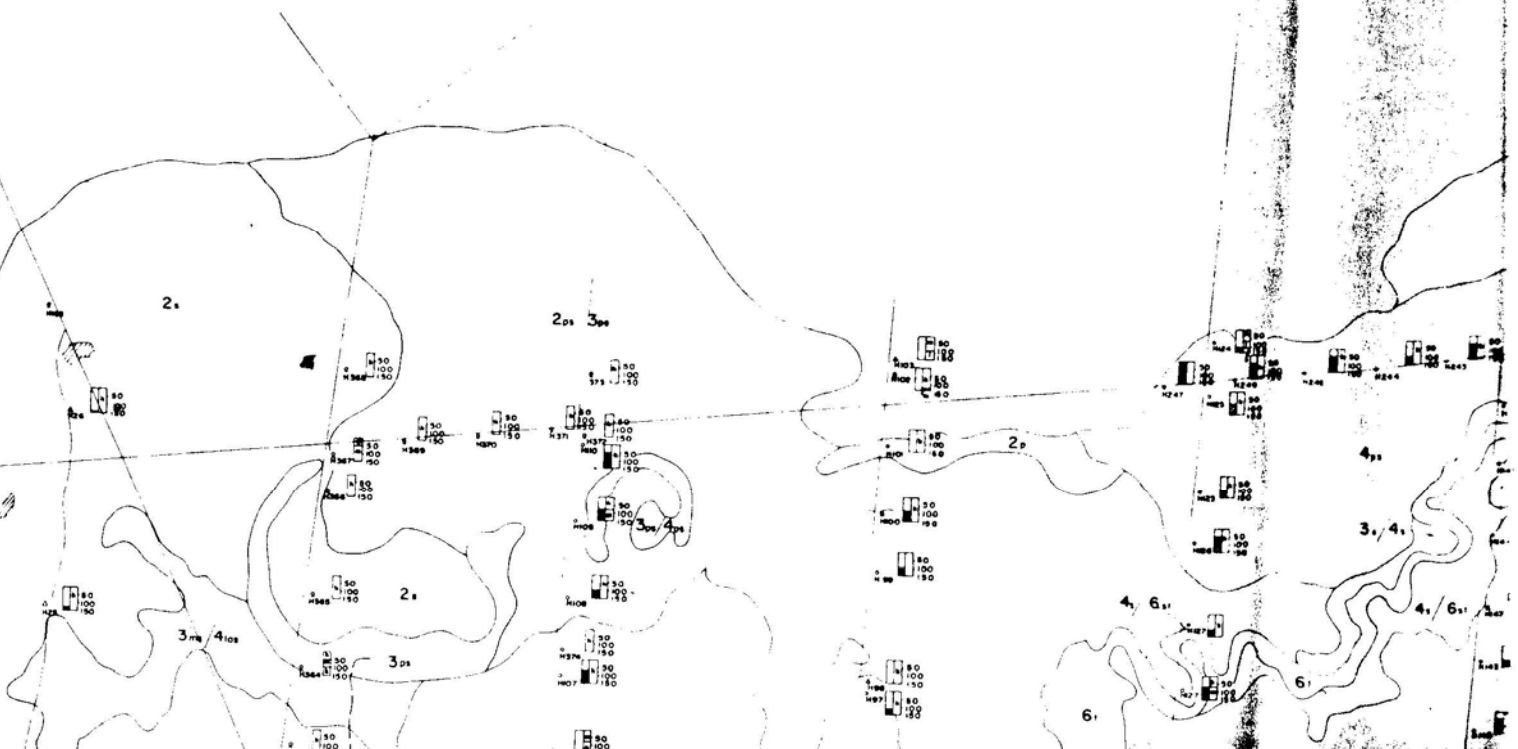
LOCATION OF SAMPLE SITES

- H123 2 metre sample site
- H124 2 metre observation site
- H125 2 metre sample site

Note All sample sites are accompanied by a histogram showing the textural classes and salinity status of the profile. Observation sites only show the textural classes.



- EC less than 4 mmhos/cm 25°
- EC 4-79 mmhos/cm 25°
- ▨ EC 80-120 " " "
- ▩ EC over 120 " " "



LAND CLASSIFICATION LEGEND

(Land classes in accordance with U.S. Bureau of Reclamation Standards with errors adjusted for Salinity Conditions).

- ARABLE**
- Class 1 Highly suitable lands
 - Class 2 Moderately suitable lands
 - Class 3 Moderately to marginally suitable lands

- LIMITED ARABLE**
- Class 4 Special Use lands

- NON ARABLE**
- Class 6 Soils with severe limitations

Land sub-classes are shown on the map in areas of class 2, 3, 4 & 6 by the following subscripts:

- d Land downgraded due to depth limitation
- s Land downgraded due to salinity
- e Land downgraded due to alkalinity
- g Land downgraded due to gipsi formation
- f Land downgraded due to topographical limitations
- p Land downgraded due to profile limitations

Textural classes

- v Very coarse texture
- l Moderately coarse texture
- m Moderately fine texture
- h Very fine texture
- b Stratifications

LOCATION OF SAMPLE SITES

- H123 2 metre sample site
- ◻ H124 2 metre observation site
- ◻ H125 2 metre sample site

Note: All sample sites are accompanied by a histogram showing the textural classes) and salinity status of the profile. Observation sites only show the textural classes.



- ◻ EC less than 4 mmhos/cm 25°
- ▒ EC 4-79 mmhos/cm 25°
- ▓ EC 80-120 " " " "
- ◼ EC over 120 " " " "

