No. 1 and those at other monitoring points in the ARIS area, a rather distrinct difference in water temperature and dissolved oxygen is found. This is mainly due to slower velocity and shallower water depth in the downstream canals resulting in raise in water temperature and decline in dissolved oxygen. However, records on tubidity, pH and electric conductivity observed at the respective monitoring points in the ARIS area in the same day converged nearly the identical level.

The water of the Ambayoan River without any mine tailing sources in its catchment area was ordinarily clear. The observed records at the Monitoring Point No. 9 established at the ADRIS intake dam site were below 80 ppm for turbidity, less than 300 μS/cm for electric conductibity and over 7.5 mg/ℓ for dissolved oxygen, indicating obvious difference in water quality compared with that of the Agno River. But the value of pH ranged between 7.8 and 8.9.

In some parts of the ARIS area, currently, the NIA ARIS Project Office is executing the temporary countermeasure for converting irrigation water source from the Agno River to ponds or small rivers. To make comparison of quality between canal water in the ARIS area and pond or river water newly used, simultaneous water sampling works were done on November 21 and 22, 1984 after checking water temperature, turbidity, pH, electric conductivity and dissolved oxygen at each water sampling point. As a result, as shown in Table F-28, it was made clear that the turbidity of pond or small river water was less than 60 ppm and quite clear compared with that of canal water being 225 ppm. Also, lower values in pH of 7.0 to 8.2 and higher values in electric conductivity were observed.

(3) Results of Laboratory Tests

The results of laboratory tests are as shown in Tables F-29 thru F-38 for water samples collected at the 10 monitoring points in the ARIS area and in Tables F-39 and F-40 for those taken at two monitoring points in the ADRIS area.

1) Suspended solid

The suspended solid content in irrigation water of the ARIS area indicated a wide variation in response to velocity and discharge of canal water at sampling times, distributed period and quantity of water in irrigation canals before taking water samples, and performance of canal dredging works. In comparing the suspended solid content in water samples collected in the same day, this content did not always decline in order from the upstream Monitoring Point No. 1 to the

downstream Monitoring Point No. 12 in the ARIS area. Sometimes, water samples taken at the downstream places had higher content in the suspended solid compared with the water sample collected at the upstream Monitoring Point No. 1. This fact suggests that sediments on the canal bed become a new load for the downstream section of canals when irrigation water is intermittently conveyed. The suspended solid content in irrigation water of the ARIS area throughout the observation period varied as follows:

Main canal	
Uppermost monitoring point	53 to 8,317 ppm (whole year)
Lowermost monitoring point	143 to 3,581 ppm (wet season)
Laterals	
Upstream monitoring point	42 to 2,295 ppm (whole year)
Downstream monitoring point	171 to 2,372 ppm (wet season)
Watercourse	12 to 2,680 ppm (whole year)

In the ADRIS area, on the contrary, the content of suspended solid in water samples taken at the Monitoring Point No. 9 nearby the intake dam on the Ambayoan River was less than 10 ppm for the dry season and below 100 ppm for the wet season, except when the water level raised due to heavy rainfalls in the upper catchment area of the Ambayoan River. The water in the lateral of ADRIS area showed a range of suspended solid content between 10 and 100 ppm throughout the observation period by the effect of inflow of drained and muddy water.

A bridge construction for the access road to the proposed San Roque dam site was performed at the point of 500 m upstream from the ARIS intake dam for five months from the beginning of 1984. For foundation works of piers, the river bed was excavated during this period. The effect of river bed excavation of sediment load to the downstream reaches of the Agno River was checked by determining suspend solid quantitatively. As shown in Tables F-41 thru F-44, suspended solid content in the river water sample taken at a point downstream from the bridge slightly increased compared with that taken at the upstream point. But water samples of the Monitoring Point No. 1 on the ARIS main canal taken at the same time showed a different pattern of change in suspended solid content. This was clear when canal dredging works were conducted.

The content of suspended solid in pond and small river water was less than 10 ppm, while it increased to about 60 ppm if surface water was drained from paddy fields irrigated by the ARIS canals.

2) Dissolved heavy metals

The variation of dissolved heavy metal concentration in water samples taken in the ARIS area is as shown in Tables F-29 thru F-38. At the Monitoring Point No. 1 on the uppermost diversion point of main canal, dissolved heavy metal concentration in the dry season irrigation water varied between 0.007 and 0.015 mg/ℓ for copper and 0.006 to 0.020 mg/ℓ for lead and was on a trace level for cadmium and arsenic. Similar tendency in variation of dissolved heavy metal concentration was found for water samples taken at other three monitoring points in the ARIS area. As shown in Tables F-39 and F-40, water samples collected in the ADRIS area contained a very small amount of copper, lead and zinc in the initial stage of dry season irrigation period. There is no distinct effect of river bed excavation work on the change in dissolved heavy metal concentration in river water.

In the ARIS area, water samples taken when the wet season irrigation supply was started had dissolved heavy metal concentration of less than 0.010 mg/ℓ for copper, less than 0.02 mg/ℓ for lead and less than 0.004 mg/ℓ for cadmium. During the wet season after June, zinc concentration was about 0.010 mg/ℓ for the whole period, while concentration of other dissolved heavy metals was always below 0.005 mg/ℓ.

Water samples collected from ponds and small rivers in the ARIS area at the end of wet season had dissolved zinc concentration of 0.015 mg/ℓ and dissolved cadmium concentration of 0.001 to 0.002 mg/ℓ as shown in Table F-45.

6. Results of Soil Survey

(1) Master Pit Survey

The profile descriptions of 10 master pits dug in the whole proposed San Roque irrigation development area are as shown in Tables F-46 thru F-55. To sum up, soils are deep with good permeability not only in paddy fields distributed over the flood plain but also gentle sloping areas on lower hills located between the ARIS and its Extension areas on the right bank of the Agno River. When the master pit survey was conducted at the end of the dry season in 1984, it was observed that the depth of dried up soils ranged from 25 to 120 cm below the surface depending on micro topography.

The typical texture of paddy soils extended over the alluvial plain is silty clay

loam and plowsole layer is not well developed. The texture varies from sand to loamy sand for subsurface soils in the lowest flood plain along the Agno River and silt loam in the higher alluvial plain. Soils of gentle sloping areas on lower hills have a texture of sandy clay loam throughout the solum.

The results of laboratory tests done by the NIA Engineering Laboratory area as shown in Tables F-56 thru F-65. From this, a distinct tendency is found in terms of chemical characteristics of plowed and subsurface soils. The plowed soils show the acid to weak acid soil reaction with the variation of pH values of 1:1 soil-water ratio extract between 5.0 and 6.5. The electric conductivity varies between 30 and 600 μS/cm, when the degree of base saturation is below 80%. On the contrary, subsurface soils of which the degree of base saturation is less than 80% show the neutral soil reaction with the pH value of 7.0 and the lower electric conductivity of less than 150 μS/cm. Furthermore, surface soils of gentle sloping areas on lower hills have the cation exchange capacity half as much as that of paddy soils. The degree of base saturation is around 50%. The pH value of 1:1 soil-water ratio extract is 5.1 indicating the soil reaction of nearly strong acid. The electric conductivity is very low and less than 30 μS/cm. On the other hand, subsoils below 25 cm from the surface show the cation exchange capacity 1.5 times as much as that of surface soils and the pH value of 6.5. Like the surface soils, the electric conductivity of subsurface soils is very low.

(2) Extractable heavy metals

In the Study, the results of heavy metal analysis are expressed as the content of the total heavy metals for the extract of sodium carbonate, the extractable heavy metals for the extract of a mixture of perchloric , sulfuric and nitric acids, and the soluble heavy metals for the simplified extract. The definition is also made for the extractable heavy metals as an element possibly translocated from soils to crops, and for the soluble heavy metals as an element easily absorbed by crops.

The results of heavy metal analysis on soils taken at the master pit survey are as shown in Table F-66 for the total element, Table F-67 for the extractable element and Table F-68 for the soluble element. In general, the behaviour of extractable copper and zinc in soils indicates the effect of siltation caused by mining activities in the upper Agro River basin to a certain extent. However, variation of lead and arsenic contents of soils has no good correlation with the siltation of mine tailings in the ARIS area. As cadmium content is very low in each soil sample, the necessity for assessment of cadmium is not recognized. The detailed interpretation on the behaviour of extractable heavy metals is presented below.

The extractable copper concentration is about 30 ppm in surface soils and around 60 ppm in subsurface soils extending over the gentle sloping areas of lower hills in the proposed San Roque irrigation development area. This sampling point is located above the canal water level of ARIS and also the flood water level of the Agno River. From the viewpoint of topography and the past land use condition, the soils of this place can be considered to have copper content mostly equivalent to the level of natural background in the proposed San Roque irrigation development area. Compared with such copper content, artificial accumulation of copper in surface soils of irrigated paddy fields in the ARIS area is clearly identified. The extractable copper concentration exceeds 500 ppm in surface soils of 50 cm at the inlet part of paddy fields. In order to control siltation, farmers set up a settling basin by re-shaping a small portion of plot of their paddy fields of which inlet connects directly to farm ditches or sub-laterals. Under such condition, the extractable copper concentration in surface soils of 20 cm declines to 150 ppm at the middle part and 100 ppm at the outlet part of paddy fields.

The extractable copper concentration in soils taken in communal irrigation scheme areas and also rainfed paddy fields ranges from 35 to 50 ppm in surface soils and varies from 50 to 70 ppm in subsoils. This is slightly higher or almost similar to the aforesaid natural background.

In respect of extractable zinc, the natural background has a range of 30 to 35 ppm in surface soils and 45 to 60 ppm in subsoils in the proposed San Roque irrigation development area. In the irrigated paddy fields of the ARIS area, artificial accumulation of zinc is observed and the extractable zinc concentration is around 270 ppm in surface soils of 50 cm at the inlet part of paddy fields and 160 ppm in subsoils up to 75 cm. The extractable zinc varies between 90 and 100 ppm in surface soils of the middle and outlet parts of the same irrigated paddy fields. In other paddy fields, irrigated by the ADRIS and communal schemes and rainfed, the extractable zinc concentration ranges from 35 to 70 ppm and the vertical change in zinc concentration in soils shows the same behaviour of copper.

With regard to lead, soils of the gentle sloping areas on lower hills show the variation of 10 to 30 ppm in the extractable lead concentration, while paddy soils have the extractable lead concentration of less than 10 ppm as usual with minor exception of higher concentration than 50 ppm.

The extractable arsenic concentration is below 15 ppm throughout the solum. This is lower than the natural background level of tropical soils. In surface soils of paddy fields in the ARIS area, a few exceptional cases are found, while there is no close correlation of the behaviours between copper and arsenic.

(3) Soluble Heavy Metals

The soluble copper, lead, zinc, cadmium and arsenic were determined quantitatively for soil samples collected from the 10 master pits, 240 random soil sampling points and 24 plots of monitoring paddy fields. The results of laboratory tests are interpreted as follows.

According to the results of laboratory tests on soil samples taken at the 10 master pits, the behaviour of soluble copper and zinc is almost similar to that of the extractable copper and zinc. The variation of soluble copper concentration in surface soils of irrigated paddy fields in the ARIS area is between 135 and 150 ppm at the inlet part. The soluble copper concentration in surface soils of the same paddy field declines to 30 ppm at the middle part and 18 ppm at the outlet part. In other master pits, the soluble copper concentration is less than 4 ppm for soils of the gentle soping area on lower hills and less than 8 ppm for irrigated and rainfed paddy soils in the outside of the ARIS area. With regard to soluble lead, zinc and cadmium concentration, surface soils taken at the settling basin and inlet of irrigated paddy fields in the ARIS area show the similar variation to the soluble copper concentration. The respective variations are between 12 and 14 ppm for the soluble lead, from 20 to 32 ppm for the soluble zinc, and between 0.3 and 0.5 ppm for the soluble cadmium. The maximum soluble arsenic concentration in surface paddy soils is 4.5 ppm. The variation is considered to be based on the parent material of soils and no correlation with sediment load of the Agno River.

Soluble heavy metal concentration in surface soils sampled at the inlet part of irrigated fields in the ARIS area and communal irrigation scheme areas in Urdaneta are shown in Tables 69 to 74 and summarized as below as a reference, soluble copper concentration of the ADRIS paddy soil is also shown below.

	ARIS	Urdaneta	ADRIS
Copper	0.1 to 352 ppm	5 to 20 ppm	12 ppm
Lead	less than 0.3 to 14	0.7 to 4	–
Zinc	less than 0.1 to 43	2 to 6	–
Cadmium	less than 0.1 to 0.5	less than 0.1 to 0.3	–
Arsenic	0.6 to 23	1 to 2	–

The variation of soluble copper concentration in surface soils of irrigated paddy fields indicates the history of irrigation water supply to the commanded paddy fields in the ARIS area. The soils with the higher values of soluble copper concentration

were taken from the surface layer in the settling basins. The depth of sediments in the settling basins reaches 15 cm where the soluble copper concentration shows the highest value. Such soils extend over paddy fields located along the main canal and around the diversion point of each lateral as illustrated in Figure F-3. This illustration indicates the distribution of paddy fields to which irrigation water can be conveyed and also the present situation regarding the effect of siltation on canal capacity. Farmers in the ARIS area usually make settling basins fallow, while smallholders sometimes grow rice plant without fertilization at their own risk.

The variation of soluble zinc concentration has generally no close correlation with the siltation volume in settling basins. As for lead and cadmium concentration, the higher values above-mentioned occur not so frequently and are considered as an exceptional case. Therefore, there exists no close correlation between the actual irrigation water supply and the distribution of soils with higher values of soluble lead and cadmium. This can be said also in case of the soluble arsenic.

In order to clarify the behaviour of sand and silt flown into the paddy field together with irrigation water, plowed and subsurface soils were sampled at each plot of monitoring paddy fields from the inlet side nearby the farm ditch and settling basin to the outlet side facing the drainage channel. The results of laboratory tests on the both extractable and soluble coppers are as shown in Table F-75. For this purpose, four monitoring paddy fields were selected in the ARIS and ADRIS areas; the Monitoring Paddy Field No. 4 from the upper most part, the Monitoring Paddy Field No. 6 from the central part, the Monitoring Paddy Field No. 8 from the downstream part of the ARIS area and Monitoring Paddy Field No. 10 of the ADRIS area.

In the year-round irrigated paddy fields at the Monitoring Paddy Field No. 4, the settling basin has been already filled with sediments. Thus, sand and silt mostly flow into the main field next to settling basin together with irrigation water. As a result, plowed soils of 15 cm at the inlet portion of the first plot have the extractable copper concentration of 1,050 ppm and the soluble copper concentration of 260 ppm. These sand and silt are mixed with subsurface soils by puddling works. The subsurface soils of 15 to 30 cm show the extractable copper concentration of 770 ppm and the soluble copper concentration of 210 ppm. On the other hand, at Monitoring Paddy Field No. 10, soluble copper concentration of surface soils (0 to 15cm) at the inlet portion show as low as 12 ppm and subsurface soils of 15 to 30 cm show only 8 ppm.

Under plot-to-plot irrigation system, the variation of copper concentration in surface soils indicates the transportation distance of sand and silt overflowed from settling basins by water. In other words, the copper concentration declines gradually from inlet to outlet sides within the same plot and from the paddy field adjacent to

watercourses to that connecting to drains. In the Monitoring Paddy Field No. 4, plowed soils sampled at the outlet portion of first plot show the extractable copper of 800 ppm and the soluble copper of 170 ppm. The copper concentration in surface soils decreases gradually from the second to third plots. Soils taken at the outlet portion of the fourth plot adjacent to the drain have the extractable copper concentration of 410 ppm and the soluble copper concentration of 95 ppm. In ADRIS area, soluble copper concentration of the surface soils at the outlet portion show as low as 8 ppm in first plot and 7 ppm in fourth plot.

As described hereinbefore, the behaviour of sand and silt flown into paddy field with irrigation water is considered to have close correlation with the copper concentration in irrigated paddy soils in the ARIS area. Thus, sediments on canal bed in the ARIS area were collected at the respective monitoring points of irrigation water quality before starting the wet season irrigation and tested for determing heavy metals quantitatively. The results of laboratory tests by particle size distribution are as shown in Table F-76 for the extractable and soluble coppers and Table F-77 for the soluble lead, zinc and cadmium. The contents of soluble copper, lead and zinc are a rather higher in the fraction of silt than in the fraction of coarse sand. As the fraction of coarse sand has a share of 90% in particle size distribution of sediments, however, this can be considered as the main source providing heavy metals to paddy fields at present. The soluble cadmium concentration shows 1.1 ppm in only one case and, in other cases, a level of trace for all the fractions of 10 sediment samples. From this fact, no cadmium is contained in sand and silt transported by the water of the Agno River. In the coarse fraction, the extractable copper concentration ranges from 600 to 1,300 ppm and the soluble copper concentration varies between 90 and 180 ppm. The copper concentration shows decline to the downstream monitoring point. It is concluded that the high content of copper in canal sediments indicates the inflow of sand and silt resulting in copper load to paddy soils in the ARIS area and the mine tailings discharged resulting in copper load to the water of the Agno River.

7. Results of Crop Survey

(1) Dry Season Crop

1) Crop growth survey

Two monitoring paddy fields were established in the ARIS area. Among these, irrigation water supply to the Monitoring Paddy Field No. 4 situated along the Lateral D was cancelled one month after the transplanting of seedlings to the main paddy field, because the NIA ARIS Project Office revised its irrigation plan due to

the water shortage in the Agno River. As a result, the new Monitoring Paddy Field No. 4 was set up along the Don Moteo Ditch in the uppermost part of ARIS area for carrying out crop growth and yield survey.

Table F-78 shows the records on crop management done by farmers cultivating the respective monitoring paddy fields during the dry season. Farmers took the differnet farming practices such as selection of rice variety, date of transplanting, amount of fertilizer applied and date of harvesting. Accordingly, it is hardly to compare with each other's growing condition.

The observation records on crop growth in the respective monitoring paddy fields are as shown in Tables F-79 thru F-82. In the ARIS area, no topdressing was done in the Monitoring Paddy Field No. 2 and thus the growing condition after heading was not much. In the new Monitoring Paddy Field No. 4, the settling basin at the inlet portion was filled with sediments, and sand and silt were overflowing into the main paddy fields with irrigation water. In the plots adjacent to the settling basin, therefore, plowed soil became compact and sandy affecting adversely the growth of observed rice plants especially in terms of number of tillers. On the contrary, urea of 200 kg/ha was applied as topdressing to the Monitoring Paddy Field No. 10 in the ADRIS area, resulting in good and uniform growth of the observed rice plants in all the plots.

2) Yield survey

The results of yield survey and yield component analysis on the dry season crop in the respective monitoring paddy fields are as shown in Tables F-83 and F-84. The summary of yield survey and yield component analysis is as follows including the summarized results of the additional yield survey done in eight places in the ARIS area.

Monitoring Paddy Field	No. of Panicles per Hill	No. of Grains per Panicle	Percent of Ripened Grains	Weight of 1,000 Grains	Weight of 1,000 Ripened Grains
ARIS No. 2	15.2	50.2	70.6%	16.0 g	20.2 g
ARIS No. 4	17.5	86.6	61.7	16.1	22.3
ADRIS No. 10	25.4	70.4	60.9	16.2	22.3
ARIS 8 places					
Inlet plots	12.3	49.7	57.5	15.9	22.6
Outlet plots	16.1	61.3	65.1	18.3	23.4

In the ARIS area, rice plants grown in plots adjacent to the settling basin showed distinctly smaller values in the respective yield components except for the weight of 1,000 grains compared with rice plants grown in plots far from the inlet or connecting to the outlet to drainage channel. This difference in yield components has no correlation with the variation of transplanting time and rice variety. In comparison with the observed rice plants in the new Monitoring Paddy Field No. 4, those in the Monitoring Paddy Field No. 10 showed larger number of panicles per hill and, in contrast, smaller number of grains per panicle.

The paddy yield in the Monitoring Paddy Field No. 2 varies 1.4 ton/ha at minimum and 5.5 ton/ha at maximum with an average of 3.3 ton/ha. In the new Monitoring Paddy No. 4, the variation was between 2.0 and 6.1 ton/ha and its average became 4.5 ton/ha. While, in the Monitoring Paddy Field No. 10, the paddy yield reached 6.1 ton/ha on an average with 4.3 ton/ha at minimum and 8.1 ton/ha at maximum. The fruitful effect of topdressing is clearly seen from the results of yield survey.

Table F-85 shows the informations collected through the interview to farmers with respect to location, variety of rice grown and date of harvesting in eight places selected for undertaking the additional yield survey in the ARIS area. In these eight places, rice plants were selected for yield survey and yield component analysis from 48 plots, comprising 25 plots located adjacent to settling basins or inlets and 23 plots located in the middle and outlet portions. The results are as shown in Tables F-86 thru F-88. The paddy yield in the said 25 plots was 2.1 ton/ha on an average with the range of 0.6 to 3.1 ton/ha, while that in the aforesaid 23 plots average 3.3 ton/ha varying between 2.4 and 4.5 ton/ha.

3) Uptaking of nutrient elements and heavy metals

The laboratory tests were carried out to check uptaking of nutrient elements and heavy metals by rice plants. For this purpose, the observed rice plants were separated into four parts. The results of laboratory tests are as shown in Tables F-89 thru F-92 for nitrogen, phosphate, potassium and silicate contents and Tables F-93 thru F-96 for copper, lead, zinc, cadmium and arcenic contents.

The followings present grain-straw ratio, amount of nitrigen absorbed by rice plants of 1 ha and amount of nutrient elements absorbed for producing grain of 1 ton.

Monitoring Paddy Field	Grain-Straw Ratio	Amount of Nitrogen Absorbed	Amount of Nutrients Absorbed for Producing Grains of 1 ton		
			Nitrogen	Phosphorus	Potassium
ARIS No. 2	0.63	80 kg/ha	11.9 kg	1.7 kg	2.4 kg
ARIS No. 4	0.95	147	13.3	2.2	3.3
ADRIS No. 10	1.03	257	19.7	1.9	3.3

There is no distinct difference in heavy metal concentration except for copper in rice plants between the ARIS and ADRIS areas. However, each part of observed rice plant grown in the ARIS area shows higher copper contents compared with rice plant grown in the ADRIS area as follow.

Monitoring Paddy Field	Leaf (ppm)	Stem (ppm)	Brown Rice (ppm)	Chaff (ppm)	Root (ppm)
ARIS No. 2	77.9	80.9	6.8	9.6	695
ARIS No. 4	41.2	76.4	7.2	7.9	663
ADRIS No. 10	5.1	7.0	3.4	3.8	20

Among other heavy metals, it is well known that cadmium contained in brown rice affects adversely human beings. It was clarified through the laboratory tests that the cadmium concentration in brown rice harvested in the ARIS area was below 0.02 ppm on an average with the exceptional maximum of 0.04 ppm. This fact means that there is no harmful problem in quality of rice produced in the ARIS area from the viewpoint of human health.

(2) Wet Season Crop

1) Crop growth survey

The records on crop management done by farmers cultivating the respective monitoring paddy fields during the wet season are as shown in Table F-78. In the six monitoring paddy fields, four different rice varieties were grown, and the different amount of fertilizer applied and time of fertilizer application were found.

The observation records on crop growth in each monitoring paddy fields are as shown in Tables F-97 thru F-102. The observed rice plants of the Monitoring Paddy Fields No. 6 and No. 12 in the ARIS area were poorer in the number of tillers than those in other monitoring paddy fields. This is closely related to the insufficiency in supplemental irrigation water supply during the initial stage of crop growth and the

poor drainage when storms occured frequently in the ripening period. There seems no close correlation between the insufficient tillering and the amount of fertilizer applied. In the Monitoring Paddy Field No. 10, urea applied as topdressing decreased to 50 kg/ha resulting in the sharp decline in the number of tillers per hill.

2) Yield survey

The results of yield survey and yield component analysis on the wet season crop in the respective monitoring points are as shown in Tables F-103 thru F-105. The summarized results are as below including the summary of the results of additional yield survey and yield component analysis conducted in 18 places in the ARIS area.

Monitoring Paddy Field	No. of Panicles per Hill	No. of Grains per Panicle	Percent of Ripened Grains	Weight of 1,000 Grains	Weight of 1,000 Ripened Grains
ARIS NO.2	15.7	50.1	78.7%	21.5 g	25.5 g
ARIS No. 4	18.5	62.2	75.1	17.7	21.1
ARIS No. 6	11.9	80.2	60.0	17.4	24.2
ARIS No. 8	14.8	96.2	67.6	15.6	19.9
ARIS No. 12	10.8	84.2	79.0	13.0	20.8
ADRIS No. 10	23.0	49.0	43.0	17.8	20.5
ARIS 18 places					
Inlet plots	14.4	54.6	70.6	18.3	21.6
Outlet plots	16.5	60.9	75.5	19.1	23.1

Like the results of yield component analysis of the dry season crop, rice plants grown in plots adjacent to settling basins showed distinctly smaller values in the respective yield components in comparison with rice plants grown in plots of the outlet portion. The yield components of rice plants grown in the Monitoring Paddy Field No. 10 was affected to large extent by the reduction of amount of fertilizer applied. The variation of paddy yield in each monitoring paddy field is summarized as below.

