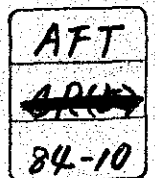
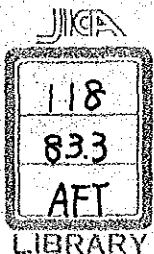


EXPLANATION NOTE  
FOR  
COMMENTS AND RECOMMENDATIONS  
FROM  
NATIONAL IRRIGATION ADMINISTRATION

THE IMPROVEMENT PROJECT  
OF  
THE OPERATION AND MAINTENANCE  
OF  
NATIONAL IRRIGATION SYSTEMS (AMRIS)

FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY



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JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団

受入 月日 '84. 3. 29	118
登録No. 10148	83.3
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Quoted below are the comments and suggestions put forward by National Irrigation Administration on the Draft Final Report on the Improvement Project of the Operation and Maintenance of National Irrigation Systems (AMRIS):

- (1) To justify the construction of the Third Maasim Diversion Dam from viewpoint of technical, economic, and O & M aspects.
- (2) To check the engineering and administration cost in the project cost, taking into account the project implementation schedule.
- (3) To reexamine the need for consultants considering that there is sufficient internal capability in the NIA.
- (4) To reexamine the need for new equipment in view of alternative reconditioning of presently available equipment.
- (5) The scheme to provide supplemental water supply to Upper Maasim through a feeder canal from Lateral A of AMRIS needs further study; since the available head is only 2.90 meters while the length of the feeder canal is 15.40 km.
- (6) The cost of facilities for the extension area should be separated and analyzed, if incremental cost could be justified by the incremental benefits.
- (7) On page C.5-14. Table C.5.3-4, Summary of Crop Production Cost, fertilizers are given in N,  $P_2O_5$ , and  $K_2O$  while agro-chemicals are in different brand names. In agro-chemicals, the cost may be lumped as one regardless of the brand. In the future with or without project, there is no certainty on the existence of these brands or might be

shifting of usage to other brands. Likewise, these data should be included in the Agronomy portion of the report.

The following presents the reply to the above comments and suggestions:

Comment (1)

To justify the construction of the Third Maasim Diversion Dam from viewpoint of technical, economic, and O & M aspects.

Explanation:

1) Technical Viewpoint

a) Study of the Water Resources

Proposed area of 680 ha to be covered by the Third Maasim Diversion Dam is being irrigated by making use of the return flow of the River basin. The water resources for the whole AMRIS area have been studied inclusive of this proposed area. The study confirms that the Bustos Diversion Dam on the Angat River is capable of directly providing the Maasim area with stable water resources. Based on this study, the Third Maasim Diversion Dam has been proposed for an area of 680 ha.

b) Raising of Levee

Raising of levee around the Diversion Dam is necessary because the elevation of levee is low relative to the elevated water level (4.0 m) at the Diversion Dam. Diversion Dam.

c) Gate Type

The operation and maintenance of Diversion Dam in the future is largely influenced by its gate type. Rubber type dam is proposed in view of the cost, safety (against the flooding), and easy operation and maintenance in the future.

d) Geology of Dam Foundation

The elevated water level of 4.0 m in the upstream of the Diversion Dam is considered to have little load on the foundation of the Diversion Dam. The geology of dam foundation, however, does not appear to be in good conditions so that it is necessary to conduct the geological investigations and reexamine the methods of foundation treatment before embarking on the implementation

2) Economic Viewpoint

a) Economic Internal Rate of Return (EIRR)

EIRR for the Third Maasim Diversion Dam is estimated at 12% as presented below:

Construction Cost;	(Unit: ₱ '000)
Diversion Dam	: 8,619
Main Canal	: 2,190
On-Farm	: 2,305
Total	: <u>13,114</u> (See Table 1-1)
Project Benefit;	
Incremental Benefit	: 1,638 (See Table 1-2)
EIRR	: 12% (See Table 1-4)

b) Socio-Economic Viewpoint

This EIRR may not seem to be high enough to definitely warrant the project implementation. From socio-economic viewpoint, however, it is not desirable to leave the less developed Maasim area as it is while the rest is developing, which may eventually lead to the social instability in the area. Enhancing the development effect in the whole Project area by including the Third Maasim Diversion Dam in the area will have a great significance in terms of improving the socio-economic environment.

3) O & M Viewpoint

a) Operation

The Third Maasim Diversion Dam starts functioning from the end of wet season throughout the dry season period and, therefore, will be of a permanent structure that makes its operation easy and helps the flooding water release smoothly.

b) Maintenance

Construction of permanent structure, which used to be considered as a temporary structure, will greatly reduce the maintenance and repair cost. On the contrary, its gate and appurtenant structures will require the maintenance and repair works.

4) Others

In addition to the above explanations presented from viewpoint of technical, economic, and socio-economic aspects, the following are observed:



- ° Construction of a temporary earth dam is becoming more difficult as embankment materials get scarce every year
- ° Present dam is incapable of sustaining a large flood
- ° Flushed embankment materials lower the runoff capacity of the cross section of the river in the lowerstream basin

It is thus noted that though the proposed construction plan of Third Maasim Diversion Dam still requires further survey and investigation, there is no question about its feasibility and the need for its implementation is strongly perceived.

TABLE 1-1 INCREMENTAL COST FOR THIRD MAASIM DAM

(Unit: ₱ '000)

<u>Item</u>	<u>F.C.</u>	<u>L.C.</u>	<u>Total</u>
Diversion Dam	6,089	2,530	8,619
Main Canal (6.8 km)	1,809	381	2,190
ON-farm (680 ha)	1,854	451	2,305
<u>Total</u>	<u>9,752</u>	<u>3,362</u>	<u>13,114</u>

TABLE 1-2 INCREMENTAL BENEFIT FOR THIRD MAASIM AREA

Incremental Benefit for Third Maasim Area

Without Project (680 ha x 0.7 = 476 ha)

Net Production Value

T.P. (50%) 237 ha x 5,451 ₱/ha = 1,297,000

Direct (50%) 237 ha x 6,474 ₱/ha = 1,541,000

Total 2,838,000

With Project (680 ha)

Net Production Value

T.P. (20%) 136 ha x 5,997 ₱/ha = 816,000

Direct (80%) 544 ha x 6,728 ₱/ha = 3,660,000

Total 4,476,000

Incremental Benefit 4,476,000 - 2,838,000 = 1,638,000

TABLE 1-3 PROJECT COST STREAM

(Unit: ₱ '000)

<u>Year</u>	<u>Capital</u>	<u>O &amp; M</u>	<u>Total</u>	<u>Incremental Benefit</u>	<u>Net Return</u>
1984	6,266	0	6,266	0	-6,266
1985	6,266	0	6,266	546	-5,720
1986	-	0	0	1,092	1,092
1987	-	0	0	1,638	1,638
1988	-	0	0	1,638	1,638
1989	-	60	60	1,638	1,578
1990	-	60	60	1,638	1,578