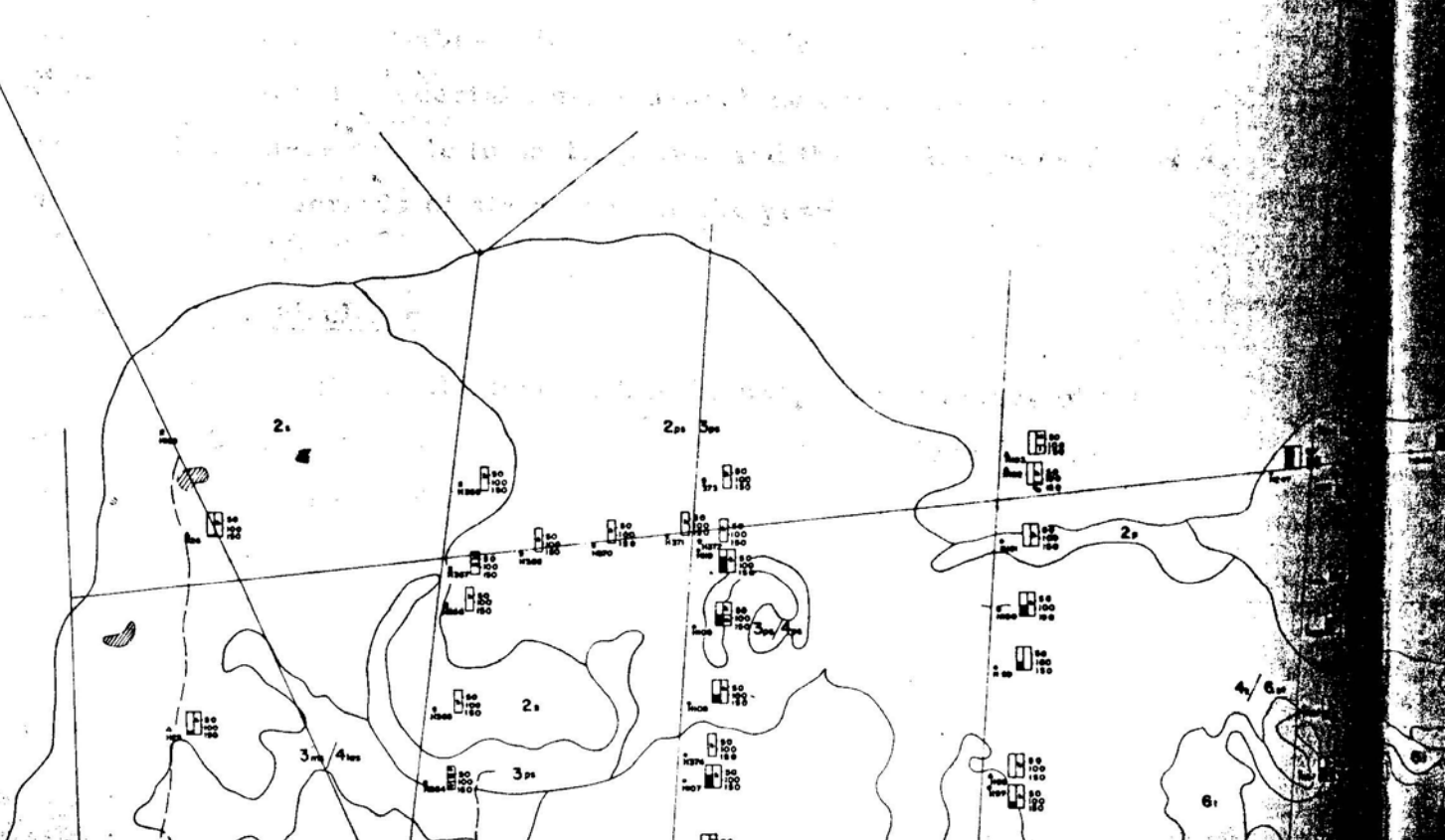
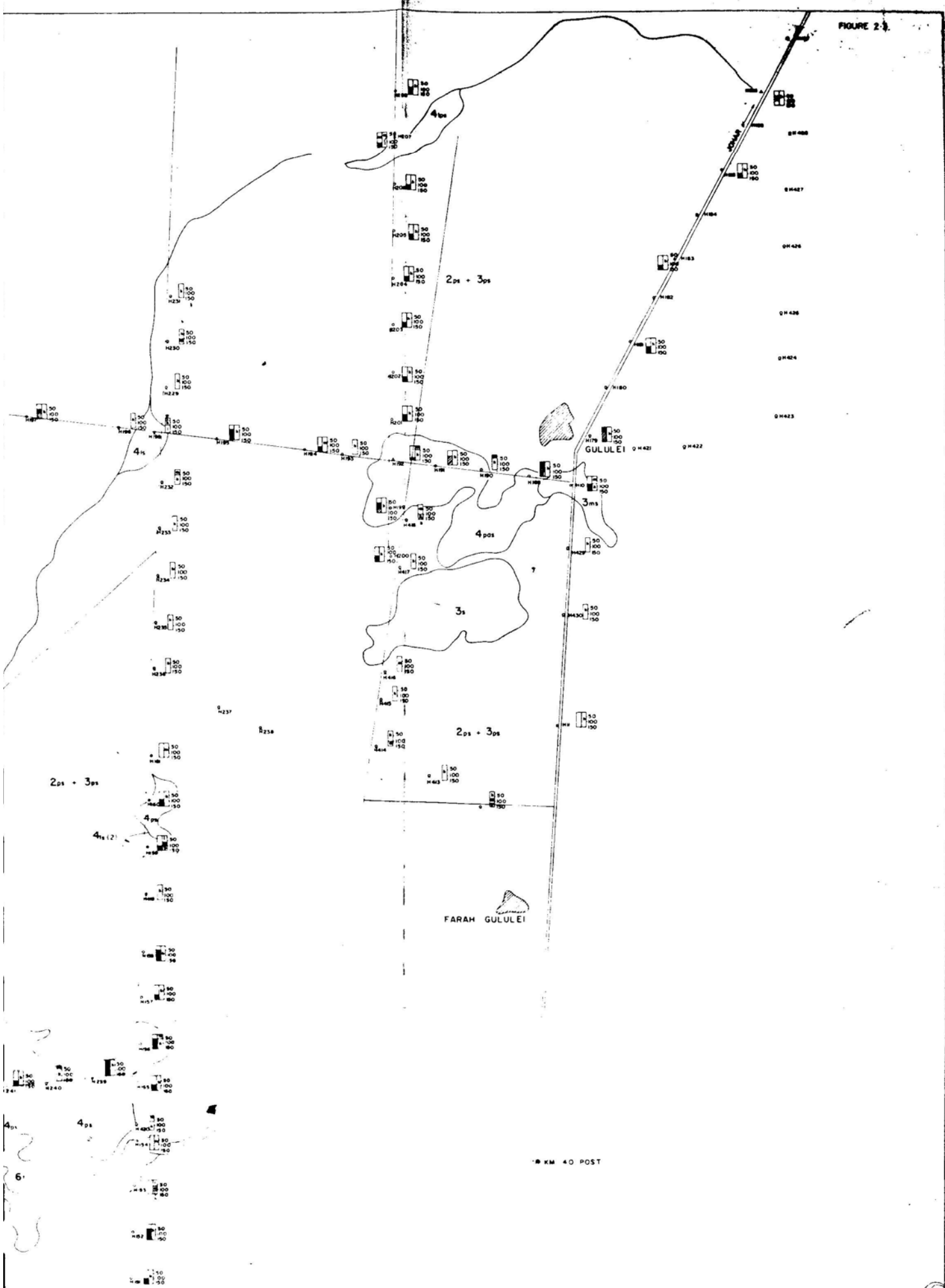
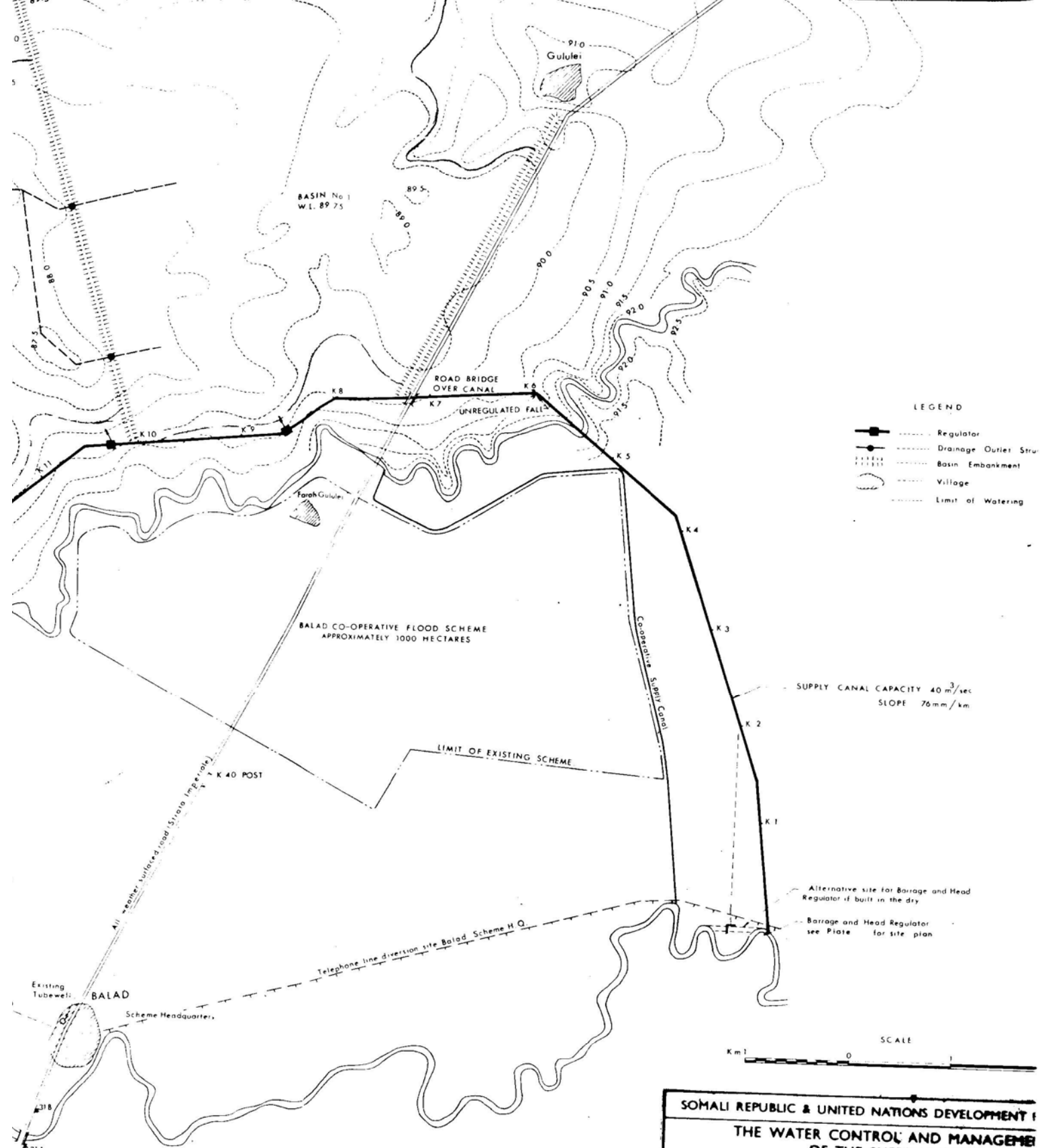


