JAMHUURIYADDA DIMOQRAADIGA SOMAALIYA
WASAARADDA BEERAHA
SOMALI DEMOCRATIC REPUBLIC
MINISTRY OF AGRICULTURE

GENALE-BULO MARERTA PROJECT

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Inception Report

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PROJECT AREA AND STUDY AREA

This study contained two elements, a Master Plan covering 67 400 hectares and a feasibility study of 5 000 hectares.

Throughout the reports the term Study Area refers to the area covered by the Master Plan studies and the term Project Area is used for the feasibility study area.

GLOSSARY OF SOMALI TERMS

Cambuulo	-	Traditional dish of chopped boiled maize with cowpeas or green grams.
Chiko	-	Chewing tobacco
Der	-	Rainy season from October to December
Dharab	-	Five jibals or approximately 0.31 ha
Gu	-	Rainy season in April and May
Hafir	-	Large reservoir on farms for storing water for use in dry periods
Hagai	-	Climatic season June to September characterised by light scattered showers
Jibal	-	Area of land approximately 25 m by 25 m or 0.0625 ha
Jilal	-	Dry season from January to April
Kawawa	-	Two man implement for forming irrigation ditches
Moos	-	Measurement of land area equal to a quarter of a jibal
Quintal	-	Unit of weight measurement equivalent to 100 kg
Uar	-	See hafir
Yambo	-	Small short-handled hoe
Zareebas	-	Thorn cattle pen

SPELLINGS OF PLACE NAMES

Throughout the report Somali spellings have been used for place names with the exception of Mogadishu where the English spelling has been used. To avoid misunderstanding, we give below a selected list of Somali, English and Italian spellings where these differ.

Somali	English	Italian
Afgooye	Afgoi	Afgoi
Awdheegle	-	Audegle
Balcad	Balad	Balad
Baraawe	Brava	Brava
Buulo Mareerta	Bulo Marerta	Bulo Mererta
Falkeerow	-	Falcheiro
Gaywèerow	-	Gaivero
Golweyn	-	Goluen
Hawaay	Avai	Avai
Hargeysa	Hargeisa	-
Janaale	Genale	Genale
Jelib	Gelib	Gelib
Jowhar	Johar	Giohar
Kismaayo	Kisimaio	Chisimaio
Marka	Merca	Merca
Muqdisho	Mogadishu	Mogadiscio
Qoryooley	-	Coriolei
Shabeelle	Shebelli	Scebeli
Shalambood	Shalambot	Scialambot

ABBREVIATIONS USED IN THE REPORTS

ADB	African Development Bank
ADC	Agricultural Development Corporation
CARS	Central Agricultural Research Station - Afgooye
DAP	Diammonium phosphate
EDF	European Development Fund
ENB	National Banana Board
FAO	Food and Agriculture Organisation
FAO/PP	FAO Pilot Project (Afgooye - Mordiile Project)
HASA	Hides and Skins Agency
HTS	Hunting Technical Services Limited
HV	High volume (crop sprayer)
IBRD	International Bank for Reconstruction and Development (the World Bank)
ITCZ	Inter-tropical convergence zone
ITDG	Intermediate Technology Development Group (London)
JOSR	Jowhar Offstream Storage Reservoir
LDA	Livestock Development Agency
Libsoma	Libya-Somalia Agricultural Development Company
LSU	Livestock unit
LV	Low volume (crop sprayer)
MLFR	Ministry of Livestock, Forestry and Range
MMP	Sir M. MacDonald & Partners
NCA	Net cultivable area
NCB	National Commercial and Savings Bank (formerly National Commercial Bank)
ONAT	National Farm Machinery and Agricultural Supply Service
PLO	Palestine Liberation Organisation
SDB	Somali Development Bank
SNAI	Jowhar Sugar Estate
TDN	Total digestible nutrients
TDP	Total digestible protein
ULV	Ultra-low volume (crop sprayer)
UNDP	United Nations Development Programme
USBR	United States Bureau of Reclamation
USDA SCS	United States Department of Agriculture, Soil Conservation Service
WHO	World Health Organisation

ACKNOWLEDGEMENTS

The ground control survey, photogrammetry, the mapping at 1 : 25 000 scale for the Study Area, and the grid levelling for the 1 : 500 scale maps of the Project Area were carried out for the Consultant by J.A. Story and Partners of Mitcham, England.

CHAPTER 1

THE STUDY AREA

1.1 Introduction

The agreement for the consulting services for the Janaale-Buulo Mareerta Study included for the preparation of 1 : 25 000 scale maps of the Study Area based on the aerial photographs taken in 1962/63 under an FAO project. Contours were to be drawn at two metre intervals. In 1964 and 1965 an attempt had been made to provide comprehensive ground control from the Study Area and this work included a training programme for Somali surveyors. Due to lack of funds and management, the ground control survey had to be curtailed and thus no controlled mosaic photographs of the area were ever produced. The Study Area was demarcated in the report "Project for the Control and Management of the Shabeelle River" (Hunting Technical Services Limited, 1969) for which maps made from uncontrolled mosaics were used.

In about 1965, the Shabeelle Flood Plain was aerially photographed by a team from the USSR, and some mosaic photographs were sent to Somalia early in 1977. It is believed that these photographs were used to prepare maps of the Study Area at a scale of 1 : 18 000 in 1977, but these were never made available.

The 1962/63 photographs were nominally at a scale of 1 : 30 000 but difficulties during the flights must have caused the aircraft to roll or turn since many of the photographs were not taken from a position vertically above. Thus, many of the earlier uncontrolled maps prepared from these photographs are severely distorted in certain areas.

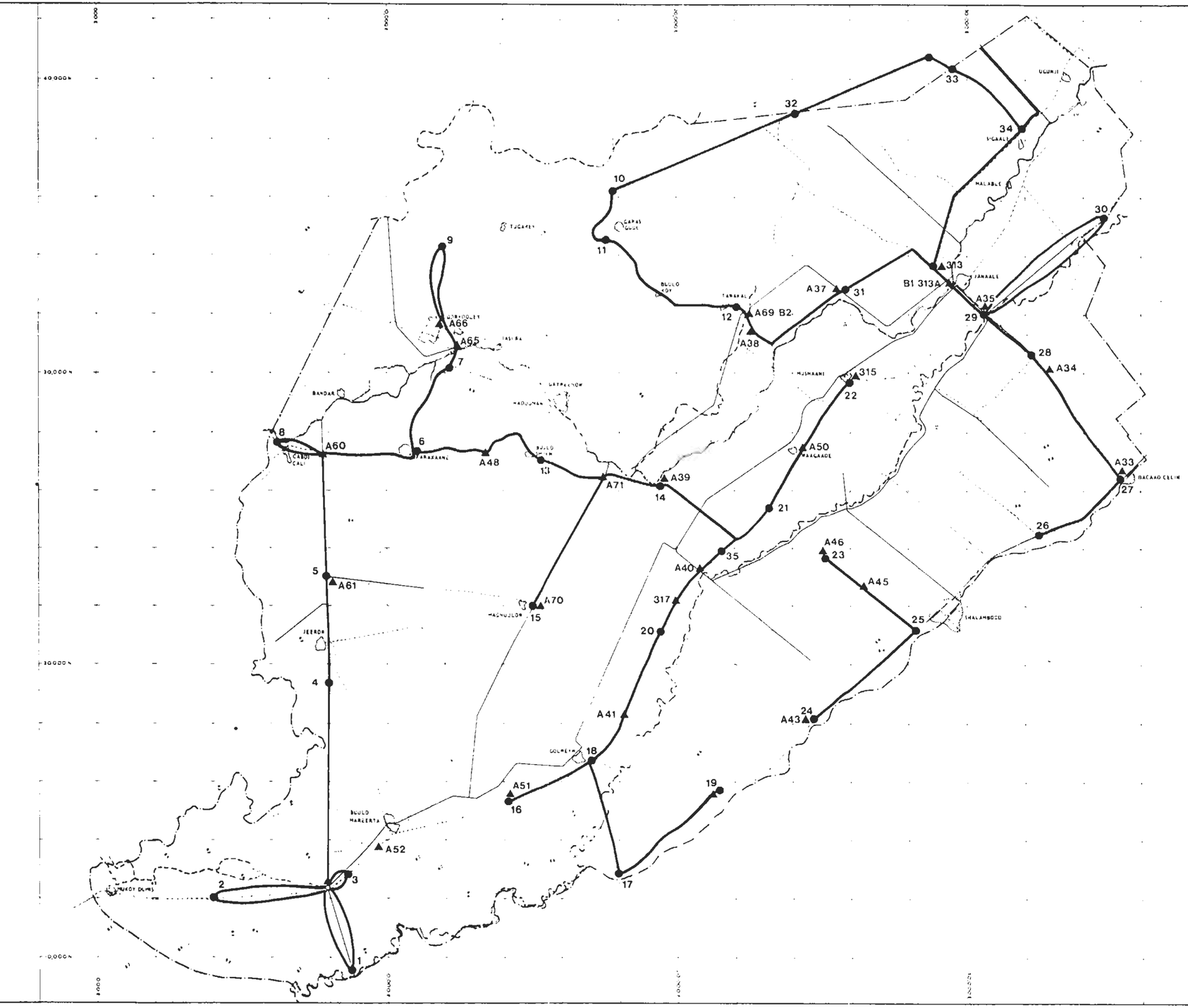
1.2 Method of Mapping

It was stated in the agreement for consulting services that the maps were to be prepared by photogrammetry using the original photographs and a ground control survey. The films from the 1962/63 survey were taken to the United Kingdom for the preparation of orthophotographs for use by the photogrammetrist. At this stage, the ideal control points were selected and a team of four surveyors visited Somalia in May 1977 to put in the ground controls.

All the details of the benchmarks (BM) established during the 1964/65 work were taken from the records held at the Survey and Mapping Department of the Ministry of Defence, Mogadishu, and all the sites recorded in the Study Area were visited as part of the levelling operation. Most of the benchmarks placed as nails in trees no longer existed and some of those placed as paint-marks on culverts proved very difficult to find, so assumptions often had to be made as to their exact positions. Of a total of 47 existing benchmarks recorded as being in the Study Area, 18 either could not be located or were found to have been destroyed. The numbers of these are given in Appendix A. The remaining 29 benchmarks were located and either used with the given value for their level being accepted or, in a few cases, replaced by a new mark and re-levelled. Great difficulty was experienced in interpreting the benchmark descriptions since in

FIGURE 1.1

STUDY AREA BENCHMARKS AND HEIGHT CONTROL DETAILS



one or two cases the description indicated that the benchmark was on the north-east corner of a road bridge or culvert, but it was eventually found on the south-west side. Two additional benchmarks were established by the Consultant in March 1978; these were given the numbers B1 and B2. Descriptions of all identified benchmarks are given in Appendix B and their positions are marked up on Figure 1.1.

In order to produce horizontal control for the area, an arbitrary co-ordinate system was used and a tellurometer traverse run from a point on the sand dunes near Shalambood to Qoryooley. Additional control points were observed as bearing and distance fixes, and the mast at Janaale was co-ordinated by intersection.

It had been decided that 36 height control points were required for the mapping operation. Each control point was either observed on a line of levels between two different benchmarks, or could be heightened by double levelling from a benchmark which had been checked by levelling and found acceptable; a misclosure of up to 150 mm was considered to be reasonable. Figure 1.1 gives the levelling diagram and the height control points established.

Temporary benchmarks (TBM) were established along the levelling routes. These are in the form of painted crosses on culverts or other permanent structures. Descriptions and values are given in Appendix C and their positions are also marked on the 1 : 25 000 Study Area maps. In all, 164 km of levelling was carried out plus the horizontal control consisting of 14 angle stations occupied and 13 traverse legs measured.

The maps produced as a result of this work are series 5, numbers one to six. The grid on the maps is arbitrarily chosen but based on magnetic north.

1.3 Survey of Existing Canals and Rivers

As part of the investigation of the existing irrigation network, cross-sections of four of the principal existing canals were taken. Cross-sections of the Primo Secondario, Bokore, Liibaan (including one section in an old river channel) and Asayle canals are given in Drawings No. 45701-12 and 13.

River cross-sections were also surveyed and these are shown in Drawing No. 45701-14.

CHAPTER 2

THE PROJECT AREA

2.1 Introduction

The agreement for the consulting services required maps of the 5 000 ha Project Area to be produced at a scale of 1 : 5 000 with contours at 0.25 m intervals. These maps were prepared by running parallel lines of levels at 250 m intervals across the Project Area. A total area of 5 850 ha was surveyed by this method.

2.2 Existing Benchmarks

Of the 1964/65 benchmarks detailed in Appendix B, four were chosen to form the basic control, viz. A39, A65, A66 and A69. These benchmarks were found to be out of sympathy with each other by as much as 0.202 m and so all levelling in the survey area was related to benchmark A39 which is near to the new Gayweerow barrage site. This benchmark was also related to the levels of the new barrage and so all levels on the project maps are consistent.

2.3 Survey Procedure

To produce the required grid of levels a base line was first established between Qoryooley and Janaale radio masts. The line was marked at 250 m intervals across the area, the zero point being at the Qoryooley mast. Lines of levels were then observed perpendicular to this base line. Bank and invert levels of major canals and drainage ditches were recorded as were the positions of principal tracks.

A total of 20 new benchmarks was established in the area, either by double levelling or closing between two existing benchmarks. The benchmarks placed were either concrete blocks or steel bars set into the ground with concrete, or, in a few cases, a point mark on an existing structure. Appendix D gives descriptions of all benchmarks thus established.

From the grid of spot levels taken, contour maps of the area were drawn at a scale of 1 : 5 000 and these were then superimposed on orthophotographs of the area which were specially prepared. These orthophotographs are reproduced as maps 4/1 to 4/7.

2.4 Main Canal Long Sections

Once the maps had been prepared with 0.25 m contours, the preparation of the irrigation layouts could proceed. When the lines of the branch canals had been provisionally marked on the maps, they could be transferred to the field.

On site, the intersection points (IP) of the canal junctions and bends were set out according to their apparent positions on the orthophotographs. In general, despite the age of the photography (1962-63), good correlation was found between features shown on the orthophotographs and those now present on the ground.

Each intersection point was marked by two benchmarks, a primary and a secondary. The primary benchmarks were located as close as possible to the determined actual intersection point. As a precaution against the primary benchmarks being destroyed or lost, the secondary benchmarks were located in easily identifiable positions where they should not be disturbed, such as on canal banks or close to large trees, usually within 50 m of the intersection point.

Appendix E gives the method used to locate each intersection point along with a description of each benchmark placed. Except where otherwise stated the intersection point positions were subject to at least one check using features not used in the basic setting out. Wherever possible, a check was made of the angles turned at each intersection point using a theodolite. Using this method, the positioning of the intersection points on the ground from the layouts should be correct to within 10 m in any direction. Lack of available control in the case of intersection points 8T and 9T meant that they could only be positioned to within 50 m.

The levels of all benchmarks at the intersection points were determined by double levelling from those benchmarks detailed in Section 2.1.2 (and were thus established relative to a level of 71.182 at A39). Levels are given in Appendix E. The lines between the intersection points were not intervisible; the lines were first set out on compass bearings, then adjusted to take up any error. Levels were then determined at 100 m intervals along the lines. A maximum closing error of 50 mm was accepted. Principal features on the lines were also recorded.

The only significant bush on the proposed lines was located between IP 2G and IP 3G. The only burial ground close to a canal line was around IP 5G. However, nowhere did the centre line of the canal come within 50 m of any graves.

The levels produced along the canal lines were plotted on the 1 : 5 000 layouts to check correlation between contours and spots levels. Generally, the agreement was very good.

The levels were also plotted as long sections for the intake channel, Gayweerow and Tawakal canals (see Drawings No. 45701-10 and 11) together with design details of bed levels, water levels and bank top levels.

2.5 Outfall Drain Area Survey

The line of the proposed outfall drain extends to the Liibaan canal, 1.8 km beyond the area mapped at 1 : 5 000 scale.

A survey of this area was carried out in March 1978. Levels were recorded at 100 m intervals along a line running due west along the extended line of the outfall drain as far as the Liibaan canal. Additional levels were recorded at 100 m intervals on the right bank of the Liibaan canal downstream of the intersection point with the outfall drain line as far as the old river channel. Bed levels were taken every 250 m in the canal and for 500 m in the old river channel.

All levelling done in this area is plotted out on Drawing No. 45701-8.

2.6 Asayle Canal

A survey of the Asayle canal was carried out as part of the study of the proposal to use it to gravity feed the Tawakal branch canal.

Bank levels were recorded every 100 m and water levels every 500 m from the canal head as far as Tawakal village, Km 8.9. These levels were all related to benchmark A39. For details of this survey, see Drawing No. 45701-10.

2.7 Detailed Topography

Two areas of particular significance were surveyed in detail in March 1978.

(i) An area 150 m x 100 m around the proposed inlet from the River Shabeelle.

(ii) The area around the Asayle canal near Tawakal village, which will be the site of the intake for the Tawakal canal if the alternative supply system is adopted.

For details of these surveys, see Drawing No. 45701-9.

APPENDIX A

STUDY AREA BENCHMARKS FROM 1964-65

LOST OR DESTROYED BEFORE MAY 1977

APPENDIX A

Study Area Benchmarks from 1964/5 Lost or Destroyed before May 1977

No.	No.
A31	A68
A36	A72
A47	A73
A49	BM311
A53	BM314
A54	BM316
A63	BM318
A64	BM319
A67	BM320

APPENDIX B

LIST OF BENCHMARKS IN THE STUDY AREA IDENTIFIED BY THE 1977 SURVEY

APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

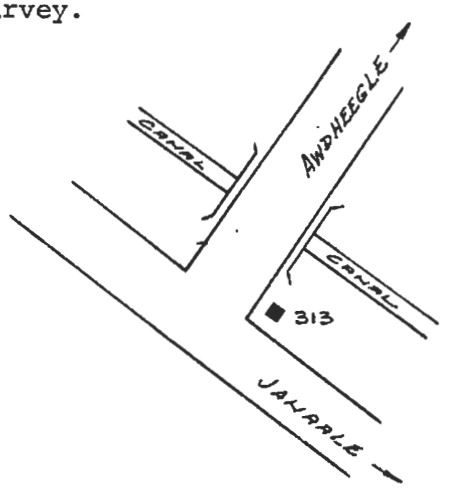
Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER : 313

ELEVATION : 69.714 m

SURVEY DATE : Agriculture and Water Survey, 1964.

DESCRIPTION : Concrete monument on the south-east corner of the round junction approximately 0.9 km north of Janaale. Level value accepted by the 1977 survey.

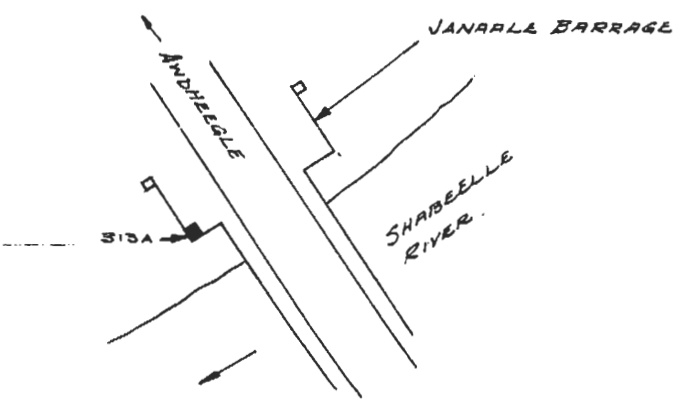


B.M. NUMBER : 313 A

ELEVATION : 72.736 m

SURVEY DATE : Agriculture and Water Survey, 1964.

DESCRIPTION : Painted cross on the top centre of the concrete post at the south-west corner of the wing wall at the north end of the bridge over the river at Janaale. Level value accepted by survey, 1977.



APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

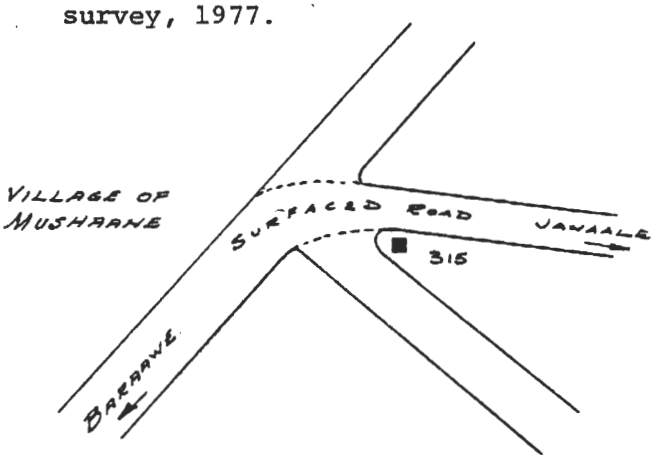
Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER : 315

ELEVATION : 68.142 m

SURVEY DATE : Agriculture and Water Survey, 1964.

DESCRIPTION : A concrete monument at the road intersection in the village of Mushaani between the roads to Janaale and Marka. Approximately 5.0 km west of Janaale. Level value checked from A39 by survey, 1977.



B.M. NUMBER : A 39

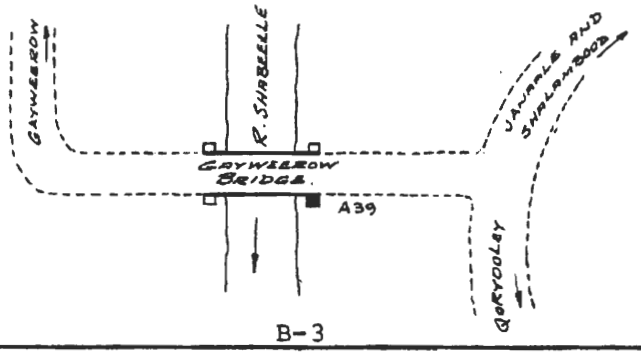
ELEVATION : 71.182* m

SURVEY DATE : Janaale Control Survey March 1965

DESCRIPTION : Originally a white painted cross on top of the stone column at the south-west corner of Gayweerow Bridge, 1.0 m above ground level.

* In 1977 the column was found damaged. Value of 71.182 for paint mark at the base used.

N.B. Subsequent survey work by the Consultant has cast doubt on the level value.



APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER : 317

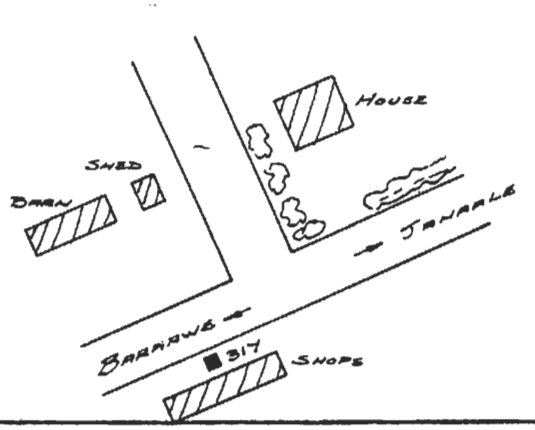
ELEVATION : 67.178* m

SURVEY DATE : Agriculture and Water Survey 1964.

DESCRIPTION : Originally a concrete monument on the south side of the road opposite a row of shops.

Village approximately 14 km west of Janaale.