TABLE 1-4 PROJECT ECONOMIC COST AND RETURN  
( PHILIPPINE AMRIS O&M PROJECT )

( UNIT : THOUSAND PESO )

YEAR	PROJECT COST		TOTAL (1)	INCREMENT- AL BENEFITS (2)	PROJECT RETURN (3) =(2)-(1)	PRESENT WORTH VALUE (3)*DISCOUNT RATE ( 12 % ) ( 13 % )	
	CAPITAL	O & M				( 12 % )	( 13 % )
1 1984	6266.00	0.0	6266.00	0.0	-6266.00	-5594.64	-5545.14
2 1985	6266.00	0.0	6266.00	546.00	-5720.00	-4559.95	-4479.61
3 1986	0.0	0.0	0.0	1092.00	1092.00	777.26	756.81
4 1987	0.0	0.0	0.0	1638.00	1638.00	1040.98	1004.62
5 1988	0.0	0.0	0.0	1638.00	1638.00	929.45	889.05
6 1989	0.0	60.00	60.00	1638.00	1578.00	799.47	757.95
7 1990	0.0	60.00	60.00	1638.00	1578.00	713.81	670.75
8 1991	0.0	60.00	60.00	1638.00	1578.00	637.33	593.59
9 1992	0.0	60.00	60.00	1638.00	1578.00	569.04	525.30
10 1993	0.0	60.00	60.00	1638.00	1578.00	508.08	464.87
11 1994	0.0	60.00	60.00	1638.00	1578.00	453.64	411.39
12 1995	0.0	60.00	60.00	1638.00	1578.00	405.04	364.06
13 1996	0.0	60.00	60.00	1638.00	1578.00	361.64	322.18
14 1997	0.0	60.00	60.00	1638.00	1578.00	322.89	285.11
15 1998	0.0	60.00	60.00	1638.00	1578.00	288.30	252.31
16 1999	0.0	60.00	60.00	1638.00	1578.00	257.41	223.29
17 2000	0.0	60.00	60.00	1638.00	1578.00	229.83	197.60
18 2001	0.0	60.00	60.00	1638.00	1578.00	205.20	174.87
19 2002	0.0	60.00	60.00	1638.00	1578.00	183.22	154.75
20 2003	0.0	60.00	60.00	1638.00	1578.00	163.59	136.95
21 2004	0.0	60.00	60.00	1638.00	1578.00	146.06	121.19
22 2005	0.0	60.00	60.00	1638.00	1578.00	130.41	107.25
23 2006	0.0	60.00	60.00	1638.00	1578.00	116.44	94.91
24 2007	0.0	60.00	60.00	1638.00	1578.00	103.96	83.99
25 2008	0.0	60.00	60.00	1638.00	1578.00	92.82	74.33
26 2009	0.0	60.00	60.00	1638.00	1578.00	82.88	65.78
27 2010	0.0	60.00	60.00	1638.00	1578.00	74.00	58.21
28 2011	0.0	60.00	60.00	1638.00	1578.00	66.07	51.51
29 2012	0.0	60.00	60.00	1638.00	1578.00	58.99	45.59
30 2013	0.0	60.00	60.00	1638.00	1578.00	52.67	40.34
31 2014	0.0	60.00	60.00	1638.00	1578.00	47.03	35.70
32 2015	0.0	60.00	60.00	1638.00	1578.00	41.99	31.59
33 2016	0.0	60.00	60.00	1638.00	1578.00	37.49	27.96
34 2017	0.0	60.00	60.00	1638.00	1578.00	33.47	24.74
35 2018	0.0	60.00	60.00	1638.00	1578.00	29.89	21.90
36 2019	0.0	60.00	60.00	1638.00	1578.00	26.68	19.38
37 2020	0.0	60.00	60.00	1638.00	1578.00	23.83	17.15
38 2021	0.0	60.00	60.00	1638.00	1578.00	21.27	15.18
39 2022	0.0	60.00	60.00	1638.00	1578.00	18.99	13.43
40 2023	0.0	60.00	60.00	1638.00	1578.00	16.96	11.88
41 2024	0.0	60.00	60.00	1638.00	1578.00	15.14	10.52
42 2025	0.0	60.00	60.00	1638.00	1578.00	13.52	9.31
43 2026	0.0	60.00	60.00	1638.00	1578.00	12.07	8.24
44 2027	0.0	60.00	60.00	1638.00	1578.00	10.78	7.29
45 2028	0.0	60.00	60.00	1638.00	1578.00	9.62	6.45
46 2029	0.0	60.00	60.00	1638.00	1578.00	8.59	5.71
47 2030	0.0	60.00	60.00	1638.00	1578.00	7.67	5.05
48 2031	0.0	60.00	60.00	1638.00	1578.00	6.85	4.47
49 2032	0.0	60.00	60.00	1638.00	1578.00	6.12	3.96
50 2033	0.0	60.00	60.00	1638.00	1578.00	5.46	3.50
TOTAL	12532.00	2700.00	15232.00	78624.00	63392.00	9.30	-812.83

I E R R = 12 ..... 12 + 9.30 / ( 9.30 + 812.83 ) = 12.01

Comments (2) and (3)

To check the engineering and administration cost in the project cost, taking into account the project implementation schedule.

To reexamine the need for consultants considering that there is sufficient internal capability in the NIA.

Explanation:

Basic plans of the Project is summarized as follows:

- i) Construction works of the Project comprise construction and rehabilitation of irrigation and drainage system, road networks, and on-farm facilities.
- ii) Irrigation, drainage, and road systems together with appurtenant structures will be constructed on the contract basis.
- iii) On-farm facilities, on the other hand, will be constructed on the force account basis taking into account the central government policy, staff mobilization ability of NIA, budget allocation, foreign financing as well as necessary cooperation from the beneficiary farmers for the on-farm development.
- iv) The implementation period will be seven years considering the one-year preparatory works (such as survey, detail design, preparation of tender documents and others), amount of construction, budget allocation, mobilization of NIA staff, generation of early project benefits, establishment of irrigators' association, and partial transfer of O & M works to beneficiary farmers.

Engineering and administration cost has been reviewed in due consideration of the above plans and internal capability of NIA. The major items of this cost are remuneration for consultants and personal expenses at NIA-AMRIS Office.

#### Remuneration for Consultants

In principle the engineers at the NIA-AMRIS Offices are responsible for the detail design of the Project with the assistance of the consultants. Proposed schedule for consulting services shown in Figure 2-1 has been made separately for the preparatory works and the construction supervision stages. It is summarized as follows.

<u>Consultant</u>	<u>Required Service (Man-Month)</u>		<u>Total</u>
	<u>Prep. Works</u>	<u>Const. Supervision</u>	
Foreign Consultant	69	76	145
Local Consultant	80	95	175
Total	<u>149</u>	<u>171</u>	<u>320</u>

Note: Preparatory Work Stage : 12 months  
 Construction Supervision Stage : 72 months  
 Details of the required services in man-month appear in Table 2-1.

