SUPPORTING REPORT

P: FIELD SURVEYS

Supporting Report P: Field Surveys

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P FIELD SURVEYS

1. TOPOGRAPHIC SURVEY

1.1 Purpose

The purpose of topographic survey is to make a topographic map of 1/10,000 along the river where river improvement works are expected. The maps were used for river improvement planning especially in study of plan configuration of the new course of the stream.

1.2 Survey Area

The area to be surveyed was pre-decided taking into account the expected area of river improvement works. It covers the main river and vicinity area from the confluence of Guayabal and San Miguel River and down to the river mouth including the part of San Felipe Flood Way, which had been one of the alternative works in the Master Plan.

The area covered by the survey is shown in Fig. P.1.1. The total area of survey is 300 km^2.

1.3 Survey Method

1.3.1 Aerial Photography

Aerial photographs were taken covering 1,600 km^2 of the basin by a scale of 1/20,000.
The survey plan is shown in Fig. P.1.2. The number of flight lines is 18 and the total length of flight line is 550 line km.

All photographs were utilized for studies of topography, geology, river course, land use and erosion.

1.3.2 Ground Control Point Survey

In order to rectify the topographical map compiled from the aerial photography, ground control point survey was conducted by utilizing GPS technique. Fig. P.1.3 shows survey plan.

1.4 Result

The result of all survey has been compiled as 18 sheets of topographic maps of scale 1/10,000.

2. RIVER SURVEY

2.1 River Longitudinal/Cross Sectional Survey

2.1.1 Purpose

The purpose of river survey is to make a longitudinal profile and cross sections of San Miguel River. It consists of the main survey in the First Stage of Study in El Salvador and the supplementary survey conducted in the Third Stage of Study in El Salvador.

In the supplementary survey, parts of San Miguel River and Olomega Drainage were selected as the river bed slope there is very steep or the part is composed of hard rocks and the survey results give significant effect in river planning and cost estimate.

2.1.2 Method

(1) Establishment of Temporary Bench Mark

Temporary bench marks were staked in ground close to river cross sectional survey sites along the river at an interval of 500m.

(2) Direct Leveling

The elevation each bench mark tops was surveyed with high accuracy by using the existing National Bench Marks.

(3) River Cross Sectional Survey

Cross sectional leveling was performed for every proposed line along the river at intervals of 500m.

(4) Plotting and Drawing

The cross sectional survey data was plotted at scale of V=1/200 and H=1/200.

(5) Longitudinal Profile Plotting

Using the lowest river bed height of each cross section data, longitudinal profile was plotted at scale of V=1/200 and H=1/2,500

2.1.3 Results

River survey results were compiled as 206 cross sections and three longitudinal sections (for the main survey) and 23 cross sections (for the supplementary survey). A part of the survey result is shown in the Data Book.

2.2 Flood Mark Survey

2.2.1 Purpose

Along with river survey, flood mark survey was conducted in order to assess the effect of the flood in September 1995. This result was used to draw inundation map and analyze the flood mechanism.

2.2.2 Method

In order to plot the highest water marks on the river longitudinal profile, points were selected along the river and the flood mark elevation s were surveyed. The interval of points surveyed is about 1 km. Target flood marks were selected from permanent structures such as houses.

2.2.3 Results

The result of the survey was plotted on the longitudinal profile of the river together with the profiles of river banks on both sides of the river.

2.3 Echo Sounding of Lake Olomega

2.3.1 Purpose

The purpose of this survey is to grasp the depth-volume relationship of Lake Olomega.

2.3.2 Method

The depth of the water at each point in the lake was measured by echo-sounding instrument mounted on a boat equipped with a GPS system identifying the location of the boat. The depth of the water was converted into bottom elevation incorporating with the elevation survey of the lake water surface at that time.

As the lake water area at the survey time was small, the ground contour map of the periphery of the lake was connected with the echo-sounding result to finalize the contour map around the lake area.

2.3.3 Results

The results of the survey are shown in Fig. P.2.1 as a contour map around the lake. Elevation-Area-Volume relationship of Lake Olomega was derived from the map.

2.4 Structure Survey

Three bridges along the San Miguel River were surveyed in order to check the channel capacity at those points. The result of survey is shown in Data Book 9 (Result of Surveys).

3. WATER QUALITY SURVEY

3.1 Purpose

The purpose of water quality survey is to get rough idea on water quality along San Miguel River including Lake Olomega to use a basic information in flood control master plan.

The main concern on water quality problem was deteriorating quality dwonstream from San Miguel City and eutrophication of Lake Olomega.

However, as water quality is not the central issue of the project, the scope of the survey was limited.

3.2 Survey Items

Survey items in water quality are listed in Table P.3.1 together with the results. As the main concern of the problem was eutrophication, items for testing included T-P, T-N, BOD, COD and DO.

3.3 Survey Method

(1) Sampling Points

It was estimated that the main source of polutant is San Miguel City. Therefore, the sampling locations were arranged up and downstream of San Miguel City. Three locations were selected in Lake Olomega so that the direction of pollution source could be guessed.

(2) Sampling Time

The first intention of selection of sampling time is to obtain information both in dry season and in wet season. Considering the study period in El Salvador, May for dry season and July for wet season were selected as representative of two seasons. However, as the result shows, the discharge in July was not so large and the value of SS is not so different from those in May. So it is difficult to say that the values in July are representative of wet season.

(3) Sample Number

Three samples were taken for each place, time and item for taking average.

3.4 Result

The result of the survey is shown in Table P.3.1.
As the number of sample is so limited that it is difficult to make a conclusion. However there are some prominent observation as follows;

(1) Such items like T-P, T-N, BOD and COD show poor quality of water both in the river and in the lake, giving lower value than Japanese Environment Standard in most items.
(2) The content of DO is above the Japanese Environment Standard showing the eutrophication has not reached the critical stage yet.
(3) The location S-9 is located upstream from San Miguel City and free from the effect of urban drainage, but still the water quality values are poor in terms of T-P, T-N, COD and BOD.
(4) Water quality in Lake Olomega is poor in both May and July. In these months of the year without inflow from the San Miguel River, the main source of pollutant is not the San Miguel River but the lake catchment itself.

4. SEDIMENT AND RIVER BED MATERIAL SURVEY

Sediment and river bed materials of the San Miguel River and its major tributaries were surveyed from April to July in 1996. The survey was carried out by FUSADES (Fundacion Salvadorena para el Desarrollo Economico y Social) under sublet contract based on the program and specifications prepared by the Study Team.

4.1 Objective of Survey

The survey aims to provide sediment and river bed material data to examine sediment transport features of the San Miguel River, by conducting sampling and laboratory tests of suspended loads, bed loads and river bed materials.

4.2 Sampling and Laboratory Tests

Suspended load, bed load and river bed materials were sampled at the sites shown in Table P.4.1 and Fig.P.4.1.

All laboratory tests and analyses of samples of the sediment and river bed materials were performed, in principle, in accordance with the AASHTO or ASTM. In order to identify the

sample, code was put on each sample as shown in Table P.4.2.

(1) Suspended Load

1) Location: 25 sites were planned. However, samples were not collected at three sites due to security problem and little water flow.
2) Sampling: One water sample at each site
3) Number of samples: 1 sample x 25 sites x 3 times = 75 samples
4) Laboratory tests: Suspended solids (SS)

(2) Bed Load

1) Location: 15 sites were planned. However, samples were not collected at four sites due to bad site conditions and little sediment flow.
2) Sampling: Three bed load samples at left, center and right of each sampling section
3) Number of samples: 3 samples x 15 sites = 45 samples
4) Laboratory tests: Grain size and specific gravity

(3) River Bed Materials

1) Location: 15 sites
2) Sampling: Three river bed materials on both river banks and river bed sand bar of each sampling section. In order to show the locations and conditions of sampling sites, recording sheets of sampling sites were prepared. The sheet includes general location map (1/50,000), and sketch and photos of each sampling place.
3) Number of samples: 3 samples x 15 sites = 45 samples
4) Laboratory tests: Grain size and specific gravity

(4) Manufacturing Bed Load Sampler

Two units of bed load samplers were manufactured with metal.

4.3 Result of Survey

As a result of survey, suspended solids (SS) of river water are shown in Table P.4.3. Results of grain sizes analyses and specific gravity tests are summarized in Table P. 4.4 for the bed load and Table P.4.5 for the river bed materials.

Table P.3.1 RESULT OF WATER QUALITY SURVEY (1/2)
(MAY 1, 1996)

Identificacion	Codigo Laboratorio	pH	Conductividad µmos/cm	Fosfatos mg/l	Nitrogeno mg/l	DBO mg/l	DQO mg/l	OD mg/l	Solidos Susp. mg/l	Temperatura °C
S.9.1	A-269	7.61	290.00	0.61	11.14	13.00	8.20	7.63	48	29
S.9.2	A-270	7.65	290.00	0.63	7.71	10.00	40.98	6.63	8	29
S.9.3	A-271	7.54	290.00	0.69	4.86	5.00	8.20	5.75	8	29
Average		7.60	290.00	0.64	7.90	9.33	19.13	6.67	21.33	29.00
S.3.1	A-272	7.73	390.00	1.38	7.43	1.25	32.78	4.38	40	31
S.3.2	A-273	7.59	395.00	1.47	12.57	2.50	4.10	1.63	1	31
S.3.3	A-274	7.64	395.00	1.42	11.14	1.50	24.59	6.38	7	31
Average		7.65	393.33	1.42	10.38	1.75	20.49	4.13	16.00	31.00
S.7.1	A-275	7.45	375.00	1.33	11.14	5.00	57.37	1.63	3	29
S.7.2	A-276	7.52	370.00	1.54	14.00	5.00	32.78	1.88	68	29
S.7.3	A-277	7.43	380.00	1.26	11.14	4.00	32.78	1.75	108	29
Average		7.47	375.00	1.38	12.09	4.67	40.98	1.75	59.67	29.00
S.6.1	A-278	7.56	365.00	2.04	14.00	35.00	36.88	2.38	38	30
S.6.2	A-279	7.56	365.00	2.03	14.00	17.50	24.59	2.75	26	30
S.6.3	A-280	6.94	365.00	2.10	18.00	8.00	8.20	2.25	55	30
Average		7.35	365.00	2.06	15.33	20.17	23.22	2.46	39.67	30.00
O.E.1	A-281	7.83	320.00	0.13	6.29	1.25	8.20	10.00	2	31
O.E.2	A-282	7.69	305.00	0.15	6.29	1.00	32.78	6.75	84	31
O.E.3	A-283	7.84	315.00	0.13	8.00	1.25	32.78	7.38	22	31
Average		7.79	313.33	0.14	6.86	1.17	24.59	8.04	36.00	31.00
O.C.1	A-284	8.57	310.00	0.12	7.43	5.00	8.20	11.50	10	31
O.C.2	A-285	8.59	310.00	0.20	6.29	10.00	32.78	11.00	7	31
O.C.3	A-286	8.72	315.00	0.25	8.57	15.00	8.20	11.50	3	32
Average		8.63	311.67	0.19	7.43	10.00	16.39	11.33	6.67	31.33
O.W.1	A-287	8.50	335.00	0.11	18.00	5.00	8.20	8.63	5	33.5
O.W.2	A-288	8.63	330.00	0.11	14.00	3.00	4.10	8.88	1	34
O.W.3	A-289	8.58	315.00	0.15	11.14	2.00	16.39	8.50	15	35
Average		8.57	326.67	0.12	14.38	3.33	9.56	8.67	7.00	34.17