* The 1977 survey found the monument had been moved and this was relevelled.

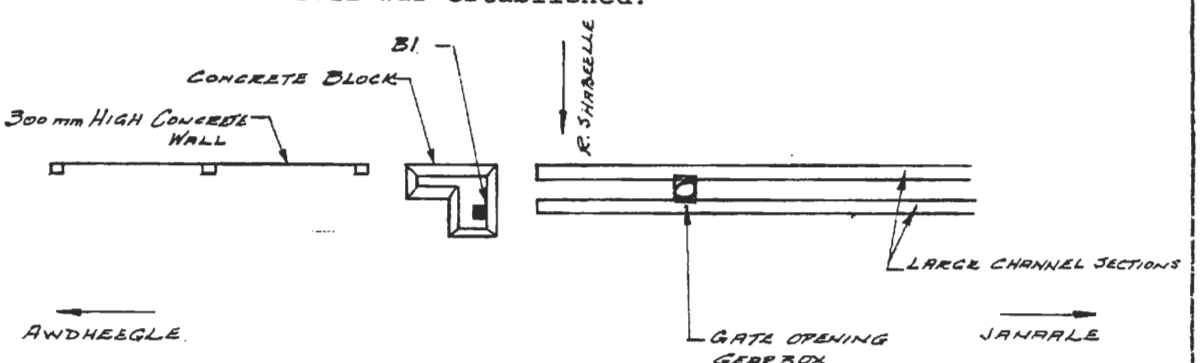


B.M. NUMBER : B1

ELEVATION : 72.697 m

SURVEY DATE : Established by the Consultant, March 1978.

DESCRIPTION : The bench-mark is located on a 50 cm high pillar on the Janaale barrage. The pillar is in the centre of the barrage on the upstream side of the road. A black rectangular paint mark denotes the exact position at which the level was established.



APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmark

Datum 1963 Mean Sea Level Mogadishu

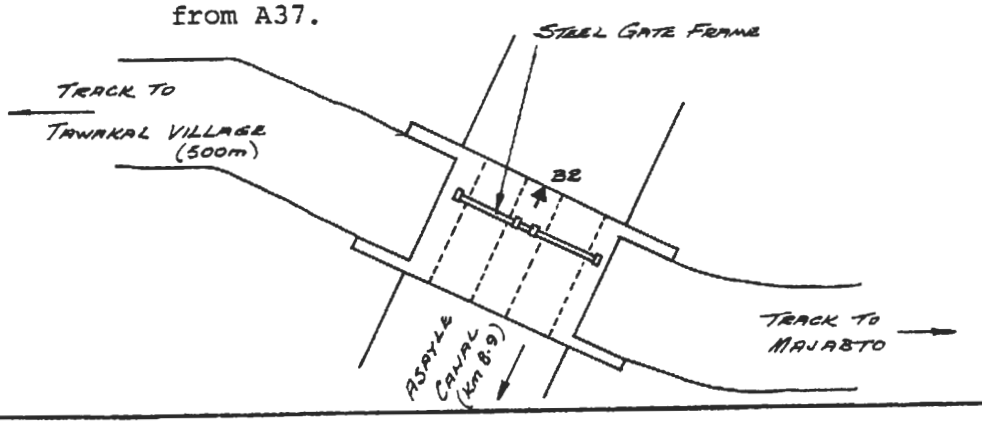
B.M. NUMBER : B2

ELEVATION : 70.135m

SURVEY DATE : Established by the Consultant March 1978.

DESCRIPTION : The bench-mark is located on the cross-regulator on the Asayle Canal near Tawakal Village. It is marked by a black painted arrow in the centre of the upstream side of the regulator.

This bench-mark replaces A69 which could not be identified in March 1978. It was established from A37.



APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER :	A 30.
ELEVATION :	66.105 m
SURVEY DATE :	3rd Order Level Programme, February 1965
DESCRIPTION :	On 90km monument south side of Mogadishu to Shalambood road. Level value accepted by May/June 1977 Survey.

B.M. NUMBER :	A33
ELEVATION :	69.193* m
SURVEY DATE :	3rd Order Level Programme, February 1965/J.A.S.1977*.
DESCRIPTION :	Originally a painted white cross, on North-West corner of culvert at junction of Janaale road and Mogadishu road at Bacaad Celin village, 8 km North-East of Shalambood. Cross repainted and relevelled in 1977.

B.M. NUMBER :	A34
ELEVATION :	69.777 m
SURVEY DATE :	3rd Order Level Programme, February 1965.
DESCRIPTION :	Painted white cross on centre line of the north-side of culvert on south-side of road 4 km south-east of Janaale. 1.2m above ground level. The 1977 survey found agreement with A32 but disagreement with A35 and 313A.

APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER :	A35
ELEVATION :	69.942. m
SURVEY DATE :	3rd Order Level Programme, February 1965.
DESCRIPTION :	Originally a painted white cross on centre of line of culvert, on South-side of road 1.3km South-east of Janaale. New green paint mark left in 1977, relevelled from 313A

B.M. NUMBER :	A37
ELEVATION :	70.512 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on Eastern corner of South-East abutment of a bridge over large canal, approximately 4.6 East of Janaale. Level value accepted by J.A.S. 1977 survey.

B.M. NUMBER :	A38
ELEVATION :	69.514 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on North-East corner of South-East culvert, approximately 8km East of Janaale and 0.41m above ground level. Checked by the survey in 1977, fair agreement with A37 and 313A.

APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER :	A40
ELEVATION :	68.506 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on top of South-East abutment of a canal bridge, near a mechanical garage approximately 8.3.km North-East of Golweyn. In 1977 the abuttments had been damaaged but agreed with level. New road culvert also levelled, value 68.473 m.

B.M. NUMBER :	A41
ELEVATION :	67.255 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on North end corner of West headwall of culvert, approximately 2.8km North-East of Golweyn. 0.6m above ground level. Level value accepted by 1977 survey.

B.M. NUMBER :	A42
ELEVATION :	65.842m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on concrete block on East-side of Shalambood-Kismaayo road approximately 10km South-West of Shalambood and 0.6m above ground level Level value checked from A71 in 1977.

APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER :	A43
ELEVATION :	66.960 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on North-East headwall of culvert, approximately 5.6km South-West of Shalambood and 0.3m above ground level. Level value checked from A46 in 1977.

B.M. NUMBER :	A45
ELEVATION :	68.490 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on South headwall of culvert in East corner approximately 3km East of Shalambood. Level value checked from A46 in 1977.

B.M. NUMBER :	A46
ELEVATION :	67.250 m
SURVEY DATE :	Janaale Control Survey March 1965.
DESCRIPTION :	No detail available but thought to be painted white cross on culvert 2km North-West of A45 on road from Shalambood towards main Janaale to Golweyn road. Not checked in 1977.

B.M. NUMBER :	A48
ELEVATION :	65.593 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on East end of South culvert headwall, at bend in road approximately 2.5km South-East of Faraxaane and 0.35m above ground level. Level value checked from A60 in 1977.

B.M. NUMBER :	A50
ELEVATION :	69.200 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on South-West corner of culvert, 150m East of Waagaade village and 0.46m above ground level. Level value checked from A39 and 315 in 1977.

B.M. NUMBER :	A51
ELEVATION :	65.774 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on top of culvert, approximately 3km South-West of Golweyn and 0.25m above ground level. Level value checked from A42 and A51 in 1977.

APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER :	A52
ELEVATION :	64.832.
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on South-East corner of headwall on South-West abutment of culvert. Approximately 0.8km South of Buulo Mareerta and 0.2m above ground level. Culvert identifield but not used in level survey and marked with green paint but not used in level survey.

B.M. NUMBER :	A60
ELEVATION :	67.086*m
SURVEY DATE :	Janaale Control Survey, March 1965/1977 Survey*
DESCRIPTION :	Originally a painted white cross on top North-West corner of south abutment of a bridge over a canal, approximately 3 km East of Faraxaane village. Bridge identified in 1977 with pillars demaged. New green paint mark placed and levelled in.

B.M. NUMBER :	A61
ELEVATION :	66.271*m
SURVEY DATE :	Janaale Control Survey, March 1965/1977 Survey*.
DESCRIPTION :	Originally a painted white cross on top of the North-East corner of the east abutment of a bridge over a canal, approximately 5.6 km South-West of Faraxaane village. This culvert is not identified but level on culvert over small irrigation canal adjacent to main canal established in 1977.

APPENDIX B

Janaale-Buulo Mareerta Study Area Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu

B.M. NUMBER :	A62
ELEVATION :	66.835 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Originally a painted white cross on the west end corner of the east abutment of a bridge over a canal approximately 2km east of Buulo Mareerta at 0.7m above ground level. Painted cross found and repainted green in 1977, level value accepted.

B.M. NUMBER :	A65
ELEVATION :	68.199 m
SURVEY DATE :	Janaale Control Survey, March 1965
DESCRIPTION :	Painted white cross on south-east corner of south abutment at approximately 0.7km east of Qoryooley. Level checked from A66 in 1977.

B.M. NUMBER :	A66
ELEVATION :	66.534 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on north end corner of foundation of District Commissioners Office in Qoryooley. 0.18 m above ground level. The 1977 survey used south-west corner of foundation value but accepted the original level value.

B.M. NUMBER :	A69
ELEVATION :	70.145*m
SURVEY DATE :	Janaale Control Survey, March 1965/J.A.S.1977.*
DESCRIPTION :	Originally a painted white cross on the south end of the culvert on the Asayle Canal approximately 0.7km East of Tawakal Village. Relevelled in 1977 from A37 but mark not found by the consultant (1978), see note on B.M. B2.

B.M. NUMBER :	A70
ELEVATION :	67.687 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on East side of culvert approximately 5.3km North-West of Golweyn and 0.35m above ground level. Level checked from A71 in 1977.

B.M. NUMBER :	A71
ELEVATION :	68.807 m
SURVEY DATE :	Janaale Control Survey, March 1965.
DESCRIPTION :	Painted white cross on centre of East abutment of culvert approximately 3.3km East of Haduuman village and 0.2m above ground level. Culvert identified in 1977 on main road to Qoryooleey, level checked from A39.

APPENDIX C

LIST OF TEMPORARY BENCHMARKS ESTABLISHED IN THE STUDY AREA DURING MAY AND JUNE 1977

N.B. For locations of the temporary benchmarks, refer to map series 4, the 1 : 25 000 topographical maps of the Study Area.

APPENDIX C

LIST OF TEMPORARY BENCHMARKS ESTABLISHED IN THE STUDY AREA DURING MAY AND JUNE, 1977

Point No.	Elevation (m)	Description				
C1	67.42	Green paint	-	culvert	-	W side road
C2	67.74	Green paint	-	culvert	-	W side road
C3	69.23	Green paint	-	culvert	-	W side road
C4	69.39	Green paint	-	culvert	-	NW side road top of pillar
C5	69.15	Green paint	-	culvert	-	S side road
C6	69.24	Green paint	-	culvert	-	E side road
C7	69.14	Green paint	-	culvert	-	W side road
C8	70.27	Green paint	-	culvert	-	W side road
C9	70.05	Green paint	-	culvert	-	W side road
C10	69.51	Green paint	-	culvert	-	S side road
D1	68.47	Green paint	-	culvert	-	NW side road
D2	67.07	Green paint	-	culvert	-	NW side road
D3	67.40	Green paint	-	culvert	-	NW side road
D4	66.91	Green paint	-	culvert	-	W side road
D5	66.86	Green paint	-	culvert	-	W side road
D6	67.35	Green paint	-	culvert	-	NW side road
D7	67.16	Green paint	-	culvert	-	NW side road
D8	66.96	Green paint	-	culvert	-	S side road
D9	66.40	Green paint	-	culvert	-	S side road
E1	69.40	Black cross	-	culvert	-	N side road
E2	69.42	Black cross	-	culvert	-	N side road
E3	69.87	Black cross	-	culvert	-	N side road
E4	68.51	Black cross	-	culvert	-	N side road
E5	67.01	Black cross	-	culvert	-	N side road
E6	65.10	Black cross	-	culvert	-	NW side track
E7	65.32	Green paint	-	culvert	-	NW side track
E8	67.94	Black cross	-	culvert over stream by canal - S side track		
E9	66.43	Black cross	-	culvert over stream by canal - S side track		
E10	69.37	Black cross	-	culvert	-	N side track
E11	68.88	Black cross	-	sluice	-	W of river
E12	68.28	Black cross	-	bridge		
E13	68.51	Black cross	-	culvert	-	N side road
E14	67.28	Green cross	-	culvert	-	N side road
E15	66.67	Black cross	-	culvert	-	N side road
E16	66.50	Black cross	-	culvert	-	N side road
E17	66.76	Black cross	-	culvert	-	N side road
E18	66.67	Green cross	-	culvert	-	S side road
E19	65.65	Black cross	-	culvert	-	N side track
E20	65.84	Black cross	-	E culvert	-	E side track
E21	66.04	Black cross	-	S culvert	-	S side track

Point No.	Elevation (m)	Description
E22	64.92	Black cross - middle S culvert - S side track
E23	65.24	Black cross - S culvert - S side track
E24	65.05	Black cross - N culvert - N side track
E25	65.59	Black cross - W culvert - W side track
E26	66.36	Black cross - W culvert - W side track
E27	67.59	Black cross - W culvert - W side track
E28	66.23	Black cross - culvert - W side canal western culvert
E29	66.23	Black cross - S side Jeerow bridge
E30	66.43	Black cross - S part of culvert - E side canal
E31	65.98	Black cross - S part of culvert - E side canal
E32	65.98	Black cross - S part of culvert - E side canal
E33	65.67	Black cross - middle culvert - E side canal
E34	66.37	Black cross - N part of culvert - E side culvert
E35	65.51	Black cross - middle culvert - E side canal
E36	65.20	Black cross - middle culvert - E side canal
E37	65.82	Black cross - middle culvert - E side canal
E38	65.49	Black cross - middle W culvert - E side canal
E39	65.26	Green paint - culvert wall - E side canal
E40	67.14	Black cross - middle N culvert - N side road
E41	66.89	Green paint - NE culvert - NE side road
E42	68.97	Black cross - middle N culvert - N side road
E44	66.72	Black cross - middle E culvert - E side canal
R1	65.15	Green paint - culvert - S side road
R2	64.94	Green paint - culvert - N side road
R3	62.39	Green paint - culvert - S side road
R4	62.19	Green arrow on road sign - N side road
R5	65.79	Green paint - culvert - N side road
R6	64.90	Green paint - culvert - S side road
R7	65.76	Green paint - culvert - N side road
R8	64.44	Green paint - km post 120 - W of Buulo Mareerta
R9	61.81	Green paint - concrete block - S side road

Point No.	Elevation (m)	Description
W1	68.08	Black cross - culvert - W side road
W2	68.11	Black cross - culvert - W side road
W3	69.26	Black cross - culvert - SW road junction
W4	69.57	Black cross - NE sluice corner - canal junction
W5	70.35	Black cross - NE sluice corner - S side track
W10	71.47	Grey paint - centre of bridge
W11	70.64	Black cross - culvert - NE road junction
W12	69.29	Black cross - culvert - E side road
W20	69.48	Black cross - "Caltex" sign
W21	69.44	Black cross - sluice
W30	71.41	Black cross - culvert - E side road
W31	71.93	Black cross - culvert - E side road
W32	72.23	Black cross - culvert - E side road
W33	71.69	Black cross - culvert - E side road
W40	68.96	Black cross - wooden culvert - E side road
W41	66.32	Black cross - wooden culvert - S side road
W43	67.36	Black cross - concrete foundation
W45	70.27	Black cross - centre of sluice gate

APPENDIX D

PROJECT AREA BENCHMARKS

N.B. All levels are given correct to benchmark A39

APPENDIX D

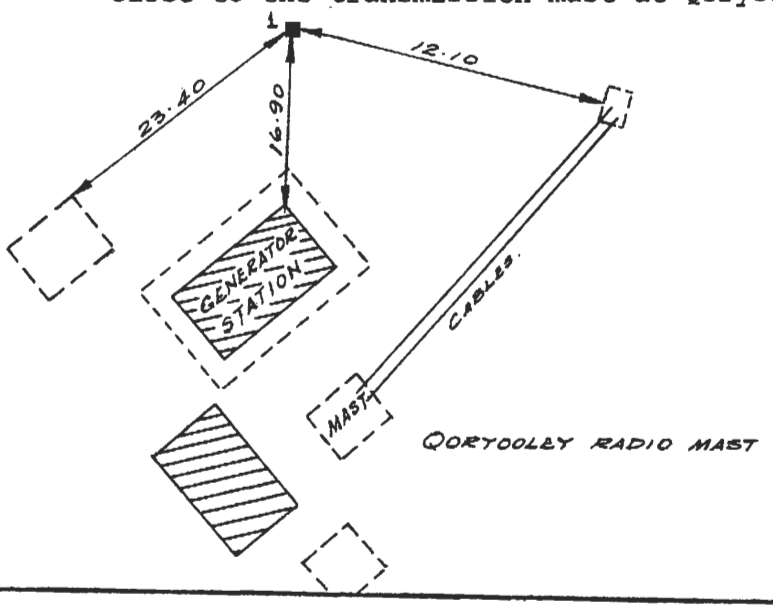
Janaale-Buulo Mareerta Project Area — Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 1977

B.M. NUMBER : J.A.S. 1

ELEVATION : 65.855 m

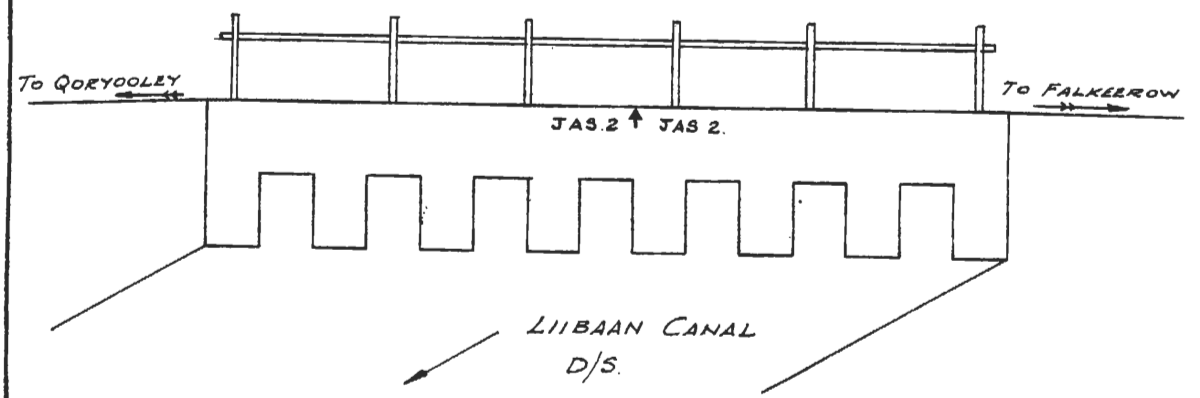
DESCRIPTION : A 20 mm diameter bar set into a concrete base, the base being at ground level; located close to the transmission mast at Qoryooley.



B.M. NUMBER : J.A.S. 2

ELEVATION : 68.001 m

DESCRIPTION : The bench-mark is located on the bridge over the Liibaan Canal on the road from Qoryooley to Falkeerow. It is marked by a black painted arrow on the downstream central arch of the bridge.



APPENDIX D

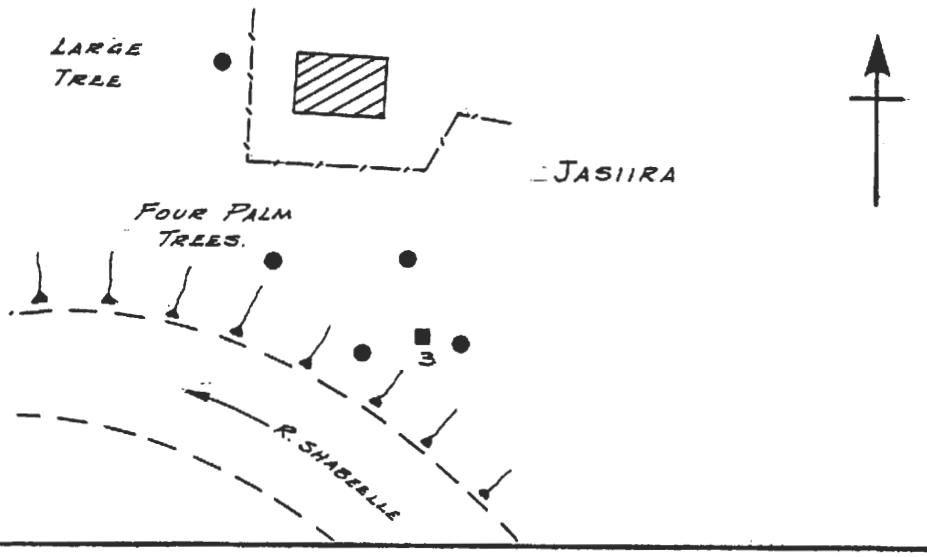
Janaale-Buulo Mareerta Project Area — Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 197

B.M. NUMBER : J.A.S. 3

ELEVATION : 66.711 m

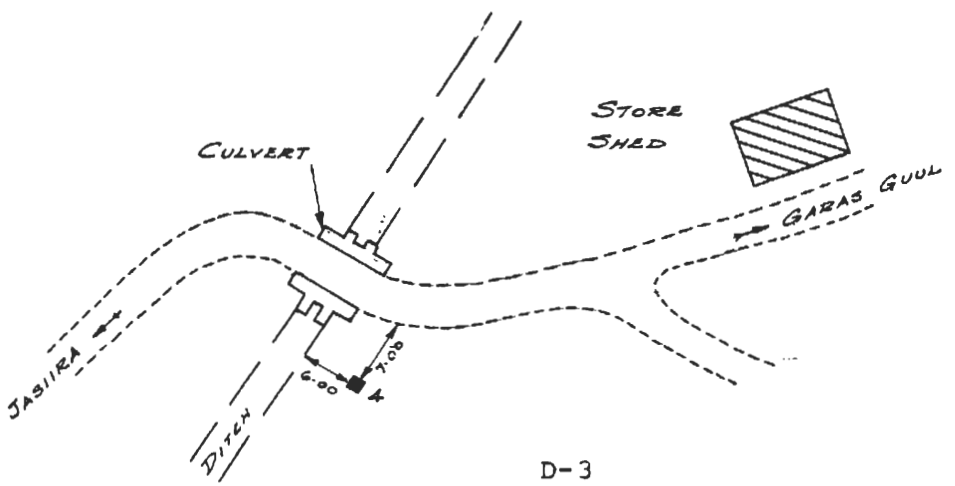
DESCRIPTION : A precast concrete bench-mark block set into a concrete base, the base being at ground level; located in Jasiira Village.



B.M. NUMBER : J.A.S. 4

ELEVATION : 66.055 m

DESCRIPTION : A precast concrete bench-mark block set into a concrete base, the base being at ground level; located 3 300 m from Jasiira on the road to Garas Guul.