FIGURE 2-3





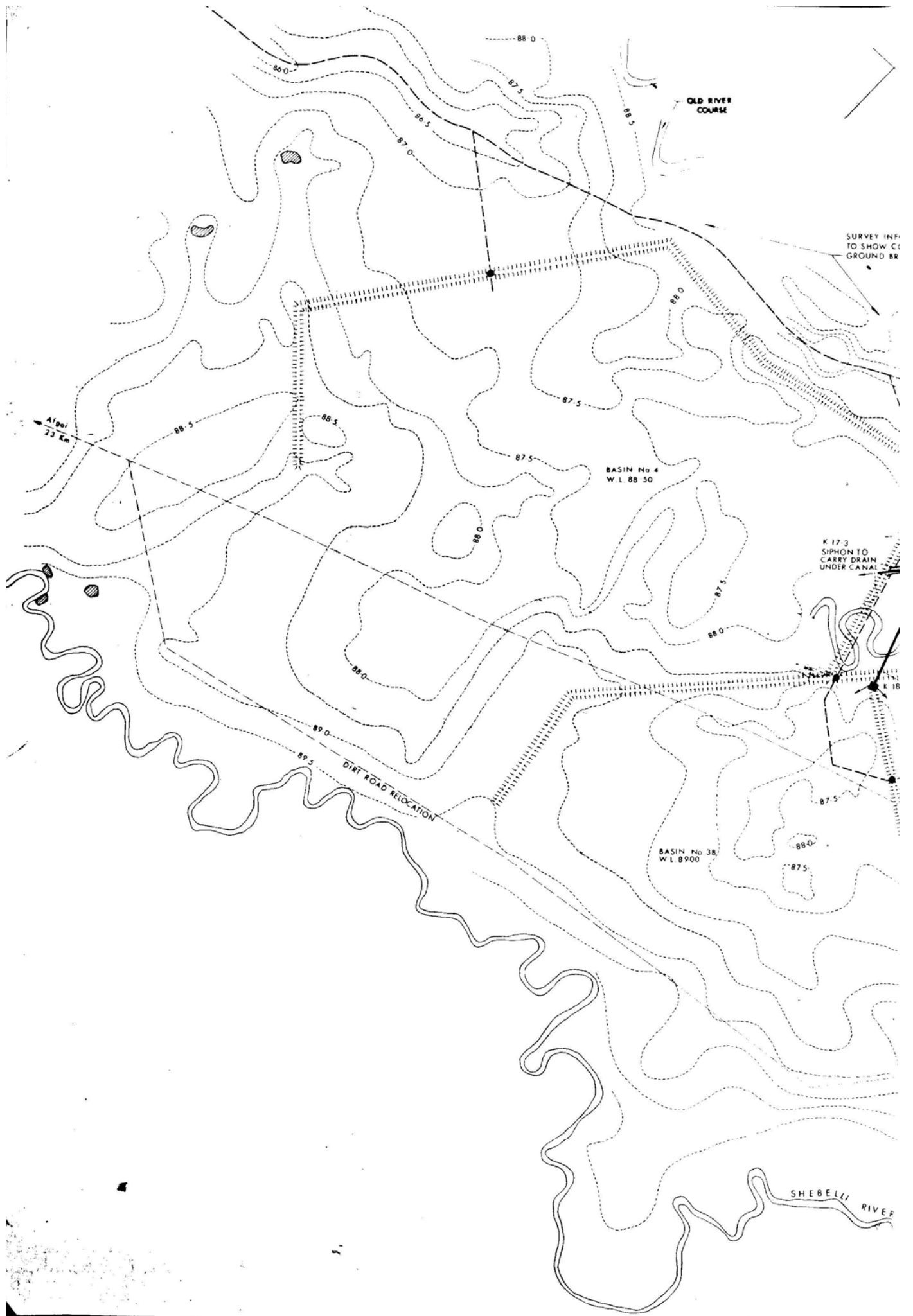
LEGEND

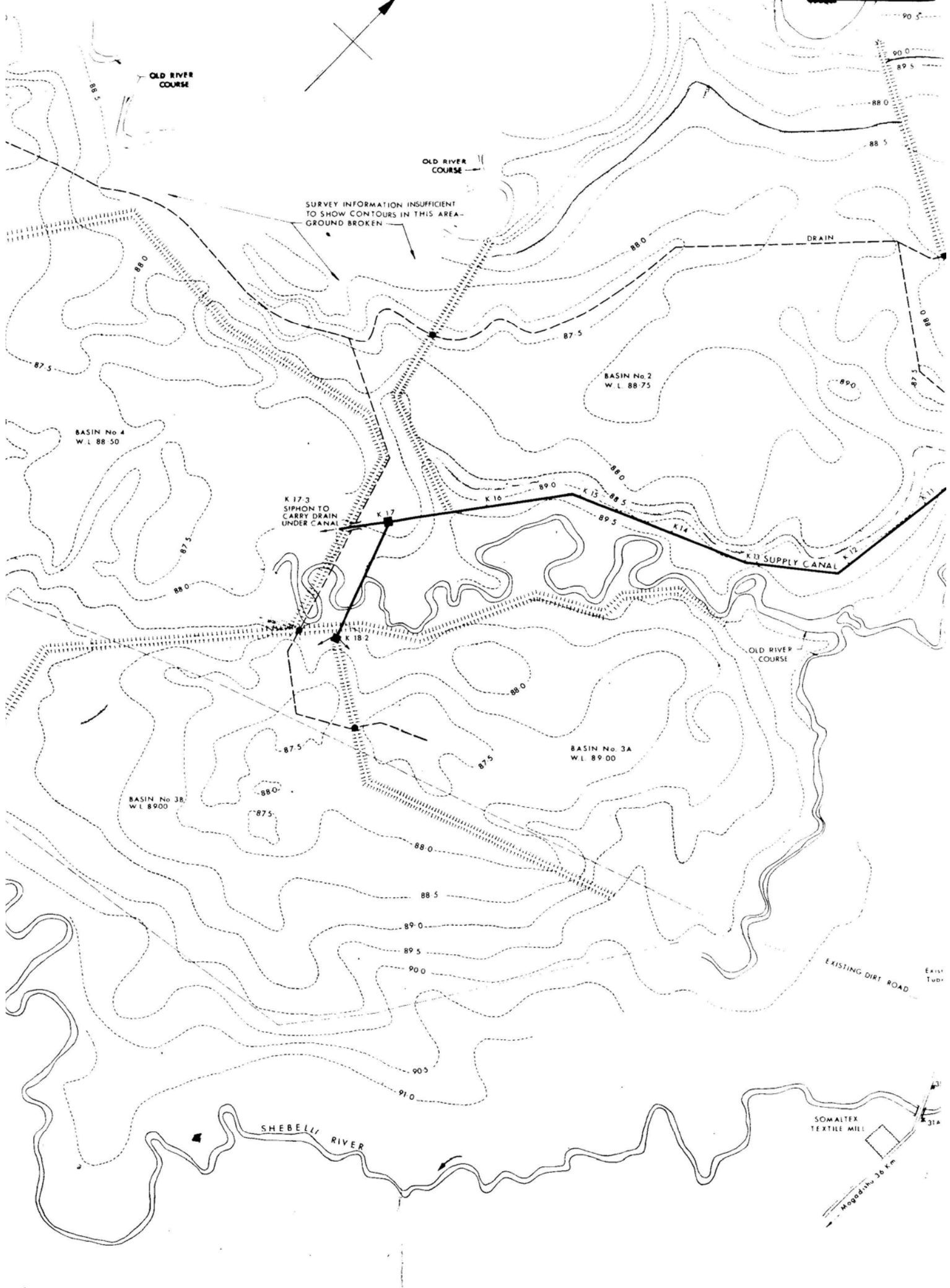
- Regulator
- Drainage Outlet Structure
- ▬ Basin Embankment
- Village
- Limit of Watering