O.E.1., O.E.2. y O.E.3. = Olomega East
O.C.1., O.C.2. y O.C.3 = Olomega Center
O.W.1., O.W.2. y O.W.3. = Olomega West

Table P.3.1 RESULT OF WATER QUALITY SURVEY (2/2)
(JULY 2 & 5, 1997)

Identificacion	Codigo Laboratorio	pH	Conductividad µmos/cm	Fosfatos mg/l	Nitrogeno mg/l	DBO mg/l	DQO mg/l	OD mg/l	Solidos Susp. mg/l	Temperatura °C
S.6.12a	A-444/96	7.18	195.00	1.38	7.57	5.50	65.38	3.50	304	27
S.6.ssa	A-445/96	7.37	187.00	1.19	4.43	20.50	59.23	4.25	780	27
S.6.32a	A-446/96	7.59	187.00	1.09	5.71	2.50	50.00	4.00	1040	27
Average		7.38	189.67	1.22	5.90	9.50	58.20	3.92	708.00	27.00
S.7.12a	A-447/96	7.41	155.00	1.39	4.29	5.50	42.31	5.00	368	26
S.7.22a	A-448/96	7.42	150.00	1.38	5.43	10.50	57.69	5.50	328	26
S.7.32a	A-449/96	7.38	149.00	1.40	4.42	2.50	15.38	5.50	1432	26
Average		7.40	151.33	1.39	4.71	6.17	38.46	5.33	709.33	26.00
S.9.12a	A-450/96	7.35	105.00	0.90	6.57	27.50	76.92	5.00	801	26
S.9.22a	A-451/96	7.56	105.00	0.93	7.43	5.50	76.92	5.00	654	26
S.9.32a	A-452/96	7.56	105.00	0.91	6.57	2.50	69.23	4.00	699	26
Average		7.49	105.00	0.91	6.86	11.83	74.36	4.67	718.00	26.00
S.3.12a	A-453/96	7.23	225.00	0.78	8.29	5.50	30.53	4.50	274	29
S.3.22a	A-454/96	7.25	230.00	0.56	5.43	10.50	53.44	4.25	290	28.5
S.3.32a	A-455/96	7.26	230.00	0.76	5.14	20.50	76.92	5.50	151	28.5
Average		7.25	228.33	0.70	6.29	12.17	53.63	4.75	238.33	28.67
O.E.12a	A-462/96	7.07	210.00	0.11	3.71	38.13	15.27	3.75	28	28
O.E.22a	A-463/96	7.21	200.00	0.12	3.57	28.13	61.07	3.75	6	28
O.E.32a	A-464/96	7.25	205.00	0.10	1.43	15.63	38.17	2.00	1	28
Average		7.18	205.00	0.11	2.90	27.30	38.17	3.17	11.67	28.00
O.C.12a	A-465/96	7.47	220.00	0.19	4.00	28.13	45.80	4.50	3	27
O.C.22a	A-466/96	7.52	220.00	0.07	2.29	40.63	50.00	4.50	10	27
O.C.32a	A-467/96	7.58	225.00	0.08	1.43	15.63	57.69	4.50	8	27
Average		7.52	221.67	0.11	2.57	28.13	51.16	4.50	7.00	27.00
O.W.12a	A-468/96	7.61	225.00	0.08	4.14	30.63	42.31	5.00	78	29
O.W.22a	A-469/96	7.83	230.00	0.11	4.72	33.13	65.38	7.50	4	29
O.W.32a	A-470/96	7.85	240.00	0.10	3.71	53.13	42.31	7.50	43	29
Average		7.76	231.67	0.10	4.19	38.96	50.00	6.67	41.67	29.00

O.E.1., O.E.2. y O.E.3. = Olomega East
O.C.1., O.C.2. y O.C.3 = Olomega Center
O.W.1., O.W.2. y O.W.3. = Olomega West

Table P.4.1 LOCATION OF SAMPLING SITES

Site	Sample	Location
S1	BM (SL and BL)	San Miguel River/ Canton Capitan Zaldana, Usulutan (No sample was collected due to bad site conditions)
S2	SL BM (BL)	San Miguel River/ Broken bridge at Moropala on the road to El Espino San Miguel River/ Moropala bridge on the road to El Espino (No sample was collected due to little sediment flow)
S3	SL and BM (BL)	San Miguel River/ Vado Marin (No sample was collected due to little sediment flow)
S4	SL	BL and BM: San Miguel River/ El Salto, Canton La Canoa
S5	SL, BL and BM	San Miguel River/ El Delirio bridge
S6	SL, BL and BM	San Miguel River/ Los Brincos and Los Ranchos (Canoe route)
S7	SL, BL and BM	San Miguel River/ Moscoso bridge
S8	SL and BL	San Miguel River/ Canton las Delicias, between Moscoso and Urbina bridges at the street end to bus terminal
S9	SL, BL and BM	San Miguel River/ Urbina bridge
E1	SL and BL	San Esteban River/ San Esteban bridge
C1	SL, BL and BM	Villerias River/ El Espino bridge
C2	SL and BL	Villerias River/ Canton Hualama
C3	SL	Canas River/ Bridge
C4	SL	Chapeltique River/ Bridge on the east of Chapeltique
C5	SL	Santo Tomas River/ Bridge at 4 km west of Chapeltique
G1	SL, BL and BM	Guayabal River/ Canton La Arenera
G2	SL and BL	Seco River/ Military route bridge to San Francisco Gotera
G3	SL (BL)	Seco River/ Canton Guachipilin between San Francisco Gotera and Jocoro (No sample was collected due to little sediment flow)
G4	SL	San Francisco River/ Bridge to Yamabal on the west of San Francisco Gotera
G5	SL	Yamabal River/ On Yamabal-Chapeltique route
U1	BM (SL)	Batres River/ Batres bridge (No sample was collected due to little water flow)
U2	SL and BM	Ereguayquin River/ Ereguayquin bridge
U3	SL and BM	Constancia River/ Constancia bridge
U4	SL and BM	Mejicapa River/ Santa Maria bridge
U5	BM (SL)	Zope River/ Gavidia bridge (No sample was collected due to little water flow)

NOTES:
SL: Sampling site of suspended load
BL: Sampling site of bed load
BM: Sampling site of river bed materials

Table P.4.2 IDENTIFICATION CODE OF SAMPLES

Site Code	River	Suspended Load			Bed Load			River Bed Materials		
		1st. sample	2nd. sample	3rd. sample	1st. sample	2nd. sample	3rd. sample	Left Bank	Center	Right Bank
S1	San Miguel R.	*	*	*	*	*	*	S1-RBL	S1-SB	S1-RBR
S2	San Miguel R.	S2-1	S2-2	S2-3	**	**	**	S2-RBL	S2-SB	S2-RBR
S3	San Miguel R.	S3-1	S3-2	S3-3	**	**	**	S3-RBL	S3-SB	S3-RBR
S4	San Miguel R.	S4-1	S4-2	S4-3	S4-1a	S4-2a	S4-3a	S4-RBL	S4-SB	S4-RBR
S5	San Miguel R.	S5-1	S5-2	S5-3	S5-1a	S5-2a	S5-3a	S5-RBL	S5-SB	S5-RBR
S6	San Miguel R.	S6-1	S6-2	S6-3	S6-1a	S6-2a	S6-3a	S6-RBL	S6-SB	S6-RBR
S7	San Miguel R.	S7-1	S7-2	S7-3	S7-1a	S7-2a	S7-3a	S7-RBL	S7-SB	S7-RBR
S8	San Miguel R.	S8-1	S8-2	S8-3	S8-1a	S8-2a	S8-3a	-	-	-
S9	San Miguel R.	S9-1	S9-2	S9-3	S9-1a	S9-2a	S9-3a	S9-RBL	S9-SB	S9-RBR
E1	San Esteban R.	E1-1	E1-2	E1-3	E1-1a	E1-2a	E1-3	-	-	-
C1	Villerias R.	C1-1	C1-2	C1-3	C1-1a	C1-2a	C1-3a	C1-RBL	C1-SB	C1-RBR
C2	Villerias R.	C2-1	C2-2	C2-3	C2-1a	C2-2a	C2-3a	-	-	-
C3	Canas R.	C3-1	C3-2	C3-3	-	-	-	-	-	-
C4	Chapeltique R.	C4-1	C4-2	C4-3	-	-	-	-	-	-
C5	Santo Tomas R.	C5-1	C5-2	C5-3	-	-	-	-	-	-
G1	Guayabal R.	G1-1	G1-2	G1-3	G1-1a	G1-2a	G1-3a	G1-RBL	G1-SB	G1-RBR
G2	Seco R.	G2-1	G2-2	G2-3	G2-1a	G2-2a	G2-3a	-	-	-
G3	Seco R.	G3-1	G3-2	G3-3	**	**	**	-	-	-
G4	San Francisco R.	G4-1	G4-2	G4-3	-	-	-	-	-	-
G5	Yamabal R.	G5-1	G5-2	G5-3	-	-	-	-	-	-
U1	Batres R.	***	***	***	-	-	-	U1-RBL	U1-SB	U1-RBR
U2	Ereguyquin R.	U2-1	U2-2	U2-3	-	-	-	U2-RBL	U2-SB	U2-RBR
U3	Constancia R.	U3-1	U3-2	U3-3	-	-	-	U3-RBL	U3-SB	U3-RBR
U4	Mejicapa R.	U4-1	U4-2	U4-3	-	-	-	U4-RBL	U4-SB	U4-RBR
U5	Zope R.	***	***	***	-	-	-	U5-RBL	U5-SB	U5-RBR

Remarks:

* : No sample due to bad site conditions (access, workability, security, etc.), in spite of sending survey party to the site.

