CHAPTER 4 PROJECT PLANNING AND DESIGNING

This chapter addresses the detailed plan of the project components namely: 1) the agricultural development and extension service delivery, 2) the irrigation and drainage system development together with countermeasures against flood damages, and 3) the infrastructure improvement on water distribution, as well as the outline designs of major facilities for the implementation of these components. As the flood simulation have reached a conclusion that the dike construction is not technically and financially feasible, only the countermeasures against damages to be caused in LMSA by flood are to be discussed in this chapter: **(It is noted that non-disclose information for 3-year is included in this chapter as procurement by the Philippines government is scheduled.)**

4.1 Direction Setting and Major Project Components

4.1.1 Lessons Learnt and Impacts from MMIP I

Lessons learnt from MMIP I and impacts produced by the same Project can be summarized as follows. They are drawn from results of: Special Assistance for Project Formation (SAPROF) Study (May 2010), interviews to relevant organizations including NIA-PMO and ATI Kabacan, and will be fed-forwarded in the planning and designing of the remaining part of MMIP II. In addition, issues arisen from the on-going MMIP II should be also addressed in this section.

Lessons learnt:

a) Inundation in the lower part of Maridagao Service Area;
b) Land acquisition for canals and drainages (Right-of-Way);
c) Uneven benefit distribution (e.g. SEED MALMAR);
d) Difficulty of constructing on-farm ditches by farmers; and
e) Delay in contractors' construction progress.

Impacts from MMIP I:

a) Increase of agriculture production, whereby income increase;
b) Improved access to markets facilitated by canal maintenance roads and intra-site roads;
c) Food sufficiency and livelihood sustainability; and
d) Contribution to peace and order condition.

The following are details of the lessons learnt and impacts from MMIP I are illustrated.

1) Lessons learnt

1.1) Inundation in the lower part of Maridagao Service Area,

Figure 4.1.1 shows the land use map made through the analysis of satellite images for the period from February to July 2016, namely for the dry season of 2016. The areas highlighted with purple color are swampy areas, or water body areas, spreading in the mid-downstream of the MSA. In fact, these areas are lower in elevation compared to the

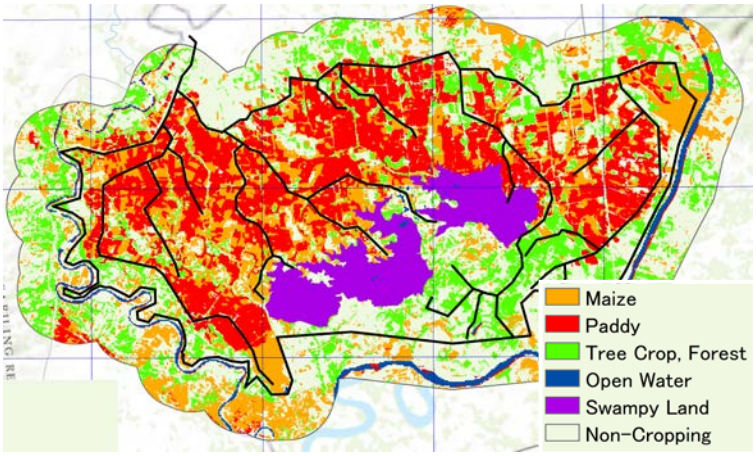


Figure 4.1.1 Land Use Map of the dry season in 2016, made with satellite images
Source: JICA Survey Team

neighboring areas, and therefore, they tend to be inundated especially during the rainy season.

However, even in the dry season, these areas remained as inundated. One of the reasons for the inundation is the extra water irrigation practice. The paddy cultivation requires ponding water, and therefore, for the paddy cultivation, extra water irrigation practice tends to be seen in many places.

Likewise, as the MMIP II area does not require so much water being still under the construction, the water volume taken at the diversion dam is much more than what is needed in the completed MMIP I area. Therefore, at this moment there is no incentive to save irrigation water for user farmers, and this is leading to extra water application to their farms. Worse, in many cases, there are turnouts which have not been equipped with gates, although these gates were once installed; they have been stolen. With these open or uncontrolled turnouts, water is continuously running and finally stagnated in lower places.

The situation mentioned above may have contributed to a low rate of the irrigated area against the irrigable area. In 2016, the rate of the irrigated area against the irrigable area reached to 58.5% and 59.1% for the rainy and the dry season, respectively. There may be other reasons for such low rates in the application of irrigation, such as inadequate experience, farm tools, financial capacity in the user farmers to manage irrigated paddy fields. To reduce the extra water irrigation cases and also to enhance the drainage functions could contribute to an expansion of the cropped area.

Table 4.1.1 Cropped Area in the Dry and Rainy Seasons (2016)

Particular	Irrigable Area	Rainy Season (2016)	Dry Season (2016)
Area (ha)	5,562	3,256	3,233
Percent	100.0	**58.5**	**59.1**

Source: JICA Survey Team

There are lower areas/ spots where they are easily inundated within the MMIP II area, especially, the southern parts of the LMSA which have been inundated many times in the past by flooding from the Pulangi river. Should this situation continue in LMSA, southern parts of the area would turn into swampy area, and thus irrigated cultivation can be hardly practiced. In the MMIP II area as well as completed MMIP I area, water distribution should be well controlled with the installation and sound operation of gates together with the drainage system establishment.

1.2) Land Acquisition for Canals and Drainages (Right-of-Way: ROW)

Major problems regarding ROW of MMIP I were experienced during its implementation period[1]: 1) multi-claimants from the same family members for the land ownership; 2) multi-claimants from two or more parties for the ownership of untitled pieces of land; and 3) multiple land title certificates on the same piece of land or certificates of paid local taxes on untitled pieces of land.

Majority of the beneficiaries of MMIP I does not have much knowledge of required procedures for issuance and transfer of land titles, since, traditionally, the only evidence for the transfer of land ownership was through word-of-mouth by the few living witnesses.

In order to avoid any ROW problems, parcellary maps for the project sites should be prepared prior to the construction works, and the negotiation for ROW arrangements should be started base on the maps. Those maps can also contribute to define the actual irrigable area as well as the potential members of future Irrigators Associations (IAs).

[1] Referred to SAPROF study, May 2007, also confirmed through interviews to NIA-PMO

1.3) Uneven Benefit Distribution (e.g. SEED MALMAR)

Uneven distribution of benefits to farmers has brought negative impact[2]. In 2004, the Special Economic Enhancement and Development for Malitubog and Maridagao (SEED-MALMAR) Program provided farmers with farming equipment, inputs, machineries and trainings. The equipment procured by the Provincial Government under the same program was transferred to the IA Federation established in the MMIP I area for further distribution to each of the IAs. However, the equipment and inputs were distributed in an arbitrary way to IA members, in accordance with preference of IA leaders in most of the IAs, while there were no transparent distribution rules and mechanisms put into place. This incidence resulted in conflicts between benefitted and non-benefitted farmers[3].

MMIP II will have the agriculture component, and therefore, for example, farming inputs, when arranged, shall be distributed in an equitable manner to all the IA members, or only to poorer farmers, when the budget is limited. Likewise, there should be put into place a revolving mechanism in which beneficiaries shall pay back the due out of his/her produce so that other farmers can be next beneficiaries with the revolved resources.

1.4) Difficulty of Constructing On-farm Ditches by Farmers,

In NIA's national irrigation system, the on-farm ditches composed of main and supplemental farm ditches are supposed to be constructed by the beneficiary farmers, while the irrigation facilities from the diversion up to the turnouts should be constructed by NIA. In fact, supplementary farm-ditches could be constructed by farmers with simple tools like hoe. However, farmers tend to face difficulties in the construction of main-farm ditches due to their size (see typical section and photos of farm ditches).

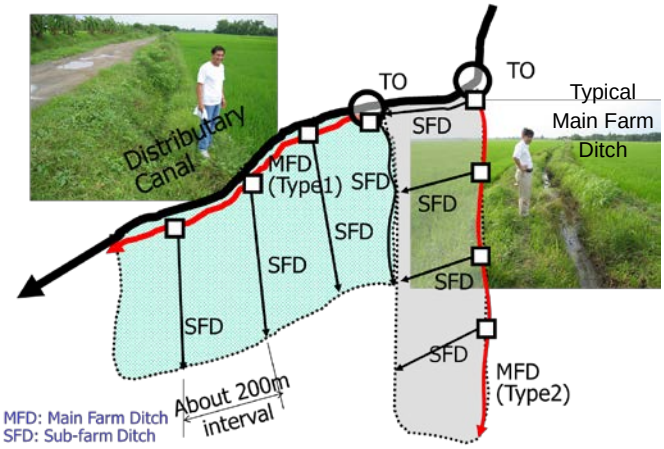


Figure 4.1.2 Typical On-farm Ditch Arrangement
Source: JICA Survey Team

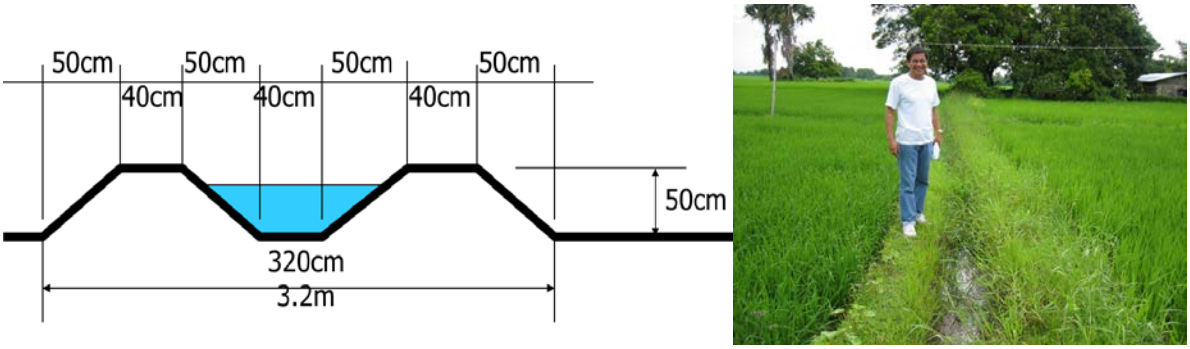


Figure 4.1.3 Typical Cross Section of Main Farm Ditch (Left) and Typical Supplementary Farm Ditch (Right)
Source: JICA Survey Team

Since the beneficiary farmers cannot afford to construct main farm ditches, NIA-PMO would construct the main farm ditches, too, while farmers would remain with the responsibility for the construction of

[2] Referred to the SAPROF study, May 2007
[3] Originally, the monitoring and advisory group of SEED-MALMAR requested for PhP 369 Million fund to different concerned agencies but was only allocated PhP 20 million. This limited fund available at that time was also one of the reasons behind the uneven distribution of the procured equipment and materials.

supplementary ditches. Or, alternatively, farmers bear fuel cost while NIA-PMO deploys small backhoes to construct the main farm ditches. In this regard, the MMIP II project should procure and rent small size backhoes to be used in the construction of main farm ditches.

1.5) Delay in Contractors' Construction Progress

There are considerable delays in the current construction works under MMIP II. For example, 16 packages were contracted out to local private construction companies during the fiscal year of 2015 with the contract effective dates of June 15, 2015 for all the packages. The contracts expiry dates were set between October 2015 and April 2016, depending upon the contract size. Surprisingly, all the 16 packages had not been accomplished within the original contract periods, and therefore, the contracts for 15 packages were extended until June 30, 2017 (more than one-year extension), while another remaining package was extended only until March 15, 2016. As of mid May 2017, in fact, there are packages whose accomplish rate has not reached even to 50%, though the contract expiry dates have already passed.

Table 4.1.2 Progress of Procured Packages in 2015 and 2016

Package	Amount (PhP)	Effective Date	Original Duration	Revised Duration	Contract Expiry Date	Achievement rate (%) as of May 15, 2017
Procured in 2015			Days	days		
Package 1	[redacted]	15-Jun-15	300	655	31-Mar-17	80.59
Package 2	[redacted]	15-Jun-15	300	655	31-Mar-17	69.07
Package 3	[redacted]	15-Jun-15	300	655	31-Mar-17	76.07
Package 4	[redacted]	15-Jun-15	300	655	31-Mar-17	72.23
Package 5	[redacted]	15-Jun-15	240	655	31-Mar-17	50.00
Package 6	[redacted]	15-Jun-15	180	655	31-Mar-17	45.25
Package 7	[redacted]	15-Jun-15	240	746	30-Jun-17	45.00
Package 8	[redacted]	15-Jun-15	180	655	31-Mar-17	56.23
Package 9	[redacted]	15-Jun-15	180	565	31-Dec-17	60.00
Package 10	[redacted]	15-Jun-15	210	655	31-Mar-17	87.34
Package 11	[redacted]	15-Jun-15	180	655	31-Mar-17	100.00
Package 12	[redacted]	15-Jun-15	150	655	31-Mar-17	98.00
Package 13	[redacted]	15-Jun-15	120	655	15-Mar-16	100.00
Package 14	[redacted]	15-Jun-15	120	655	31-Mar-17	84.00
Package 15	[redacted]	15-Jun-15	240	655	31-Mar-17	53.00
Package 16	[redacted]	15-Jun-15	240	655	31-Mar-17	45.69
Procured in 2016						
Package 1	[redacted]	15-Aug-16	180	319	30-Jun-17	12.33
Package 2	[redacted]	15-Aug-16	180	319	30-Jun-17	2.77
Package 3	[redacted]	15-Aug-16	180	319	30-Jun-17	20.31
Package 4	[redacted]	15-Aug-16	180	319	30-Jun-17	6.69
Package 5	[redacted]	15-Aug-16	180	319	30-Jun-17	9.91
Package 6	[redacted]	15-Aug-16	180	319	30-Jun-17	3.12
Package 7	[redacted]	15-Aug-16	180	319	30-Jun-17	20.72
Package 8	[redacted]	15-Aug-16	180	319	30-Jun-17	8.90
Package 9	[redacted]	15-Aug-16	180	319	30-Jun-17	1.70
Package 10	[redacted]	15-Aug-16	180	319	30-Jun-17	0.97
Package 11	[redacted]	15-Aug-16	180	319	30-Jun-17	10.24
Package 12	[redacted]	15-Aug-16	120	319	30-Jun-17	13.88
Package 13	[redacted]	15-Aug-16	100	319	30-Jun-17	6.23
Package 14	[redacted]	15-Aug-16	120	319	30-Jun-17	2.72
Package 15	[redacted]	15-Aug-16	120	319	30-Jun-17	2.68
Package 16	[redacted]	15-Aug-16	150	319	30-Jun-17	10.23
Package 17	[redacted]	11-Nov-16	120	319	30-Jun-17	2.01
Package 18	[redacted]	15-Aug-16	100	319	30-Jun-17	7.32

Source: NIA-PMO

Delays in the construction works again took place with the construction packages procured in 2016 as well. In the fiscal year of 2016, a total of 18 packages was contracted out to local civil contractors on the same date of August 15, 2016. Though the contract expiry dates were set between November 2016

and March 2017, none of the packages were completed within the agreed dates. Worse, Notice of Termination could have been issued in accordance with the guideline of NIA to the 15 packages out of the 18 could have been issued due to serious delay in the schedule.

Most of the contractors are local firms from Midsayap, Pikit, Kabacan, Davao, and other cities, and it seems that their financial capacity may be a hampering factor for them to meet the contract expiry dates. Therefore, it is recommended that the package size should be designed large enough to attract bigger civil contractors, who could associate with local companies to join the bidding. The contract amount per packages for the 2016 procurement ranges from PhP [redacted] to PhP [redacted], and the majority of packages amounted to almost PhP [redacted]. The amounts were not attractive enough for the target contractors, and the size of packages should be made bigger.

2) Impacts from MMIP I

2.1) Increase in Agriculture Production and Income

Prior to the implementation of MMIP I, the local people used to cultivate rain-fed corn and paddy in those areas where water was available. The data allow us to compare the situations before and after MMIP I are not available, however, the difference in yields before and after the project can be summarized as follows, based on the results of surveys conducted by YLTA and the SAPROF team.

Table 4.1.3 Differences in paddy yields before and after MMIP I

Particulars	Rain-fed (Without Project) (t/ha)			Irrigated (with Project) (t/ha)		
Project/ Program	Dry	Rainy	Year-round	Dry	Rainy	Year-round
YLTA Terminal Report (ATI)	NA	NA	2.93	5.52	5.63	5.63
SAPROF Report (May, 2007)	NA	2.00	2.00	4.95	4.77	NA

Source: YLTA Terminal Report, JBIC SAPROF Report (May 2007)

As shown in table above, year-round yield of 2.93 ton/ha was increased to as high as 5.63 ton/ha, increased by 1.9 times under the YLTA program. Also, the SAPROF team confirmed that the rainy season paddy yield was increased more than double from 2.0 ton/ha to 4.77 ton/ha after MMIP I. Through this simple comparison, it can be said that gross profit of the farmers cultivating paddy was almost doubled after the completion of MMIP I.

Table 4.1.4 shows differences in the unit profitability of rain-fed paddy and corn per hectare. Rice is cultivated with irrigation in those farms, where rain-fed corns were cultivated previously, as rice is more profitable. The average net profit of rain-fed paddy can be estimated as PhP 24,896/ha, with the disaggregation of PhP 29,796/ha for the rainy season and PhP 19,996/ha in the dry season. For corn, the average net profit is PhP 16,115/ha disaggregating of PhP 17,454/ha and PhP 14,774/ha in the rainy and dry seasons, respectively.

Table 4.1.4 Differences in Net Profit of Rain-fed Paddy, Corn and Irrigated Paddy

Crops	Financial Gross Profit per ha (PhP)	Financial Cost per ha (PhP)	Financial Net Profit per ha (PhP)	Average PhP/ha
Rain-fed Paddy, Rainy	54,880	25,084.5	**29,795.5**	24,896
Rain-fed Paddy, Dry	45,080	25,084.5	**19,995.5**	
Rain-fed Corn, Rainy	33,500	16,046.0	**17,454.0**	16,115
Rain-fed Corn, Dry	30,820	16,046.0	**14,774.0**	
Irrigated Paddy wo/YLTA, Rainy	75,200	31,557.9	**43,642.1**	43,642 (1.75, 2.71)
Irrigated Paddy wo/YLTA, Dry	75,200	31,557.9	**43,642.1**	
Irrigated Paddy, w/YLTA Rainy	88,360	36,291.6	52,068.4	
Irrigated Paddy, w/YLTA Dry	84,600	36,291.6	48,308.4	

Source: YLTA Terminal Report, JBIC SAPROF Report (May 2007)

With the MMIP I completed, farmers are expected to grow irrigated paddy 2 times in a year, and therefore the net profit of irrigated paddy is estimated at PhP 43,642/ha (average of rainy and dry). It means that the change from rain-fed paddy to irrigated paddy increases the farmer's net profit to 175%

and further the change from rain-fed corn to irrigated paddy increases the net profit to 271%.

2.2) Improved Access to Markets facilitated by Canal Maintenance and Intra-site Roads

The provision of roads along the canal and access roads linking canal roads with Barangay roads has made the inhabitants transport farm products easily to markets. The length of canal roads in MMIP I area stretches over 70 km and access roads over 22 km with a total of 92 km road in Maridagao Service Area. With the improved road condition, transport of agriculture produces can be done at lower price[4].

Further, children now have wider access to formal educational privileges in primary and elementary level provided by the Government. The provision of roads and bridges made the children commute with the nearest Barangay or Municipality to reach their educational facilities. Parents are proud of and confident of sending children to primary and elementary schools because there is a feeling of peace in the area.

The opening of access roads to service road areas promotes the physical inter-intra integration among the conflict affected communities. This has resulted in the attraction of some temporary populations both during construction and during peak periods of agricultural labor demands. Mobility and transfer of goods and commodities were also improved. With the increasing population, more social service facilities will be needed. Through the implementation of the MMIP I, the social structure and activities could gain grounds based on activated local economy.

2.3) Contribution to Peace and Order Condition

There may be a difficulty of finding out direct relationship between the MMIP I and peace and order establishment in the area. However, there may be a possibility that the MMIP I has contributed to sustain peace and order once, for example, cessation of hostilities were agreed upon. As a matter of fact, for decades, the Project area was a ground for armed encounters between the Armed Forces of the Philippines (AFP) and the Moro National Liberation Front (MNLF), and then Moro Islamic Liberation Front (MILF). This condition was further aggravated by the constant occurrence of conflicting clans and tribes.

However, according to SAPROF report (May 2007), it is said that with the implementation of the MMIP I and the continued commitment of the Government to effect peace and development in the region, the peace and order condition were drastically improved. The project area was declared a zone of peace and therefore, the implementation of MMIP I was regarded by many local people as a development project that promoted the building of a community of peace.

The members of MNLF and MILF are basically such people who engaged themselves in fighting once ordered or once incident takes place, however otherwise they engage themselves in raising their own livelihood. It means that when the cessation of hostilities is agreed upon, they may tend to return to their livelihood, which is basically farming. The last major conflict recorded between MILF and AFP in and around the Project site was in 2003. The delivery of irrigation water by MMIP I, according to NIA-PMO, served as turning point for several MILF members who had returned and resumed the livelihood, farming and also fisheries to some extent.

4.1.2 Project Implementation Schedule

MMIP I was completed in year 2011, and at the same time construction in MMIP II was launched

[4] During SAPROF survey, it was confirmed that prior to canal road construction, according to interviews with local residents, they used to pay 35 Pesos to 45 Pesos per bag of rice for carabaos with sled from farm to market depending on distance. Upon completion of the roads within MMIP I area, the inhabitants can sell rice with only the cost of P25 Pesos per bag.

starting with UMSA. The construction of the Upper Malitubog irrigation facilities was completed in 2016, and also the construction moved into PESA and a mid-eastern part of Lower Malitubog Service Area in year 2015.