Consultant fees for the above services are shown in Table 2-2. The consulting services in man-months for the preparatory works and the construction supervision are regarded as the minimum required for smooth implementation of the Project. It is noted that the consultant fees account for 8.4% of the total Project cost (excluding price escalation) and that this ratio is reasonable as compared with that of other similar-natured projects.

#### Personnel Expenses at NIA-AMRIS Offices

Staffs at NIA-AMRIS Office at present total 441, but the project implementation requires another 142 staffs who engage in the

detail design and the construction supervision. The total required services during the implementation period of seven years by these additional staffs amount to 994 man-months as presented in Table 2-1. The necessary expenses for these services are estimated at 28.5 million pesos as shown in Table 2-2. These expenses are considered reasonable accounting for 10% of the cost of items 1 through 7 in Table 5.2-1 of Main Report, which is close to the NIA standard.

FIGURE 2-1

PROPOSED SCHEDULE FOR CONSULTING SERVICES

Description	Project Year																												F	L	Total	Remarks				
	Year				1st				2nd				3rd				4th				5th				6th								7th			
	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12								
<b>A. WORKING SCHEDULE</b>																																				
1. Preparatory Works																																				
1.1. Preparatory Works for Major Facilities																																				
1.2. Tendering for Major Facilities																																				
1.3. Surveying																																				
2. Construction of Civil Works																																				
2.1. Major Facilities																																				
*Diversion Dam																																				
- Bustos Diversion Dam																																				
- Upper Maasim Diversion Dam																																				
- Lower Maasim Diversion Dam																																				
- Third Maasim Diversion Dam																																				
*Irrigation System																																				
*Drainage System																																				
*Road System																																				
2.2. On-Farm Facilities																																				
3. Procurement of Equipment																																				
4. Land Acquisition																																				
5. Project Facilities																																				
6. Institutional Development and O & M																																				
<b>B. MANNING SCHEDULE</b>																																				
1. Preparatory Works Stage																																				
1.1. Detailed Design																																				
Team Leader (F) <sup>1</sup> / <sub>1</sub>																													8	-		8				
Assist. Team Leader (L) <sup>2</sup> / <sub>1</sub>																													-			8				
Irrigation Engineer (F)																													7	-		7				
Irrigation & Drainage Engineer (L)																													-			8				
Design Engineer: (A) (F)																													7	-		7				
- do - (B) (F)																													-			8				
- do - (A) (L)																													-			8				
- do - (B) (L)																													-			8				
- do - (C) (L)																													-			8				
Construction Planner (L)																													-			3				
Mechanical Engineer (F)																													4	-		4				
Equipment Engineer (F)																													3	-		3				
Cost Estimator (F)																													4	-		4				
Agronomist (L)																													-			4				
Agro-Economist (F)																													4	-		4				
Surveyor (L)																													-			8				
Sub-total																													44	55		99				
1.2. Tendering																																				
Team Leader (F)																													4	-		4				
Assist. Team Leader (L)																													-			5				
Specification Writer (F)																													5	-		5				
- do - (L)																													-			5				
Sub-total																													9	10		19				
1.3. Institutional Development																																				
Water Management Expert (F)																													8	-		8				
F.I. Organizing Specialist (L)																													-			8				
Institutional Expert (F)																													8	-		8				
- do - (L)																													-			7				
Sub-total																													16	15		31				
Total (1)																													69	80		149				
2. Construction Supervision Stage																																				
2.1. Supervision of Civil Works																																				
Team Leader (F)																													-			23				
Assist. Team Leader (L)																													-			26				
Construction Supervisor (A) (F)																													20	-		20				
- do - (B) (L)																													-			20				
Sub-total																													43	46		89				

		F L Total	
3. Procurement of Equipment			
4. Land Acquisition			
5. Project Facilities			
6. Institutional Development and O & M			
<b>B. MANNING SCHEDULE</b>			
1. Preparatory Works Stage			
1.1. Detailed Design			
Team Leader (F) <sup>1/</sup>		8	8
Assist. Team Leader (L) <sup>2/</sup>		-	8
Irrigation Engineer (F)		7	7
Irrigation & Drainage Engineer (L)		-	8
Design Engineer (A) (F)		7	7
- do - (B) (F)		-	8
- do - (A) (L)		-	8
- do - (B) (L)		-	8
- do - (C) (L)		-	8
Construction Planner (L)		-	8
Mechanical Engineer (F)		-	3
Equipment Engineer (F)		4	4
Cost Estimator (F)		3	3
Agronomist (L)		4	4
Agro-Economist (F)		-	4
Surveyor (L)		4	4
Sub-total		44	55
1.2. Tendering			
Team Leader (F)		4	4
Assist. Team Leader (L)		-	5
Specification Writer (F)		5	5
- do - (L)		-	5
Sub-total		9	10
1.3. Institutional Development			
Water Management Expert (F)		8	8
F.I. Organizing Specialist (L)		-	8
Institutional Expert (F)		8	8
- do - (L)		-	7
Sub-total		16	15
Total (1)		69	80
2. Construction Supervision Stage			
2.1. Supervision of Civil Works			
Team Leader (F)		(4)	(4)
Assist. Team Leader (L)		(4)	(4)
Construction Supervisor (A) (F)		(4)	(4)
- do - (B) (L)		(4)	(4)
Sub-total		16	16
2.2. Supervision of Institutional Development and O & M			
Team Leader (F)		4	4
Assist. Team Leader (L)		-	3
Irrigation Engineer (F)		5	5
Design Engineer (A) (L)		-	5
- do - (B) (L)		-	4
Water Management Expert (F)		10	10
Agronomist (L)		-	5
F.I. Organizing Specialist (L)		-	12
Institutional Expert (F)		14	14
- do - (L)		-	20
Sub-total		33	49
Total (2)		76	95
Grand Total (1)+(2)		145	175
		89	320

Note: <sup>1/</sup>F; Foreign Consultants  
<sup>2/</sup>L; Local Consultants



TABLE 2-1 REQUIRED MAN-MONTH

I) Engineering Staff

(Unit: Man-Month)

Speciality	Foreign Consultants		Local Consultants	
	Detail Design	Construction Supervision	Detail Design	Construction Supervision
1. Team Leader	12	27	13	29
2. Irrigation Engineer	7	5	8	-
3. Design Engineer	14	-	24	9
4. Mechanical Engineer	4	-	-	-
5. Equipment Engineer	3	-	-	-
6. Construction Planner	-	-	3	-
7. Cost Estimator	4	-	-	-
8. Specification Writer	5	-	5	-
9. Construction Supervisor	-	20	-	20
10. Agronomist	-	-	4	5
11. Agro-Economist	4	-	-	-
12. Water Management Expert	8	10	-	-
13. F.F. Organizing Specialist	-	-	8	12
14. Institutional Expert	8	14	7	20
15. Surveyor	-	-	8	-
<u>Total</u>	<u>69</u>	<u>76</u>	<u>80</u>	<u>95</u>