SUPPLY CANAL CAPACITY 40 m³/sec
SLOPE 76 mm/km



SOMALI REPUBLIC & UNITED NATIONS DEVELOPMENT PROGRAM	
THE WATER CONTROL AND MANAGEMENT OF THE SHEBELLI RIVER	
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS	
BALAD FLOOD IRRIGATION PROJECT LAYOUT OF SUPPLY CANAL BASINS AND DRAINS	
SCALE AS SHOWN	
SERIAL No. 30M 12	HUNTING TECHNICAL SERVICES LAND USE & AGRICULTURAL ENGINEERING & ELSTREE WAY, BOREHAM HERTS., ENGLAND. IN ASSOCIATION WITH SIR M. MACDONALD & PARTNERS CONSULTING ENGINEERS MANOVER HOUSE, 73 HIGH STREET LONDON W.C.1
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OLD RIVER COURSE

OLD RIVER COURSE

SURVEY INFORMATION INSUFFICIENT TO SHOW CONTOURS IN THIS AREA - GROUND BROKEN

BASIN No 4
W.L. 88.50

BASIN No. 2
W.L. 88.75

K 17.3
SIPHON TO
CARRY DRAIN
UNDER CANAL

K 17

K 16

K 15

K 14

K 13

K 12

BASIN No 3B
W.L. 89.00

BASIN No. 3A
W.L. 89.00

OLD RIVER COURSE

EXISTING DIRT ROAD

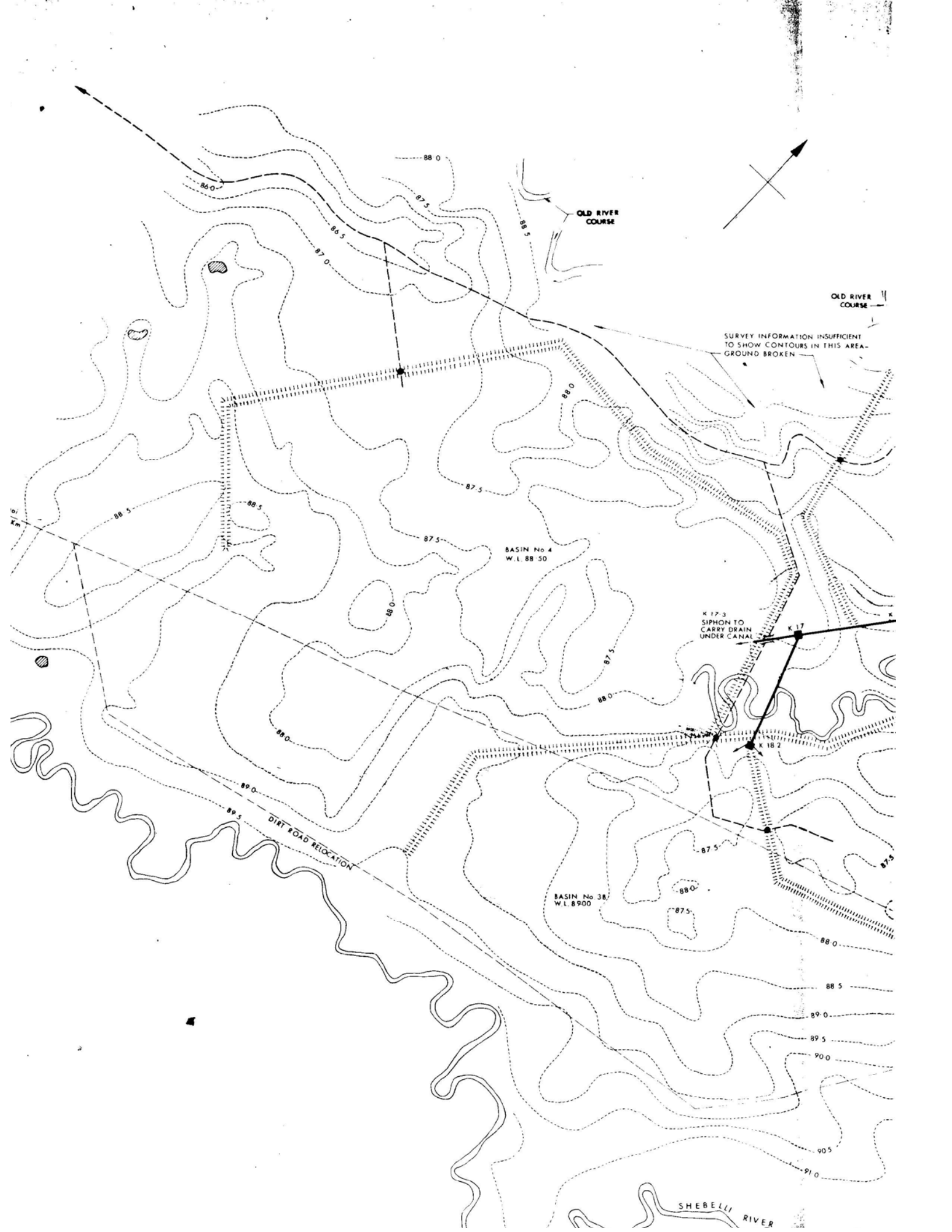
SHEBELLI RIVER

SOMALTER
TEXTILE MILL

Magdhu 36 Km

EXIST
TUDR

314



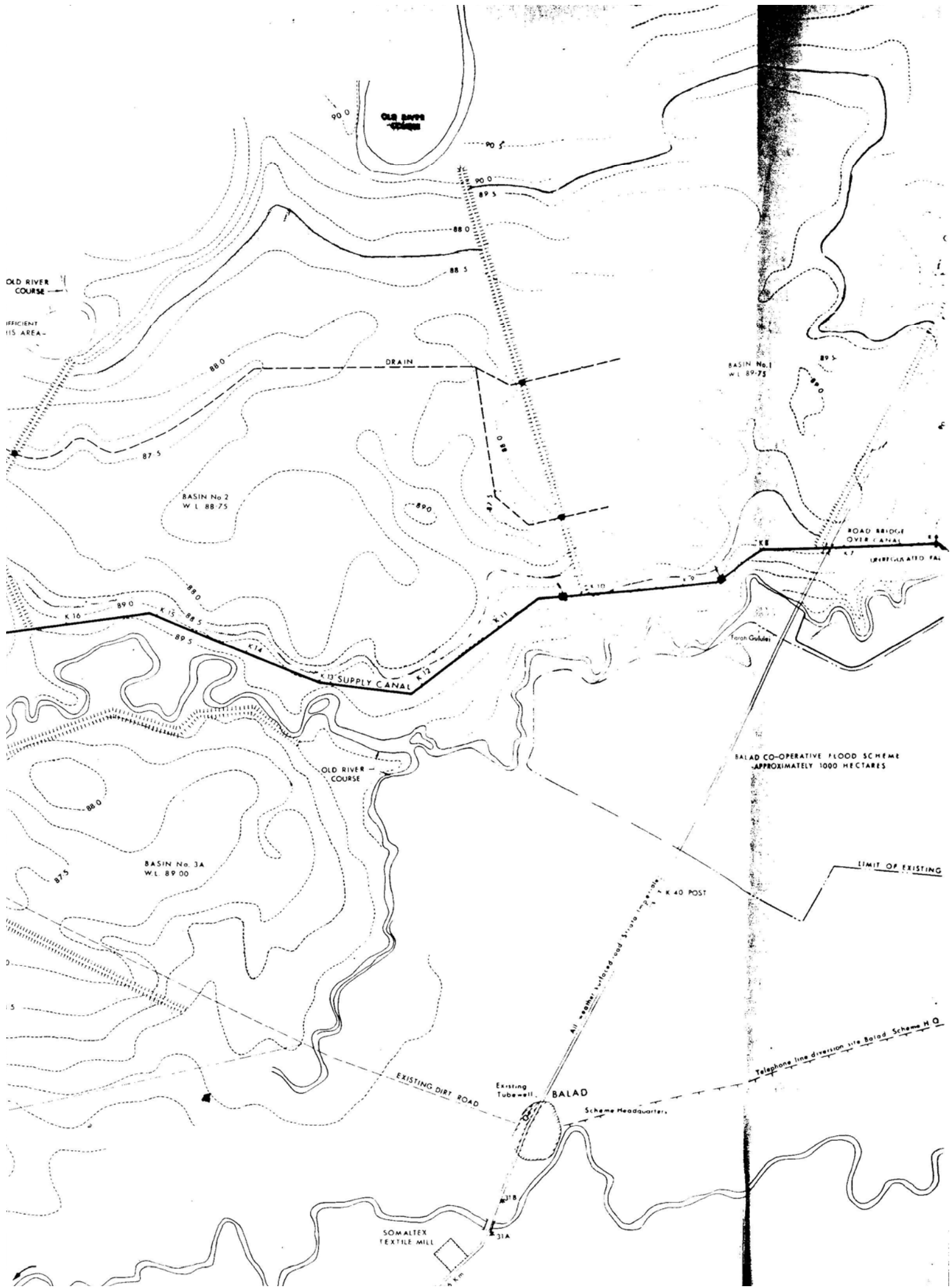
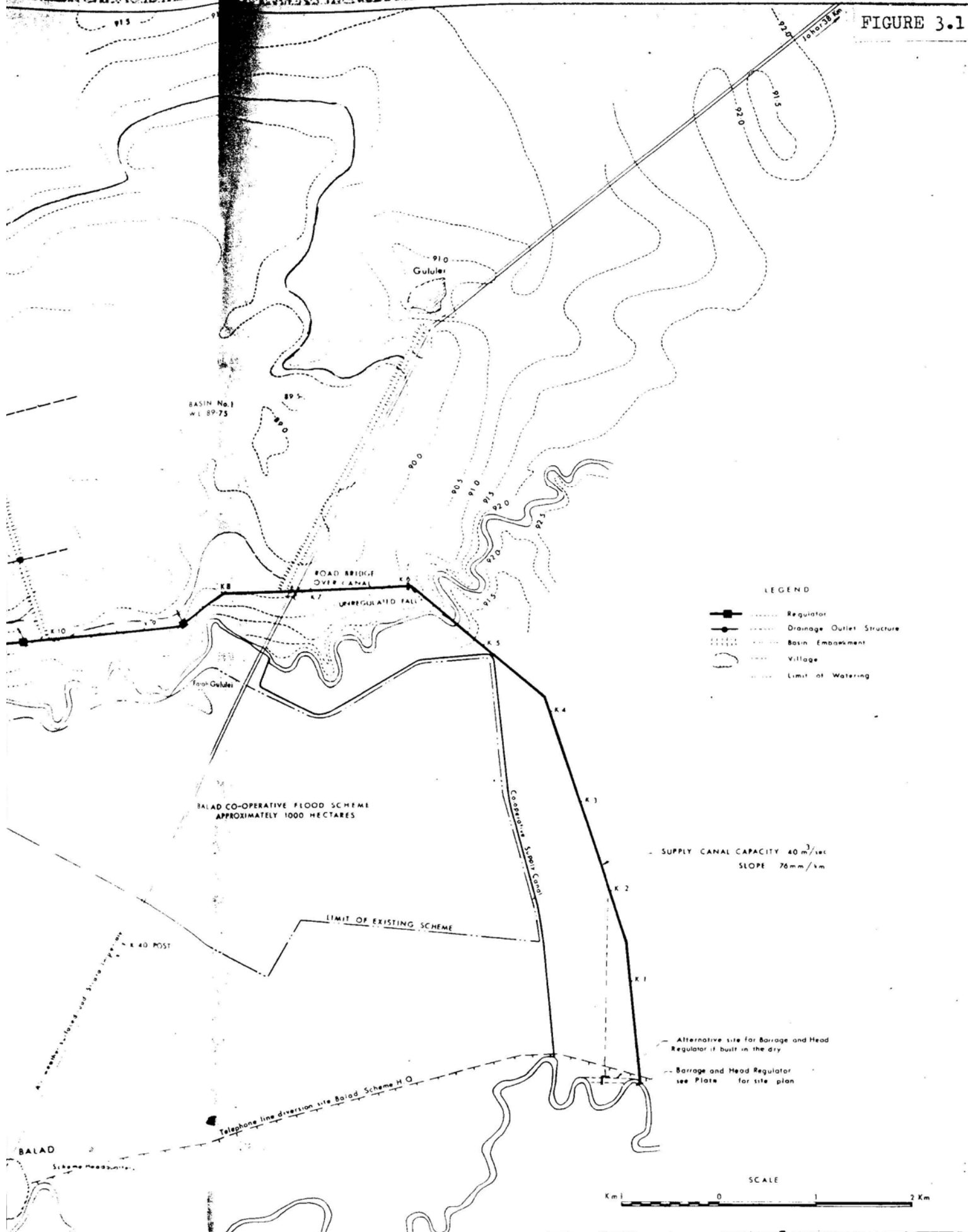


FIGURE 3.1



SOMALI REPUBLIC & UNITED NATIONS DEVELOPMENT PROGRAM
 THE WATER CONTROL AND MANAGEMENT
 OF THE SHEBELLI RIVER
 FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

2.10 Soils

A semi-detailed soil survey of the area was made at a density of 2 sites per square kilometre, 102 of these sites being sampled with 443 samples taken at fixed depths and later chemically analysed. In addition, at selected sites, core samples were taken for laboratory analysis of soil physical characteristics.

The soils were classified on the basis of the U.S. Department of Agriculture Soil Classification 7th Approximation (1960) and subsequent Supplements (1964 and 1967) using field profile descriptions and chemical analysis results. Two soil Orders were identified in the area, namely Entisols and Vertisols and the soils map, Plate 2, shows the distribution of these Orders and the subdivisions of each Order based on soil texture and electrical conductivity. This soil classification is shown in Table 2.6.

Vertisols occur in flat areas and slight depressions, are brown to yellowish brown in colour and of fine texture, ranging from clay loam to silty clay to clay. In some cases they overlie medium or coarse textured horizons or stratified material. The surface consists of a soft mulch or semi-hard to hard crust. These soils have no salt or sodium hazard in the topsoil, but may have a slight to moderate or occasionally severe salt hazard in the subsoil.

Entisols occur as isolated patches or narrow, relatively high ridges corresponding to former river levees. They have coarse to moderately fine textures and are generally more saline and alkaline than the Vertisols.