Further, the central part of the LMSA launched the construction in 2016, and then, as of May 2017, tendering for the most western part of LMSA had been completed, and the construction was commenced within the year 2017. In year 2018, NIA is planning to start such works as dredging of Calawag creek running almost along northern boundary of LMSA. Those works are to require minimum 2 years, or even more than 3 years, till the completion from the commencement taking into account the capacity of the contractors available.

Following chart illustrates the past construction progress by service area and current on-going and estimated future construction plan. In this schedule, since ODA request was officially withdrawn on June 21, 2018, all the remaining works are to be managed by NIA's budget within the NEDA approved budget of PhP 5,444,850,000.00. With this, the remaining part is to start in 2019 and continue up to year 2023, requiring almost 4-year implementation based on the on-going experiences.

Table 4.1.5 Implementation Schedule

Construction of MMIP I & MMIP II	Area, ha	Progress	1990	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Maridagao Service Area	5,562	Completed in 2011															
Upper Malitubog Service Area (MMIP I)	1,611																
Upper Malitubog Service Area (MMIP II)	2,958	Target															
		Actual															
Pagalungan Extension Service Area	988	Target															
		Actual															
Lower Malitubog Service Area (LMSA)	6,590																
Mid-eastern part	1,303	Target															
		Actual															
Central Part	1,736	Target															
		Actual															
Western Part	1,418	Target															
		Actual															
Eastern Part (remaining area)	2,133	Target															

Source: NIA-PMO, JICA Team

Estimated

4.1.3 MMIP II Delineation and Components

As the flood simulation revealed (see Chapter 3), there should be NO dike construction for the purpose of protecting the LMSA from flood coming from the Pulangi river. This is because, as afore-explained in Chapter 3, 1) the dike construction may need foundation treatment which raises construction cost beyond the economic viability, 2) rainfall on the LMSA will accumulate therein whereby inland inundation would take place which accordingly reduces the beneficiary area of LMSA, and 3) other means e.g. dreading of the Pulangi river and/or pumping of the accumulated inland inundation would also go beyond economic viability.

Therefore, this Survey recommends that in any case NO dike should be constructed, and instead 2 cases of development of irrigation networks for the LMSA should be explored; i.e. 1) construct the irrigation network up to the peripheral delineated, within which the paddy cultivation can still be managed with allowable inundation depth (usually maximum 50cm), and 2) construct the irrigation network as originally planned. For the latter case (Case-2), lower parts of the irrigation network will be inundated every year during rainy season, however during dry season full beneficial area could be cultivated on condition that damaged parts during the rainy season are to be well maintained/ repaired.

As for drainages, all the planned drainage canals should be recommended to construct for the both Case 1 and Case 2 in order to facilitate the dry season paddy cultivation. With the well-established drainage networks draining out to the Pulangi river, dry up of the wet lands inundated during rainy season could be facilitated, so that the dry season paddy cultivation could be started as planned. However, it is noted that maintenance of drainage canals should be well financed as every year inundation would definitely increase the cost as compared to commonly developed irrigation systems seldom affected by flooding.

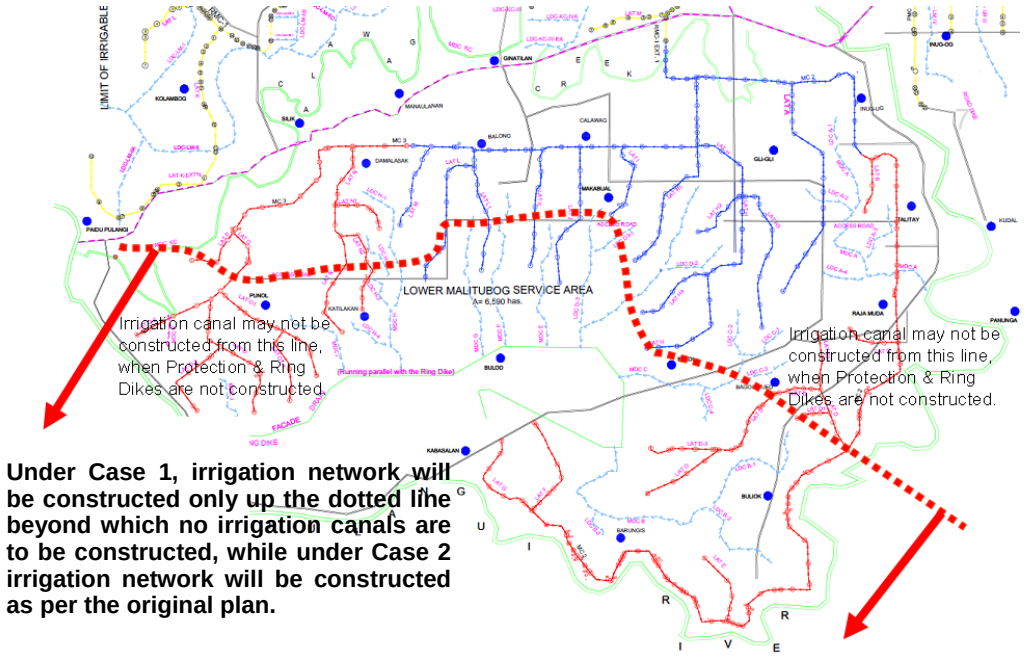


Figure 4.1.4 Conceptual Irrigation Development of Case 1 and Case 2
Source: JICA Survey Team

Given the 2 cases for the LMSA irrigation development, the major component is, no doubt, the irrigation and drainage installment for the remaining areas of LMSA. The LMSA is sub-divided into 4 parts in terms of contractor procurement year, meaning commencement year of the civil works. The construction works have continued since 2015, and as of July 2018, the untouched area is the only eastern part of the LMSA. Note that construction in the most western part has not yet started within 2017, however tendering for the civil contractor had already been held in May 2017. Therefore, the contractor procurement for the western part had been completed within 2017, and actual construction works started in 2018.

Taking into account what was mentioned above and also the current condition of MMIP I and MMIP II which had been already completed somewhat ago, the remaining construction area and the components are to be as follows:

1) Irrigation and drainage development of the remaining area of LMSA in which there should be 2 cases; namely, 1) development of irrigation canals within a limited LMSA where paddy can be cultivated even during rainy season, and 2) development of irrigation canals as per the original plan under which dry season cultivation could be made as per the original plan while rainy season cultivation would be restricted due to the flooding. In the most eastern part of LMSA, still untouched area as of 2018 and originally requested area for ODA loan, main canal (MC 2) and associated lateral canals should be constructed according to the coverage by case, and main drainage canal and lateral drainage canals are to be constructed as per the original plan.

2) Distribution infrastructure improvement (construction of intra-roads), which works as

farm-to-market road in order to ship produced agricultural commodities out of the farmlands as well as facilitate rural population's mobility especially during rainy season, in which roads become muddy and impassable,

3) Agriculture and extension development to facilitate the beneficiary farmers able to well utilize irrigation water, whereby 2 times irrigated paddy cultivation is to be established in the MMIP II area. Note that this agriculture and extension development activity should cover not only the remaining eastern part of LMSA but also whole MMIP areas which have not yet received any agriculture extension services by, e.g. YLTA.

4) Other related works in line with the irrigation development, i.e. parcellary mapping, IA establishment, which are conducted by NIA-PMO and maintenance office. Note that these activities are to be implemented as a part of project management/ administration.

5) Rehabilitation and, to some extent, improvement of irrigation and drainage facilities in the MMIP I area since the construction of MMIP I started in 1990 whereby there are facilities already aged and in need of rehabilitation,

6) Improvement of irrigation and drainage facilities in the MMIP II already completed area, namely, Upper Malitubog Service Area, which could be, for example, partial concrete lining for large lateral canals, bifurcation points, branching points and points where there are hydraulic structure, and

7) Procurement of machineries to be used for the maintenance of irrigation facilities of MMIP I and also MMIP II, e.g., excavator, dump truck, etc.

Of them above, No.1 is the major project component, which is the construction and development of the irrigation and drainage facilities in the untouched area of LMSA. The sub-component of No.2 is a sort of rural infrastructure, which can facilitate transportation of agriculture produces and mobility of local population. Sub-component No.3 is conducted by ATI in collaboration with NIA-PMO and Cotabato Irrigation Management Office, which could complement irrigated agriculture promotion. Further, No.4 activity should be implemented in line with the irrigation development. These 4 sub-components are the highest priorities among above 7 sub-components, which should be put into implementation.

In addition to above 4 sub-components, the JICA team also recommends to implement sub-components No.5, No.6 and No.7 as well, on condition that these 3 components could be conducted by another GOP budget allocation or otherwise there could be donor assistances as MMIP III. No.5 is recommended to undertake rehabilitation works for the MMIP I area; No.6 to conduct an improvement of MMIP II completed area, and No.7 to be a procurement of machineries which facilitate maintenance works.

4.2 Agriculture and Extension Development

4.2.1 Agricultural Development Strategy of the Philippine Development Plan 2017-2022

The Philippine Development Plan 2017-2022 was officially approved by the National Economic and Development Authority (NEDA) Board on February 20, 2017. A framework of mid-term agricultural development strategy in the development plan is summarized in Table 4.2.1:

Table 4.2.1 Strategic Framework of Agricultural Development of the Philippine Development Plan 2017-2022

Goal	The goal is to increase productivity and access
Outcome A	**Expanded economic opportunities for farmers**
A-1	Productivity within ecological limit improved
	・ To identify the comparative advantage of specific areas for promoting suitable crops and agricultural activities
	・ To construct irrigation system in high potential area (Central Luzon, Cagayan Valley (Region II), SOCCSKSARGEN (Region XII), ARMM and Bicol Region)
	・ To promote effective and efficient water saving and management technologies
	・ To facilitate the use of appropriate farm machinery and equipment
	・ To strengthen the extension system
A-2	Agro-based enterprises increased
	・ To develop commodities based on vulnerability, sustainability, and value-chain analysis in order to promote commodities with high value-adding and market potential
	・ To develop new form of linkages such as contract farming and corporate farming that will connect with agro-based enterprises
	・ To strengthen community-based enterprises in upland areas
Outcome B	**Increased access to economic opportunities by small farmers**
B-1	Access to value-chains increased
	・ To improve linkage between production area to market through transport networks and logistic system
	・ To organize small farmers into formal groups and farms into clusters to create economies of sale
	・ To provide capacity building for small farmers on value adding activities
	・ To provide non-farm livelihood options to seasonal farm workers through community-based employment programs
B-2	Access to innovate financing increased
	・ To increase the number of small farmers who are provided with agricultural insurance
	・ To provide small farmers easy access to affordable formal credit
B-3	Access to technology increased
	・ To raise investments in R&D for production and post-harvest technologies
	・ To enhance capacity building of small farmers to adopt better and new technologies (certified seeds and technologies for post-harvest, processing and packaging)
B-4	Access of small farmers to land and water resources increased and protected
	・ To ensure and protect the land tenure security of ARBs (Agrarian Reform Beneficiaries)
	・ To provide timely and free legal assistance to ARBs
	・ To authorize LGUs to reclassify agricultural land for other users

Note: Descriptions related to fisheries development are excluded
Source: Philippine Development Plan 2017-2022

The strategy is focusing on expansion of economic opportunities for farmers through increasing agricultural productivity, as well as on increased access to the opportunities through improving farm management and supporting systems. While the government has maintained key priorities in the agricultural policy, which have been to alleviate poverty by ensuring a stable and affordable supply of food and to promote self-sufficiency, particularly in rice production, the new strategy would pay more attention to the strengthening of overall farm productivity and profitability on a sustainable basis.

4.2.2 Agriculture Planning on the Project

The agriculture promotion by the Project well corresponds with the above agricultural development strategy of the Philippine Development Plan 2017-2022, especially with Outcome A-1. As shown in Table 4.2.1, Outcome A-1 pursues improvement of agricultural productivity through; 1) promotion of “right crop for right land”, 2) development of irrigation systems (Region XII and ARMM are included in the high potential area), 3) promotion of water saving and management technologies, 4) facilitation of the use of farm machinery and equipment and, 5) enhancement of extension services.

1) Cropping Pattern in the MMIP II area

As the MMIP I area has achieved to a large extent, rice shall be exclusively promoted also in the irrigated area of MMIP II with the following reasons:

a) Rice is the most important crop of overwhelming majority of farmers in terms of main food and their livelihood;
b) Sufficient irrigation water will be available for growing rice throughout the year with the project completed;
c) Rice is the right crop for the irrigated land (consistent with "right crop for right land" strategy);
d) Rice promotion has been a principal pillar of the national agricultural policy considering food security and poverty reduction;
e) Farmers can expect a certain level of stable returns from rice, especially with a help of irrigation; and
f) Productivity of rice in the area is still low, leaving currently a big room for production increase of rice.

Corn, rice and coconut are the dominant crops planted in the Project area at present. Corn and rice are mostly grown under rain-fed condition in annual crop fields mainly developed in flat river basins. Local farmers generally grow corn or/and rice two times or even more in a year, depending on water availability, starting from around February or March until the end of the year. Both crops actually do not have a definite cropping season due to relatively steady condition of rainfall and temperature throughout the year.

As explained in the above cropping strategy, two-time cropping of rice in a year is expected in all the irrigated areas developed by the Project (see Figure 4.2.1). The Project, however, should maintain existing coconut trees and some other perennial crops grown around annual crop fields as they are. Besides, JICA team recommends introduction of vegetable crops on home gardens in terms of crop diversification in the MMIP area".

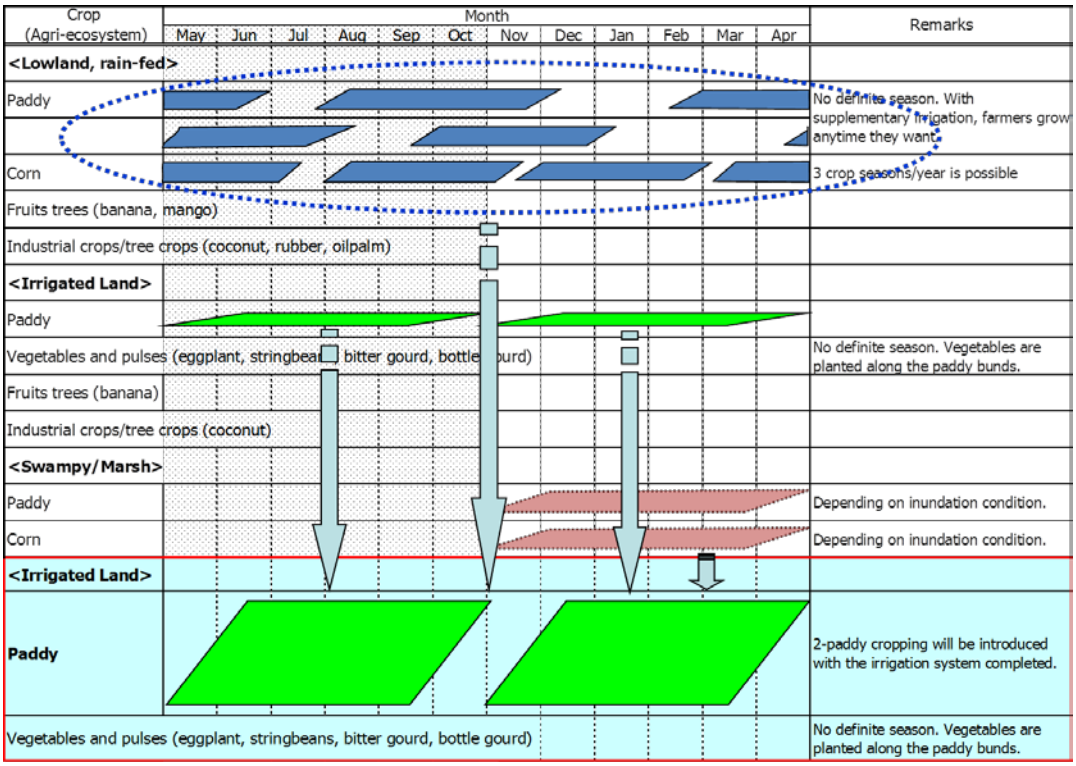


Figure 4.2.1 Conceptual Cropping Pattern in the Project Area before and after the Project

Source: JICA Survey Team

2) Increase of Crop Production by Improvement of Yield and Expansion of Planted Area

The JICA team estimated average productivity of rice and corn before and after the Project in the area from relevant statistical data of various sources, e.g. Country STAT Philippines, the Terminal Report of YLTA-MMIP, information from the OPA of Cotabato Province, DAF-ARMM, and the Baseline Survey. Table 4.2.2 summarizes data from the relevant statistics, and also shows, in the lowest part, estimated current yields and expected target yields with irrigation water to be supplied upon completion of the Project. For the current yield, those from baseline survey were referred, and the target was decided as year-round yield mainly based on the wet season yield of SAPROF report:

Table 4.2.2 Productivity (ton/ha) of Rice and Corn from Relevant Statistical Data

No	Source	Crop	Rain-fed			Irrigated			Remarks
			Dry	Wet	Year-round	Dry	Wet	Year-round	
1	YLTA Terminal Report (ATI)	Rice	NA	NA	2.93	5.52	5.63	5.63	368 farmers from 7 IAs in Phase I
2	Country STAT Philippines (Production)	Rice	NA	NA	2.95	NA	NA	4.18	Cotabato Province, 2014-16 Ave.
			NA	NA	2.36	NA	NA	3.56	Maguindanao Province, 2014-16 Ave
		Corn	White		2.30	Yellow		3.34	Cotabato Province, 2013-15 Ave.
			White		2.38	Yellow		3.36	Maguindanao Province, 2013-15 Ave.
3	Country STAT Philippines (Production Costs & Returns)	Rice	2.76	2.98	2.92	3.88	4.18	4.05	Region XII, 2013
			1.88	2.65	2.28	3.26	3.24	3.25	ARMM, 2013
4	OPA, Cotabato Province	Rice	NA	NA	3.50	NA	NA	4.50	Pikit Municipality (2014-16 Ave.)
		Corn	White		3.90	Yellow		4.20	
5	SAPROF Report (May, 2007)	Rice	NA	2.00	2.00	3.00	3.00	3.00	Before irrigation facilities completed
			NA	NA	NA	4.95	**4.77**	NA	After irrigation facilities completed
6	Baseline Survey (JICA Survey Team)	Rice	NA	NA	**1.69**	NA	NA	3.38	
		Corn	NA	NA	**2.12**	NA	NA	NA	
	Rice (Current/ target)		**-**	**-**	**1.7**	**-**	**-**	**4.7**	
	Corn (current)		**-**	**-**	**2.1**	**-**	**-**	**-**	

Note: current yields were decided based on the results of baseline survey (JICA survey team), and the target yield of rice was mainly based on the wet season rice yield of SAPROF report as year-round yield. Note that the yields between dry season and wet season are not much different in the Project area and also in the Philippines or even the wet season yield is sometimes higher that of dry season, and therefore in this survey, year-round yield was applied irrespective of the season.
Source: Various statistics, JICA Survey Team

Table 4.2.3 shows estimated planted area and production of crops in LMSA before the project and after the project while Table 4.2.4 shows that of whole MMIP II area. Rice and corn are grown in the both seasons of dry season and wet season under rain-fed condition at present. The annual production of the both crops from the both seasons is estimated at 5,354 tons (1,401 for rice and 3,953 for corn) and 8,559 ton (2,240 for rice and 6,319 for corn) for LMSA and MMIP II area respectively.

As per the LMSA (see Table 4.2.3), while 3,688 ha of land is expected to be irrigated and planted with the Project, the area in wet season is to be 2,810 ha of which decrease is attributed to inundation in Case-1 where the irrigation canals are to be constructed only within the area having not more than 50 cm inundation. Out of 2,810 ha, 870 ha is estimated not to be inundated by flooding and can be fully planted during wet season. On the other hand, 1,940 ha of land have inundation with its height of up to 0.5m. In this regard, irrigated rice production on this 1,940 ha of land would have some damages on its productivity due to flooding, and therefore Table 4.2.3 takes into account possible production reduction of 30%, 50% and 80%. Case-2 where the canal network is constructed as per the NIA-PMO original plan is also calculated given above conditions as Table 4.2.3 indicates.

On the whole area of MMIP II, Table 4.2.4 shows total 7,634 ha of planted area in dry season while it

is 6,756 ha in the wet season under Case-1 where the irrigation canals in the LMSA are to be constructed only within the area of LMSA having not more than 50 cm inundation. If the canal network is constructed as per the original NIA-PMO design for the LMSA, the irrigable area will 10,536 ha same as the MMIP II original design area during the dry season and that of wet season will be 7,756 ha due to inundation within the LMSA.

For the MMIP II whole area, out of 6,756 ha, 4,816 ha is estimated not to be inundated by flooding and can be fully planted during wet season. On the other hand, 1,940 ha of land have inundation with its height of up to 0.5 m. In this regard, irrigated rice production on this 1,940 ha of land would have some damages on its productivity due to flooding, and therefore Table 4.2.4 takes into account possible production reduction of 30%, 50% and 80%. Case-2 where the canal network is constructed as per the NIA-PMO original plan is also calculated given above conditions as Table 4.2.4 indicates.

On the whole, the growing area and productivity will be remarkably increased by the Project upon completion. Consequently, a total of the annual rice production will be 30,541 ton with Case-1 and 48,880 ton with Case-2 for the irrigable area of LMSA unless flooding occurs. As for MMIP II whole area, the total of the annual rice production will be 67,633 ton with Case-1 and 85,972 ton with Case-2 unless flooding occurs in the LMSA.