APPENDIX D

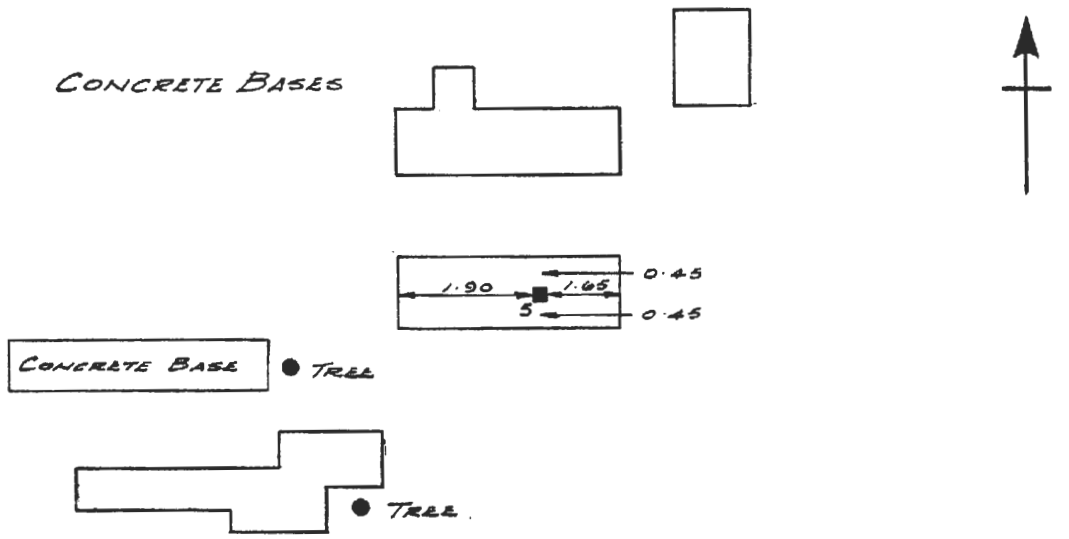
Janaale-Buulo Mareerta Project Area — Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 1977

B.M. NUMBER : J.A.S. 5

ELEVATION : 67.293 m

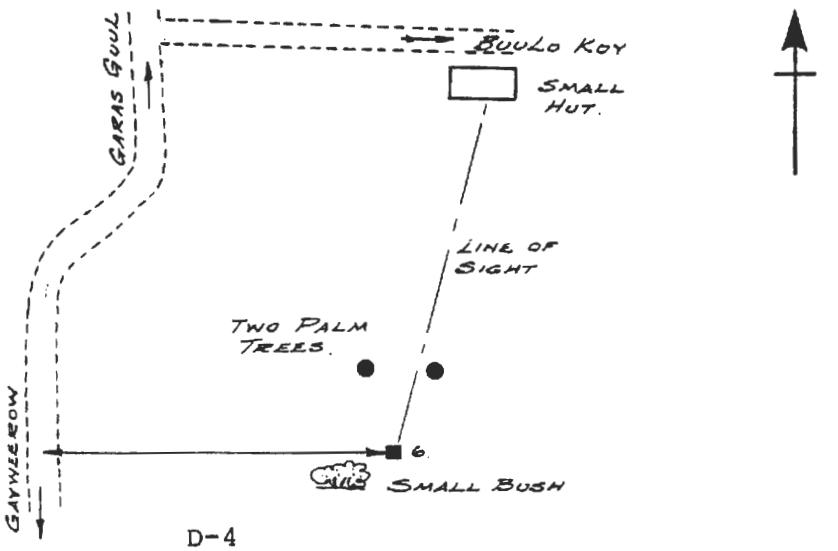
DESCRIPTION : A black painted cross on one of several concrete foundation slabs; located 1 000 m north-west of Garas Guul.



B.M. NUMBER : J.A.S. 6

ELEVATION : 64.930 m

DESCRIPTION : The top rim of a disused 10 inch diameter tube well; located 3 500 m from Gayweerow on the road to Garas Guul.



APPENDIX D

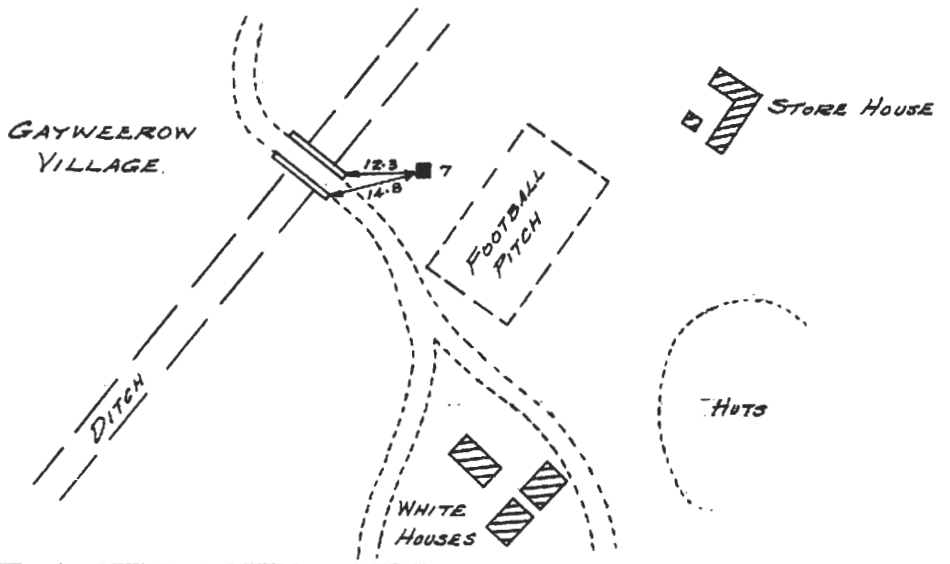
Janaale-Buulo Mareerta Project Area — Register of Benchmarks –

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 19-7

B.M. NUMBER : J.A.S. 7

ELEVATION : 66.218 m

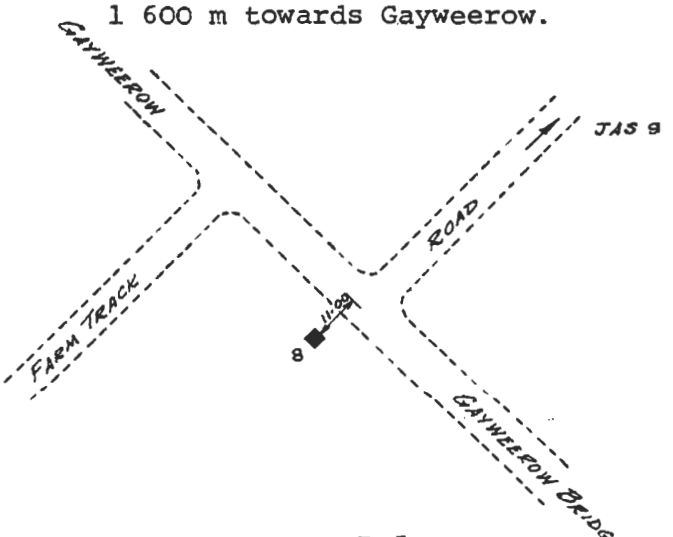
DESCRIPTION : A precast concrete bench-mark block set into a concrete base, the base being at ground level; located on the outskirts of Gayweerow Village.



B.M. NUMBER : J.A.S. 8

ELEVATION : 66.420 m

DESCRIPTION : A precast concrete bench-mark block set into a concrete base, the base being at ground level; located on the left side of the road from Nimcooley, 1 600 m towards Gayweerow.



APPENDIX D

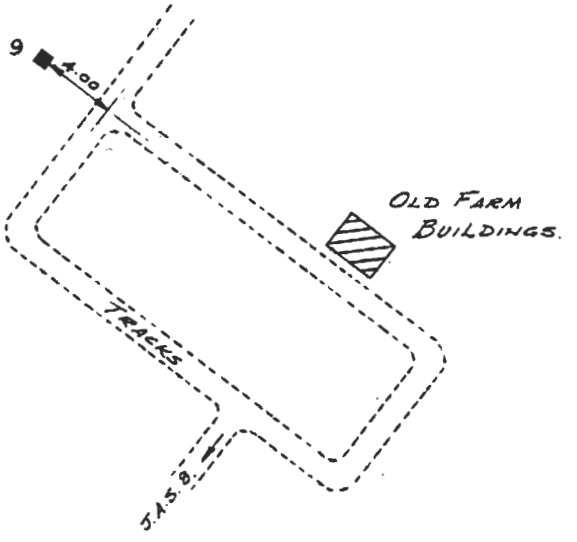
Janaale-Buulo Mareerta Project Area — Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 1977

B.M. NUMBER : J.A.S. 9

ELEVATION : 65.997 m

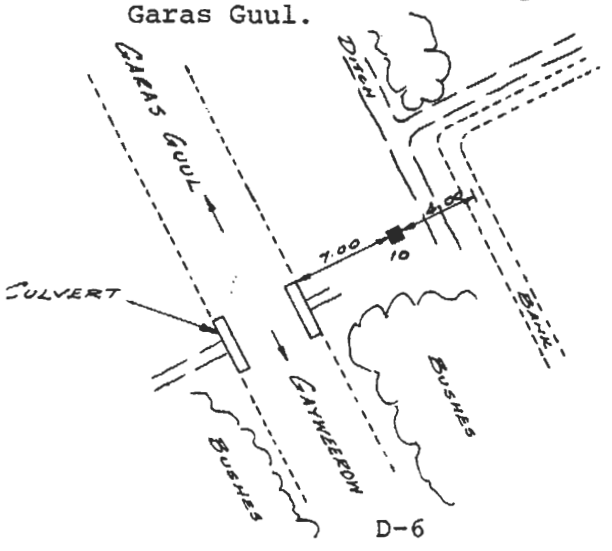
DESCRIPTION : A precast concrete bench-mark block set into a concrete base, the base being at ground level; located 1 700 m to the north-east of J.A.S. 8.



B.M. NUMBER : J.A.S. 10

ELEVATION : 65.654 m

DESCRIPTION : A precast concrete bench-mark block set into a concrete base, the base being at ground level; located 1 100 m from Gayweerow on the road to Garas Guul.



APPENDIX D

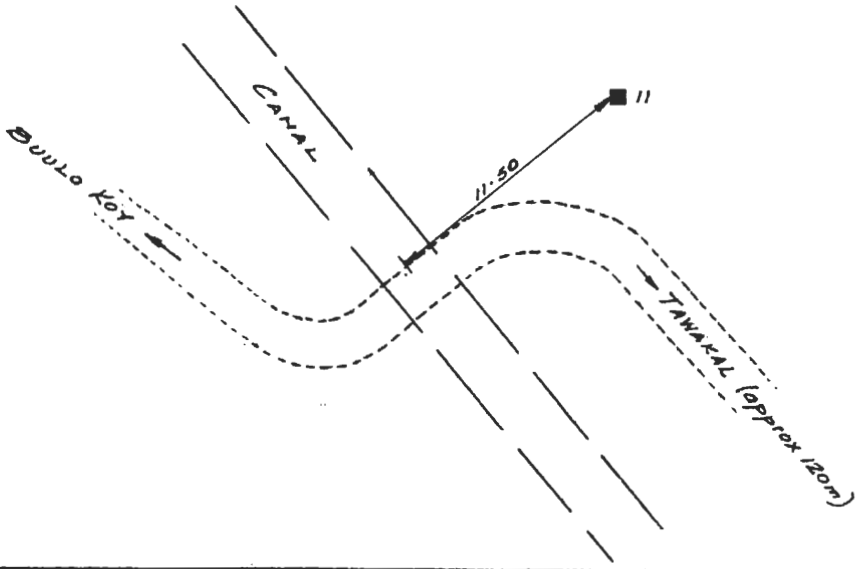
Janaale-Buulo Mareerta Project Area — Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 1977

B.M. NUMBER : J.A.S. 11

ELEVATION : 66.922m

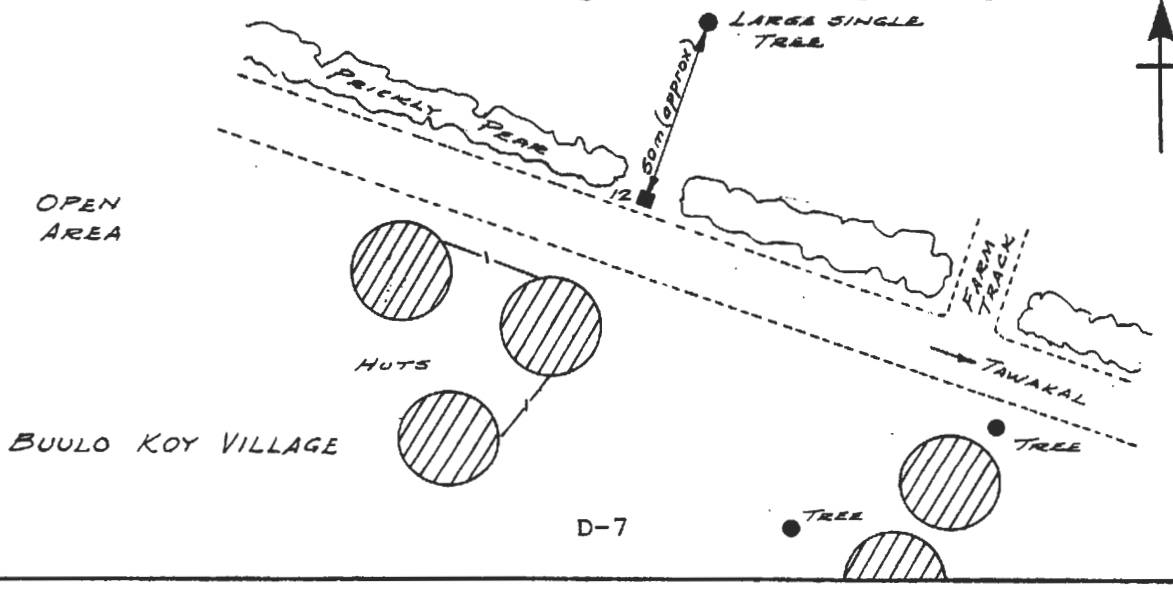
DESCRIPTION : a 20 mm diameter steel bar set into a concrete base, the base being at ground level; located 100 m outside Tawakal on the road to Buulo Koy.



B.M. NUMBER : J.A.S. 12

ELEVATION : 65.972m

DESCRIPTION : A 20 mm diameter steel bar set into a concrete base, the base being at ground level; located at the side of the road through Buulo Koy Village.



APPENDIX D

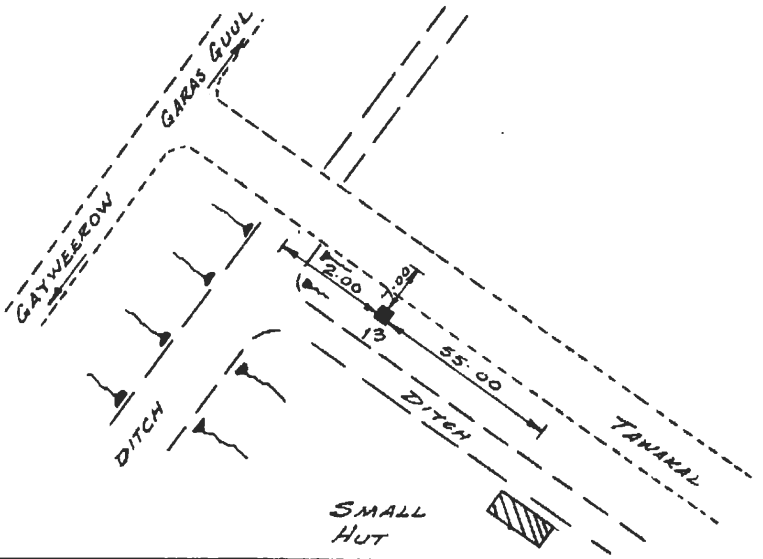
Janaale-Buulo Mareerta Project Area — Register of Benchmarks

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 1977

B.M. NUMBER : J.A.S. 13

ELEVATION : 65.651m

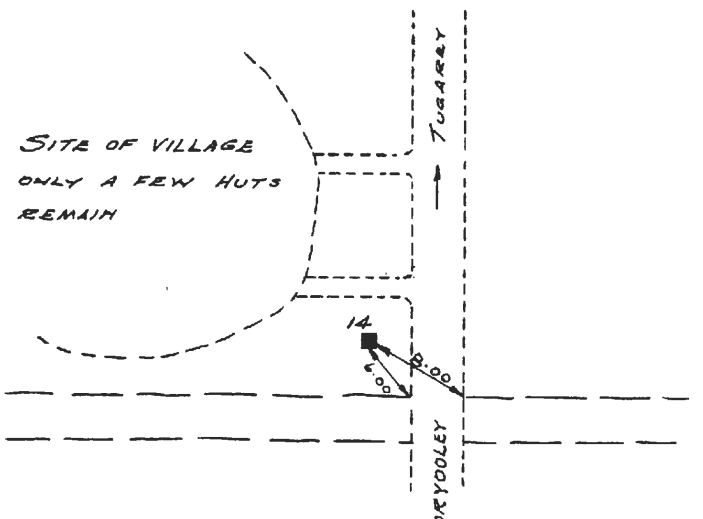
DESCRIPTION : A 20 mm diameter steel bar set into a concrete base, the base being at ground level; located 2 300 m from Buulo Koy on the road to the north-west.



B.M. NUMBER : J.A.S. 14

ELEVATION : 66.262m

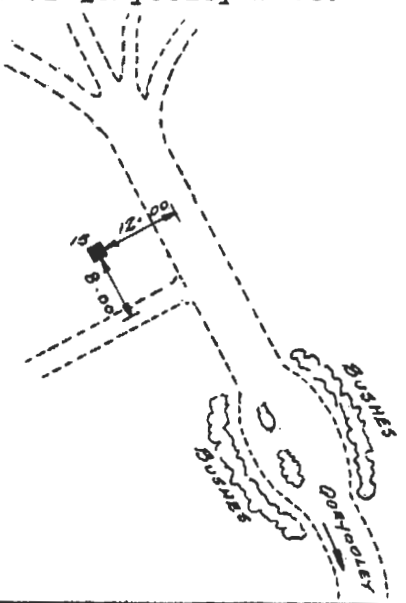
DESCRIPTION : A 20 mm diameter steel bar set into a concrete base, the base being at ground level; located 2 300 m from Qoryooley on road to Tugarey.



B.M. NUMBER : J.A.S. 15

ELEVATION : 65.926m

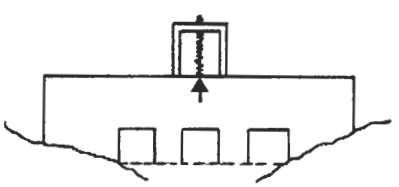
DESCRIPTION : A 20 mm steel bar set into a concrete base, the base being at ground level; located 1 300 m north of Qoryooley mast.



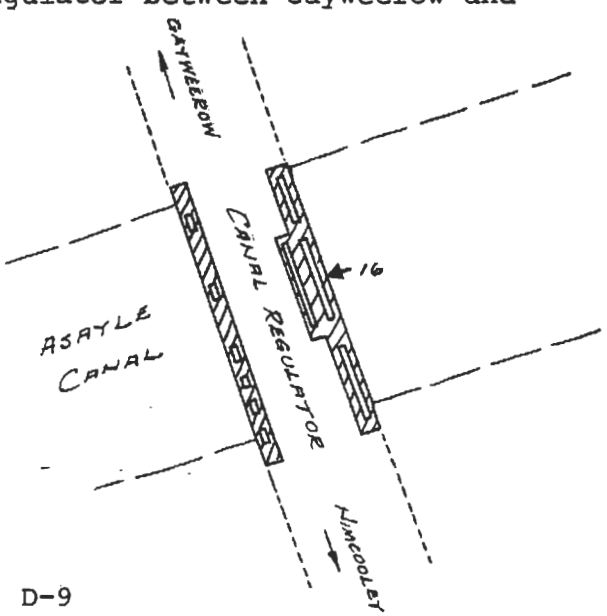
B.M. NUMBER : J.A.S. 16

ELEVATION : 69.816m

DESCRIPTION : A black painted arrow over central gate on Asayle Canal cross regulator between Gayweerow and Nimcooley.



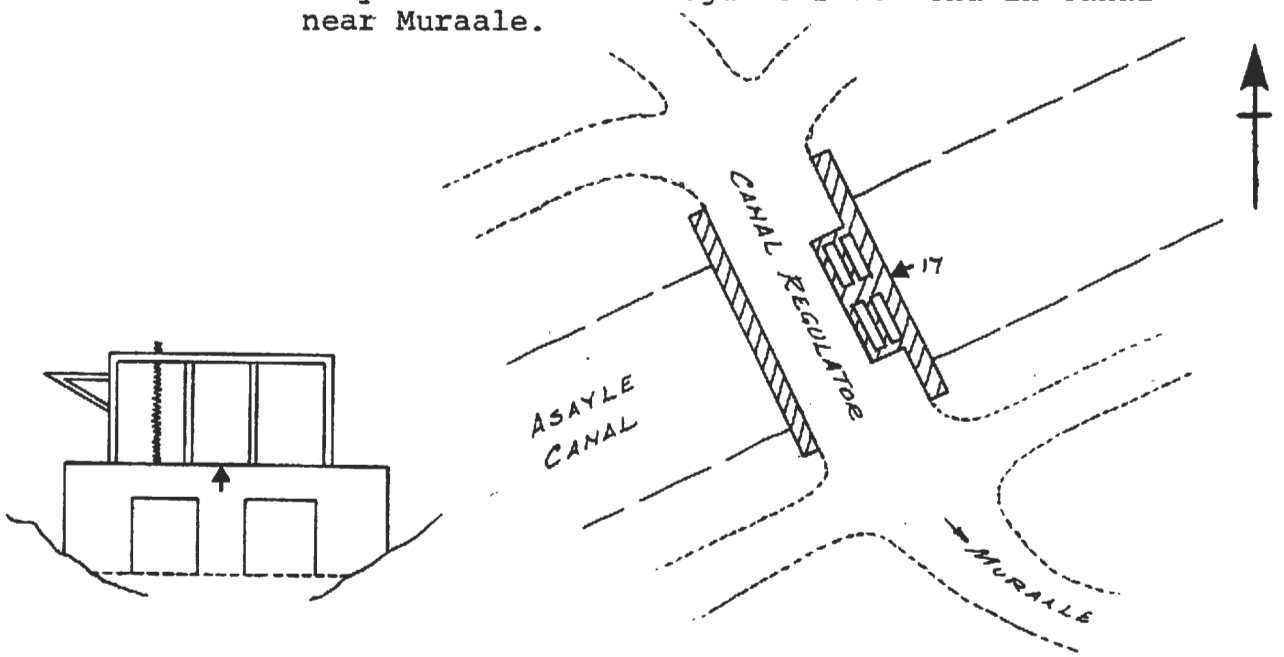
VIEW FROM NORTH-EAST



B.M. NUMBER : J.A.S. 17

ELEVATION : 69.506 m

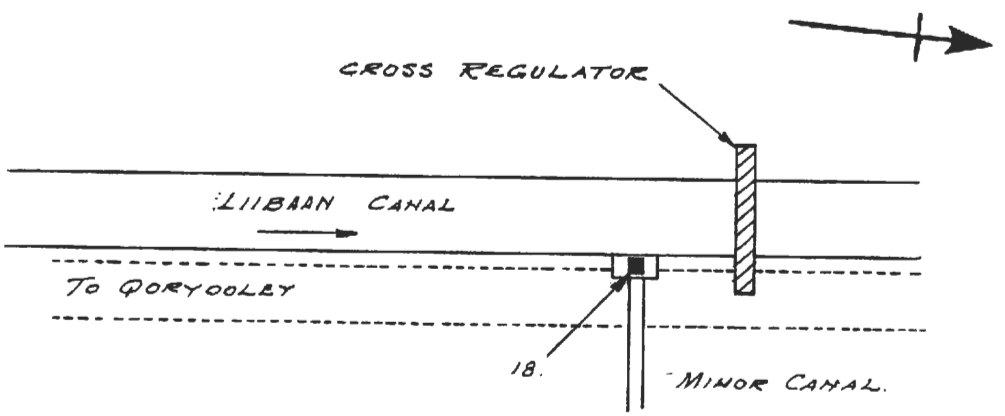
DESCRIPTION : A black painted arrow between the two gates on Asayle Canal cross regulator at bend in canal near Muraale.