** : No sample due to little sediment flow, in spite of sending survey party to the site.

*** : No sample due to little water flow, in spite of sending survey party to the site.

Table P.4.3 RESULT OF SUSPENDED SOLID TEST

Sample Code	SS (mg/l)		SG	Date of	Labo.
	Sample	Site Ave.	(g/cc)	Sampling	No.
S2-1	442	221	1.0004	29/05/96	347
S2-2	129		0.9965	05/06/96	379
S2-3	63		1.0018	07/06/96	409
S3-1	398	223	1.0006	29/05/96	346
S3-2	125		0.9975	05/06/96/	380
S3-3	145		1.0001	07/06/96	407
S4-1	269	135	0.9226	29/05/96	345
S4-2	57		1.0013	05/06/96	381
S4-3	79		1.0001	07/06/96	406
S5-1	204	115	0.9988	29/05/96	344
S5-2	103		0.9962	05/06/96	382
S5-3	39		1.0001	05/06/96	390
S6-1	372	260	0.9999	29/05/96	342
S6-2	192		1.0000	05/06/96	386
S6-3	216		0.9979	12/06/96	417
S7-1	527	227	1.0003	25/05/96	343
S7-2	141		1.0001	05/06/96	385
S7-3	13		0.9999	11/06/96	403
S8-1	158		0.9972	04/06/96	363
S8-3	85		1.0001	12/06/96	412
S9-1	65	49	0.9996	31/05/96	354
S9-2	26		1.0006	05/06/96	384
S9-3	57		1.0001	11/06/96	404
E1-1	85	64	1.0015	31/05/96	357
E1-2	46		1.0003	05/06/96	383
E1-3	61		1.0005	11/06/96	401
C1-1	26	45	1.0015	31/05/96	350
C1-2	20		1.0001	05/06/96	389
C1-3	88		0.9970	11/06/96	402
C2-1	62	63	1.0001	04/06/96	369
C2-2	19		1.0004	07/06/96	394
C2-3	109		1.0007	12/06/96	415

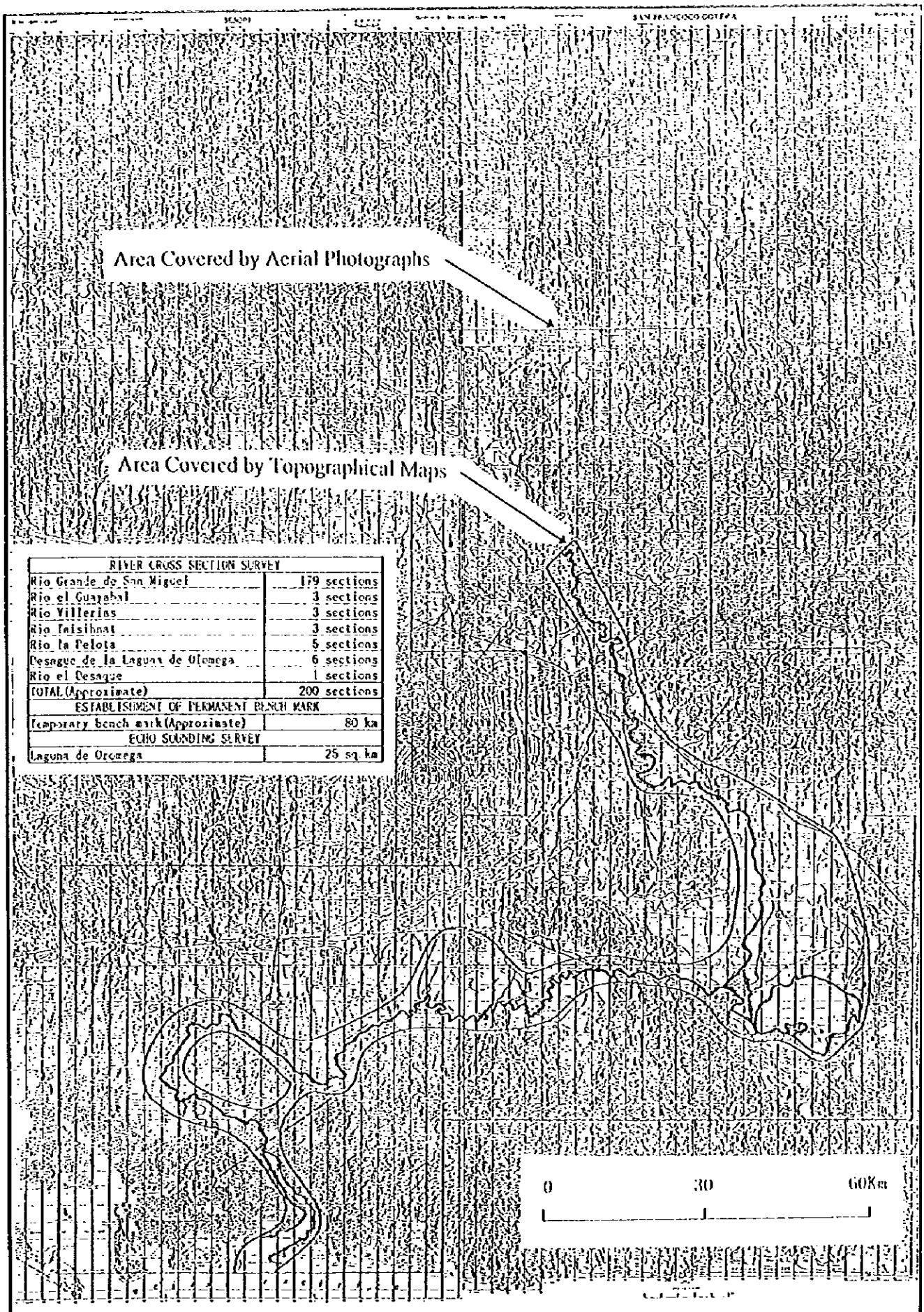
Sample Code	SS (mg/l)		SG	Date of	Labo.
	Sample	Site Ave.	(g/cc)	Sampling	No.
C3-1	9	10	0.9972	04/06/96	368
C3-2	9		0.9997	08/06/96	393
C3-3	13		1.0004	12/06/96	416
C4-1	66	31	1.2414	04/06/96	362
C4-2	18		1.0010	07/06/96	392
C4-3	8		1.0003	12/06/96	414
C5-1	40	20	1.0006	04/06/96	367
C5-2	8		0.9973	07/06/96	391
C5-3	13		0.9989	12/06/96	413
G1-1	68	49	1.0013	31/05/96	352
G1-2	25		1.0004	05/06/96	388
G1-3	55		1.0003	11/06/96	400
G2-1	86	64	0.9975	31/05/96	353
G2-2	52		0.9934	04/06/96	371
G2-3	55		0.9997	11/06/96	399
G3-1	11	14	1.0012	31/05/96	355
G3-2	7		0.9998	05/06/96	387
G3-3	23		0.9997	11/06/96	398
G4-1	39	17	1.0015	31/05/96	351
G4-2	4		0.9962	04/06/96	370
G4-3	9		0.9997	11/06/96	397
G5-1	42	25	0.9978	04/06/96	364
G5-2	17		1.0004	12/06/96	395
G5-3	15		0.9976	07/06/96	418
U2-1	762	355	1.0021	31/05/96	356
U2-2	201		1.0001	05/06/96	378
U2-3	102		1.0003	07/06/96	408
U3-1	26	268	0.9969	04/06/96	366
U3-2	470		1.0006	05/06/96	377
U3-3	309		1.0005	07/06/96	410
U4-1	54	202	1.0038	04/06/96	365
U4-2	23		0.9973	04/06/96	376
U4-3	528		0.9950	07/06/96	411

Table P.4.4 GRAIN SIZE OF BED LOAD

Sample code	Cumulative percentage of passing materials					dm (%) 50 (mm)	Specific gravity (g/cc)	Sampling date (d/m/y)
	<0.045 (%)	<0.106 (%)	<0.181 (%)	<2.0 (%)	>2.0 (%)			
	0.045	0.106	0.181	2				
S4-1a	0.06	0.32	2.02	76.57	100.00	1.35	2.42	04/07/96
S4-2a	0.07	0.19	1.34	72.81	100.00	1.42	2.19	04/07/96
S4-3a	0.01	0.05	0.19	41.40	100.00	>2.00	2.35	04/07/96
S5-1a	0.48	2.29	7.07	86.77	100.00	1.16	1.65	17/06/96
S5-2a	0.28	0.81	2.38	87.12	100.00	1.20	2.53	17/06/96
S5-3a	0.46	1.88	5.21	72.12	100.00	1.40	2.83	17/06/96
S6-1a	0.17	0.29	0.52	78.96	100.00	1.33	3.44	03/07/96
S6-2a	0.39	1.06	1.87	76.94	100.00	1.35	2.43	03/07/96
S6-3a	0.11	0.12	0.18	84.04	100.00	1.26	2.51	03/07/96
S7-1a	0.09	0.11	0.51	97.03	100.00	1.11	2.60	03/07/96
S7-2a	0.07	0.08	0.15	95.38	100.00	1.13	2.55	03/07/96
S7-3a	0.07	0.12	1.24	94.94	100.00	1.13	2.36	03/07/96
S8-1a	0.00	0.01	0.02	27.68	100.00	>2.00	2.53	02/07/96
S8-2a	0.04	0.05	0.07	49.94	100.00	>2.00	2.19	02/07/96
S8-3a	0.82	0.85	0.88	43.80	100.00	>2.00	2.64	02/07/96
S9-1a	0.08	0.11	0.47	57.51	100.00	1.76	2.24	27/06/96
S9-2a	0.01	0.02	0.07	42.30	100.00	>2.00	2.48	27/06/96
S9-3a	0.09	0.10	0.33	49.76	100.00	>2.00	2.00	27/06/96
E1-1a	0.06	0.08	0.26	45.38	100.00	>2.00	2.39	21/06/96
E1-2a	0.04	0.05	0.16	53.47	100.00	1.88	2.31	21/06/96
E1-3a	0.04	0.08	0.32	46.81	100.00	>2.00	2.28	21/06/96
C1-1a	0.26	0.43	1.06	94.22	100.00	1.14	2.42	21/06/96
C1-2a	0.23	0.38	0.99	98.80	100.00	1.09	2.36	21/06/96
C1-3a	0.16	0.23	0.65	97.81	100.00	1.10	2.72	21/06/96
C2-1a	0.06	0.09	0.36	53.02	100.00	1.90	2.38	02/07/96
C2-2a	0.08	0.10	0.47	48.84	100.00	>2.00	2.47	02/07/96
C2-3a	0.12	0.16	0.72	54.03	100.00	1.86	2.56	02/07/96
G1-1a	0.12	0.17	1.13	76.72	100.00	1.36	2.29	25/06/96
G1-2a	0.03	0.06	0.45	79.60	100.00	1.32	1.97	25/06/96
G1-3a	0.13	0.16	0.64	78.50	100.00	1.33	2.40	25/06/96
G2-1a	0.65	0.97	1.04	84.91	100.00	1.24	2.56	27/06/96
G2-2a	0.06	0.08	0.14	70.54	100.00	1.47	2.39	27/06/96
G2-3a	0.05	0.07	0.11	57.49	100.00	1.76	2.28	27/06/96