Table 4.2.3 Annual Planted Area and Production of Rice and Corn in the LMSA

Case	Crop	Dry Season			Wet Season			Total Production (ton)
		Planted Area (ha)	Yield (ton/ha)	Production (ton)	Planted Area (ha)	Yield (ton/ha)	Production (ton)	
-	**Without Project**							
-	Rice (rain-fed)	457	1.7	777	367	1.7	624	1,401
-	Corn	795	2.1	1,670	1,087	2.1	2,283	3,953
C1	**With Project (Case-1)**							
C1-LM-D00	Rice (Irrigated)	3,688	4.7	17,334	2,810	4.7	13,207	30,541
C1-LM-D30	30% reduction	3,688	4.7	17,334	870	4.7	4,089	27,631
					1,940	3.2	6,208	
C1-LM-D50	50% reduction	3,688	4.7	17,334	870	4.7	4,089	25,885
					1,940	2.3	4,462	
C1-LM-D80	80% reduction	3,688	4.7	17,334	870	4.7	4,089	23,169
					1,940	0.9	1,746	
C2	**With Project (Case-2)**							
C2-LM-D00	Rice (irrigated)	6,590	4.7	30,973	3,810	4.7	17,907	48,880
C2-LM-D30	30% reduction	6,590	4.7	30,973	870	4.7	4,089	44,470
					2,940	3.2	9,408	
C2-LM-D50	50% reduction	6,590	4.7	30,973	870	4.7	4,089	41,824
					2,940	2.3	6,762	
C2-LM-D80	80% reduction	6,590	4.7	30,973	870	4.7	4,089	37,708
					2,940	0.9	2,646	

Note: planted areas for rice and corn for the without project (current condition) were estimated based on the satellite data analysis for the LMSA.
Source: JICA Survey Team

Table 4.2.4 Annual Planted Area and Production of Rice and Corn in the whole MMIP 2 Area

Case	Crop	Dry Season			Wet Season			Total Production (ton)
		Planted Area (ha)	Yield (ton/ha)	Production (ton)	Planted Area (ha)	Yield (ton/ha)	Production (ton)	
-	**Without Project**							
-	Rice (rain-fed)	731	1.7	1,242	587	1.7	997	2,240
-	Corn	1,271	2.1	2,669	1,738	2.1	3,650	6,319
C1	**With Project (Case-1)**							
C1-LM-D00	Rice (Irrigated)	7,634	4.7	35,880	6,756	4.7	31,753	67,633
C1-LM-D30	30% reduction	7,634	4.7	35,880	4,816	4.7	22,635	64,723
					1,940	3.2	6,208	
C1-LM-D50	50% reduction	7,634	4.7	35,880	4,816	4.7	22,635	62,977
					1,940	2.3	4,462	
C1-LM-D80	80% reduction	7,634	4.7	35,880	4,816	4.7	22,635	60,261
					1,940	0.9	1,746	

Case	Crop	Dry Season			Wet Season			Total Production (ton)
		Planted Area (ha)	Yield (ton/ha)	Production (ton)	Planted Area (ha)	Yield (ton/ha)	Production (ton)	
C2	**With Project (Case-2)**							
C2-LM-D00	Rice (irrigated)	10,536	4.7	49,519	7,756	4.7	36,453	85,972
C2-LM-D30	30% reduction	10,536	4.7	49,519	4,816	4.7	22,635	81,562
					2,940	3.2	9,408	
C2-LM-D50	50% reduction	10,536	4.7	49,519	4,816	4.7	22,635	78,916
					2,940	2.3	6,762	
C2-LM-D80	80% reduction	10,536	4.7	49,519	4,816	4.7	22,635	74,800
					2,940	0.9	2,646	

Note: planted areas for rice and corn for the without project (current condition) of the MMIP II area were estimated by applying the same cropping ratios of LMSA to whole the MMIP II area.
Source: JICA Survey Team

Table 4.2.5 shows characteristics of irrigated rice varieties planted in 2017 and irrigated rice varieties recommended by PhilRice. Out of them, NSIC RC 222 is one of the four recommended varieties for the rainy season in Philippines, which stands at most 100 cm and with strong stems that can withstand against 40-60 kph wind speed and also against inundation. Since the MMIP area, particularly the MMIP II area, is prone to be inundated, such submerge-tolerant varieties should be tried.

According to an officer in-charge of the PhilRice Midsayap, the institute once conducted trials for the submerged-tolerant varieties, but found out that the yield performance is very low and therefore discontinued. He mentioned that said tested varieties can tolerate flooding, up to a maximum of 21 days during the vegetative stage of the plant. However, the varieties rarely grow if waterlogging occurs over the farmland during the maturing stage. It is obvious that even submerge-tolerant varieties cannot be grown in the totally inundated area of MMIP II during a long wet season, therefore reduction of the planted area is inevitable as Table 4.2.3 and Table 4.2.4 show. In order to mitigate reduction of the productivity in the partial inundated area, such submerge-tolerant variety should still be tested in the farmers' field.

Table 4.2.5 Characteristics of Planted and Recommended Rice Varieties by PhilRice in the MMIP Area

Name of Variety	Average Yield (ton/ha)	Max Yield (ton/ha)	Maturity (days)	Height (cm)	Reaction to Pest and Diseases	Grain Size	Milling Recovery (%)
Existing irrigated rice varieties planted in 2017							
NSIC RC 238 (Tubigan 21)	6.4	10.6	110	104	Moderately resistant to blast, BPH, stemborer and GLH, intermediate reactions to BLB and sheat blight, susceptible to tungro	long	70.4
NSIC RC 158 (Tubigan 13)	6	8.1	113 after seeding	94	Intermediate reaction to blast, bacterial leaf blight, green leaf hopper and tungro. Moderately susceptible to brown plant hopper. Resistant to white stem borer	long	71.1
NSIC RC 222 (tubigan 18) If transplanted	6.1	10	114	101	Intermediate to blast, bacterial leaf blight and tungro, Moderately resistant to brown planthopper and green leaf hopper.	long	68.5
NSIC RC 222 (tubigan 18) If direct seeded	5.7	7.9	106	98	Suitable for prolonged rainfed area.		
NSIC RC 128 (Mabango 1) (A)	5.5	6.2	118 days after seeding	99	Intermediate reaction to blast and tungro, moderately susceptible to brown planthopper and green leafhopper. Intermediate reaction to stem borer and bacterial leaf blight	long	65.4
NSIC RC 226 (Tubigan 20) If transplanted	6.2	9.8	112	102	Moderately resistant to brown planthopper and green planthopper. Susceptible to blast, tungro and bacterial leaf blight	NA	NA
NSIC RC 226 (Tubigan 20) If direct seeded	5.4	8.5	104	102		NA	NA
Recommended Irrigated Rice Varieties							
NSIC RC 158	ditto						
NSIC RC 222	ditto						
NSIC RC 226	ditto						

Name of Variety	Average Yield (ton/ha)	Max Yield (ton/ha)	Maturity (days)	Height (cm)	Reaction to Pest and Diseases	Grain Size	Milling Recovery (%)
PSB RC 10 (PAGSANJAN)	4.8	7.5	106 after seeding	77	Resistance to blast and brown planthopper. Intermediate reaction to bacterial leaf blight, tungro and stem borer. Moderately resistant to green leaf hopper.	mediu m	66.62
PSB RC 18	5.1	8.1	123 after seeding	102	Moderately susceptible to stemborer Intermediate reaction to blast, bacterial leaf blight, tungro, brown planthopper and green planthopper	long	65.34

Source: Interview to rice seed growers and PhilRice

4.2.3 Agriculture Supporting Plan

To ensure the aforementioned productivity and accelerate impact of the infrastructure development, the Project should incorporate an agriculture supporting plan into its development. This agricultural support plan shall basically be funded solely by ATI[1] with possible provisions from donors and other institutions will technically support the implementation, who are NIA, PhilRice, University of Southern Mindanao (USM), the Bureau of Plant Industry - National Seed Quality Control Services (BPI-NSQCS).

The plan possesses; 1) Technical Assistance for Irrigated Rice Production, 2) Enhancement of Agriculture Extension Services at Municipality Level, and 3) Development of Seed Production (see Appendix IV for the details of planned inputs and cost on each sub-component).

1) Technical Assistance for Irrigated Rice Production

As already discussed in "2.3.5 Agricultural Extension Service to Farmers", Yen Loan Technical Assistance (YLTA) had achieved significant and tangible results on the rice productivity improvement. Given a strong request from IAs' members in the MMIP area, the Government has also funded a similar program to YLTA. Although the government program continues until dry season in 2019, all the IAs in the MMIP area will not be benefited, particularly those in the MMIP II area. Therefore, the Project should continue the same approach to cover the entire area of the MMIP.

1.1) Objective

This sub-component expands technical assistance for irrigated rice production to Irrigators Associations (IAs) who were not targeted by the original YLTA and the government fund, so that it aims at increasing the productivity of rice in the whole MMIP area through improvement of farming technologies and management of the IAs.

1.2) Approach

The supporting approach of the original YLTA is systematized by the MMIP technical team of the ATI Regional Training Centre (XII) as summarized in Table 4.2.6 and Table 4.2.7. The supporting approach in this sub-component should basically adhere to the approach of YLTA including the implementation setup. As already discussed, the main components of YLTA are; 1) Participatory Demonstration Farms (PDF), 2) Farm Production Input Assistance (FPIA), and 3) Development of Extension Modality (see Table 4.2.6).

In order to cope with the uneven benefit distribution observed in SEED MALMAR, Farm Production Input Assistance on this activity has to have an arrangement of roll-over scheme as the original YLTA

[1] Even if Bangsamoro Basic Law (BBL) is enacted and the Bangsamoro Autonomous Region is established, ATI should still implement the agriculture supporting plan in the project area of the Region. In that case, ATI should gain permission from the Region to conduct the activities. Therefore, memorandum of understanding on the activities should be agreed by both department of agriculture in the Bangsamoro Autonomous Region and ATI.

achieved 100% of repayment for agricultural inputs from the beneficial farmers.

Regarding PDF, the participant farmers tried three technologies on their farm plot; i.e., Palaycheck, System of Rice Intensification (SRI), Direct Wet Seed Rice in addition to ordinary practices. The JICA team suggests that this sub-component also undertakes trials on varietal performance, fertilizer application and planting method; direct sowing versus transplanting, to test not only the yield but also the optimum economic benefit.

Especially, fertilizer application should not be maximized in the areas likely inundated by flooding since it may cause lodging of paddy when used in high amounts. This would increase the damages of rice production caused by inundation during wet season. According to PhilRice, although it depends on soil analysis results and recommended nutrient requirement rates, it is better to reduce fertilizer application rates by 20-30% in the season.

Table 4.2.6 Main Components of YLTA and Their Activities

1	**Establishment of Participatory Demonstration Farm (PDF) on a 5-hectare area, per IA** - conduct of major ground working activities; selection of IA beneficiaries, farmer-cooperators and benchmark survey - soil sampling and analysis - conduct of technical briefing on rice production - provision/distribution of agricultural support facilities - conduct of Farmer's Field Day (FFD) - conduct of Climate Smart Field School (CSFS)
2	**Farm Production Input Assistance (FPIA) to 25-hectare rice farm areas** - conduct of major ground working activities: selection of IAs, farmer-beneficiaries, and benchmark survey - soil sampling and analysis - conduct of technical briefing on rice production - provision/distribution of agricultural farm inputs - expository tour - conduct of values re-orientation and Islamic culture appreciation - farmer-led extension - organizational strengthening of IAs: training on enterprise development
3	**Extension Modality** - conduct of weekly project implementation monitoring activities - mid-year progress report review and planning-workshop - year-end progress report review and planning/ workshop cum presentation to stakeholders - preparation of extension manuals - exit conference

Source: Adapted from the MMIP Experience

Then, above components are organized in a step-wise manner as Table 4.2.7 shows:

Table 4.2.7 YLTA Implementation Process

Step	Activity	Description
Step 1	To prepare project document	Finalizing a detailed project proposal and manual for project operation.
Step 2	To brief project implements	Field facilitators together with PMT (Project Management Team) meet to discuss specific duties as enumerated in the project manual.
Step 3	To prepare local community	PMT prepares to make courtesy calls or meetings with local formal/informal leaders.
Step 4	To identify beneficiaries and participatory demonstration sites	Using criteria, recipient IAs are named. Farmers from the participating IA's who qualify as PDF (Participatory Demonstration Farm) and FPIA (Farm Production Input Assistance) cooperators are also identified.
Step 5	To set project launching	A separate MOA (Memorandum of Agreement) between the project and the recipient IAs is signed to document the commitment of participating farmers to the project implementation. On this occasion, local community leaders witness the signing of MOA.
Step 6	To train the project implementers (TOT: training of trainers)	Various trainings or capacity building activities are conducted at all phases of the project to equip and enhance the knowledge and skills of the project implementers.
Step 7	To collect baseline data	Baseline data are gathered from PDF and FPIA farmer-cooperators before the start of a cropping season. A focus group discussion with the farmer-cooperators is also conducted to validate the results.

Step	Activity	Description
Step 8	To conduct rice production briefing to farmers; To collect soil samples for analysis; To train farmers to use and maintain farm machines	PDF and FPIA farmer-cooperators are required to attend a technical briefing on rice production technologies (Palay Check System). The farmer-cooperators collect soil samples with a field facilitator's assistance in order determine the type and amount of fertilizers. At this briefing, the farmers get hands-on training on farm machine operation and maintenance.
Step 9	To procure and deliver farm inputs, tools and machines	Necessary farm inputs and farm machinery for PDF and FPIA are identified by the lead project implementer together with the farmer-cooperators, recipient IAs and irrigation water administrators. The procurement process follows the required bidding rules and procedures set by the COA (Commission on Audit).
Step 10	To conduct various farmers trainings	Social and technical trainings to the farmer-cooperators are carried out with parallel implementation of CSFS (Climate Smart Field School). Trained farmers act as lead farmers to their respective IA and share knowledge to other IA members.
Step 11	To set-up PDF and organize CSFS	PDF utilizes a 5.0 ha compact area composed of several different plots designed to showcase rice farming technology that is cost-reducing and yield enhancing from land preparation to post harvest management. Within the 5.0 ha PDF, a small area of 1000 m2 is allocated as learning site for CSFS.
Step 12	To monitor fields and coach/mentor farmers	Regular field monitoring after establishment of PDF and CSFS is carried out primary by PMT. Also close monitoring of PDF and FPIA beneficiaries is made on proper utilization of farm inputs.
Step 13	To conduct periodic assessment of the project	PMT meets once a month to assess the status of project implementation and to discuss issues and concerns that need immediate/appropriate action.
Step 14	To organize farmers field day (FFD)	A field day is scheduled when the rice crop is at the ripening phase in order to showcase the results of PDF and the collaborative studies of CSFS.
Step 15	To organize educational trips	After harvest, an organized educational/exposure trip for CSFS graduates is conducted to reinforce their learnings and insights gained from PDF and CSFS. The education trip exposes the farmers in rice trading and other business or entrepreneurial activities.
Step 16	To conduct project evaluation/review	In determining the strengths and weaknesses of the project, a review is conducted to determine whether target accomplishments both physical and financial are met. The review also looks at whether project aims and objectives are achieved.
Step 17	To write the project terminal report	The report tells the story of the project. It documents the project accomplishment and outcome and constitutes a full record of project activities especially the results of an evaluation. PTM takes care of the documentation.

Source: Adapted from the MMIP Experience

1.3) Activities

The supporting services will be provided through IAs in the Project area and there will be soon a total of 49 IAs in the entire MMIP area as of June 2018. Those IAs shall be the potential target for the agricultural supporting plan of the Project. However, as shown in Table 4.2.8, 21 IAs in MSA and UMSA have already received the supporting services from YLTA or additional extension program funded by GOP, so that the recommended successive YLTA program will not target those IAs.

Table 4.2.8 Number of IAs in the MMIP Area as of June 2018

Irrigation Service Areas	Number of IAs	Remarks
Maridagao Service Area (MSA)	12	All the IAs participated in YLTA and/or the GOP funded program
Upper Malitubog Service Area (UMSA)	13	While all of them did not participated in YLTA, 9 IAs out of 13 did in the GOP funded program.
Lower Malitubog Service Area (LMSA) and Pagalungan Ext. Service Area	24	Thirteen IAs registered to the Security and Exchange Commission (SEC)* and 3 IAs are now on process. Additional 8 IAs are soon to be established as of June 2018.
Total	49	

Note: *Organizations, particularly associations with a set of incorporators that need to have a legal personality, are required to be registered with the SEC. It usually provides a pro-forma Articles of Incorporation to associations to be organized.
Source: NIA PMO and ATI

As the program of GOP is expected to continue up to the dry season in 2019, all of the 18 IAs would be able to receive the 2nd round services. The agriculture support plan is therefore scheduled as shown in Table 4.2.9 with the following assumptions considering the present progress of the additional program of GOP and the total project implementation schedule:

a) Implementation period from dry season in 2020 to dry season in 2022 (the additional program of GOP will cover the period from the wet season in 2018 to the dry season in 2019);

b) The supporting plan concentrates on 28 IAs which have neither received supporting services from YLTA nor additional program of GOP; and

c) The supporting services are provided for a set of seasons, dry and wet season, per one IA.

Table 4.2.9 Implementation Schedule of YLTA Phase II

IAs	2018		2019		2020		2021		2022		2023		2024	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
GOP funded support program														
1st batch (10 IAs)														
2nd batch (10 IAs)														
3rd batch (8 IAs)														
M&E and report making														

Source: JICA Survey Team

Table 4.2.10 summarizes necessary inputs of this sub-component;

Table 4.2.10 Necessary Inputs of Technical Assistance for Irrigated Rice Production

Inputs	Description
Staff	Technical Staff; 11person x 3 years Documenter/ Information Officer; 1 person x 3 years Support Staff/ Administration; 1 person x 3 years Accounting Clerk; 1 person x 3 years
Equipment and Office Materials	Motorcycle (125 cc, 4-stroke) x 11 Photocopying machine x 1 Mobile phone x 12 Laptop computer x 2 Desktop Computer x 1 Computer Table with Chair x 1 Laptop Computer x 1 Printer x 1
Trainings	**For Farmer Cooperator** 1. Orientation & Briefing of PDF & CSFS Cooperators 2. Benchmarking and FGD Among Prospective PDF & FPIA Beneficiaries 3. Season Long Training on Climate Smart Field School **For IA officers** 4. Orientation of IA Officers 5. Planning Workshop of Implementers 6. Farmer-Led Extension Approach on Rice Production 7. Enterprise Development Training 8. Skills Training on Financial Resource Management for the Beneficiaries 9. Soil Sampling Technique and Methodology 10. Benchmarking/Field Tour 11. Value Reorientation & Islamic Culture & Islamic Culture Appreciation Training 12. Training Course on Social Mobilization for IA Officers **For Project Management Team** 13. Project Management Team Monthly Meeting 14. Mid- and Year-End Review & Planning WS
Participatory Demonstration Farm & Farm Production Input Assistance	28 IA x 30 farmer cooperators x 2 seasons

Source: JICA Survey Team

2) Enhancement of Agriculture Extension Services at Municipality Level

LGUs are responsible to deliver agriculture and fisheries extension services directly to their clientele farmers under the present administrative system in the Philippines. It is, however, widely recognized that the agricultural extension services remain ineffective due to low capability of LGUs in terms both of finance and manpower. In coping with the reality, various DA agencies including ATI, universities and colleges have been involved in providing the extension services directly to farmers on a project basis, like YLTA.

Such shortcut method is not always a good countermeasure considering future sustainable development of the agricultural extension system in the Country. ATI, as a leading national agency of agricultural extension, should incorporate a transition system into the implementation approach, so that LGU extension workers will be able to take over the responsibility for the extension works in the Project area gradually. A strategic and long-term TOT, which will enable LGU extension workers to carry out their duties, is therefore programmed in this agricultural support plan.

2.1) Objective

The objective is to enhance agriculture extension services provided to clientele farmers by LGUs in a timely and efficient manner, based on critical examination of existing farming practices and desires, problems encountered at the farm level and solutions for them.

2.2) Approach

The activity provides a step-wise training including technical and on-the-job trainings to Municipal Agriculturist (MA) and Agricultural Technologists in Cotabato Province and Municipality Agriculture Officer[2] and Agricultural Technologists in Maguindanao Province, those who are working at municipality level. It targets five municipalities, Carmen, Pikit, Aleosan, Datu Montawal and Pagalungan, under which currently post-filled 42 staff are to be trained in total. In addition to technical matter on rice production, they should also be trained with basic computer skills for data processing and IT based extension.

In line with the training process, on-farm technical handbooks/manuals shall be distributed in order to mitigate the limitations of individual farmers, as well as the agricultural staff working at municipality level. This enables them to refer to the handbooks/manuals for information about farming technology and farm management improvement as the closest starting point in their questioning.

In Philippines, many technical manuals on rice production have been published by several organizations such as ATI, PhilRice, IRRI, universities and colleges, etc. Therefore, contents of the manuals should be evaluated and selected by ATI and the municipal level officers. All the information on technical issues should be supported by photos or graphic drawings both in printed format and electronic ones. After selecting the manuals, ATI must have permission to copy from the copyright owner.

Technically, damage caused by pests and diseases is a serious problem on the rice production in the MMIP area. The baseline survey revealed that the largest number of interviewees, 75% of them, recognize them as a challenging problem; followed by bad/poor transportation road to market/millers (61%) and occurrence of floods or prolonged inundation (30%). Prolonged rainfall in the project area also increases an incidence of fungal diseases like rice blast. Thus, LGU extension workers should be equipped with knowledge, know-how and skills to control pests and diseases particularly on rice farming, so that they can support the farmers in the Project area.

2.3) Activities

Table 4.2.11 shows implementation schedule of this sub component;

[2] MAOs in Maguindanao Province are staffs of DAF-ARMM and there is always a possibility of the officers' transfer to another Municipality and/or promotion to PAO. However, they are not likely to happen over a long period since they are residing in their assigned municipality according to informal interview with the MAO.