Monitoring Paddy Field	Maximum (ton/ha)	Minimum (ton/ha)	Average (ton/ha)
ARIS No. 2	5.2	2.4	4.2
ARIS No. 4	4.8	3.3	3.9
ARIS No. 6	4.1	2.6	3.2
ARIS No. 8	5.5	1.5	4.1
ARIS No. 12	5.8	3.5	4.8
ADRIS No. 10	3.2	1.6	2.4

Table F-106 shows the informations collected through the interview to farmers in respect of location, variety of rice grown and date of harvesting in 18 places selected for conducting the additional yield survey in the ARIS area. In these 18 places, rice plants selected for yield survey and yield component analysis from 168 plots, consisting of 72 plots located adjacent to settling basins on inlets and 96 plots located in the middle and outlet portions. The results are as shown in Tables F-107 thru F-114. The average paddy yield in the aforesaid 72 plots was 3.1 ton/ha with the range of 0.5 to 6.2 ton/ha, while that in the said 96 plots was 4.1 ton/ha with the minimum yield of 2.1 ton/ha and the maximum yield of 7.0 ton/ha.

3) Uptaking of nutrient elements and heavy metals

The laboratory tests were undertaken to determine nutrient elements and heavy metals absorbed by rice plants quantitatively. The results of laboratory tests are as shown in Tables F-115 thru F-120 for nitrogen, phosphate, potassium and silicate contents and Tables F-121 thru F-126 for copper, lead, zinc, cadmium and arsenic contents.

The followings present the grain-straw ratio, the amount of nitrogen absorbed by rice plants of 1 ha and the mount of nutrient elements absorbed for producing grain of 1 ton.

Monitoring Paddy Field	Grain-Straw Ratio	Amount of Nitrogen Absorbed	Amount of Nutrients Absorbed for Producing Grains of 1 ton		
			Nitrogen	Phosphorus	Potassium
ARIS No. 2	0.78	111 kg/ha	12.2 kg	3.1 kg	3.1 kg
ARIS No. 4	0.74	113	15.7	2.9	2.8
ARIS No. 6	0.98	68	13.3	2.9	3.2
ARIS No. 8	0.72	105	14.3	2.7	3.2
ARIS No. 12	0.80	83	15.3	3.2	2.9
ADRIS No. 10	1.04	110	18.2	3.9	4.0

Similar characteristics for the absorption of heavy metals by the dry season crop are found in the observed rice plants for the wet season. The copper concentration in each part of rice plant is as follows.

Monitoring Paddy Field	Leaf (ppm)	Stem (ppm)	Brown Rice (ppm)	Chaff (ppm)	Root (ppm)
ARIS No. 2	21.6	53.3	6.4	7.6	263
ARIS No. 4	30.7	48.5	4.7	5.9	630
ARIS No. 6	18.9	52.8	4.8	5.5	255
ARIS No. 8	31.8	52.8	5.6	5.3	340
ARIS No. 12	11.9	41.9	6.6	6.1	186
ADRIS No. 10	6.6	10.1	4.5	3.7	12

The cadmium concentration in brown rice of the wet season crop harvested ranged from 0.3 to 0.4 ppm at the Monitoring Paddy Field No. 2 in the uppermost part of ARIS area, 0.2 ppm at maximum in other monitoring paddy fields in the ARIS area and 0.06 ppm at maximum in the Monitoring Point No. 10 in the ADRIS area.

8. Selection of Problem Heavy Metals

Throughout the field observation works on irrigation water, soils and rice plants for one year and laboratory tests, it is pointed out that the main problem in the ARIS area is the inflow of sediments containing copper into paddy fields so far as irrigation water is diverted from the Agno River having the present level of water quality. These sediments also cause physical damages such as expansion of sub-laterals and farm ditches buried under sand and silt. Furthermore, the copper content in leaf, stem and root of the observed rice plants in the ARIS area indicates that soluble copper translocates from surface soils to rice plants to some extent. Also, lead, zinc and arsenic contents of surface soils show a certain correlation with artificial accumulation due to the diversion of water from the Agno River to the ARIS area for irrigation purposes. But any of the above three heavy metal contents is far less than the limits allowed over which a normal growth of crop can hardly be expected. The cadmium content in brown soils is far below the limits allowed over which it becomes poisonous for human beings.

The projected quality of released water from the proposed San Roque dam suggests that the future irrigation water will not contain coarse sediments like the present one and, on the contrary, will become rich in very fine suspended solid contents. It is considered that such a very fine suspended solid is hardly settled even though the water is at rest and also shows the same behaviour of water. Furthermore, the projected water quality indicates the existence of copper in this very fine suspended solid to some extent.

In due consideration of the findings throughout the field observation and laboratory works as well as the projection of reservoir water quality in the future, the necessity to make further study on the behaviour of copper is found for evaluating the future irrigation water quality.

From this point of view, copper is selected for the further evaluation study. Hence the estimate is made for the inflow of suspended solid into the paddy fields and the accumulation of copper in the paddy soils in the proposed San Roque irrigation development area.

9. Future Quality of Irrigation Water and Evaluation of Its Effect

(1) Projected Water Quality

The new water resources to be developed by constructing the proposed San Roque dam will make it possible to supply irrigation water throughout the year to the proposed San Roque irrigation development area of 70,800 ha. The water to be impounded in the reservoir of the proposed San Roque dam will be released downstream through the power waterways and spillway to the Agno River. There is no tributary flown in the main stream of the Agno River between the proposed San Roque dam and the existing ARIS intake dam. As all of water demanded for irrigating 70,800 ha are planned to be diverted from the existing ARIS intake dam site, the future quality of irrigation water can be considered to be same as the projected quality of released water from the proposed San Roque dam in the Study.

According to the projected water quality, dissolved copper concentration will range between 0.002 and 0.009 mg/ℓ. In the future, all of sand and silt will be settled in the reservoir of the proposed San Roque dam, though these are directly transported by irrigation water to the ARIS area at present. In the future, however, a very fine suspended solid with a particle size of less than 5μ will be discharged downstream with the outflow from the proposed San Roque dam. The results of projection indicate that suspended solid concentration in water released from the proposed San Roque dam will decline from 1,600 mg/ℓ at present to 720 mg/ℓ in the future. But; such a very fine suspended solid will not be controlled by passing irrigation water through any type of settling basin and thus will spread to the whole irrigation service areas to be benefited under the proposed San Roque irrigation development. The future copper concentration in the suspended solid is projected to be 140 ppm as soluble copper and 520 ppm as extractable copper.

(2) Methodology for Evaluation

In comparison with the limit allowed over which dissolved copper concentration in irrigation water may affect harmfully rice plants in terms of physiological disorder of crop growth, projected level of dissolved copper concentration is low to a considerable extent. In the Study, therefore, the dissolved copper is considered as a kind of pollutant load to cumulative copper in soils. Thus, sources of pollutant load in the proposed San Roque irrigation development area consist of copper contained in the very fine suspended solid and dissolved copper of irrigation water.

The following equation can give the amount of copper accumulated in soils, including copper dissolved in irrigation water and contained in suspended solid, silt and sand.

$$CAS = (LW + LS_1 + LS_2) \times a \times e$$

$$LW = Dw \times Wc$$

$$LS_1 = Dw \times Ws \times Sc \times 10^{-6}$$

$$LS_2 = Sp \times Spc$$

where,

CAS : Annual amount of accumulated copper in soils (g/ha)
LW : Copper load derived from irrigation water (g/ha)
LS_1 : Copper load derived from suspended solid contained in irrigation water (g/ha)
LS_2 : Copper load derived from transported sand and silt (g/ha)
a : Rate of accumulation
e : Rate of activation
Dw : Diversion water requirement (m^3/ha)
Wc : Average seasonal concentration of dissolved copper (ppm)
Ws : Average seasonal concentration of suspended solid (ppm)
Sc : Average copper concentration in suspended solid (ppm)
Sp : Amount of transported sand and silt by fraction of particle size (ton/ha)
Spc : Average copper concentration in transported sand and silt by fraction of particle size (ppm)

In the above equations, the diversion water requirement is referred to the ELC's calculation results of irrigation water demand for the respective irrigation systems of the proposed San Roue irrigation development area. In referring the ELC Feasibility Report, minor modification in respect to effective basin rainfall is made taking into account the results of hydrologic review in the Study. The copper concentration in

irrigation water and suspended solid is referred to the projected water quality obtained through the assessment of the reservoir water quality in the Study. The transported sand and silt are neglected from the aforesaid equations, because all of sand and silt are anticipated to be settled in the reservoir of the proposed San Roque dam according to the projection of reservoir water quality in the Study. The value of "a" is assumed to be equal to the irrigation efficiency determined in the ELC Feasibility Report. This value assumed is 55% in case of rice cultivation and 50% in case of upland crop cultivation. Instead of the value of "e", the soluble copper concentration is applied to the values of Sp and Spc in the above equations. This value is obtained from the projected water quality in the Study.

(3) Accumulation of Copper in Soils

Based on the future irrigation development plan described in Chapter 3, the crop irrigation water requirement at diversion work is calculated for each of the seven cropping patterns proposed for the San Roque irrigation development project. Monthly basin rainfall records employed for this calculation are as shown in Table F-127. The proposed irrigation area by cropping pattern in each of the four irrigation systems is as shown in Table F-128. The irrigation diversion requirements calculated for the seven proposed cropping patterns are as shown in Tables F-129 thru F-132. The monthly irrigation diversion requirements are as shown in Table F-133 for the ARIS area, Table F-134 for the ARIS Extension area, Table F-135 for the ADRIS area and Table F-136 for the LARIS area. The average monthly irrigation diversion requirements for 30 years are summarized below.

Month	ARIS (m^3/ha)	ARIS-Extension (m^3/ha)	ADRIS (m^3/ha)	LARIS (m^3/ha)
Jan.	4,087	3,814	3,303	3,808
Feb.	3,386	3,317	3,032	3,333
Mar.	2,136	2,094	2,011	2,109
Apr.	715	648	668	621
May	388	310	291	254
June	1,527	1,568	1,416	1,539
July	1,548	1,662	1,569	1,673
Aug.	1,054	1,035	958	1,083
Sept.	577	577	534	609
Oct.	444	464	470	486
Nov.	1,052	818	597	803
Dec.	2,283	1,993	1,609	1,982
Annual	19,199	18,302	16,458	18,300

There are four cases made for projecting the future reservoir water quality in the Study. Among these, two cases, namely "Run-1" and "Run-4", are selected for the evaluation of the projected water quality from the viewpoint of agricultural use. The latter case is the future water quality projected in the worst manner under the given condition for the Study. By applying the projected water quality under the case of "Run-1" to the equations described hereinbefore, copper load is calculated and its results are as shown in Table F-137 for dissolved copper concentration in irrigation water, Table F-138 for suspended solid concentration in irrigation water, Table F-139 for total copper concentration in suspended solid and Table F-140 for soluble copper concentration in suspended solid. As for the case of "Run-4", the calculation is also made in the same manner and its results are as shown in Tables F-141 thru F-144.

After the future water supply to the proposed San Roque irrigation development area is started by diverting released water from the proposed San Roque dam, the copper, dissolved in irrigation water and contained in suspended solid, is transported to paddy fields through irrigation canals. Thus, copper load to the paddy field of 1 ha is calculated and, taking into account the rate of accumulation, the remaining amount of copper on the surface of paddy fields is estimated. The results of estimate under the case of "Run-1" are as shown in Tables F-145 thru F-147 for the ARIS area, Table F-148 thru F-150 for the Aris Extension area, Table F-151 thru F-153 for the ADRIS area and Tables F-154 thru F-156 for the LARIS area. The following shows the summary of the average monthly accumulated amount of soluble copper in surface soils of paddy fields for 30 years.

Month	ARIS (g/ha)	ARIS-Extension (g/ha)	ADRIS (g/ha)	LARIS (g/ha)
Jan.	226	211	183	211
Feb.	178	175	160	175
Mar.	145	142	136	143
Apr.	140	126	130	121
May	46	37	35	30
June	141	145	131	142
July	142	152	144	153
Aug.	77	75	70	79
Sept.	17	17	16	18
Oct.	17	18	18	18
Nov.	62	48	35	48
Dec.	159	139	112	138
Annual	1,350	1,286	1,169	1,277

The results of estimate under the case of "Run-4" are as shown in Tables F-157 thru F-159 for the ARIS area, Tables F-160 thru F-162 for the ARIS Extension area, Tables F-163 thru F-165 for the ADRIS area and Tables F-166 thru F-168 for the LARIS area. The following shows the summary of the average monthly accumulated amount of soluble copper in surface soils of paddy fields for 30 years. In this case, the monthly outflow from the proposed San Roque dam becomes short to meet the monthly irrigation diversion requirement for the whole proposed San Roque irrigation development area to a certain extent in some months of the drought year. In estimating the accumulated amount of copper in paddy soils, such occurrence of water shortage is not taken into account. Hence the results of estimate indicate the accumulated amount of copper in surface soils of paddy fields to which irrigation water is supplied in accordance with the original water distribution programme.

Month	ARIS (g/ha)	ARIS-Extension (g/ha)	ADRIS (g/ha)	LARIS (g/ha)
Jan.	317	295	255	295
Feb.	281	275	252	277
Mar.	286	280	268	281
Apr.	162	147	151	141
May	72	58	54	48
June	219	225	203	218
July	168	180	170	181
Aug.	83	83	77	85
Sept.	38	39	36	40
Oct.	24	24	25	27
Nov.	78	59	43	60
Dec.	193	167	135	167
Annual	1,921	1,832	1,670	1,819

Table F-169 shows the average value for 30 years in terms of monthly accumulated amount of total copper in paddy soils in the respective irrigation system areas.

(4) Evaluation of Projected Water Quality

In evaluating the projected water quality of water released from the proposed San Roque dam from the viewpoint of agricultural use, considerable attention is paid to the behaviour of copper in soils, which is clarified through the undertaking of field observation and laboratory works in the Study. Thus, the projected quality

of reservoir water is evaluated based on the behaviour of soluble copper in paddy soils. As described hereinbefore, the annual accumulated amount of soluble copper in paddy soils ranges from 1.15 to 1.35 kg/ha under the case of "Run-1" and 1.65 to 1.95 kg/ha under the case of "Run-4", when the reservoir water released from the proposed San Roue dam is utilized for irrigation in the future.

As pointed out, the very fine suspended solid is considered to spread over the whole irrigated paddy fields even though irrigation water passes through a settling basin. Except for the suspended solid contained in the outflow from paddy fields to drainage channels through the outlet, the suspended solid will remain after being transported to paddy fields. This accumulated suspended-solid will be mixed with the surface paddy soils by tillage done in the initial stage of every crop season. Absorption by rice plants and loss by deep percolation of irrigation water are neglected in estimating soluble copper concentration in surface paddy soils. In case that tillage depth is assumed to be 15 cm, hence, soluble copper concentration in surface paddy soils will increase by around 0.8 ppm every year.

It is well known through the preceding findings in Japan, reduction of crop yield influenced by copper contained in soils will usually occur when the soluble copper concentration in surface soils exceeds a level of 125 ppm. Following this, the period of time required for reaching the above limits allowed is estimated to be about 120 years for the ARIS area and around 160 years for other three irrigation systems such as ADRIS, LARIS and ARIS Extention. If the estimate is done taking into account the projected water quality in the worst manner, it will take about 75 years until the soluble copper concentration in soils in the ARIS area attains to 125 ppm.

Actually, a part of soluble copper in surface soils reachs subsurface soils by percolation of irrigation water. Also rice straws absorbing copper accumulated in surface soils to some extent are taken out from the paddy field after harvesting. Hence the copper contents of surface soils will become lower than the estimated level of accumulation and the period of time will also become longer than the aforementioned estimate.

10. Conclusion

It is projected that the released water from the proposed San Roque dam will have a large amount of very fine suspended solid containing copper if all of mine tailings are discharged to the Agno River system and impounded in the reservoir of the proposed San Roque dam as planned in the ELC's feasibility study. This water having such characteristics in water quality is provided to the proposed San Roque irrigation development area in the future. As

a result, copper will accumulate in paddy soils to the whole beneficial areas through the spread of very fine suspended solid together with irrigation water. After 120 to 160 years, thus, copper concentration in soils will reach the limits allowed over which copper determines the cause of crop yield reduction. This estimated period exceeds over the project evaluation period of 50 years which is set up in the ELC Feasibility Report.

Table F-1 PRESENT LAND USE IN PROPOSED IRRIGATION DEVELOPMENT AREA

Unit: ha

Crop	ARIS	ARIS Extension	ADRIS	LARIS	Other Area*	Total
(1) Wet Season						
Paddy						
Irrigated	19,490	110	6,570	7,480	1,600	35,250
Rainfed	5,710	22,820	1,830	4,840	8,800	44,000
Corn	640	2,900	—	250	300	4,090
Sugarcane	1,710	370	—	280	2,960	5,320
Total	27,550	26,200	8,400	12,850	13,660	88,660
(2) Dry Season						
Paddy						
Irrigated	7,385	—	600	1,000	600	9,585
Pump Irri.	385	110	—	—	20	515
Corn	60	135	10	2,400	285	2,890
Sugarcane	1,710	370	—	280	2,960	5,320
Cotton	285	400	—	40	50	775
Tobacco	1,250	520	1,470	1,000	300	4,540
Mongo	5,750	675	3,145	25	690	10,285
Vegetables	670	500	60	200	155	1,585
Peanuts	250	550	80	125	425	1,430
Idle	9,795	22,940	3,035	7,780	8,175	51,725
Total	27,550	26,200	8,400	12,850	13,660	88,660

Source; ELC's feasibility study

Table F-2 RECORD ON DESILTING WORKS IN ARIS

Year	Excavated Volume (m^3)	Total Cost (Peso)	Unit Cost (Peso/m^3)
1978	147,575	100,023	0.68
1979	108,065	279,445	2.59
1980	132,587	626,522	4.73
1981	69,777	249,433	3.57
1982	67,481	229,837	3.41
1983	31,787	263,249	8.28

Source; NIA Region I Office

Table F-3 RECORD ON IRRIGATED AREAS IN ARIS AND ADRIS

Unit: ha

Year	ARIS		ADRIS	
	Dry Season	Wet Season	Dry Season	Wet Season
1975	4,505	13,545	—	—
1976	5,212	16,278	—	—
1977	3,978	16,593	—	—
1978	4,409	12,394	—	—
1979	4,498	13,742	339	3,330
1980	4,290	13,095	304	3,430
1981	4,017	9,689	574	3,413
1982	4,785	10,036	670	3,657
1983	3,932*	10,318	704	2,640

Source; NIA Region I Office
Remarks; This is a schedule.
Actually irrigated (planted) area is reported to be about 2,000 ha.

Table F-4 PROPOSED CROPPING PATTERN FOR IRRIGATION DEVELOPMENT AREA

Unit: %

Pattern	ARIS	ARIS Extension	ADRIS	LARIS
Paddy-Paddy	47	35	25	36
Paddy-Tobacco	8	9	19	18
Paddy-Cotton	16	28	21	21
Paddy-Diversified Crops	17	17	17	17
Paddy-Vegetables-Vegetables	3	5	14	3
Vegetables (3 crops/year)	1	1	4	1
Sugarcane	8	5	—	4
Total	100	100	100	100

Source; ELC's feasibility study

Table F-5 LIST OF MONITORING POINTS FOR OBSERVATION OF IRRIGATION WATER QUALITY IN ARIS AND ADRIS

Monitoring Point		Location	Monitoring Items	Monitoring Period
No.	1.	ARIS, Main Canal, Diversion Point at Lateral A	Water quality & canal discharge	Both seasons
	2.	ARIS, Lateral B, Crossing Point of San Roque Dam Access Road	Water quality, canal discharge & crop growth	Dry season
		ARIS, Lateral D, Nearby Barangay Macalong	Water quality & crop growth	Wet season
	3.	ARIS, Don Moteo Ditch Diversion Point from Main Canal	Water quality & canal discharge	Both seasons
	4.	ARIS, Don Moteo Ditch, Crossing Point of San Roque Dam Access Road	Water quality & crop growth	Both seasons
	5.	ARIS, Lateral F, Diversion Point from Main Canal	Water quality & canal discharge	Wet season
	6.	ARIS, Lateral F, Crossing Point of Urdaneta-Asingan Road	Water quality & crop growth	Wet season
	7.	ARIS, Main Canal, Crossing Point of National Road	Water quality	Wet season
	8.	ARIS, Lateral J, Nearby Barangay Maleen	Water quality, canal discharge & crop growth	Wet season
	9.	ADRIS, Main Canal, Intake Dam	Water quality	Both seasons
	10.	ADRIS, Lateral A-3. Along Tayug-San Nicolas Road	Water quality & crop growth	Both seasons
	11.	ARIS, Lateral D, Diversion Point from Main Canal	Water quality & canal discharge	Wet season
	12.	ARIS, Lateral M, Second Turnout	Water quality & crop growth	Wet season

Table F-6 NUMBER OF SAMPLES ANALYZED BY ITEM IN LABORATORY

Item	Water Samples	Soil Samples				Plant Samples	Total
		A	B	C	D		
Suspended solid	303	–	–	–	–	–	303
Total Cu	303	–	14	–	6	–	323
Total Pb	303	–	14	–	6	–	323
Total Zn	303	–	14	–	6	–	323
Total Cd	303	–	14	–	6	–	323
Total As	39	–	14	–	6	–	59
Extractable Cu	–	–	48	68	30	204	350
Extractable Pb	–	–	48	–	30	204	282
Extractable Zn	–	–	48	–	30	204	282
Extractable Cd	–	–	48	–	30	204	282
Extractable As	–	–	48	–	–	41	89
Soluble Cu	–	249	48	68	30	–	395
Soluble Pb	–	249	48	–	–	–	297
Soiuble Zn	–	249	48	–	–	–	297
Soluble Cd	–	249	48	–	–	–	297
Scluble As	–	249	48	–	–	–	297
Nitrogen	–	–	–	–	–	163	163
Phosphate	–	–	–	–	–	163	163
Potassium	–	–	–	–	–	163	163
Silicate	–	–	–	–	–	163	163

Remarks;
- Soil sample A: Surface soils sampled as an inlet portion of paddy field in and around ARIS.
- Soil sample B: Soils sampled from 10 master pits in the proposed irrigation development area.
- Soil sample C: Surface and subsurface soils sampled at inlet, middle and outlet portions of monitoring paddy field in ARIS and ADRIS.
- Soil sample D: Sediments on canal bed at 10 monitoring points in ARIS.

Table F-7 RECORDS ON AVERAGE INTAKE DISCHARGE BY MONTH AT ARIS INTAKE DAM AND MONTHLY EFFECTIVE RAINFALL IN ARIS

Month	Year						
	1978	1979	1980	1981	1982	1983	1984
(1) Average Intake Discharge at ARIS Intake Dam (m^3/s)							
Jan.	5.84	3.74	7.94	4.90	10.15	4.16	0.76
Feb.	9.07	6.39	6.61	5.77	6.50	4.78	1.17
Mar.	6.53	6.39	6.66	7.09	6.66	4.74	1.64
Apr.	7.52	6.32	8.72	6.26	6.66	3.67	1.53
May	6.89	7.36	8.35	8.82	5.63	1.78	6.11
June	5.18	2.32	8.04	7.75	3.98	1.15	2.79
July	6.59	2.32	10.86	9.24	8.99	1.82	4.91
Aug.	3.55	1.97	19.44	10.70	13.62	5.85	1.29
Sept.	3.16	9.32	8.26	14.80	15.36	7.88	8.73
Oct.	5.23	7.97	15.89	14.20	10.51	4.43	4.62
Nov.	5.06	6.32	5.85	10.68	8.15	3.66	—
Dec.	8.27	4.94	7.29	11.44	4.16	0.44	—
(2) Monthly Effective Rainfall in ARIS (mm)							
Jan.	0	0	111	0	0	30	0
Feb.	0	0	0	0	35	0	0
Mar.	0	0	105	0	98	0	0
Apr.	51	0	62	221	47	0	65
May	81	192	197	246	227	43	105
June	272	134	279	513	193	83	129
July	490	378	487	395	504	23	200
Aug.	493	273	220	510	620	144	691
Sept.	488	293	283	197	455	250	635
Oct.	199	160	188	197	187	64	514
Nov.	138	35	0	86	24	0	—
Dec.	0	36	0	89	25	0	—
Year	2,212	1,501	1,932	2,454	2,415	637	2,339

Remarks; — : Not available
Source; NIA Region I Office

Table F-8 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO.1 (MAIN CANAL AT STATION 0+320) IN ARIS

Unit: m^3/s

Date		Time	Dis-charge	Weather	Date		Time	Dis-charge	Weather
Dec.	28	8:30	3.15	Fair	July	6	9:00	14.24	Cloudy*
	29	16:00	4.69	Fair		9	9:45	20.11	Fair
Jan.	16	16:00	3.14	Fair		11	10:30	17.94	Fair
	20	8:30	4.69	Fair		13	11:05	18.93	Fair
	23	11:30	4.79	Fair		16	15:25	19.50	Fair
	26	16:00	1.80	Fair		17	9:55	26.89	Fair
	31	16:10	1.89	Fair		23	10:30	23.27	Fair
Feb.	3	16:00	2.88	Fair		25	9:10	26.87	Fair
	6	16:05	1.74	Fair		27	9:20	22.98	Fair
	7	10:05	1.41	Fair		30	10:10	20.81	Fair
	10	9:30	2.24	Cloudy	Aug.	2	10:00	27.01	Cloudy*
		14:15	8.33	Cloudy			13:00	26.65	Cloudy
	14	15:25	6.24	Fair			16:00	27.75	Cloudy
	16	11:00	8.37	Fair			19:00	29.53	Cloudy
	21	14:45	8.62	Fair			22:00	28.02	Cloudy*
	24	14:30	8.02	Fair		3	1:00	28.63	Cloudy*
	28	11:30	7.14	Fair			4:00	26.88	Cloudy*
Mar.	1	11:05	6.52	Fair			7:00	26.43	Cloudy
	9	16:15	5.92	Fair			10:00	25.75	Cloudy*
	12	16:45	7.39	Fair		6	10:00	25.04	Cloudy
	14	15:30	5.89	Fair		8	14:15	23.88	Cloudy
	19	16:55	9.07	Cloudy		13	11:00	27.64	Fair
	23	11:30	4.72	Fair		15	9:10	21.06	Cloudy*
	28	10:45	4.66	Fair		20	10:25	No diversion	
	31	10:35	5.01	Fair		22	10:15	No diversion	
Apr.	12	9:00	6.10	Fair		27	9:45	15.73	Fair
		15:00	8.19	Fair	Sept.	5	9:30	15.39	Fair
	23	10:10	4.40	Fair		6	11:00	11.57	Fair
		13:35	12.20	Fair			14:00	11.65	Fair
	24	10:30	2.27	Fair			17:00	12.95	Cloudy*
		15:10	7.94	Fair			20:00	13.09	Cloudy*
May	8	10:20	3.80	Fair			23:00	13.84	Cloudy
	11	15:35	8.31	Fair		7	2:00	14.08	Cloudy
	15	15:00	7.49	Fair			5:00	13.54	Cloudy
	17	14:40	8.60	Fair			8:00	12.71	Fair
	21	11:25	1.73	Fair			11:00	11.52	Fair
	25	15:05	8.91	Fair		10	9:50	11.34	Fair
	28	14:45	16.32	Fair		12	11:20	16.38	Fair
June	4	14:05	11.39	Fair		17	10:00	7.15	Fair
	6	10:35	4.83	Fair		19	11:15	12.74	Fair
	8	10:00	3.89	Fair		24	11:00	17.02	Fair
	13	11:35	3.24	Fair		26	10:15	17.51	Fair
	15	11:25	24.32	Fair	Oct.	3	11:00	15.56	Fair
	18	11:55	4.50	Fair		5	15:45	22.95	Fair
	20	11:30	24.81	Cloudy		9	13:25	9.59	Fair
	22	11:05	16.29	Cloudy		11	14:45	14.33	Fair
	25	12:15	20.36	Cloudy*		15	9:45	8.48	Fair
	26	13:45	13.37	Cloudy		18	9:35	10.31	Fair
	27	9:45	10.89	Cloudy*		19	10:25	8.28	Cloudy*
	29	10:20	10.81	Cloudy		22	10:15	5.12	Cloudy*
July	2	10:30	19.13	Cloudy		24	10:00	3.58	Cloudy
	4	10:30	10.11	Fair		26	10:45	3.18	Fair
	5	9:00	9.03	Fair		30	12:50	2.21	Fair
		12:00	13.58	Fair		31	10:05	2.01	Fair
		15:00	12.62	Fair	Nov.	6	11:30	5.68	Fair
		18:00	14.27	Cloudy*		8	13:00	10.31	Fair
		21:00	11.91	Cloudy*		12	9:30	16.31	Fair
		24:00	14.66	Cloudy*		14	9:45	15.95	Fair
	6	3:00	14.19	Cloudy*		19	14:45	13.67	Fair
		6:00	13.17	Cloudy*		20	11:10	10.11	Fair

Remarks; Cloudy*: Cloudy with rain shower.