B.M. NUMBER : J.A.S. 18

ELEVATION : 68.660 m

DESCRIPTION : A black painted cross on a minor canal head regulator, on the right bank of the Liibaan Canal. It is 1 255 m upstream from where the Liibaan Canal joins the Old River Channel, and 20 m upstream from a large cross regulator on the Liibaan Canal.



APPENDIX D

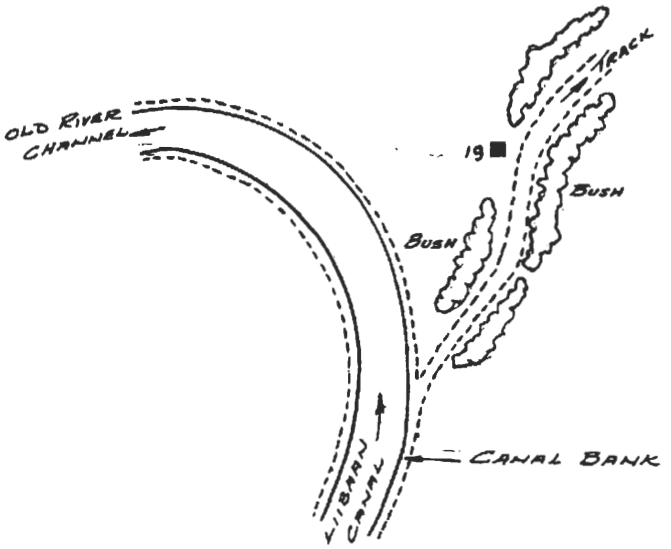
Janaale-Buulo Mareerta Project Area — Register of Benchmarks –

Datum 1963 Mean Sea Level Mogadishu — Established Aug/Sept 1977

B.M. NUMBER : J.A.S. 19

ELEVATION : 66.617m

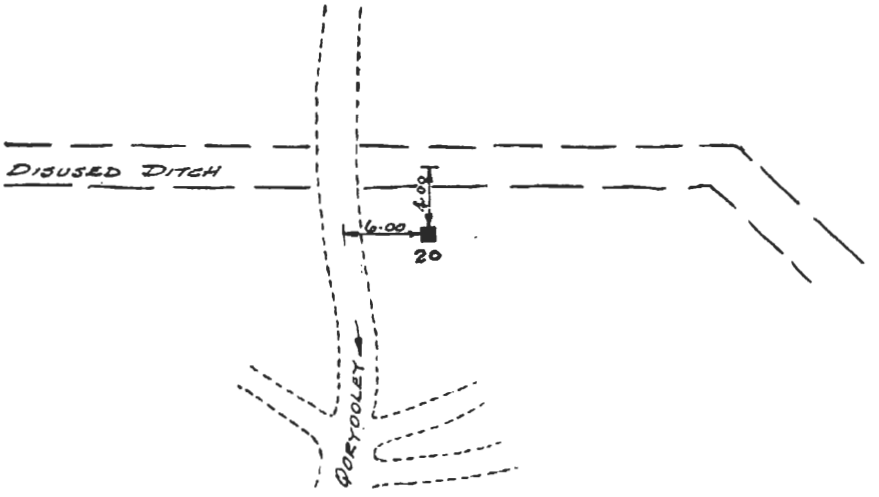
DESCRIPTION : A 20 mm diameter steel bar set into a concrete base, the base being at ground level. It is located close to the intersection of the Liibaan Canal and the Old River Channel.



B.M. NUMBER : J.A.S. 20

ELEVATION : 66.590 m

DESCRIPTION : A 20 mm diameter steel bar set into a concrete base, the base being at ground level; located 3 200 m north of Qoryooley mast.



APPENDIX E

PROJECT AREA LIST OF BENCHMARKS

AT CANAL INTERSECTION POINTS

N.B. All intersection points coincide with the primary benchmark, unless otherwise stated

APPENDIX E

Janaale - Buulo Mareerta Project Area

Datum 1963 Mean Sea Level Mogadishu

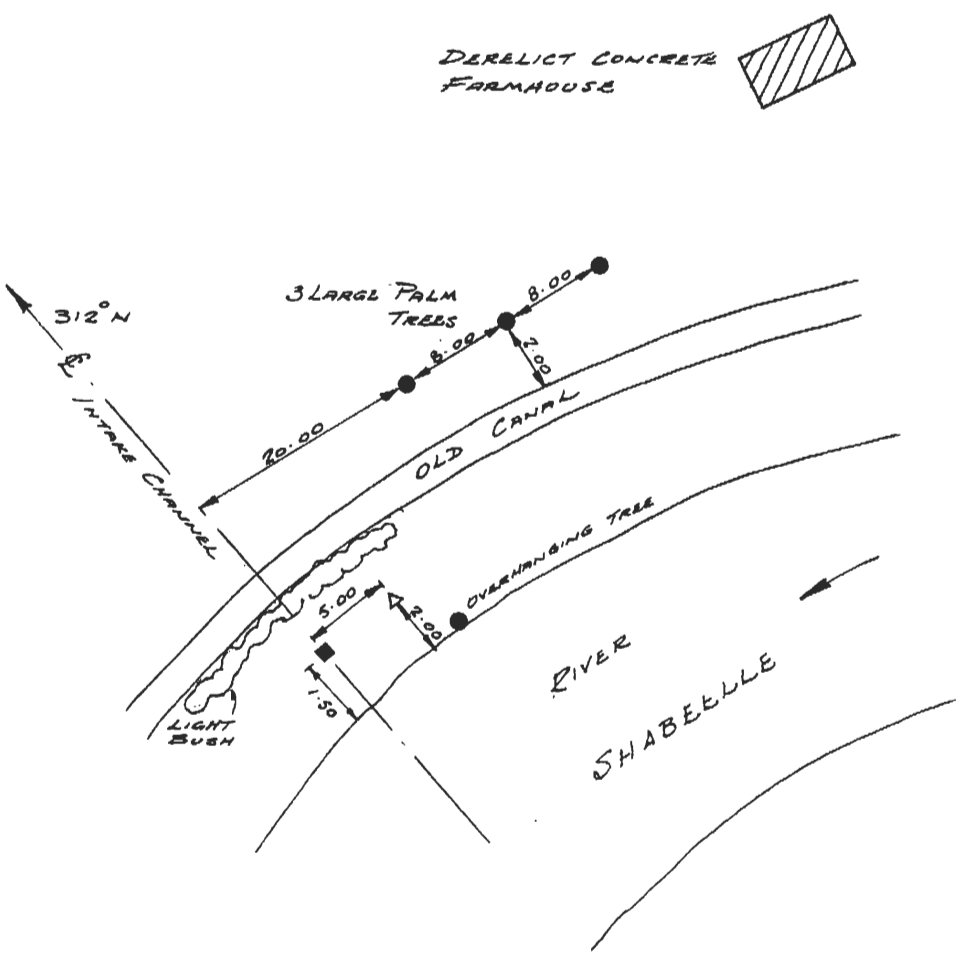
Register of Benchmarks

At Canal Intersection Points

Established Feb/March 1978

I.P. NUMBER	1 (inlet on river Shabeelle)
PRIMARY B.M.	20 mm steel bar set into mass concrete. Steel set 100mm above local ground level. On river bank 1.5 m from the edge.
SECONDARY B.M.	20 mm steel bar set into mass concrete. Steel set 400 mm above local ground level. Painted white. Also positioned on river bank.
ELEVATION	Primary 68.87 m ■ Secondary 69.17 m △

LOCATION OF I.P.



APPENDIX E

Janaale - Buulo Mareerta Project Area

Datum 1963 Mean Sea Level Mogadishu

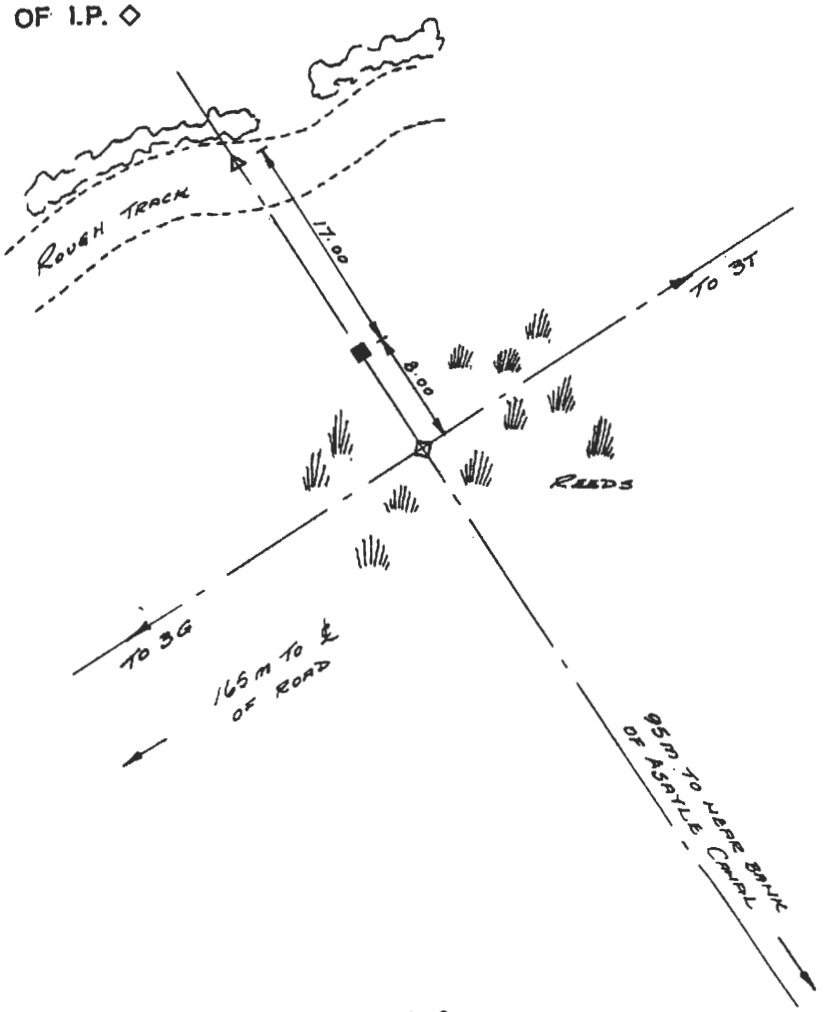
Register of Benchmarks

At Canal Intersection Poir s

Established Feb/March 1978

I.P. NUMBER	2 (intersection point of inlet channel with heads of Tawakal and Gayweerow branch canals)
PRIMARY B.M.	20(mm steel bar set 50 mm above its mass concrete base. Positioned 8 m beyound the actual intersection point on an extension of the centre-line of the intake channel
SECONDARY B.M.	20 mm steel bar set 400 mm above its mass concrete base. Painted white. Positioned a further 17 m beyound the primary away from the intersection point.
ELEVATION	Primary 68.00 m ■ Secondary 68.41 m △

LOCATION OF I.P. ◇



APPENDIX E

Janaale - Buulo Mareerta Project Area

Datum 1963 Mean Sea Level Mogadishu

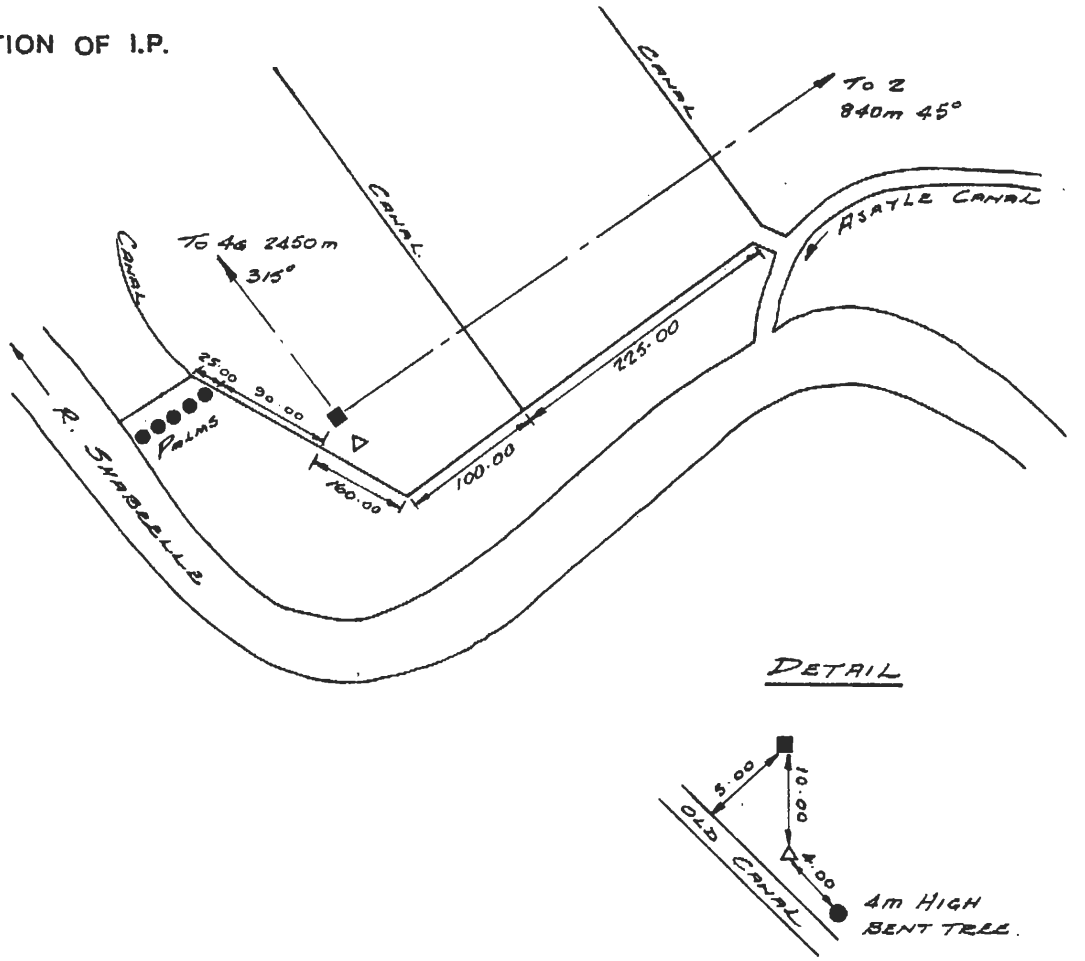
Register of Benchmarks

At Canal Intersection Points

Established Feb/March 1978

I.P. NUMBER	3G (first intersection point on Gayweerow branch canal at km 0.84)
PRIMARY B.M.	12 mm steel bar in mass concrete base. Bar set 50 mm above local ground level. Positioned at the intersection point.
SECONDARY B.M.	20 mm steel bar in mass concrete base. Bar set 400 mm above local ground level. Painted white.
ELEVATION	Primary 68.18 m ■ Secondary 68.78 m △

LOCATION OF I.P.



APPENDIX E

Janaale - Buulo Mareerta Project Area

Datum 1963 Mean Sea Level Mogadishu

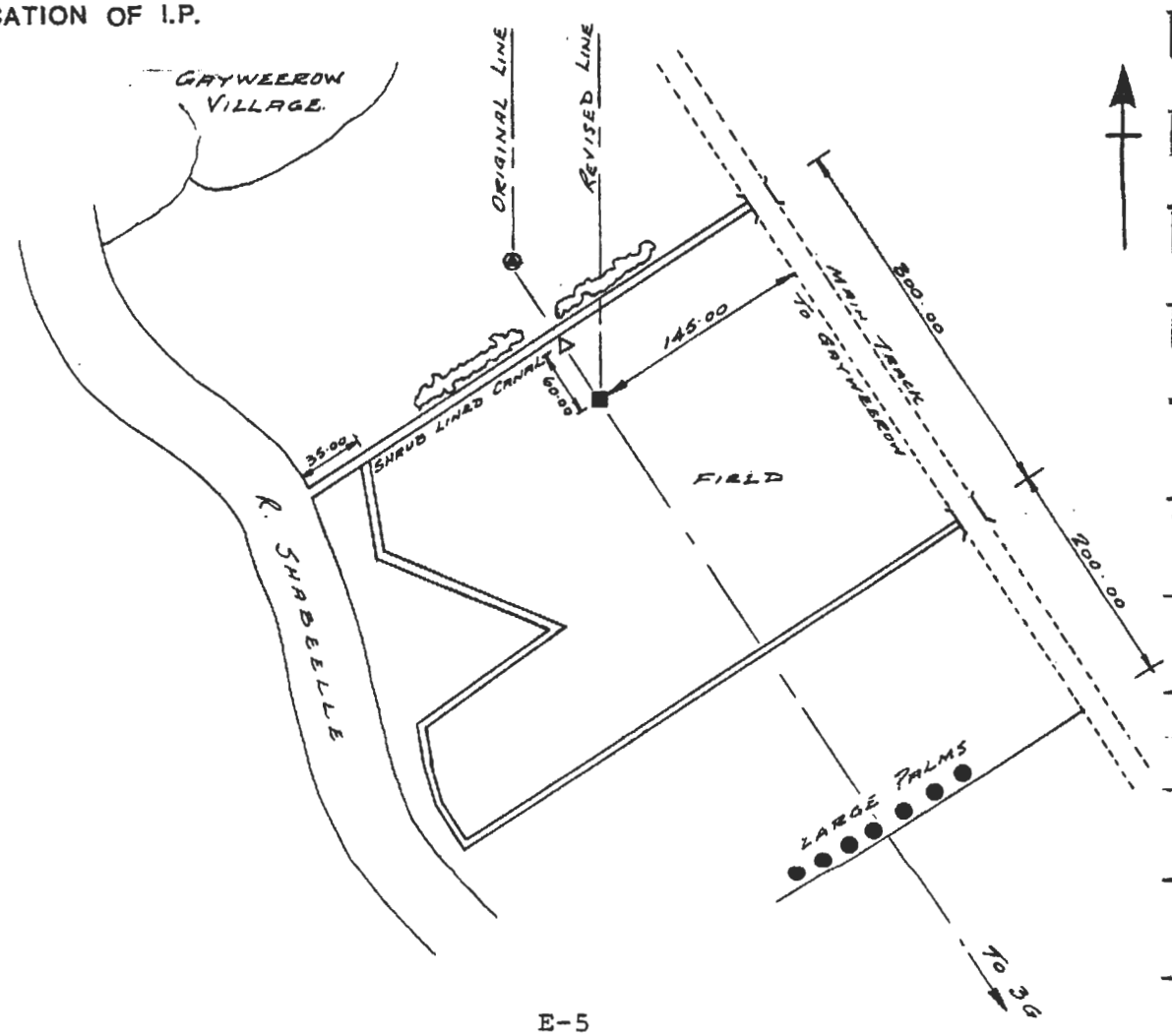
Register of Benchmarks

At Canal Intersection Poin

Established Feb/March 1978

I.P. NUMBER	4G (first intersection point adjacent to Gayweerow at km 3.29 on the branch canal).
PRIMARY B.M.	12 mm steel bar in mass concrete base. Bar 50 mm above local ground level. A second primary was also installed before an amendment to the canal line was made (see sketch).
SECONDARY B.M.	20 mm steel bar in mass concrete base. Bar set 400 mm above the base. Painted white. Set into a canal bank.
ELEVATION	Original primary — Not levelled ◉ Revised primary — 66.77 m ■ Secondary — 67.83 m △

LOCATION OF I.P.



APPENDIX E

Janaale - Buulo Mareerta Project Area

Datum 1963 Mean Sea Level Mogadishu

Register of Benchmarks

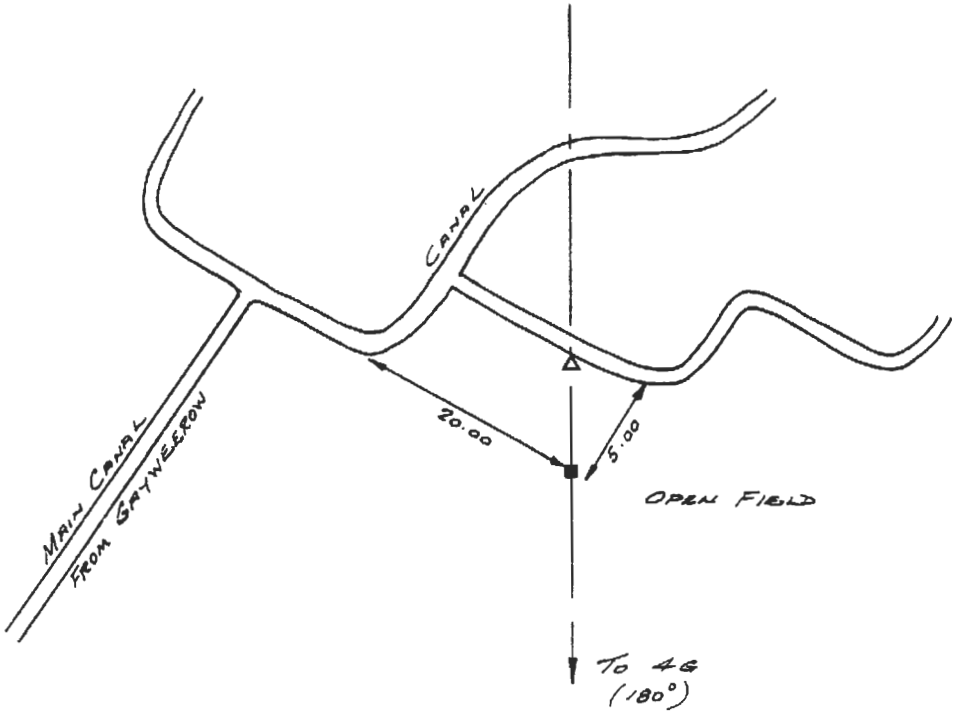
At Canal Intersection Points

Established Feb/March 1978

I.P. NUMBER	5G (second intersection point adjacent to Gayweerow at km 4.21 on the branch canal)
PRIMARY B.M.	12 mm steel bar set 50 mm above its mass concrete base.
SECONDARY B.M.	20 mm steel bar set 400 mm above mass concrete base. Painted white. In canal bank, 5 m north of the primary
ELEVATION	Primary 66.90 m ■ Secondary 67.64 m △

LOCATION OF I.P.