Table 4.2.11 Implementation Schedule of Enhancement of Agriculture Ex. Services at Municipality Level

Activity	2020		2021		2022		2023		2024	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Training Needs Assessment										
Provision of Equipment and Materials										
Distribution Manuals										
Technical Trainings										
On-the-job Trainings										
M&E and report making										

Source: JICA Survey Team

2.3.1) Provision of Equipment and Materials

In order to enhance the LGUs extension set-up, the offices should be equipped with necessary equipment including computers, accessories, audio-visual equipment, etc. at municipality level. This supports the officers to collect necessary information in accordance with the farmers' actual needs and keep their activity record and farmers' data, and preparation of extension materials. The following equipment should be installed to the respective municipal offices;

Table 4.2.12 Equipment to be Installed to the Five Municipal Offices

Item	Pikit	Carmen	Aleosan	Datu Montawal	Pagalungan	Total
Desk-top computer	1	1	1	1	1	5
Computer table with chair	1	1	1	1	1	5
Laptop computer	1	1	1	1	1	5
Printer	1	1	1	1	1	5
Internet accessories (modem & router)	1	1	1	1	1	5
Photocopier	1	1	1	1	1	5
Tablet	5	2	1	1	1	10
Overhead projector	1	1	1	1	1	5
UPS	1	1	1	1	1	5

Source: JICA Survey Team

In addition, motorcycles can promote the mobility of officers to the project site and deliver immediate extension services when the farmers encounter a challenge on irrigated rice production. Therefore, the following number of motorcycles are planned to be provided to the offices;

Table 4.2.13 No. of Motorcycles to be provided to the Five Municipal Offices

Province	Municipality	No. of Motorcycles
Cotabato	Pikit	5
	Carmen	2
	Aleosan	1
Maguindanao	Datu Montawal	1
	Pagalungan	1
Total	Total	10

Source: JICA Survey Team

2.3.2) Distribution of Manuals

After being selected by ATI, the manuals are translated into either Tagalog or other local dialect like Maguindanao. Then, ATI prints them and distributes to the municipal level officers in addition to the IA members in the entire MMIP area. The total IA members registered are 6,365 and additional 11 IAs are to be registered or established soon. Since the members are estimated to be more than 8,000 after the registration and establishment, ATI needs 9,000 sets of manuals in total. Besides, 1,000 sets of technology posters relative to rice production should be printed and mounted on walls of the offices or relevant place.

2.3.3) Technical Trainings and On-the-job Trainings

Although training needs assessment is carried out by the officers in order to determine the priority

issues, possible training topics on the agriculture extension are shown in Table 4.2.14. They include year-round and hands-on training on rice production practices, literacy and skills enhancement on computer operation and IT-based technology.

Table 4.2.14 Training Topics for the Agriculture Staff at Municipality Level

No.	Topic	Description	Total Day	No. of Participants
1	Training Needs Assessment	- To determine the priority trainings to be done in accordance with farmers' needs and the staffs weakness	1	42
2	Introduction of Agriculture Extension	- Progress of MMIP and YLTA - Theory of key topics on YLTA such as Palay Check System, Climate Smart Field School (CSFC), SRI (System of Rice Intensification), Integrated Pest Management (IPM), etc.	2	42
3	Technology of Rice Production	- Crop management such as seed quality, land preparation, crop establishment, nutrient and water management, pest and diseases, and post-harvesting - Business management such as accounting, marketing, etc.	5	42
4	Computer Operation and IT-based Technology	- Computer-based extension material preparation - Real time updates on commodity market information - Use of IT-besed Information on rice production like videos and manuals, diagnostics tool[1] for Android mobile developed by IRRI - Use of web-based SNS (e.g. Facebook) as instrument in technology transfer/promotion by creating a scheme for effective delivery	2	42
5	Refresher Training (OJT) 1	- Study Tour to Participatory Demonstration Farm (PDF) to be established by the subcomponent of Technical Assistance for Irrigated Rice Production and seed production area - Analyze on-going problems on the farm - On-site Training on the analyzed problems - If necessary, samples are taken, further analyzed and discussed such as produced rice, rice seed, soil, etc.	4	42
6	Refresher Training (OJT) 2	ditto	4	42

Source: JICA Survey Team

Note: Mobile application/software called Rice Doctor is available on http://www.knowledgebank.irri.org/decision-tools/rice-doctor in both English and Tagalog.

3) Development of Seed Production

While the irrigable area in the MMIP I area is 7,173 ha, that in the MMIP II area is maximum 10,536 ha. Theoretically, about 708 ton of seed is required per cropping season because recommended seed requirement is 40 kg per ha for transplanted rice and the entire area of MMIP is 17,709 ha. Direct seeding method, commonly practiced in the area, requires more seed rate which is 80 to 100 kg per ha and needs more than 1,417 tons to 1,771 tons of seed. As Table 4.2.15 shows only 842 bags, equivalent to 34 tons of seeds are currently produced in the relevant municipalities covering the MMIP area.

To meet 708 tons of seeds at least, 151 ha of land needs to be planted for rice seed production. In this regard, rice is a self-pollinating plant and farmers can save rice seed from their produced rice and replant it again at maximum 3 times. After the 3rd time, rice seed should be renewed to avoid cross pollination with other varieties. Therefore, one-third of 151 ha of land or 50 ha, should supply rice seed to the whole MMIP area.

Although there are 22 seed growers and 139 ha of seed production area in Pikit and Carmen Municipality, they produce only 34 tons of seeds in 2017, worth of only 7 ha of the production area. If the area is planted to the maximum, the production should be 639 tons meeting most of the necessary amount of rice seeds. There is big difference of actual production and expected production of rice seed, which has been planted by the current seed growers. Thus, seed production should be further promoted and the planted area within the MMIP area should be expanded accordingly.

Table 4.2.15 Amount of Rice Seed Produced by Seed Growers in 2017 in Selected Municipalities of Cotabato Province

Rice Variety	Midsayap	Pikit	Carmen	Kabacan			TOTAL		
				Local	USM				
	CS	CS	CS	CS	CS	RS	bag (=40kg)	kg	ton
PSB Rc 10	405	0	0	0	0	0	405	16,200	16
PSB Rc 18	200	0	0	0	0	0	200	8,000	8
NSIC Rc 15	0	0	0	0	81	0	81	3,240	3
PSB Rc 82	227	0	0	0	0	0	227	9,080	9
NSIC Rc 122	74	0	0	0	0	0	74	2,960	3
NSIC Rc 128	72	0	0	362	0	0	434	17,360	17
NSIC Rc 158	756	0	100	642	0	0	1,498	59,920	60
NSIC Rc 160	1,589	0	0	100	0	0	1,689	67,560	68
NSIC Rc 222	1,797	0	400	5,898	75	304	8,474	338,960	339
NSIC Rc 224	627	0	0	0	0	0	627	25,080	25
NSIC Rc 226	170	42	300	638	0	0	1,150	46,000	46
NSIC Rc 238	190	0	0	94	45	50	379	15,160	15
NSIC Rc 342	269	0	0	53	0	0	322	12,880	13
NSIC Rc 344	0	0	0	80	0	0	80	3,200	3
NSIC Rc 352	570	0	0	40	0	0	610	24,400	24
NSIC Rc 358	540	0	0	818	93	0	1,451	58,040	58
NSIC Rc 360	241	0	0	0	0	0	241	9,640	10
NSIC Rc 390	150	0	0	0	0	0	150	6,000	6
TOTAL	**7,877**	**42**	**800**	**8,725**	**294**	**354**	**18,092**	**723,680**	**724**

Source: BPI-NSQCS, Midsayap. Cotabato
CS: Certified Seeds RS: Registered Seeds
USM: University of Southern Mindanao at Kabacan in the province of Cotabato. It has about a 60 ha of rice seed production area.

Table 4.2.16 Number and Area of Accredited Seed Growers in the MMIP Area and Nearby Municipalities

Municipality	No. of Seed Growers (Individual and Institution)	Total Area (ha)	Average Size of Area (ha)
Carmen	21	129	6.1
Pikit	1	10	10.0
Sub-total	**22**	**139**	**6.3**
Kabacan	44	577	13.1
Libungan	5	62	12.4
Midsayap	22	250	11.4
Sub-total	**71**	**889**	**12.5**
Total	**93**	**1,028**	**11.1**

Source: BPI-NSQCS - Midsayap, Cotabato

3.1) Objective

This sub-component aims at ensuring availability and reliable supply of healthy rice seed for farmers within the MMIP area. Here, seed should be a recommended variety one and free from seed-borne diseases and meet seed certification standard in the Philippines.

3.2) Approach

This sub-component pursues establishment of community based, meaning IA based, registered or certificated seed production system[3] rather than building large-scale seed center producing foundation seeds, since the irrigation systems are still under developed to attain higher crop intensity and have an access road problem to markets. Rice seed production area is established within IAs to be selected by meeting conditions such as accessibility to other farmers and seed inspectors for regular monitoring, well-experienced in irrigated rice production, relatively less damage from waterlogging. In this regard, IAs in the MMIP I should be a candidate for the rice seed production. ATI should be the main implementing body of this sub-component in coordination with BPI-NSQCS and PhilRice, LGUs.

[3] Seed certification standard in the Philippines is multi-layered and categorized into four factors; breeder, foundation, registered and certified seed.

The Project should first encourage the aforementioned 22 seed growers to produce more rice seed in their farms. ATI should make a survey of the growers' desire to produce rice seed and potential production volume, and then decide target beneficiaries from the current growers. In addition to them, ATI possibly selects beneficiaries from the farmers in the MMIP I area, those who are interested in, if the current growers cannot meet the target volume of the seed.

This sub-component should take into account a BPI-NSQCS procedure that a farmer becomes an accredited seed grower as following:

1) A farmer who wants to become an accredited seed grower undergoes a 5-day training on Basic Rice Seed Production and Certification required by BPI-NSQCS. Protocols on area (minimum of 1 ha), water, seeds and other requirements are discussed during the 5-day training.
2) After the training, a farmer expecting to be a seed grower now applies for certification.
3) Area validation and other documentary requirements are checked before granting the certification to become a seed grower. If qualified;
4) A seed inspector, an agricultural extension workers designated to the position either from office of the municipal agriculturist or office of provincial agriculturist, conducts a series of inspection in the area of an accredited seed grower. It is done two or more times per cropping season, from seeds to be planted until harvesting in coordination with BPI-NSQCS.
5) After harvesting rice seed, a sample is collected subject to laboratory analyses. Seed certification standard in the Philippines such as 14% of moisture content, 98% purity, contamination of other varieties, etc. should be met before BPI-NSQCS issues a tag, an indicator that rice seeds are ready for market as inputs to rice farming activity.

3.3) Activities

Table 4.2.17 shows implementation schedule of this sub-component. Although technical supports and monitoring are conducted until the wet season of 2024, inputs supports for the target IAs are carried out on one season, either dry or wet season of 2020. In this regard, this sub-component pursues that the farmer cooperators will be an independent accredited seed grower after one season support from the project.

Table 4.2.17 Implementation Schedule of Development of Seed Production in MMIP

Activity	2020		2021		2021		2023		2024	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Selection of IAs and potential farmer cooperators										
5-day seed production training required by BPI-NSQCS										
Provision of machineries, equipment, foundation seeds to be planted										
Support seed registration and certification process										
Support marketing of produced seed to the other farmers										
Regular inspection and monitoring of established seed production areas										
M&E and report making										

Source: JICA Survey Team

3.3.1) Selection of IAs and Potential Farmer Cooperators

ATI selects the number of target seed growers to meet aforementioned 50 ha of the seed production area and the current seed growers are given priority for being selected as the beneficiaries. Here, we assume to select 5 IAs and then 10 growers from each IA; a total of 50 growers (e.g. 22 current seed grower and 28 new seed growers).

3.3.2) Seed Production Training

ATI provides the aforementioned 5-day training to the beneficial seed growers in coordination with BPI-NSQCS. The training contents are expected to cover: 1) outline such as classification of rice seed, recommended and local seed varieties, rice seed production and inspection, 2) seed treatment and nursery management, 3) farming practices in main paddy field, 4) field inspection and removal of off-type, and 5) post-harvest technology. If the current seed growers participated to the same training course before, provided by BPI-NSQCS, advance training should be prepared and provided to them.

3.3.3) Provision of Machineries, Equipment and Foundation Seeds

Table 4.2.18 shows necessary inputs for this sub-component;

Table 4.2.18 Necessary Inputs for Development of Seed Production

Item	Quantity	No. of IA	No. of Farmer	Total
Machinery & Equipment				
Thermometer	1	5	-	10
Hand Tractor with Trailer	1	5	-	5
Floating Turtle/Rotavator	1	5	-	5
Rice Reaper	1	5	-	5
Rice Thresher	1	5	-	5
Dryer	1	5	-	5
Rice moisture meter, portable	1	5	-	5
Material				
Urea for seed treatment	1 bags	5	10	50 bags
Net bag	50 bags	5	10	2,500 bag
Foundation seed	50 kg	5	10	2,500 kg
Laminated sacks	100 bags	5	10	5,000 bag
Fertilizer	3 or 4 bags	5	10	200 bag

Source: JICA Survey Team

3.3.4) Monitoring of Established Seed Production Areas

Based on the procedure specified by BPI-NSQCS, the agriculture officers who work at five municipalities conduct a series of inspection on the paddy field with the support of ATI and BPI-NSQCS. This activity can be integrated into the training content of “Enhancement of Agriculture Extension Services at Municipality Level”.

3.3.5) Support Monitoring, Registration and Certification Process by BPI-NSQCS

BPI-NSQCS has existing laboratory facilities located within the PhilRice compound at Midsayap in the province of Cotabato which is responsible for conducting analyses of submitted samples by accredited growers. Likewise, it conducts seed production training, seed production area monitoring, in coordination with ATI and the seed inspectors from each municipality, registration and certification issuance. Inventory of seed laboratory equipment in the Bureau shows the following necessary items to enhance the measuring of seed quality;

Table 4.2.19 Necessary Items for Seed Inspections by BPI-NSQCS

Item	Quantity
Automatic Seed Counter	3
Laminar Flow (Airflow fume hood for laboratory)	1
OMAX 3MP Camera 40X2000x (Digital Biological Compound Binocular)	1
Digital Handheld GPS (Garmin Oregon)	3
Total	8

Source: JICA Survey Team

3.3.6) Support for Marketing of Produced Seed to Other Farmers

After the produced rice seed tagged by BPI-NSQCS, it expects to be marketed to other farmers within the MMIP area. Any excess would be marketed outside the project area. Following the government set

price for the registered and certified seeds, ATI technically supports marketing of the seed produced by the growers.

4.2.4 Further Recommendation for Agriculture Development in the MMIP Area

1) Crop Diversification

Crop diversification is another strategy to increase total productivity of agriculture. Progress of the crop diversification is still very minimal in and around the Project area. In fact, high value and market potential commodities could, at first, be promoted in upland areas while in lowland areas rice cultivation would still prevail due to the natural condition preferable for paddy cultivation but not for high value crops e.g. vegetables.

As the government envisages in the Philippine Development Plan 2017-2022, crop diversification needs a comprehensive approach including development of promising crops, enhancement of new form of linkages between farmers and agro-based enterprises, promotion of community-based enterprises, etc. Only one project will not be able to handle all expected outputs as they are very cross-sectional and complicated. A LGU-centered decentralized approach would be ideal for addressing the issues properly, provided that LGUs are equipped with sufficient funds and manpower.

A realistic approach of the crop diversification in the area could only be the following initiatives;

- ✓ Introduction of early ripening crops suitable after the 2-time rice cropping such as pulses upon the establishment of high-yielding and reliable rice farming on sustainable basis in future, and upon development of a system of technology to shorten the rice crop seasons by introduction of early maturing varieties, farm mechanization, advanced direct-sawing[4], etc.
- ✓ Introduction of vegetable crops to home gardens for promoting a balanced diet of farm households, as well as for generating additional income, especially for housewives, when they are blessed with surplus of the production.

In order to initiate crop diversification, a supporting component of home gardening should be considered. As mentioned above, harvested crops contribute to improving balanced diet of farm households in the Project area. Farmers in the area, especially women farmers, will be able to expect additional income from the crops when they are blessed with surplus of the production, even though the amount is small. Farmers will be ready to start growing various kinds of crops gradually after having familiarized such home gardening.

2) Agriculture Mechanization

The agricultural development strategy of the Philippine Development Plan 2017-2022 stresses agricultural mechanization as an important tool to attain improvement of the agricultural productivity. The plan expresses that the government will encourage adoption of farm machinery and equipment to reduce production costs of rice, as well as encouraging custom hiring and machine pooling to provide alternative livelihood to low-skilled workers in rural areas. The farm mechanization will be accelerated by private service providers as envisaged in the plan. The plan states that the following government supporting measures to facilitate the use of appropriate farm machinery and equipment:

- ✓ Provision of fund to local manufacturers and assemblers,
- ✓ Intensified information, education & communication activities on available local machinery, and
- ✓ Provision of proper training and certification for machine operation

[4] Direct-sowing of rice is becoming a spotlight as a low-cost and labor-saving technology in many countries. Various research works focus on developing an advanced direct-sowing technology with high and stable yielding, as well as with low-costs.

In the Project site, it is noteworthy that out-migration of people from rural to urban centers results in scarcity of manpower working in the farms. Especially, once the prospective irrigable area of MMIP II is fully developed and operational, a problem on availability of farm workers is expected to rise. Irrigated rice production is more labor intensive than the current livelihood activities of farmers in MMIP II areas, e.g. rain-fed rice, corn farming and fisheries.

As in the results of Household Economic Survey conducted by the JICA team, very limited numbers of farmers own agriculture machineries in the MSA and almost none of them own the machineries in the LMSA. Besides, based on an inventory survey of agriculture machines in the MMIP area (Table 4.2.20) and capacity of each machine, progress of agricultural mechanization in the area is estimated. As Table 4.2.21 shows, the irrigated area still requires a significant number of pre- and post-harvest machineries to be fully mechanized. Compared to the machines for land preparation, the number of harvesting and post-harvesting machines are very small in the MMIP area. An insufficient number of them would result in reduction of production, post-harvest losses, and poor quality of rice paddy.

Table 4.2.20 Inventory of Agriculture Machines in the MMIP area

Particular	No. of Barangay	Irrigable Area (ha)	Expected Production (ton) in dry season	Power Tiller/ Hand Tractor	Floating Tiller	Rice Reaper	Rice Thresher	Solar Dryer	Rice Mill
MMIP I									
MSA	7	5,562	25,585	14	72	2	31	36	4
UMSA	6	1,611	7,411	20	10	2	14	8	3
Sub-total	13	7,173	32,996	34	82	4	45	44	7
MMIP II									
UMSA	11	2,958	13,607	59	73	0	51	48	9
PESA	2	998	4,591	5	6	0	5	1	1
LMSA (Case-1)	27	3,688	16,965	31	35	0	26	52	13
Sub-total	40	7,644	35,162	95	114	0	82	101	23

Source: 5 Municipalities

Table 4.2.21 Capacity of Agriculture Machines and Estimated Progress (%) of Agricultural Mechanization

Particular	Power Tiller/ Hand Tractor	Floating Tiller	Rice Reaper	Rice Thresher	Solar Dryer	Rice Mill
Capacity of Agricultural Machines	2 ha/ day	1.8 ha/ day	0.33 ha/ day	4 ton/ day	5 ton/ batch	6 ton/ day
Capacity per month*	60 ha	54 ha	10 ha	120 ton	75 ton	180 ton
Area & Volume to be Covered by Current Agriculture Machines						
MMIP I	2,040 ha	4,428 ha	40 ha	5,400 ton	3,300 ton	1,260 ton
MMIP II	5,700 ha	6,156 ha	0 ha	9,840 ton	7,575 ton	4,140 ton
Estimated Progress (%) of Agricultural Mechanization						
MMIP I (%)	28%	62%	1%	16%	10%	4%
MMIP II (%)	75%	81%	0%	28%	22%	12%

Source: 5 Municipalities & JICA survey Team

Note: One month is assumed to be necessary for each faming practice (e.g. preparation of land, harvesting, etc.).

YLTA had agricultural machinery intervention, yet it was limited to just leasing a set of floating tiller, rotavator, hand tractor with trailer, thresher and welding machine to the respective target IAs on the condition that it is returned after a year of utilization. A government project should pay much attention to the promotion of farm mechanization services rather than leasing farm machinery directly to farmers or farmers' group e.g. IA, not as conducted in YLTA. In case of anxious demand for farm machinery from IA members, one of alternative solution is to allow IAs to procure farm machinery and be a reliable provider of farm mechanization services. Appendix IV describes a detailed plan of "Enhancement of Agriculture Mechanization" particularly in LMSA, which is proposed by JICA survey Team.

4.3 Irrigation and Drainage Improvement

4.3.1 Irrigation Water Reliability

Maridagao river is the water source for the irrigation systems of MMIP wherein a diversion dam was constructed at Barangay Kibnes, Carmen, Cotabato. This section explores the sufficiency of the water volume from the river to irrigate the entire planned beneficiary area of MMIP I and MMIP II. The amount of water to be diverted from the river was determined through the feasibility study (FS) concluded long time back in June 1986. The FS proposed that the river discharge would be gauged at the Tinutulan station around 10 km downstream from the current diversion point, however the said station was operational only between 1960 and 1972.

Since the data of water discharge from the Maridagao river are not available, except for the above mentioned period of 1960-1972, the river runoff over a long period was estimated by interpolating the relationship between rainfalls and river runoff. Rainfall data from the Municipality of Midsayap recorded during 1979-2014 and the rainfall data estimated based on the satellite images of catchment area during the same period were employed (see section 2.1.5 Hydrology and Future Irrigation Water Availability). River runoff was also estimated using the 1956-2014 period of two rainfall data.

A drought frequency analysis is now carried out based on the estimated river runoff for a long time. A non-exceedance probability analysis in Iwai method was also conducted and results showed the annual runoff probabilities of 50%, 20%, 10% and 5% were estimated at 2,061 MCM, 1,576 MCM, 1,341 MCM and 1,156 MCM, respectively. The design reliability of the MMIP was decided at 20% during the FS, which means the reliability of the irrigation system counts at 80%. This implies that the designed irrigable area can benefit from irrigation water without any shortage of water for 8 years over a 10-year period.