Table F-9 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO.2 (LATERAL B AT STATION 0+400 AND LATERAL D AT STATION 0+000) IN ARIS

Unit: m^3/s

Date		Time	Dis-charge	Weather	Date		Time	Dis-charge	Weather
(1) Lateral B at Station 0+400									
Feb.	14	10:25	0.50	Fair	Mar.	14	9:00	0.64	Fair
	16	9:20	0.55	Fair		28	10:20	0.50	Fair
	21	11:00	0.24	Fair	Apr.	24	9:25	0.35	Fair
	24	9:20	0.46	Fair	May	31	9:15	0.25	Fair
	28	10:40	0.25	Fair	June	15	9:40	0.27	Fair
Mar.	1	10:05	0.65	Fair	July	9	10:55	0.18	Fair
	9	10:00	0.56	Fair		11	9:40	0.11	Fair
	12	10:05	0.44	Fair		16	14:45	0.16	Fair
(2) Lateral D at Station 0+000									
July	23	13:25	0.52	Fair	Sept.	13	11:00	0.52	Fair
	25	10:30	0.50	Fair			14:00	0.55	Fair
	27	10:30	0.35	Fair			17:00	0.44	Fair
	30	11:45	0.63	Fair			20:00	0.48	Cloudy*
Aug.	6	11:25	0.29	Cloudy			23:00	0.51	Cloudy
	8	13:00	1.10	Cloudy		14	2:00	0.66	Fair
	9	9:30	0.47	Cloudy			5:00	0.58	Fair
		12:30	0.40	Cloudy			8:00	0.61	Fair
		15:30	0.61	Cloudy*			11:00	0.58	Fair
		18:30	0.55	Cloudy		17	11:10	0.48	Fair
		21:30	0.52	Cloudy		19	9:30	0.42	Fair
	10	0:30	0.60	Cloudy		24	10:00	1.24	Fair
		3:30	0.53	Cloudy		26	11:05	1.15	Fair
		6:30	0.42	Cloudy	Oct.	3	10:15	No diversion	
		9:30	0.42	Cloudy		5	14:10	0.77	Fair
	13	12:30	0.24	Cloudy*		30	11:15	0.12	Fair
	15	10:25	0.20	Cloudy*		31	11:20	0.15	Fair
	20	11:10	No diversion		Nov.	6	9:35	0.17	Fair
	22	11:00	No diversion			8	12:10	1.44	Fair
	27	11:20	0.25	Fair		12	10:35	1.27	Fair
Sept.	5		No diversion			14	11:00	0.34	Fair
	10	11:45	0.46	Fair		19	15:55	0.06	Fair
	12	9:45	0.19	Fair		20	10:10	0.06	Fair

Remarks; Cloudy*: Cloudy with rain shower.

Table F-10 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO. 3 (DON MOTEO DITCH AT STATION 0+000) IN ARIS

Unit: m^3/s

Date		Time	Discharge	Weather	Date		Time	Discharge	Weather
Feb.	14	12:30	0.45	Fair	Aug.	22	10:30	No diversion	
	16	10:05	0.53	Fair		27	10:30	0.48	Fair
	21	10:30	0.58	Fair	Sept.	5	10:10	0.86	Fair
	24	9:55	1.26	Fair		6	11:30	0.80	Fair
	28	11:00	0.43	Fair			14:30	0.85	Fair
Mar.	1	10:30	0.82	Fair			17:30	0.91	Cloudy*
	9	11:00	0.76	Fair			20:30	1.06	Cloudy*
	12	10:45	1.28	Fair			23:30	1.15	Cloudy
	14	9:30	0.91	Fair		7	2:30	1.26	Cloudy
Apr.	23	10:45	0.60	Fair			5:30	1.11	Cloudy
	24	9:50	0.40	Fair			8:30	0.90	Fair
June	15	9:50	1.75	Fair			11:30	0.81	Fair
	22	10:10	0.16	Cloudy*		10	10:15	0.87	Fair
	25	11:50	0.59	Cloudy*		12	11:00	0.98	Fair
July	2	10:10	0.43	Cloudy		17	10:25	No diversion	
	9	10:35	1.58	Fair		19	10:50	0.64	Fair
	11	10:20	1.03	Fair		24	10:40	0.73	Fair
	13	10:35	0.93	Fair		26	9:30	0.78	Fair
	16	15:05	1.21	Fair	Oct.	3	10:35	No diversion	
	23	9:50	1.71	Fair		5	15:20	1.01	Fair
	25	9:30	1.68	Fair		9	13:00	No diversion	
	27	9:40	1.39	Fair		11	14:20	1.11	Fair
	30	10:30	0.89	Fair		15	10:00	No diversion	
Aug.	2	9:25		Cloudy		18	9:55	No diversion	
		12:25	0.89	Cloudy		19	10:55	No diversion	
		15:25	1.48	Cloudy*		22	10:35	No diversion	
		18:25	1.84	Cloudy*		24	10:30	No diversion	
		21:25	1.43	Cloudy*		26	10:25	No diversion	
	3	0:25	1.81	Cloudy*		30	12:30	No diversion	
		3:25	0.89	Cloudy*		31	10:30	No diversion	
		6:25	0.75	Cloudy*	Nov.	6	10:40	0.55	Fair
		9:25	0.73	Cloudy*		8	13:15	0.75	Fair
	6	10:25	1.16	Cloudy*		12	9:55	0.71	Fair
	8	13:55	0.73	Cloudy		14	10:20	0.86	Fair
	13	11:45	0.55	Fair		19	15:20	0.62	Fair
	15	9:25	0.37	Cloudy*		20	10:50	0.39	Fair
	20	10:35	No diversion						

Remarks; Cloudy* : Cloudy with rain shower.

Table F-11 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO. 5 (LATERAL F AT STATION 0+000) IN ARIS

Unit: m^3/s

Date	Time	Discharge	Weather	Date	Time	Discharge	Weather
June 4	13:05	0.61	Fair	Aug. 9	18:00	1.64	Cloudy
6	10:45	0.63	Fair		21:00	2.14	Cloudy
8	9:05	0.64	Fair		24:00	2.36	Cloudy
13	10:15	0.19	Fair	10	3.00	2.18	Cloudy
15	9:25	0.90	Fair		6:00	1.82	Cloudy
18	10:55	0.77	Fair		9:00	1.66	Cloudy
20	9:10	1.12	Cloudy	13	12:45	1.58	Cloudy*
22	9:40	1.13	Cloudy*	15	10:45	1.08	Cloudy
25	11:15	0.89	Cloudy*	20	11:20	No diversion	
26	9:35	1.12	Cloudy	22	11:30	No diversion	
27	8:55	0.92	Cloudy*	27	11:45	1.48	Fair
29	9:35	0.65	Cloudy	Sept. 5		No diversion	
July 2	9:00	0.96	Cloudy	10	12:25	0.68	Fair
4	9:20	0.81	Fair	12	9:25	0.47	Fair
9	11:30	1.07	Fair	13	10:00	0.26	Fair
11	9:20	1.13	Fair		13:00	0.30	Fair
13	10:15	0.08	Fair		16:00	0.28	Fair
16	14:00	0.76	Fair		19:00	0.32	Cloudy
17	8:55	0.61	Fair		22:00	0.37	Cloudy
19	11:00	0.14	Fair	14	1:00	0.54	Cloudy
	14:00	0.11	Fair		4:00	0.48	Fair
	17:00	0.11	Fair		7:00	0.51	Fair
	20:00	0.08	Fair		10:00	0.47	Fair
	23:00	0.08	Fair	17	11:40	0.53	Fair
20	2:00	0.08	Fair	19	8:55	1.74	Fair
	5:00	0.08	Fair	24	9:25	1.55	Fair
	8:00	0.08	Fair	26	11:40	1.16	Fair
	11:00	0.08	Fair	Oct. 3	9:40	0.71	Fair
23	9:00	0.04	Fair	5	13:50	0.65	Fair
25	10:50	0.91	Fair	9	12:15	0.73	Fair
27	10:45	1.49	Fair	11	13:25	0.79	Fair
30	12:05	1.44	Fair	15	10:45	0.85	Fair
Aug. 6	11:55	0.95	Cloudy	18	11:00	0.26	Fair
8	12:40	1.54	Fair	19	13:35	0.08	Cloudy
9	9:00	1.57	Cloudy	22	11:20	No diversion	
	12:00	1.23	Cloudy	24	11:35	0.04	Cloudy
	15:00	1.89	Cloudy*	26	11:00	0.09	Fair

Remarks: Cloudy*: Cloudy with rain shower.

Table F-12 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO. 8 (LATERAL J AT STATION 0+000) IN ARIS

Unit: m³/s

Date	Time	Discharge	Weather	Date	Time	Discharge	Weather
June 4	15:20	0.11	Cloudy	Aug. 17	3:30	0.15	Cloudy
6	14:40	0.11	Fair		6:30	0.13	Cloudy*
8	12:15	0.12	Fair		9:30	0.13	Cloudy*
15	14:10	0.01	Fair	20	12:55	No diversion	
18	13:40	0.13	Cloudy	22	13:15	No diversion	
20	13:45	0.11	Cloudy*	27	12:20	No diversion	
22	13:50	0.11	Cloudy*	Sept. 5		No diversion	
25	15:05	0.10	Cloudy	10	13:45	0.44	Fair
26	17:10	0.13	Cloudy	12	14:15	0.16	Fair
27	13:10	0.08	Cloudy*	17	12:35	0.11	Fair
29	12:35	0.12	Cloudy	19	13:00	0.41	Fair
July 2	13:00	0.13	Cloudy	20	8:45	0.53	Fair
4	13:10	0.17	Fair		11:45	0.49	Fair
9	14:20	0.25	Fair		14:45	0.44	Fair
11	14:05	0.17	Fair		17:45	0.50	Cloudy*
13	12:30	0.28	Fair		20:45	0.52	Cloudy*
16	10:20	0.34	Fair		23:45	0.44	Cloudy
17	11:30	0.36	Fair	21	2:45	0.59	Cloudy
19	9:00	0.25	Fair		5:45	0.62	Fair
	12:00	0.17	Fair		8:45	0.41	Fair
	15:00	0.16	Fair	24	14:20	0.35	Fair
	18:00	0.15	Fair	26	13:40	0.33	Fair
	21:00	0.15	Fair	Oct. 3	14:15	0.31	Fair
	24:00	0.14	Fair	5	10.40	0.14	Fair
20	3:00	0.15	Fair	9	10:35	0.19	Fair
	6:00	0.10	Fair	11	12:15	0.24	Fair
	9:00	0.35	Fair	15	13:05	No diversion	
23	14:30	0.36	Fair	18	13:40	0.11	Fair
25	12:20	0.28	Fair	19	15:30	0.08	Cloudy*
27	12:05	0.40	Fair	22	14:25	0.08	Cloudy
30	13:35	0.32	Fair	24	13:35	0.04	Cloudy
Aug. 6	15:00	0.37	Cloudy	26	14:25	No diversion	
8	15:05	0.33	Fair	30	13:25	No diversion	
13	16:00	0.21	Cloudy	31	13:45	No diversion	
15	11:35	0.17	Cloudy*	Nov. 6	13:35	No diversion	
16	9:30	0.11	Fair	8	14:35	0.18	Fair
	12:30	0.14	Cloudy	12	15:15	0.12	Fair
	15:30	0.12	Cloudy	14	13:25	0.08	Fair
	18:30	0.17	Cloudy	19	16:30	0.16	Fair
	21:30	0.14	Cloudy	20	13:10	0.15	Fair
17	0:30	0.18	Cloudy*				

Remarks; Cloudy*: Cloudy with rain shower.

Table F-13 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO.12 (LATERAL M AT STATION 0+000) IN ARIS

Unit: m^3/s

Date	Time	Dis-charge	Weather	Date	Time	Dis-charge	Weather
June 4	16:35	0.56	Cloudy	Sept. 24	15:10	0.67	Fair
6	14:45	0.41	Fair	26	15:10	1.49	Cloudy*
8	13:55	0.02	Fair	27	10:00	1.61	Fair
15	15:15	0.14	Fair		13:00	1.53	Fair
18	15:50	0.03	Cloudy		16:00	1.76	Cloudy
20	15:30	0.29	Cloudy		19:00	1.96	Cloudy*
22	14:45	0.38	Cloudy*		22:00	1.98	Cloudy
25	16:00	0.37	Cloudy*	28	1:00	2.08	Cloudy
27	13:45	0.79	Cloudy*		4:00	1.97	Cloudy
July 2	14:25	0.71	Cloudy		7:00	1.83	Cloudy
4	14:50	0.22	Fair		10:00	1.79	Cloudy
9	15:35	0.18	Cloudy	Oct. 3	15:30	No diversion	
11	15:45	0.23	Fair	5	14:30	No diversion	
13	13:25	0.21	Fair	9	15:15	No diversion	
16	12:25	0.24	Fair	11	14:10	No diversion	
25	14:15	No diversion		15	14:15	No diversion	
27	14:00	0.24	Fair	18	15:15	0.56	Fair
30	15:30	0.22	Fair	19	16:00	0.51	Cloudy
Aug. 6	16:05	0.04	Cloudy	22	15:00	0.50	Cloudy
8	16:15	0.58	Cloudy*	24	14:30	0.63	Cloudy
13	17:15	1.00	Cloudy	26	15:15	0.55	Cloudy
15	14:05	1.06	Cloudy*	30	14:30	No diversion	
20		No diversion		31	14:50	No diversion	
22		No diversion		Nov. 6	14:20	No diversion	
27	15:50	1.28	Fair	8	15:05	0.56	Fair
Sept. 5		No diversion		12	12:10	0.44	Fair
10	14:30	No diversion		14	15:50	0.55	Fair
12	15:15	No diversion		19	17:05	0.56	Fair
17	14:10	No diversion		20	13:55	0.56	Fair
19	14:15	No diversion					

Remarks; Cloudy*: Cloudy with rain shower.

Table F-14 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO.9 (MAIN CANAL AT STATIONS 0+020) AND 0+700 IN ADRIS

Unit: m³/s

Date	Discharge	Date	Discharge
(1) At Station 0+200			
Jan. 1 to Jan. 28	0.89	Apr. 1 to Apr. 14	0.62
Jan. 29 to Jan. 31	0.80	Apr. 15 to Apr. 20	0.89
Feb. 1 to Feb. 20	0.89	Apr. 21 to Apr. 23	0.62
Feb. 21 to Feb. 29	0.80	Apr. 24 to Apr. 30	0.89
Mar. 1 to Mar. 31	1.00		
(2) At Station 0+700			
May 1 to May 4	1.00	July 7 to July 10	2.52
May 5 to May 10	1.11	July 11 to July 14	1.42
May 11 to May 12	1.39	July 15 to July 17	1.36
May 13 to May 15	1.11	July 18 to July 30	1.11
May 16	1.00	July 31	1.36
May 17	1.11	Aug. 1 to Aug. 5	0.89
May 18 to May 20	1.39	Aug. 6 to Aug. 7	1.00
May 21	1.11	Aug. 8 to Aug. 14	1.11
May 22 to May 29	1.00	Aug. 15	0.89
June 1 to June 5	1.11	Aug. 16 to Aug. 20	No diversion
June 6 to June 14	1.00	Aug. 21 to Aug. 23	1.11
June 15	0	Aug. 24 to Aug. 28	0.89
June 16 to June 20	1.00	Aug. 29 to Sept. 4	No diversion
June 21 to June 25	1.11	Sept. 5 to Sept. 15	0.89
June 26	0	Sept. 16 to Oct. 20	1.00
June 27 to June 30	1.39	Oct. 21 to Oct. 26	1.11
July 1 to July 6	1.42	Oct. 27 to Oct. 31	No diversion

Table F-15 DISCHARGE MEASUREMENT RECORD AT MONITORING POINT NO. 10 (LATERAL A-3 AT STATION 0+040) IN ADRIS

Unit: m^3/s

Date	Discharge	Date	Discharge
Jan. 1 to Jan. 6	0	Apr. 17 to Apr. 22	0
Jan. 7 to Jan. 9	0.30	Apr. 23 to Apr. 25	0.20
Jan. 10 to Jan. 13	0	Apr. 26 to May 3	0
Jan. 14 to Jan. 16	0.30	May 4 to May 6	0.20
Jan. 17 to Jan. 20	0	May 7 to May 10	0
Jan. 21 to Jan. 23	0.30	May 11 to May 13	0.20
Jan. 24 to Jan. 27	0	May 14 to May 20	0
Jan. 28 to Jan. 30	0.30	May 21 to May 23	0.20
Jan. 31 to Feb. 4	0	May 24 to May 31	0
Feb. 5 to Feb. 7	0.35	June 1 to June 20	0.50
Feb. 8 to Feb. 14	0	June 21 to July 10	0.60
Feb. 15 to Feb. 17	0.35	July 11 to July 31	0.65
Feb. 18 to Feb. 23	0	Aug. 1 to Aug. 7	0.55
Feb. 24 to Feb. 26	0.35	Aug. 8 to Aug. 14	0.65
Feb. 27 to Mar. 3	0	Aug. 15	0.55
Mar. 4 to Mar. 7	0.35	Aug. 16 to Aug. 20	0
Mar. 8 to Mar. 14	0	Aug. 21 to Aug. 23	0.65
Mar. 15 to Mar. 17	0.35	Aug. 24 to Aug. 28	0.55
Mar. 18 to Mar. 23	0	Aug. 29 to Sept. 4	0
Mar. 24 to Mar. 26	0.35	Sept. 5 to Sept. 15	0.60
Mar. 27 to Apr. 4	0	Sept. 16 to Sept. 22	0.48
Apr. 5 to Apr. 7	0.20	Sept. 23 to Oct. 20	0.50
Apr. 8 to Apr. 13	0	Oct. 21 to Oct. 26	0.65
Apr. 14 to Apr. 16	0.20	Oct. 27 to Oct. 31	0

Table F-16 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 1 IN ARIS

Date		Time	Water Trmpera-ture (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
Dec.	26	10:30	23.3	500+	8.1	700	8.0
Jan.	5	10:30	23.2	500+	8.2	690	7.2
	12	10:35	25.0	415	8.2	440	8.0
	19	14:20	27.5	500+	8.3	1,000	8.0
	26	14:30	26.0	500+	8.4	480	9.5
Feb.	8	11:20	24.5	500+	8.2	470	6.7
	15	14:40	28.3	500+	8.2	460	5.9
	23	14:15	27.4	500+	8.3	450	4.3
Mar.	6	14:15	28.8	500+	8.4	630	6.6
	14	9:20	25.6	500+	8.4	480	6.6
	22	8:50	24.5	500+	8.3	410	7.3
	30	14:50	28.9	500+	8.4	430	6.3
Apr.	3	14:30	29.5	500+	8.2	380	3.6
	20	9:30	27.5	400	8.0	400	6.2
	25	11:00	28.5	300	8.0	500	—
May	4	9:30	27.0	275	7.8	460	6.1
	11	9:35	26.5	500+	8.0	430	5.4
	17	10:00	26.5	500+	8.1	500	4.8
	22	9:35	26.5	500+	8.1	350	3.9
	31	9:30	26.5	250	—	350	6.3
June	5	10:20	28.0	500+	—	395	7.1
	13	10.40	28.5	500+	—	440	6.9
	20	8:55	26.0	500+	8.3	450	7.6
	25	9:25	26.0	500+	8.8	440	7.1
July	2	9:10	26.0	500+	8.5	440	8.7
	9	9:00	25.5	500+	8.5	455	7.5
	16	8:45	25.5	500+	8.1	390	7.2
	23	9:00	26.0	500+	8.1	420	7.2
	30	8:50	26.0	500+	8.4	440	7.1
Aug.	8	8:55	25.5	500+	8.4	350	7.2
	13	9:15	25.5	500+	8.4	275	7.5
	20	9:10	24.0	500+	8.4	310	7.3
	28	9:00	24.0	500+	8.4	310	7.3
Sept.	5	9:00	24.0	260	8.3	290	6.5
	10	9:25	24.5	330	—	260	7.8
	17	9:05	24.5	290	—	270	7.2
	25	10:50	24.5	450	8.2	295	5.9
Oct.	5	11:50	25.5	350	8.0	330	6.6
	9	8:40	24.0	500+	8.1	340	7.9
	16	8:35	24.5	325	8.3	335	7.0
	24	9:35	24.5	500+	8.1	485	6.4
	28	8:20	24.0	500+	7.9	275	7.1
Nov.	14	14:40	25.0	100	8.0	275	7.1
	21	14:55	26.0	225	8.3	325	7.2

Remarks; Location : At diversion point of Lateral A on Main Canal.
500+ : Over 500 ppm.
— : Not available.

Table F-17 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 2 IN ARIS

Date		Time	Water Temperature (°C)	Turbidity (ppm)	pH	EC (umhos)	DO (mg/l)
Dec.	26	11:00	23.3	500+	8.3	600	8.9
Jan.	5	No water available					
	13	9:30	25.3	430	8.1	400	8.0
	19	10:20	23.8	240	8.1	500	8.7
	26	13:30	25.5	500+	8.4	650	8.1
Feb.	9	13:45	24.4	270	8.5	470	6.6
	15	No water available					
	23	15:20	31.1	355	8.3	440	4.0
Mar.	6	No water available					
	14	No water available					
	22	No water available					
	30	No water available					
Apr.	3	No water available					
	20	10:50	33.0	270	8.2	450	4.6
	25	12:20	30.5	350	8.1	500	—
May	4	No water available					
	11	10:05	27.0	500+	7.8	460	6.1
	17	10:45	28.5	500+	8.1	450	6.5
	22	No water available					
	31	9:45	27.5	450	—	340	7.4
June	5	No water available					
	15	11:25	29.0	500+	—	415	7.3
	20	No water available					
	25	No water available					
July	2	No water available					
	9	10:10	26.5	500+	8.3	450	7.3
	16	9:35	26.5	500+	8.0	395	7.2
	23	14:10	31.1	500+	8.2	405	6.8
	30	11:10	28.0	295	7.9	460	5.4
Aug.	8	11:15	28.0	500+	8.2	345	6.9
	13	11:15	28.0	500+	8.3	340	7.3
	21	10:40	31.5	350	7.2	640	5.7
	28	11:00	26.5	500+	7.6	330	5.4
Sept.	6	13:50	30.0	500+	7.6	330	5.4
	10	11:40	30.0	380	—	270	6.6
	17	10:35	27.5	150	—	290	6.6
	26	No water available					
Oct.	5	15:05	30.0	500+	—	290	6.6
	9	Terminated monitoring works					

Remarks; Location : At diversion point from Main Canal on Lateral D, but observed at diversion point on Lateral C between Dec. 26 and Jan. 13
500+ : Over 500 ppm.
— : Not available.