II) NIA-AMRIS Staff

(Unit: Man-Month)

Office	Present Staff	Proposed Staff	Additional Staff
Main Office	441	198	-243
North Zone Engineer Office	0	235	235
South Zone Engineer Office	0	150	150
<u>Total</u>	<u>441</u>	<u>583</u>	<u>142</u>

Additional staff during the implementation =

142 Man-Month x 7 years = 994 Man-Months

TABLE 2-2 ENGINEERING AND ADMINISTRATION COST

(Unit: ₱ '000)

<u>Item</u>	<u>Foreign Currency</u>	<u>Local Currency</u>	<u>Total</u>
I) Engineering Cost			
1. Remuneration			
1.1 Foreign Consultants	14,500	0	14,500
1.2 Local Consultants	6,300	0	6,300
2. Direct Cost	720	4,540	5,260
3. Contingencies	2,480	460	2,940
<u>Sub-total</u>	<u>24,000</u>	<u>5,000</u>	<u>29,000</u>
4. Training	882	278	1,160
<u>Total</u>	<u>24,882</u>	<u>5,278</u>	<u>30,160</u>
II) Administration Cost			
1. Personal Expense	0	17,600	17,600
2. Direct Cost	0	10,870	10,870
<u>Total</u>	<u>0</u>	<u>28,470</u>	<u>28,470</u>

Comment (4)

To reexamine the need for new equipment in view of alternative reconditioning of presently available equipment.

Explanation:

Table B.2.6-1 of Appendix B shows that AMRIS Office at present owns 85 units of O & M equipment, of which 46 units are regarded as operable whereas the remaining 39 units either require considerable repair works or are not operable at all.

The number of necessary O & M equipment, on the other hand, is 66 units(excl. motorcycles) as shown in Table 4.3-3 of Main Report and Table B.5.6-1 of Appendix B. Types and number of equipment necessary for O & M works will be supplemented with i) currently operable equipment(existing), ii) construction equipment to be mobilized for O & M works after the project implementation (transfer), and iii) newly purchased equipment(procurement)(See Table B.5.6-1).

Of the 46 units of currently operable equipment, 11 units will be considered usable and the remaining 35 units not usable after seven years when the project is completed.

Construction works require 66 units of construction equipment(See Table C.3.2-7), of which 27 units will be mobilized for O & M works after the project implementation. The O & M equipment to be newly purchased, therefore, is 28 units(66 minus 11 minus 27) as shown in Table B.5.6-1.

It is thus noted that the number of necessary equipment has been estimated in due consideration of alternative reconditioning of presently available equipment and that the number of newly purchased equipment has been made minimum. The estimated units of newly purchased equipment therefore is considered the minimum number necessary for the implementation and the O & M works.

TABLE B.2.6-1 OPERABLE AND NON-OPERABLE EQUIPMENTS OF AMRIS  
(Appendix)

Item	Type	Operable Units	Non-Operable Units	Total No. of Units
1. TRACTOR CRAWLER	Komatsu D40P	2	-	2
	Komatsu D50P	1	-	1
	Komatsu D50A	1	3	3
2. CRANE	Truck Mounted	1	-	1
	Crawler	1	2	3
3. LOADER	Kimco	2	1	3
4. BACKHOE	Sumitomo	3	-	3
	Hitachi UH07	1	1	2
5. MOTOR GRADER	Komatsu GD22	1	2	3
	Komatsu GD37	1	-	1
	Mitsubishi LG2H	1	-	1
6. ROAD ROLLER	Sakai	1	3	4
7. VIBRATORY ROLLER	Sakai	-	2	2
8. DUMP TRUCK	Toyota	2	9	11
	Hino	4	2	6
9. STAKE TRUCK	Toyota	2	2	4
	Hino	2	-	2
10. TRUCK TRACTOR W/ TRAILER	Hino	2	1	3
11. FUEL TANKER	Hino	-	1	1
12. PICK UP	Toyota	4	1	5
	Nissan	4	-	4
13. STATION WAGON	Toyota	1	-	1
14. JEEP	Toyota	4	-	4
	Willy's	-	4	4
15. LUBRICATION TRUCK	Hino	1	-	1
16. FORK LIFT	Komatsu	1	-	1
17. MOBILE SHOP TRUCK	Isuzu	1	-	1
18. PICK UP VAN	Hi Lux	1	-	1
19. CAR	Volkswagon	2	1	3
20. FARM TRACTOR	International H	-	4	4
<u>TOTAL NO. OF UNITS</u>		<u>46</u>	<u>39</u>	<u>85</u>

TABLE 4.3-3 LIST OF EQUIPMENT FOR O&M  
(Main Report)

<u>Item</u>	<u>Quantity</u>	<u>Remarks</u>
Dump truck 6.0 ton	8	6 units from construction, remainder will be existing one.
Stake truck 6.0 ton	4	To be procured
Front end loader	2	Existing
Backhoe, 0.40 cu.m	5	Transfer from construction
Crawler, crane	2	Existing
Bulldozer 140HP	4	Transfer from construction
Motorgrader 75HP	3	- Ditto -
Road roller 8 ton	1	- Ditto -
Truck tractor	2	Existing
Station wagon	4	To be procured
Jeep	4	To be procured
Pick-up truck 3/4 ton	9	To be procured
Fork lift	1	Existing
Mobile car	1	- Ditto -
Lubrication car	1	- Ditto -
Water tank truck	1	Transfer from construction
Concrete mixer	6	- Ditto -
Centrifugal pump 100 mm	6	To be procured
Sand pump unit	2	- Ditto -
Motorcycle	(80)	- Ditto -
<u>Total</u>	<u>66</u>	

TABLE B.5.6-1 PROPOSED EQUIPMENT FOR O&M  
(Appendix)

Name of Equipment	Quantity	through from			Remarks
		Existing	Transfer	Procured	
Dump truck 6.0 ton	8	2	6	-	L.E.
Stake truck 6.0 ton	4	-	-	4	L.E.
Front end loader	2	2	-	-	H.E.
Backhoe 0.4 cu.m.	5	-	5	-	H.E.
Crawler crane	2	2	-	-	H.E.
Bulldozer 140 HP	4	-	4	-	H.E.
Motor grader 75 HP	3	-	3	-	H.E.
Road roller 8 ton	1	-	1	-	H.E.
Trank tractor	2	2	-	-	H.E.
Station wagon	4	-	1	3	L.E.
Jeep	4	-	-	4	S.V.
Pick-up Truck 3/4 ton	9	-	-	9	L.E.
Fork lift	1	1	-	-	H.E.
Mobile car	1	1	-	-	L.E.
Lubrication car	1	1	-	-	L.E.
Water tank truck	1	-	1	-	L.E.
Concrete mixer	6	-	6	-	L.E.
Centrifugal pump 100mm	6	-	-	6	L.E.
Sand pump unit	2	-	-	2	L.E.
Motorcycle	(320)	-	-	(320)	Tr
	66			28	
<u>Total</u>	<u>(386)</u>	<u>11</u>	<u>27</u>	<u>(348)</u>	

Note: L.E.: Light Equipment 42 unit.  
H.E.: Heavy Equipment 20 unit.  
S.V.: Service Vehicle 4 unit.  
Tr : Transportation Eq. 80 unit.