Table 4.3.1 Return Periods of Maridagao River Runoff at the Diversion Point

Return Period	Probability	Annual Runoff (MCM)	Ratio	Remarks
2	0.50	2,061	0.983	
3	0.33	1,807	0.862	
4	0.25	1,669	0.796	
5	0.20	1,576	0.752	Design reliability
8	0.13	1,410	0.672	
10	0.10	1,341	0.640	
15	0.07	1,229	0.586	
20	0.05	1,156	0.551	
25	0.04	1,104	0.526	
30	0.03	1,063	0.507	
40	0.03	1,002	0.478	
50	0.02	957	0.457	
60	0.02	922	0.440	
80	0.01	869	0.414	
100	0.01	830	0.396	
Average		2,097		

Source: JICA Survey Team, MMIP FS report (June 1986), NCEP of US for long-term rainfall

As shown in table above, the ratio between the annual runoff with 80% reliability and the average annual runoff is computed at 0.752. By applying this ratio, the average runoffs estimated on a 10-day basis at the diversion point are proportionally reduced to those with 80% of reliability as illustrated in Figure 4.3.1. The figure shows the transition of both the average run-off on a 10-day basis and that with 80% of reliability. On the other hand, a horizontal red line at the value of 31.88 cum/s shows the overall design discharge required at the diversion point for all the MMIP I and MMIP II irrigable area, namely, 17,709 ha. The pre-conditions for this analysis are:

- ✓ MMIP I & MMIP II design gross irrigation duty: 1.8 l/s/ha[1]
- ✓ MMIP I & MMIP II Irrigation Area: 17,709 ha (7,173 + 10.536)
- ✓ Total design discharge: 31.88 cum/s (1.8 / 1000 x 17,709 ha)

According to Figure 4.3.1, there are periods when runoffs with 80% of reliability remain below the design discharge of 31.88 cm/s: they are the 2nd 10-day period of February to 3rd 10-day period of March (the lowest runoffs of 29.4 cum/s was marked at the 1st 10-day period of March). However, the chart shows only the runoff and the design discharge, and it does not consider effect of rainfalls. This is because the total volume of actual rainfall cannot be simply added to the runoffs, since part of rainfall would be required by crops. Furthermore, the 31.88 cum/s is the water requirement at maximum, which could be marked during dry seasons when land soaking is high and rice is flowering (in a latter growing stage). Therefore, if the period of lowest runoffs does not correspond to the period when the water requirement reaches at its maximum, the system reliability is still secured.

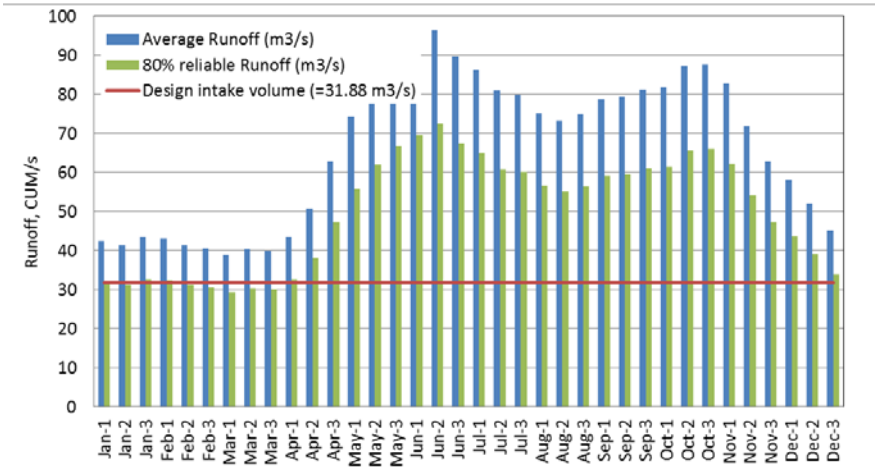


Figure 4.3.1 Runoff at Diversion Point for Average and 80% Reliability
Source: JICA Survey Team

Figure 4.3.2 shows the rainfall on Pikit area estimated based on satellite images on a 10-day basis for the period of 1973-2013. The chart shows average 10-day period rainfall data, 10-day period rainfall data of 80% of probability, and effective rainfall data. The rainfall data of 80% of probability were estimated by applying the following formula.

- ✓ Effective rainfall: he=0.75 × (h-5) mm, where h: 10-day rainfall (referred to the FS report)

The effective rainfall data marked its lowest record at the 3rd 10-day period of February, at 2.5 mm/10-day only. By applying the following formula, how many days it would be required to reach 0.51 cum/s over the whole irrigable area of 17,709ha, when the rainfall remains at 2.5 mm/10-day period effective rainfall: 2.5 / 1,000 x 17,709 x 10,000 / 86,400 / 10.

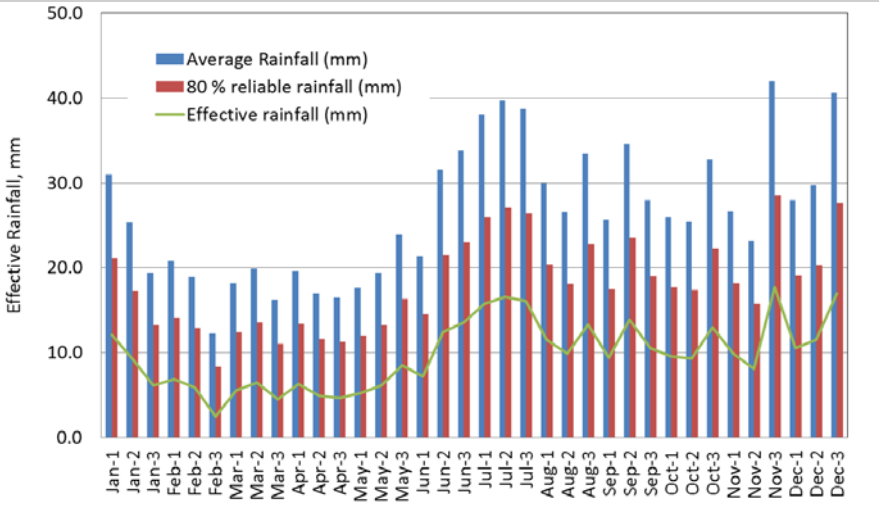


Figure 4.3.2 Average, 80% Probability and Effective Rainfalls (Pikit)
Source: JICA Survey Team

At the highest of dry season, from late January to mid-May except the 3rd 10-day period of February, still effective rain can reach around

[1] Design gross irrigation duty of 1.8 l/s/ha was adopted from the one prepared by the Feasibility Study.

5mm/10-day-period. Therefore, during this period, except for the 3rd 10-day period of February, approximately additional 1 cum/s, generated from 5 mm/10-day-period of effective rainfall, can be expected in effective runoff.

Further, Table 4.3.2 shows the proposed cropping pattern and required irrigation water, required diversion runoff, and also surplus or deficit estimated with the following conditions[2]:

- ✓ Cropping patterns: rice (May-October) – rice (October-March)
- ✓ Potential evapotranspiration: estimated by application of modified Penman method with use of PAGASA agro-meteorological station data available for the period of 1969-1988 (as the FS, 1986 estimated.)
- ✓ Deep percolation: 2.8 mm/day (as the FS, 1986 estimated.)
- ✓ Land soaking + ponding: 84 mm + 20 mm (as the FS, 1986 estimated.)
- ✓ Irrigation efficiency: 51% (80% for delivery, 80% for distribution, 80% for on-farm, as the FS, 1986 estimated.)

Table 4.3.2 Cropping Pattern and Irrigation Water Requirement Computation

MONTH	MAY			JUN			JUL			AUG			SEP			OCT			NOV			DEC			JAN			FEB			MAR			APR		
DECADE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
RICE-RICE CROPPING	WET SEASON																		DRY SEASON																	
	LAND SOAKING			LAND PREPARATION			CROP MAINTENANCE						DRAINAGE		HARVEST	LAND SOAKING			LAND PREPARATION			CROP MAINTENANCE						DRAINAGE		HARVEST						
WATER BALANCE																																				
Evaporation,mm	47	47	51	43	43	43	44	44	48	43	43	47	45	45	45	45	45	50	40	40	40	35	35	39	41	41	45	46	46	37	54	54	59	53	53	53
						104															104															
Land Soaking/Ponding,mm	14	22	28	27	10	3	0	0	0	0	0	0	0	0	6	21	24	28	19	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evapotranspiration,mm	6	18	34	40	45	46	48	48	53	47	47	50	35	23	13	14	24	40	41	43	44	39	39	43	45	45	41	29	16	4	0	0	0	0	0	0
Deep Percolation,mm	4	11	20	25	28	28	28	28	31	28	28	29	20	13	7	8	15	25	28	28	28	28	28	31	28	28	25	16	9	2	0	0	0	0	0	0
Crop Water Req',mm	24	51	82	92	83	77	76	76	84	75	75	79	55	36	26	43	63	93	88	76	73	67	67	74	73	73	66	45	25	6	0	0	0	0	0	0
Effective Rainfall,mm	5.3	6.2	8.5	7.2	12.4	13.5	15.7	16.5	16.1	11.5	9.8	13.3	9.4	13.9	10.5	9.5	9.3	13.0	9.9	8.1	17.7	10.5	11.5	17.0	12.1	9.2	6.1	6.9	5.9	2.5	5.5	6.4	4.5	6.3	4.9	4.7
Crop Irrig Req't,mm	18.7	44.8	73.5	84.8	70.6	63.5	60.3	59.5	67.9	63.5	65.2	65.7	45.6	22.1	15.5	33.5	53.7	80	78.1	67.9	55.3	56.5	55.5	57	60.9	63.8	59.9	38.1	19.1	3.52	0	0	0	0	0	0
Overall Efficiency,%	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Diversion Req't,mm	36.7	87.9	144	166	138	124	118	117	133	124	128	129	89.5	43.3	30.4	65.7	105	157	153	133	108	111	109	112	119	125	117	74.8	37.4	6.9	0	0	0	0	0	0
Water Duty, l/s/ha	0.43	1.02	1.52	1.93	1.60	1.44	1.37	1.35	1.40	1.44	1.48	1.36	1.04	0.50	0.35	0.76	1.22	1.65	1.77	1.54	1.26	1.28	1.26	1.18	1.38	1.45	1.23	0.87	0.43	0.10	0.00	0.00	0.00	0.00	0.00	0.00
				C																																
Diversion Req't (MCM)	6.51	15.6	23.2	29.5	24.5	22	20.9	20.6	21.4	22	22.6	20.7	15.8	7.67	5.38	11.6	18.7	25.3	27.1	23.6	19.2	19.6	19.3	18	21.1	22.2	18.9	13.2	6.63	1.53	0	0	0	0	0	0
Steamflow, (MCM)	48.29	53.69	57.84	60.19	62.62	58.37	56.08	52.60	52.02	48.87	47.69	48.75	51.15	51.55	52.74	53.13	56.69	57.02	53.83	46.72	40.88	37.73	33.87	29.36	27.58	26.98	28.30	28.04	26.98	26.39	25.36	26.21	26.03	28.30	32.95	40.88
Surplus/Deficit, (MCM)	41.79	38.12	34.63	30.74	38.10	36.32	35.15	31.95	30.57	26.83	25.06	28.01	35.30	43.88	47.37	41.51	38.03	31.75	26.70	23.13	21.67	18.13	14.59	11.36	6.43	4.83	9.41	14.80	20.35	24.86	25.36	26.21	26.03	28.30	32.95	40.88
																										C										

NOTE:
1 First Cropping Area = 17,709 hectares, Second Cropping Area = 17,709 hectares
2 Number of days staggered for Land soaking and land preparation = 40 days (104mm)
3 Percolation Rate used = 2.8 mm/day(F/S,1986)
4 Effective Rainfall at 80 percent dependable rainfall by frequency analysis

C = Critical

Source: JICA Survey Team

According to the computation in table above, the peak of the irrigation duty comes in the 1st 10-day period of June at 1.93 l/s/ha, which is, in fact, bigger than the estimate of the feasibility study at 1.8 l/s/ha. The critical period, from the view point of the availability of diversion discharge, is the 2nd 10-day period of January, leaving only 4.83 MCM/10-day-period as water discharge in the river. This

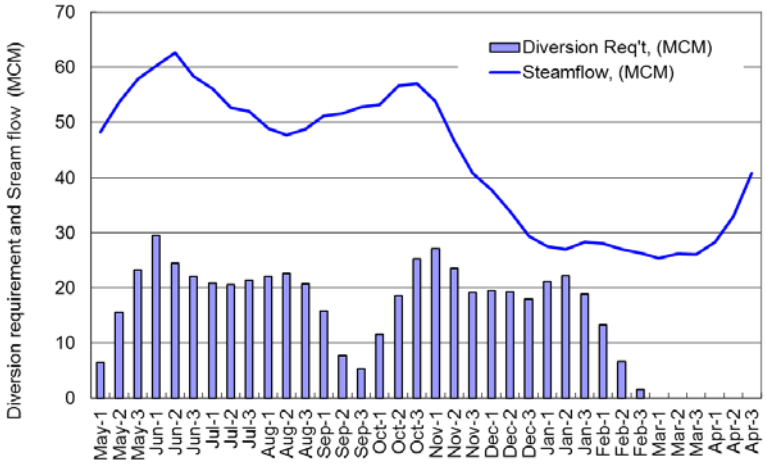


Figure 4.3.3 Diversion Requirement and 80% Reliable Runoff

Source: JICA Survey Team

[2] "Potential evapotranspiration", "Deep percolation", "Land soaking + ponding" and "Irrigation efficiency" were adopted from the one prepared by the Feasibility Study. Field tests for evaluating these numbers are not planned in this survey.

4.83 MCM/10-day-period discharge is equivalent to 5.59 cum/s (4.83 x 1,000,000 / 10 / 86,400), which seems still enough for the requirement of downstream. The diversion requirement on a 10-day basis and runoffs with 80% of reliability are summarized in Figure 4.3.3. The chart further implies that the river runoff could still meet the diversion requirement even if the second cropping which is to be started from October, is delayed by about one month.

4.3.2 Development Direction for Lower Malitubog Service Area in MMIP II

A large part of the Lower Malitubog Service Area (LMSA) is inundated during the rainy season. The inundation in this area needs mitigation such as construction of ring dike and protection dike, lest its condition will be same as the present. Therefore, target irrigable area in LMSA shall be considered based on the inundation condition. And then the project component shall be planned based on the target irrigable area.

1) Irrigable Area in LMSA based on the satellite image analysis

The satellite image analysis in Figure 4.3.4, shows the inundated area in LMSA during the rainy season. Table 4.3.3 shows the comparison of the irrigable areas in LMSA with and without the construction of dikes. Based on the data presented, if the dikes are not constructed, 44% of gross Service Area would be inundated. In this case, it is impossible to develop 6,590 ha of all the irrigable area in LMSA, and only 3,688 ha (about 56 % of planned irrigable area) will be available for development. Hence, the remaining portion for development from 2019, would only be 1,001 ha, which is short of 1,132 ha unless the planned dikes will be constructed.

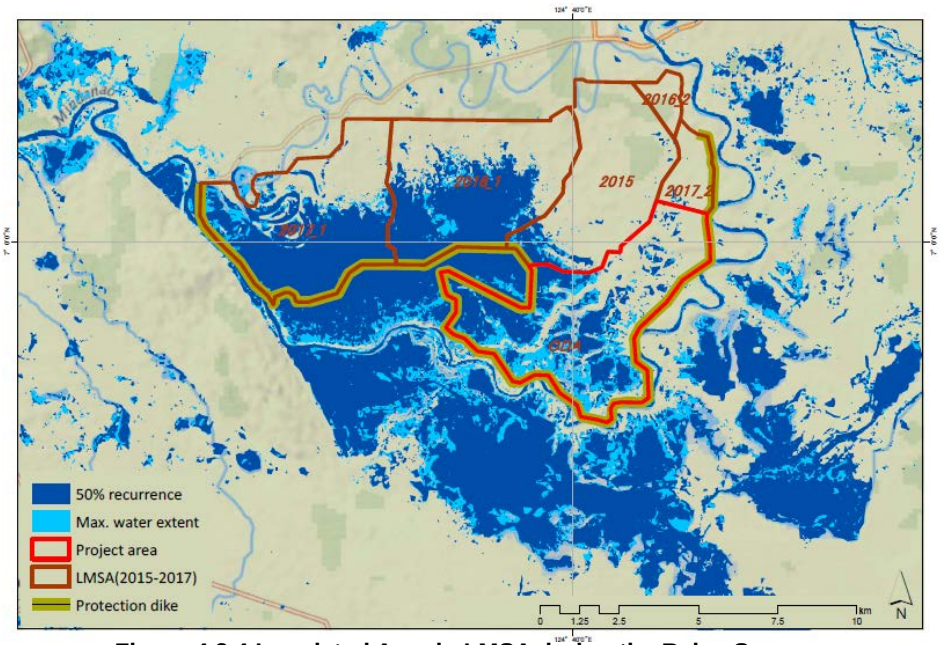


Figure 4.3.4 Inundated Area in LMSA during the Rainy Seasons

Data Resource: High‐resolution mapping of global surface water and its long‐term changes (Jean-François Pekel et.al., Nature 540, 418‐422,15 December 2016)

Source: JICA Study Team

Table 4.3.3 Comparison of the Irrigated Areas in LMSA with and without the Construction of the Dikes

Fiscal Year for work	Irrigable Area (ha)	Present Condition						Rate of Inundation (%)	Irrigable area (ha)	
		Rainy Season (ha)			Dry Season (ha)					
		Total	Paddy	Maize	Total	Paddy	Maize		With dikes	Without dikes
Whole	**6,590**	**1,454**	**367**	**1,087**	**1,252**	**457**	**795**	**44.0**	**6,590**	**3,688**
2015	1,303	272	48	224	194	11	183	10.0	1,303	1,173
2016	1,736	323	111	212	372	154	218	46.5	1,736	929
2017-18	1,418	313	77	236	229	139	91	55.3	1,418	634
ODA	**2,133**	**546**	**131**	**415**	**457**	**154**	**303**	**53.1**	**2,133**	**1,001**

Base drawing: NIA PMO of MMIP-2

Source: JICA study team

Figure 4.3.5 shows the locations of the major Project Components in LMSA. Since the dikes will not be constructed, some portions of the irrigation canals will not have to be constructed. Nevertheless, inundated areas can be irrigated during the dry seasons with the construction of all the planned irrigation canals. In this case however, the countermeasures for possible damage of irrigation canals that are easily coursed by flood is necessary such as; raising height of canal embankment, slope protection of embankment, and construction of the concrete flume canal at end portion of lateral canals instead of the earth canal.

A panoramic view of LMSA lowland part from Punol Barangay toward the Pulangi river. Without an embankment, irrigated agriculture in the rainy season in this area is impossible, and 2,902 ha of irrigable area will be lost in LMSA.

Accordingly, the project cost shall also be increased to keep the original planned irrigable area of 6,590 ha during dry season. In addition, the possibility of damaged farm ditches and farm drainages in the inundated area could result to high maintenance costs every year after the rainy season.

Therefore, the project shall select one from two cases, namely **Case-1**: target area is within the upper limits of the LMSA, constructing parts of the irrigation canals and other appurtenant facilities which are above the broken line (Figure 4.3.5), and **Case-2**: target area is all of LMSA constructing all irrigation canals and other component facilities .