Hydraulic conductivity tests carried out on undisturbed core samples indicate that, in general, the soils have no irrigation or drainage problems except for the Udorthentic Chromusterts, which need careful management under irrigation, due to their rather low hydraulic conductivities. Soils overlying stratified deposits may also suffer some degree of reduced conductivity.

Previous studies of infiltration at the Afgoi Research Farm indicated a steady infiltration rate of approximately 0.4 cm/hour after rapid initial

TABLE 2.6 Soil Classification

Landform Subdivision, Order, Series and Subseries	Mapping Symbol	Texture	I mmhc
<u>FLOOD PLAIN MEANDER</u>			
<u>VERTISOLS</u>			
<u>CHROMUSTERT (Recent Alluvial)</u>			
<u>Udic Chromustert: hue 10 YR.</u>	Gl		
	Gl 1a		
	Gl 1a11	medium/fine overlying medium/coarse	<
	Gl 1a21)-medium/fine overlying	<
	Gl 1a22)- fine	>
	Gl 1a31	medium/fine overlying stratifications	<
<u>Udic Chromustert: hue 7.5 YR.</u>	Gl 1b		
	Gl 1b11	medium/fine overlying medium/coarse	<
	Gl 1b21	medium/fine overlying fine	<
	Gl 1b31	medium/fine overlying stratifications	<
<u>Udorthentic Chromustert</u>	Gl 2		
	Gl 211	medium/fine overlying medium/coarse	<
	Gl 221	medium/fine overlying fine	<
<u>PELLUSTERT</u>			
<u>Udorthentic Pellustert</u>	G 1		
	G 13		
	G 1311	medium/fine overlying fine	<
<u>CHROMUSTERT (Old Alluvial)</u>			
<u>Udic Chromustert</u>	Sr		
	Sr 11		
	Sr 111)-medium/fine overlying	<
	Sr 112) fine	>
<u>Udorthentic Chromustert</u>	Sr 2		
	Sr 211)-medium/fine overlying	<
	Sr 212) fine	>
<u>FLOOD PLAIN SLACKWATER</u>			
<u>VERTISOLS</u>			
<u>PELLUSTERT</u>			
<u>Udorthentic Pellustert</u>	Sc		
	Sc 11		
	Sc 111	medium/fine overlying fine	<
<u>CHANNEL REMNANT (Levee Soils)</u>			
<u>ENTISOLS</u>			
<u>USTORTHENT</u>			
<u>Typic Ustorthent</u>	C		
	C 11		
	C 111	coarse/medium throughout profile	<
	C 121	coarse/medium overlying fine	<
	C 131	coarse/medium overlying stratifications	<

infiltration in dry soil through cracks. Two further field tests in the Afgoi area confirmed this infiltration value, which may be used for the similar soils of the Balad area. It is not possible to forecast accurately the effects of irrigation on the soils over a long period. The possibility of changes arising in hydraulic conductivity due to the presence of salts and sodium in the irrigation water must be borne in mind. Reduction in permeability would affect the time taken for the required flood irrigation application to infiltrate into the soil, resulting in possible underwatering or delay in planting.

Soil moisture retention characteristics were measured on undisturbed core samples from eight sites, typical of the more important soil series. Available moisture is defined as the difference in moisture content of the soil between Field Capacity and Permanent Wilting point. A soil suction of 0.3 atmospheres is frequently taken as the Field Capacity condition, but under flood irrigation conditions, a value of 0.1 atmosphere suction would seem more applicable for this condition after an extended period of flooding and subsequent drainage. A soil suction of 15 atmospheres is taken as being equivalent to the Permanent Wilting Point. Using 0.1 atmosphere suction as field capacity, the soils can retain between 20 and 25 per cent V/v moisture, but if the value of 0.3 atmosphere is used, available moisture is only 12 to 15 per cent. Thus 1 metre depth of wet soil contains at the most 20 to 25 cm of moisture available to the plant.

A Land Classification map (Plate 3) has been prepared, based on the U.S. Bureau of Reclamation Standards Specifications, modified to suit prevailing local conditions. In the classification, the following criteria were used:-

- a) Depth of soil to horizons likely to limit root development.
- b) Salinity expressed in mmhos/cm electrical conductivity (EC).
- c) Exchangeable Sodium Percentage (ESP) a value of 15 being taken as critical.

d) Major soil textures classed and recognised

18.

- e) Topography, former river channels being excluded from cultivable land.
- f) Profile characteristics affecting drainage and root development.

The characteristics of each land class are shown in Table 2.7.

For further detail of the soils of the area and similar soils studied in the Afgoi area, the reader is referred to Volume V Soils and Agriculture. Results of individual analyses and all profile descriptions are included in the Data Supplement reproduced in limited numbers to accompany the reports.

Soil Profile Description

Class (cms)	100	60	40	50	50
Maximum soil depth to different texture					

Salinity
E. C. in mmhos at

fixed depths					
0-50 cm	< 4	< 4	4-8	8-12	unlimited
50-100 cm	< 4	< 4	< 8	8-12	"
100-150 cm	< 4	4-8	< 8	unlimited	unlimited

Alkalinity
ESP at fixed depths

0-50 cm	< 15	< 15	< 15	15-25	unlimited
50-100 cm	< 15	< 15	< 15	< 25	"
100-150 cm	< 15	< 15	< 15	unlimited	unlimited

Texture

clay loam	clay loam	sandy clay	loamy	unlimited
to	to	loam to	to	
permeable clay	moderately permeable clay	moderately permeable clay	clay	

o = stratification
v = very coarse texture
- = moderately coarse texture
1 = moderately fine texture
h = very fine texture

Topography

restrictions	no restrictions	moderate restrictions	moderate restrictions	unlimited
no	no			

Profile Characteristics

no limit to water movement or root development.	water movement and root development a little impeded.	water movement and root development restricted.	water movement and root development moderately to severely restricted	unlimited
Well structured	Well to moderately	Moderately structured	severely restricted	

t = topography

TABLE 2 6 Soil Classification

Landform Subdivision, Order, Series and Subseries	Mapping Symbol	Texture	EC mmhos/cm
<u>FLOOD PLAIN MEANDER</u>			
<u>VERTISOLS</u>			
<u>CHROMUSTERT</u> (Recent Alluvial)	G1		
<u>Udic Chromustert</u> : hue 10YR.	G1 1a		
	G1 1a11	medium/fine overlying medium/coarse	< 4
	G1 1a21)	medium/fine overlying	< 4
	G1 1a22)	fine	> 4
	G1 1a31	medium/fine overlying stratifications	4
<u>Udic Chromustert</u> : hue 7.5YR.	G1 1b		
	G1 1b11	medium/fine overlying medium/coarse	< 4
	G1 1b21	fine	
	G1 1b31	medium/fine overlying stratifications	< 4
<u>Udorthentic Chromustert</u>	G1 2		
	G1 211	medium/fine overlying medium/coarse	< 4
	G1 221	medium/fine overlying fine	< 4
<u>PELLUSTERT</u>	G1		
<u>Udorthentic Pellustert</u>	G 13		
	G13 11	medium/fine overlying fine	< 4
<u>CHROMUSTERT</u> (Old Alluvial)	Sr		
<u>Udic Chromustert</u>	Sr 1		
	Sr 111)	medium/fine overlying	< 4
	Sr 112)	fine	> 4
<u>Udorthentic Chromustert</u>	Sr 21		
	Sr 211)	medium/fine overlying	< 4
	Sr 212)	fine	> 4
<u>FLOOD PLAIN SLACKWATER</u>			
<u>VERTISOLS</u>			
<u>PELLUSTERT</u>	Sc		
<u>Udorthentic Pellustert</u>	Sc 11		
	Sc 111	medium/fine overlying fine	< 4
<u>ANNEL REMNANT (Levée Soils)</u>			
<u>VERTISOLS</u>			
<u>USTORTHENT</u>	C		
<u>Typic Ustorthent</u>	C 11		
	C 111	coarse/medium throughout profile	< 4
	C 121	coarse/medium overlying fine	< 4
	C 131	coarse/medium overlying stratifications	< 4

The soils were classified on the basis of the U.S. Department of Agriculture Soil Classification 7th Approximation (1960) and subsequent Supplements (1964 and 1967) using field profile descriptions and chemical analysis results. Two soil orders were identified in the area, namely Entisols and Vertisols and the soils map, Plate 2, shows the distribution of these orders and the subdivisions of each order based on soil texture and electrical conductivity. This soil classification is shown in Table 2.6.