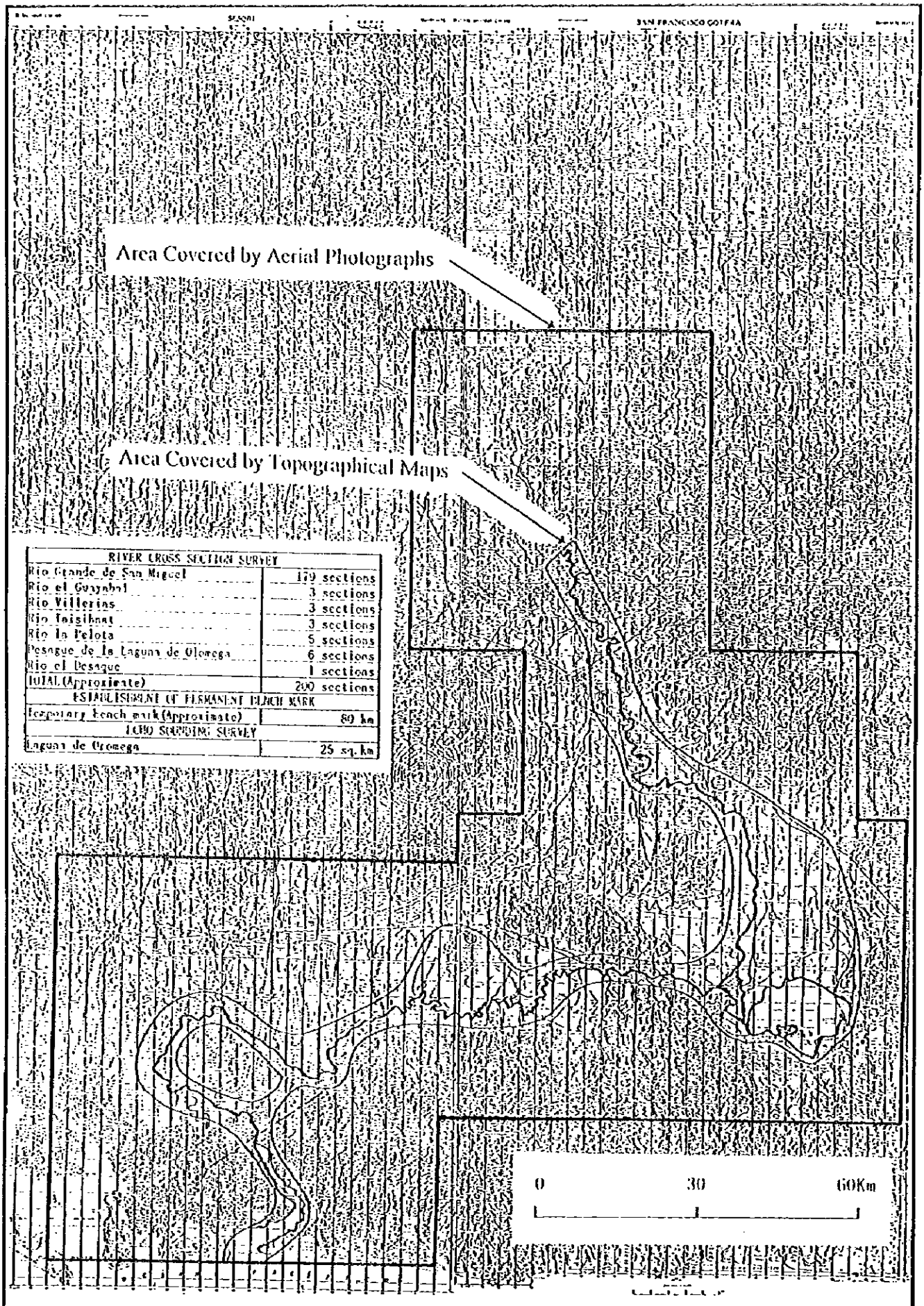
Table P.4.5 GRAIN SIZE OF RIVER BED MATERIALS

Sample code	Cumulative percentage of passing materials (%)							dm (mm)	Specific	Sampling
	<0.045 (mm)	<0.106 (mm)	<0.181 (mm)	<0.355 (mm)	0.710 (mm)	<2.0 (mm)	>2.0 (mm)	50 (%)	gravity (g/cc)	date (d/m/y)
	0.045	0.106	0.181	0.355	0.71	2				
S1-RBL	10.80	58.31	71.06	76.71	83.88	97.24	100.00	0.10	2.39	16/07/96
S1-RBR	45.3	32.52	66.36	94.30	97.67	99.64	100.00	0.14	2.31	16/07/96
S1-SB	0.17	0.24	0.97	10.32	25.72	71.72	100.00	1.39	2.28	16/07/96
S2-RBL	10.08	19.62	38.92	57.38	68.98	86.02	100.00	0.28	2.29	14/05/96
S2-RBR	5.35	12.23	21.06	33.71	43.72	62.41	100.00	1.14	1.97	14/05/96
S2-SB	2.48	5.54	9.36	19.37	38.63	79.35	100.00	1.07	2.40	14/05/96
S3-RBL	3.49	8.16	12.44	22.38	36.57	73.03	100.00	1.19	2.56	14/05/96
S3-RBR	7.27	21.55	36.60	50.96	63.62	84.23	100.00	0.34	2.39	14/05/96
S3-SB	2.67	10.26	16.22	25.40	37.71	72.45	100.00	1.17	2.28	14/05/96
S4-RBL	0.68	5.51	11.05	17.47	28.80	58.79	100.00	1.62	2.24	22/05/96
S4-RBR	1.51	8.58	20.95	46.07	85.59	94.20	100.00	0.39	2.48	22/05/96
S4-SB	0.60	3.23	9.41	52.37	77.13	85.59	100.00	0.34	2.00	22/05/96
S5-RBL	2.68	12.50	16.45	25.64	38.97	63.41	100.00	1.29	2.38	21/05/96
S5-RBR	3.11	23.04	34.84	45.37	62.30	80.90	100.00	0.45	2.47	21/05/96
S5-SB	0.87	6.14	16.98	46.86	70.12	79.53	100.00	0.40	2.56	21/05/96
S6-RBL	0.34	6.18	10.73	17.42	27.41	54.68	100.00	1.78	2.53	22/05/96
S6-RBR	4.08	19.09	36.81	53.75	60.92	75.84	100.00	0.31	2.19	22/05/96
S6-SB	0.42	1.23	2.81	12.12	41.33	87.12	100.00	0.95	2.64	22/05/96
S7-RBL	1.63	8.10	17.72	40.04	58.96	76.53	100.00	0.54	3.44	21/05/96
S7-RBR	3.71	17.69	30.07	62.28	71.73	84.43	100.00	0.29	2.43	21/05/96
S7-SB	0.51	3.41	6.69	15.50	29.73	62.27	100.00	1.51	2.51	21/05/96
S9-RBL	1.44	11.34	21.39	40.20	54.92	75.09	100.00	0.59	2.60	21/05/96
S9-RBR	0.97	6.27	15.61	42.39	74.34	91.26	100.00	0.44	2.55	21/05/96
S9-SB	0.49	2.25	4.10	9.45	24.79	61.16	100.00	1.60	2.36	21/05/96
G1-RBL	0.55	5.08	9.21	19.49	36.61	68.45	100.00	1.25	2.42	21/05/96
G1-RBR	6.06	10.18	17.07	40.62	65.55	83.57	100.00	0.49	2.36	21/05/96
G1-SB	0.61	2.49	8.67	44.31	89.38	92.94	100.00	0.40	2.72	21/05/96
C1-RBL	0.89	6.94	12.36	18.66	27.26	48.73	100.00	>2.00	1.65	21/05/96
C1-RBR	1.43	6.77	16.10	30.05	47.35	75.19	100.00	0.83	2.53	21/05/96
C1-SB	0.63	2.75	8.25	29.46	63.87	76.59	100.00	0.56	2.83	21/05/96
U1-RBL	5.03	12.42	34.43	51.28	67.39	86.03	100.00	0.34	2.42	14/05/96
U1-RBR	3.41	10.59	26.65	50.02	67.89	88.93	100.00	0.35	2.19	14/05/96
U1-SB	3.57	11.51	20.26	37.93	49.54	65.21	100.00	0.75	2.35	14/05/96
U2-RBL	7.90	16.81	42.46	67.22	82.55	92.83	100.00	0.23	2.37	14/05/96
U2-RBR	3.82	9.84	17.28	35.37	54.52	80.80	100.00	0.63	2.59	14/05/96
U2-SB	0.56	2.45	6.50	21.64	37.53	59.18	100.00	1.45	2.17	14/05/96
U3-RBL	2.11	10.06	42.04	55.71	68.52	85.32	100.00	0.28	2.31	15/05/96
U3-RBR	0.86	5.78	23.57	39.64	57.42	82.74	100.00	0.56	2.33	15/05/96
U3-SB	0.69	3.13	8.74	28.91	53.33	84.56	100.00	0.66	2.09	15/05/96
U4-RBL	0.96	5.20	19.89	38.87	59.10	84.99	100.00	0.55	2.34	15/05/96
U4-RBR	0.72	5.03	21.33	41.05	57.34	81.03	100.00	0.55	2.17	15/05/96
U4-SB	0.47	1.37	3.11	7.82	13.26	24.92	100.00	>2.00	2.65	15/05/96
U5-RBL	3.23	11.94	34.49	50.51	65.49	87.79	100.00	0.34	2.02	15/05/96
U5-RBR	1.26	7.24	31.43	52.89	67.43	87.73	100.00	0.33	2.11	15/05/96
U5-SB	0.81	2.28	5.00	15.36	33.69	70.08	100.00	1.29	2.57	15/05/96