Table F-18 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 3 IN ARIS

Date	Time	Water Temperature (°C)	Turbidity (ppm)	pH	EC (umhos)	DO (mg/l)
Dec. 26	No water available					
Jan. 5	13:40	27.4	500+	8.3	310	5.5
12	13:30	28.2	500+	8.3	390	7.7
19	No water available					
26	No water available					
Feb. 9	14:50	26.8	345	8.5	500	6.5
15	15:10	28.6	500+	8.1	470	5.6
23	14:30	27.5	500+	8.3	470	4.3
Mar. 6	14:35	28.6	500+	8.4	650	6.3
14	9:40	25.7	500+	8.6	480	7.4
22	9:10	24.9	500+	8.4	410	7.6
30	15:10	28.9	500+	8.5	440	6.7
Apr. 3	14:55	32.0	500+	8.2	360	3.4
20	9:50	27.5	345	7.9	400	6.4
25	11:20	28.5	350	8.1	500	—
May 4	No water available					
11	9:20	26.0	500+	8.1	420	6.6
17	10:15	27.5	500+	8.0	500	5.0
22	No water available					
31	No water available					
June 5	No water available					
13	11:40	29.5	500+	—	460	6.2
20	9:20	26.5	500+	8.3	450	7.5
25	9:45	26.0	500+	8.8	440	7.5
July 2	9:30	26.0	500+	8.6	440	8.2
9	9:25	26.0	500+	8.6	460	7.6
16	9:05	25.5	500+	8.1	395	7.4
23	9:15	26.0	500+	8.1	430	7.4
30	9:10	26.0	500+	8.4	445	6.7
Aug. 8	9:20	25.5	500+	8.3	330	7.3
13	9:55	25.8	500+	8.4	405	7.4
20	No water available					
28	9:15	24.5	500+	8.3	290	7.0
Sept. 5	9:20	24.5	255	8.2	290	6.7
10	9:50	24.5	310	—	260	7.1
19	10:30	25.0	350	—	290	6.8
25	11:10	25.0	340	8.2	290	6.7
Oct. 5	12:15	26.0	350	8.0	340	6.2
9	16:40	26.5	360	8.3	325	6.2
16	15:20	26.5	280	8.3	295	7.3
24	No water available					
29	8:40	24.0	500+	7.8	265	6.6
Nov. 14	14:55	26.0	125	8.0	275	6.7
21	15:15	26.0	275	8.2	360	7.0

Remarks; Location : At diversion point from Main Canal on Don Moteo Ditch, but observed at diversion point on Lateral D between Dec. 26 and Jan. 26.
500+ : Over 500 ppm.
— : Not available.

Table F-19 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 4 IN ARIS

Date	Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
Dec. 26	No water available					
Jan. 5	No water available					
12	14:30	28.8	500+	8.3	370	7.3
19	No water available					
26	No water available					
Feb. 10	11:15	23.8	500+	8.5	520	6.0
15	15:20	28.7	450	8.2	440	6.9
23	15:50	27.7	500+	8.3	480	3.7
Mar. 6	15:00	28.1	500+	8.3	700	6.4
14	10:10	26.3	500+	8.2	400	7.2
22	9:30	25.1	500+	8.3	430	7.4
30	15:30	29.2	500+	8.4	440	6.6
Apr. 3	15:15	33.3	—	8.2	330	3.1
20	10:10	27.5	440	8.4	450	4.7
25	11:50	28.5	350	8.1	450	—
May 4	No water available					
11	9:50	26.5	500+	8.1	440	6.1
17	10:25	28.0	500+	8.0	500	4.5
22	No water available					
31	No water available					
June 5	No water available					
13	14:10	34.0	500+	—	420	5.8
20	No water available					
25	10:05	26.0	500+	8.7	450	7.3
July 2	9:50	26.0	500+	8.6	445	7.6
9	9:50	26.0	500+	8.4	455	7.2
16	9:25	26.0	500+	8.0	405	6.9
23	9:35	26.0	500+	8.4	420	6.8
30	9:30	26.0	500+	8.4	450	6.5
Aug. 8	9:40	26.0	500	8.2	305	7.0
13	9:35	26.0	400	8.4	385	6.3
20	No water available					
28	9:00	24.5	500+	8.3	290	7.2
Sept. 5	9:40	26.0	270	8.2	290	6.4
10	10:05	25.5	500+	—	270	7.6
19	10:45	25.5	500+	—	190	6.4
25	11:25	25.5	375	8.2	290	6.1
Oct. 5	11:15	27.0	450	7.9	300	6.1
9	16:20	27.5	500+	8.2	360	6.6
16	15:40	27.5	360	8.2	370	6.4
24	No water available					
29	9:00	24.0	500+	—	315	6.8
Nov. 14	15:20	25.5	180	—	265	6.9
21	15:45	26.0	275	8.2	360	7.0

Remarks; Location : On Don Moteo Ditch, but observed at crossing point of Urdaneta-Asingan Road on Lateral D between Dec. 26 and Jan. 26.
500+ : Over 500 ppm.
— : Not available.

Table F-20 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 5 IN ARIS

Date	Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
May 4	11:00	34.0	500+	7.4	460	5.6
11	10:45	30.5	500+	7.7	405	6.7
17	No water available					
22	10:25	27.0	500+	7.9	410	5.4
31	14:25	32.0	250	—	280	6.6
June 6	13:20	31.5	360	—	330	7.0
13	15:05	39.0	230	—	550	5.3
20	10:55	27.5	500+	8.1	275	7.0
25	10:55	27.0	500+	8.7	455	7.1
July 2	10:30	26.0	500+	8.4	425	7.5
9	10:40	27.5	500+	8.0	450	6.6
16	10:10	27.0	500+	8.0	380	6.8
23	10:15	27.0	500+	8.2	405	7.0
30	10:25	27.5	500+	8.2	435	6.5
Aug. 8	10:35	26.5	500+	8.2	345	6.9
13	10:35	26.5	500+	8.4	365	7.6
20	10:05	27.0	500+	7.9	350	6.3
28	10:20	25.0	285	8.2	275	7.5
Sept. 6	14:25	29.5	285	—	270	8.3
10	11:05	27.5	480	—	285	6.9
17	9:50	26.5	290	—	250	7.0
26	13:40	27.0	500+	8.3	320	6.9
Oct. 5	14:35	29.0	450	8.2	315	6.0
9	9:45	25.5	435	8.1	345	6.9
16	9:50	26.0	250	8.2	290	6.6
24	10:20	25.0	500+	8.1	440	5.5
29	10:00	24.5	460	—	290	6.1
Nov. 14	15:50	26.5	190	—	305	7.8

Remarks; Location : At diversion point from Main Canal on Lateral F.
500+ : Over 500 ppm.
— : Not available.

Table F-21 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 6 IN ARIS

Date		Time	Water Temperature (°C)	Turbidity (ppm)	pH	EC (umhos)	DO (mg/l)
May	4	11:30	34.5	500+	7.4	460	5.8
	11	11:05	31.0	330	7.8	365	6.2
	17	No water available					
	22	10:45	27.5	190	8.1	390	5.8
	31	14:50	33.0	100	—	240	5.8
June	6	15:05	33.0	120	—	390	7.2
	13	15:50	36.5	150	—	550	5.5
	20	11:20	28.5	500+	8.0	420	6.5
	25	11:20	27.0	500+	8.5	425	6.7
July	2	11:10	26.5	500+	8.4	435	7.3
	9	11:05	28.5	500+	7.7	425	6.6
	16	10:35	28.5	500+	7.8	385	6.5
	23	14:30	32.5	500+	8.1	405	7.0
	30	11:50	29.0	500+	7.7	420	5.3
Aug.	8	11:45	28.0	500+	7.9	345	6.8
	13	11:40	27.5	500+	8.1	330	7.3
	20	10:50	28.0	500+	8.0	340	6.2
	28	11:30	25.0	500+	8.1	170	6.7
Sept.	6	13:25	31.0	300	—	280	6.7
	10	12:10	30.0	400	—	320	6.6
	17	11:15	27.5	200	—	255	6.9
	26	14:45	29.5	500+	7.5	275	6.9
Oct.	5	15:25	31.0	500+	7.5	310	5.9
	9	10:25	26.0	345	8.1	355	6.9
	16	10:05	26.5	250	8.1	290	6.8
	24	10:40	25.5	330	8.0	500	6.3
	29	10:20	25.0	410	—	325	7.0
Nov.	14	16:10	30.5	135	7.5	325	6.3
	21	Terminated monitoring works					

Remarks; Location : On Lateral F.
500+ : Over 500 ppm.
— : Not available.

Table F-22 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 7 IN ARIS

Date		Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
May	4	12:00	38.5	500+	7.5	400	5.2
	11	12:15	32.5	500+	7.8	390	6.1
	17	11:30	39.0	325	8.1	440	5.5
	22	11:15	27.0	500+	8.1	430	6.3
	31	13:50	32.0	500+	—	320	6.6
June	5	9:50	29.0	500+	—	340	7.3
	15	11:00	30.0	500+	—	390	6.8
	20	10:30	27.5	500+	8.0	395	7.4
	25	8:40	26.0	500+	8.7	450	7.8
July	2	8:20	26.0	500+	8.1	465	8.7
	9	8:15	26.5	500+	8.2	410	7.4
	16	8:05	26.5	500+	7.9	400	7.1
	23	8:15	26.5	500+	8.2	400	7.5
	30	8:05	26.0	500+	8.2	450	7.1
Aug.	8	8:10	26.0	500+	8.3	355	7.3
	13	8:30	27.0	500+	8.3	390	7.4
	20	8:15	26.0	500+	8.0	370	6.6
	28	8:10	25.0	500+	8.1	295	6.7
Sept.	6	14:50	32.0	390	—	270	7.5
	10	8:45	25.5	500+	—	305	6.8
	17	8:20	25.5	500	—	285	7.2
	25	10:00	26.0	410	8.1	340	6.0
Oct.	5	10:50	28.0	500+	7.9	355	6.5
	9	7:55	25.0	500	8.0	325	7.1
	16	7:55	25.5	280	8.1	310	7.2
	24	8:35	24.5	500+	8.2	430	6.2
	29	7:30	24.5	500	8.2	295	6.5
Nov.	14	13:35	27.0	250	7.8	280	6.0
	21	13:50	27.5	270	8.2	420	6.2

Remarks; Location : At crossing point of National Road Route No.7 on Main Canal.
500+ : Over 500 ppm.
— : Not available.

Table F-23 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 8 IN ARIS

Date		Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
May	4	No water available					
	11	No water available					
	17	No water available					
	22	No water available					
	31	15:30	34.5	290	—	310	5.7
June	6	8:55	29.5	275	—	375	7.0
	15	14:10	32.5	310	—	405	6.7
	20	13:30	30.0	500+	8.0	410	7.1
	25	13:55	28.0	500+	8.5	465	6.8
July	2	13:35	27.5	500+	8.7	460	7.8
	9	13:35	31.0	500+	8.0	360	6.5
	16	13:25	30.5	500	7.9	380	6.7
	23	15:00	31.0	500+	8.2	385	7.7
	30	13:45	30.5	500+	7.9	415	5.2
Aug.	8	13:50	38.5	500+	7.9	335	6.6
	13	13:30	28.5	500+	7.9	350	7.8
	21	13:40	37.0	75	7.8	370	6.6
	28	No water available					
Sept.	6	No water available					
	10	14:20	32.0	250	—	280	7.8
	17	13:30	30.5	80	—	270	6.0
	26	15:45	28.0	500+	7.3	290	7.0
Oct.	5	16:45	31.5	500+	8.1	320	6.2
	9	14:30	29.0	410	8.2	355	6.9
	21	10:40	25.0	500+	8.1	370	7.0
	24	13:40	26.0	500+	8.2	390	6.4
	29	No water available					
Nov.	14	16:40	27.0	200	8.2	290	6.6
	21	Terminated monitoring works					

Remarks; Location : On Lateral J.
500+ : Over 500 ppm.
— : Not available.

Table F-24 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 11 IN ARIS

Date		Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
May	4	No water available					
	11	11:40	31.0	500+	7.8	360	6.4
	17	No water available					
	23	11:20	34.0	150	8.3	370	3.9
	31	No water available					
June	6	11:00	32.5	110	—	385	5.4
	15	No water available					
	20	14:40	31.0	500+	7.9	365	7.4
	25	14:50	28.5	500+	8.3	430	6.8
July	2	15:20	29.5	325	8.8	470	6.6
	9	14:10	35.5	245	8.1	360	5.2
	16	No water available					
	23	13:50	29.5	500+	8.2	395	7.4
	30	10:50	27.5	500+	8.2	445	6.1
Aug.	8	10:55	26.5	500+	8.3	360	7.5
	13	10:55	27.0	500+	8.4	380	7.5
	21	No water available					
	28	10:40	24.5	500+	8.0	275	7.2
Sept.	6	14:10	—	500+	—	260	—
	10	11:20	28.0	300	—	270	6.7
	17	10:10	27.5	200	—	195	7.5
	26	13:55	27.5	500+	7.8	270	6.7
Oct.	5	14:50	28.0	320	8.2	320	6.4
	9	Terminated monitoring works					

Remarks; Location : At crossing point of Urdaneta-Dagupan road on Lateral L, but observed at diversion point from Main Canal on Lateral D from July 23 and onward.
500+ : Over 500 ppm.
— : Not available.

Table F-25 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 12 IN ARIS

Date		Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
May	4	No water available					
	11	No water available					
	17	No water available					
	22	No water available					
	31	16:00	34.5	500+	—	310	6.4
June	6	9:55	30.5	450	—	395	6.4
	15	No water available					
	20	No water available					
	25	No water available					
July	2	14:40	29.0	500+	8.7	470	7.7
	9	14:40	35.0	445	8.0	365	5.3
	16	14:20	33.0	500+	7.8	385	6.7
	23	No water available					
	27	15:45	34.0	310	7.8	380	6.4
	30	15:10	32.5	500+	7.8	400	4.8
Aug.	8	15:00	29.5	500+	7.6	345	6.8
	13	14:20	20.0	500+	7.9	380	6.9
	21	No water available					
	28	14:30	26.0	500+	—	270	7.0
Sept.	6	15:35	34.0	500+	—	240	7.1
	10	No water available					
	17	No water available					
	26	16:35	29.0	500+	7.7	345	6.0
Oct.	5	No water available					
	9	15:20	30.5	500+	8.2	310	6.1
	16	17:00	31.0	500+	8.0	285	6.7
	24	15:10	26.5	500+	8.2	410	6.7
	29	No water available					
Nov.	14	17:15	29.5	150	8.0	290	5.8
	21	Terminated moitoring works					

Remarks; Location : On Lateral M.
500+ : Over 500 ppm.
— : Not available.

Table F-26 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 9 IN ADRIS

Date	Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
Jan. 11	14:20	26.2	2	8.9	230	8.2
20	9:50	24.3	0	8.4	280	8.2
26	9:50	23.4	0	8.6	240	10.4
Feb. 2	9:30	23.0	15	8.4	290	7.4
9	9:30	22.2	78	8.3	290	7.7
15	9:20	24.2	1	8.6	260	6.7
23	10:05	24.5	9	8.6	270	7.5
Mar. 6	8:50	22.8	68	8.2	230	7.5
15	9:05	26.9	28	8.2	290	7.2
23	8:40	25.1	9	8.7	280	7.8
31	11:50	31.0	18	8.9	250	5.7
Apr. 4	9:30	26.8	9	8.6	270	6.6
20	12:30	31.0	500+	8.8	290	3.9
25	9:05	27.0	10	8.1	300	—
May 3	14:30	30.5	40	7.9	275	8.0
11	—	—	—	—	—	—
17	—	—	—	—	—	—
23	14:35	29.5	62	8.3	200	5.2
June 1	9:40	27.5	85	—	195	6.2
7	9:15	26.5	50	—	240	6.3
14	9:30	28.0	39	—	245	8.4
21	9:00	26.0	130	8.6	240	9.6
26	9:00	24.5	150	8.7	215	6.7
July 3	9:20	24.5	105	8.9	215	6.8
10	9:15	23.5	215	8.0	205	7.5
17	9:10	25.5	45	8.4	245	7.5
24	9:15	25.5	35	8.1	210	7.6
31	8:55	25.5	60	8.4	150	7.6
Aug. 10	9:10	24.5	170	8.3	200	7.5
14	9:20	24.5	80	8.0	205	8.5
22	9:45	25.0	150	7.8	210	6.5
30	9:40	23.5	500+	—	105	8.2
Sept. 4	13:20	26.5	330	8.2	210	7.1
11	11:30	27.5	110	—	230	6.6
18	9:50	25.0	200	—	205	7.1
26	9:15	25.5	25	8.4	215	6.8
Oct. 7	9:05	25.5	45	8.4	220	7.3
11	15:40	29.5	75	8.6	215	6.2
17	14:30	28.5	0	8.4	200	7.8
25	14:40	26.5	15	8.3	205	7.3
29	No water available					
Nov. 16	9:30	24.0	25	8.1	225	7.4
21	Terminated monitoring works					

Remarks; Location : At intake dam on Main Canal.
500+ : Over 500 ppm.
— : Not available.

Table F-27 OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT MONITORING POINT NO. 10 IN ADRIS

Date		Time	Water Temperature (°C)	Turbid-ity (ppm)	pH	EC (umhos)	DO (mg/l)
Jan.	11	15:30	26.3	105	8.2	240	5.3
	20	11:00	27.8	105	7.8	280	7.4
	26	10:50	24.8	35	7.8	300	6.3
Feb.	2	10:50	23.4	32	8.2	270	6.6
	9	No water available					
	15	No water available					
	23	11:10	24.7	30	8.3	270	6.1
Mar.	6	No water available					
	15	No water available					
	23	No water available					
	31	No water available					
Apr.	4	No water available					
	20	No water available					
	25	No water available					
May	3	No water available					
	11	No water available					
	17	No water available					
	23	No water available					
June	1	10:30	29.0	105	—	205	5.3
	7	9:40	27.0	120	—	245	6.1
	14	9:50	28.5	110	—	240	7.3
	21	9:25	26.5	145	8.4	245	6.7
	26	9:25	24.5	260	8.5	215	7.3
July	3	9:50	25.0	350	8.7	240	7.0
	10	9:40	26.0	130	7.8	235	5.6
	17	9:35	28.0	110	7.8	255	6.5
	24	9:40	28.0	95	7.8	230	6.7
	31	9:20	26.5	185	7.8	220	6.7
Aug.	10	9:30	25.0	210	8.0	210	6.8
	14	9:50	25.5	90	8.0	210	7.6
	22	10:10	26.5	65	7.6	245	6.2
	30	10:20	24.5	—	—	160	7.5
Sept.	4	No water available					
	11	No water available					
	18	10:20	27.0	70	—	220	3.3
	26	9:35	26.0	145	8.0	230	6.1
Oct.	7	No water available					
	11	No water available					
	17	14:55	32.0	5	7.8	215	3.4
	25	15:00	27.5	55	8.1	210	4.3
	29	No water available					
Nov.	16	9:45	25.0	50	7.8	245	5.2
	21	Terminated monitoring works					

Remarks; Location : On Lateral A.
— : Not available.

Table F-28 **OBSERVATION RECORDS ON IRRIGATION WATER QUALITY AT SELECTED MONITORING POINTS IN ARIS AND INTAKE SITE OF CLEAR WATER IRRIGATION PROJECTS**

Date	Time	Water Temperature (°C)	Turbidity (ppm)	pH	EC (umhos)	DO (mg/l)
Monitoring point No. 1 on Main Canal at first structure						
Nov. 21	14:55	26.0	225	8.3	325	7.2
Monitoring point No. 3 on Don Moteo Ditch at diversion point from Main Canal						
Nov. 21	15:55	26.0	275	8.2	360	7.0
Monitoring point No. 4 on Don Moteo Ditch						
Nov. 21	15:45	26.0	275	8.2	360	7.0
Monitoring point No. 7 on Main Canal at crossing point of national road						
Nov. 21	13:50	27.5	270	8.2	420	6.2
Intake site at Casabar Clear Water Irrigation Project						
Nov. 21	14:15	29.5	0	8.2	335	6.5
Intake site at Porgana Clear Water Irrigation Project						
Nov. 21	16:15	28.0	62	7.3	440	5.4
Intake site at Agpaoa Clear Water Irrigation Project						
Nov. 21	16:45	30.5	2	7.0	600	2.5
Intake site at Sinapog Clear Water Irrigation Project						
Nov. 21	17:05	30.0	5	7.4	550	4.7
Intake site at Tagamusing Clear Water Irrigation Project						
Nov. 22	14:50	29.5	14	7.9	550	5.7
Intake site at Angalacan Clear Water Irrigation Scheme						
Nov. 22	15:30	30.0	6	8.1	550	8.9
Sinocalan Intake Dam in ARIS						
Nov. 22	16:05	29.5	44	7.9	520	6.7

Table F-29 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 1 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals				
	Date	Time		Cu	Pb	Zn	Cd	As
1	26/12/83	10:30	1,730	0.015	0.014	0.008	+	+
4	12/01/84	10:35	558	0.014	0.019	0.008	+	+
31	19/01/84	14:40	422	0.009	+	+	+	+
49	08/02/84	11:15	585	+	0.006	+	+	+
56	23/02/84	14:15	503	+	0.014	+	+	+
62	06/03/84	14:15	2,150	0.010	+	+	+	+
84	14/03/84	9:20	737	0.007	+	+	+	+
100	30/03/84	14:50	222	+	+	0.011	+	+
116	25/04/84	9:30	318	0.008	0.020	0.065	0.004	—
133	04/05/84	9:35	357	0.009	0.013	+	0.003	—
137	11/05/84	9:35	880	0.005	0.020	+	0.003	—
145	22/05/84	9:35	662	0.005	+	+	0.003	—
151	05/06/84	10:20	250	+	+	0.014	+	—
172	02/07/84	9:10	387	+	+	0.003	+	—
183	09/07/84	9:00	612	+	+	0.002	+	—
195	23/07/84	9:00	959	+	0.007	0.005	+	—
207	08/08/84	8:55	391	+	+	0.034	+	—
217	18/08/84	10:55	667	0.005	+	0.016	+	—
219	20/08/84	9:10	53	+	+	0.003	+	—
227	05/09/84	9:00	278	+	+	0.008	0.002	—
238	17/09/84	9:05	92	+	+	0.004	0.005	—
250	05/10/84	11:50	694	+	+	0.004	0.007	—
261	16/10/84	8:35	498	+	+	0.002	0.010	—
271	29/10/84	8:20	8,317	+	0.026	0.014	+	—
277	14/11/84	14:40	1,780	+	+	0.022	+	—
287	21/11/84	14:55	612	0.004	+	0.013	+	—

Remarks; + : Trace

Table F-30 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 2 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals				
	Date	Time		Cu	Pb	Zn	Cd	As
2	26/12/83	11:00	170	0.013	0.019	0.009	+	+
5	13/01/84	9:30	425	0.010	0.012	0.008	+	0.024
32	19/01/84	10:20	154	0.009	0.009	0.006	+	+
50	09/02/84	13:45	309	+	+	+	+	+
57	23/02/84	15:20	204	+	+	+	+	+
117	25/04/84	9:50	347	0.007	0.005	0.025	0.003	—
138	11/05/84	10:05	544	0.008	0.020	+	0.003	—
152	15/06/84	11:25	255	+	+	0.013	+	—
184	09/07/84	10:10	1,026	+	+	0.011	+	—
196	23/07/84	14:10	1,416	+	+	0.001	+	—
208	08/08/84	11:15	1,722	0.005	+	0.005	+	—
220	21/08/84	10:40	279	0.019	+	0.001	+	—
228	06/09/84	13:50	175	+	+	0.003	0.003	—
239	17/09/84	10:35	262	+	+	0.011	0.005	—
251	05/10/84	15:05	3,084	+	+	0.004	0.008	—

Remarks; + : Trace

Table F-31 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 3 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals				
	Date	Time		Cu	Pb	Zn	Cd	As
6	12/01/84	13:30	1,130	0.015	0.020	0.008	+	+
51	09/02/84	14:50	422	+	+	+	+	0.016
58	23/02/84	14:30	267	0.004	0.009	+	+	+
63	06/03/84	14:35	811	0.004	+	+	+	+
85	14/03/84	9:40	594	0.004	+	+	+	+
101	30/03/84	15:10	145	+	+	+	+	+
118	25/04/84	10:10	265	0.007	0.008	0.048	0.003	—
139	11/05/84	9:20	578	0.008	0.020	+	0.003	—
153	13/06/84	11:40	909	+	+	0.015	+	—
163	20/06/84	9:20	42	+	+	0.004	+	—
173	02/07/84	9:30	730	+	+	0.003	+	—
185	09/07/84	9:25	780	+	+	0.001	0.001	—
197	23/07/84	9:15	1,278	+	+	0.001	0.001	—
209	08/08/84	9:20	501	+	+	0.018	0.002	—
229	05/09/84	9:20	184	+	+	0.009	0.003	—
240	19/09/84	10:30	357	+	+	0.006	0.005	—
252	05/10/84	12:15	695	+	+	0.005	0.008	—
262	16/10/84	15:20	354	+	+	0.002	0.010	—
272	29/10/84	8:40	2,295	0.006	0.038	0.024	+	—
278	14/11/84	14:55	503	+	+	0.015	+	—
288	21/11/84	15:15	840	+	+	0.012	+	—