Vertisols occur in flat areas and slight depressions, are brown to yellowish brown in colour and of fine texture, ranging from clay loam to silty clay to clay, in some cases, overlying moderate or coarse textured horizons or stratified material. The surface consists of a soft mulch or semi-hard to hard crust. These soils have no salt or sodium hazard in the topsoil but may have a slight to moderate or occasionally severe salt hazards in the subsoil.

Entisols occur as isolated patches or narrow relatively high ridges corresponding to former river levées. They have coarse to moderately fine textures and are generally more saline and alkaline than the vertisols.

Hydraulic conductivity tests carried out on undisturbed core samples indicate that, in general, the soils have no irrigation or drainage problems except for the Udorthentic Chromusterts, which need careful management under irrigation due to their rather low hydraulic conductivities. Soils overlying stratified material may also suffer some degree of reduced conductivity.

Previous studies of infiltration at the Afgoi Research Farm indicated a steady infiltration rate of approximately 0.4 cm/hour after rapid initial infiltration in dry soil through cracks. Two further tests in the Afgoi Project area confirmed infiltration to be of this order. It is not possible to forecast accurately the effects of irrigation on the soils over a long period. The possibility of changes arising in hydraulic conductivity due to the presence of salts or sodium in the irrigation water must be

Soil moisture retention characteristics were measured on undisturbed core samples from six sites typical of the more important soil series. Available moisture is defined as the difference in moisture content of the soil between Field Capacity and Permanent Wilting Point. A soil suction of 0.3 atmospheres is frequently accepted as representing the field capacity condition and a suction of 15 atmospheres is taken as equivalent to the permanent wilting point. The soils of the Afgoi-Mordile area can retain 10 to 15 per cent v/v available moisture or between 10 and 15 cms of moisture per metre depth of soil.

The Land Classification Map, Plate 3, has been prepared, based on the U. S. Bureau of Reclamation Standards Specification, modified to suit prevailing local conditions. In the classification, the following criteria were used:-

- a) Depth of soil to horizons likely to limit root development.
- b) Salinity expressed in mmhos/cm electrical conductivity (EC).
- c) Exchangeable Sodium Percentage (ESP) a value of 15 being taken as critical.
- d) Texture, Five textural classes are recognised.
- e) Topography. Former river channels being excluded from cultivable land.
- f) Profile characteristics affecting drainage and root development.

The characteristics of each land class are shown in Table 2.7.

For further details of the soils of the Afgoi-Mordile area and similar soils studied in the Balad area, the reader is referred to Volume V - 'Soils and Agriculture'. Results of individual analyses and all profile descriptions are included in the Data Annex reproduced to accompany the report Volumes 4 and 5.

T, Bilt 2.7 Land Classification Applicable to Controlled Irrigation Schemes

Class	1	2	3	4	5	6	Symbol
Minimum soil depth to different texture classes (cms)	100	60	60	50	50		d
Salinity							
E.C. in mmhos at fixed depths							
0-50 cm	<4	<4	4-8	8-12	unlimited		s
50-100 cm	<4	<4	<8	8-12	unlimited		
100-150 cm	<4	4-8	<8	unlimited	unlimited		
Alkalinity							
ESP at fixed depths							
0-50 cm	<15	<15	<15	15-25	unlimited		a
50-100 cm	<15	<15	<15	<25	unlimited		
100-150 cm	<15	<15	<15	unlimited	unlimited		
Texture	sandy loam to friable clay	loamy sand to permeable clay	loamy sand to moderately permeable clay	loamy sand to clay	loamy sand to clay	unlimited	b = stratifications v = very coarse texture l = moderately coarse texture m = moderately fine texture h = very fine texture

Table 2.7 Land Classification Applicable to Controlled Irrigation Schemes (cont d.)

Class	1	2	3	4	6	Symbol
<u>Topograp</u>	little gilgai formations or no restrictions	moderate gilgai formation or no restrictions	moderate gilgai formation or moderate restrictions	severe gilgai or moderate restrictions	unlimited	g = gilgai t = topography
<u>Profile</u>	no limit to water movement or root development.	water movement and root movement a little impeded.	water movement and root development restricted	water movement and root development moderately	unlimited	p
<u>Characteristics</u>	Well structured	Well to moderately structured.	moderately structured.	to severely restricted moderately to poorly structured		

2.11 Vegetation and Bush Clearance

A classification of the vegetation over the area was made by means of ground observation and photo-interpretation. The vegetation comprises grasses and herbs, shrub and tree species. The following four categories were used as a basis for the estimation of clearance requirements.

- Class I Land at present under cultivation carrying only scattered shade trees, usually Dobera glabra, and Acacia bussei or land recently abandoned with only light regeneration of bush.
- Class II Land cultivated in the past, but with considerable regenerated bush largely Corniphora spp. with some Acacia nubica and A. nilotica and scattered specimens of Dobera glabra. Open grassy areas are common and constitute about 50 per cent of the area covered by this class.
- Class III Dense bush comprising Acacia nubica, A. nilotica, A. bussei, A. seyal, Comiphora spp., Cordia gharaf, Dobera glabra, Grewia spp., Dichrostachys glomerata, Euphorbia spp. and Salvadoria persica with less than 25 per cent of the area constituted by open grassy areas.
- Class IV Impenetrable heavy bush with few open spaces with Dichrostachys glomerata being the dominant species.

Mechanised clearance will involve the use of crawler tractors of 100 H. P. or larger, preferably equipped with a front mounted rock rake to uproot and windrow the bush for burning. The operation should be followed by root ploughing. Mechanised clearance should not be necessary for vegetation Class I. The areas of each vegetation class and the estimated tractor hours required for clearance and subsequent root ploughing are shown in Table 2.8.

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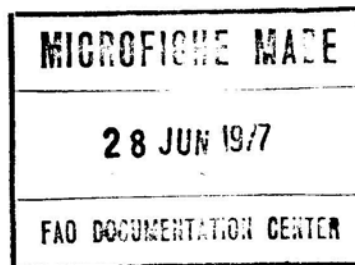
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VOLUME III

THE AFGOI - MORDILE
CONTROLLED IRRIGATION PROJECT
FEASIBILITY STUDY

NOVEMBER 1969



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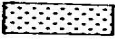
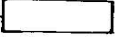


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LEGEND

- Canal in use. -----
- Canal in poor condition. -----
- Canal not in use 1969. -----
- Farm in use. ----- 
- Farm not in use. ----- 
- Irrigation tubewell. ----- 
- Banana packing station tubewell. ----- 

Notes:-

Farms in use from Lockwood Survey Corporation Report Vol.1 Map 18 with revision for Principale Canal area from February 1969 survey.

Tubewell locations from S.A.C.A. plan.