FOR LOCATION OF CANALS SEE THE ORTHOPHOTOGRAPHS



GAYWEEROW

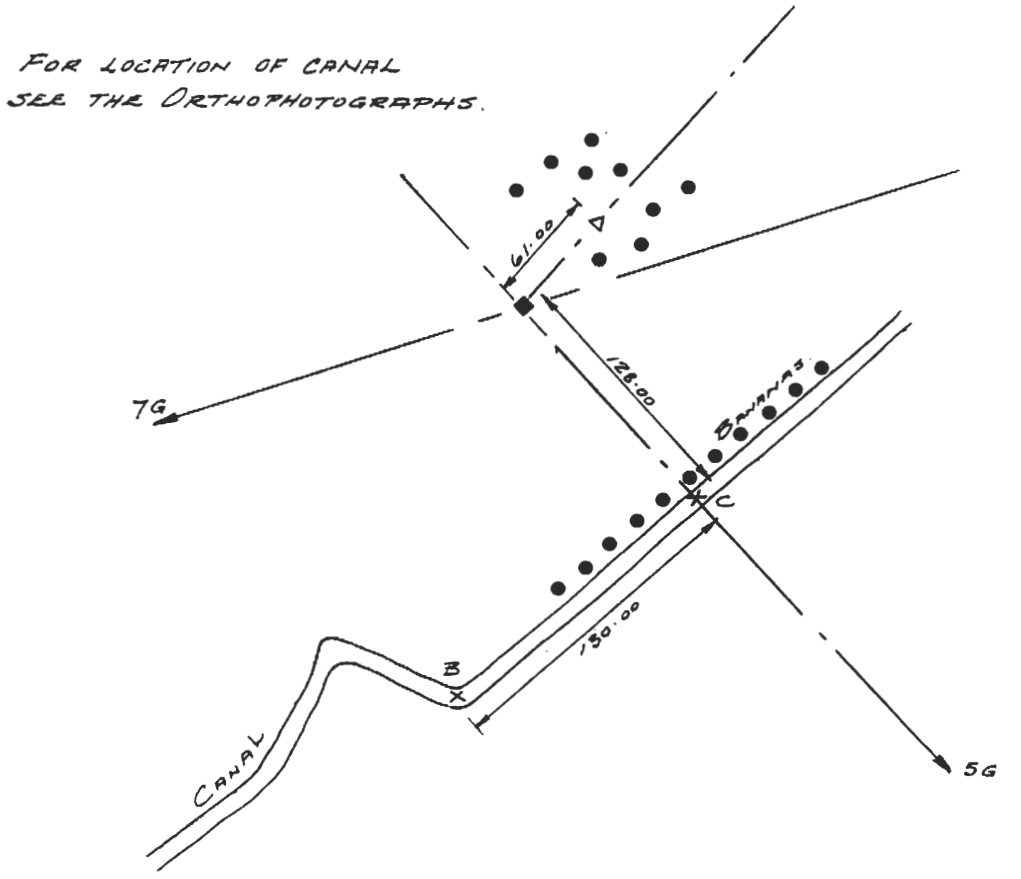
I.P. NUMBER 6G (third intersection point adjacent to Gayweerow at km 4.835 on the branch canal)

PRIMARY B.M. 12 mm steel bar set 50 mm above a mass concrete base.

SECONDARY B.M. 20 mm steel bar set 400 mm above a mass concrete base. Painted white. Located next to a large tree, 61 m from the primary on a bearing of 29°.

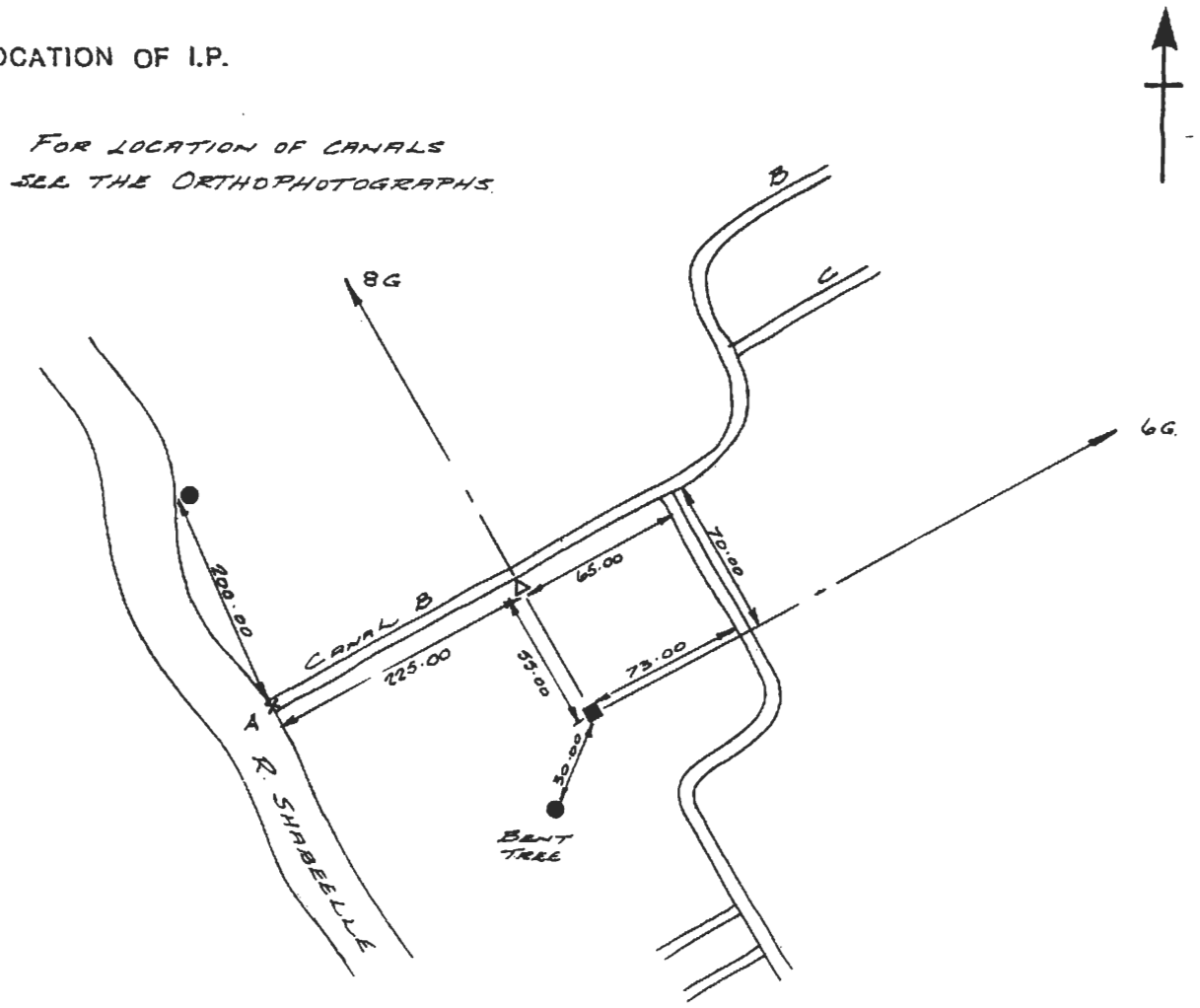
ELEVATION
Primary 65.30 m ■
Secondary 54.65 m △

LOCATION OF I.P.



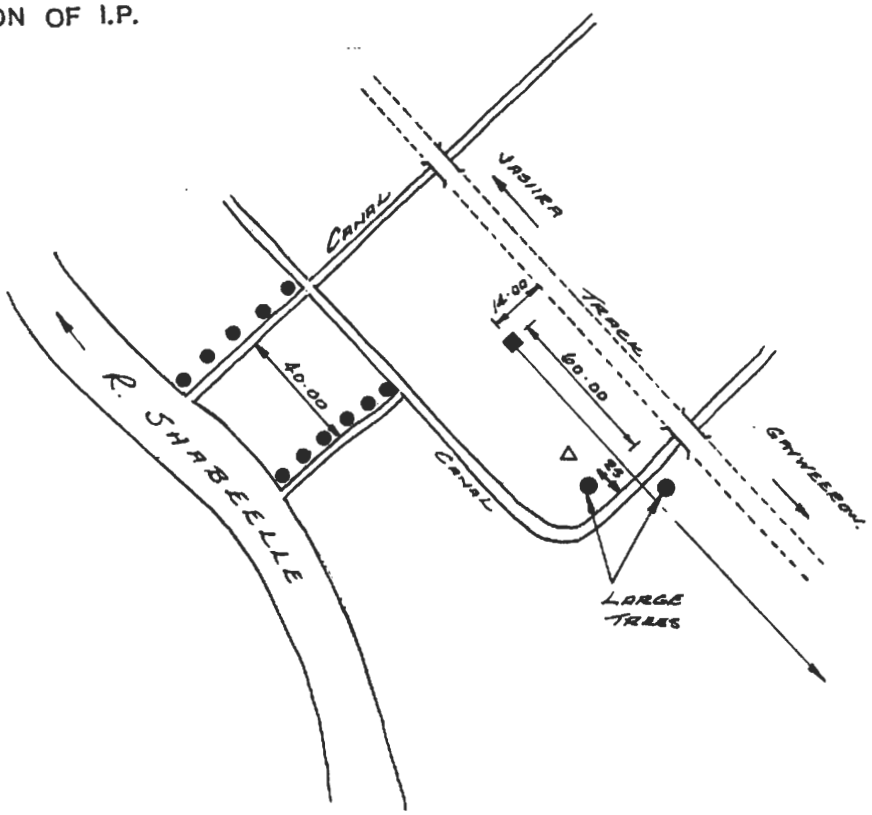
I.P. NUMBER	7G (fourth intersection point adjacent to Gayweerow, at km 5.425 on the branch canal).
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base.
SECONDARY B.M.	20 mm steel bar set 400 mm above mass concrete base in canal bank. Painted white.
ELEVATION	Primary 66.30 m ■ Secondary 67.17 m △

LOCATION OF I.P.



I.P. NUMBER	8 G (tail of Gayweerow branch canal)
PRIMARY B.M.	12 mm steel bar set 50 mm above mass concrete base.
SECONDARY B.M.	20 mm steel bar set 400 mm above mass concrete base. Painted white.
ELEVATION	Primary 66.43 m ■ Secondary 67.06 m △

LOCATION OF I.P.



APPENDIX E

Janaale - Buulo Mareerta Project Area

Datum 1963 Mean Sea Level Mogadishu

Register of Benchmarks

At Canal Intersection Points

Established Feb/March 1978

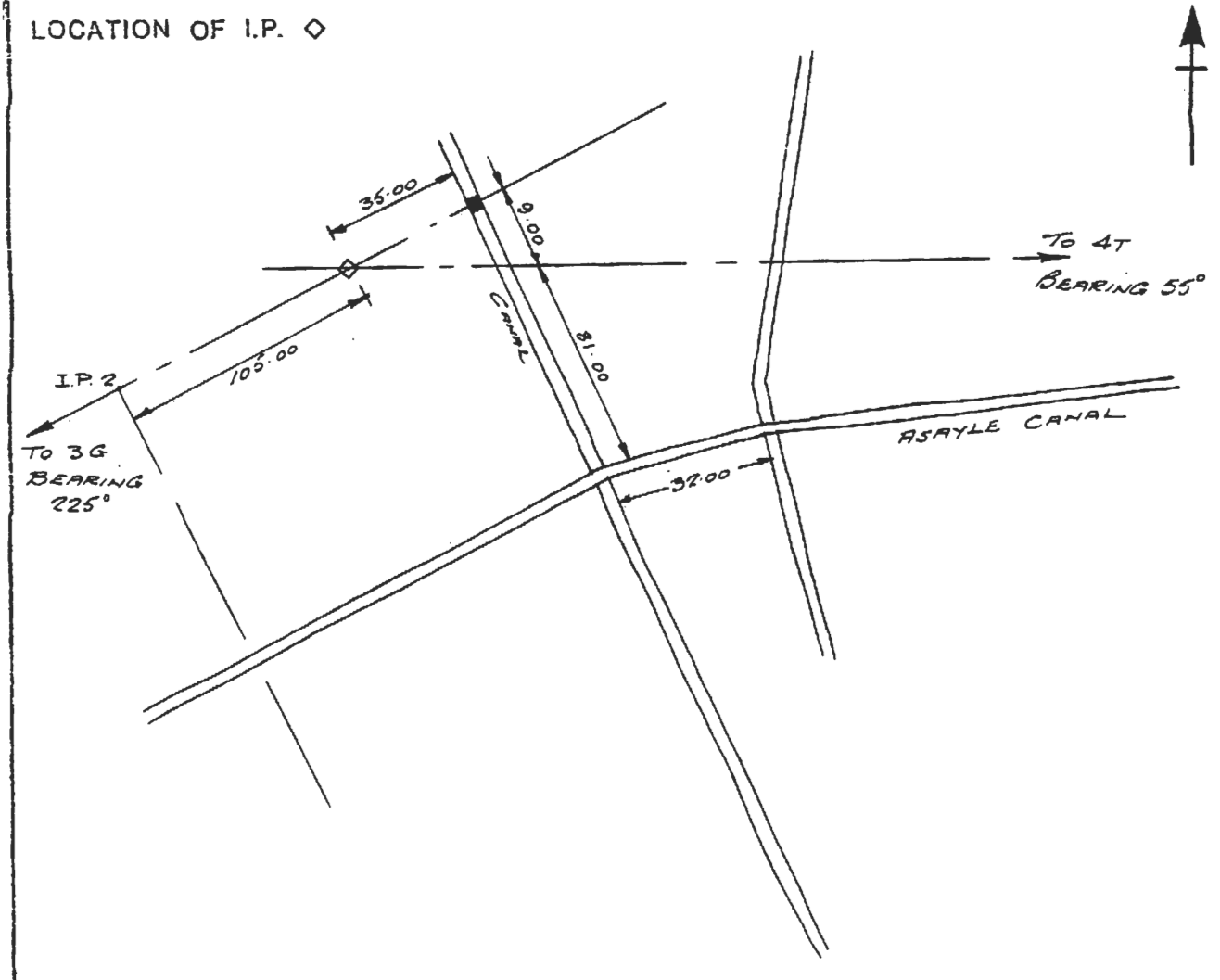
I.P. NUMBER 3 T (at km 0.105 on Tawakal branch canal)

PRIMARY B.M. 12 mm steel bar set 50 mm above mass concrete base. Set into bank top of minor canal. Location of intersection point is 35 m away on a bearing of 225°.

SECONDARY B.M. Not installed

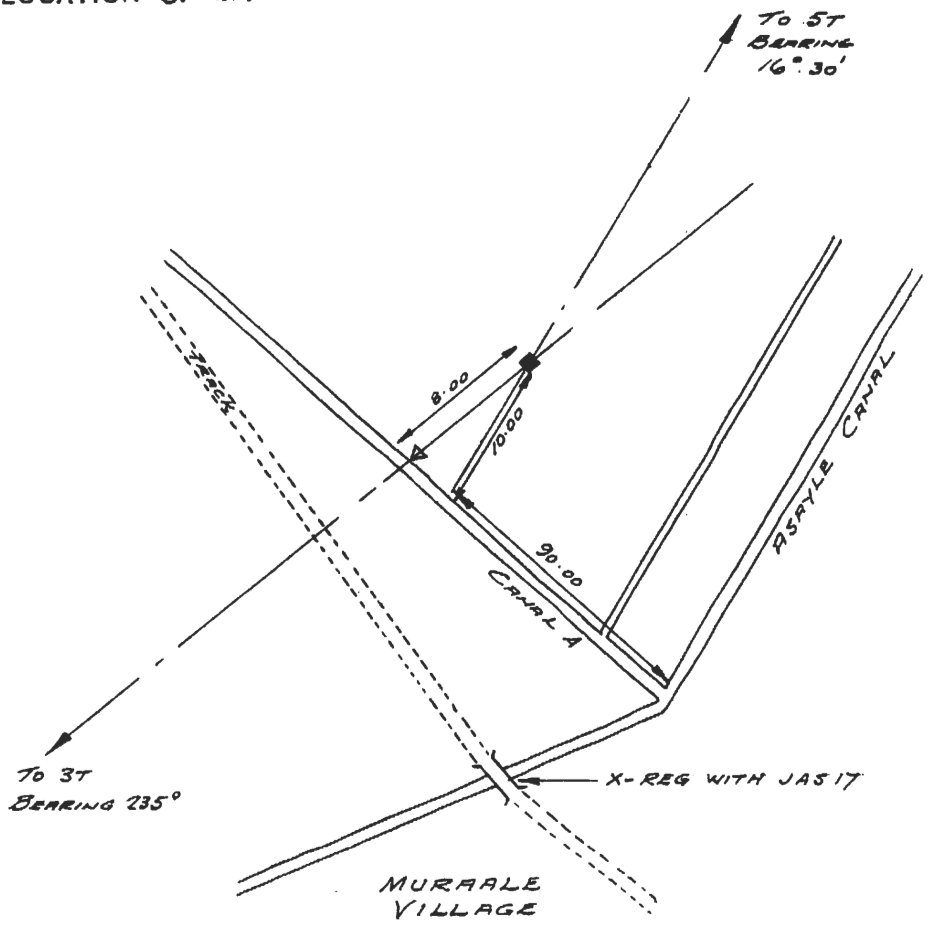
ELEVATION Primary 68.27 m ■

LOCATION OF I.P. ◇



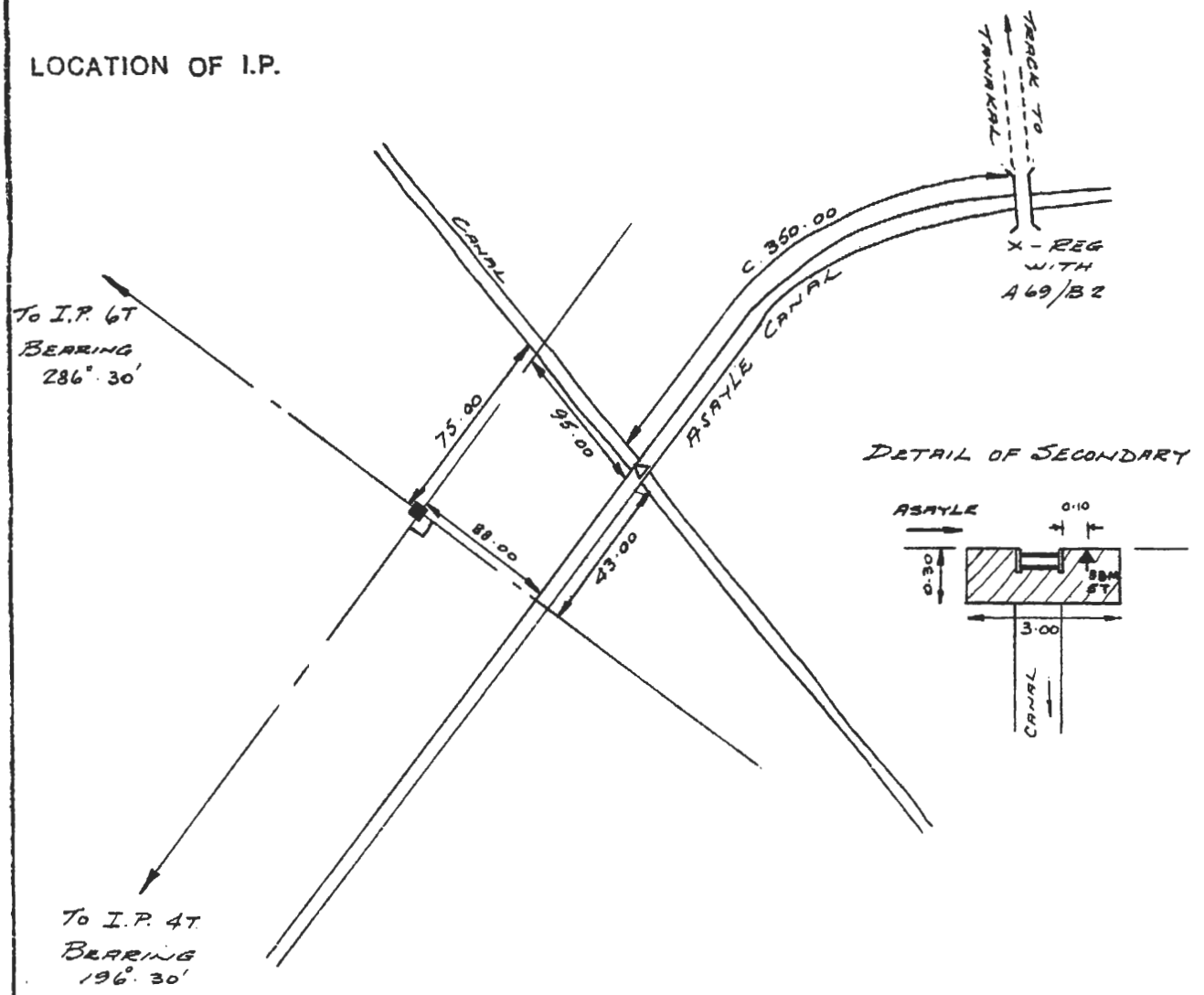
I.P. NUMBER	4T (Muraale - at km 2.805 on the Tawakal branch canal)	
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base.	
SECONDARY B.M.	20 mm steel bar set 400 mm above a mass concrete base. Painted white. Set in canal bank.	
ELEVATION	Primary	68.25 m ■
	Secondary	68.78 m △

LOCATION OF I.P.



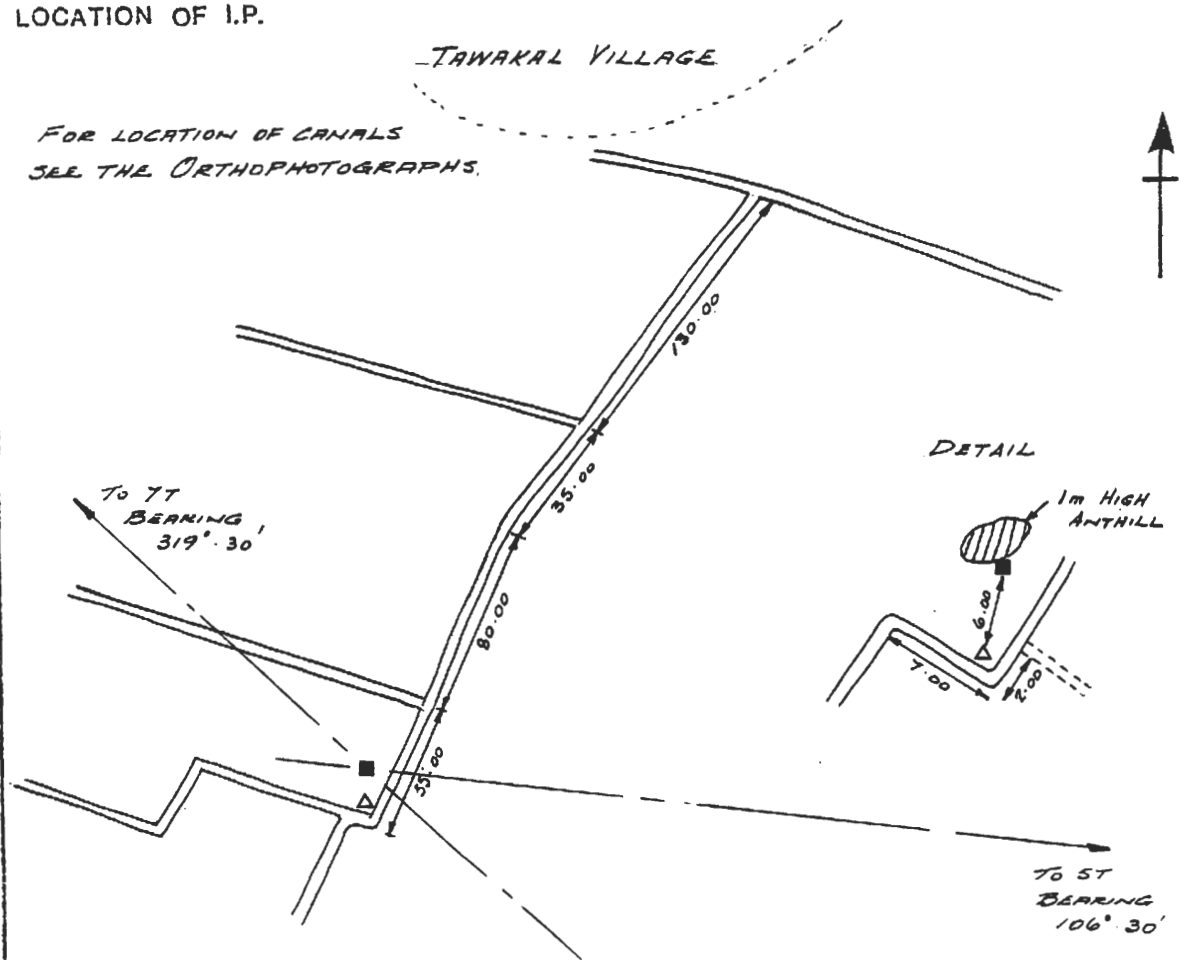
I.P. NUMBER	5T (intersection point for the right angled bend at km 5.785 on the Tawakal branch canal).
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base.
SECONDARY B.M.	Head regulator of the minor canal : a black arrow is painted on the top of the regulator on the upstream left hand side, 0.1 m from the edge of the gate.
ELEVATION	Primary 67.61 m ■ Secondary 69.30 m △

LOCATION OF I.P.