Remarks; + : Trace

Table F-32 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 4 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals				
	Date	Time		Cu	Pb	Zn	Cd	As
7	12/01/84	14:30	1,970	0.014	0.016	0.007	+	+
52	10/02/84	11:20	692	+	+	+	+	0.015
53	— do —	11:25	13.9	0.007	0.022	+	+	0.016
54	— do —	11:30	13.2	0.007	+	+	+	+
55	— do —	11:35	11.6	0.009	+	+	+	+
59	23/02/84	14:50	228	0.002	0.012	+	+	+
64	06/03/84	15:00	875	0.007	+	+	+	+
86	14/03/84	10:10	796	0.006	+	+	+	+
102	03/03/84	15:30	349	0.004	0.009	+	+	+
119	25/04/84	10:50	255	0.008	0.013	+	0.003	—
140	11/05/84	9:50	708	0.005	0.008	+	0.003	—
154	13/06/84	14:10	244	+	+	0.012	+	—
164	25/06/84	10:05	540	+	+	0.007	+	—
174	02/07/84	9:50	722	+	+	0.004	+	—
186	09/07/84	9:50	1,282	+	+	0.002	0.001	—
198	23/07/84	9:35	683	+	+	0.007	0.001	—
210	08/08/84	9:40	419	+	+	0.003	0.002	—
230	05/09/84	9:40	296	+	+	0.013	0.003	—
241	19/09/84	10:45	1,627	0.014	+	0.002	0.005	—
253	05/10/84	11:15	287	+	+	0.002	0.008	—
263	16/10/84	15:40	685	+	+	0.003	0.010	—
273	29/10/84	9:00	2,680	0.002	0.037	0.024	+	—
279	14/11/84	15:20	348	+	0.005	0.019	+	—
289	21/11/84	15:45	790	0.002	+	0.014	0.001	—
290	— do —	15:50	160	+	+	0.015	0.001	—
291	— do —	15:55	39	0.002	+	0.013	+	—
292	— do —	16:00	88	+	+	0.020	+	—

Remarks; + : Trace

Table F-33 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 5 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals			
	Date	Time		Cu	Pb	Zn	Cd
134	04/05/84	11:35	1,322	0.009	0.020	+	0.001
141	11/05/84	10:40	944	0.005	0.018	0.007	0.003
146	22/05/84	10:25	992	0.006	0.010	+	0.003
155	06/06/84	13:20	60	+	+	0.023	+
165	20/06/84	9:20	771	+	+	0.008	+
175	02/07/84	10:30	526	+	+	0.003	+
187	09/07/84	10:40	1,242	+	+	0.002	0.001
199	23/07/84	10:15	5,568	+	+	0.003	0.001
211	08/08/84	10:35	555	+	+	0.004	0.002
221	20/08/84	10:05	403	+	+	0.005	0.002
231	06/09/84	14:50	193	+	+	0.008	0.003
242	17/09/84	9:50	204	+	+	0.006	0.006
254	05/10/84	14:35	693	+	+	0.003	0.008
264	16/10/84	9:50	566	+	+	0.001	0.010
274	29/10/84	10:00	692	0.004	0.003	0.011	+
280	14/11/84	15:50	367	0.002	0.016	0.013	+

Remarks; + : Trace

Table F-34 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 6 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals			
	Date	Time		Cu	Pb	Zn	Cd
142	11/05/84	11:00	306	0.009	0.008	0.013	0.003
147	22/05/84	10:45	691	0.006	0.003	0.008	0.003
156	06/06/84	15:05	610	+	+	0.011	+
166	20/06/84	11:20	84	+	+	0.005	+
176	02/07/84	11:10	404	+	+	0.001	+
188	09/07/84	11:05	611	+	+	0.001	0.001
200	27/07/84	14:30	1,696	+	+	0.003	0.001
212	08/08/84	11:45	378	+	+	0.003	0.002
222	20/08/84	10:50	648	+	+	0.003	0.002
232	06/09/84	13:25	173	+	+	0.006	0.004
243	17/09/84	11:15	433	+	+	0.015	0.006
255	05/10/84	15:25	562	+	+	0.003	0.009
265	16/10/84	10:05	353	+	+	0.002	0.011
275	29/10/84	10:20	711	0.010	0.012	0.009	+
281	14/11/84	16:10	216	0.003	0.009	0.013	+

Remarks; + : Trace

Table F-35 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 7 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals			
	Date	Time		Cu	Pb	Zn	Cd
135	04/05/84	12:00	697	0.009	0.013	+	0.003
143	11/05/84	11:50	1,650	0.009	0.013	+	0.003
148	22/05/84	11:20	143	0.009	0.010	+	0.003
157	05/06/84	9:50	260	+	0.018	0.013	+
167	20/06/84	10:30	3,581	+	+	0.001	+
177	02/07/84	8:20	642	+	+	0.001	+
189	09/07/84	8:15	786	+	+	0.005	0.001
201	23/07/84	8:15	3,558	+	+	0.005	0.001
213	08/08/84	8:10	643	+	+	0.005	0.002
223	20/08/84	8:15	331	0.008	+	0.006	0.002
233	06/09/84	14:50	396	+	+	0.017	0.004
244	17/09/84	8:20	429	+	+	0.006	0.006
256	05/10/84	10:50	1,212	+	+	0.003	0.009
266	16/10/84	7:55	492	+	+	0.003	0.011
276	29/10/84	7:30	277	+	0.016	0.019	+
282	14/11/84	13:55	1,181	0.007	0.013	0.009	+
293	21/11/84	13:50	1,193	+	0.003	0.015	+

Remarks; + : Trace

Table F-36 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 8 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals			
	Date	Time		Cu	Pb	Zn	Cd
158	06/06/84	8:55	65	+	+	0.022	+
168	20/06/84	13:30	1,339	+	+	0.001	+
178	02/07/84	13:35	603	+	+	0.001	+
190	09/07/84	13:35	735	+	+	0.006	0.001
202	23/07/84	15:00	1,568	+	+	0.005	0.001
214	08/08/84	13:50	1,484	+	+	0.004	0.002
224	21/08/84	13:40	112	0.026	+	0.024	0.002
237	10/09/84	14:20	226	+	+	0.004	0.005
245	17/09/84	13:30	110	+	+	0.008	0.007
257	05/10/84	16:45	685	+	+	0.003	0.009
267	21/10/84	10:40	1,019	+	+	0.006	0.011
283	14/11/84	16:40	870	+	0.026	0.010	+

Remarks; + : Trace

Table F-37 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 11 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals			
	Date	Time		Cu	Pb	Zn	Cd
144	11/05/84	11:30	1,048	0.008	0.010	+	0.003
150	23/05/84	11:20	215	0.009	0.018	+	0.003
161	06/06/84	11:00	86	+	+	0.014	+
171	20/06/84	14:40	2,547	+	+	0.011	+
181	03/07/84	15:20	245	+	+	0.002	+
193	09/07/84	14:10	269	+	+	0.001	0.001
205	23/07/84	13:50	1,574	+	+	0.003	0.001
235	06/09/84	14:10	204	+	+	0.006	0.004
248	17/09/84	10:10	163	+	+	0.005	0.007
259	05/10/84	14:50	11	+	+	0.003	0.010

Remarks; +: Trace

Table F-38 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 12 IN ARIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals			
	Date	Time		Cu	Pb	Zn	Cd
162	06/06/84	9:55	171	+	+	0.012	+
182	03/07/84	14:40	576	+	+	0.003	+
194	09/07/84	14:40	524	+	+	0.002	0.001
206	27/07/84	15:45	313	+	+	0.002	0.002
218	18/08/84	15:00	361	0.005	+	0.004	0.002
236	06/09/84	15:35	586	+	+	0.015	0.004
249	26/09/84	16:35	1,483	+	+	0.004	0.007
260	09/10/84	15:20	2,372	+	0.015	0.002	0.010
270	16/10/84	17:00	1,443	+	+	0.002	0.002
286	14/11/84	9:45	243	+	+	0.013	+

Remarks; +: Trace

Table F-39 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 9 IN ADRIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals				
	Date	Time		Cu	Pb	Zn	Cd	As
8	11/01/84	14:20	3.9	0.005	0.018	0.007	+	+
33	20/01/84	9:50	1.9	+	+	+	+	+
35	02/02/84	9:35	2.2	+	0.002	0.003	+	0.016
60	23/02/84	10:05	2.3	+	+	0.004	+	+
87	15/03/84	9:05	6.7	+	+	+	+	+
103	31/03/84	11:50	6.0	+	0.030	+	+	+
120	25/04/84	12:30	523	0.005	0.013	+	0.003	—
136	04/05/84	14:45	31	0.002	0.013	+	0.003	—
149	23/05/84	14:35	31	0.007	0.008	+	0.005	—
159	07/06/84	9:15	34	+	+	0.011	+	—
169	21/06/84	9:00	70	+	+	0.004	+	—
179	03/07/84	9:20	84	+	+	0.001	+	—
191	17/07/84	9:10	19	+	+	0.001	0.001	—
203	24/07/84	9:15	68	+	+	0.006	0.001	—
215	10/08/84	9:10	134	+	+	0.003	0.002	—
225	22/08/84	9:45	96	+	+	0.003	0.002	—
234	04/09/84	13:20	88	+	+	0.002	0.004	—
246	18/09/84	9:50	63	+	+	0.008	0.007	—
258	07/10/84	9:05	748	+	+	0.002	0.009	—
268	17/10/84	14:30	7	+	+	0.001	0.011	—
284	16/11/84	9:30	3	+	0.002	0.010	+	—

Remarks; + : Trace

Table F-40 WATER SOLUBLE HEAVY METAL CONTENTS OF CANAL WATER AT MONITORING POINT NO. 10 IN ADRIS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals				
	Date	Time		Cu	Pb	Zn	Cd	As
3	27/12/83	10:30	10.5	0.005	0.026	0.005	+	+
9	11/01/84	15:30	62.2	0.005	0.021	0.009	+	+
34	20/01/84	11:00	63.4	+	+	0.006	+	+
36	02/02/84	10:30	57.9	+	+	0.006	+	+
61	23/02/84	10:30	34.3	+	+	+	+	+
160	07/06/84	9:40	73	+	+	0.012	+	—
170	21/06/84	9:25	65	+	+	0.001	+	—
180	03/07/84	9:50	459	+	+	0.001	+	—
192	17/07/84	9:35	64	+	+	0.003	0.001	—
204	24/07/84	9:40	187	+	+	0.007	0.001	—
216	10/08/84	9:30	91	+	+	0.003	0.002	—
226	22/08/84	10:10	73	+	+	0.004	0.002	—
247	18/09/84	10:20	20	+	+	0.008	0.007	—
269	17/10/84	15:55	9	+	+	0.001	0.012	—
285	16/11/84	9:45	26	+	+	0.019	+	—

Remarks; + : Trace

Table F-41 EFFECT OF RIVER BED DREDGING ON WATER QUALITY OF AGNO RIVER (1/4)

Unit: mg/l

Sample No.	Sampling Point	Sampling Time	Suspended Solid	Water Soluble Heavy Metals Cu	Pb	Zn	Cd
(1) Sampling Date: January 21, 1984							
10	P/E	6:25	652	0.009	0.016	0.010	+
11	I/D	6:45	740	0.023	0.030	0.009	+
12	No. 1	7:30	696	0.012	0.018	0.008	+
13	P/E	8:45	1,260	0.013	0.010	0.006	+
14	I/D	9:05	1,360	0.015	0.013	0.007	+
15	No. 1	9:15	1,260	0.011	0.024	0.006	+
16	P/E	10:30	1,200	0.011	0.014	0.008	+
17	I/D	10:25	957	0.010	0.021	0.008	+
18	No. 1	10:40	1,220	0.011	0.020	0.007	+
19	P/E	13:20	1,180	0.010	0.026	0.009	+
20	I/D	13:00	1,020	0.009	0.014	0.008	+
21	No. 1	13:05	972	0.012	0.022	0.007	+
22	P/E	14:50	1,680	0.014	0.019	0.008	+
23	I/D	15:10	2,080	0.012	0.018	0.007	+
24	No. 1	15:00	1,850	0.007	0.016	0.010	+
25	P/E	16:40	1,810	0.014	0.010	0.008	+
26	I/D	16:55	1,840	0.010	0.008	0.007	+
27	No. 1	16:50	1,930	0.011	0.025	0.009	+
28	P/E	18:20	2,090	0.015	0.020	0.007	+
29	I/D	18:35	2,110	0.010	0.019	0.006	+
30	No. 1	18:45	1,600	0.015	0.010	0.007	+

Remarks; P/E : Point E upstream from bridging site
I/D : ARIS intake dam downstream from bridging site
+ : Trace

Table F-42 EFFECT OF RIVER BED DREDGING ON WATER QUALITY OF AGNO RIVER (2/4)

Unit: mg/l

Sample No.	Sampling Point	Sampling Time	Suspended Solid	Water Soluble Heavy Metals Cu	Pb	Zn	Cd
(1) Sampling Date: February 4, 1984							
37	P/E	7:55	355	0.007	+	0.035	+
38	I/D	8:05	581	0.010	0.006	0.015	+
39	No. 1	8:10	276	0.004	+	0.046	+
40	P/E	10:55	473	0.005	+	0.076	+
41	I/D	11:10	228	0.004	0.029	0.085	+
42	No. 1	11:15	1,520	0.004	0.006	0.091	+
43	P/E	13:55	513	0.005	+	0.112	+
44	I/D	14:05	976	0.005	+	0.110	+
45	No. 1	14:10	900	0.004	+	0.126	+
46	P/E	16:55	1,078	+	0.022	+	+
47	I/D	17:10	797	0.003	+	+	+
48	No. 1	17:15	1,087	0.005	0.009	+	+
(2) Sampling Date : March 2, 1984							
65	P/E	8:00	562	+	+	+	+
66	I/D	8:15	590	+	+	+	+
67	No. 1	8:25	557	+	+	+	+
68	P/E	11:10	825	+	+	+	+
69	I/D	11:15	847	+	+	+	+
70	No. 1	11:25	795	+	+	+	+
71	P/E	14:00	2,950	+	+	+	+
72	I/D	14:15	2,780	+	+	+	+
73	No. 1	14:25	2,460	+	+	+	+
74	P/E	17:00	288	0.004	+	+	+
75	I/D	17:15	231	0.004	+	+	+
76	No. 1	17:25	681	0.003	+	+	+

Remarks; P/E : Point E upstream from bridging site
I/D : ARIS intake dam downstream from bridging site
+ : Trace

Table F-43 EFFECT OF RIVER BED DREDGING ON WATER QUALITY OF AGNO RIVER (3/4)

Unit: mg/l

Sample No.	Sampling Point	Sampling Time	Suspended Solid	Water Soluble Heavy Metals Cu	Pb	Zn	Cd
(1) Sampling Date: March 24, 1984							
88	P/E	7:35	339	0.005	+	+	+
89	I/D	7:50	221	0.005	+	+	+
90	No. 1	7:55	251	0.008	+	+	+
91	P/E	10:25	313	0.008	+	+	+
92	I/D	10:35	315	0.008	+	+	+
93	No. 1	10:45	465	0.004	+	+	+
94	P/E	14:20	96.4	0.004	+	+	+
95	I/D	14:30	338	0.015	0.030	+	+
96	No. 1	14:40	170	0.003	+	+	+
97	P/E	16:24	311	0.005	+	+	+
98	I/D	16:30	302	0.004	+	+	+
99	No. 1	16:50	196	+	+	+	+
(2) Sampling Date : April 10, 1984							
104	P/E	7:15	122	+	+	+	+
105	I/D	7:30	240	0.004	0.015	+	+
106	No. 1	7:40	110	+	+	+	+
107	P/E	11:15	81.6	0.005	+	+	+
108	I/D	11:30	104	+	+	+	+
109	No. 1	11:40	81.3	0.005	+	+	+
110	P/E	13:20	1,310	+	+	+	+
111	I/D	13:30	895	+	+	+	+
112	No. 1	13:40	68.5	0.005	+	+	+
113	P/E	15:30	841	0.005	+	+	+
114	I/D	15:45	615	+	+	+	+
115	No. 1	15:50	951	+	+	+	+

Remarks; P/E : Point E upstream from bridging site
I/D : ARIS intake dam downstream from bridging site
+ : Trace

Table F-44 EFFECT OF RIVER BED DREDGING ON WATER QUALITY OF AGNO RIVER (4/4)

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Water Soluble Heavy Metals			
	Point	Time		Cu	Pb	Zn	Cd
Sampling Date: April 28, 1984							
121	P/E	7:30	146	0.005	0.013	0.004	+
122	I/D	7:40	157	0.009	0.013	0.003	+
123	No. 1	7:50	163	0.005	0.005	0.002	+
124	P/E	10:25	78	0.005	0.008	0.002	+
125	I/D	10:30	116	0.008	0.013	0.003	+
126	No. 1	10:35	161	0.010	0.005	0.003	+
127	P/E	13:05	274	0.009	0.013	0.003	+
128	I/D	13:15	133	0.014	0.013	0.003	0.003
129	No. 1	13:20	312	0.011	0.013	0.002	+
130	I/D	16:20	216	0.018	0.018	0.003	+
131	P/E	16:25	235	0.009	0.013	0.003	+
132	No. 1	16:30	316	0.009	0.013	0.014	+

Remarks: P/E: Point E upstream from bridging site
I/D: ARIS intake dam downstream from bridging site
+ : Trace

Table F-45 WATER SOLUBLE HEAVY METAL CONTENTS OF IRRIGATION WATER AT INTAKE SITES OF CLEAR WATER IRRIGATION PROJECTS

Unit: mg/l

Sample No.	Sampling		Suspended Solid	Heavy Metals			
	Point	Time		Cu	Pb	Zn	Cd
Intake Site at Casabar Clear Water Irrigation Project							
294	21/11/84	14:15	3	+	+	0.015	+
Intake Site at Porgana Clear Water Irrigation Project							
295	21/11/84	16:15	58	+	+	0.014	0.001
Intake Site at Agpaoa Clear Water Irrigation Project							
296	21/11/84	16:45	11	+	0.002	0.016	0.001
Intake Site at Sinapog Clear Water Irrigation Project							
297	21/11/84	17:05	5	+	+	0.016	0.002
Intake Site at Tagamusing Clear Water Irrigation Project							
298	22/11/84	14:50	9	+	0.003	0.013	0.001
Intake Site at Angalacan Clear Water Irrigation Project							
299	22/11/84	15:30	3	+	+	0.010	0.002
Sinocalan Intake Dam in ARIS							
300	22/11/84	16:05	57	+	+	0.013	0.002

Remarks; +: Trace

Table F-46 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (1/10)

A. General Information

Master Pit No.	:	1
Project	:	San Roque Reservoir
Photo No.	:	111 flight 115
Location	:	Macalong, Asingan, Pangasinan
Landform	:	Alluvial terrace
Relief	:	Nearly level
Land Use	:	Paddy rice
Elevation	:	
Slope	:	0 -- 1%
Aspect	:	
Surface Drainage	:	Good
Internal Drainage	:	Excessive
Soil Drainage Class	:	Well drained
Soil Parent Material	:	Recent alluvial deposit
Soil Series/Type	:	San Manuel
Land Class	:	$\frac{1R}{PrlIBY}$(2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
401	0-26	Light brownish gray (10YR 6/2) dry silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; few soft iron and manganese concretions; slightly sticky and slightly plastic when wet; sub-angular blocky structure; many fine to medium roots; common fine to medium tubular interstitial pores; presence of few earthworm burrow; clear irregular horizon boundary.
402	26-54	Dark gray (10YR 4/1) dry clay loam, few fine faint brownish yellow (10YR 6/6) mottles; no concretions, friable, angular blocky structure; common fine to medium pores; common fine roots; clear wavy horizon boundary.
403	54-87	Brown (10YR 4/3) dry sandy loam, no mottles; moderately compact, friable; granular structure; many fine to medium pores; few fine to very fine roots; clear smooth horizon boundary.
404	87-113	Yellowish brown (10YR 5/4) dry loamy sand, single grain structure; absence of plant roots; diffused irregular horizon boundary.
405	113-153	Brown (10YR 4/3) moist loamy fine sand friable, weak granular structure.

Described by: T.C. Anyaya/R.A. Umagat Date: March 29, 1984

Table F-47 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (2/10)

A. General Information

Master Pit No.	:	2
Project	:	San Roque Reservoir
Photo No.	:	064 flight 117
Location	:	Pias, Villasis, Pangasinan
Landform	:	Alluvial terrace
Relief	:	Nearly level
Land Use	:	Tobacco
Elevation	:	
Slope	:	0 — 1%
Surface Drainage	:	Good
Internal Drainage	:	Fair to Good
Soil Drainage Class	:	Fairly drained
Soil Parent Material	:	Recent alluvial deposit
Soil Series/Type	:	San Manuel
Land Class	:	$\frac{1R}{TCllBY}$ (2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
406	0-22	Light brownish gray (10YR 6/2) dry silt loam, common fine distinct brownish yellow (10YR 6/8) mottles; no concretions, angular blocky structure; friable, common fine tubular pores, many fine to medium roots; presence of few earthworm burrows; clear smooth horizon boundary.
407	22-48	Grayish brown (10YR 4/2) dry silty clay loam, common fine faint dark yellowish brown (10YR 4/4) mottles; no concretions; prismatic structure, friable, few medium tubular pores; common fine to very fine roots; presence of patchy thin clay cutans along pores lining; diffused smooth horizon boundary.
408	48-81	Very dark grayish brown (10YR 3/2) dry silt loam, few fine faint yellowish brown (10YR 5/4) mottles, no concretions, blocky structure; friable, few fine to very fine roots; common fine to medium interstitial pores; clear irregular horizon boundary.
409	81-120	Grayish brown (10YR 5/2) dry silt loam, common medium distinct yellowish brown (10YR 4/6) mottles; moderately strong angular blocky structure; friable, common fine tubular pores, gradual irregular horizon boundary.
410	120-150	Pale brown (10YR 6/3) moist silt loam, common medium distinct dark yellowish brown (10YR 4/4) mottles; friable, moderately weak granular structure; common fine to medium tubular pores; friable, slightly sticky.

Described by: R.A. Umagat Date: March 29, 1984

Table F-48 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (3/10)

A. General Information

Master Pit No.	:	3
Project	:	San Roque Reservoir
Photo No.	:	
Location	:	Pinmaludpod, Urdaneta, Pnagasinan
Landform	:	Alluvial terrace
Relief	:	Nearly level
Land Use	:	Paddy rice
Elevation	:	
Slope	:	0 — 1%
Aspect	:	
Surface Drainage	:	Fair
Internal Drainage	:	Good
Soil Drainage Class	:	Fairly drained
Soil Parent Material	:	Recent alluvial deposit
Soil Series/Type	:	San Manuel
Land Class	:	$\frac{1R}{PrllBY}$(2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
411	0-18	Brown (10YR 5/3) dry silty clay loam, few fine faint reddish brown (5YR 4/3) mottles; slightly sticky, non plastic when wet; sub-angular blocky structure; common fine to medium root penetration; absence of tubular pores; clear smooth horizon boundary.
412	18-52	Dark yellowish brown (10YR 4/4) dry clay loam, common fine distinct reddish brown (5YR 4/4) mottles; slightly sticky slightly plastic when wet; moderately strong sub-angular blocky structure; friable, common fine root penetration; few fine tubular pores; clear irregular horizon boundary.
413	52-79	Brown (10YR 4/3) dry silty clay loam, common distinct yellowish brown (10YR 5/8) mottles, friable when moist; weak sub-angular blocky structure; common fine tubular pores; clear wavy horizon boundary.
414	79-125	Pale brown (10YR 6/3) moist silt loam, common medium distinct yellowish brown (10YR 5/6) mottles; no concretions, non sticky, non plastic; friable, weak granular structure; few fine roots, common fine tubular pores.

Described by: T.C. Anyaya Date: March 30, 1984

Table F-49 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (4/10)

A. General Information

Master Pit No.	:	4
Project	:	San Roque Reservoir
Photo No.	:	193 Flight 125
Location	:	Flores, San Manuel, Pangasinan
Landform	:	Alluvial terrace
Relief	:	Nearly level
Land Use	:	Paddy rice irrigated
Elevation	:	
Slope	:	0 — 1%
Aspect	:	
Surface Drainage	:	Fair
Internal Drainage	:	Good
Soil Drainage Class	:	Well drained
Soil Parent Material	:	Recent alluvial deposit
Soil Series/Type	:	Umingan
Land Class	:	$\frac{1R}{PrlIBy}$ (2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
415	0-11	Light brownish gray (10YR 6/2) dry silt loam; common fine distinct yellowish brown (10YR 5/8) mottles; few medium coarse to soft black concretion; moderately compact, angular blocky structure; many medium to fine roots; few fine tubular pores; clear smooth horizon boundary.
416	11-52	Gray (10YR 5/1) dry silty clay loam; many medium distinct dark yellowish brown (10YR 4/6) mottles; no concretions, moderately sticky and slightly plastic when wet; moderately strong sub-angular blocky structure; common fine to very fine roots; very few fine pores; diffused smooth horizon boundary.
417	52-75	Dark gray (10YR 4/1) dry silty clay loam, few fine faint yellowish brown (10YR 5/6) mottles; common fine soft black concretions; moderately sticky and slightly plastic when wet; blocky structure; few fine to very fine roots; very few fine pores; abrupt irregular horizon boundary.
418	75-83	Dark grayish brown (10YR 4/2) moist loamy sand; absence of plant roots; granular structure; gradual irregular horizon boundary.
419	83-120	Grayish brown (10YR 5/2) moist coarse sand, single grain structure.