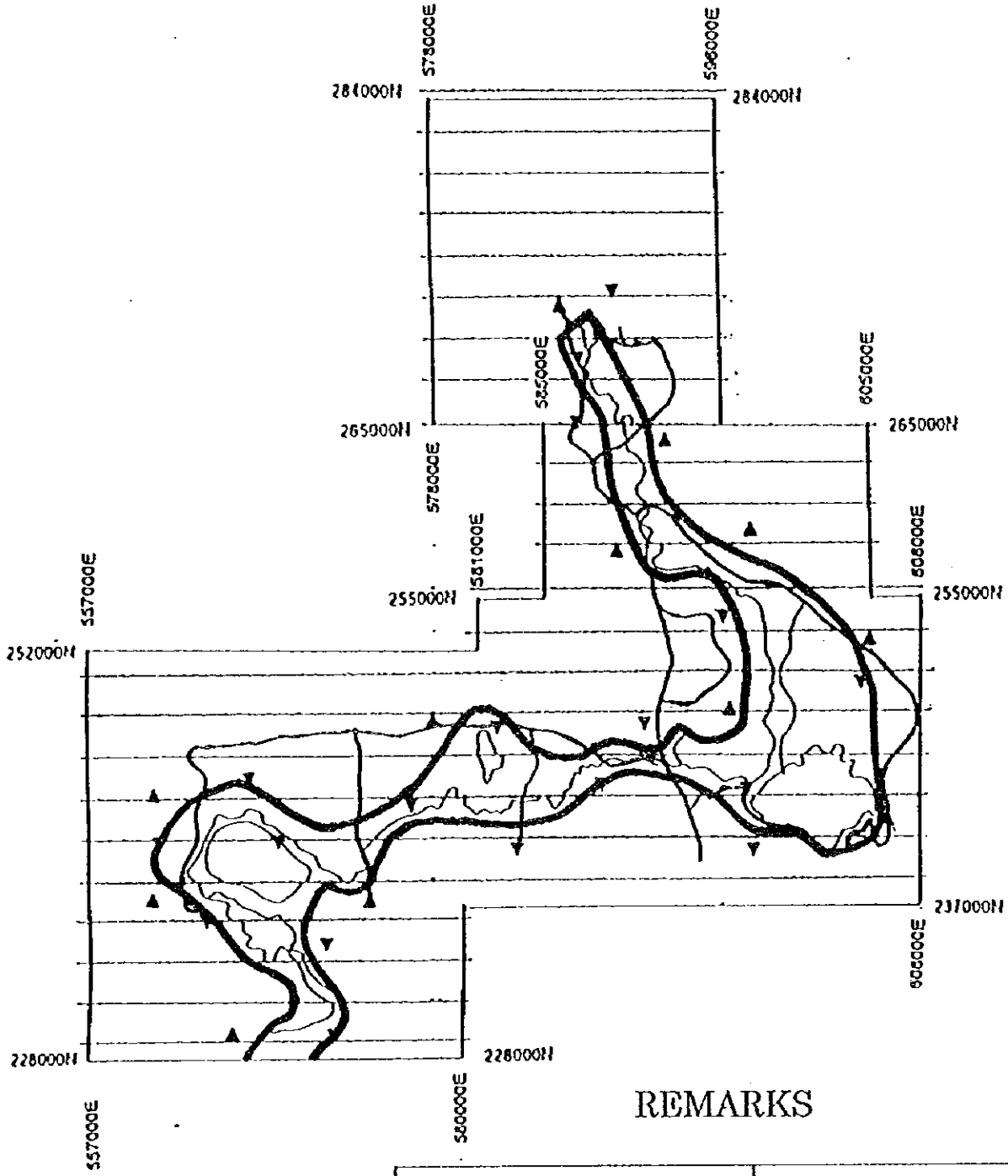
RIVER CROSS SECTION SURVEY	
Rio Grande de San Miguel	179 sections
Rio el Guayabal	3 sections
Rio Villerias	3 sections
Rio Talsihnat	3 sections
Rio la Pelota	5 sections
Desague de la Laguna de Olomega	6 sections
Rio el Desague	1 sections
TOTAL (Approximate)	200 sections
ESTABLISHMENT OF PERMANENT BENCH MARK	
Temporary bench mark (Approximate)	80 ka
ECHO SOUNDING SURVEY	
Laguna de Olomega	25 sq km

Figure P.1.1 AREA COVERED BY TOPOGRAPHIC SURVEY



RIVER CROSS SECTION SURVEY	
Rio Grande de San Miguel	179 sections
Rio el Guaynbal	3 sections
Rio Villerias	3 sections
Rio Isisihuat	3 sections
Rio la Pelota	5 sections
Desague de la Laguna de Olomega	6 sections
Rio el Desague	1 sections
TOTAL (Approximate)	200 sections
ESTABLISHMENT OF PERMANENT BENCH MARK	
Temporary bench mark (Approximate)	80 km
ECHO SOUNDING SURVEY	
Laguna de Olomega	25 sq. km

Figure P.1.2 SURVEY PLAN OF AERIAL PHOTOGRAPHY



REMARKS

———	Aerial photography flight line
▼	New Control Point (GPS)
▲	Existing Control Point (Pricking)
———	Minor Order Leveling Route
———	Area to be Mapped

Figure P.1.3 SURVEY PLAN OF GROUND CONTROL POINT SURVEY

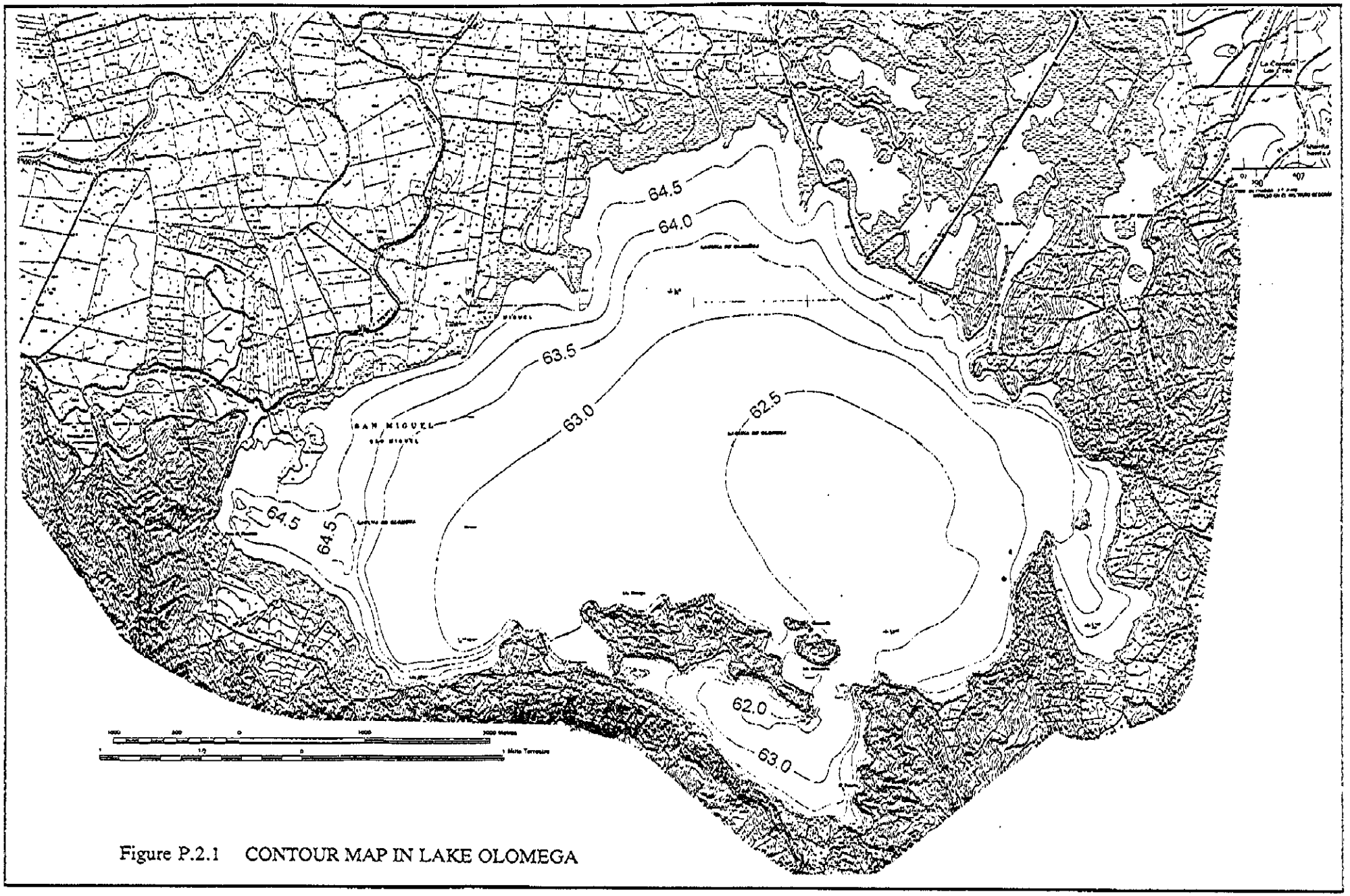


Figure P.2.1 CONTOUR MAP IN LAKE OLOMEGA

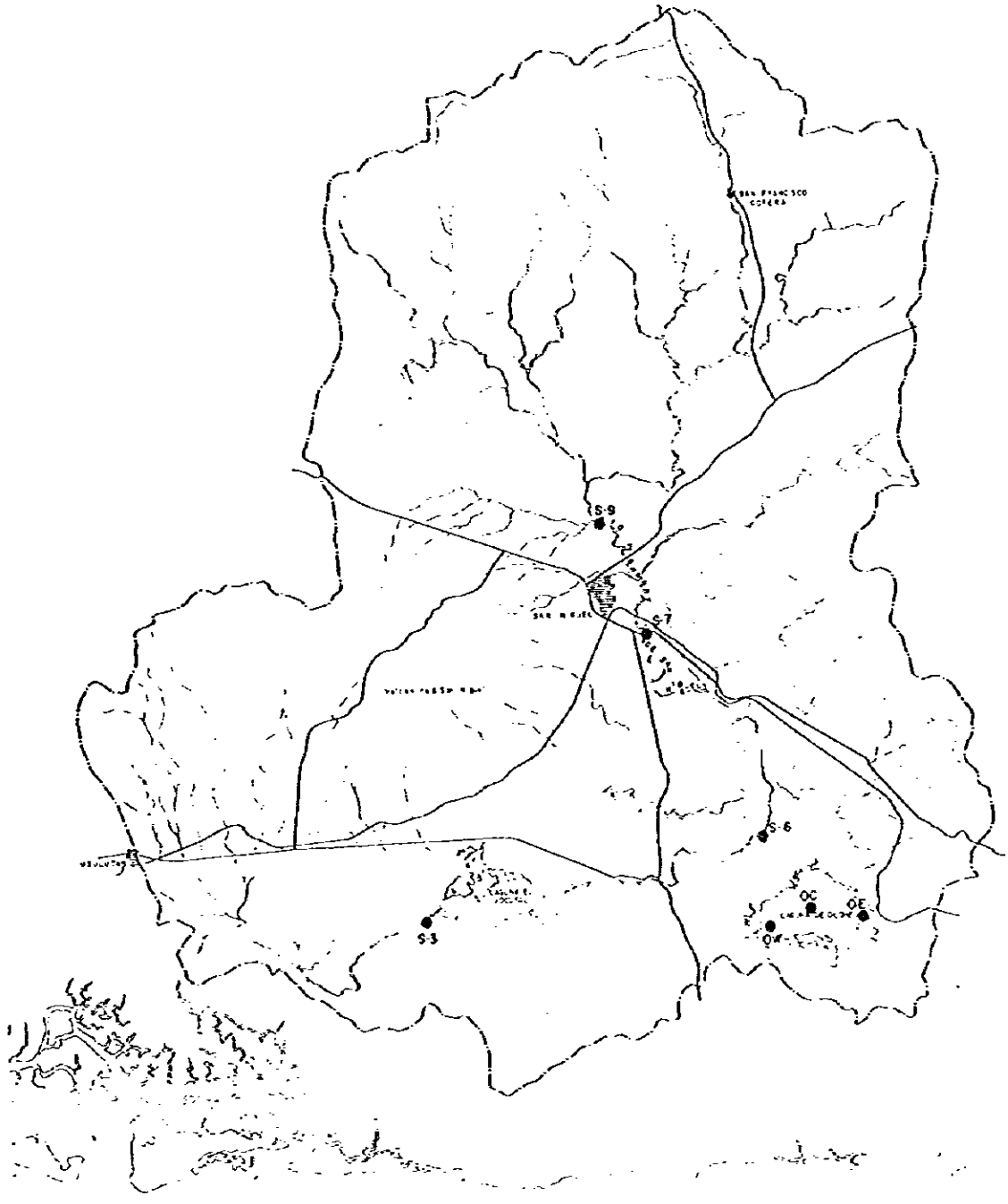
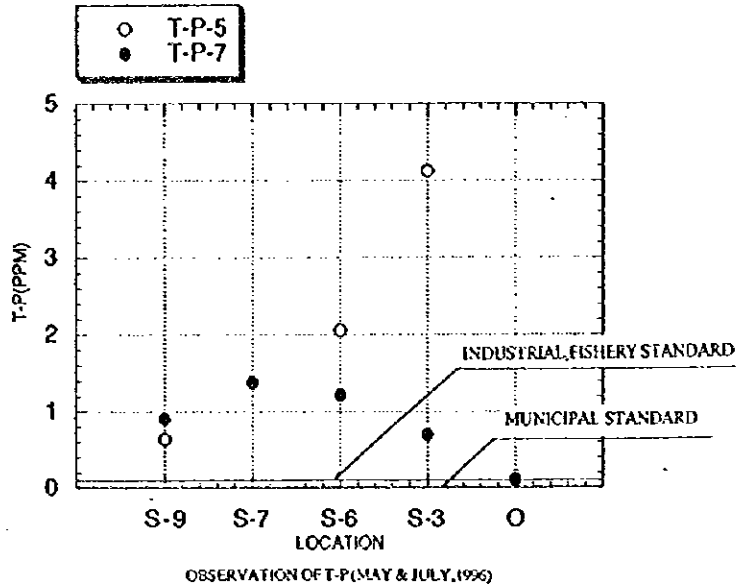
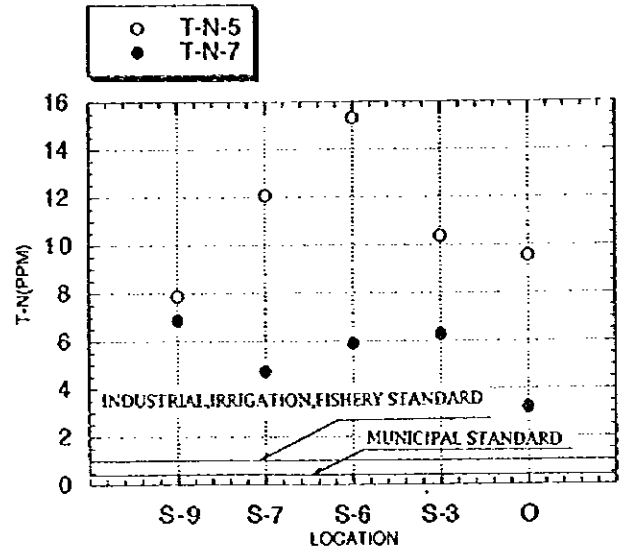