TABLE C.3.2-7 LIST OF PROCUREMENT OF EQUIPMENT  
(Appendix) FOR ON-FARM FACILITY CONSTRUCTION

<u>Item</u>	<u>Quantity</u>	<u>Unit Cost</u> (P 1,000)	<u>Total Cost</u> (P 1,000)
<u>1. Foreign Currency Portion</u>			
Tractor, Crawler, 220HP	4	1,200	4,800
Tractor, Crawler, 140HP	8	700	5,600
Backhoe, Crawler, 0.4 cu.m	8	530	4,240
Motor grader, 75HP	7	430	3,010
Tire roller, 8 ton	7	280	1,960
Water tank truck, 10 <sup>4</sup> liters	2	180	360
Concrete mixer, 140 l	10	14	140
Dump truck, 6 ton	6	160	960
Pick-up truck, 3/4 ton	10	40	400
Station wagon	4	140	560
<u>Sub-total</u>	<u>66</u>		<u>22,030</u>
Spare parts (15%)			3,270
<u>Total</u>			<u>25,300</u>
<u>2. Local Currency Portion</u>			
Inland transportation	L.S.		500
Delivery charge	"		100
Others	"		100
<u>Total</u>			<u>700</u>
<u>Grand total</u>			<u>26,000</u>

Comment (5)

The scheme to provide supplemental water supply to Upper Maasim through a feeder canal from Lateral A of AMRIS needs further study; since the available head is only 2.90 meters while the length of the feeder canal is 15.40 km.

Explanation:

The scheme to provide supplemental water supply to Upper Maasim through a feeder canal from Lateral A of AMRIS is presented in detail in the following pages:

Main Report: Page III-35 (Canal Alignment)

Attached Drawing No.202 (Profile of Maasim Feeder Canal and Cordero Canal #1 and #2)

Appendix A : Page A.3-84, 85, 86 (Canal Alignment and Profile)

A.3-166 (Figure A.3.3-16)

A.3-168 (Figure A.3.3-18)

The scheme presented in the above sections are summarized as follows:

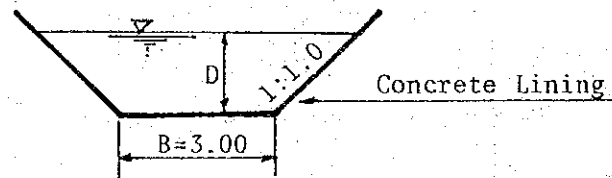
- ° Longitudinal slope of the canal is planned at 1/7,000 to 1/8,000. Hydraulic dimensions of the canal section as determined by this longitudinal slope are shown in Table 5-1. The velocity is about 0.7 m/sec, which can readily be regarded as an allowable velocity of the canals in general. As a result, the friction loss head becomes about 2.0 m when the length of the feeder canal is 15.40 km.
- ° 0.9 m has been allowed as a loss head at totally nine appurtenant structures, i.e., five siphons, one gate, and three aqueducts(Refer to Table 5-2)



- ° Concrete lining canal that can be easily operated and maintained in the future has been proposed considering that the longitudinal slope is relatively gentle, 1/7,000 to 1/1,800, and that the feeder canal is 15.40 km long.

This summary confirms that the available head of 2.90 m is sufficient relative to the length of the feeder canal of 15.40 km. It is considered that there will be no problem in the future in operation and maintenance of the canal.

TABLE 5-1 HYDRAULIC ELEMENTS OF MAASIM FEEDER CANAL

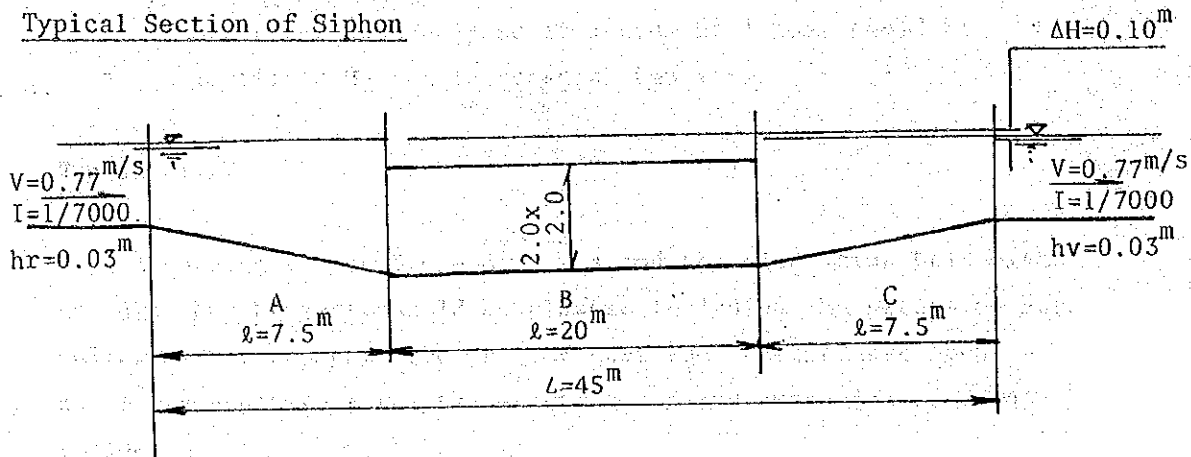


SECTION		Unit	LAT.A	LAT.A-1	PROPOSED
CANAL ELEMENT					
Design discharge	Q	m <sup>3</sup> /s	5.466	4.804	4.193
Gradient of canal	I	-	1/7000	1/8000	1/8000
Roughness coefficient	n	-	0.015	0.015	0.015
Water depth	D	m	1.56	1.50	1.41
Flow Area	A	m <sup>2</sup>	7.11	6.75	6.22
Velocity	V	m/s	0.77	0.71	0.67
Wetted perimeter	P	m	7.41	7.24	6.99
Hydraulic mean depth	R	m	0.960	0.932	0.890

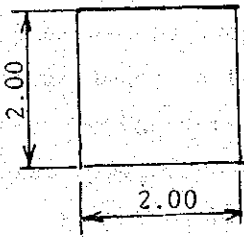
TABLE 5-2 HYDRAULIC CALCULATION OF SIPHON