Described by: R.A. Umagat Date: March 30, 1984

Table F-50 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (5/10)

A. General Information

Master Pit No.	:	5
Project	:	San Roque Reservoir
Photo No.	:	193 Flight 125
Location	:	Malanay, Sta. Barbara, Pangasinan
Landform	:	Alluvial terrace
Relief	:	Nearly level
Land Use	:	Paddy rice
Elevation	:	
Slope	:	0 — 1%
Aspect	:	
Surface Drainage	:	Fair
Internal Drainage	:	Fair
Soil Drainage Class	:	Fairly drained
Soil Parent Material	:	Alluvial deposit
Soil Series/Type	:	Quingua
Land Class	:	$\frac{1R}{PrllBY}$ (2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
420	0-18	Brown (10YR 5/3) dry silty clay loam, few fine faint reddish brown (5YR 4/4) mottles; slightly sticky, slightly plastic when wet; strong sub-angular blocky structure; common fine to medium roots; clear irregular horizon boundary.
421	18-42	Dark grayish brown (10YR 4/2) dry clay loam, few fine faint yellowish brown (10YR 5/6) mottles; moderately sticky and plastic when wet; weak sub-angular blocky structure; common fine to very fine roots; clear smooth horizon boundary.
422	42-59	Grayish brown (10YR 5/2) dry clay loam, few fine faint to distinct yellowish brown (10YR 5/6) mottles; no concretions; slightly sticky and slightly plastic when wet; friable when moist, weak sub-angular blocky structure; common fine roots; few fine open tubular pores, abrupt irregular horizon boundary.
423	59-98	Yellowish brown (10YR 5/4) moist silty clay loam; common fine distinct brownish yellow (10YR 6/8) mottles; no concretions; slightly sticky, non plastic; friable weak sub-angular blocky structure; few fine roots, few fine tubular pores; clear irregualr horizon boundary.
424	98-145	Yellowish brown (10YR 5/6) moist, silt loam; common fine distinct brownish yellow (10YR 6/8) mottles; non sticky, non plastic; friable granular structure; few fine tubular pores.

Described by: T.C. Anyaya Date: April 2, 1984

Table F-51 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (6/10)

A. General Information

Master Pit No.	:	6
Project	:	San Roque Reservoir
Photo No.	:	126 Flight 119
Location	:	Santiago, Binalonan, Pangasinan
Landform	:	Alluvial terrace
Relief	:	Nearly level
Land Use	:	Paddy rice
Elevation	:	
Slope	:	0 — 1%
Aspect	:	
Surface Drainage	:	Fair
Internal Drainage	:	Good
Soil Drainage Class	:	Well drained
Soil Parent Material	:	Recent alluvial deposit
Soil Series/Type	:	San Manuel
Land Class	:	$\frac{1R}{PrllBY}$ (2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
425	0-15	Dark gray (10YR 4/1) dry clay loam, few fine faint yellowish brown (10YR 5/8) mottles; no concretions, sticky and plastic when wet; angular blocky structure; many medium to fine roots; few fine to medium pores; clear wavy horizon boundary.
426	15-64	Very dark grayish brown (10YR 3/2) dry fine sandy clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; slightly sticky, non-plastic when wet; common fine to very fine roots; many fine to medium pores; presence of few earthworm burrows; diffused irregular horizon boundary.
427	64-98	Grayish brown (10YR 5/2) dry sandy clay loam; common fine faint to brownish yellow (10YR 5/6) mottles; no concretions; compact, slightly plastic when wet; sub-angular blocky structure; very few fine roots; common fine to medium tubular pores; presence of few earthworm burrows; patchy thin layers of clay cutans along pores lining; gradual irregular horizon boundary.
428	98-119	Grayish brown (10YR 5/2) dry silty clay loam, few medium distinct brownish yellow (10YR 6/8) mottles; moderately sticky, slightly plastic when wet; sub-angular blocky structure; very few fine roots; presence of few earthworm burrows; common fine to medium pores; diffused smooth horizon boundary.
429	119-150	Dark grayish brown (10YR 4/2) moist loamy sand; granular structure, absence of plant roots.

Described by: R.A. Umagat Date: April 2, 1984

Table F-52 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (7/10)

A. General Information

Master Pit No.	:	7
Project	:	San Roque Reservoir
Photo No.	:	117 Flight 121
Location	:	Unsad, Villasis, Pangasinan
Landform	:	Residual Terrace
Relief	:	Undulating
Land Use	:	Cassava
Elevation	:	
Slope	:	2 — 3%
Aspect	:	
Surface Drainage	:	Good
Internal Drainage	:	Fair to poor
Soil Drainage Class	:	Fairly drained
Soil Parent Material	:	Tuffaceous sandstone
Soil Series/Type	:	Tarlac
Land Class	:	2rt

B. Profile Description

Sample No.	Depth (cm)	Profile Description
430	0-12	Brown (10YR 5/3) dry sandy clay loam, few fine faint brownish yellow (10YR 5/8) mottles; few coarse hard reddish brown concretions; friable, hard and compact; moderately strong sub-angular blocky structure; common medium to fine pores; common medium to fine roots; clear wavy horizon boundary.
431	12-25	Brown (10YR 4/3) sandy clay loam, few fine faint brownish yellow (10YR 5/8) mottles; few fine soft black concretions; sticky, slightly plastic when wet; friable moderately weak angular blocky structure; common fine to very fine roots; few fine to medium tubular pores; clear smooth horizon boundary.
432	25-87	Brown (10YR 5/3) dry fine sandy clay loam; common medium distinct yellowish brown (10YR 4/6) mottles; common fine to medium soft black concretions; sticky, slightly plastic when wet; angular blocky structure; few fine to very fine roots; abrupt smooth horizon boundary.
433	87-110	Dark yellowish brown (10YR 3/4) dry fine sandy clay; common medium distinct to prominent yellowish brown (10YR 4/6) to brownish yellow (10YR 6/8) mottles; common fine to medium black soft concretions; friable, sub-angular blocky structure; very few fine roots, few fine tubular pores.

Described by: R.A. Umagat Date: April 3, 1984

Table F-53 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (8/10)

A. General Information

Master Pit No.	:	8
Project	:	San Roque Reservoir Project
Photo No.	:	033 Flight 123
Location	:	Bo. Mangayaw, Bayambang, Pangasinan
Landform	:	Alluvial terrace
Relief	:	Slightly undulating
Land Use	:	Corn
Elevation	:	
Slope	:	1 – 2%
Aspect	:	
Surface Drainage	:	Fair
Internal Drainage	:	Good
Soil Drainage Class	:	Well drained
Soil Parent Material	:	Recent alluvial deposit
Soil Series/Type	:	Quingua
Land Class	:	$\frac{1R}{CnllBY}$(2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
434	0-17	Light yellowish brown (10YR 6/4) dry silt loam; few fine faint reddish brown to yellowish brown (5YR 4/4) to (10YR 5/8) mottles; no concretions, non-sticky non-plastic when wet; weak sub-angular blocky structure; common fine to medium roots; clear irregular horizon boundary.
435	17-47	Dark yellowish brown (10YR 4/4) dry silty clay loam; no mottles and concretions; friable, granular structure; common fine roots, abrupt irregular horizon boundary.
436	47-62	Yellowish brown (10YR 5/4) dry silt loam; no mottles and concretions, friable, granular structure; few to common fine roots; diffused irregular horizon boundary.
437	62-110	Yellowish brown (10YR 5/4) dry fine sandy loam, friable, granular structure; very few fine roots; clear wavy horizon boundary.
438	110-153	Yellowish brown (10YR 5/4) moist very sandy loam, friable, weak granular structure.

Described by: T.C. Anyaya Date: April 4, 1984

Table F-54 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (9/10)

A. General Information

Master Pit No.	:	9
Project	:	San Roque Reservoir
Photo No.	:	100 Flight 118
Location	:	Salcedo, San Manuel, Pangasinan
Landform	:	Alluvial terrace
Relief	:	Nearly level
Land Use	:	Tobacco
Elevation	:	
Slope	:	0 — 1%
Aspect	:	
Surface Drainage	:	Fair
Internal Drainage	:	Good
Soil Drainage Class	:	Well drained
Soil Parent Material	:	Recent alluvial deposit
Soil Series/Type	:	San Manuel
Land Class	:	$\frac{1R}{TcllBY}$(2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
439	0-11	Pale brown (10YR 6/3) dry silty clay loam; no mottles, no concretions; friable, strong sub-angular blocky structure; common to many fine roots; gradual wavy horizon boundary.
440	11-25	Brown (10YR 5/3) dry silty clay loam; common medium distinct reddish yellow (7.5YR 7/8) mottles, friable weak sub-angular blocky structure; common fine to very fine roots; few fine tubular pores; gradual smooth horizon boundary.
441	25-54	Pale brown (10YR 6/3) moist very fine sandy clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; no concretions; non sticky, non plastic; friable weak sub-angular blocky structrure; few to common fine roots; common fine open tubular pores; diffused smooth horizon boundary.
442	54-78	Dark yellowish brown (10YR 5/4) wet very fine sandy loam; few fine faint yellowish brown (10YR 5/8) mottles; no concretions, granular structure; few fine roots; common to many open tubular pores; diffused broken horizon boundary.
443	78-110	Dark yellowish brown (10YR 5/4) wet; loamy fine sand; single grain structure.

Described by: T.C. Anyaya Date: April 4, 1984

Table F-55 PROFILE DESCRIPTION OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (10/10)

A. General Information

Master Pit No.	: 10		
Project	: San Roque Reservoir		
Photo No.	: 108, Flight 111		
Location	: San Roque, San Nicolas, Pangasinan		
Landform	: Alluvial Terrace		
Relief	: Nearly level		
Land Use	: Paddy rice irrigated		
Elevation	:		
Slope	: 0 — 1%	Soil Parent Material	: Alluvial deposit
Aspect	:	Soil Series/Type	: San Manual
Surface Drainage	: Fair		
Internal Drainage	: Fair		
Soil Drainage Class	: Fairly drained	Land Class	: $\frac{1R}{PrllBy}$(2do)

B. Profile Description

Sample No.	Depth (cm)	Profile Description
444	0-15	Grayish brown (10YR 5/2) dry silty clay loam; common fine distinct yellowish brown (10YR 5/8) to brownish yellow (10YR 6/8) mottles; no concretions, slightly sticky, moderately strong blocky structure; many medium to fine roots, few fine to medium pores; clear wavy horizon boundary.
445	15-37	Dark grayish brown (10YR 4/2) dry silty clay loam, few fine faint yellowish brown (10YR 5/6) mottles; few coarse black concretions; moderately sticky when wet; sub-angular blocky structure; many fine to very fine roots; common fine tubular pores; diffused smooth horizon boundary.
446	37-89	Very dark grayish brown (10YR 3/2) dry fine sandy clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; slightly sticky when wet, non-plastic; moderately weak angular blocky structure; few fine to very fine roots; few fine pores; presence of lime precipitates and disintegrating materials; diffused irregular horizon boundary.
447	89-131	Dark grayish brown (10YR 4/2) moist clay loam, common fine distinct dark yellowish brown (10YR 4/4) mottles; slightly sticky, slightly plastic, friable granular structure; common fine to medium tubular pores; presence of few eathworm burrows and patchy thin layer of clay cutans along pores lining; diffused smooth horizon boundary.
448	131-150	Grayish brown (10YR 5/2) moist silty clay loam, common fine distinct yellowish brown (10YR 5/6) mottles; slightly sticky, slightly plastic; weak angular structure; common fine pores; patch to continuous thin layer of clay cutans along ped faces.

Described by: R.A. Umagat

Date: April 4, 1984

Table F-56 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (1/10)

A. Master Pit No. and Location: No. 1, Macalong, Asingan

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
401	0— 26	5.8	400	11.5	1.94	3.33
402	— 54	6.2	100	23.5	1.39	2.38
403	— 87	6.8	60	25.0	1.59	2.74
404	—113	6.9	50	29.0	0.94	1.62
405	—153	7.0	70	25.0	0.71	1.22

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
401	20.59	0.13	0.26	12.00	3.68	4.52
402	27.74	0.16	0.26	19.78	3.52	4.02
403	25.96	0.13	0.26	17.69	3.86	4.02
404	16.54	0.08	0.26	11.23	2.46	2.51
405	23.40	0.09	0.26	16.53	4.01	2.51

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
401	0— 26	41	51	8	SiL
402	— 54	37	50	13	L, SiL
403	— 87	35	55	10	SiL
404	—113	89	8	3	S
405	—153	58	37	5	SL

Remarks;

pH	:	Soil-water ratio is 1:1.
EC	:	Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
P_2O_5	:	Available phosphorus on Olsen method.
OC & OM	:	Organic carbon and organic matter, respectively.
CEC	:	Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
Exchangeable cations	:	Expressed by milligram equivalent per 100 g dry soil.
Ex-Ac	:	Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-57 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (2/10)

A. Master Pit No. and Location: No. 2, Pias, Villasis

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
406	0—22	5.6	320	21.0	2.27	3.91
407	— 48	6.9	80	18.0	1.81	3.12
408	— 81	6.9	110	32.0	1.29	2.22
409	—120	6.9	130	30.0	0.66	1.13
410	—150	7.0	160	37.5	1.07	1.84

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
406	29.79	0.35	0.26	20.41	4.75	4.52
407	31.47	0.20	0.39	20.40	6.46	4.02
408	25.71	0.26	0.40	19.68	2.35	3.02
409	29.96	0.16	0.40	20.35	6.03	3.02
410	28.30	0.12	0.26	18.21	6.69	3.02

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
406	— 22	33	55	12	SiL
407	— 48	35	48	17	L
408	— 81	30	50	20	L, SiL
409	—120	28	56	16	SiL
410	—150	16	71	13	SiL

Remarks;

pH	:	Soil-water ratio is 1:1.
EC	:	Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
P_2O_5	:	Available phosphorus on Olsen method.
OC & OM	:	Organic carbon and organic matter, respectively.
CEC	:	Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
Exchangeable cations	:	Expressed by milligram equivalent per 100 g dry soil.
Ex-Ac	:	Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-58 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (3/10)

A. Master Pit No. and Location: No. 3, Pinmaludpod, Urdaneta

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
411	0— 18	6.4	490	13.0	2.19	3.77
412	— 52	6.5	180	13.0	0.86	1.49
413	— 79	6.9	130	23.0	0 86	1.49
414	—125	7.0	120	17.5	0.24	0.41

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
411	26.14	0.22	0.52	15.37	6.51	3.52
412	27.27	0.14	0.39	16.14	7.08	3.52
413	36.28	0.15	0.40	21.79	10.42	3.52
414	35.17	0.02	0.40	21.39	9.84	3.52

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
411	0— 18	30	54	16	SiL
412	— 52	34	49	17	L
413	— 79	27	60	13	SiL
414	—120	20	71	9	SiL

Remarks;
- pH : Soil-water ratio is 1:1.
- EC : Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
- P_2O_5 : Available phosphorus on Olsen method.
- OC & OM : Organic carbon and organic matter, respectively.
- CEC : Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
- Exchangeable cations : Expressed by milligram equivalent per 100 g dry soil.
- Ex-Ac : Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-59 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (4/10)

A. Master Pit No. and Location: No. 4, Flores, San Manuel

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
415	0— 11	6.7	360	17.5	1.78	2.06
416	— 52	7.1	210	12.5	1.24	2.17
417	— 75	7.0	160	14.0	1.21	2.09
418	— 83	7.1	110	11.0	1.21	2.09
419	—120	7.1	60	8.0	0.99	1.70

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
415	25.31	0.41	0.26	17.14	4.48	3.02
416	35.82	0.47	0.13	20.46	12.25	2.51
417	26.99	0.45	0.13	18.04	5.86	2.51
418	17.96	0.33	0.13	10.90	5.09	1.51
419	9.21	0.20	0.08	5.81	2.11	1.01

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
415	0— 11	28	56	16	SiL
416	— 52	30	49	21	L
417	— 72	53	29	18	SL
418	— 83	44	30	26	L
419	—120	45	39	16	L

Remarks;
- pH : Soil-water ratio is 1:1.
- EC : Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
- P_2O_5 : Available phosphorus on Olsen method.
- OC & OM : Organic carbon and organic matter, respectively.
- CEC : Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
- Exchangeable cations : Expressed by milligram equivalent per 100 g dry soil.
- Ex-Ac : Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-60 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (5/10)

A. Master Pit No. and Location: No. 5, Malanay, Santa Barbara

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
420	0— 18	6.1	470	17.5	2.00	3.44
421	— 42	7.0	250	17.5	1.05	1.81
422	— 59	6.9	240	14.0	1.54	2.66
423	— 98	6.8	160	7.5	1.24	2.14
424	—145	6.9	150	11.0	0.79	1.35

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
420	48.18	0.26	0.27	28.62	8.48	10.55
421	44.85	0.11	0.41	30.69	10.12	3.52
422	44.80	0.12	0.41	29.99	10.76	3.52
423	44.85	0.08	0.27	31.36	10.12	3.02
424	41.88	0.08	0.27	30.43	8.08	3.02

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
420	0— 18	82	14	4	LS
421	— 42	79	14	7	LS
422	— 59	45	32	23	L
423	— 98	62	30	8	SL
424	—145	59	26	15	SL

Remarks;

pH	:	Soil-water ratio is 1:1.
EC	:	Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
P_2O_5	:	Available phosphorus on Olsen method.
OC & OM	:	Organic carbon and organic matter, respectively.
CEC	:	Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
Exchangeable cations	:	Expressed by milligram equivalent per 100 g dry soil.
Ex-Ac	:	Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-61 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (6/10)

A. Master Pit No. and Location: No. 6, Santiago, Binalonan

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
425	0— 15	6.9	230	18.5	2.52	4.32
426	— 64	7.3	50	23.0	1.67	2.87
427	— 98	7.6	40	24.5	1.61	2.77
428	—119	8.2	110	23.0	1.53	2.63
429	—150	8.0	60	17.0	1.39	2.39

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
425	45.23	0.24	0.40	31.99	9.08	3.52
426	42.11	0.13	0.27	31.97	7.23	2.51
427	37.98	0.08	0.27	29.26	7.36	1.01
428	41.94	0.09	0.27	32.78	8.30	0.50
429	31.09	0.07	0.26	24.16	6.10	0.50

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
425	0— 15	99	<2	<2	S
426	— 64	38	43	19	L
427	— 98	62	30	8	SL
428	—119	52	30	18	SL, L
429	—150	37	38	25	L

Remarks;
- pH : Soil-water ratio is 1:1.
- EC : Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
- P_2O_5 : Available phosphorus on Olsen method.
- OC & OM : Organic carbon and organic matter, respectively.
- CEC : Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
- Exchangeable cations : Expressed by milligram equivalent per 100 g dry soil.
- Ex-Ac : Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-62 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (7/10)

A. Master Pit No. and Location: No. 7, Unsad, Villasis

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
430	0— 12	5.1	30	12.5	2.07	3.56
431	— 25	5.1	20	11.0	2.25	3.87
432	— 87	6.4	20	10.0	1.74	3.00
433	—110	6.6	20	24.0	1.74	3.00

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
430	13.56	0.06	0.13	6.25	1.59	5.53
431	13.47	0.13	0.13	5.16	2.52	5.53
432	20.29	0.07	0.13	12.20	3.37	4.52
433	23.38	0.07	0.16	14.30	4.33	4.52

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
430	0— 12	36	45	19	L
431	— 25	52	40	8	SL, L
432	— 87	40	20	40	C, CL
433	—110	34	23	43	C

Remarks;
- pH : Soil-water ratio is 1:1.
- EC : Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
- P_2O_5 : Available phosphorus on Olsen method.
- OC & OM : Organic carbon and organic matter, respectively.
- CEC : Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
- Exchangeable cations : Expressed by milligram equivalent per 100 g dry soil.
- Ex-Ac : Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-63 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (8/10)

A. Master Pit No. and Location: No. 8, Bo, Mangayaw, Bayambang

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
434	0— 17	6.6	250	79.0	2.55	4.39
435	— 47	6.7	90	37.5	2.47	4.25
436	— 62	7.1	40	33.0	2.02	3.49
437	—110	7.2	50	30.5	1.98	3.41
438	—153	7.8	120	30.5	1.83	3.15

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
434	20.53	0.77	0.13	12.56	3.55	3.52
435	27.42	0.37	0.16	16.47	6.90	3.52
436	21.79	0.15	0.18	14.20	4.24	3.02
437	22.96	0.02	0.39	14.13	5.40	3.02
438	24.74	0.06	0.52	15.12	7.03	2.01

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
434	0— 17	40	52	8	SiL
435	— 47	33	51	16	SiL
436	— 62	40	54	6	SiL
437	—110	36	60	4	SiL
438	—153	22	73	5	SiL

Remarks;
- pH : Soil-water ratio is 1:1.
- EC : Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
- P_2O_5 : Available phosphorus on Olsen method.
- OC & OM : Organic carbon and organic matter, respectively.
- CEC : Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
- Exchangeable cations : Expressed by milligram equivalent per 100 g dry soil.
- Ex-Ac : Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-64 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (9/10)

A. Master Pit No. and Location: No. 9, Salcedo, San Manuel

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
439	0— 11	6.1	590	57.0	2.82	4.86
440	— 25	6.7	80	49.0	2.71	4.65
441	— 54	6.9	70	30.5	2.53	4.35
442	— 78	7.0	60	29.5	2.43	4.17
443	—110	7.1	70	35.0	1.98	3.41

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
439	25.85	0.39	0.39	14.27	5.27	5.53
440	28.69	0.39	0.39	17.46	5.93	4.52
441	29.48	0.31	0.19	18.89	5.37	4.52
442	27.15	0.23	0.26	17.87	5.27	3.52
443	23.19	0.14	0.26	14.88	4.89	3.02

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
439	0— 11	40	45	15	L
440	— 25	30	52	18	SiL
441	— 54	42	41	17	L
442	— 78	51	35	14	L
443	—110	57	34	9	SL

Remarks;

pH	:	Soil-water ratio is 1:1.
EC	:	Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
P_2O_5	:	Available phosphorus on Olsen method.
OC & OM	:	Organic carbon and organic matter, respectively.
CEC	:	Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
Exchangeable cations	:	Expressed by milligram equivalent per 100 g dry soil.
Ex-Ac	:	Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-65 RESULTS OF LABORATORY ANALYSIS ON SOIL SAMPLES OF MASTER PIT SURVEY IN PROPOSED SAN ROQUE PROJECT AREA (10/10)

A. Master Pit No. and Location: No. 10, San Roque, San Nicolas

B. Chemical Analysis

Sample No.	Depth (cm)	pH	EC (umho)	P_2O_5 (ppm)	OC (%)	OM (%)
444	0— 15	6.7	180	37.0	2.45	4.21
445	— 37	7.0	30	23.0	2.41	4.15
446	— 89	7.3	30	17.0	2.33	4.02
447	—131	7.4	30	30.0	2.31	3.97
448	—150	7.1	40	24.0	1.57	2.69

Sample No.	CEC (me)	Exchangeable Cations (me)				Ex-Ac (me)
		K^+	Na^+	Ca^{++}	Mg^{++}	
444	39.64	0.15	0.26	19.80	7.87	11.56
445	31.43	0.17	0.40	19.51	6.32	5.03
446	34.36	0.08	0.26	20.04	8.95	5.03
447	33.79	0.13	0.26	21.38	6.99	5.03
448	34.89	0.15	0.26	21.95	8.01	4.52

C. Physical Analysis

Sample No.	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture
444	0— 15	43	42	15	L
445	— 37	49	36	15	L
446	— 89	54	29	16	SL
447	—113	54	29	17	SL
448	—150	45	36	19	L

Remarks;

pH	:	Soil-water ratio is 1:1.
EC	:	Electric conductivity, at 25°C for sample with soil-water ratio of 1:1, expressed by umho/cm.
P_2O_5	:	Available phosphorus on Olsen method.
OC & OM	:	Organic carbon and organic matter, respectively.
CEC	:	Cation exchange capacity on summation method, expressed by approximate milligram equivalent per 100 g dry soil.
Exchangeable cations	:	Expressed by milligram equivalent per 100 g dry soil.
Ex-Ac	:	Exchangeable acidity on $BaCl_2$-TEA method, expressed by milligram equivalent per 100 g dry soil.