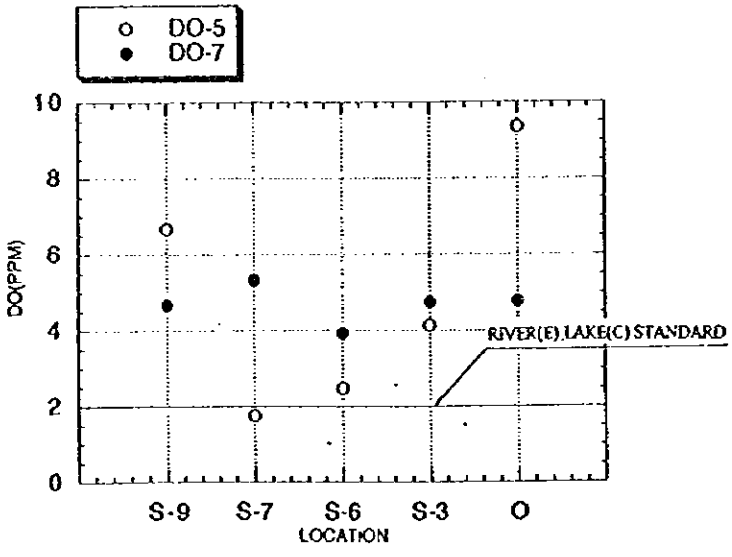
Figure P.3.1 LOCATION OF WATER SAMPLING



OBSERVATION OF T-P (MAY & JULY, 1996)

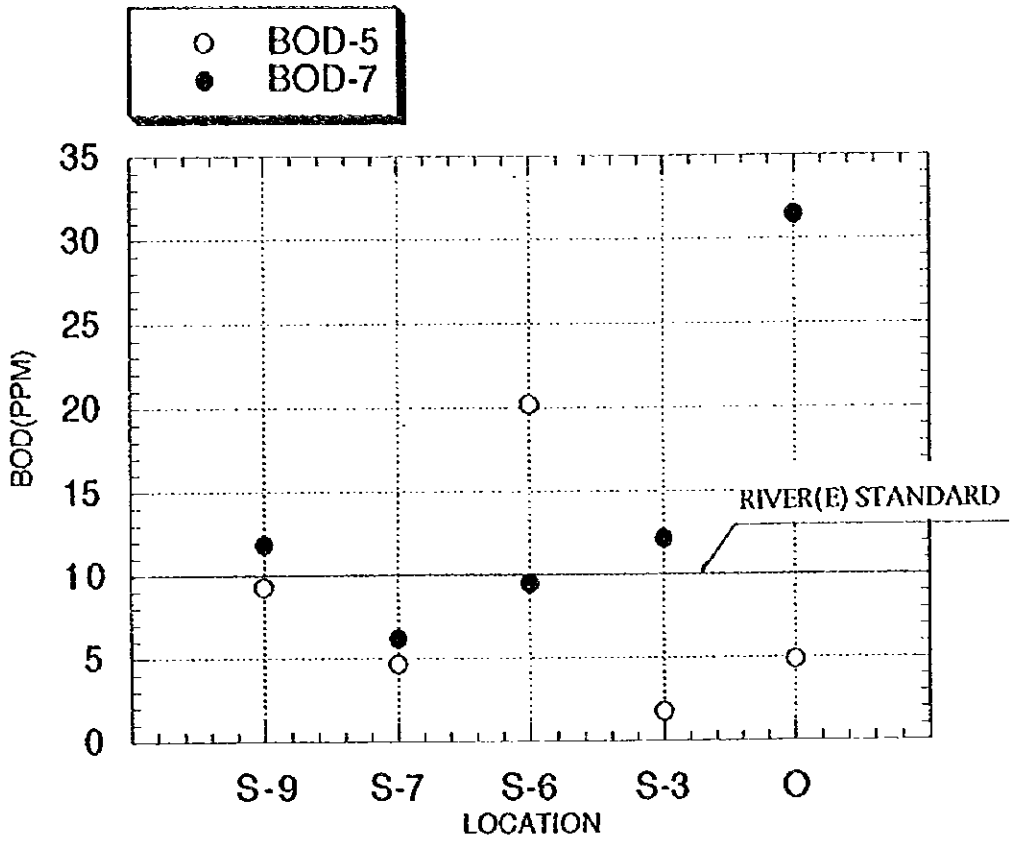


OBSERVATION OF T-N (MAY & JULY, 1996)

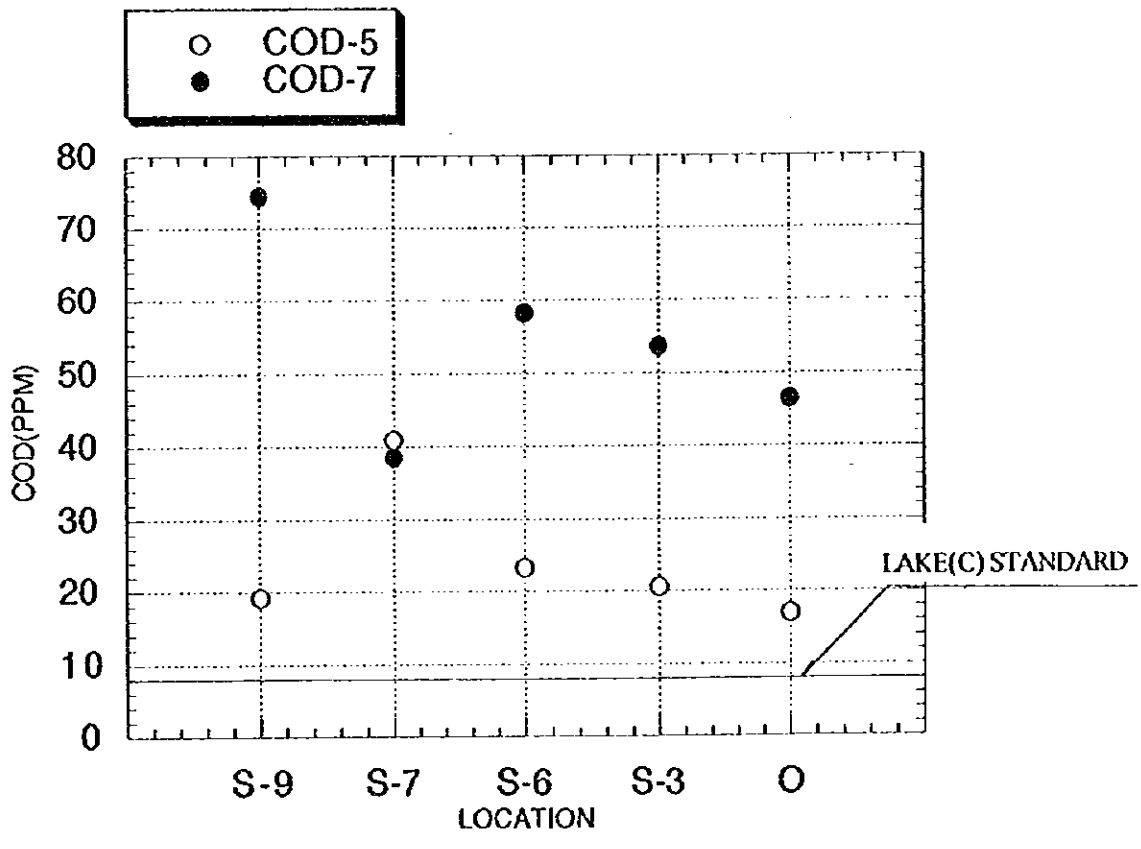


OBSERVATION OF DO (MAY & JULY, 1996)

Figure P.3.2 RESULT OF WATER QUALITY SURVEY (1/2)



OBSERVATION OF BOD (MAY & JULY, 1996)



OBSERVATION OF COD (MAY & JULY, 1996)

Figure P.3.2 RESULT OF WATER QUALITY SURVEY (2/2)