Hydraulic Calculation of loss head can be calculated as shown below:

Typical Section of Siphon



Sectional Elements of Siphon



$$Q = 5.466 \text{ m}^3/\text{s}$$

$$n = 0.015$$

$$A = 2.0 \times 2.0 = 4.0 \text{ m}^2$$

$$V = 1.37 \text{ m/s} \quad h_v = \frac{1.37^2}{1 \times 9.8} = 0.099 \text{ m}$$

$$R = A/P = 4.0/2 \times 4 = 0.5$$

$$I = \left( \frac{n \cdot V}{R^{2/3}} \right)^2 = \left( \frac{0.015 \times 1.37}{0.5^{2/3}} \right)^2$$

$$\approx 0.0011$$

Loss

Section A  $\Delta H_A = 0.3\Delta h_v + I_m \cdot \ell$   
 $= 0.3(0.099-0.03) + (1/7000+0.0011) \times 1/2 \times 7.50$   
 $= 0.021 + 0.005 = 0.026 \text{ m}$

Section B  $\Delta H_B = I \cdot \ell = 0.0011 \times 20 = 0.022 \text{ m}$

Section C  $\Delta H_C = 0.5\Delta h_v + I_m \cdot \ell$   
 $= 0.5(0.099-0.03) + (1/7000+0.0011) \times 1/2 \times 7.50$   
 $= 0.040$

Total  $\Delta H = 0.088 \text{ m} \approx 0.100 \text{ m}$

As is shown in the above calculation, the required head losses needed for one siphon are calculated at  $0.10 \text{ m}$ .

Comment (6)

The cost of facilities for the extension area should be separated and analyzed if incremental cost could be justified by the incremental benefits.

Explanation:

According to the Scope of Works and the discussion held with the NIA, the Project should be planned including the extension area. Following the comment, the project cost and benefit have been estimated separately for the existing and the extension areas as follows:

Construction Cost for the Existing Area

Since the extension area scatters in the circumference of the Project area and is situated at the end of irrigation network, it is not possible to propose a plan that covers the extension area only. Construction cost for the existing area is shown in Table 6-1. With respect to the water resource facilities (diversion dam) and main and lateral canals, construction cost has been allocated based on the discharge ratio while the cost of on-farm facilities has been estimated based on the proportion of acreage.

Construction cost for the existing area only is 399 million pesos (Refer to Table 6-1).

Incremental Benefit for the Extension Area

The total Project area of 34,965 ha divided into the existing and the extension areas will be utilized as follows:

	<u>Existing Area</u>	<u>Extension Area</u>	<u>Total</u>
Area(ha)	31,485	3,480	34,965
Total Cultivated Area(ha)	59,778	4,010	63,788
Crop Intensity(%)	189.9	115.2	182.4

Incremental benefit for the existing and the extension area is estimated as follows:

(Unit: ₱ '000)		
<u>Existing Area</u>	<u>Extension Area</u>	<u>Total</u>
65,463	10,204	75,667

Economic Internal Rate of Return

With the above construction cost and incremental benefit, economic internal rate of return is estimated at 20.1% for the existing area only, 9.5% for the extension area only and 17.5% for the whole project area. This may be interpreted that implementation of the extension area only is not necessarily feasible from the economic viewpoint; however, as noted in Comment (1), it is considered the project should include the extension area as well considering the improvement of the socio-economic environment.

Existing Area Only	:	20.1%
Extension Area Only	:	9.5%
Whole Area	:	17.5%

Note) Refer to Tables 6-2, 6-3, and 6-4.

TABLE 6-1 SUMMARY OF THE PROJECT COST FOR EXISTING AREA

(Unit: ₱ '000)

<u>Description</u>	<u>Foreign Currency</u>	<u>Local Currency</u>	<u>Total</u>
1. Survey, Design	-	3,000	3,000
2. Civil Works	86,881	63,927	150,808
3. Procurement	26,540	820	26,360
4. Land Acquisition	-	1,742	1,742
5. Project Facilities	372	1,130	1,502
6. Institutional Development	277	14,054	14,331
7. Consulting Services	19,009	4,031	23,040
8. Administration	-	22,078	22,078
9. Physical Contingency	19,921	16,218	36,139
10. Price Escalation	43,000	77,000	120,000
<u>Total</u>	<u>195,000</u>	<u>204,000</u>	<u>399,000</u>

TABLE 6-2 ECONOMIC PROJECT COST BY YEAR FOR EXISTING AREA

(Unit: P '000)

Description	1st	2nd	3rd	4th	5th	6th	7th	Total
1. Preparation	1,538	615	308	-	-	-	-	2,461
2. Civil Works	-	20,337	20,189	33,305	28,694	25,523	11,698	139,746
3. Procurement Equipment	-	22,197	298	-	-	-	3,754	26,249
4. Land Acquisition	-	-	-	-	-	-	-	-
5. Project Facilities	1,306	-	-	-	-	-	-	1,306
6. Institutional Development	1,138	1,978	3,007	2,514	1,815	881	465	11,798
7. Consulting Services	9,467	4,722	2,334	1,659	1,374	1,698	1,059	22,313
<u>Sub-total (1 - 7)</u>	13,449	49,849	26,136	37,478	31,883	28,102	16,976	203,873
8. Administration	1,344	4,984	2,613	3,747	3,188	2,810	1,697	20,387
<u>Total (1 - 8)</u>	14,793	54,833	28,749	41,675	35,071	30,912	18,673	224,260
9. Physical Contingency	2,218	8,224	4,312	6,250	5,260	4,636	2,800	33,700
10. Price Escalation	-	-	-	-	-	-	-	-
<u>Grand Total</u>	<u>17,011</u>	<u>63,057</u>	<u>33,061</u>	<u>47,925</u>	<u>40,331</u>	<u>35,548</u>	<u>21,473</u>	<u>258,406</u>

TABLE 6-3 PROJECT ECONOMIC COST AND RETURN  
( PHILIPPINE AMRIS PROJECT )

( UNIT : THOUSAND PESO )