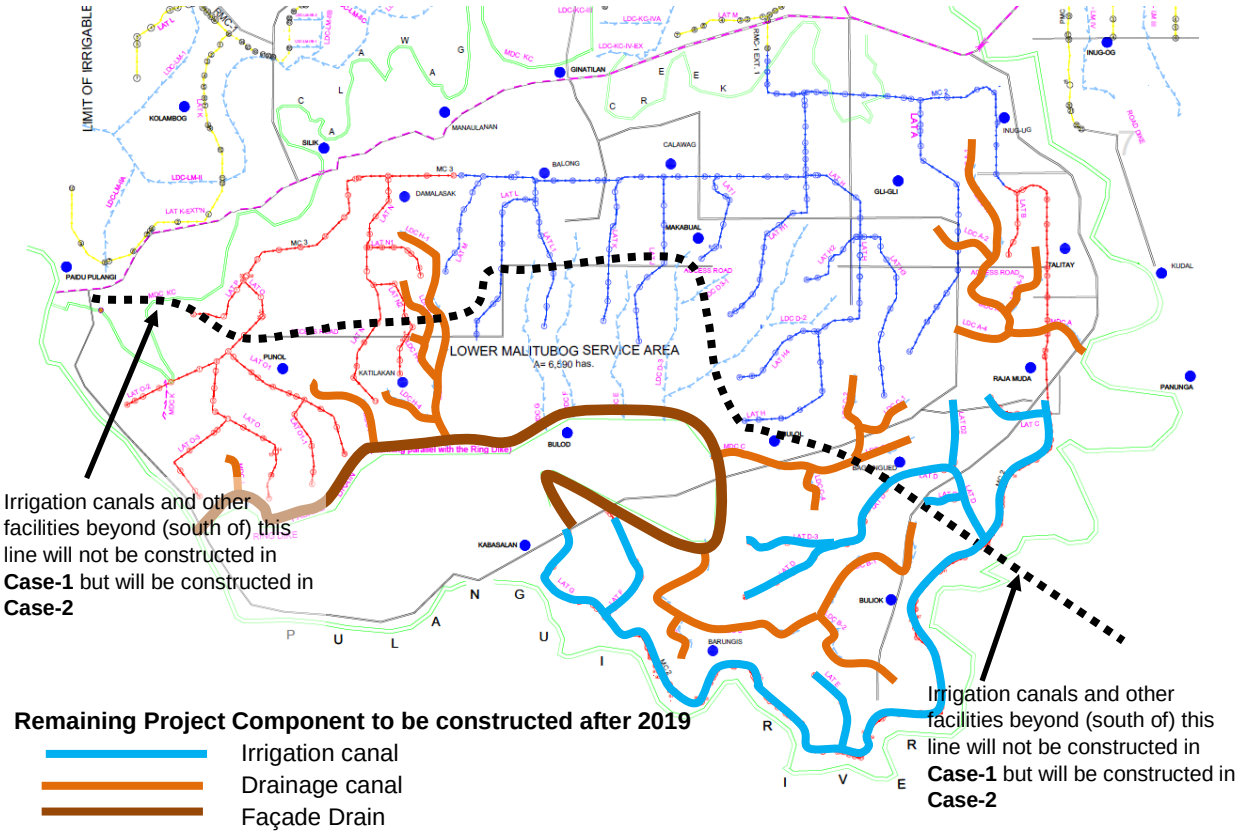


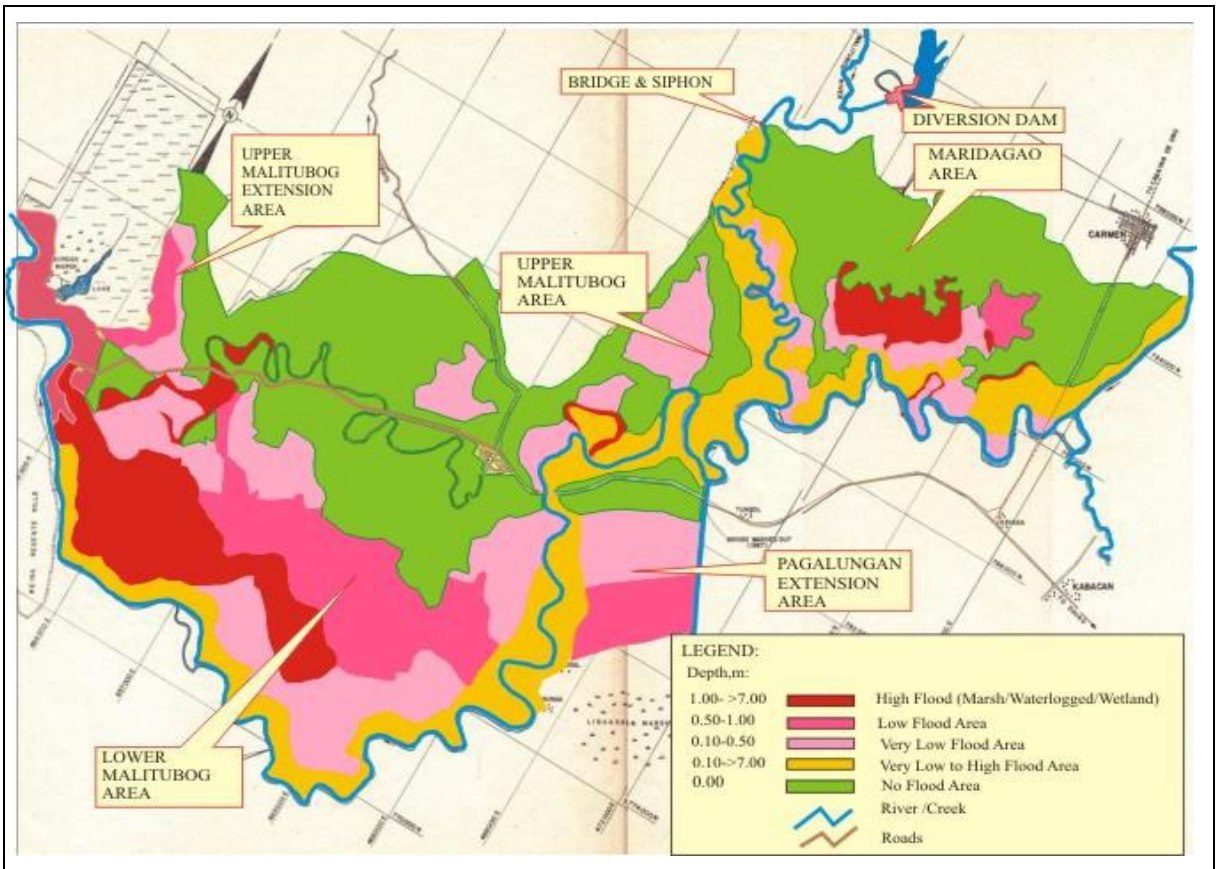
Figure 4.3.5 Locations of the Remaining Project Components to be Constructed after 2019

Source: JICA sturdy team
Base drawing: NIA PMO of MMIP II
Note: Blue color is ongoing construction; red color is still for construction as of June 2017.

2) Irrigable Area in LMSA based on the result of Vulnerability Assessment for Flooding in MMIP II conducted by NIA PMO

After a severe flood in 2009, NIA conducted a survey in 2010 on the assessment of impact of the past floods within the MMIP I and MMIP II areas. The survey was carried out to the residents of the 49 Barangays within MMIP area to confirm flood information such as frequency of flood occurrence, depth of flood, flooding period, among others. GPS coordinates of the survey locations were also collected. The flooded areas were categorized based on the survey results, as shown in Figure 4.3.6.

Table 4.3.4 shows the distribution of flooded area according to depth of submergence on the total net irrigable area. It should be noted that high flooded area such as wetland, marsh, or waterlogged located in each Service Area was already excluded in the net irrigable area. In this data, it shows that Lower Malitubog Service Area has the highest record of flooded area with about 5,720 ha or 87% inundated ranging from very low to low flood. Only 870 ha are safe from flood.



Color	Depth (m)	Description	Remarks
Red	1.01 - 7.00>	High Flood	Areas mostly wet, waterlogged, ground elevation lower than river normal flow elevations, submerged areas expand during annual flood, part of the area is tillable during long dry period
Pink	0.51 – 1.00	Low Flood	Areas with low elevations, mostly under water comes heavy rain or during occurrence of annual flood, but easily dried with efficient drainage system
Light pink	0.10 - 0.50	Very Low Flood	Areas submerged during occurrence of maximum flood, but easily dried with efficient drainage system
Yellow	0.10 – 7.00>	Very Low Flood to High Flood	Areas submergence varies from annual flood to maximum flood, areas mostly not recommended with irrigation due to soil high infiltration rate
Green	0	No Flood	No submergence or no flooding

Figure 4.3.6 Flooded Area Affected based on the Vulnerability Assessment conducted in 2010

Source: Vulnerability Assessment for Flooding in MMIP II

Table 4.3.4 Flooded Status of Irrigable Areas

Flood Status	Color code	Service net area (ha)					Total
		MSA	UMSA(1)	UMSA(2)	LMSA	PESA	
No flood	Green	4,362	853	1,736	870	200	8,021
Sub-total		4,362	853	1,736	870	200	8,021
% of area		78%	53%	79%	13%	20%	47%
Very low flood	Light pink	360	758	470	2,940	250	4,778
Low flood	Pink	230	0	0	2,780	538	3,548
Very low flood to high flood	Yellow	610	0	0	0	0	610
Sub-total		1,200	758	470	5,720	788	8,936
% of area		22%	47%	21%	87%	80%	53%
Total		5,562	1,611	2,206	6,590	988	16,957

Source: Vulnerability Assessment for Flooding in MMIP II

3) Target service area to be developed and irrigable area in rainy season

The 870 ha, which is non-flooded area of LMSA, is targeted as irrigable area. On one hand, the 2,940 ha flooded area (with 10 - 50 cm flood depth) is also targeted as possible irrigable area. Magnitude of damage of paddy by inundation varies with the timing, duration and depth. Figure 4.3.7 shows the estimated paddy production loss by inundation. From this, it can be said that the booting period receives damages the most. If rice is submerged 2 days, production loss would reach as much as 80%.

The flooding period continues more than 3 days in half of Barangays in the project area according to the interviews conducted under Vulnerability Assessment for Flooding. Taking into account the fact that the planted rice would grow to 100 cm or more at the booting period and the flooding period in the project site, the allowable inundation depth can be set at 50 cm in order to prevent the damage mainly in the booting period. Accordingly, the 2,940 ha with flood water depth of 10 - 50 cm can/should be included in the target area for irrigation. However, flood water beyond the 50 cm would cause certain damage to the crop, whereby reducing the production. Thus, the target service areas to be developed and irrigable areas in dry & rainy season are set as shown in Table 4.3.5.

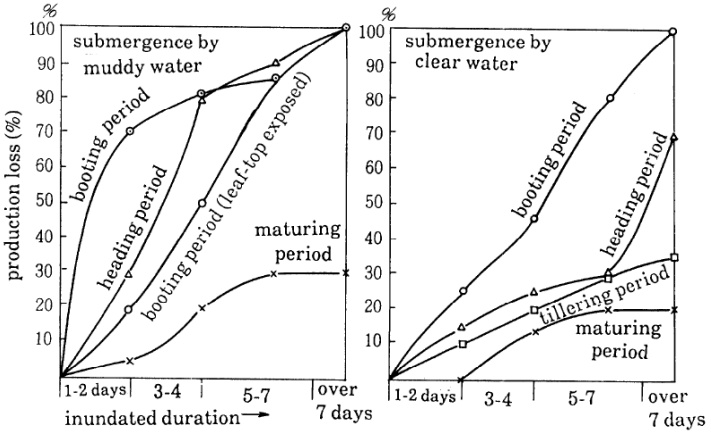


Figure 4.3.7 Estimated losses on Paddy Production by Inundation

Source: Engineering Manual for Irrigation & Drainage (Drainage)

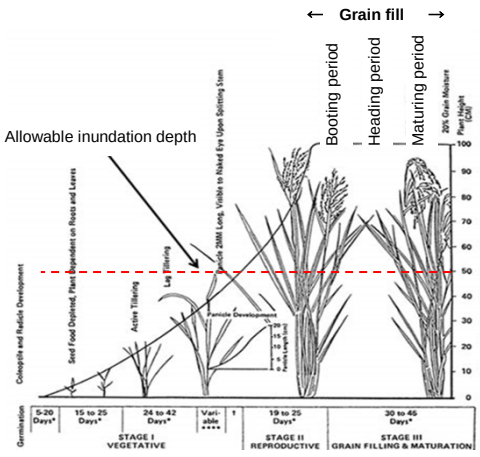


Figure 4.3.8 Growing Stage of Rice

Table 4.3.5 Target Service Area to be Developed and Irrigable Area in Dry & Rainy Season

Category	Case-1	Case-2	Remarks
Target Developed service area	3,688 ha	6,590 ha	
Non-submerged area by flood	870 ha	870 ha	Target irrigable area in rainy season
Flooded area of 0.1 to 0.5 m	1,940 ha	2,940 ha	Including in target irrigable area in rainy season. But this area will be affected by flood.
Flooded area of 0.5 to 1.0 m	878 ha	2,780 ha	Excluded from target irrigable area of rainy season.

Case-1: target area is part of LMSA with constructing the part of the irrigation canals and all drainage system
Case-2: target area is all LMSA with constructing all irrigation canals and drainage canals.
Source: JICA Survey Team

4.3.3 Irrigation Development Component

The Main Supply Canal for the Upper and Lower Malitubog Service Areas is designated as Right Main Canal No. 1 (RMC-1) which starts from the outlet of the siphon crossing the Malitubog River. The facilities were constructed during the implementation of MMIP I. RMC-1 extends southwestward to UMSA. RMC-1, branches out at Sta. 12+554 into RMC-1 Extension No.1 (RMC-1 EXT-1), which traverses south to the LMSA.

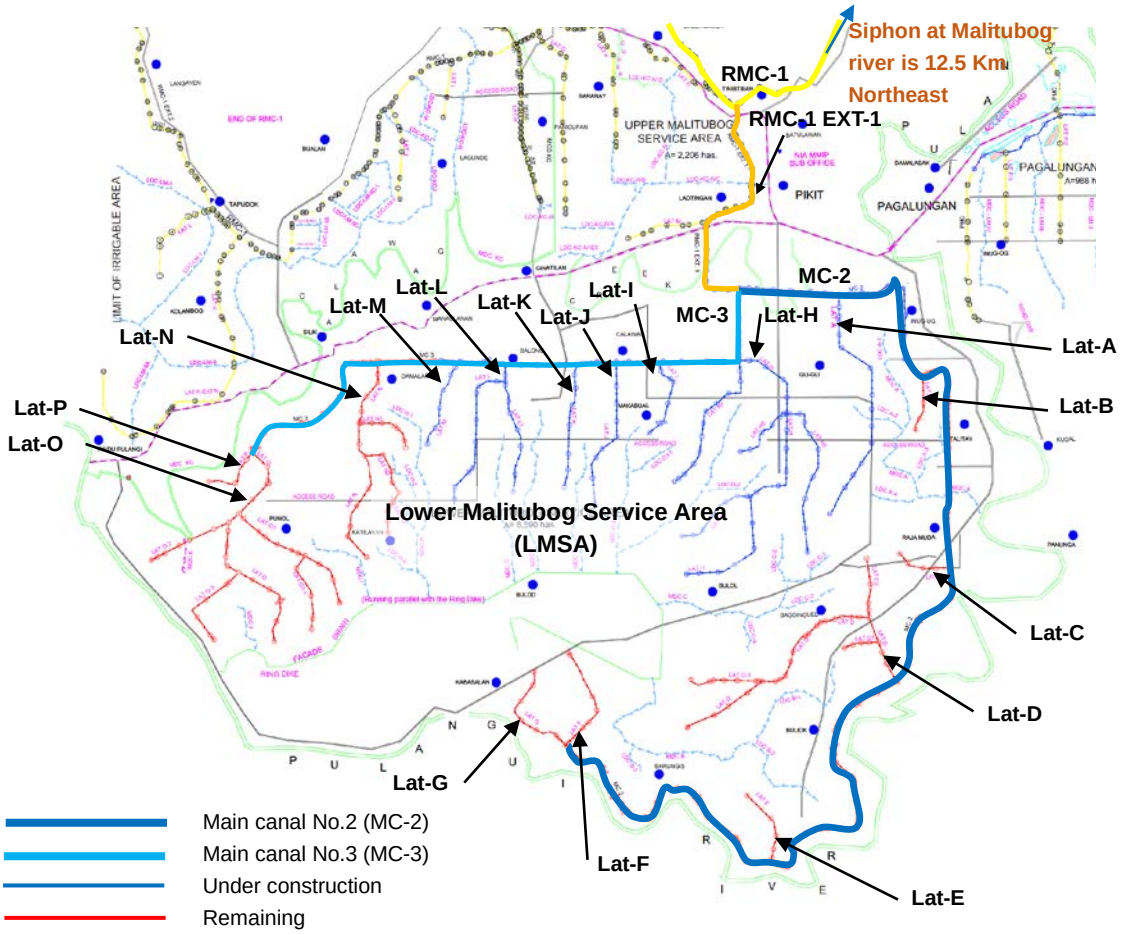


Figure 4.3.9 Plan of Irrigation Canal System for LMSA
Source: NIA-PMO

The irrigation canal system for LMSA consists of 2 main canals, which both branch out from RMC-1 EXT-1, namely Main Canal No.2 (MC-2) and Main Canal No.3 (MC-3). The two main canals further branch out to 31 lateral canals for the irrigation of 6,590 ha. The total length of canals arrives at 107.3 km, where 34.2 km is covered by the main canals and about 84.5 km is covered by the lateral canals. The main canals will be concrete while laterals will be earth canals.

MC-2 will convey irrigation water for the eastern portion of the Service Area of about 3,224 ha as planned in the original proposal. Several Lateral Canals are off-taking from Main Canal No. 2 designated as follows: Lateral A; B, C, D with its sub-Laterals D-1, D-2 and D-3, Lateral E, F and G. MC-2 will end at the head gates of Laterals F and G for the total length of 22.3 km.

On the other hand, MC-3 will transport irrigation water for the middle and western portions of LMSA which is about 4,336 ha. Several Lateral Canals are off-taking from the MC-3 designated as follows: Lateral H with its sub-Laterals H-1, H-2, H-3 and H-4; Lateral I, J, K, Lateral L with sub-Laterals L-1 and L-2; Lateral M; Lateral N with sub-Lateral N-1 and N-2; Lateral O with its sub-Laterals O-1, O1-1,

O-2 and O-3 and Lateral P. Main Canal No. 3 will end at the head-gates of Lateral O and Lateral P with the total length of 11.4 km.

In case of no dike construction, all or parts of irrigated areas covered by the Lateral canals D, D-3, E, F, G, J, K, L, L-1, N, N-2, O, O-1, O-1-1, O-2, and O3 will be inundated during rainy season. Accordingly, these canals will totally or partially not form part of the project component as in **Case-1**. In this scenario, the length of main canal reduces to 23.0 km from 34.2 km, and the length of lateral canals reduces to 57.8 km from 84.5 km, and then total length of canals reduces to 69.4 km from 107.3 km.

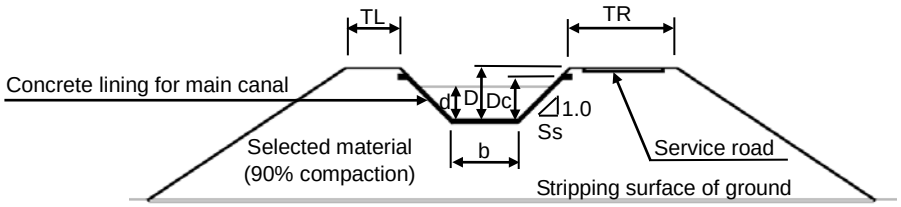
Regarding the remaining area to be constructed after 2019, target canal is MC-2 of 14,109 m from Sta. 8+680 to Sta. 22+279, and Lateral canals C, D, D-1, D-2, D-3, E, F and G. The total length of lateral canals reaches to 22,589 m. In case of no dike construction, irrigated area covered by Lateral D-3, E, F, G and downstream portion of irrigated area covered by Lateral D will be inundated during rainy season. Accordingly target canal for the construction are the MC-2 of 2,920 m from Sta. St.8+680 to Sta. 11+600, and Lateral canals C of 1,677 m, D of 3,820 m, D-1 of 1,299 m, D-2 of 2,250m, and thus total length of lateral canals reduced to 11,966 m.

Table 4.3.6 List of Irrigation Canals and Irrigable Area in LMSA

No	Canal	Case-1		Case-2		Difference		Remarks
		Canal length (m)	Irrigable area (ha)	Canal length (m)	Irrigable area (ha)	Canal length (m)	Irrigable area (ha)	
1-1	RMC-2(～Sta. 8+680)	8,680	768	8,680	768	0	0	On going
1-2	RMC-2(Sta.8+660～)	2,920	162	14,109	796	11,189	634	Remaining
2	RMC-3(～Sta.11+386)	11,386	464	11,386	464	0	0	On going
3	LATERAL A	4,442	251	4,442	251	0	0	On going
4	LATERAL B	1,369	96	1,369	96	0	0	On going
5	LATERAL C	1,677	101	1,677	101	0	0	Remaining
6	LATERAL D	3,820	259	6,341	419	2,521	160	Remaining
7	LATERAL D-1	1,299	67	1,299	67	0	0	Remaining
8	LATERAL D-2	2,250	226	2,250	226	0	0	Remaining
9	LATERAL D-3	0	0	2,288	194	2,288	194	Remaining
10	LATERAL E	0	0	1,948	121	1,948	121	Remaining
11	LATERAL F	0	0	1,990	214	1,990	214	Remaining
12	LATERAL G	0	0	2,653	134	2,653	134	Remaining
13	LATERAL H	5,987	382	5,987	382	0	0	On going
14	LATERAL H-1	3,037	168	3,037	168	0	0	On going
15	LATERAL H-2	1,248	126	1,248	126	0	0	On going
16	LATERAL H-3	3,007	184	3,007	184	0	0	On going
17	LATERAL H-4	1,606	72	1,606	72	0	0	On going
18	LATERAL I	1,648	76	1,648	76	0	0	On going
19	LATERAL J	1,200	30	2,849	193	1,649	163	On going
20	LATERAL K	1,300	34	2,302	197	1,002	163	On going
21	LATERAL L	2,360	43	2,360	370	0	327	On going
22	LATERAL L-1	1,000	31	2,114	155	1,114	124	On going
23	LATERAL M	1,702	83	1,702	83	0	0	On going
24	LATERAL N	2,500	38	3,510	240	1,010	202	On going
26	LATERAL N-1	1,120	63	1,120	63	0	0	On going
27	LATERAL N-2	1,000	28	1,921	114	921	86	On going
28	LATERAL O	1,400	27	4,542	214	3,142	187	On going
29	LATERAL O-1	0	0	2,320	247	2,320	247	On going
30	LATERAL O1-1	0	0	1,077	88	1,077	88	On going
31	LATERAL O-2	0	0	1,210	105	1,210	105	On going
32	LATERAL O-3	0	0	1,794	80	1,794	80	On going
33	LATERAL P	1,488	146	1,488	146	0	0	On going
Total		**69,446**	**3,925**	**107,274**	**7,154**	**37,828**	**3,229**	
Total (on going portion)		**57,480**	**3,110**	**72,719**	**4,882**	**15,239**	**1,772**	
Total (Reaming portion)		**11,966**	**815**	**34,555**	**2,272**	**22,589**	**1,457**	

Source: NIA PMO of MMIP II

Note: **Case-1** Some portions of canals and appurtenant facilities will not be constructed **Case-2** All facilities will be constructed as planned.