I.P. NUMBER	6T (intersection point close to Tawakal village at km 6.38 on the branch canal)
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base. Adjacent to a 1 m high ant hill.
SECONDARY B.M.	20 mm steel bar set 400 m above a mass concrete base. Located on a canal bank, 6 m away from the primary on a bearing of 172°. Painted white.
ELEVATION	Primary 66.63 m ■ Secondary 67.37 m △

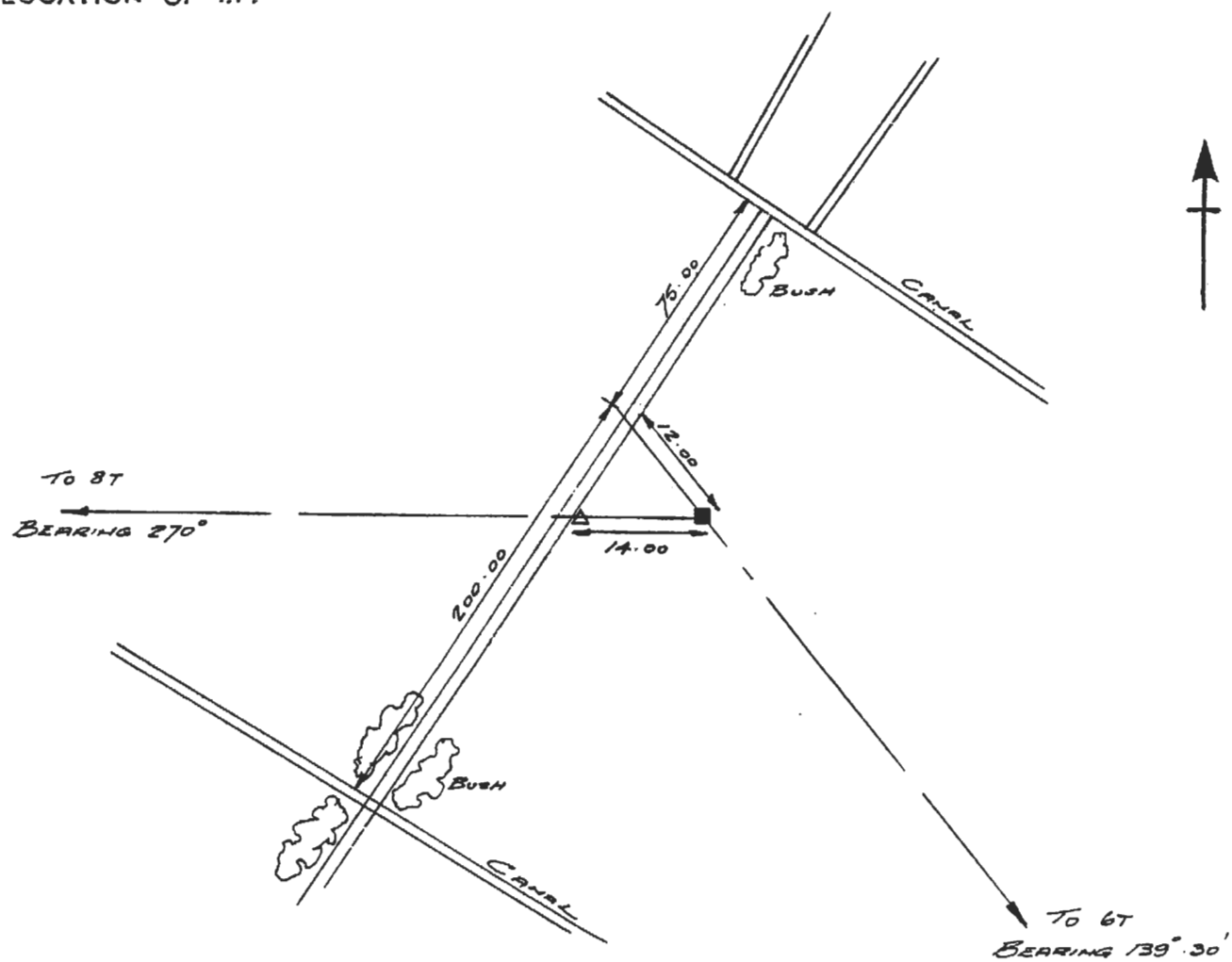
LOCATION OF I.P.



I.P. NUMBER	7 T (at km 8.475 on the Tawakal branch canal)
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base.
SECONDARY B.M.	20 mm steel bar set 400 mm above a mass concrete base in the canal bank. Positioned 14 m due west of primary. Painted white.

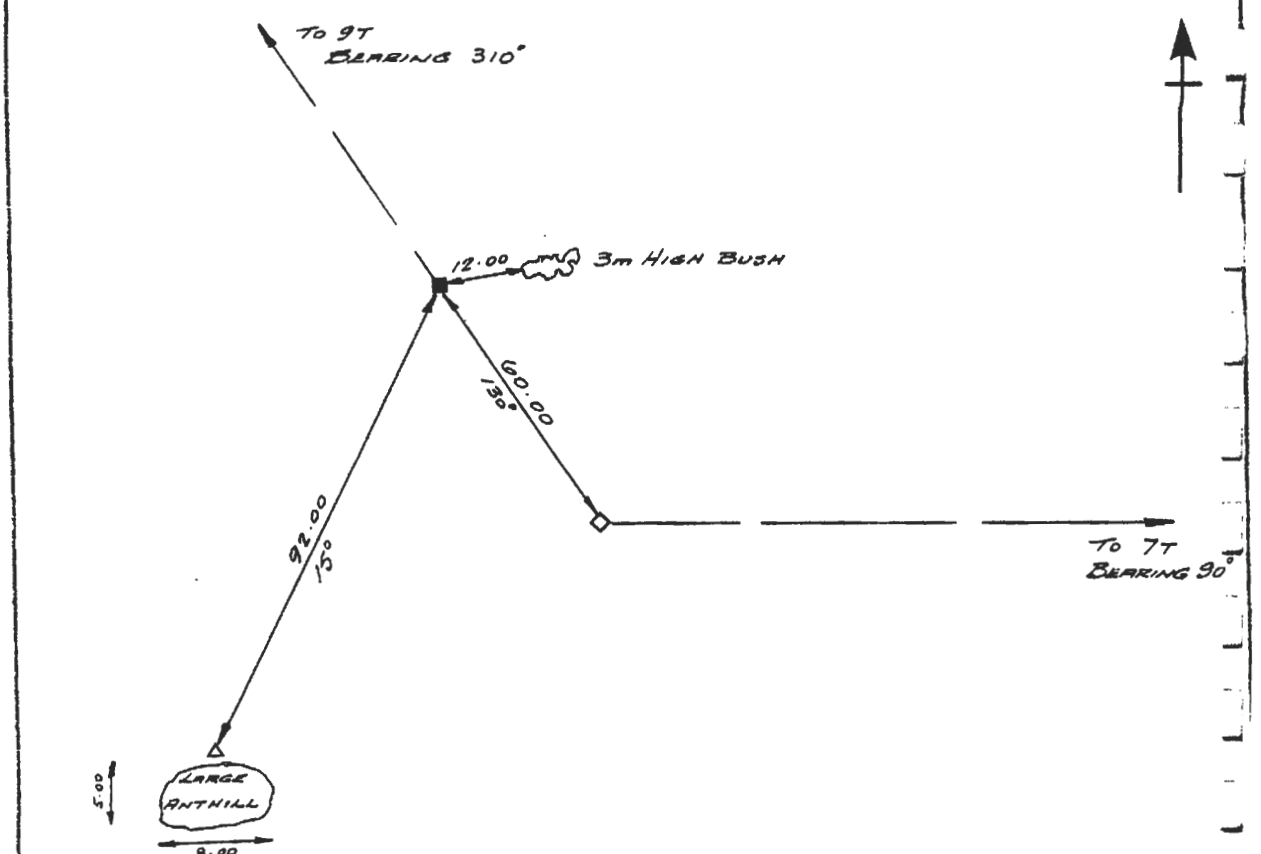
ELEVATION		
	Primary	66.15 m ■
	Secondary	66.77 m △

LOCATION OF I.P.



I.P. NUMBER	8 T (at km 9.62 on Tawakal branch canal)
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base. Actual intersection point is thought to be 60 m away on a bearing of 130°. This requires verification.
SECONDARY B.M.	20 mm steel bar set 400 mm above a mass concrete base. Placed on the side of a large 2 m high ant hill. Painted white.
ELEVATION	Primary 66.10 m ■
	Secondary 66.67 m △

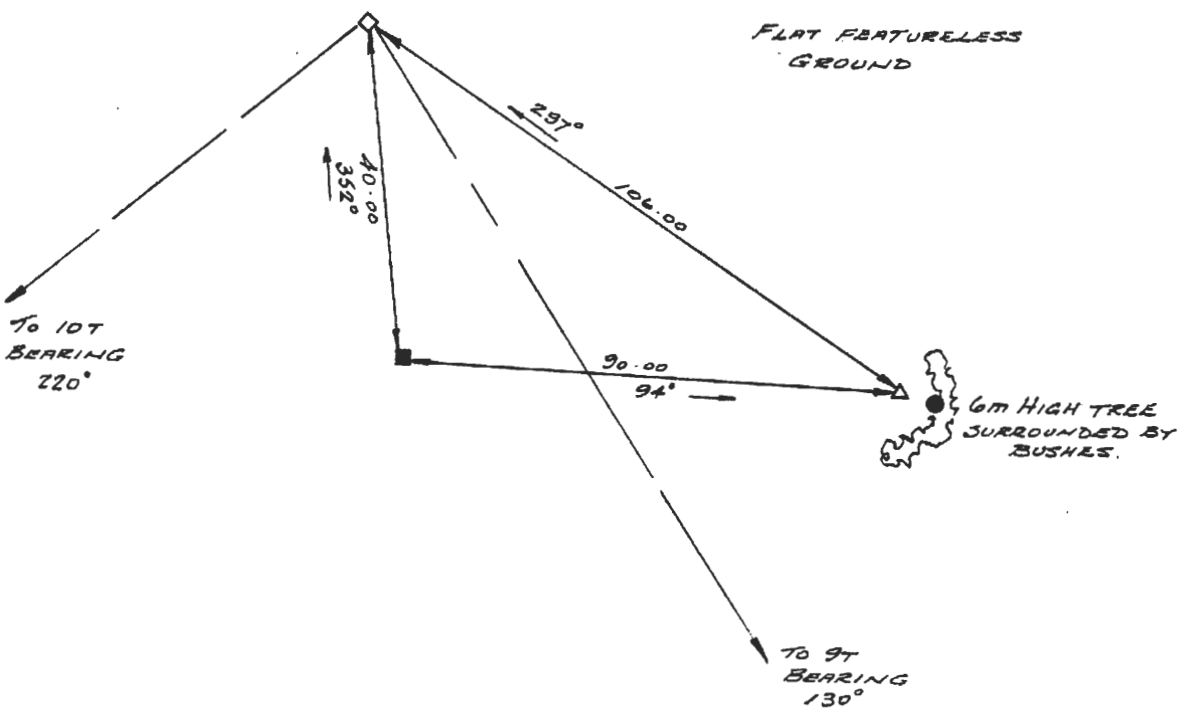
LOCATION OF I.P. ◇



I.P. NUMBER	9 T (at km 12.23 on the Tawakal branch canal)
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base. Actual intersection point is thought to be 40 m away on a bearing of 352°.
SECONDARY B.M.	20 mm steel bar set 400 mm above a mass concrete base. Adjacent to a 6 m high tree. Painted white.

ELEVATION	Primary	66.68 m ■
	Secondary	67.38 m △

LOCATION OF I.P. ◇



APPENDIX E

Janaale - Buulo Mareerta Project Area

Datum 1963 Mean Sea Level Mogadishu

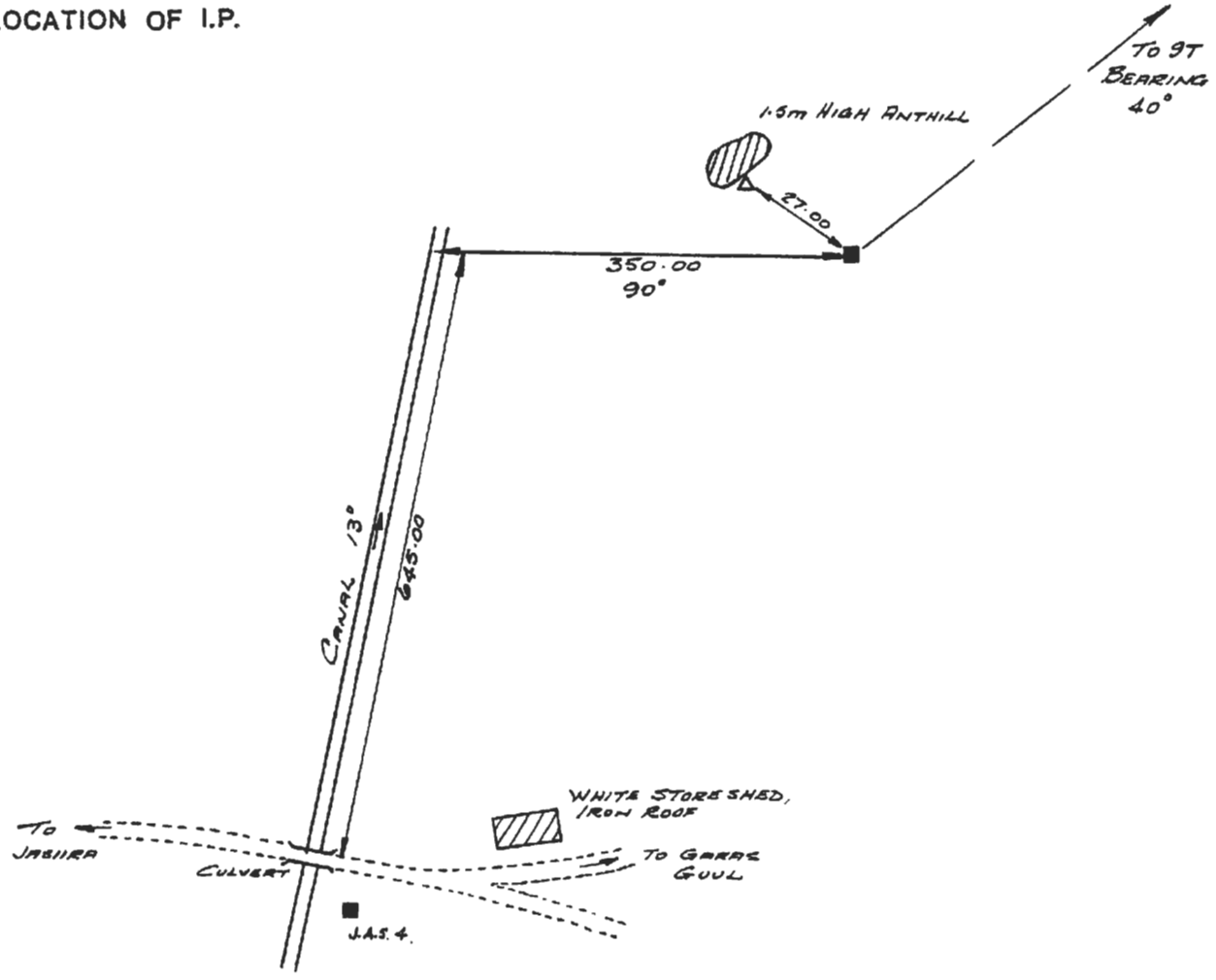
Register of Benchmarks

At Canal Intersection Poin

Established Feb/March 1978

I.P. NUMBER	10 T (tail of Tawakal branch canal at km. 13.365)
PRIMARY B.M.	12 mm steel bar set 50 mm above a mass concrete base.
SECONDARY B.M.	20 mm steel bar set 400 mm above a mass concrete base. Sited on the edge of a 1.5m high ant hill, 27 m away from the primary on a bearing of 335°. Painted white.
ELEVATION	Primary 65.80 m ■
	Secondary 66.65 m △

LOCATION OF I.P.



JAMHUURIYADDA DIMOQRAADIGA SOMAALIYA
WASAARADDA BEERAHA
SOMALI DEMOCRATIC REPUBLIC
MINISTRY OF AGRICULTURE

GENALE-BULO MARERTA PROJECT

ANNEX XI
Inception Report

SIR M MACDONALD & PARTNERS LIMITED
Consulting Engineers
Demeter House, Cambridge CB1 2RS, United Kingdom

JULY 1978

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SUMMARY

1. The present and proposed agricultural developments, both irrigated and rainfed, are much greater than the Study Team had anticipated.

2. Surface water supplies from the Shabeelle river are already in short supply, water will be a major constraint on irrigation development and some form of control in its allocation will be required. We should therefore like confirmation that the proposed projects listed in Appendix A of this report will all be implemented except for:

(a) Mahaddaay Weyn Rice Project
(b) Balcad Cotton Project - Stage 3

In addition we would like the extent of the settlement schemes downstream confirmed. Without guidance in respect of these proposed projects the water availability in the Study Area cannot be quantified. There is a possibility that the proposed size of the feasibility study area might need to be reduced due to insufficient surface/groundwater supplies.

3. The national objectives for the development effort in Somalia are defined in the 1974 -78 Development Programme as maximum growth, equitable income distribution, regionally balanced economic activity, maximum participation by Somalis and national self-reliance. The balance in emphasis between these objectives will be an important consideration when projects are being identified and formulated.

As our studies proceed and prospective projects are identified, we shall seek, in close consultation with the Government, to develop an appropriate balance.

4. A substantial proportion of the Study Area has been committed to on-going or planned projects. The Study Team will examine these projects in terms of their effects on the Master Plan but will accept their specifications in all respects.

5. One of the main tasks of the study has been to select an area of 5 000 hectares for the feasibility study.

During the preparation of this report the Team met His Excellency Major-General Hussein Kulmie Afrah, Vice-President of the Republic, who suggested that more than one area should be identified and that the Somali Government should make the final choice. The Team agreed with this approach and three areas were identified, one of which has since been eliminated. We shall now be pleased to be advised of the Government's choice.

6. The usual sequence of work in studies of this nature would provide for the selection of an area and the study of its feasibility to emerge rather later during the master planning process than is the case in the present undertaking. As a consequence we take the opportunity to point out that, as more extensive and detailed information is collected, further priority areas may be identified. Furthermore, we stress that the Master Plan may reveal other projects with a greater potential contribution to national objectives.

FOREWORD

1. Throughout the draft report and in future reports the 70 000 hectares (ha) area of the Master Plan will be referred to as the "Study Area" while the 5 000 ha area for the feasibility study will be referred to as the "Project Area".

2. A standard set of spellings of Somali place names has been derived and will be used throughout the studies. These spellings will be presented to the Client for rectification before the Final Report is prepared.

3. All units of measurement are according to the revised SI system. For the purposes of this Inception Report these units are expressed in conventional terms although in the Final Reports the full mathematical symbols may be used. For example, cubic metres per second are here expressed as m^3/s rather than as $m^3\ s^{-1}$.

CHAPTER 1

INTRODUCTION

1.1 The Setting of the Study Area

The Janaale - Buulo Mareerta Study Area lies between latitudes 1° 30' and 2° 00'N, some 100 kilometres (km) south-west of Mogadishu (Figure 1). It comprises a block of land of 70 000 ha lying on either side of the Shabeelle river. The area forms part of the lower section of the Shabeelle Flood Plain, a region which is characterised by level terrain, fine textured soils and a semi-arid climate under which rainfed cropping is unreliable. Nevertheless, it is highly suitable for irrigation and the region represents the major portion of the nation's potentially irrigable land.

Over the past 40 years several large irrigation schemes, including some extensive banana planations within the Study Area, have been developed along the Shabeelle Flood Plain, using water diverted from the river. However, in response to the Government's stated policy of increasing domestic food production the extent of land within the region which is either presently irrigated or proposed for future irrigation development has increased rapidly in recent years. The consequent rise in demand for water is placing severe strain on the supplies available from the Shabeelle particularly in the downstream sections of the river, where the Janaale - Buulo Mareerta area is located and where several new irrigation schemes are currently being proposed.

1.2 Objectives of the Study

The principal objectives of the Janaale - Buulo Mareerta Study, as presented in the Terms of Reference, are seen to comprise both an expansion of agricultural production by irrigation and the provision of a plan for the optimum development of agriculture in the area as a whole.

The first objective is to be achieved by the selection of an area of 5 000 ha and the execution of a feasibility study for irrigated agricultural development. This would be to a standard sufficient to meet the requirements of an international loan agency. The second objective would involve the preparation of a Master Plan for the 70 000 ha Study Area, to include recommendations on the optimum methods for integrating all existing and currently proposed developments as well as identifying possibilities for future agricultural development.

A period of 15 months, commencing May 1977, was allocated for the complete study. Under the Terms of Reference, the work was to be phased - Phase I comprising an initial appraisal of the Study Area and the selection of 5 000 ha for subsequent feasibility studies. The results of this phase are presented in this Inception Report. Phase II, scheduled to commence two months from the start date, is to embrace the feasibility studies of the 5 000 ha Project Area. Phase III is to comprise studies leading to the preparation of the Master Plan, commencing at the start of the project and running concurrently with the other phases.

CHAPTER 2

STUDY AREA

2.1 Location

The area demarcated for the study comprises a 70 000 ha block of land some 20 km by 40 km, bisected along its length by the Shabeelle river (Figure 2). The area is bounded in the south-west by the coastal sand dunes, while the Shabeelle Swamps and an abandoned river channel form natural boundaries in the south-west and north-west, respectively. The administrative boundary delimits the area in the north-east.