YEAR	PROJECT COST			INCREMENTAL BENEFITS (2)	PROJECT RETURN (3) =(2)-(1)	PRESENT WORTH VALUE (3)*DISCOUNT RATE	
	CAPITAL	O & M	TOTAL (1)			( 20 % )	( 21 % )
1 1984	17011.00	-1236.00	15775.00	0.0	-15775.00	-13145.84	-13037.20
2 1985	63057.00	-1236.00	61821.00	1963.00	-59858.00	-41568.10	-40883.90
3 1986	33061.00	-1236.00	31825.00	5891.00	-25934.00	-15008.12	-14639.11
4 1987	47925.00	-1236.00	46689.00	13747.00	-32942.00	-15886.41	-15367.75
5 1988	40331.00	-1236.00	39095.00	23566.00	-15529.00	-6240.77	-5987.13
6 1989	35548.00	790.00	36338.00	36004.00	-334.00	-111.86	-106.42
7 1990	21473.00	1143.00	22616.00	47133.00	24517.00	6842.27	6456.14
8 1991	0.0	1143.00	1143.00	56298.00	55155.00	12827.34	12003.44
9 1992	0.0	1143.00	1143.00	61535.00	60392.00	11704.42	10862.14
10 1993	0.0	1143.00	1143.00	64808.00	63665.00	10282.30	9463.50
11 1994	0.0	1947.00	1947.00	65463.00	63516.00	8548.54	7802.78
12 1995	0.0	6835.00	6835.00	65463.00	58628.00	6575.56	5952.32
13 1996	0.0	1143.00	1143.00	65463.00	64320.00	6011.63	5396.87
14 1997	0.0	1143.00	1143.00	65463.00	64320.00	5009.70	4460.23
15 1998	0.0	1143.00	1143.00	65463.00	64320.00	4174.75	3686.15
16 1999	0.0	1143.00	1143.00	65463.00	64320.00	3478.96	3046.41
17 2000	0.0	1143.00	1143.00	65463.00	64320.00	2899.14	2517.69
18 2001	0.0	1143.00	1143.00	65463.00	64320.00	2415.95	2080.74
19 2002	0.0	1143.00	1143.00	65463.00	64320.00	2013.29	1719.62
20 2003	0.0	1143.00	1143.00	65463.00	64320.00	1677.74	1421.18
21 2004	0.0	1947.00	1947.00	65463.00	63516.00	1380.64	1159.85
22 2005	0.0	1143.00	1143.00	65463.00	64320.00	1165.10	970.69
23 2006	0.0	1143.00	1143.00	65463.00	64320.00	970.92	802.22
24 2007	0.0	1143.00	1143.00	65463.00	64320.00	809.10	662.99
25 2008	0.0	1143.00	1143.00	65463.00	64320.00	674.25	547.93
26 2009	0.0	1143.00	1143.00	65463.00	64320.00	561.87	452.83
27 2010	0.0	1143.00	1143.00	65463.00	64320.00	468.23	374.24
28 2011	0.0	1143.00	1143.00	65463.00	64320.00	390.19	309.29
29 2012	0.0	1143.00	1143.00	65463.00	64320.00	325.16	255.61
30 2013	0.0	1143.00	1143.00	65463.00	64320.00	270.97	211.25
31 2014	0.0	1947.00	1947.00	65463.00	63516.00	222.98	172.41
32 2015	0.0	6835.00	6835.00	65463.00	58628.00	171.52	131.52
33 2016	0.0	1143.00	1143.00	65463.00	64320.00	156.81	119.25
34 2017	0.0	1143.00	1143.00	65463.00	64320.00	130.67	98.55
35 2018	0.0	1143.00	1143.00	65463.00	64320.00	108.90	81.45
36 2019	0.0	1143.00	1143.00	65463.00	64320.00	90.75	67.31
37 2020	0.0	1143.00	1143.00	65463.00	64320.00	75.62	55.63
38 2021	0.0	1143.00	1143.00	65463.00	64320.00	63.02	45.97
39 2022	0.0	1143.00	1143.00	65463.00	64320.00	52.52	38.00
40 2023	0.0	1143.00	1143.00	65463.00	64320.00	43.76	31.40
41 2024	0.0	1947.00	1947.00	65463.00	63516.00	36.01	25.63
42 2025	0.0	1143.00	1143.00	65463.00	64320.00	30.39	21.45
43 2026	0.0	1143.00	1143.00	65463.00	64320.00	25.33	17.73
44 2027	0.0	1143.00	1143.00	65463.00	64320.00	21.10	14.65
45 2028	0.0	1143.00	1143.00	65463.00	64320.00	17.59	12.11
46 2029	0.0	1143.00	1143.00	65463.00	64320.00	14.66	10.01
47 2030	0.0	1143.00	1143.00	65463.00	64320.00	12.21	8.27
48 2031	0.0	1143.00	1143.00	65463.00	64320.00	10.18	6.83
49 2032	0.0	1143.00	1143.00	65463.00	64320.00	8.48	5.65
50 2033	0.0	1143.00	1143.00	65463.00	64320.00	7.07	4.67
TOTAL	258406.00	59502.00	317908.00	2929465.00	2611557.00	816.51	-6436.94

$I E R R = 20 \dots 20 + 816.51 / ( 816.51 + 6436.94 ) = 20.11$



TABLE 6-4 PROJECT ECONOMIC COST AND RETURN  
( PHILIPPINE AMRIS PROJECT )

( UNIT : THOUSAND PESO )