Station		Q	V	A	b	d	D	Dc	R	TR	TL	Ss	S	n
from	to	m^3/s	m/s	m	m	m	m	m	m	m	m			
0+000	1+867	5.80	0.92	6.29	2.80	1.47	2.10	1.80	0.90	4.00	2.00	1.0	0.00025	0.0016
1+867	4+911	5.26	0.90	5.83	2.60	1.44	2.00	1.70	0.87	4.00	2.00	1.0	0.00025	0.0016
4+911	9+018	5.06	0.89	5.65	2.50	1.40	2.00	1.70	0.86	4.00	2.00	1.0	0.00025	0.0016
9+018	11+586	4.84	0.88	5.47	2.50	1.40	2.00	1.70	0.86	4.00	2.00	1.0	0.00025	0.0016
11+586	17+198	3.31	0.86	3.85	2.10	1.17	1.70	1.50	0.71	4.00	2.00	1.0	0.00030	0.0016
17+198	22+789	3.05	0.84	3.61	2.00	1.15	1.60	1.40	0.69	4.00	2.00	1.0	0.00030	0.0016

Source: NIA PMO of MMIP II

Note: Q: Discharge, V: Velocity, A: Flow area, b: Canal bed width, d: water depth, D: canal depth, TR: Width of right canal bank, TL: Width of left canal bank, Ss: Slope of canal side slope, S: Slope of canal, n: Coefficient of friction

Figure 4.3.10 Typical Cross section of Canal and Elements of Main Canal MC-2

This picture shows portion of MC-3 at the diversion point from RMC-1 EXT-1. The height of canal embankment at this point is about 8.5m to convey the irrigation water to its final section that is 22.8 km away.

Concrete lining is planned for main canals. Picture shows concrete lining of RMC-1 EXT-1

4.3.4 Drainage Component

All the drainage canals should be constructed to improve the drainage system in the LMSA which will be beneficial not only to the residents and farmers within the irrigated area but also to those within the inundated area enabling the farmers to immediately start the cropping once rainy season ends. However, since the elevation of most parts of LMSA is lower than that of Pulangi river, the drainage facilities with flap gates should be considered to prevent back flow of water at connection point to the Pulangi river.

There are many streams from which flood water comes into LMSA during rainy season while out of which inland flooding goes during low water period for the Pulangi river. To prevent such back-water flooding coming from the Pulangi river into LMSA, drainage sluice should be considered to install all along the natural streams as well as on the man-made drainages existent on the right bank of Pulangi river. Such drainage sluice should be with flap gate, which stops flood water coming into LMSA while releases inland flood water according to the water levels in and out of the LMSA.

As shown in Figure 4.3.11 and Table 4.3.7, the drainage canal system for LMSA consists of 11 main drainage canals and 31 lateral drainage canals to handle excess rainfall in the Service Area. Total length of drainage canals is 75.8 km; 27.9 km belongs to main drainage canals, 24.7 km for lateral drainages, 14.7 km Façade drain, and 8.5 km Kalawag creek.

The eastern section of LMSA has 3 Main Drainage Canals, designated as MDC-A, MDC-B and MDC-C. Four (4) lateral drainage canals discharge into MDC-A. The final outfall of MDC-A is the Pulangi river at the side of Barangay, Raja Muda. There are four (4) lateral drainage canals discharging

into MDC-B which outfalls to the Facade drain. MDC-C, which connects with three (3) drain canals, also discharges drain water to the Facade drain. The Façade drain is originally planned to be constructed with the proposed Ring Dike along the natural depression.

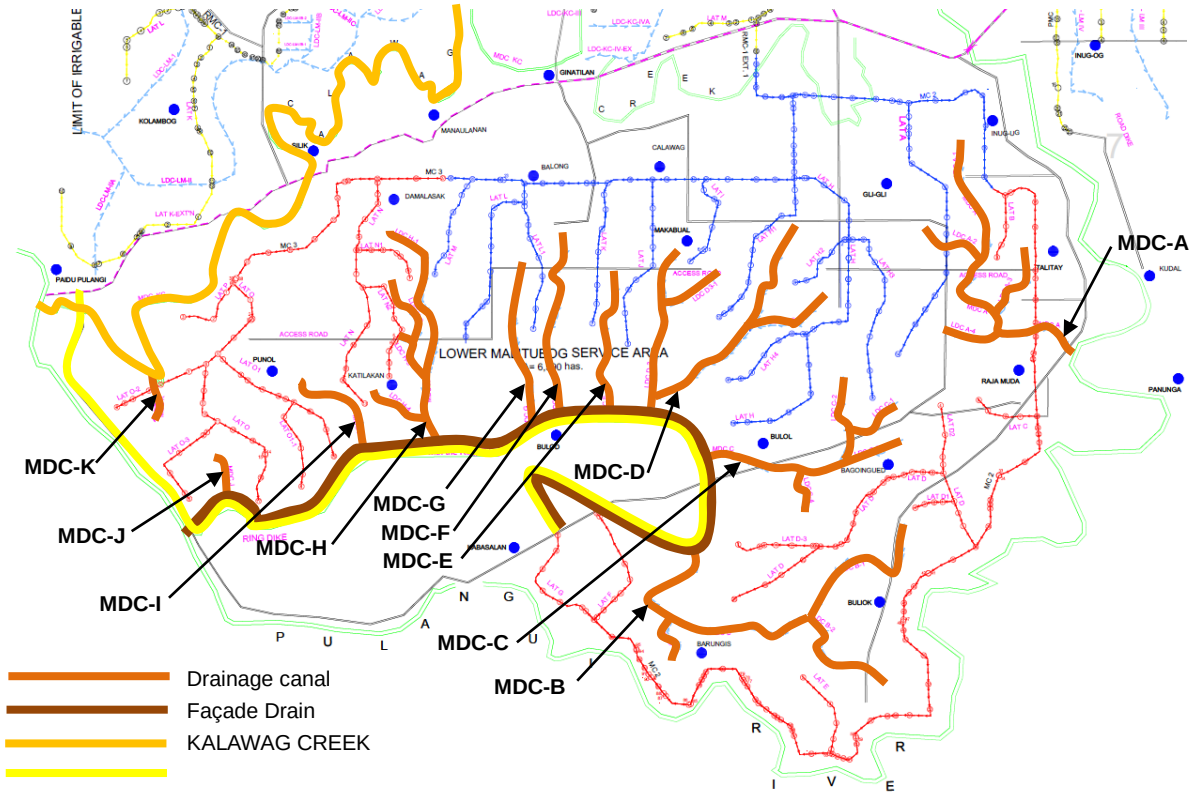


Figure 4.3.11 Plan of Drainage Canal System for LMSA
Source: NIA-PMO, JICA Survey Team

The middle and western portions of LMSA have seven (7) main drainage canals designated as MDC-D, MDC-E, MDC-F, MDC-G, MDC-H, MDC-I, MDC-J and MDC-K. Two (2) of the seven (7) main drainage canals have lateral drainage canals namely MDC-D and MDC-H. There are three (3) lateral drainage canals discharging into MDC-D, while four (4) lateral drainage canals discharge into MDC-H. The outfall of the main drainages except MDC-K is also at the Facade drain.

NIA-PMO has completed the design of all the drainage canals, where the design of the cross sections and longitudinal sections were based on the hydraulic calculation. The design runoff was decided based on intensities corresponding to five-year return period. A drainage model for paddy field considering two-day rainfall and two-day drainage gives a peak unit drainage discharge of 6.4 l/s/ha.

Table 4.3.7 List of Drainage Canals and Excavation Volume in LMSA

No.	Drainage Canal	Length (m)	Excavation (m3)	Remarks
1	Lateral Drainage Canal A (LDC-A1)	547	1,283	Remaining
2	LDC-A2	1,079	3,833	Remaining
3	LDC-A3	1,275	3,165	Remaining
4	LDC-A4	882	5,478	Remaining
5	LDC-B1	2,746	11,727	Remaining
6	LDC-B2	1,941	8,437	Remaining
7	LDC-B3	651	2,092	Remaining
8	LDC-C1	1,082	4,425	Remaining
9	LDC-C2	874	3,378	Remaining
10	LDC-C3	1,161	7,711	Remaining
11	LDC-C4	689	1,554	Remaining
12	LDC-D1	1,760	4,840	On going
13	LDC-D2	1,220	3,303	On going

No.	Drainage Canal	Length (m)	Excavation (m3)	Remarks
14	LDC-D3	940	1,674	On going
15	LDC-F	3,116	15,831	On going
16	LDC-H1	1,824	7,680	Remaining
17	LDC-H2	1,091	4,722	Remaining
18	LDC-H3	883	1,166	Remaining
19	LDC-H4	896	1,449	Remaining
20	Main Drainage Canal A (MDC-A)	4,540	61,070	
21	MDC-B	4,294	102,797	Remaining
22	MDC-C	2,871	56,366	Remaining
23	MDC-D	2,412	19,270	On going
24	MDC-E	2,562	8,109	On going
25	MDC-F	3,116	15,866	On going
26	MDC-G	2,871	7,137	On going
27	MDC-H	2,296	21,289	Remaining
28	MDC-I	1,908	6,341	Remaining
29	MDC-J	1,066	2,083	Remaining
	Sub-total of MDC	**27,936**	**300,328**	
	Sub-total of LDC	**24,657**	**93,748**	
30	FAÇADE DRAIN	14,748	1,288,535	Remaining
31	KALAWAG CREEK	8,460	675,077	On going
	Total	**75,801**	**2,357,688**	
	on going	**30,997**	**812,177**	
	Remaining Portion	**44,804**	**1,545,511**	

Data Source: NIA PMO of MMIP II

Photo shows the lateral drainage canal (LDC-PR-III) excavated in 2011 to improve the drainage capacity.
Source: NIA-PMO

Photo shows the drainage pipe crossing at Sta. 0+120 of MC-3, which is the facility for drainage canal to cross the irrigation canal.
Source: NIA-PMO

4.3.5 Countermeasure for the Damage of Irrigation Canal Caused by Flood

Following the scenario for **Case-2**, having countermeasures for the possible damage of irrigation canals and facilities easily coursed by flood is a must hence, it is necessary to: 1) raise the height of canal embankment, 2) employ slope protection on the slope of embankment, 3) concrete lining inside the canal and; 4) replacement of earth canals with concrete flume canal at the end portion of lateral canals.

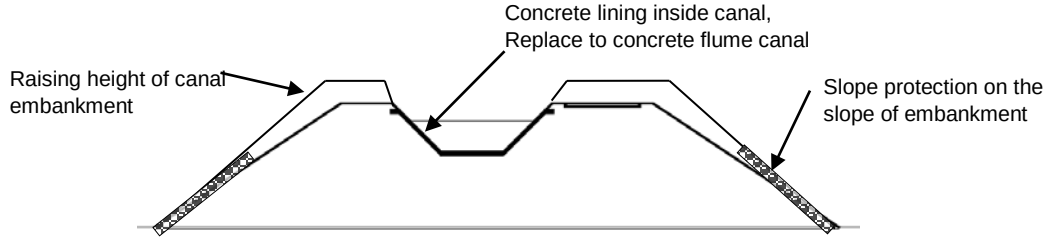


Figure 4.3.12 Countermeasure Method for the Damage of Irrigation Canal by Flood
Source: JICA Survey Team

4.3.6 Construction Cost of Irrigation System and Drainage System in LMSA

In order to compare the irrigation development cost per hectare of both cases in LMSA, the direct cost

of civil works is estimated in **Case-1** and **Case-2**. Unit cost of the works is the same as the unit cost NIA PMO uses for cost estimation in 2018. The quantity of each work, except for the countermeasure for the damage of canal caused by flood, is according to the estimation of NIA-PMO. Regarding cost estimation of the countermeasure for the damage of canal caused by flood, unit cost is used the reference unit price which is used for the construction of the canal and canal structure.

As shown in Table 4.3.8, the total cost of irrigation development in LMSA becomes PhP [redacted] ([redacted] Japanese Yen) for **Case-1**. On the other hand, **Case-2** will be PhP [redacted] ([redacted] Japanese Yen). In **Case-1**, the irrigable area of 3,688 ha is to be developed; therefore, the irrigation development cost per hectare would be [redacted] ([redacted] yen). While **Case-2**, the irrigable area of 6,590 ha is to be developed; therefore, the irrigation development cost per hectare arrives at [redacted] PHP ([redacted] Japanese yen).

Table 4.3.8 Comparison of Direct Cost on Civil Works for Irrigation Development in LMSA

No	Item	Portion	Original Plan		Case-1		Case-2		Difference between Case-1 & 2	
			(M. Peso)	(M. JPY)	(M. Peso)	(M. JPY)	(M. Peso)	(M. JPY)	(M. Peso)	(M. JPY)
1	Construction of the MC-2	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		Remain	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2	Construction of the MC-3	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3	Construction n of the Lateral, MC-2	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		Remain	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
4	Construction of the Lateral, MC-3	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5	Construction of the Main Drainage (MDC)	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		Remain	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
6	Construction of the Main Drainage (LDC)	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		Remain	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
7	FAÇADE DRAIN	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8	KALAWAG CREEK	On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9	Protection Dike	Remain	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
10	Ring Dike	Remain	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
11	Countermeasure for the damage of canal by flood	Additional	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Total	**Whole**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		On going	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		Remain	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Irrigable area (ha)	**Whole**	**6,590**		**3,688**		**6,590**		**2,902**	
		On going	4,457		4,457		2,687,		1,770	
		Remain	2,133		2,133		1,001		1,132	
	Irrigable area in dry and rainy season (ha)	**Whole**	**13,180**		**6,498**		**10,400**		**3,902**	
		On going	8,914		4,496		7,266		2,770	
		Remain	4,266		2,002		3,134		1,132	
Unit cost per irrigable area (000 Peso/ha) (000 JPY/ha)			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Unit cost per irrigable area of dry and rainy season (000 Peso/ha) (000 JPY/ha)			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Data Source: NIA PMO of MMIP II

Note: 1) Original plan is that the Dikes will be constructed according to the original design without foundation treatment
2) Case-1: target area is part of LMSA with constructing the part of the irrigation canals and all drainage system
3) Case-2: target area is all LMSA with constructing all irrigation canals and all drainage canals.
4) Costs of the canal structure and the drainage structure are included in the costs of the canals

4.3.7 Operation and Maintenance of Irrigation Systems

The Operation and Maintenance (O&M) of the National Irrigation Systems is managed by the Irrigation Superintendent (Principal Engineer) appointed under the Regional Irrigation Manager of

NIA. The Superintendent is responsible for the management of such activities as planning, programming, monitoring and evaluation, and care and maintenance of NIA properties in the region. The Engineering Division is responsible for planning, programming, scheduling and implementation of the maintenance activities, in coordination with the Administrative and Equipment Management Divisions, under the supervision of the Superintendent.

The Maridagao River Irrigation System (MRIS) Management Office, which is in the Operation & Maintenance Section of Cotabato Irrigation Management Office under the NIA Region XII, has the responsibility in the operation of the irrigation systems and the maintenance of main structures such as diversion dam, siphon, diversion canals, main canals and lateral canals in the Service Areas of MMIP I. Concerning MMIP II area, the service areas under two IAs namely Nalapaan and Chrislam IAs were completed and already handed over to the MRIS Management Office from the PMO. Thus, after the completion of the project, all irrigation systems and drainage systems will be handed over to MRIS Management Office from PMO.

Table 4.3.9 shows the current staffing structure and appointment status of the MRIS Management Office. In terms of the appointment status at the time of survey, all the 21 positions were filled as planned. The executing agency did not report any significant O&M constraints due to shortages in staff. Routine (day-to-day) and monthly inspections based on a pre-set maintenance items are conducted in order to identify probable problems as early as possible. Once problems are identified, they are immediately reported and addressed in order to prevent further deterioration and to ensure optimum sustainable performance of the irrigation systems.

However, after completion of the project, the Service Area will be expanded up to almost two times of current service area, therefore, NIA shall increase staff based on the size of service area and work volume. The future plan shown in Table 4.3.9 is proposed by the JICA survey team. The number of the water resources facilities operator B will be revised according to the necessity from view point of the actual water management. The number of the driver mechanic B will be revised based on the maintenance machinery including procured one and annual work volume as well. Temporary driver will be acceptable.

Table 4.3.9 Proposed Staffing Plan of the Maridagao River Irrigation System (MRIS) Management Office

	Title	Major Responsibilities	Planned	Appointed	Future Plan
1	Principal Engineer A	Direct supervision of the implementation and O&M	1	1	1
2	Senior Engineer A	Assistance in supervisory activities	1	1	1
3	Senior Irrigators Development Officer	Training/capacity building, strengthening of Irrigators' Associations	1	1	2
4	Senior Water Resources Facilities Technician	Maintenance of machinery and other mechanical equipment	4	4	4
5	Collection Representative A	Collection of irrigation service fees (1/), developing plans and strategies to improve collection rates	1	1	0
6	Plant Electrician B	O&M of plant electrical system	1	1	1
7	Heavy Equipment Operator	Operation of heavy equipment	1	1	2
8	Accounting Processor A (Billing Check)	Accounting	1	1	1
9	Industrial Security Guard A	Safeguarding of properties, facilities and compounds	4	4	4
10	Data Encoder	Data input related to various acquired data and information	1	1	1
11	Driver Mechanic B	Mechanic maintenance and driving service	1	1	2
12	Water Resources Facilities Operator B	Operation of gates to regulate amount of water to store/needed	3	3	10
13	Utility Worker	Office maintenance	1	1	1
Total			**21**	**21**	**30**

Data Source: NIA-Region XII organizational structure and its authorized positions (as of May 2017), and the future plan is a

proposal by the JICA survey team
Note: 1/ According to the current president's pledge, the irrigation service fee was granted free of charge from the monsoon season of 2017. Therefore, from this season of 2017 monsoon, the fee is not collected.

The MRIS Management Office has their own machinery as shown in Table 4.3.10 for maintenance of irrigation canals and drainage canals including service road. According to the MRIS Management Office, with the existing equipment, they could not accommodate all repair works and rehabilitation in the operation & maintenance of all present service road, which is 141.191 km including the service roads at the new irrigation Service Area of 2,206 ha in UMSA. Therefore, additional maintenance machinery was requested by MRIS Management Office as shown in Table 4.3.11.

Table 4.3.10 Existing Maintenance Machinery which MRIS Office Owns

No	Item	Specification	Year of procurement	unit	Quantity
1	Dump Truck	Nissan Dump Truck, UD model CPC14HHLT	2004	unit	2
2	Backhoe	Hydraulic Walking Excavator, Euromack Mdl, 650M, wheeled type, hydraulic operated Kubota Engine, Model V3300 turbocharged, 80HO at 2200 rpm, fully air-conditioned	2001	unit	1
3	Grade	Komatsu Model GD510R Hydraulic operated Kumatsu diesel engine Model S6D95L 125 HP	2002	unit	1
4	Loader	Front end loader, Furukawa FL 150-1, 6BD1 engine	2002	unit	1
5	Crane			unit	1

Data Source: MRIS Management Office

Table 4.3.11 MRIS Office's Request of Additional Maintenance Machinery

No	Item	Specification	unit	Quantity	Remark
1	Dump Truck	332HP(246kW), Loading Capa. 10 ton	unit	6	
2	Hydraulic Excavator	Bucket 0.8m3(0.6m3), 20 ton	unit	1	
3	Long Armed Hydraulic Excavator	Bucket 0.4m3(0.3m3), 22 ton	unit	1	
4	Motor Grader	120 HP (89kW), 10 ton	unit	1	
5	Wheel Loader (Front-End Loader)	Bucket 1.3~1.4m3, 6.9 ton	unit	1	
6	Compactor (Tamping Roller)	10 ton, Vibratory	unit	1	

Source: JICA survey team
Note: Item of maintenance machinery and number is added by JICA survey team based on the original request

The MRIS Management Office has its own O&M Manual that consists of the following three volumes: Volume I- Main System; Volume II- Diversion Dam O&M; and Volume III- Annexes. The Manual provides sound and appropriate guidance for operating and maintaining the irrigation system. There have been no reported issues related to usefulness and actual usage of the manual. While most parts of the manual are still useful however, there are parts that need revision.

The revision should be made based on the actual irrigated area, as-built (actual) canal design and irrigation facilities in order to avoid the shortage of irrigation water especially at lower areas by proper operation. In addition, it is important to reduce the excess irrigation water which flows to low ground level areas as drainage water in order to prevent damage by inundation. Therefore, the operation for reducing excess water shall be added to the operation manual.

NIA has provided a wide range of training courses in order to ensure technical standards for O&M activities, including not only O&M related subjects but also financial planning/management, organization of IAs, collection of irrigation service fees[3] and agricultural techniques. Some training courses, such as 'Preparation of O&M plans' and 'Financial planning and control', were repeated year after year. It is required that such trainings shall be continued in order to keep irrigation system suitable.

4.3.8 IMT and Irrigators Association Establishment

[3] Irrigation fee was decided free from 2017 monsoon season by a current president's pledge, and therefore, from this season the irrigation service fee is not collected.

With the development of the irrigation system, the operation and maintenance (O&M) of the facilities are to be another crucial sphere to enhance irrigation performance, as well as to sustain the facilities and ensure the water supply up to the end beneficiaries. In order to make irrigation facilities function equally to the water users at the upstream, midstream, and downstream, it is important to consider that NIA and the farmers would organize joint management through irrigation management transfer (IMT).

This section provides the plan for the government – farmer joint irrigation management and also farmers organization, Irrigators Association (IA), establishment.

1) Direction of Irrigation Management

To improve irrigation performance, there are mainly 3 options of irrigation management: government management, farmers' management, and joint management. Several countries where there are national irrigation systems have chosen joint management between the government and the beneficiary farmers, and transferred the responsibility, or a part of the responsibility, of irrigation management from the government to farmers' organizations.

This handing over of irrigation management is known as irrigation management transfer, so-called IMT. The movement had gradually begun around the 1950s to 1970s in distinct parts of the world, such as France, Taiwan, the United States of America, and Colombia; then it was spread in the 1980s to 1990s to the other various countries such as the Philippines, Mali, Tunisia, Bangladesh, New Zealand, Mexico, and Dominican Republic, totaling more than 60 countries.

The advantages of the IMT are considered as the beneficiary-oriented irrigation management and the better cost and human allocation based on the reformation of the government irrigation sector. Farmers are the ones who use the water, conduct irrigation farming, and are directly benefited from the irrigation systems, and also, know the condition and the needs of the terminal irrigation facilities.

Frequent minor maintenance by the end water users can reduce necessity of large-scale rehabilitation to be organized by the government. In addition, reduction of the government maintenance expenses allows them to invest more in the primary construction needs in the other parts of the country or large scale rehabilitation of existing aged systems. Finally, it leads to the increment not only of agricultural productivity but also overall revenue related to the irrigated agriculture, e.g. through irrigation service fee paid by the farmers or otherwise government subsidy in lieu of the service fee, within the country.