2.2 Climate and Hydrology

The climate is tropical semi-arid, with a mean annual precipitation of about 475 millimetres (mm) which falls mainly during the "gu" season (April to July) and the "der" season (October and November). Temperatures are uniform throughout the year, mean monthly maxima range from 29 to 34°C and minima from 21 to 24°C. Open water evaporation is estimated to be about 5 to 7 mm/d, with the highest values occurring during the hot, dry season from January to April.

The hydrology is dominated by the characteristics of the Shabeelle river, which has two annual high flow periods corresponding to the "gu" and "der" seasons. The latter is usually the larger because of heavy "der" rains in the Ethiopian catchment of the river. The nearest gauging station to the Study Area is at Awdheegle, 38 km upstream of Janaale where the maximum recorded discharge is 81 cubic metres per second (m^3/s). Nearly every year this figure is approached to within 3 or 4 m^3/s for periods of up to two months during the "der" season.

2.3 Soils and Land Suitability

The soils have already been mapped at reconnaissance level by FAO (1968) and detailed studies have been conducted for specific projects by Agroloni (1966), US AID (1964) and Citaco (1974).

Throughout the area the soil parent material comprises fine textured alluvium of the Shabeelle Flood Plain. The soils, which are classed as Vertisols, are very uniform in morphological characteristics, being dark brown to dark reddish brown, clay textured and having moderately well drained and deep profiles. In the dry state vertical cracks develop and a friable mulch forms at the surface. A small area of hydromorphic soils occurs in the extreme south-west, bordering the depressional area of the Shabeelle Swamps.

The soils are reported to contain relatively high levels of calcium carbonate and have a moderately alkaline reaction (pH 7.2 to 7.8). Calcium is the dominant exchangeable cation and there is no apparent sodium hazard. Salinity levels are varied but usually increase down the profile. Analyses of 95 samples collected within the Study Area by FAO (1968) show the mean electrical conductivity (EC_e) to be 3.54 micromhos per centimetre (mmhos/cm) (SE = 0.19), with individual values of up to 9.0 mmhos/cm, indicating a potential salinity hazard. Similar salinity levels can be inferred from the Citaco (1974) study.

The previous reports (FAO, 1968; Citaco, 1974) quote moderate to moderately slow hydraulic conductivity rates (2.2 to 82.0 millimetres per hour (mm/h)) but experience on the established irrigation schemes suggests that there has been sufficient leaching via deep seepage to prevent an adverse accumulation of salts. In the dry state, water intake rates into the soil are satisfactory, apparently aided by the cracking network of the soil. Citaco (1974) report relatively fast terminal infiltration rates for 12 tests (mean 72 mm/h, SE = 6.90).

The terrain is uniformly flat with elevations ranging from about 70 metres (m) above sea level along the river to 64 m along the margins of the Study Area. Shallow abandoned river channels run through the south-east of the area, parallel to the present course of the Shabeelle.

According to FAO (1968) some 90 per cent of the land is suitable for irrigation, the remainder being only marginally suitable due to limitations of irrigation water command and predicted soil salinity. However, the implications of the current expansion of the irrigated area and the associated strain on water supplies, need to be assessed in relation to the possibility of salt accumulation in the soil and the future need for sub-surface drainage.

2.4 Agriculture

Present Land Use

Four main categories of land use occur (Figure 2), ranging from open savanna woodland to intensive irrigated agriculture. Some 80 per cent of the area is under arable crops (Table 2.1).

(i) Open woodland - consists of uncultivated open savanna scrub and woodland vegetation. The area affords extensive grazing and browsing for livestock.

(ii) Low scrub and rainfed agriculture - includes areas of low scrub and abandoned farmland as well as scattered areas of poor rainfed crop production. It is used for grazing and browsing of cattle, sheep and goats.

(iii) Irrigated annual crops - the dominant land use in the area. In the "gu" season maize occupies over 90 per cent of the cropped area, generally interplanted with small areas of groundnuts, green grams, cow peas and pumpkins. Sesame, (maize and legumes) are the major crops grown during the "der" season. This irrigated agriculture is predominantly practised by smallholders, but some 3 000 ha are cultivated on Government owned or private farms, co-operatives and under Crash Programmes.

(iv) Irrigated perennial crops - banana production occupies about 80 per cent of the land in this category. There are 53 production units, operated as private, co-operative and Government farms. The remainder comprises small production units of grapefruit, coconuts, mangoes, papaya and limes.

TABLE 2.1

Present Land Use

Class	Gross area (ha)	(%)	Net cultivated area (ha)
Open woodland	14 500	20.7	-
Low scrub and rainfed agriculture	13 000	18.6	2 500
Irrigated annual crops	37 000	52.9	24 000
Irrigated perennial crops	5 500	7.8	4 400
TOTAL	70 000	100.0	30 900

Note: Provisional estimates derived from field observations and 1962 aerial photographs.

Agricultural Development

(i) Crops

Apart from banana production little of the irrigated crop production receives any form of improved management. Nevertheless, several projects and schemes recently have been established or are being planned (Figure 3) in order to increase agricultural output.

(a) Perennial Crops

A grapefruit production scheme, financed by the European Development Fund (EDF), will start planting an initial 230 ha of budded seedlings in 1978, with a total of 1 385 ha planned for establishment by 1982 (Citaco, 1974). Recently, the Government has introduced financial incentives to revitalise declining banana production: the National Banana Board has established a large seedling nursery and is developing a further 650 ha plantation. However, because of deficient dry season water supplies, expansion of perennial crops is being officially discouraged.

(b) Annual Crops

The major development proposal for improving production of annual crops is a 5 000 ha State Planning Commission project. It is intended to produce 3 000 ha of rice and 500 ha of maize during the "gu" season with 4 500 ha of

sesame and rice during the "der" season. In addition, 39 co-operatives, two Crash Programmes and several Government farms have been, or soon will be, established.

Several research projects, carried out at Afgooye since 1965, have indicated a high potential for improvement of a range of crops including maize, upland rice, groundnuts, tomatoes and pulses. However, bird damage, particularly that caused by quelea to rice and by other species of weaver bird, weeds and other pests are agronomic problems requiring immediate attention.

(ii) Livestock

Large numbers of cattle, sheep and goats are grazed and watered in the Study Area. In the Lower Shabeelle region as a whole it is estimated that there are some 300 000 head of cattle or more than ten per cent of the population of the country as a whole.

There is a large demand for meat and milk and crop by-products (sesame cake, cereal straw, banana leaves and stems are freely available). Tsetse fly is known to occur in the area.

(iii) Forestry

The intensity of agricultural activity, both cropping and livestock, and the relatively high population density have resulted in the removal of large areas of former woodland. Firewood and charcoal are scarce commodities. However, the presence of successfully growing stands of pine and eucalyptus, planted during the initial period of Italian settlement, indicates that there is a potential for integrating tree planting with the irrigation developments to provide a supply of timber and firewood as well as affording windbreaks against the prevailing high winds. A major limitation to any expansion of tree planting could be the risk of the spread of tsetse.

2.5 Water Supply and Distribution

Land under controlled irrigation on the Shabeelle at present has a total annual water requirement including losses due to seepage and spillage of about 870 million cubic metres (Mm^3). This represents 63 per cent of the "three years out of four" annual river flow at Mahaddaay Weyn of 1 390 Mm^3. Nevertheless, even with this total river discharge, periods of water shortage may occur; for example in 1973 total flow amounted to 1 390 Mm^3 but during March and December the discharges were only 8 and 22 Mm^3 respectively. During these months the present water requirements are 50 and 90 Mm^3 respectively, the deficit being partly met by the use of groundwater but the remainder representing a water

shortage. This situation will be partially alleviated by the operation of the Jowhar offstream storage reservoir but any expansion of the irrigated area is likely to encounter serious shortages unless strict water budgeting is enforced.

The Study Area itself relies on the river barrages at Janaale, Qoryooley and Falkeerow to gravity feed the main canals. Offtakes from these or secondary canals are either by gravity or by pumping.

The system generally operates poorly for the following major reasons:

(i) Excessive command of the main canals (especially the Wadajir) causes seepage water to pond on the surrounding land.

(ii) Secondary canals, where constructed, are too widely spaced and large areas cannot be effectively irrigated. This applies especially to the area between the Wadajir and Bokore canals.

(iii) Water control equipment on barrages, regulators and offtake structures is badly maintained and often inoperable.

(iv) There is a shortage of trained staff to undertake water control management.

Supplementing the water supply from the canals in the Study Area are 78 irrigation tubewells and 150 small on-farm storage reservoirs (Hunting Technical Services Limited, 1969).

In Table 2.2 and Appendix A we have summarised the existing and proposed developments known to us, including those being constructed along the River Shabeelle. The most obvious feature is that the proposed developments, including those being constructed at present, will increase the area under irrigation by 60 per cent. Whilst most of the proposals are for seasonal crops as opposed to perennial crops it is clear that the water shortage is going to be exacerbated. This would be relieved to a small extent by the construction of a new offstream storage reservoir at Duduble.

TABLE 2.2

Existing and Proposed Controlled Irrigation on the Shabeelle River

Type of irrigation		Approximate cultivated area (ha x 1 000)			
		Gross		Net	
Existing					
	Seasonal	49.5		34.3	
	Perennial	14.0		11.2	
	Sub-total	63.5	63.5	45.5	45.5
Proposed					
	Seasonal	37.7		26.9	
	Perennial	3.7		2.8	
	Sub-total	41.4	41.4	29.7	29.7
Total			104.9		75.2

Appendix A gives all the proposed developments on the Shabeelle river which we have been able to establish but all may not be implemented. In view of this uncertainty we intend to base our analysis on the following assumptions:-

(i) The Crash Programme for 2 000 ha of rice at Mahaddaay Weyn will not proceed.

(ii) The final phase of the Balcad cotton scheme (4 000 ha) will not proceed.

(iii) The size of the settlement schemes at Kurtenwaarey and Sablaale may be reduced in the light of water availability following the Master Plan.

We shall consider the case without Duduble offstream storage reservoir but would consider its effects if the findings of a proposed study become available.

To permit the progress of the studies it is essential that we have confirmation that the assumptions made above are correct. We would also need to be advised of the capacity of the proposed Duduble reservoir and the estimated completion date.

2.6 Social and Economic Aspects

Physical infrastructure, the marketing system and population growth are all important factors in identifying appropriate development strategies and projects. Their importance lies in their impact within the Study Area compared with that elsewhere in Somalia.

Although the availability of marketing facilities and the quality of infrastructure are limited throughout Somalia, the Study Area appears to be better served than the rest of the country.

It also enjoys notable advantages of proximity to irrigation water and ready access to the Mogadishu markets. It does not seem likely that any production possibility will be eliminated on the grounds of these factors.

Ready access to the waters of the Shabeelle represents a prime advantage over most other parts of the country. The availability of irrigation water confers on the area a wider range of production possibilities and creates the opportunity to introduce high value crops for export and for import substitution. However, the area is susceptible to unfair competition for irrigation water from upstream projects, a disadvantage which can be overcome only by concerted action to allocate equitable water rights among projects and to ensure control of these rights in practice. This need for rational water allocation was a major conclusion in a report on the control and management of the water resources of the Shabeelle river (Hunting Technical Services Limited, 1969).

The Study Area is linked by paved road to Mogadishu and also has a low standard but effective internal road network which give it important locational and competitive advantages over other areas. First, Mogadishu represents the nation's largest market segment and hence the prime market target for food crops grown for import substitution or for expanding domestic demand. Secondly, the capital represents the major centre for the country's import/export trade. Thirdly, the movement of personnel required for development projects is facilitated.

The area is inadequately supplied with institutional support including agricultural extension services, co-operative management, farmer credit and on-farm inputs but probably to no greater degree than other parts of Somalia. Moreover, the Government has made and is currently making progress towards building up these institutional capabilities.

Preliminary observations indicate that the population of the area is much greater than had been anticipated prior to the commencement of the study. The implications of a large population are highly significant; in particular it strengthens the prospects for autonomous agricultural development, in the absence of specific Government initiatives and may thus downgrade the potential for major new land projects. Population size and character will be an important consideration in the future studies as it is essential that they be properly enumerated and the implications of proposed developments for the people be rightly considered.

CHAPTER 3

MASTER PLAN

3.1 Requirements for Master Plan

Preliminary consideration has been given by the Team during the first weeks of its task to the broad structure and needs of the Master Plan.

The requirements for the Master Plan are best considered in terms of the apparent intense competition for extremely limited productive resources within the area. In view of these limits it is essential that the resources be deployed in that manner which contributes most to the development effort of the area and the nation.

The Master Plan will follow a conventional resource allocation approach, involving the following steps:

Definition of national objectives which the Master Plan seeks to serve

Identification of resources and constraints on their use

Definition of production possibilities

Identification and planning of potential projects

Quantification of costs and benefits of projects

Ranking of projects in order of priority.

In practice, the usual aim of resource allocation is to maximise the return to the scarcest resource, that is, that resource which will be exhausted first as successive priority projects are implemented. In this case the scarcest resource will probably be irrigation water unless significant reserves of accessible groundwater can be found. One of the purposes of the field investigations will be to assess resource availability and identify resulting constraints on development.

National Objectives

The national objectives which the development project being considered here may serve, will include:

Maximising resource utilisation in the production of both commodities and services and ensuring continued growth.

Creating conditions where the national product is distributed equitably among the people.

Decentralising socio-political administration of the country in the regions and districts to enable socio-economic development in the country to take place in a regionally balanced manner.

Organising economic activities on a basis where the means of production are owned and operated by and in the interest of society as a whole and also through that process involve as many people as possible in decisions regarding investment, production, employment and income distribution.

Mobilising and utilising internal resources including the labour force to the maximum.

Creating co-operative movement in line with the socio-economic requirements and political philosophy of the country.

Since some of these objectives are complementary and some competitive, a balance must be struck in the extent to which individual objectives can be met.

The Master Plan will focus its attention upon the competition among objectives and resources in order to derive a realistic ranking of priorities in resource utilisation so as to obtain an appropriate balance between objectives. Whilst some of the aspects of competition for resources can be localised to the Study Area others are regional and national and there is a large degree of overlap. In addition some elements of the competition for resources are international in character.

The Master Plan aims to devise a rational system for allocating water and land among competing users and to maximise the Study Area's contribution to national objectives. The allocation of resources will attempt to satisfy these objectives in terms of effectiveness of irrigation water. For example, if the objective of maximising the creation of occupational opportunities takes precedence, then as a general rule it will be preferable to develop new lands rather than upgrade existing lands. If the objective of maximising food production or securing food supplies takes priority, then grain crops should be promoted in preference to cash crops for export. If the objective is to minimise capital costs of a new project without regard to potential benefits, then remodelling will be preferred to new works. These examples are illustrative only, however, and careful analysis is required before definite conclusions can be drawn on the likely outcome of different courses of development.

The Competition for Resources

The prime competition for resources will be for irrigation water and land. These resources are severely limited and subject to intense competition. In common with the rest of Somalia, skilled manpower resources are also in short supply.

Water is sought by several competing projects which are in production, being implemented or in preparation. Each of these will require part of the limited irrigation water resource. A report on production possibilities for the Shabeelle river (Hunting Technical Services, 1969) concluded:

> "...unless a management plan is devised for the river with an Irrigation Section capable of supervising and enforcing the fair allocation of water on a priority basis, then the planning of any future development along the river cannot be contemplated."

The report further concluded that indiscriminate development would, in times of shortage, seriously inconvenience those schemes furthest downstream, i.e. in the Janaale - Buulo Mareerta area. The World Bank (1973) strongly endorsed these views.

An important corollary of the competition for resources is the possible complementarity to cropping of other enterprises including livestock and forestry. This factor should be considered since, for example, some areas not readily suited to irrigation and cropping may be suited to silviculture to serve Somalia's demand for timber. Another possibility is the integration of livestock production with cropping, for example, by grazing under tree crops or by producing forage crops.

3.2 Proposed Approach

The approach to the Master Plan involves a systematic examination of the resources available and the constraints to their utilisation with a view to ordering a set of priority projects for implementation; appropriate policies and measures for implementation of the priority projects are to be developed. Seven identifiable phases in the approach to the approach to the Master Plan are described below.

Present Land Use Classification

As a starting point a present land use classification will be established to serve as the basis from which alternative development projects can be evaluated in terms of costs of development, potential benefits and contribution to national objectives.

Although it is premature to specify the appropriate land use classes which will be used, a first classification might be:-

Currently Uncultivated	Currently Cultivated
Savanna	Rainfed annual crops
Scrub woodland	Irrigated annual crops
Cleared or grassland	Irrigated perennial crops

In addition to this classification by land use it will be necessary to take account of the tenure system under which land is held and by its long term commitment to certain projects.

The land tenure system and its implications for development must be appreciated when determining appropriate settlement patterns, labour intensity of production and management structures for the crop options.

The range of existing and planned projects in the Study Area includes some, notably grapefruit, in which land is committed for a long time and some, for example grains, in which the crop can be changed from season to season. In addition to commitment by crop, land is also institutionally committed to some projects whose effect upon the land resource is significant and which must be considered in developing recommendations for land use.

As a result, we have concluded that it would be essential to consider all existing and proposed projects as fixed. Accordingly, in the Master Plan, development proposals relating to such "fixed" projects will be limited to those which will accord with or reinforce the effectiveness of those projects as already designed.

Selection of Enterprises

The selection of suitable enterprises for development will follow a detailed investigation of all factors which define production possibilities and may affect the viability of enterprises. These factors will include:

(i) land characteristics

(ii) agronomy and ecology

(iii) water availability and quality

(iv) infrastructure

(v) policy objectives

(vi) markets.

The likely market prospects for crops whose production possibilities have been proven will be an important part of the selection of prospective enterprises. The market available to producers can be considered in three segments: the international export market, the domestic market for import substitution and the domestic market to satisfy expanding and diversifying demands. There is limited availability of markets for the output of the Study Area and this may impose a constraint upon the viability of certain enterprises.

The international market is theoretically so large that regions within Somalia face highly inelastic demand curves and can produce and sell virtually unlimited quantities of commodities for export. In practice, constraints of access, knowledge and competitiveness define a very narrow range of export opportunities and several market reviews have all concluded that immediate prospects for export of Somali agricultural commodities are restricted to citrus fruits in Europe and to bananas, livestock, fruit juices and fruits in the Middle East.

Prospects for import substitution are principally rice, other grains and vegetable oils. These markets are limited in size however, and any new project would experience competition from projects currently being planned or implemented.

The prospects for expansion and diversification of the domestic market are not great. Effective demand is limited by low participation rates and by low incomes; these factors act as a severe constraint upon the introduction of new products. There are, however, a number of prospects which bear close examination; these include groundnuts, pulses, some fruits and vegetables.

Specification of Development Options

This phase involves identifying the different types of development which can be introduced for each present land use classification. The potential desirability of each type of development can then be assessed in terms of expected benefits and costs.

The output of each land use class can be increased by construction of physical infrastructure and irrigation works to service the implementation of agricultural development projects. Each development involves changing the intensity of application of inputs, notably irrigation water, and it is in terms of varying water usage that the significance of developments becomes apparent. Irrigated perennial crops are the most intensive users of water and uncultivated lands the least intensive. Hence, in view of the limited supply of water, it is important to measure the implications of development on each land use class.

The available options include the application of irrigation water to now uncultivated areas, the upgrading of rainfed cropping land to irrigation for annual or perennial crops and the upgrading of currently irrigated annual crops to perennial crops. A further possibility is to reduce the intensity of water application, as by taking land out of production of perennial crops, to use the water so released to support larger areas of annual cropping.

Apart from the development opportunities which appear to exist for crop production, preliminary field work suggests that production of livestock products and livestock feeds may be increased and intensified. The natural pasture of both the cultivated flood plain and the surrounding bush savanna is considered to be of sufficient quality to respond to improved management. Research has indicated potentially high productivity of several forage legumes under irrigation (Central Agricultural Research Station 1965 - 1972). In view of the large demand for meat and milk and the availability of crop by-products for supplementary feed (sesame cake, cereal straw, banana stalks) some form of livestock development should be considered. This could be either confined to the Study Area or integrated with improved rangeland management in adjacent areas. The selective bush clearance which would be required to encourage range pasture would also assist in the control of tsetse fly, which exists locally in the area. Finally evidence suggests that there are possibilities for developing a tree planting programme to provide windbreaks, fuel and building materials.

In examining the effects of a proposed development, account must be taken of all its effects upon both the area under consideration and elsewhere. In particular, any intensification of water usage may involve lowering water availability to other projects to the extent where production will decline and these losses must be charged as a cost to the project.

Management Structure

The management structure for a major development project is an integral part of both a feasibility study and a development plan. Care must be taken in choosing the most appropriate one.

Some examples are listed below. We shall give consideration to those most suited to development of the Study Area, in consultation with the appropriate authorities.

Project development & irrigation management	Field production	Processing & marketing
Government agency	State farm	State agency
Joint venture	Joint venture	Joint venture
Co-operative	Co-operative	Co-operative
	Smallholders	Individuals
	Nucleus estate	Nucleus estate

The nucleus estate is a concept, previously untried in Somalia, which might prove relevant to its agricultural needs. The principle of the nucleus estate is that a central organisation operates a large area of land with the enterprises involved, together with processing and marketing facilities. The nucleus estate then makes available farm inputs, extension services, processing facilities and markets to small farmers beyond the periphery of the nucleus estate, to support their own efforts.

Appraisal

The appraisal of the options is to be conducted using conventional project evaluation techniques. For each option of developing a land use class, the costs of development and operation for each crop are first calculated. The incremental benefits of each option are then calculated making due allowance for the "without" project situation and the likely level of autonomous development which would have occurred.

The two elements of the appraisal are then compared using discounted cash flow techniques.

Project Plans

The discount cash flow analysis indicates an order of priorities for development of each land use class identified. The first priority, with the highest return, will be recommended for implementation until the supply of the scarcest resource, irrigation water, is exhausted. Should water be available after this land use class is fully developed, then the second priority land use class should be developed and so on until all irrigation water is used.

Beyond the recommendations for irrigation, the Master Plan will identify the prospects for development of rainfed agriculture and for other land use including timber plantations and the integration of livestock into the cropping pattern.

Policy Recommendations

In addition to ordering a set of priorities for land use and project development, the Master Plan must also recommend appropriate actions to ensure effective implementation including:

Water allocation measures

Enforcement of water allocation decisions

Land development methods

Irrigation systems management

Institutional requirements.

These and possibly others will depend upon the results of the field investigation and data analysis after discussion with all concerned parties.

CHAPTER 4

THE PROJECT AREA

4.1 Criteria of Selection

The approach proposed for preparing the Master Plan (Chapter 3), requires the following criteria to be used for selection of a 5 000 ha Project Area.

Soil Suitability

If the apparent overall uniformity of the soils and the reported suitability of all but minor parts of the area for irrigation are substantiated, this criterion will not be a major determinant for the selection of the Project Area. However, differences in soil characteristics such as salinity and drainability are likely to assume greater importance during detailed planning.