Site Code	River	Suspended Load	Bed Load	River Bed Materials
S1	San Miguel R.	○	○	○
S2	San Miguel R.	○	○	○
S3	San Miguel R.	○	○	○
S4	San Miguel R.	○	○	○
S5	San Miguel R.	○	○	○
S6	San Miguel R.	○	○	○
S7	San Miguel R.	○	○	○
S8	San Miguel R.	○	○	
S9	San Miguel R.	○	○	○
E1	San Esteban R.	○	○	
C1	Villerias R.	○	○	○
C2	Villerias R.	○	○	
C3	Canas R.	○		
C4	Chapeltique R.	○		
C5	Santo Tomas R.	○		
G1	Guayabal R.	○	○	○
G2	Seco R.	○	○	
G3	Seco R.	○	○	
G4	San Francisco R.	○		
G5	Yamabal R.	○		
U1	Batres R.	○		○
U2	Ereguyquin R.	○		○
U3	Constancia R.	○		○
U4	Mejicapa R.	○		○
U5	Zope R.	○		○
	(Total Sites)	25	15	15

Figure P.4.1 SAMPLING SITES OF SEDIMENT AND BED MATERIALS

SUPPORTING REPORT

Q: SCOPE OF WORK

SCOPE OF WORK

FOR

THE STUDY

ON

COMPREHENSIVE FLOOD CONTROL

FOR

THE RIO GRANDE DE SAN MIGUEL

IN

THE REPUBLIC OF EL SALVADOR

AGREED UPON BETWEEN

MINISTRY OF AGRICULTURE AND LIVESTOCK

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

SAN SALVADOR, SEPTEMBER 22 ,1995

MR. ANTONIO ADOLFO VILLACORTA GUANDIQUE
TECHNICAL DIRECTOR,
PLANNING OFFICE OF AGRICULTURE,
MINISTRY OF AGRICULTURE AND LIVESTOCK,
REPUBLIC OF EL SALVADOR

MR. NOBORU MARUOKA
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Republic of El Salvador (hereinafter referred to as "the Government of El Salvador"),the Government of Japan has decided to conduct the Study on the Comprehensive Flood Control for the Rio Grande de San Miguel (hereinafter referred to as "the Study")in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of El Salvador.

The present document sets forth the scope of work with regard to the Study.

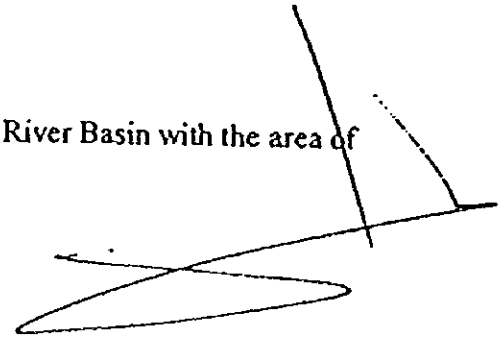
II. OBJECTIVES OF THE STUDY

The objectives of the Study are

1. to formulate a master plan for comprehensive flood control for Rio Grande de San Miguel,
2. to conduct a feasibility study on the urgent and/or priority project(s),and
3 to carry out technology transfer to the counterpart personnel of the Government of El Salvador in the course of the Study.

III. STUDY AREA

The Study area shall cover Grande de San Miguel River Basin with the area of approximately 2,050km^2.



N. SCOPE OF THE STUDY

In order to achieve the above objectives, the Study will cover the following items:

Phase I : Formulation of the master plan for comprehensive flood control and Water resources development

(1)Collection and review of existing data and information

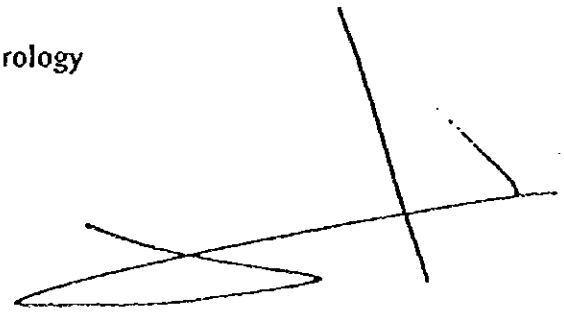
(a) Topography
(b) Meteorology and hydrology
(c) River and river basin
(d) Existing facilities and measures related to flood control and drainage
(e) Flood mark and Flood damage
(f) Existing Flood forecasting and warning system
(g) Laws, regulations, policy and institution related to the river management
(h) Water use
(i) Land use and vegetation
(j) Agriculture, Livestock, Forestry and Fishery
(k) Environmental Policy
(l) National and regional socio-economy
(m) Regional development plans and policies
(n) Others

(2)Field reconnaissance

(a) Topography
(b) River and river basin
(c) Existing facilities and measures related to flood control and drainage
(d) Flood mark and Flood damage
(e) Existing Flood forecasting and warning system
(f) Water use
(g) Land use
(h) Environment
(i) Socio-economic situation

(3)Field survey (if necessary)

(a) Meteorology and hydrology
(b) Geology and Soil
(c) Water quality
(d) Sediment discharge



(e) Profile and cross-section of the river

(f) Topography

(4)Study and Analysis

(a) Hydrological analysis

(b) Run-off analysis

(c) Clarification of flood mechanism

(d) Flood damage(inundated area and damage cost)

(e) Water balance analysis

(f) Sediment discharge

(g) Regional development trend in the future (socio-economy, agriculture, water use, land use etc.)

(5)Formulation of master plan

(a) Structural measures

(b) Non-structural measures

(c) Cost estimation

(6)Initial Environmental Examination (IEE)

(7)Evaluation

(a) Economic and financial evaluation

(b) Selection of priority project(s)

Phase Ⅱ :Feasibility study on the urgent and/or priority project(s)

(1)Supplemental data collection and field survey

(2)Preliminary design of facilitie(s)

(3)Execution plan

(4)Operation and maintenance plan

(5)Cost estimation

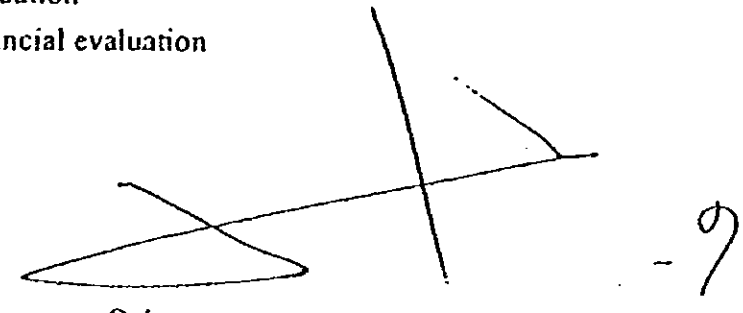
(6)Evaluation

(a) Environment Impact Assessment (EIA)

(b) Social impact evaluation

(c) Economic and financial evaluation

(7)Implementation plan



V. SCHEDULE OF THE STUDY

The Study will be carried out in accordance with the tentative schedule attached in Appendix.

VI. REPORTS

JICA shall prepare and submit the following reports in English to the Government of El Salvador.

1. Inception Report:
   Twenty(20) copies at the beginning of the work in El Salvador.

2. Progress Report(1):
   Twenty(20) copies at the end of the first work period in El Salvador.

3. Interim Report:
   Twenty(20) copies at the beginning of the second work period in El Salvador.

4. Progress Report(2):
   Twenty(20) copies at the end of second work period in El Salvador.

5. Draft Final Report:
   Twenty(20) copies within sixteen(16) months after the commencement of the Study.
   The Government of El Salvador will present its comments to JICA within one(1) months after the receipt of the Draft Final Report.

6. Final Report:
   Fifty(50) copies within one(1) month after JICA's receipt of the said comments on the Draft Final Report.

Ⅵ. UNDERTAKINGS OF THE GOVERNMENT OF El SALVADOR

1. To facilitate smooth implementation of the Study, the Government of El Salvador shall take necessary measures:

(1) to secure the safety of the Japanese Study Team,

(2) to permit the members of the Study Team to enter, leave and sojourn in El Salvador for the duration of their assignment therein, and to exempt them from foreign registration requirements and consular fees,

(3) to exempt the members of the Study Team from taxes, duties and any other charges on equipment, machinery and other materials brought into and out of El Salvador for the implementation of the Study,

(4) to exempt the members of the Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study Team for their services in connection with the implementation of the Study,

(5) to provide necessary facilities to the Team for remittance as well as utilization of funds introduced into El Salvador from Japan in connection with the implementation of the Study,

(6) to secure permission for entry into private properties or restricted areas for the implementation of the Study,

(7) to secure permission for the Study Team to take all data and documents (including photographs and maps) related to the Study out of El Salvador to Japan, and

(8) to provide medical services as needed. Its expenses will be chargeable on the members of the Study Team.

2. The Government of El Salvador shall bear claims, if any arises, against the members of the Study Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Study Team.

3. Ministry of Agriculture and Livestock (hereinafter referred to as "MAG") shall act as a counterpart agency to the Study Team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. MAG shall, at its own expense, provide the Study Team with the followings, in cooperation with other organizations concerned:

(1) available data (including photographs and maps) and information related to the Study,

(2) counterpart personnel,

(3) suitable office space with necessary equipment and furniture in San Salvador,

(4) credentials or identification cards, and

(5) appropriate number of vehicles with drivers.

VI. UNDERTAKINGS OF JICA

For the implementation of the Study, JICA shall take the following measures:

1. to dispatch, at its own expense, the Study Team to El Salvador; and

2. to pursue technology transfer to the El Salvador counterpart personnel in the course of the Study.