Table F-66 RESULTS OF COMPLETE ANALYSIS ON TYPICAL SOIL SAMPLES OF MASTER PIT SURVEY AND SEDMENTS ON CANAL BED IN PROPOSED SAN ROQUE PROJECT AREA

Unit: mg/kg dry soil

Location	Sample No.	Depth (cm)	Total Heavy Metal				
			Cu	Zn	Cd	Pb	As
(1) Master Pit							
No. 4	415	0— 11	473	187	+	121	9.0
	416	11— 52	518	176	+	154	5.6
	417	52— 75	133	92	1.6	410	9.1
	418	75— 83	169	85	0.5	12	1.4
	419	83—120	102	76	+	34	13.0
No. 6	425	0— 15	216	70	+	178	5.7
	426	15— 64	136	81	+	66	12.2
	427	64— 98	67	64	1.6	122	1.4
	428	98—119	76	75	+	61	2.9
	429	119—150	107	81	1.6	51	24.1
No. 7	430	0— 12	140	76	+	214	12.0
	431	12— 25	156	67	+	24	1.4
	432	25— 87	167	54	+	126	5.5
	433	87—110	136	79	+	50	0.4
(2) Monitoring Point on ARIS Main Canal							
No. 1	Particle size						
	2.0 — 0.2 mm		945	65	+	236	10.5
	0.2 — 0.02 mm		1,640	87	+	672	3.7
No. 3	Particle size						
	2.0 — 0.2 mm		3,200	59	+	90	21.7
	0.2 — 0.02 mm		1,020	112	2.0	95	2.1
No. 12	Particle size						
	2.0 — 0.2 mm		1,020	145	+	84	12.2
	0.2 — 0.02 mm		740	73	1.0	243	1.6

Remarks; + : Below 0.1 mg

Table F-67 VERTICAL CHANGE IN TOTAL SOLUBLE HEAVY METAL CONTENTS OF SOILS TAKEN AT MASTER PIT

Unit: mg/kg dry soil

Pit No.	Sample No.	Depth (cm)	Extractable Heavy Metal				
			Cu	Zn	Cd	Pb	As
1	401	0 — 26	45.2	61.8	0.1*	3.2	12.5
	402	26 — 54	72.1	83.2	0.1*	7.6	8.4
	403	54 — 87	65.2	61.4	0.1*	6.8	8.4
	404	87 — 113	39.8	73.4	0.1*	24.0	4.5
	405	113 — 153	57.6	72.6	0.6	4.0	5.0
2	406	0 — 22	149.6	99.6	1.0	0.8	8.4
	407	22 — 48	73.0	92.4	0.4	5.2	10.6
	408	48 — 81	66.2	95.6	0.1	123.6	8.5
	409	81 — 120	70.8	92.2	0.1	3.2	13.1
	410	120 — 150	74.0	58.2	0.3	7.6	10.5
3	411	0 — 18	35.2	73.2	0.4	31.2	6.3
	412	18 — 52	52.2	89.3	1.0	2.4	8.9
	413	52 — 79	65.7	89.2	1.4	4.8	6.9
	414	79 — 125	64.4	83.2	0.8	2.0	6.8
4	415	0 — 11	474.0	281.8	1.4	90.0	29.0
	416	11 — 52	571.2	264.2	1.0	96.8	16.8
	417	52 — 75	83.0	163.7	0.7	45.6	21.7
	418	75 — 83	31.2	68.5	1.0	10.4	10.7
	419	83 — 120	30.6	46.2	0.7	2.4	10.1
5	420	0 — 18	102.8	97.4	1.9	14.4	4.8
	421	18 — 42	83.8	89.7	1.0	10.0	6.7
	422	42 — 59	74.8	59.8	1.0	11.2	2.2
	423	59 — 98	71.6	76.6	0.6	7.6	4.5
	424	98 — 145	63.5	66.8	0.6	8.8	6.6
6	425	0 — 15	46.4	62.5	1.6	9.2	4.3
	426	15 — 64	55.2	56.4	1.8	7.6	6.5
	427	64 — 98	54.6	48.8	1.2	36.4	2.1
	428	98 — 119	61.0	60.4	1.0	8.0	6.5
	429	119 — 150	40.0	48.0	0.7	7.6	8.4
7	430	0 — 12	29.6	32.6	1.0	10.0	4.1
	431	12 — 25	33.4	35.5	1.2	10.4	6.2
	432	25 — 87	60.9	47.0	2.4	13.6	6.5
	433	87 — 110	56.8	56.0	2.5	14.0	10.8
8	434	0 — 17	47.6	72.6	1.8	11.2	18.4
	435	17 — 47	67.2	83.2	1.6	28.4	21.0
	436	47 — 62	58.0	74.8	1.2	10.8	12.3
	437	62 — 110	61.8	77.6	1.3	18.8	18.5
	438	110 — 153	67.8	82.6	1.3	31.2	8.3
9	439	0 — 11	50.4	68.8	2.4	8.4	10.3
	440	11 — 25	49.6	67.0	1.6	8.0	8.4
	441	25 — 54	58.6	75.9	1.5	9.2	12.6
	442	54 — 78	55.5	75.6	1.5	8.4	10.5
	443	78 — 110	47.5	66.6	1.5	6.8	27.1
10	444	0 — 15	38.2	70.0	1.5	6.0	8.5
	445	15 — 37	34.2	63.9	2.3	5.6	8.5
	446	37 — 89	38.2	66.8	2.5	4.8	19.0
	447	89 — 131	41.9	72.5	2.5	9.2	14.9
	448	131 — 150	44.2	73.3	1.8	6.4	8.7

Remarks; 0.1* : Below 0.1mg

Table F-68 VERTICAL CHANGE IN SOLUBLE HEAVY METAL CONTENTS OF SOILS TAKEN AT MASTER PIT

Unit: mg/kg dry soil

Pit No.	Sample No.	Depth (cm)	Soluble Heavy Metal				
			Cu	Zn	Cd	Pb	As
1	401	0 — 26	7.9	2.9	0.1*	2.9	2.0
	402	26 — 54	4.5	2.2	0.1*	2.5	1.1
	403	54 — 87	3.7	2.6	0.1*	3.0	1.1
	404	87 — 113	2.0	2.4	0.1*	2.5	0.6
	405	113 — 153	2.9	2.3	0.1*	2.5	0.7
2	406	0 — 22	29.9	4.9	0.1*	3.0	1.1
	407	22 — 48	4.2	2.4	0.1*	2.7	1.4
	408	48 — 81	2.9	2.0	0.1*	2.3	1.1
	409	81 — 120	2.7	2.3	0.1*	3.0	1.7
	410	120 — 150	3.1	3.4	0.1*	3.0	1.4
3	411	0 — 18	6.0	4.0	0.1*	12.0	0.8
	412	18 — 52	3.0	2.6	0.1*	2.5	1.2
	413	52 — 79	1.7	2.3	0.1*	2.9	0.9
	414	79 — 125	1.3	2.1	0.1*	3.0	0.9
4	415	0 — 11	148.8	31.8	0.5	11.8	3.8
	416	11 — 52	136.2	28.0	0.3	14.0	2.2
	417	52 — 75	11.4	20.8	0.1*	4.6	2.8
	418	75 — 83	5.8	4.2	0.1*	3.8	1.4
	419	83 — 120	2.0	1.1	0.1*	2.8	1.3
5	420	0 — 18	18.0	5.9	0.1*	3.8	0.6
	421	18 — 42	4.8	2.8	0.1*	3.6	0.8
	422	42 — 59	3.5	2.8	0.1*	3.5	0.1
	423	59 — 98	2.5	2.6	0.1*	3.4	0.3
	424	98 — 145	2.4	2.6	0.1*	3.5	0.3
6	425	0 — 15	3.8	2.7	0.1*	3.2	0.2
	426	15 — 64	2.5	1.5	0.1*	3.4	0.6
	427	64 — 98	2.3	1.6	0.1*	3.7	0.2
	428	98 — 119	1.0	0.9	0.1*	3.8	0.6
	429	119 — 150	1.3	1.3	0.1*	4.0	1.0
7	430	0 — 12	1.7	1.3	0.1*	3.4	0.5
	431	12 — 25	1.9	1.2	0.1*	3.7	0.6
	432	25 — 87	1.3	0.7	0.1*	3.7	0.6
	433	87 — 110	1.5	1.2	0.1*	3.9	1.7
8	434	0 — 17	3.6	4.8	0.1*	3.7	2.1
	435	17 — 47	5.4	3.0	0.1*	3.8	2.7
	436	47 — 62	4.1	2.6	0.1*	3.6	1.6
	437	62 — 110	4.5	2.6	0.1*	3.3	2.1
	438	110 — 153	4.7	2.6	0.1*	3.8	1.1
9	439	0 — 11	4.5	2.6	0.1*	3.6	1.2
	440	11 — 25	3.5	2.1	0.1*	4.0	0.8
	441	25 — 54	3.4	2.0	0.1*	3.6	1.5
	442	54 — 78	3.1	2.2	0.1*	4.0	1.4
	443	78 — 110	2.5	2.1	0.1*	4.2	3.3
10	444	0 — 15	3.5	2.8	0.1*	3.8	1.1
	445	15 — 37	1.8	1.7	0.1*	3.8	1.0
	446	37 — 89	1.7	1.4	0.1*	3.7	2.2
	447	89 — 131	1.5	1.4	0.1*	3.7	1.8
	448	131 — 150	1.6	1.4	0.1*	4.1	1.1

Remarks; 0.1* : Below 0.1 mg

Table F-69 SOLUBLE HEAVY METAL CONTENTS OF SURFACE SOILS SAMPLED AT INLET OF PADDY FIELDS IN AND AROUND ARIS (1/6)

Unit: mg/kg dry soil

Sample No.	Location	0.1 N-HCl Soluble			N-NH_4Ac Soluble	N-HCl Soluble
		Cu	Zn	Cd	Pb	As
1	Along Main Canal	265.1	5.4	0.1	1.3	2.6
2	Along Main Canal	228.0	6.1	0.1	1.3	6.8
3	Along Main Canal	127.2	3.4	0.1*	1.9	1.4
4	Along Main Canal	159.6	8.9	0.1*	3.6	2.0
5	Along Main Canal	287.4	6.0	0.1	1.3	5.3
6	Along Main Canal	287.3	13.9	0.2	6.1	4.5
7	Along Main Canal	230.3	23.5	0.3	13.2	4.7
8	Along Main Canal	128.1	30.0	0.3	11.0	0.9
9	Along Main Canal	104.4	36.6	0.4	8.5	5.9
10	Along Main Canal	138.0	8.7	0.2	4.0	7.3
11	Along Main Canal	205.6	10.8	0.3	2.9	5.8
12	Along Main Canal	203.3	9.0	0.3	3.0	5.9
13	Along Main Canal	120.3	24.4	0.5	3.4	7.0
14	Along Main Canal	144.0	14.3	0.1	3.7	1.4
15	Along Main Canal	174.6	7.0	0.1	1.3	4.9
16	Along Main Canal	102.4	8.4	0.1	3.2	1.8
17	Along Main Canal	171.4	24.2	0.3	2.0	8.7
18	Along Main Canal	151.4	16.9	0.1	4.0	5.4
19	Along Main Canal	149.0	12.6	0.4	3.9	5.8
20	Along Main Canal	272.9	7.9	0.1	1.5	22.3
21	Along Main Canal	176.4	10.2	0.2	1.8	4.3
22	Along Main Canal	23.1	6.1	0.1*	2.4	0.9
23	Along Lateral A	301.0	8.2	0.2	3.4	5.6
24	Along Lateral A	270.3	8.1	0.2	2.8	4.9
25	Along Lateral A	259.1	7.5	0.1	1.8	7.1
26	Along Lateral A	283.3	12.8	0.2	3.4	92.0
27	Along Lateral A	217.0	12.7	0.2	2.9	7.4
28	Along Lateral A	221.3	24.0	0.3	0.9	8.2
29	Along Lateral A	183.9	10.4	0.2	1.0	5.3
30	Along Lateral A	226.0	9.2	0.2	1.4	6.7
31	Along Lateral A-2	191.4	4.8	0.1	0.8	5.1
32	Along Lateral A-2	283.4	7.3	0.2	0.8	6.3
33	Along Lateral B	176.6	6.5	0.1	0.5	3.9
34	Along Lateral B	221.7	8.7	0.2	2.4	3.0
35	Along Lateral B	198.7	8.3	0.3	4.4	4.5
36	Along Lateral B	81.0	5.9	0.1	0.3	5.0
37	Along Lateral B	20.6	5.0	0.1	1.8	2.9
38	Along Lateral C	274.3	8.1	0.2	2.1	7.0
39	Along Lateral C	204.0	12.5	0.2	3.4	7.8
40	Along Lateral C	31.1	8.1	0.3	0.3	3.5
41	Along Lateral C	62.2	9.5	0.2	1.3	5.2
42	Along Lateral D	187.7	7.1	0.2	2.5	5.1
43	Along Lateral D	143.9	11.5	0.3	1.0	6.3

Remarks; 0.1* : Below 0.1 mg

Table F-70 SOLUBLE HEAVY METAL CONTENTS OF SURFACE SOILS SAMPLED AT INLET OF PADDY FIELDS IN AND AROUND ARIS (2/6)

Unit: mg/kg dry soil

Sample No.	Location	0.1 N-HCl Soluble			N-NH_4Ac Soluble	N-HCl Soluble
		Cu	Zn	Cd	Pb	As
44	Along Lateral D	170.0	9.7	0.2	0.7	12.1
45	Along Lateral D	49.5	14.5	0.3	1.0	3.5
46	Along Lateral D	67.7	14.0	0.3	1.5	4.6
47	Along Lateral D	49.5	13.1	0.4	6.6	6.6
48	Along Lateral D	171.0	16.7	0.3	1.0	5.4
49	Along Lateral D	161.5	15.6	0.1	4.5	1.6
50	Along Lateral D	167.7	17.8	0.3	1.9	8.6
51	Along Lateral D	138.8	11.5	0.2	1.5	6.9
52	Along Lateral D	195.6	19.7	0.3	1.4	7.0
53	Along Lateral D	106.9	10.9	0.3	0.3	4.5
54	Along Lateral E	352.2	10.2	0.2	2.0	5.8
55	Along Lateral E	126.7	12.5	0.2	1.0	5.5
56	Along Lateral E	132.2	16.4	0.3	6.0	7.4
57	Along Lateral E	187.1	25.1	0.3	1.7	5.2
58	Along Lateral E	123.0	42.6	0.5	5.1	4.4
59	Along Lateral E	51.3	7.3	0.3	1.4	3.4
60	Along Lateral E	15.7	3.3	0.1	0.5	2.1
61	Along Lateral F	185.9	31.9	0.6	9.0	4.8
62	Along Lateral F	279.5	11.7	0.2	1.9	6.0
63	Along Lateral F	243.2	9.2	0.2	4.1	5.0
64	Along Lateral F	135.9	15.4	0.3	1.9	4.8
65	Along Lateral F	210.5	6.8	0.1*	0.8	8.1
66	Along Lateral F	199.3	9.9	0.2	1.5	4.8
67	Along Lateral F	281.4	10.2	0.1	1.8	8.4
68	Along Lateral F	206.9	9.3	0.1	0.9	6.4
69	Along Lateral F	177.3	4.9	0.1	0.5	6.0
70	Along Lateral F	135.8	10.1	0.2	0.6	3.5
71	Along Lateral F	197.6	7.7	0.2	0.3	5.2
72	Along Lateral F-1	214.4	8.2	0.3	1.3	5.3
73	Along Lateral F-1	185.8	11.1	0.3	1.0	8.0
74	Along Lateral F-1	24.6	3.7	0.2	0.8	3.2
75	Along Lateral F-1	145.9	8.5	0.2	0.3	4.8
76	Along Lateral F-1	193.6	4.4	0.2	1.0	5.5
77	Along Lateral F-1	27.6	4.9	0.3	0.9	3.9
78	Along Lateral F-la	161.6	7.3	0.1	1.0	4.3
79	Along Lateral F-la	12.3	3.6	0.1	0.3*	2.7
80	Along Lateral F-la	22.4	4.6	0.3	0.3*	4.2
81	Along Lateral G	285.5	14.3	0.2	2.3	3.6
82	Along Lateral G	22.8	6.8	0.2	0.3	3.4
83	Along Lateral G	13.0	4.2	0.1	0.5	2.5
84	Along Lateral G	16.7	5.1	0.1	0.5	3.5
85	Along Lateral G	16.7	5.1	0.1	0.5	3.5
86	Along Lateral G	16.5	9.4	0.2	0.3*	3.8

Remarks; 0.1* : Below 0.1 mg
0.3* : Below 0.3 mg

Table F-71 SOLUBLE HEAVY METAL CONTENTS OF SURFACE SOILS SAMPLED AT INLET OF PADDY FIELDS IN AND AROUND ARIS (3/6)

Unit: mg/kg dry soil

Sample No.	Location	0.1 N-HCl Soluble			N-NH_4Ac Soluble	N-HCl Soluble
		Cu	Zn	Cd	Pb	As
87	Along Lateral G	10.8	2.2	0.1	0.3*	3.4
88	Along Lateral G	4.3	2.0	0.1	0.8	4.5
89	Along Lateral G	0.5	1.2	0.1	2.9	5.0
90	Along Lateral G -Ex	186.6	9.5	0.1	1.3	4.0
91	Along Lateral G -Ex	148.4	7.3	0.1*	1.7	2.2
92	Along Lateral H	206.2	8.9	0.2	3.2	5.1
93	Along Lateral H	155.6	17.9	0.2	3.1	4.9
94	Along Lateral H	101.4	8.3	0.1	1.9	5.6
95	Along Lateral I	144.9	14.8	0.1	3.7	3.2
96	Along Lateral I	10.7	5.5	0.1*	2.2	1.4
97	—	—	—	—	—	
98	Along Lateral I	15.7	5.7	0.2	1.8	7.6
99	Along Lateral J	227.0	10.6	0.1	1.9	3.8
100	Along Lateral J	200.1	17.1	0.2	2.6	5.8
101	Along Lateral J	158.3	14.7	0.2	2.2	7.5
102	Along Lateral K	159.1	32.8	0.1	1.5	6.7
103	Along Lateral K	177.8	8.7	0.2	2.1	5.3
104	Along Lateral K	148.0	13.8	0.1*	4.4	6.0
105	Along Lateral K	19.0	6.0	0.2	1.8	4.3
106	Along Lateral L	138.9	8.9	0.1*	3.7	0.5
107	Along Lateral L	146.2	9.0	0.2	1.3	4.1
108	Along Lateral L	156.7	17.0	0.1*	3.8	6.8
109	Along Lateral L	119.1	15.1	0.2	2.2	3.1
110	Along Lateral L	78.2	17.2	0.4	4.5	3.3
111	Along Lateral L	146.4	12.9	0.2	3.2	2.1
112	Along Lateral L-1	30.6	14.8	0.2	3.6	0.9
113	Along Lateral L-1	98.6	10.7	0.2	1.3	4.1
114	Along Lateral L-1	103.1	27.8	0.4	3.1	5.4
115	Along Lateral L-1	0.7	3.9	0.3	6.2	3.7
116	Along Lateral L-1	76.7	22.5	0.2	3.7	0.5
117	Along Lateral L-1	23.0	10.1	0.4	3.7	1.7
118	Along Lateral L-la	14.8	7.3	0.1	1.6	1.5
119	Along Lateral L-la	47.4	8.4	0.2	4.6	2.1
120	Along Lateral L-la	28.4	7.9	0.1	3.0	0.9
121	Along Lateral L-la	19.3	9.7	0.2	4.8	2.4
122	Along Lateral L-2	129.2	13.0	0.2	4.9	3.1
123	Along Lateral L-2	103.5	13.0	0.3	5.6	4.2
124	Along Lateral L-2	94.0	10.9	0.2	5.1	2.7
125	Along Lateral L-2	68.1	15.6	0.3	5.6	2.7
126	Along Lateral L-2	26.9	5.2	0.1	4.6	1.7
127	Along Lateral L-2	6.0	2.5	0.1*	3.1	0.8
128	Along Lateral M	104.4	6.9	0.2	4.5	2.2
129	Along Lateral M	118.8	11.0	0.2	4.9	5.0

Remarks; 0.1* : Below 0.1 mg
0.3* : Below 0.3 mg

Table F-72 SOLUBLE HEAVY METAL CONTENTS OF SURFACE SOILS SAMPLED AT INLET OF PADDY FIELDS IN AND AROUND ARIS (4/6)

Unit: mg/kg dry soil

Sample No.	Location	0.1 N-HCl Soluble			N-NH_4Ac Soluble	N-HCl Soluble
		Cu	Zn	Cd	Pb	As
130	Along Lateral M	134.4	5.3	0.1*	4.4	6.5
131	Along Lateral M	32.3	3.6	0.1*	3.1	2.7
132	Along Lateral M	144.5	7.7	0.1	4.5	3.1
133	Along Lateral M	54.2	8.6	0.4	7.7	4.4
134	Along Lateral M	135.2	8.2	0.2	4.6	3.3
135	Along Lateral M -1	130.5	22.6	0.3	8.3	6.7
136	Along Lateral M -1	21.0	5.6	0.1	3.6	3.4
137	— —	—	—	—	—	—
138	Along Lateral M-1	9.0	2.2	0.1	3.1	1.1
139	Along Lateral M-2	35.0	9.3	0.4	6.7	4.0
140	Along Lateral M-2	38.3	5.4	0.2	3.5	3.0
141	Along Lateral M-2	14.9	3.3	0.1	3.5	1.8
142	Main Canal-Lateral A	217.2	6.2	0.1	6.0	4.8
143	Main Canal-Lateral A	18.0	4.0	0.1	4.2	1.3
144	Main Canal-Lateral B	104.3	10.5	0.1	4.7	0.3
145	Lateral C-Lateral E	21.1	5.5	0.2	5.2	2.4
146	Lateral A-Lateral A -2	73.3	11.6	0.3	5.5	4.1
147	Main Canal-Lateral A	168.7	10.5	0.2	6.0	2.7
148	Main Canal-Lateral A	158.7	6.1	0.1	4.1	4.0
149	Main Canal-Lateral A	166.9	15.0	0.1	5.4	5.7
150	Lateral C-Lateral E	118.3	4.4	0.1	5.1	2.1
151	Lateral C-Lateral E	148.9	6.1	0.2	3.9	2.8
152	Lateral C-Lateral E	123.7	5.1	0.1	3.9	2.9
153	Lateral C-Lateral E	16.4	3.8	0.1	3.1	1.5
154	Lateral E-Lateral G	105.7	10.4	0.2	3.5	2.6
155	Lateral E-Lateral G	15.8	7.5	0.1*	2.4	1.4
156	Lateral E-Lateral G	4.2	1.6	0.2	3.9	1.2
157	Lateral E-Lateral G	27.6	5.3	0.1*	3.1	3.7
158	Lateral E-Lateral G	3.9	1.7	0.1*	3.0	1.5
159	Lateral E-Lateral G	1.8	1.6	0.1	3.8	2.4
160	Along B-M Road	4.5	1.7	0.1*	0.3*	1.0
161	Along B-M Road	3.7	2.2	0.1*	0.3*	0.1
162	Along B-M Road	1.0	2.1	0.1*	0.3*	0.5
163	—	—	—	—	—	—
164	—	—	—	—	—	—
165	—	—	—	—	—	—
166	Along B-M Road	2.4	2.9	0.1*	0.3*	1.3
167	Lateral A-Lateral D	129.5	8.5	0.1	3.0	2.4
168	Main Canal-Lateral E	28.7	7.8	0.2	4.7	2.3
169	Lateral E-Lateral G	16.9	2.9	0.1	2.6	1.3
170	Main Canal-Lateral G	19.7	4.6	0.1	3.0	1.0
171	Main Canal-Lateral G	14.8	2.7	0.1	3.1	1.9
172	Main Canal-Lateral G	8.7	2.5	0.1	2.6	2.3

Remarks; B-M Road : Binalonan-Manaoag Road
0.1* : Below 0.1 mg
0.3* : Below 0.3 mg

Table F-73 SOLUBLE HEAVY METAL CONTENTS OF SURFACE SOILS SAMPLED AT INLET OF PADDY FIELDS IN AND AROUND ARIS (5/6)

Unit: mg/kg dry soil

Sample No.	Location	0.1 N-HCl Soluble			N-NH_4Ac Soluble	N-HCl Soluble
		Cu	Zn	Cd	Pb	As
173	Main Canal-Lateral G	9.4	2.5	0.1	3.6	3.4
174	Main Canal-Lateral G	0.1	0.1*	0.1*	3.0	0.6
175	Main Canal-Lateral G	8.3	1.6	0.1	3.0	2.6
176	Main Canal-Lateral G	2.9	1.7	0.1	4.2	3.5
177	Lateral G-Lateral H	0.1	0.9	0.1	4.7	2.9
178	Lateral G-Lateral H	3.5	0.9	0.1	3.9	2.9
179	Lateral G-Lateral H	4.4	1.7	0.1	3.6	4.3
180	Lateral D-Lateral F	16.3	2.7	0.1*	2.4	1.0
181	Main Canal-Lateral F	11.0	2.2	0.1	3.2	1.6
182	Main Canal-Lateral F	25.7	2.6	0.1	2.1	1.7
183	Main Canal-Lateral F	48.8	5.6	0.1	2.7	1.3
184	Main Canal-Lateral G	15.6	7.5	0.1*	3.0	1.3
185	Main Canal-Lateral F	9.9	2.7	0.1	2.4	0.8
186	Main Canal-Lateral F	41.6	8.2	0.1*	3.0	0.4
187	Lateral G-Lateral H	3.2	2.3	0.1*	2.3	2.9
188	Main Canal-Lateral K	13.7	3.7	0.1	2.5	1.9
189	Main Canal-Lateral K	8.1	2.7	0.1	3.1	1.9
190	Main Canal-Lateral K	14.9	3.8	0.1	2.6	4.9
191	Main Canal-Lateral K	4.7	3.2	0.1*	3.0	2.5
192	Main Canal-Lateral K	4.0	1.5	0.1*	2.0	1.0
193	Lateral M-Lateral M-1	9.6	3.2	0.1	2.1	1.5
194	Lateral D-Lateral F	13.8	5.7	0.1	1.8	1.4
195	Main Canal-Lateral F	21.9	4.1	0.1	1.9	1.1
196	Main Canal-Lateral F	17.7	3.2	0.1	1.3	0.8
197	Main Canal-Lateral L	5.1	4.3	0.1*	3.1	1.7
198	Main Canal-Lateral L	139.6	9.5	0.2	2.4	2.5
199	Main Canal-Lateral L	15.4	3.6	0.1	1.9	2.1
200	Lateral L-1-Lateral L-2	4.1	1.9	0.1*	1.9	0.8
201	Lateral L-1-Lateral L-2	4.0	1.5	0.1*	1.8	0.7
202	Lateral L-1-Lateral L-2	7.4	4.6	0.1	3.3	2.2
203	Lateral D-Lateral F	11.7	2.2	0.1	1.9	2.3
204	Lateral L-1-Lateral L-2	13.7	0.5	0.1*	3.2	3.5
205	Lateral L-1-Lateral L-2	6.8	3.0	0.1	1.6	1.7
206	Lateral D-Lateral F	12.2	2.2	0.2	1.6	4.9
207	Lateral D-Lateral F	86.9	5.9	0.1	4.2	3.6
208	Lateral F-Lateral F1-a	6.6	3.6	0.1*	3.3	3.1
209	Lateral F-Lateral F-1	7.4	3.7	0.1	2.8	5.0
210	Lateral F-Lateral F-1	10.7	3.1	0.2	1.6	2.8
211	Lateral L-Lateral L-2	3.2	1.7	0.1*	0.8	0.6
212	Lateral F-Lateral F-1	9.3	3.8	0.1	3.1	3.7
301	Along Lateral L-3	29.7	6.4	0.1	3.2	5.1
302	Along Lateral L-3	40.1	5.6	0.1	1.0	3.7
303	Along La teral L-3	27.5	10.3	0.3	5.0	3.0