Water Availability and Quality

The present and future availability and security of supply of water is a major factor to be considered when selecting the area, especially in view of the currently proposed developments both upstream and downstream. The quality of the water, in terms of salinity or sediment load, is unlikely to affect the area selection. The availability of groundwater as a supplementary source of irrigation water could affect the choice of area. As the Shabeelle water supplies are becoming critical, the choice should be guided by the need to produce maximum returns per unit of water because there is a distinct possibility that there will prove to be insufficient water to irrigate an additional 5 000 ha. In such circumstances the area would have to be reduced.

Infrastructure

The main Mogadishu - Kismayo highway passes through the Study Area, affording an all-weather tarmac road link to the capital and to the port of Marka. Most of the main centres of population, namely Janaale, Golweyn, Buulo Mareerta and Shalambood, lie to the south-east of the river, either adjacent to the main highway or linked to it by gravel or tarmac roads. Four permanent river crossings link the right bank villages of Qoryooley, Gayweerow and Falkeerow to the principal road network of the left bank. In terms of basic infrastructure, as represented by roads, the Study Area is well served; few areas are more than 8 km from an all-weather road. Consequently, accessibility is unlikely to be a significant factor in selecting the Project Area.

Topography

The area for the feasibility study should, if possible, be chosen so that it can be irrigated by gravity. Observations to date indicate that a drainage system will be required and it is preferable to drain the area by gravity. In addition the land slope in the area should be such that surface irrigation methods may be easily implemented with minimal land levelling. Slopes appear to be even throughout most of the region apart from some localities adjacent to former river channels.

Flood Protection

The Shabeelle river is prone to overtopping its banks and consequently the location of the feasibility study area should be chosen so as to minimise flood protection works. However, no particular locality has any advantage in this respect.

Present Land Use

Nearly 80 per cent of the land is currently cultivated and some 60 per cent is already under irrigation (Figure 2). In addition extensive areas are scheduled for implementation in the near future (Figure 3).

Even before these schemes are implemented there are signs of water shortage in the Study Area. Therefore any further expansion of irrigation on to new land would exacerbate this current shortage and could lead to inadequate supplies not only for the new land but also for the existing irrigated areas.

Evidently, the choice of whether the Project Area should be located on currently uncultivated, rainfed or irrigated land must depend on an evaluation of the technical feasibility and benefits of each change of land use, especially the implications for water availability.

In view of the apparent shortage of water, it is considered that at this stage no further irrigation should be recommended for currently uncultivated lands. In addition, the relatively high costs which could be involved in bush clearance and land levelling are also considered to preclude use of this land. The selection of a site for the Project Area therefore broadly depends on a choice between irrigating currently rainfed crop areas, or upgrading and remodelling existing irrigation or a combination of each.

The areas of rainfed cropping occur mainly as narrow zones fringing the outer limits of the irrigated areas and are usually remote from the river. Therefore, to upgrade the rainfed crop land by irrigation would necessitate the development of several new areas, each with its own canal and offtake from the river, in order to achieve a total area of 5 000 ha. As these new canals would pass through existing irrigated lands it would be preferable to remodel and upgrade these intervening areas and include them within the scope of the feasibility studies; the Project Area could therefore comprise both rainfed and irrigated crop areas. The development of solely rainfed cropped areas should not be considered at this stage.

The remaining choice lies between remodelling and upgrading in an area of irrigated perennial crops or in one of irrigated annual crops. The areas of perennial crops are devoted, almost exclusively, to bananas and lie mainly between Janaale and Buulo Mareerta. The complexity of the existing land management and crop production is considered, at this stage, to represent a serious constraint on remodelling this land. Furthermore, Government policy discourages perennial crops along the Shabeelle and favours the Juba region instead. In view of these uncertainties it is considered wiser to eliminate the banana growing areas from the Project Area and to appraise their prospects under the Master Plan.

4.2 Areas Selected

We have concluded that, of the criteria applied, water availability and present land use will be the main factors affecting selection of a Project Area. The principal aim must be to maximise returns per unit of water, which involves a detailed evaluation of the costs and benefits associated with developing new land, rainfed crop land or upgrading existing irrigated land. Such an evaluation calls for the same resource allocation procedure which will be adopted during the Master Plan study. However, at this early stage in the study, utilising the available information, it would appear that the Project Area should be sited to include an area which is mainly under irrigated annual crops. To this end, three possible areas have been selected, each of 5 000 ha, which could be considered for irrigation development subject to surface and groundwater availability. These areas are shown in Figure 3 and are described below:

(i) Area 1 - Faraxaane

On the left bank between the Wadajir (Fornari) and Bokore canals.

(ii) Area 2 - Qoryooley

On the right bank extending north from Qoryooley and Gayweerow villages.

(iii) Area 3 - Asayle

An area on the right bank centred on the Asayle (Riva Destra) canal.

Other areas exist within the Study Area which are equally suitable for development but they occur in fragmented units much smaller than 5 000 ha and would therefore be unlikely to provide the desired scale of benefits.

The boundaries of the Faraxaane area are clearly defined by canals on the east and west and by the grapefruit project in the south. The northern boundary will be determined by topographic factors but present information indicates that it could extend almost as far as the river. This area would be irrigated from the new Gayweerow barrage.

The other two areas are less clearly defined. The Qoryooley area would commence at the tail end of the Asayle canal and would include all land currently irrigated in the area. The water would be supplied from the proposed Gayweerow barrage making it possible to extend the area irrigated to include some land which is currently rainfed. The northern boundary will be defined only after the detailed topographical survey.

The Asayle area would incorporate all the land commanded by the Asayle canal, which is currently about 3 000 ha. From Figure 3 it can be seen that the River Shabeelle bounds the area on two sides and the limit of irrigation in the north-west is determined by the level of the land. The canal head regulator lies upstream of Janaale barrage and if this area were to be considered for development it would be possible to include the area fed by the Giddo canal which has its offtake about 1 km upstream of the Asayle head regulator.

Areas 1 and 2 appear to be equally suitable on technical grounds; areas currently unirrigated remain so due to inadequate distribution systems rather than due to any physical limitations other than elevation. However, areas of abandoned irrigation in the Asayle area are thought to derive from waterlogging and poor soil drainage. Further investigations would be required to confirm the drainage needs of this area.

We therefore suggest areas 1 and 2 as possible alternatives for the Project Area. The final selection of the one of these will be made by the Somali Government.

CHAPTER 5

MASTER PLANNING AND FEASIBILITY STUDY INTERACTION

The Terms of Reference combine both master planning of a large tract of land and feasibility planning of an area within it. The usual sequence for carrying out these tasks would commence with a resource appraisal of the former, from the results of which would subsequently emerge one or more areas suitable for feasibility study.

It is recognised that the early selection of an area for feasibility study in the Janaale - Buulo Mareerta region is dictated by the need to achieve rapid agricultural developments. In these circumstances the two activities are to be undertaken in parallel.

It is prudent to point out that the identification of possible areas for immediate feasibility study has been undertaken using available data and evidence which has been collected within the first six weeks of commencing our task. Clearly substantially more information regarding the Study Area as a whole will be accumulated as the master planning process continues.

The possibility should not therefore be ignored that, in the light of more detailed evidence, opportunities could emerge for more profitable utilisation of resources elsewhere in the region. Because of this the opportunity is now taken to stress that, although it is by no means certain, the Master Plan may reveal other projects of greater potential contribution to the national objectives.

APPENDIX A

EXISTING AND PROPOSED CONTROLLED IRRIGATION

ON THE SHABEELLE RIVER

APPENDIX A

EXISTING AND PROPOSED CONTROLLED IRRIGATION ON THE SHABEELLE RIVER

Item	District	Existing (E) or Proposed (P)	Approximate Cultivated Area (ha x 1 000) Gross	Net	Major Crops	Controlling Authority
1.	Jalalaqsi	P	0.5	0.4	Sisal	Somali Development Bank
2.	Mahaddaay Weyn	P	2.5	2.0	Rice	Crash Programme
3.	Jowhar	E	8.0	6.3	Sugar	Ministry of Industry
4.	Jowhar	P	2.0	1.5	Sugar	Ministry of Industry
5.	Jowhar	E	0.8	0.6	Annual	Smallholdings
6.	Balcad Stage 1	E	1.0	0.7	Cotton	Ministry of Industry
7.	Balcad Stage 2	P	3.0	2.1	Cotton	Ministry of Industry
8.	Balcad Stage 3	P	6.0	4.2	Cotton	Ministry of Industry
9.	Balcad	P	1.0	0.8	Annual	Re-establishment of Private Estate
10.	Balcad-Awdheegle	E	0.5	0.4	Perennial	Smallholdings
11.	Balcad-Awdheegle	E	7.8	6.2	Annual	Smallholdings
12.	Afgooye	P	1.0	0.8	Annual	Crash Programme
13.	Mordiile	E	1.8	1.5	Annual	Libsoma
14.	Mordiile	P	1.8	1.5	Annual	Libsoma
15.	Mubaarig	P	0.8	0.6	Rice	Ministry of Agriculture
16.	Janaale-Buulo Mareerta	E	5.5	4.4	Banana	National Banana Board
17.	Janaale-Buulo Mareerta	E	37.0	24.0	Maize/ Sesame	Smallholdings
18.	Janaale-Buulo Mareerta	P	8.0	4.5	Rice	State Planning Commission
19.	Janaale-Buulo Mareerta	P	1.7	1.4	Grapefruit	EDF (M of A)
20.	Janaale-Buulo Mareerta	P	1.2	1.0	Annual	EDF (M of A)
21.	Kurtenwaarey	E	0.7	0.6	Annual	Settlement Development Agency
22.	Kurtenwaarey	P	5.3	4.2	Annual	Settlement Development Agency
23.	Sablaale	E	0.4	0.3	Annual	Settlement Development Agency
24.	Sablaale	P	5.6	4.5	Annual	Settlement Development Agency
25.	Haawaay	P	1.0	0.8	Rice	Settlement Development Agency
			104.9	75.3		

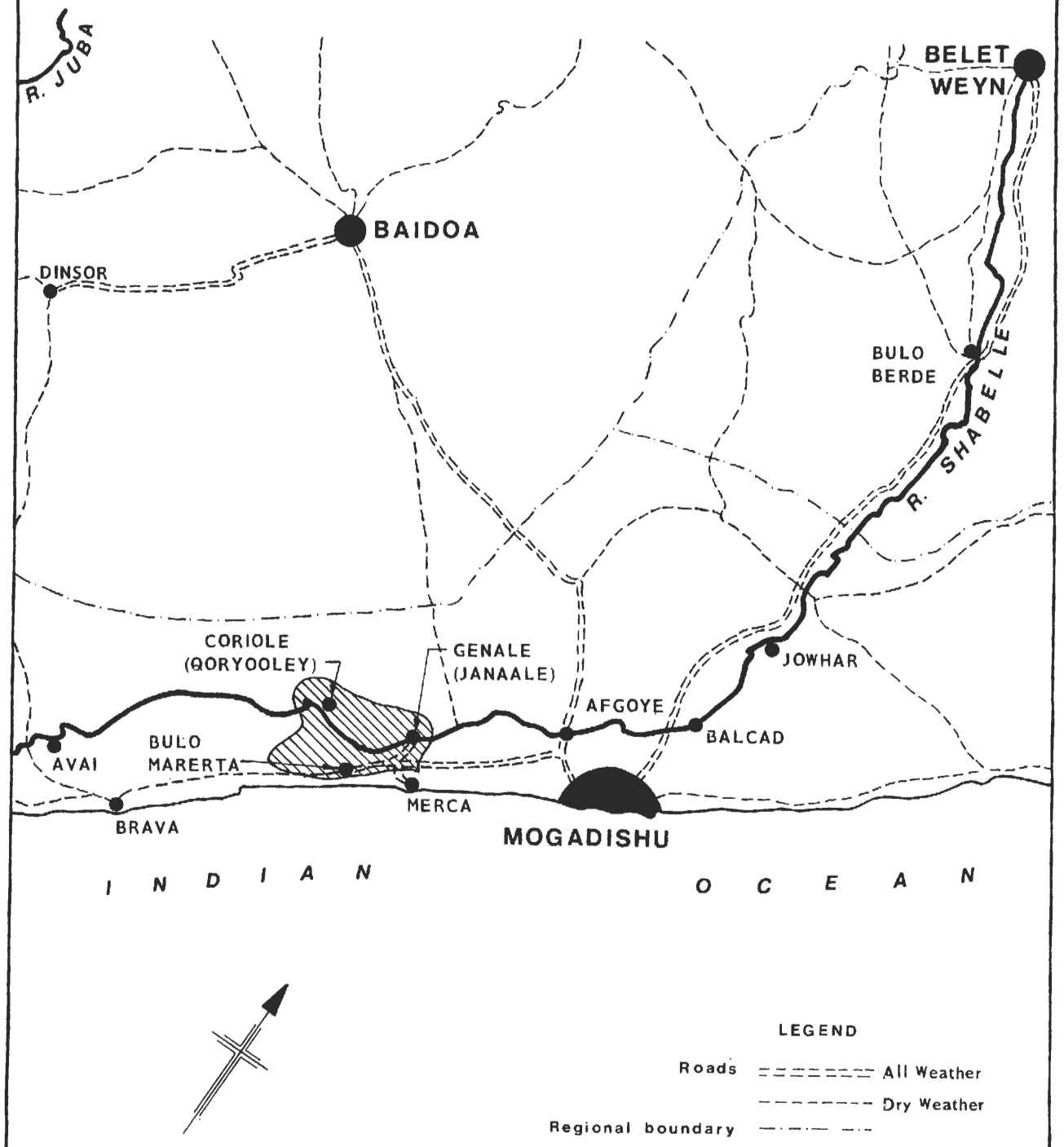
NOTE: All figures are approximate.
Figures for Janaale - Buulo Mareerta based on current observations and may include some uncontrolled irrigation.
Figures for Kurtenwaarey and Sablaale proposals obtained from Ministry of Agriculture.

REFERENCES

	AUTHOR	DATE	TITLE	PUBLISHER	SOURCE
1.	FAO/Lockwood Survey Corporation	1968	Agricultural and Water Surveys - Somalia	FAO Roma	UN Library - Mogadishu
2.	CITACO	1974	Final Design for a Grapefruit Plantation	Citaco Roma	EDF Office - Mogadishu
3.	Hunting Technical Services Limited	1969	Project for the Water Control and Management of the Shebelli River, Somalia	FAO/UNDP	UN Library - Mogadishu
4.	IBRD Permanent Mission in East Africa	1973	Agricultural Sector Project Identification Report	IBRD	Sir M MacDonald & Partners Library - Mogadishu
5.	-	1965/ 1972	Central Agricultural Research Station	Ministry of Agriculture	Afgooye Agricultural Research Station
6.	FAO	1975	Afgoi - Mordiile Scheme, Pilot Project Report	FAO	UN Library - Mogadishu

FIGURE I

PROJECT LOCATION MAP



LEGEND

Roads — All Weather

Dry Weather

Regional boundary

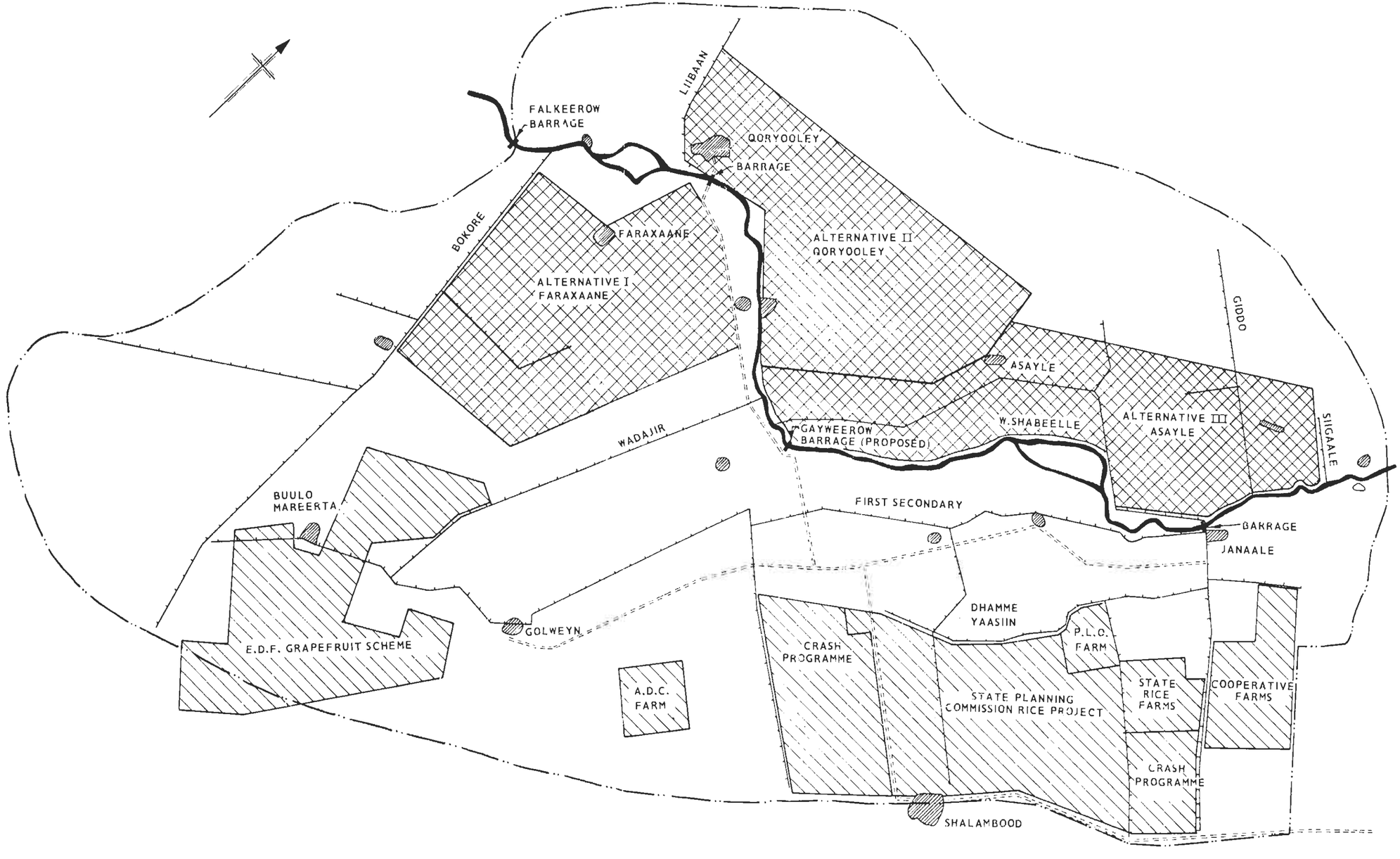
SCALE

km 20 0 20 40 60 80 100km

Note

Place name alternative spellings given in glossary of terms

FIGURE 3



KEY

- ALTERNATIVE SITES FOR 5000 ha DEVELOPMENT
- OTHER DEVELOPMENTS
- RIVER CHANNEL
- EXISTING CANAL
- STUDY AREA BOUNDARY
- SURFACED ROAD
- VILLAGE

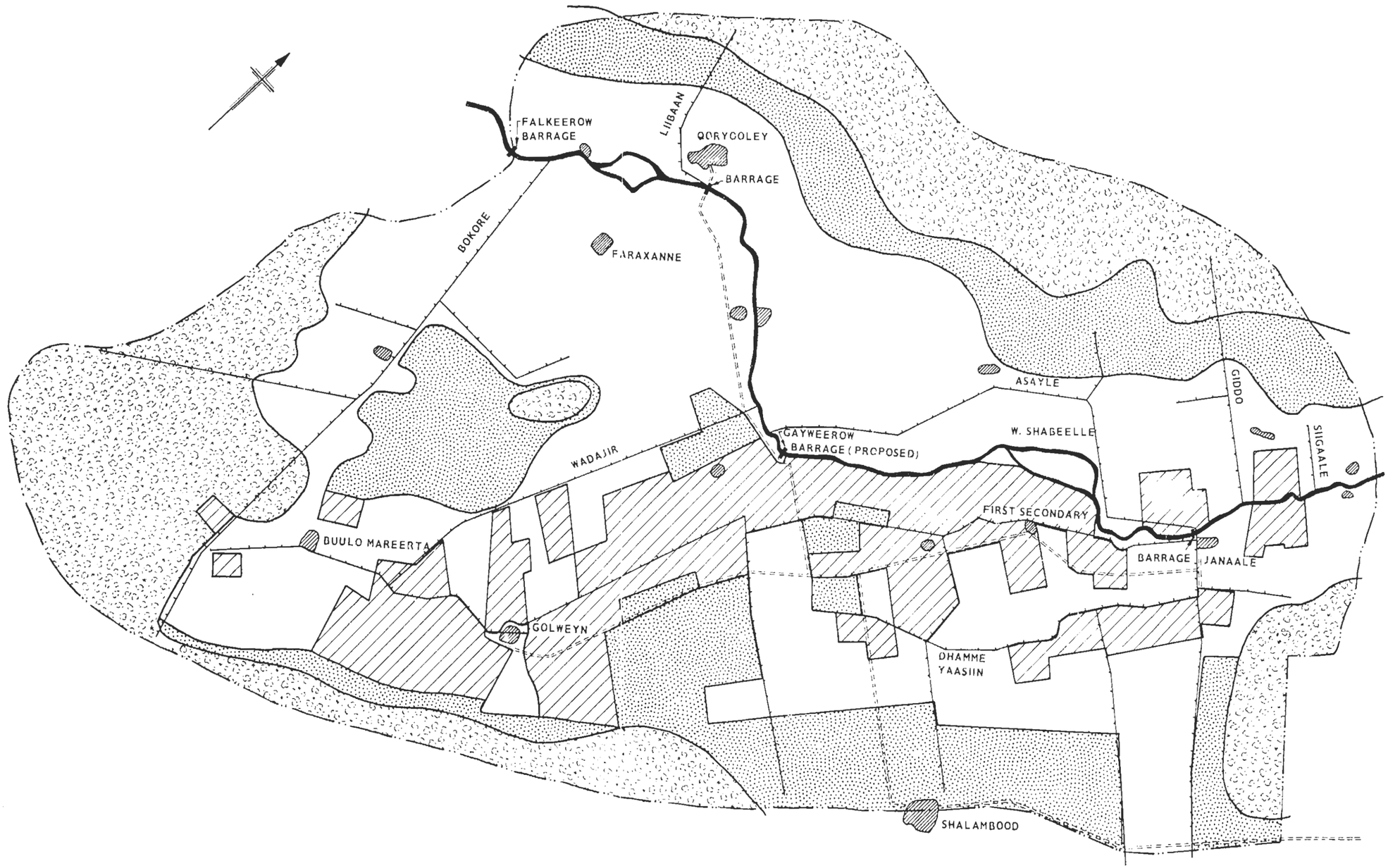
SCALE

km 1 0 1 2 3 4 5 km

DEVELOPMENT PROJECTS

JULY 1977

FIGURE 2



KEY

- WOODLAND AND SCRUB
- SCRUB AND RAINFED CROPS
- IRRIGATED ANNUAL CROPS
- IRRIGATED PERENNIAL CROPS
- RIVER CHANNEL
- EXISTING CANAL
- STUDY AREA BOUNDARY
- SURFACED ROAD
- VILLAGE

SCALE

km 1 0 1 2 3 4 5 km

PRESENT LAND USE

JULY 1977