IX. CONSULTATION

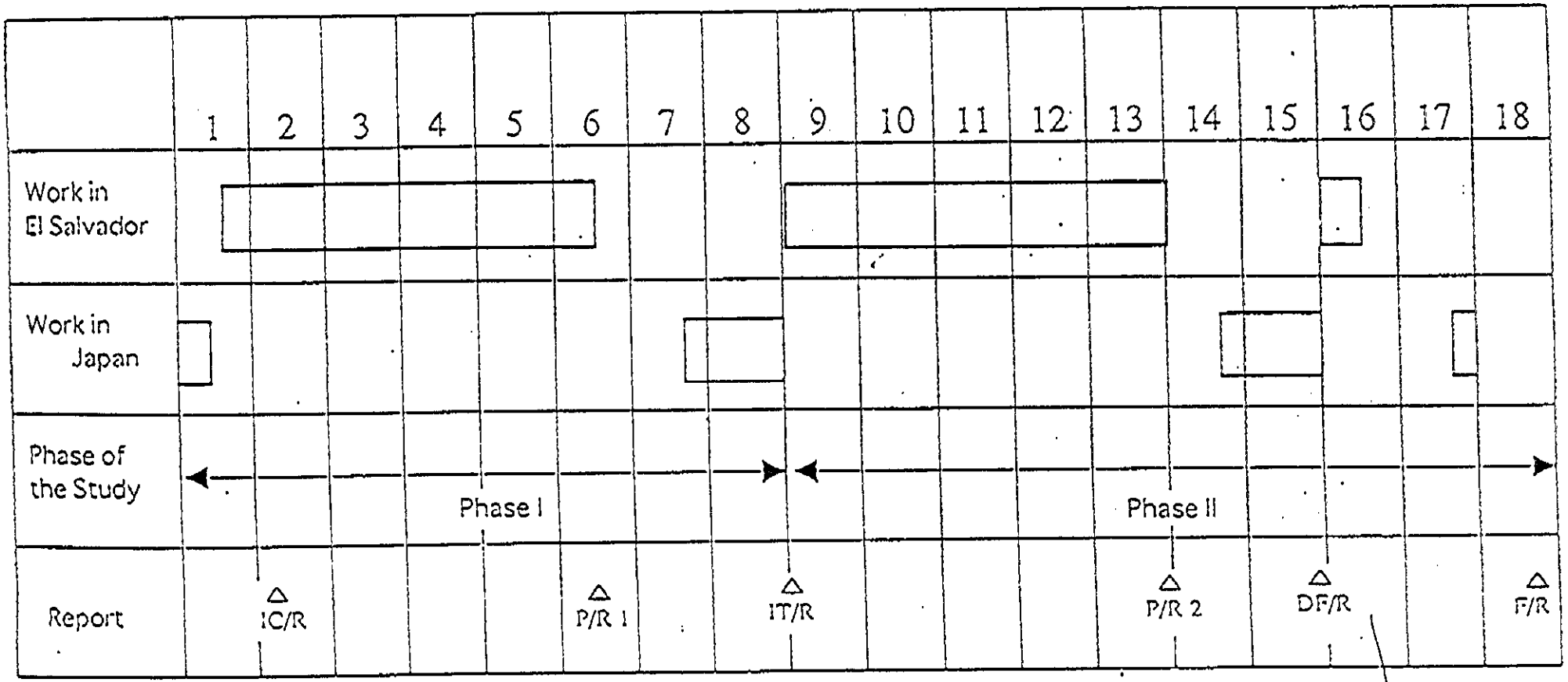
JICA and MAG shall consult with each other in respect of any matter that may arise from or in connection with the Study.

X. Others

In case any divergency arises about interpretation of the Scope of Work and Minutes of Meetings which is prepared in English and Spanish , the English text shall prevail.

Appendix

TENTATIVE SCHEDULE



IC/R : Inception Report
P/R : Progress Report
IT/R : Interim Report
DF/R : Draft Final Report
F/R : Final Report

MINUTES OF MEETINGS
FOR
THE STUDY
ON
COMPREHENSIVE FLOOD CONTROL
FOR
THE RIO GRANDE DE SAN MIGUEL
IN
THE REPUBLIC OF EL SALVADOR

AGREED UPON BETWEEN
MINISTRY OF AGRICULTURE AND LIVESTOCK
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

SAN SALVADOR, SEPTEMBER 22 ,1995

MR. ANTONIO ADOLFO VILLACORTA GUANDIQUE
TECHNICAL DIRECTOR,
PLANNING OFFICE OF AGRICULTURE,
MINISTRY OF AGRICULTURE AND LIVESTOCK,
REPUBLIC OF EL SALVADOR

MR. NOBORU MARUOKA
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

In response to the request of the Government of the Republic of El Salvador, (hereinafter referred to as "the Government of El Salvador") the Government of Japan has decided to conduct a Study on Comprehensive Flood Control for the Rio Grande de San Miguel (hereinafter referred to as "the Study") through Japan International Cooperation Agency (hereinafter referred to as "JICA").

The JICA preparatory study team(hereinafter referred to as "the Study Team"), headed by Mr. Noboru Maruoka, visited the Republic of El Salvador from Sept. 11, 1995 to Sept. 27,1995, where field survey of the study area was carried out and a series of meetings were held with Ministry of Agriculture and Livestock (hereinafter referred to as "MAG") and other authorities concerned of the Government of El Salvador. The list of attendants is shown in Annex 1 .

The draft S/W proposed by the Study Team was discussed in detail between MAG and the Study Team and both side agreed to adopt the S/W with the following understandings

I OBJECTIVES OF THE STUDY

As is mentioned in S/W, main objective of the study is to formulate the master plan for comprehensive flood control for Rio Grande de San Miguel and to carry out feasibility study on the urgent and/or priority project(s). And, in the Phase 1 of the study, master plan study on the water resources development which will be made possible by utilizing flood control facilities for multi-purpose shall also be carried out. In the Phase 2 of the study , feasibility study on priority project(s) will be conducted.

II SCOPE OF THE STUDY

1. MAG suggested that collection and review of existing data and information should be done on Livestock, Fishery, and Forestry as well as Agriculture and field reconnaissance should be done on socio-economic situation. The study team accepted the suggestion, and agreed to mention these items in the S/W.

2. MAG requested the study team to conduct study and analysis on population and housing in the master plan study . The Study Team explained that it was already included in the scope of the study , and agreed to record the request to make sure.

3. MAG requested the Study Team to include organization plan as a part of the feasibility study. The Study Team explained that it was already included in the scope of the study , and agreed to record the request to make sure.

III REPORTS

1. Accepting the request of MAG, the Study Team agreed to prepare Inception, Draft Final and Final Report in Spanish as well as English, and also prepare summaries of Progress and Interim Report in Spanish.

2. MAG suggested that the number of the reports in English could be reduced.

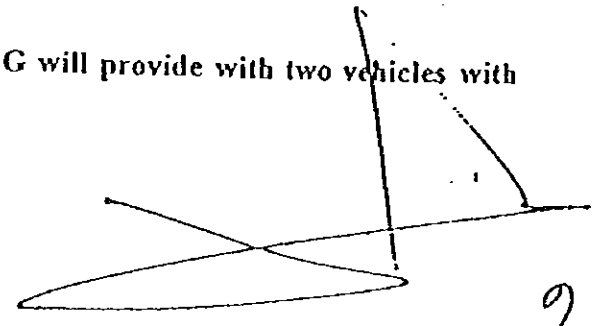
3. As for the Final Report, MAG agreed to make it open to the public at present . At the submission of the Draft Final Report it will be finally decided whether the Final Report is made open to the public or not.

IV UNDERTAKINGS OF THE GOVERNMENT OF EL SALVADOR

1. The Study Team requested MAG to assign necessary technical counterpart personnel with specialties mentioned in S/W and supporting staff for the smooth implementation of the Study and MAG accepted the request.

2. The Study Team confirmed that MAG will prepare suitable office space in San Salvador and San Miguel.

3. The Study Team confirmed that MAG will provide with two vehicles with drivers , fuel and maintenance cost.



V UNDERTAKINGS OF JICA

1. MAG requested the Study Team to carry out counterpart training in Japan and the Study Team agreed to convey the request to JICA H.Q. for the necessary arrangement for the training.

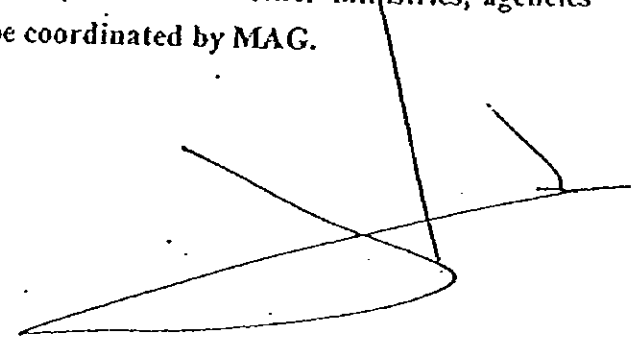
2. MAG requested the Study Team to hold a seminar as a part of technology transfer mentioned in S/W and the Study Team agreed to convey the request to JICA H.Q. for the positive consideration.

VI STUDY EQUIPMENT

· MAG requested the Study Team to provide with equipments for the Study listed in Annex 2 . The Study Team explained that detail of equipments which will be brought for the Study will be determined through the consideration of the result of the preparatory study and promised to convey the request to JICA H.Q..

VII STEERING COMMITTEE

· Both side agreed to establish the steering committee for more effective and efficient implementation of the Study. The committee will be comprised of the representatives of MAG, CEL, SEMA, ANDA and other ministries, agencies and organizations concerned and be coordinated by MAG.



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Annex 1

List of Attendants

[JAPANESE SIDE]

Mr. Noboru Maruoka	Leader / Watershed Management
Mr. Kazuhiro Tambara	Study Planning
Mr. Shuji Kuwano	Flood Control Planning
Mr. Kuniki Iwata	Facility Planning
Mr. Nobuyuki Okabe	Hydrology / Hydraulics
Mr. Yoshimi Sugano	Interpretation

[El Salvador Side]

Mr. Antonio Adolfo Villacorta G.	Technical Director , OSPA , MAG
Ms. Inés María Ortíz	General Director , DGRNR , MAG
Mr. Anselmo Renderos A.	Chief of Div., External Cooperation and Public Investment , OSPA , MAG
Mr. Juan Santos Fuentes Q.	Chief of Project Area, External Cooperation and Public Investment , OSPA , MAG
Mr. Iván Orellana	Project Technician , External Cooperation and Public Investment , OSPA , MAG
Ms. Doris de Urbina	Project Technician , External Cooperation and Public Investment , OSPA , MAG
Mr. Ramón García Vásquez	Chief of River Basin , DGRNR , MAG
Mr. Alberto García	Chief of Irrigation and Drainage , DGRNR , MAG
Mr. Rogelio Posada B.	Prog. Coordinator of Land Transfer , CENTA , MAG

Annex 2

MAG expressed the necessity to build and equip hydrological stations and clime meteorologic stations. The detail is as follows :

A. Hydrological equipment and facilities

For construction of 5 hydrological stations , following equipment is necessary.

· 5 mechanical water level recorders for the continuous recording (Type X or X/43 of A.OTT or Type X1 of SEBA)

· 5 houses for mechanical water revel recorders of around 0.60m x 0.70m

· 5 vertical metal tubes of 60 or 40 inches of diameter

· 60 meters of aluminum or porcelain staff gauges of 0-12 m

· 2 universal current meter equipment of measuring range 0.025- 10 m/sec. (A.OTT C31 or SEBA F1)

· 2 equipment's to take sediment data (A.OTT 92.050)

· 2 single portable drum winches of maximum load 50 kg and 100kg (SEW-11 SEBA Hydrometric or A.OTT 15.050)

· 4 cable way installations for aerial measurements of rivers

These installations could be in two types : a) Cable way installation (A.OTT SK-4T or SEBA SKA) or b) Cable way installation for two persons (metallic towers , cable and seats for 2 persons)

· 2 electric groundwater level conduct meter of measurement range 20-500 m (SEBA KLL- T or A.OTT KLT)

· Personal computer (PC-486/100 MHz) for digitalization of data base , data analysis and utilization of mathematical and hydrological models .