SOMALI REPUBLIC & UNITED NATIONS DEVELOPMENT PROGRAMME
 THE WATER CONTROL AND MANAGEMENT
 OF THE SHEBELLI RIVER

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
 GENALE — BULO MERERTA AREA
 EXISTING IRRIGATION

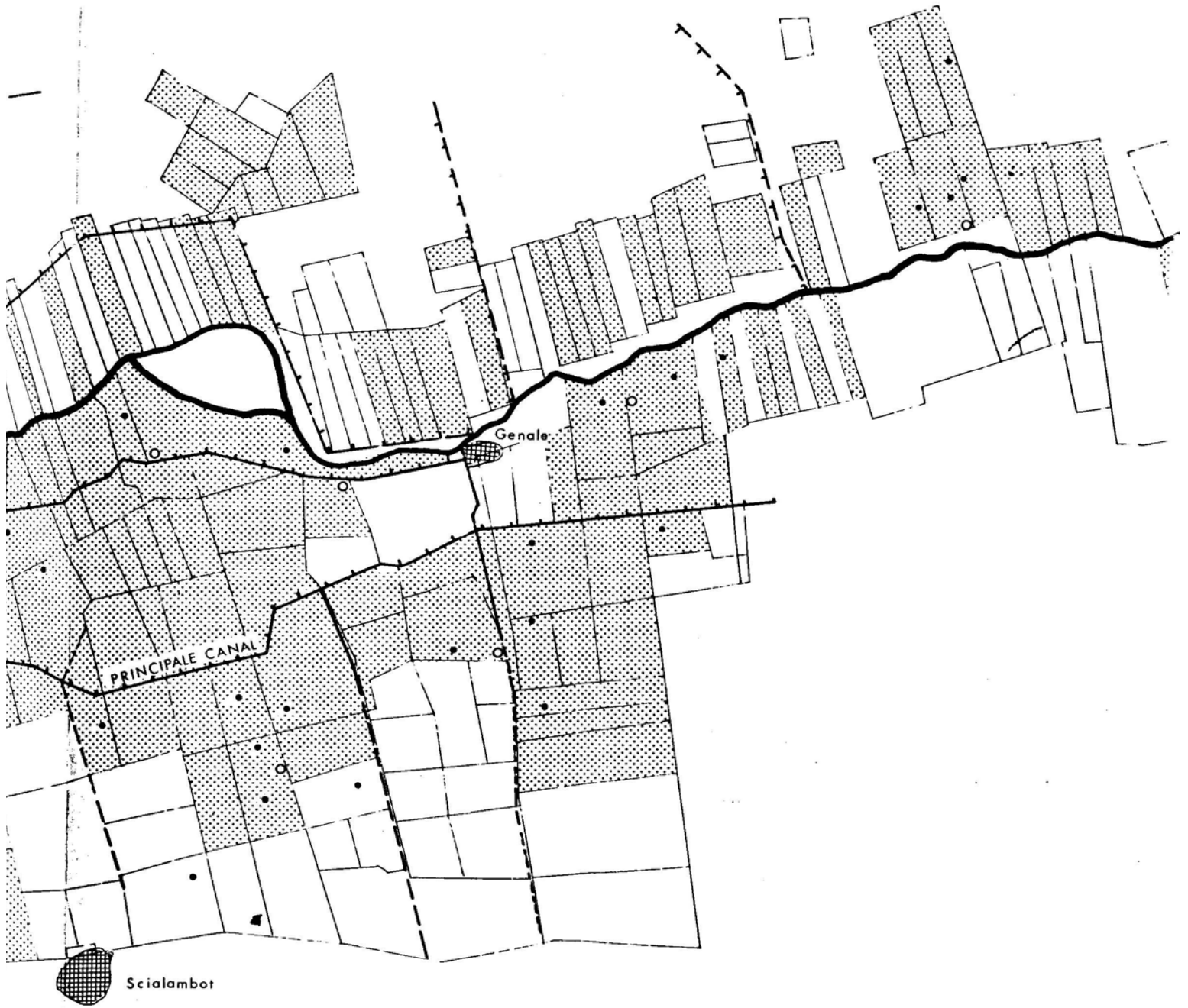
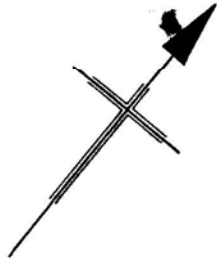
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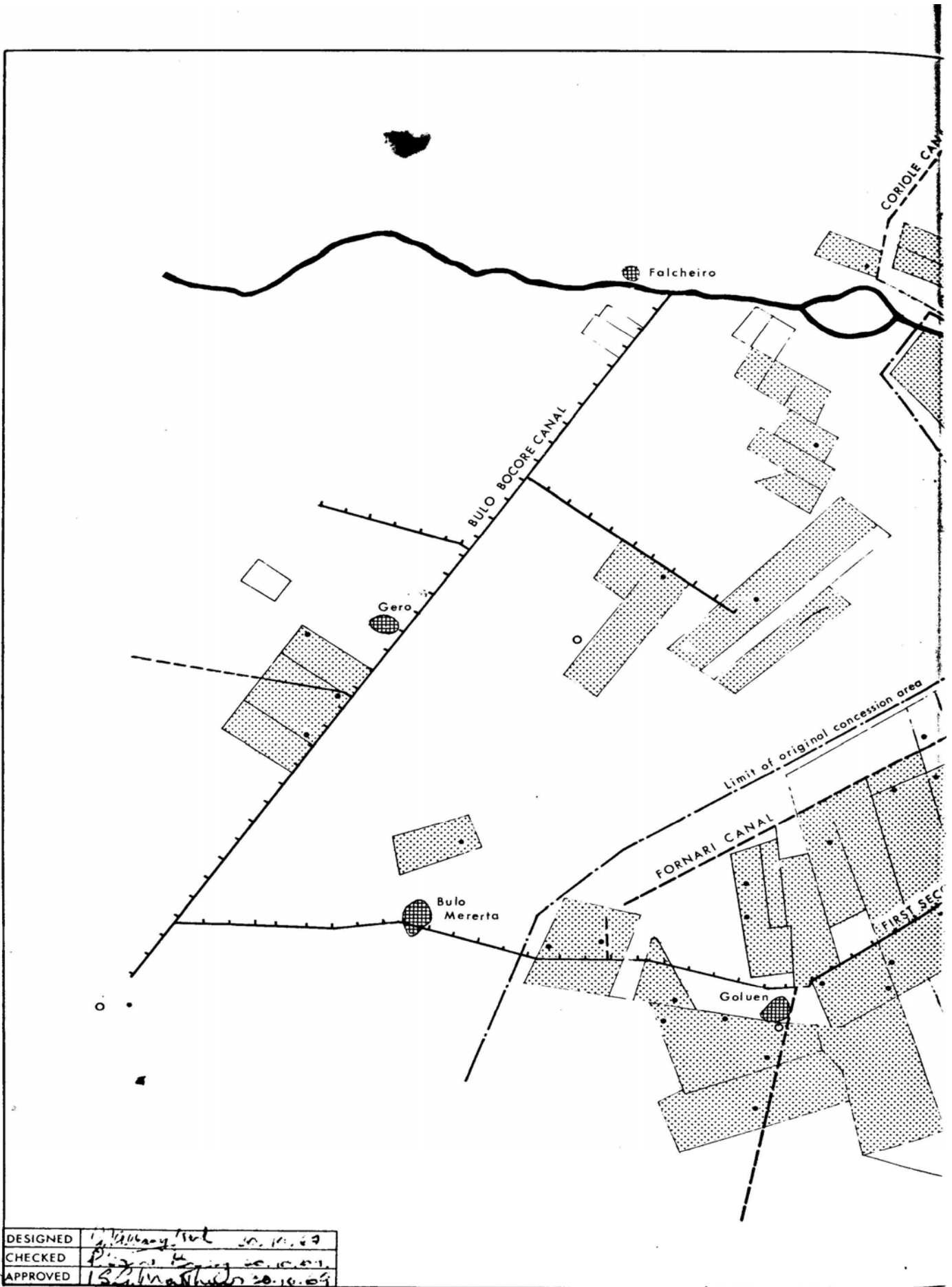
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DESIGNED	<i>[Signature]</i>	20.10.09
CHECKED	<i>[Signature]</i>	20.10.09
APPROVED	<i>[Signature]</i>	20.10.09