Remarks; 0.1*: Below 0.1 mg

Table F-74 SOLUBLE HEAVY METAL CONTENTS OF SURFACE SOILS SAMPLED AT INLET OF PADDY FIELDS IN AND AROUND ARIS (6/6)

Unit: mg/kg dry soil

Sample No.	Location	0.1 N-HCl Soluble			N-NH_4Ac Soluble	N-HCl Soluble
		Cu	Zn	Cd	Pb	As
304	Along Lateral L-3	22.9	6.6	0.3	5.0	6.7
305	Along Lateral L-3	15.5	5.1	0.1	2.1	9.6
310	Main Canal-Agno River	185.2	4.4	0.1*	1.0	5.1
311	Lateral A-Agno River	207.0	6.6	0.1*	0.2*	3.8
312	Lateral A-Agno River	208.6	6.5	0.1*	0.3*	4.7
313	Lateral A-Agno River	80.1	8.8	0.2	6.2	1.8
314	Lateral A-2-Agno River	179.4	22.5	0.4	3.4	3.0
315	—	—	—	—	—	—
316	—	—	—	—	—	—
317	Lateral A-2-Agno River	108.4	6.7	0.1*	4.8	1.9
318	Lateral A-2-Agno River	68.5	3.9	0.1*	3.8	4.6
319	Lateral A-1-Agno River	12.4	7.6	0.1*	2.3	4.5
320	Lateral A-1-Agno River	22.7	4.2	0.1*	4.1	3.6
321	Lateral A-1-Agno River	82.9	12.3	0.2	5.1	3.4
322	Lateral A-1-Agno River	150.1	9.1	0.2	2.9	4.5
323	Lateral D-Agno River	24.2	6.3	0.2	1.5	3.1
324	Lateral D-Agno River	24.6	6.0	0.1*	1.6	3.7
325	Lateral A-Agno River	36.4	7.9	0.1	3.9	4.6
326	—	—	—	—	—	—
327	Lateral A-Agno River	16.4	0.9	0.1*	2.4	4.7
328	Lateral A-Agno River	33.1	6.0	0.2	2.9	2.5
329	Lateral A-Agno River	11.8	4.0	0.2	1.5	4.8
330	Lateral D-Agno River	27.3	3.3	0.1	2.2	3.7
331	Lateral D-Agno River	64.1	9.3	0.2	3.2	3.8
332	Lateral D-Agno River	41.3	9.9	0.3	3.7	5.2
333	Lateral D-Agno River	12.3	3.5	0.2	2.9	3.8
334	Lateral D-Agno River	7.3	4.2	0.2	2.4	8.5
335	Lateral D-Agno River	7.8	3.8	0.2	1.9	3.9
336	Lateral D-Agno River	6.7	5.2	0.3	1.3	5.7
337	Lateral A-2-Agno River	121.0	4.0	0.3	4.2	9.8
338	Lateral A-2-Agno River	150.8	5.3	0.1*	3.4	8.1
339	Lateral A-2-Agno River	43.1	9.5	0.1*	1.0	4.8
340	Lateral A-1-Agno River	78.2	6.1	0.1*	1.0	5.3
341	Lateral A-1-Agno River	39.3	8.4	0.1*	0.6	5.8
342	Lateral A-Agno River	111.0	16.5	0.2	0.3*	5.2
343	Lateral A-Agno River	30.3	7.1	0.1	0.3*	5.0
344	Lateral D-Agno River	11.3	3.5	0.2	0.3	3.4
345	Urdaneta CIS	15.8	3.5	0.3	3.6	1.8
346	Urdaneta CIS	8.2	2.7	0.2	2.8	1.0
347	Urdaneta CIS	20.0	5.5	0.3	1.6	1.0
348	—	—	—	—	—	—
349	Urdaneta CIS	5.2	2.1	0.1*	2.1	1.7
350	Urdaneta CIS	7.5	2.8	0.1*	0.7	0.1

Remarks; CIS: Communal irrigation system
0.1*: Below 0.1 mg
0.3*: Below 0.3 mg

Table F-75 HORIZONTAL CHANGE IN EXTRACTABLE AND SOLUBLE COPPER CONTENTS OF SURFACE SOILS AT MONITORING PADDY FIELDS

Unit: ppm

Plot of Paddy Field and Sampling Place	Monitoring Point No. 4		Monitoring Point No. 6		Monitoring Point No. 8		Monitoring Point No. 10	
	E-Cu	S-Cu	E-Cu	S-Cu	E-Cu	S-Cu	E-Cu	S-Cu
Plot I								
Inlet								
0—15cm	1,053	262	823	163	837	165	—	12
15—30cm	773	207	507	138	569	125	—	8
Middle								
0—15cm	874	250	538	170	606	159	—	9
15—30cm	786	221	160	31	379	76	—	5
Outlet								
0—15cm	799	166	426	112	362	167	—	8
15—30cm	826	217	139	25	194	86	—	6
Plot II								
Inlet								
0—15cm	816	194	293	87	405	121	—	10
15—30cm	763	197	190	33	282	36	—	8
Middle								
0—15cm	803	198	239	70	384	113	—	7
15—30cm	740	159	90	13	348	48	—	4
Outlet								
0—15cm	775	197	213	53	287	67	—	9
15—30cm	773	189	112	11	220	26	—	5
Plot III								
Inlet								
0—15cm	684	169	150	53	241	38	—	8
15—30cm	601	154	87	6	229	27	—	5
Middle								
0—15cm	589	161	146	34	222	29	—	9
15—30cm	327	10	84	8	146	15	—	5
Outlet								
0—15cm	550	163	140	31	182	28	—	7
15—30cm	422	12	69	5	183	20	—	4
Plot IV								
Inlet								
0—15cm	562	158	112	28	183	24	—	7
15—30cm	306	73	72	6	233	31	—	5
Middle								
0—15cm	359	103	165	49	—	—	—	7
15—30cm	244	38	87	4	—	—	—	4
Outlet								
0—15cm	414	94	134	36	—	—	—	7
15—30cm	353	81	79	7	—	—	—	5

Remarks ; E-Cu: Extractable copper extracted by mixture of perchloric, nitric and sulfuric acids
S-Cu: Soluble copper extracted by 0.1 N HCl.

Table F-76 EXTRACTABLE AND SOLUBLE COPPER CONTENTS OF SEDIMENTS ON CANAL BED BY PARTICLE SIZE IN ARIS

Unit: ppm

Sampling Point	Particle Size (mm)					
	2.0—0.2		0.2—0.02		Below 0.02	
	E-Cu	S-Cu	E-Cu	S-Cu	E-Cu	S-Cu
Monitoring Point No. 1 (Main canal at station 0+320)						
	1,178	89	1,855	140	1,512	364
Monitoring Point No. 2 (Lateral D at station 0+000)						
	810	179	1,794	196	1,621	334
Monitoring Point No. 3 (Don Moteo Ditch at station 0+000)						
	1,320	118	3,834	234	3,324	276
Monitoring Point No. 4 (Don Moteo Ditch at station 2+100)						
	982	161	1,374	144	1,660	282
Monitoring Point No. 5 (Lateral F at station 0+000)						
	808	133	891	120	1,236	199
Monitoring Point No. 6 (Lateral F at station 2+100)						
	671	119	810	101	1,409	223
Monitoring Point No. 7 (Main canal at station 15+000)						
	834	164	1,110	141	1,289	203
Monitoring Point No. 8 (Lateral J at station 0+000)						
	649	132	795	130	1,299	217
Monitoring Point No.11 (Lateral L at station 5+050)						
	590	109	657	94	1,365	177
Monitoring Point No.12 (Lateral M at station 0+000)						
	627	135	674	96	995	184

Remarks ; E-Cu: Extractable copper extracted by mixture of perchloric, nitric and sulfuric acids
S-Cu: Soluble copper extracted by 0.1 N HCl.

Table F-77 EXTRACTABLE LEAD ZINC AND CADMIUM CONTENTS OF SEDIMENTS ON CANAL BED BY PARTICLE SIZE IN ARIS

Unit: ppm

Sampling Point	Particle Size (mm)								
	2.0—0.2			0.2—0.02			Below 0.02		
	Pb	Zn	Cd	Pb	Zn	Cd	Pb	Zn	Cd
Monitoring Point No. 1 (Main canal at station 0+320)									
	1.7	52.7	+	1.2	76.0	+	16.2	106.4	+
Monitoring Point No. 2 (Lateral D at station 0+000)									
	3.1	41.4	+	1.6	59.4	+	7.5	87.7	+
Monitoring Point No. 3 (Don Moteo Ditch at station 0+000)									
	3.8	34.3	+	7.7	97.1	+	2.0	96.4	+
Monitoring Point No. 4 (Don Moteo Ditch at station 2+100)									
	2.8	30.1	+	3.1	44.2	+	2.4	89.5	+
Monitoring Point No. 5 (Lateral F at station 0+000)									
	5.0	37.8	+	5.0	45.4	+	4.8	87.7	+
Monitoring Point No. 6 (Lateral F at station 2+100)									
	7.5	38.3	+	6.2	51.5	+	25.9	86.8	+
Monitoring Point No. 7 (Main canal at station 15+000)									
	8.7	39.1	+	6.7	53.1	+	47.2	89.1	+
Monitoring Point No. 8 (Lateral J at station 0+000)									
	8.6	70.2	+	5.5	54.1	+	48.7	105.1	+
Monitoring Point No. 11 (Lateral L at station 5+050)									
	6.2	49.0	+	6.5	44.2	+	30.4	89.8	1.1
Monitoring Point No. 12 (Lateral M at station 0+000)									
	10.7	59.0	+	8.1	53.8	+	35.1	82.4	+

Remarks ; + : Trace

Table F-78 RECORDS OF FARM MANAGEMENT BY FARMERS IN MONITORING PADDY FIELDS

	Monitoring Point	Location	Variety	Trans-Planting Date	Harvesting Date	Dosage of Fertilizer
(1)	Dry Season					
	ARIS No. 2	San Bonifacio, San Manuel (Lateral B)	IR 42	Feb. 5-10, 1984	May 24, 1984	1. 9 kg of urea for nursery 2. 100 kg of urea for basal (0.5 ha)
	ARIS No. 4	Macalong, Asingan (Lateral D)	UPL-RI4	Dec. 9-10, 1983	Feb. 24, 1984	1. 100 kg of complete for basal (0.4 ha)
	ARIS No. 4	San Roque, San Manuel (Don Meteo Ditch)	IR 58	Feb. 28, 1984	May 3, 1984	1. 15 kg of urea for nursery 2. 50 kg of urea and 50 kg of complete for basal 3. 100 kg of urea for additional (0.74 ha)
	ADRIS No. 10	San Roque, San Nicolas (Lateral A-3)	IR 36	Dec. 30, 1983	Mar. 20, 1984	1. 100 kg of complete for basal 2. 100 kg of urea for additional (0.48 ha)
(2)	Wet Season					
	ARIS No. 2	Macalong, Asingan (Lateral D)	UPL-RI 4	Jul. 6-7, 1984	Sep. 20-30, 1984	1. 5 kg of urea for nursary 2. 75 kg of urea for basal (0.4 ha)
	ARIS No. 4	San Roque, San Manuel (Don Moteo Ditch)	IR 42	Jul. 24, 1984	Nov. 11, 1984	1. 4 kg of urea for nursery 2. 50 kg of urea and 50 kg of complete for basal (0.74 ha)
	ARIS No. 6	Bactad, Asingan (Lateral F)	IR 58	Aug. 1, 1984	Nov. 3, 1984	1. 100 kg of urea for basal
	ARIS No. 8	Lelemaan Manaoag (Lateral J)	IR 42	Aug.16, 1984	Oct. 26, 1984	1. 5 kg of urea for nursery 2. 50 kg of urea for basal (0.35 ha)
	ARIS No. 12	Leet, Santa Barbara (Lateral M)	IR 42	Jul. 14, 1984	Oct. 26, 1984	1. 4 kg of ammonium sulfate for nursery 2. 100 kg of urea for basal
	ADRIS No. 10	San Roque, San Nicolas (Lateral A-3)	IR 36	Aug. 14, 1984	Nov. 4, 1984	1. 6 kg of urea for nursery 2. 25 kg of urea and 50 kg of complete for basal (0.48 ha)

Remarks; Urea contains 46% of nitrogen.
Complete fertilizer contains 14% of nitrogen, 14% of P_2O_5 and 14% of K_2O.

Table F-79 OBSERVATION RECORDS ON PADDY GROWTH IN DRY SEASON AT MONITORING POINT NO. 2 IN ARIS

Plot No.	Items Measured	Feb. 15	Feb. 23	Feb. 29	Mar. 6	Mar. 14	Mar. 22	Mar. 30	Apr. 3	Apr. 10	Apr. 25	May 3	May 11	May 17
I'-1	Plant height (cm)	—	—	—	22	33	40	45	48	56	64	—	—	—
	No. of tillers	—	—	—	10	23	28	26	24	22	20	—	—	—
I'-2	Plant height (cm)	—	—	—	27	38	43	58	58	65	70	—	—	—
	No. of tillers	—	—	—	6	11	11	12	14	19	12	—	—	—
I'-3	Plant height (cm)	—	—	—	21	30	41	49	49	55	61	—	—	—
	No. of tillers	—	—	—	9	12	15	16	17	18	14	—	—	—
II'-1	Plant height (cm)	—	—	—	35	44	47	52	56	64	68	—	—	—
	No. of tillers	—	—	—	18	24	24	24	26	30	27	—	—	—
II'-2	Plant height (cm)	—	—	—	37	49	50	55	56	62	64	—	—	—
	No. of tillers	—	—	—	36	40	40	46	49	53	38	—	—	—
II'-3	Plant height (cm)	—	—	—	35	47	50	56	58	66	81	—	—	—
	No. of tillers	—	—	—	16	25	27	27	28	33	25	—	—	—
I-1	Plant height (cm)	—	24	37	39	50	62	71	71	72	73	—	—	—
	No. of tillers	—	9	13	29	43	48	45	40	38	30	—	—	—
I-2	Plant height (cm)	—	26	29	47	57	70	76	76	76	79	—	—	—
	No. of tillers	—	16	23	37	48	34	33	30	25	23	—	—	—
I-3	Plant height (cm)	—	26	28	44	60	65	69	74	75	76	—	—	—
	No. of tillers	—	6	7	25	37	36	35	31	30	26	—	—	—
II-1	Plant height (cm)	21	30	30	34	52	51	61	65	69	83	86	87	88
	No. of tillers	8	8	17	27	35	35	32	28	20	17	17	16	16
II-2	Plant height (cm)	24	31	32	34	47	54	61	63	66	82	85	87	87
	No. of tillers	8	11	15	28	35	34	33	31	25	17	18	18	18
II-3	Plant height (cm)	23	33	33	39	45	50	60	62	66	77	88	90	92
	No. of tillers	6	8	8	14	23	24	21	19	16	10	10	10	9
III-1	Plant height (cm)	18	26	30	31	38	47	51	52	54	67	75	77	80
	No. of tillers	7	8	17	19	28	29	22	21	16	15	14	13	13
III-2	Plant height (cm)	21	29	33	40	49	53	57	57	60	79	80	81	82
	No. of tillers	7	9	16	20	25	26	20	23	19	16	14	13	12
III-3	Plant height (cm)	23	29	33	35	42	49	55	54	54	68	75	83	86
	No. of tillers	6	8	13	20	24	24	23	20	19	15	15	14	14
IV-1	Plant height (cm)	21	26	29	30	35	36	45	46	49	56	65	74	79
	No. of tillers	7	7	15	15	27	20	21	19	16	13	14	14	14
IV-2	Plant height (cm)	18	26	29	30	36	44	51	53	54	58	70	77	81
	No. of tillers	6	5	8	14	20	22	14	13	13	10	10	4	4
IV-3	Plant height (cm)	20	26	30	30	36	43	51	51	53	66	75	78	80
	No. of tillers	6	9	11	21	29	27	25	21	18	15	14	13	13

Note; Variety: IR 42

Table F-80 OBSERVATION RECORDS ON PADDY GROWTH IN DRY SEASON AT MONITORING POINT NO. 4 (LATERAL D) IN ARIS

Plot No.	Items Measured	Dec. 26	Jan. 5	Jan. 12	Jan. 19	Jan. 26	Feb. 2	Feb. 9	Feb. 15
I-1	Plant height (cm)	22	26	35	46	49	49	49	49
	No. of tillers	12	13	13	13	13	9	9	9
I-2	Plant height (cm)	21	24	37	43	49	50	51	51
	No. of tillers	11	11	12	12	12	12	9	9
I-3	Plant height (cm)	16	20	30	32	37	37	38	38
	No. of tillers	8	8	10	12	12	11	11	11
II-1	Plant height (cm)	36	43	49	57	59	62	63	63
	No. of tillers	9	14	15	14	13	10	9	9
II-2	Plant height (cm)	42	44	45	48	52	52	52	52
	No. of tillers	9	9	9	9	10	8	7	7
II-3	Plant height (cm)	41	41	44	47	52	52	52	52
	No. of tillers	11	12	12	11	11	11	11	11
III-1	Plant height (cm)	30	44	57	59	63	63	66	66
	No. of tillers	13	18	18	18	17	16	16	16
III-2	Plant height (cm)	27	45	57	64	69	69	69	69
	No. of tillers	11	11	13	14	13	12	11	11
III-3	Plant height (cm)	35	47	54	62	68	68	68	68
	No. of tillers	13	15	18	15	15	14	13	13
IV-1	Plant height (cm)	29	46	48	57	58	58	58	58
	No. of tillers	19	20	19	17	16	16	14	14
IV-2	Plant height (cm)	25	50	57	62	62	62	62	62
	No. of tillers	18	18	19	20	20	17	15	15
IV-3	Plant height (cm)	31	55	35	62	64	65	65	65
	No. of tillers	13	14	15	16	17	16	16	16

Note; Variety: UPL-RI4

Table F-81 OBSERVATION RECORDS ON PADDY GROWTH IN DRY SEASON AT MONITORING POINT NO. 4 (DON MOTEO DITCH) IN ARIS

Plot No.	Items Measured	Feb. 10	Feb 15	Feb. 23	Feb. 29	Mar. 6	Mar. 14	Mar. 22	Mar. 30	Apr 10	Apr. 20	Apr. 28
I-1	Plant height (cm)	20	22	28	35	45	60	68	83	94	94	95
	No. of tillers	5	5	7	17	19	19	28	27	26	21	19
I-2	Plant height (cm)	19	24	32	40	47	62	76	83	99	99	99
	No. of tillers	4	4	7	10	14	20	20	21	19	16	14
I-3	Plant height (cm)	20	25	26	37	46	54	63	75	85	92	96
	No. of tillers	4	5	9	11	13	17	18	19	18	16	15
II-1	Plant height (cm)	28	29	36	41	52	61	77	85	103	103	103
	No. of tillers	4	5	10	18	23	22	21	21	20	18	18
II-2	Plant height (cm)	29	31	37	44	53	62	73	85	101	101	101
	No. of tillers	3	4	9	19	21	23	24	20	17	14	14
II-3	Plant height (cm)	26	26	32	41	53	67	81	89	104	104	104
	No. of tillers	5	7	14	15	22	25	31	30	30	17	16
III-1	Plant height (cm)	28	28	28	34	41	51	68	78	94	95	98
	No. of tillers	5	7	14	20	24	25	26	29	24	21	21
III-2	Plant height (cm)	23	26	35	41	48	59	67	82	94	97	97
	No. of tillers	6	8	18	22	22	24	27	32	29	28	27
III-3	Plant height (cm)	25	29	39	45	51	67	81	89	90	91	91
	No. of tillers	5	7	17	21	23	28	34	35	30	30	30
IV-1	Plant height (cm)	27	30	40	47	54	58	75	87	98	98	98
	No. of tillers	10	19	42	50	50	55	55	51	42	34	33
IV-2	Plant height (cm)	30	32	40	52	62	66	77	98	113	113	113
	No. of tillers	7	8	16	23	23	23	23	25	23	20	20
IV-3	Plant height (cm)	29	32	43	44	57	64	74	86	92	92	92
	No. of tillers	7	13	24	34	37	37	38	39	34	32	30

Note; Variety: IR 58

Table F-82 OBSERVATION RECORDS ON PADDY GROWTH IN DRY SEASON AT MONITORING POINT NO. 10 IN ADRIS

Plot No.	Items Measured	Jan. 11	Jan. 20	Jan. 26	Feb. 2	Feb. 9	Feb. 15	Feb. 23	Mar. 6	Mar. 15
I-1	Plant height (cm)	27	36	41	59	63	71	80	81	82
	No. of tillers	5	12	17	29	37	42	42	43	41
I-2	Plant height (cm)	27	35	42	51	64	69	80	85	91
	No. of tillers	9	18	28	35	43	47	47	43	43
I-3	Plant height (cm)	21	38	45	48	56	62	71	72	74
	No. of tillers	15	23	27	32	46	47	47	40	39
II-1	Plant height (cm)	31	42	49	67	75	79	88	89	89
	No. of tillers	17	30	32	38	40	39	38	37	34
II-2	Plant height (cm)	30	44	49	66	73	80	91	91	91
	No. of tillers	14	25	33	42	46	47	41	40	39
II-3	Plant height (cm)	30	43	53	63	71	78	85	90	90
	No. of tillers	11	27	31	39	39	39	38	35	34
III-1	Plant height (cm)	28	40	40	55	67	73	80	80	88
	No. of tillers	8	16	17	38	47	46	43	42	38
III-2	Plant height (cm)	30	37	45	57	68	73	84	87	89
	No. of tillers	10	22	24	49	51	48	46	39	36
III-3	Plant height (cm)	28	40	43	62	65	74	84	84	89
	No. of tillers	10	22	24	44	53	53	50	48	34
IV-1	Plant height (cm)	33	36	42	59	77	78	83	88	90
	No. of tillers	13	25	24	50	56	55	50	43	38
IV-2	Plant height (cm)	26	31	36	48	57	61	71	71	72
	No. of tillers	10	20	21	46	48	50	44	41	33
IV-3	Plant height (cm)	29	30	37	47	56	62	65	70	71
	No. of tillers	7	17	18	29	31	33	32	27	25

Note; Variety : IR-36

Table F-83 RESULT OF ANALYSIS ON YIELD COMPONENTS OF DRY SEASON PADDY AT MONITORING POINT NO. 2 IN ARIS AND NO. 10 IN ADRIS

Sample No.	No. of Panicles per Hill	No. of Panicles per m²	No. of Grains per Panicle	No. of Grains per m²	Percent of Ripened Grains (%)	Weight of 1,000 Ripened Grains (g)	Unit Yield (ton/ha)
(1) Monitoring Point No. 2 in ARIS							
I'-1	19.0	533	49.4	26,300	58.4	19.6	3.0
I'-2	16.5	379	45.5	17,200	67.2	21.1	2.4
I'-3	16.4	459	48.3	22,200	66.5	20.8	3.1
II'-1	15.3	534	45.9	24,500	74.3	21.6	3.9
I-1	23.6	801	42.7	34,200	65.8	21.5	4.8
I-2	18.6	522	48.6	25,400	67.0	21.6	3.7
I-3	16.3	571	59.5	34,000	73.3	22.1	5.5
II-1	14.3	442	54.5	24,100	77.4	20.5	3.8
II-2	12.1	314	57.8	18,100	80.4	19.0	2.8
II-3	14.2	441	52.4	23,100	78.3	19.7	3.6
III-1	14.1	437	56.3	24,600	76.0	19.6	3.7
III-2	14.3	457	51.2	23,400	79.9	18.9	3.5
III-3	10.7	322	50.5	16,300	73.3	19.3	2.3
IV-1	11.4	341	51.7	17,600	65.8	19.4	2.3
IV-2	11.3	350	39.1	13,700	55.4	18.5	1.4
(2) Monitoring Point No. 10 in ADRIS							
I-1	28.8	720	76.2	54,900	43.5	22.7	5.4
I-2	25.2	630	60.3	38,000	65.4	22.9	5.7
I-3	23.5	611	67.9	41,500	67.2	23.1	6.4
II-1	24.1	554	81.0	44,900	63.8	23.4	6.7
II-2	23.4	608	73.4	44,600	66.4	22.7	6.7
II-3	23.2	580	72.6	42,100	71.3	22.4	6.7
III-1	30.4	760	74.0	56,200	65.5	22.1	8.1
III-2	21.7	608	65.6	39,900	67.5	22.1	5.9
III-3	31.0	806	60.0	48,400	51.2	22.0	6.5
IV-1	25.7	694	68.9	47,800	58.5	21.5	6.0
IV-2	23.8	500	74.1	37,100	55.6	21.1	4.3
IV-3	24.4	610	70.4	42,900	54.9	21.7	5.1