YEAR	PROJECT COST			INCREMENTAL BENEFITS (2)	PROJECT RETURN (3) =(2)-(1)	PRESENT WORTH VALUE (3)*DISCOUNT RATE	
	CAPITAL	O & M	TOTAL (1)			( 9 % )	( 10 % )
1 1984	4490.00	1040.00	5530.00	0.0	-5530.00	-5073.40	-5027.28
2 1985	20021.00	1040.00	21061.00	1734.00	-19327.00	-16267.18	-15972.75
3 1986	12036.00	1040.00	13076.00	2040.00	-11036.00	-8521.84	-8291.53
4 1987	20992.00	1040.00	22032.00	3877.00	-18155.00	-12861.51	-12400.15
5 1988	7112.00	1040.00	8152.00	1224.00	-6928.00	-4502.75	-4301.76
6 1989	8143.00	1543.00	9686.00	1326.00	-8360.00	-4984.82	-4719.03
7 1990	665.00	1543.00	2208.00	10204.00	7996.00	4374.12	4103.24
8 1991	0.0	1543.00	1543.00	10204.00	8661.00	4346.70	4040.45
9 1992	0.0	1543.00	1543.00	10204.00	8661.00	3987.80	3673.14
10 1993	0.0	1543.00	1543.00	10204.00	8661.00	3658.53	3339.22
11 1994	0.0	1543.00	1543.00	10204.00	8661.00	3356.46	3035.66
12 1995	0.0	1543.00	1543.00	10204.00	8661.00	3079.32	2759.69
13 1996	0.0	1543.00	1543.00	10204.00	8661.00	2825.07	2508.81
14 1997	0.0	1543.00	1543.00	10204.00	8661.00	2591.81	2280.74
15 1998	0.0	1543.00	1543.00	10204.00	8661.00	2377.81	2073.40
16 1999	0.0	1543.00	1543.00	10204.00	8661.00	2181.48	1884.91
17 2000	0.0	1543.00	1543.00	10204.00	8661.00	2001.36	1713.56
18 2001	0.0	1543.00	1543.00	10204.00	8661.00	1836.11	1557.78
19 2002	0.0	1543.00	1543.00	10204.00	8661.00	1684.51	1416.17
20 2003	0.0	1543.00	1543.00	10204.00	8661.00	1545.42	1287.43
21 2004	0.0	1543.00	1543.00	10204.00	8661.00	1417.82	1170.39
22 2005	0.0	1543.00	1543.00	10204.00	8661.00	1300.75	1063.99
23 2006	0.0	1543.00	1543.00	10204.00	8661.00	1193.35	967.26
24 2007	0.0	1543.00	1543.00	10204.00	8661.00	1094.82	879.33
25 2008	0.0	1543.00	1543.00	10204.00	8661.00	1004.42	799.39
26 2009	0.0	1543.00	1543.00	10204.00	8661.00	921.49	726.72
27 2010	0.0	1543.00	1543.00	10204.00	8661.00	845.40	660.66
28 2011	0.0	1543.00	1543.00	10204.00	8661.00	775.60	600.60
29 2012	0.0	1543.00	1543.00	10204.00	8661.00	711.56	546.00
30 2013	0.0	1543.00	1543.00	10204.00	8661.00	652.81	496.36
31 2014	0.0	1543.00	1543.00	10204.00	8661.00	598.91	451.24
32 2015	0.0	1543.00	1543.00	10204.00	8661.00	549.46	410.22
33 2016	0.0	1543.00	1543.00	10204.00	8661.00	504.09	372.93
34 2017	0.0	1543.00	1543.00	10204.00	8661.00	462.47	339.02
35 2018	0.0	1543.00	1543.00	10204.00	8661.00	424.28	308.20
36 2019	0.0	1543.00	1543.00	10204.00	8661.00	389.25	280.19
37 2020	0.0	1543.00	1543.00	10204.00	8661.00	357.11	254.71
38 2021	0.0	1543.00	1543.00	10204.00	8661.00	327.63	231.56
39 2022	0.0	1543.00	1543.00	10204.00	8661.00	300.57	210.51
40 2023	0.0	1543.00	1543.00	10204.00	8661.00	275.76	191.37
41 2024	0.0	1543.00	1543.00	10204.00	8661.00	252.99	173.97
42 2025	0.0	1543.00	1543.00	10204.00	8661.00	232.10	158.16
43 2026	0.0	1543.00	1543.00	10204.00	8661.00	212.94	143.78
44 2027	0.0	1543.00	1543.00	10204.00	8661.00	195.35	130.71
45 2028	0.0	1543.00	1543.00	10204.00	8661.00	179.22	118.83
46 2029	0.0	1543.00	1543.00	10204.00	8661.00	164.43	108.02
47 2030	0.0	1543.00	1543.00	10204.00	8661.00	150.85	98.20
48 2031	0.0	1543.00	1543.00	10204.00	8661.00	138.39	89.28
49 2032	0.0	1543.00	1543.00	10204.00	8661.00	126.97	81.16
50 2033	0.0	1543.00	1543.00	10204.00	8661.00	116.48	73.78
TOTAL	73459.00	74635.00	148094.00	459177.00	311083.00	3512.27	-2901.76

LERR = 10 + 9 + 3512.27 / ( 3512.27 + 2901.76 ) = 9.55

Comment (7)

On page C.5-14. Table C.5.3-4, Summary of Crop Production Cost, fertilizers are given in N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O while agro-chemicals are in different brand names. In agro-chemicals, the cost may be lumped as one regardless of the brand. In the future with or without project, there is no certainty on the existence fo these brands or might be shifting of usage to other brands. Likewise, these data should be included in the Agronomy portion of the report.

Explanation:

Brand names of insecticide and herbicide indicated in Appendix Table C.5.3-4 have been erased as suggested and will be lumped as agro-chemicals(See Table 7-1). In regard to the comment that these data should be included in the Agronomy portion of the report, since this table presents economic cost of production inputs necessary for the economic analysis, it appears to justify the inclusion of table in the chapter on Project Evaluation. However, the title of table will be altered into "Table C.5.3-4 SUMMARY OF CROP PRODUCTION COST (ECONOMIC). But reference is made to Appendix C(Chapter I. Agricultural Development) which involves the quantitative description of agro-chemicals.

TABLE 7-1 SUMMARY OF CROP PRODUCTION COST (ECONOMIC)

(Unit: Pesos)

Cropping Pattern Season Method	Without Project				With Project										
	A.B.		A.B.E.		A.B.C.D.		A.B.D.E.		C						
	Wet Season		Dry Season		Wet Season		Dry Season		Green Corn		Yellow Corn		Water Melon		Pole Sitap
	T.P.	D.S.	T.P.	D.S.	T.P.	D.S.	T.P.	D.S.	T.P.	D.S.	T.P.	D.S.	T.P.	D.S.	
Seed	200.0	260.0	200.0	260.0	120.0	160.0	120.0	160.0	24.8	37.1	50.0	150.0			
Fertilizers															
N	672.1	780.2	780.2	780.2	780.2	780.2	780.2	780.2	629.8	1,043.4	1,043.4	780.2			
P <sub>2</sub> O <sub>5</sub>	120.4	120.4	120.4	120.4	352.6	352.6	266.6	266.6	180.6	361.2	361.2	352.6			
K <sub>2</sub> O	50.4	50.4	50.4	50.4	75.6	75.6	75.6	75.6	75.6	151.2	151.2	75.6			
Sub-total	842.9	842.9	951.0	951.0	1,208.4	1,208.4	1,263.4	1,263.4	886.0	1,555.8	1,555.8	1,208.4			
Agro-chemicals															
Sub-total	360.1	360.1	360.1	360.1	360.1	360.1	360.1	360.1	237.6	435.6	180.0	3,070.0			
Machineries															
Land preparation	1,143.0	1,143.0	1,143.0	1,143.0	1,694.6	1,694.6	1,694.6	1,694.6	458.0	458.0	458.0	458.0			
Spraying	45.0	45.0	45.0	45.0	67.5	67.5	67.5	67.5	24.0	24.0	48.0	240.0			
Threshing/Shelling	213.0	213.0	255.6	255.6	255.6	255.6	319.5	319.5	-	265.0	-	-			
Sub-total	1,401.0	1,401.0	1,443.6	1,443.6	2,017.7	2,017.7	2,081.6	2,081.6	482.0	747.0	506.0	998.0			
Draft Animal	52.5	52.5	52.5	52.5	25.0	25.0	25.0	25.0	175.0	175.0	75.0	175.0			
Hired Labor	337.4	214.3	362.9	243.8	359.6	240.5	400.6	287.4	90.3	156.0	197.0	541.9			
Miscellaneous	168.1	165.2	176.9	174.0	215.2	211.3	223.3	219.5	403.3	403.5	357.2	373.7			
Total	3,362.0	3,296.0	3,547.0	3,485.0	4,306.0	4,223.0	4,474.0	4,397.0	2,299.0	3,510.0	2,921.0	6,217.0			

Note : T.P. : Transplanting ; D.S. : Direct Seeding.