From the farmers' perspective, there are both burdens and benefits associated with IMT. The possible burdens and benefits for the farmers are as follows, indicating that there are considerable benefits to the farmers with IMT though there are some burdens for the farmers:

(Burdens)

1) Need to spare long time for the meetings, group activities, and consensus making.
2) Need to bear the expenses such as membership fee or maintenance fee.
3) Need to learn some technical matters such as water management, irrigated farming and financial management.

(Benefits)

1) Can promptly maintain damages or malfunctions of the canals and farm ditches where the farmers maintain.
2) Can consider cropping patterns and the water distribution for the area collectively among the water users using the same turnout.
3) Can examine the on-farm ditch construction or maintenance as a group, even in the area where plot-to-plot irrigation is the major one.
4) Can get water in proper timing with proper amount due to above 3 benefits.

5) Can increase yield and quality of the products due to proper crop selection, uniform planting period or cropping pattern in the area, resulting in reduction of disease, insect and pests.
6) Can rapidly claim to the relevant government agency such as NIA as an association in case the water users need large-scale repair.
7) Can open a bank account as an association to manage collective capital, and can collect funds as required by the association, and
8) Joint purchase of agricultural inputs and joint sale of the products may be possible in future.

Having seen above points, joint irrigation management is recommended as the potential breakthrough in enhancing the irrigation performance upon completion of the MMIP II. In fact, this concept has been introduced to almost all the NISs, not exceptional to MMIP I area. In order to introduce above irrigation management mechanism, establishment of farmers' organization, so-called Irrigators Association, is to be required as the responsible entities, to which handing over of operation and maintenance of some irrigation facilities from the NIA will be made.

2) Farmer Organization: Irrigators Association (IA)

Based on the plan of joint irrigation management above-mentioned, the main canals, big lateral canals or parts of the big laterals, and the related irrigation facilities are, in principle, managed by the NIA, and the relatively small lateral canals and sub-laterals, turn outs attached thereto, on-farm ditches including main farm ditch and supplementary farm ditch are to be managed by the farmers' organization namely Irrigators Association (IA), though it can be adjusted depending on the length or irrigable area of the canals.

On-farm ditches should be basically created and managed under the farmers' responsibility regardless of current on-farm conditions. In case that the area does not have clear on-farm ditches at present, which is the most common case where the irrigation facilities are being constructed and to be constructed, the water users will discuss, plan and construct those after the establishment of Turnout Service Area Group (TSAG) or the IA.

Of course, the construction of new on-farm ditches is to be conducted only when the water users understand advantages and challenges as well as required costs and labors of on-farm ditch installation, and recognize the necessity together with future crop diversification which is possible only with such on-farm ditch. To assist farmers to construct the ditches, NIA may assist by providing machineries, e.g. excavator or small roller/ compactor.

The management, such as operation and maintenance of the irrigation system including weeding, desilting and collecting of irrigation service fees when applied[4], should be handed over to the IAs for the blue colored lateral canals basically managed by the IAs. The gates installed at the boundary of the NIA management and IA management area should be operated by the NIA gate keeper, and the facilities thereafter should be operated and maintained under the responsibility of the concerned IAs.

[4] The irrigation service fee is now granted free of charge from 2017 monsoon season by the current president pledge made during his election campaign. However, since such irrigation service fee paid by the users should be the basis for well operating and maintaining the irrigation facilities at a sound functional level, such fee should be considered in future or otherwise the Government should provide NIA with enough subsidy, which is meant to spend on the operation and maintenance of existing irrigation systems.

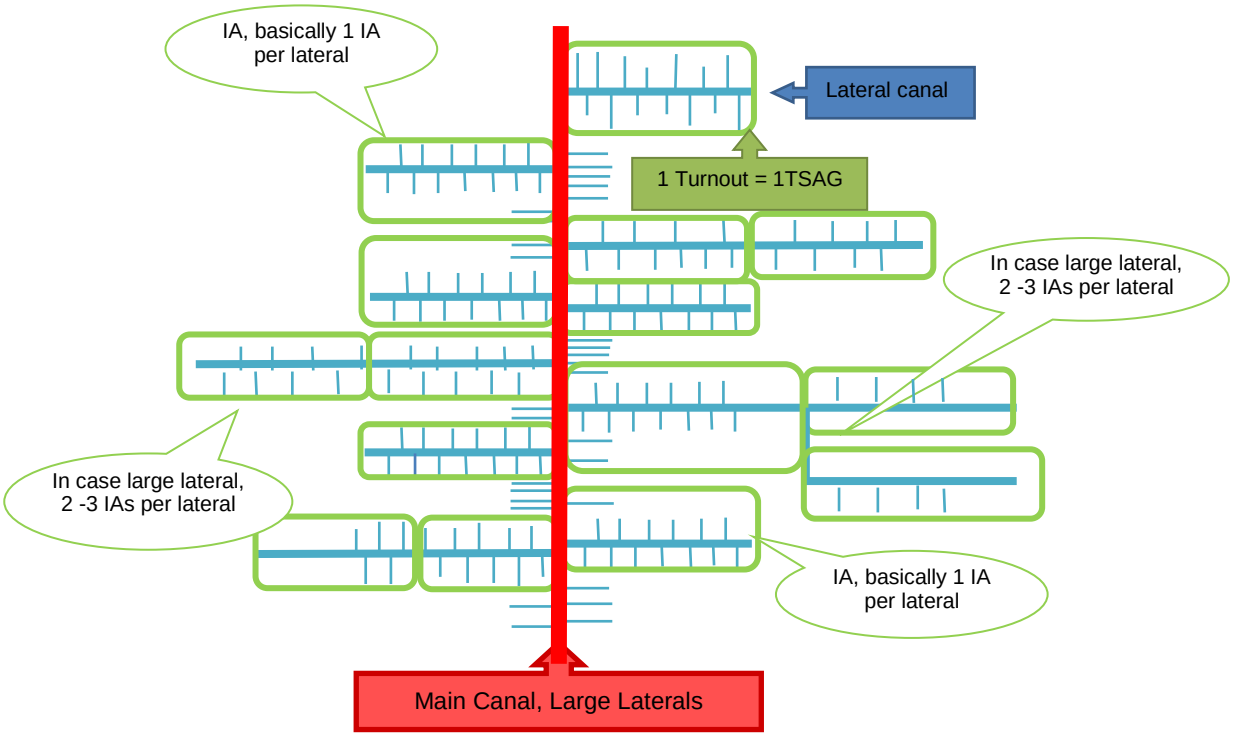


Figure 4.3.13 Image of Irrigation Management Transfer

Source: JICA Survey Team

Based on the above discussions, following table presents IA establishment in the MMIP II area in the lower part together with the IAs already established in MMIP I area and two (2) IAs in MMIP II area in the upper part. According to the IAs already established, average IA coverage comes to 350 ha with 266 farmer memberships. This size of IAs could be manageable if the structure is stratified starting with TSAGs and then IA. With reference to the total number of TSAGs in MSA, 174 in total, and also the 11 IAs in the MSA, one IA is to have 16 TSAGs.

Table 4.3.12 Irrigators Association and Turnout Service Area Group

No	Name of IA	Service Area	Service Area, ha	Membership	Area/ FHH	Remarks	No. of TSAG
1	Gagdanen Baya	MSA	349	379	0.92	MMIP I	
2	Tafia	MSA	211	180	1.17	MMIP I	
3	Katingkongan	MSA	395	400	0.99	MMIP I	
4	Morning Light	MSA	378	240	1.57	MMIP I	
5	Basbia	MSA	437	330	1.32	MMIP I	174
6	Mansapa	MSA	202	200	1.01	MMIP I	
7	Kipan	MSA	377	330	1.14	MMIP I	
8	Nasgia	MSA	215	185	1.16	MMIP I	
9	MRIS IA DIV. 5 Inc.	MSA	904	134	6.75	MMIP I	
10	Nasfia	MSA	168	165	1.02	MMIP I	No./IA
11	MRIS Div. 6	MSA	354	202	1.75	MMIP I	**16**
12	Edufia	UMSA (P1)	186	124	1.50	MMIP I	
13	Bagonabati	UMSA (P1)	642	680	0.94	MMIP I	
14	Balatikan	UMSA (P1)	398	333	1.20	MMIP I	
15	Crislam, 1/	UMSA (P2)	339	316	1.07	MMIP II	
16	Nalapani, 1/	UMSA (P2)	52	62	0.84	MMIP II	
	Total		5,608	4,260	1.32		
	Average		**350**	**266**	**1.32**		
No.	**Service Area**	**Stage**	**Area, ha**	**No. of Laterals**	**Ave Area/ IA**	**Membership/ IA**	**No. of TSAG**
1	Upper Malitubog	MMIP II	2,958	11	269	204	-
2	Pagalungan Ext.	MMIP II	988	3	329	250	28

No	Name of IA	Service Area	Service Area, ha	Membership	Area/ FHH	Remarks	No. of TSAG
3	Lower Malitubog	MMIP II	6,590	16	412	313	262
			to add +	3	347	263	No./IA
	Total/ Average of MMIP II		**10,536**	**33**	**319**	**243**	**14**

Note: 1/ Crislam and Nalapani IAs are within the Upper Malitubog SA of MMIP II, and therefor they are included in the IAs of Upper Malitubog shown in the lower part of the table (see No.1 of lower part of the table).
Source: JICA Survey Team

Concerning the MMIP II area, in fact IAs in the UMSA have been already established, or nearly completed, providing total 11 IAs at an average area of 269 ha and average membership of 204. IAs in PSA and LMSA have not yet been established, and they are to be organized from year 2018. There are in fact 3 laterals in Pagalungan area, and therefore total 3 IAs should be established, giving an average area of 329 ha and average 250 memberships.

In LMSA, there are 16 laterals in total providing irrigation water to 6,590 ha of area. If there will be 16 IAs assigned to each of the laterals, the average coverage area arrives at 412 ha with 313 memberships, which are in fact bigger than what the farmers seem to manage. Therefore, big laterals, e.g. Lateral-D, H, and O should be divided into two (2) areas hence there will be two (2) IAs each in such big laterals. Adding the three (3) IAs, there will be total 19 IAs for the 16 laterals, whereby a typical average IA is to cover 347 ha with 263 memberships.

In sum, within the MMIP II area, there will be 33 IAs with an average coverage of 319 ha, 243 memberships, and 14 TSAGs per typical IA. Since there are 14 IAs in the MMIP I area, there will be total 47 IAs upon completion of the MMIP II. In order to organize farmers into such IAs, NIA-PMO should undertake step-by-step procedure in consolidating the farmers into TSAG, and then IA with the past experiences.

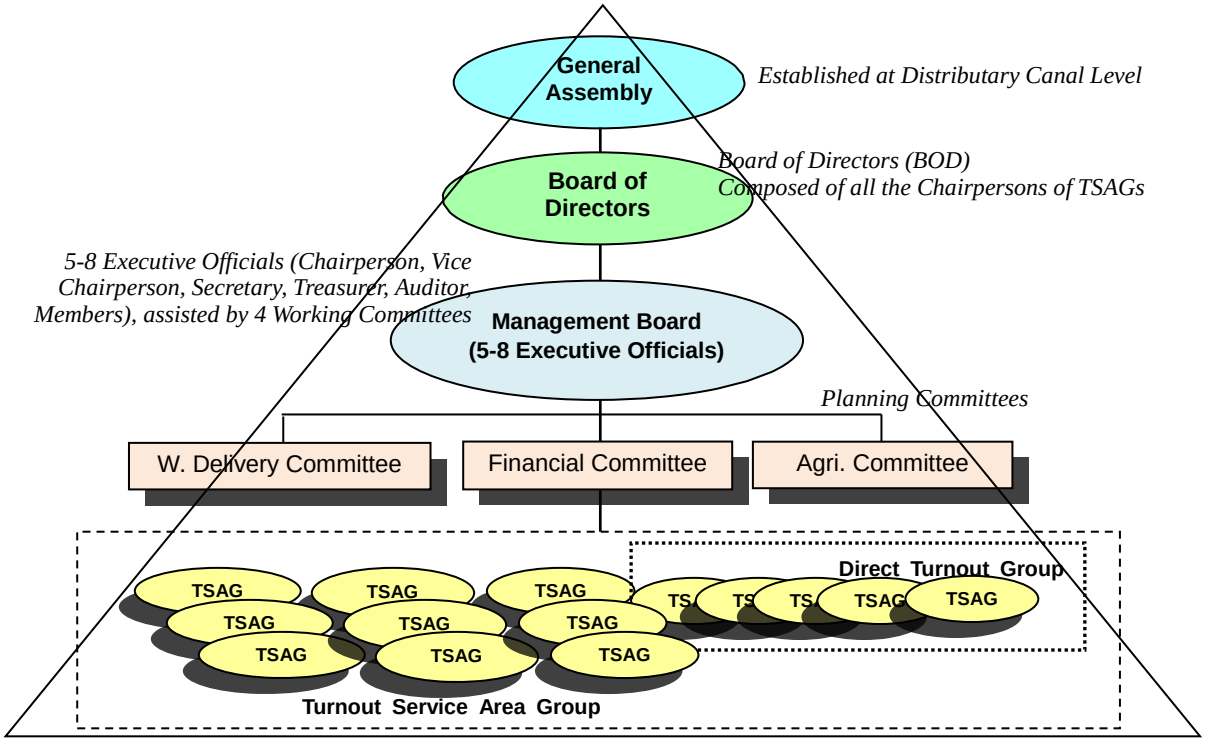


Figure 4.3.14 Organizational Structure of WUA for Distributary Canal
Source: JICA Survey Team

The IA is planned as multilayer structure to prevent centralization of the power to one specific person (see figure below). The functions of planning, decision making, and implementation should be de-centralized into the other groups of the members within the structure. As shown in the figure below,

the base structure should be the TSAGs, which are organized by each turnout water users. Each TSAG has a leader and co-leader, in addition, supporters depending on their necessity.

On the other hand, the apex structure in the IA structure is the General Assembly (GA) composed of all the water users to decide the most crucial issues for the association such as budget, registration of the association, rules and regulations. The Board of Directors (BOD) should be formed by all the TSAG leaders, which can also function as decision making body for the issues related more to the implementation such as annual target of the maintenance. When the BOD members have a meeting, NIA officers will also participate in this meeting as an observer.

Under BOD, 5 to 8 executive officials should be nominated from the BOD members and organize the Management Board (MB), which is responsible for the day-to-day implementation. Each of the MB officials has their own duty as chairperson, vice-chairperson, secretary, treasurer, auditor, and the MB members. The nominated MB members and their duties including the ones of BOD should be finally approved and decided by GA.

The workloads of these executive officials may discourage themselves to continue their duties on a voluntary basis. Therefore, incentives to the officials such as honorarium from the collected fees from members or prior water distribution may be considered and discussed among the water users based upon their needs. In addition, some positions require technical knowledge such as treasurer and auditor. Therefore, the Water Users Association (WUA) can employ those officials as a part time worker from outside of the association, if necessary.

All planning of each specific concern is made in the Planning Committees (PC) placed under the MB. The committee may include water delivery committee, financial committee, and agricultural development committee, etc. depending on their necessity. The MB officials can lead each committee as a leader: for instance, financial committee by the treasurer, water distributary committee by the vice-chairperson, and agricultural development committee by the secretary. Then, the committee members are selected from water users who are willing to participate in each committee activities.

The necessary steps to organize IA can be as follows, and the steps, especially the confirmation of turnout locations and the steps which involve farmers, such as list-up of water users and the update of the parcellary map, introduction of IA, and establishment of TSAGs, are desirable to start in parallel with the construction of the irrigation facilities. To take an attention and initial motivation of the beneficiary water users, ensured water supply from the irrigation facilities is to be crucial and fundamental to mobilize farmers into the initial multiple works required during the formation of IA:

1) Confirmation of turnout location,
2) List-up water users by each turnout,
3) Introduction of IA to the water users,
4) Decide leader and co-leader for Turnout Service Area Group (establishment of TSAGs),
5) Hold 1st meeting among leaders from all TSAGs (establishment of BOD),
6) Hold 1st General Assembly by all the IA members (establishment of GA)*,
7) Hold 1st meeting among selected 5 – 8 executive officials (start-up of MB),
8) Hold 1st meeting for Planning Committee (start-up of the PC),
9) Hold 2nd GA meeting (approval and start-up of activities as IA),
10) Preparation for legal registration of IA with SEC and;
11) Trainings on O&M and others.

In above process, NIA-PMO and the farmers will act as the main actors of implementation, while consultants may participate to be the supporters to present IA concepts, structure and necessary

preparations. This whole process requires 1-2 years. During the project implementation, the responsible PMO officers of IMT and IA establishment, for example institutional development officer, may organize a committee such as 'IA promotion committee' in order to proceed the IA establishment and lead or share the knowledge in the future.

4.3.9 Future's Plan/Project after MMIP II

1) Rehabilitation and Improvement of Irrigation Facilities in MMIP I

The construction of irrigation canals and facilities under MMIP I was started in 1990 and finished in 2011. Some of the facilities which were constructed at the beginning of the project implementation period have already more than 20 years, and there are some damaged facilities which need rehabilitation. The Maridagao River Irrigation System (MRIS) Management Office is responsible for the operation & maintenance of irrigation systems constructed under MMIP I, and their plan for rehabilitation/ improvement of the irrigation/ drainage systems constructed under MMIP I is shown in Table 4.3.13 below.

At the diversion dam site, 4 items which require rehabilitation/ improvement works are confirmed. The first item is the construction of the shade to protect the gate lifting devices at the 8 spillways from rain and sunlight, in order to avoid immediate drying up of greasing & oiling. The second item is the installation of the trash rack at the entrance of 3 intakes to avoid accumulation of debris that slows down the distribution of water. The third item is the repair and rehabilitation of riprap at the tail end of wing dike facing downstream to avoid scouring. The fourth item is the painting of the accessories to prevent from rusting.

In the Service Area for Bagonabati IA and Tafia IA, a drainage problem has been confirmed. To address it properly, it is necessary to repair and rehabilitate the drainage canal (LDC- PR II), to construct an additional drainage canal from lateral a-1 to Pulangi River, to install three (3) unit control gates at MDC-2 and to extend the canal at Lateral I-2 to prevent frequent flooding of the area from MDC-2.

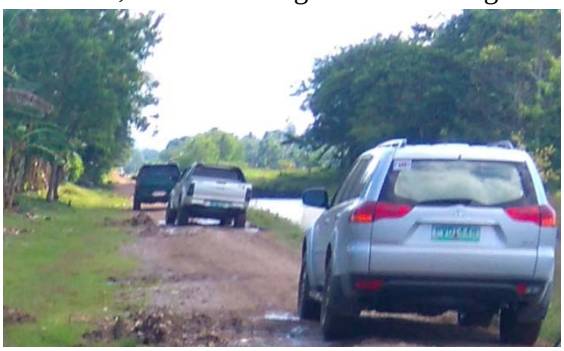
In another Service Area where Nasf IAa, Mrisia div. 5 IA, Kipan IA, Mansapa IA, Basbia IA and Morning light IA are working, MDC-1 was completed but water has never been delivered to the IA member's farms, due to lack of irrigation facilities from the said canal. Therefore, the farm canals (MFD, SFD) and structures shall be constructed in that Service Area along Lateral D (1-unit Turn out; 4.80 km MFD), Lateral D-1 (2.5 km. MFD), Lateral D-4 (2- units T.O; 3 km. MFD), Lateral C (3.4 kms. MFD), Lateral A-2 (1.20 kms. MFD), Lateral A (2.50 kms. MFD) and Lateral A1-1 (1- unit T.O; 2.00 kms. MFD).

The total length of service roads along canals constructed under MMIP I is 169.6km. Most of them are earth roads with pavement on only a small part, if any, and they are already damaged by rain. The absence of drainage ditch along the cutting section of

Above pictures show a gate lifting device at spillway. There is no shade to protect them from rain and sunshine, and metal parts of the device rust easily. Actually, in seven devices, the cable is already rusty and broken and the lifting devices are not working properly. The operation of these devices is at risk, hence the operation of the entire dam.

the canals has spurred the speed and the extent of dilapidation. Consequently, the bad condition of these roads has hampered the provision of proper O&M to irrigation facilities.

There are damaged canal structures which require rehabilitation, such as steel gates of head regulator for lateral canals and turn-outs. Some of gates are not equipped with lifting devices, steel plate frames and other gates accessories, which are vital for O&M, especially in water distribution activities.



The picture shows service road along the main canal in the Maridagao Service Area. Some parts of earthen road become muddy due to rain.

There are some main canals which do not have lining partially, such as 2.0 km in MC-2 and 0.98km in RMC-1. The MRIS Management Office proposed concrete lining for the said portions in main canals and 10 km of lateral canals to enhance smooth delivery and distribution of water to irrigated areas and to reduce water convey loss.

Table 4.3.13 Proposed Repair or Rehabilitation of Irrigation/ Drainage Systems

No	Proposed Item	Description
1	Construction of shade to the gate lifting mechanisms (at diversion dam)	To protect the gate lifting mechanism at 8 spillways from rain & sunlight to avoid immediate drying up of greasing & oiling
2	Installation of trash rack at the entrance of 3 intakes (at diversion dam)	To avoid accumulation of debris that slows down the distribution of water.
3	Repair and rehabilitation of riprap of the tail end of wing dike (at diversion dam)	To avoid scouring of riprap.
4	Painting of the dam & accessories (at diversion dam)	To prevent some accessories from rusting.
5	Repair & Rehabilitation of Drainage Canal (LDC- PR II) Construction of the additional new drainage canal from lateral a-1 to Pulangi River	Frequent flooding This will enhance the water to flow smoothly & prevent submergence of the Irrigation area. Service area of Bagonabati IA
6	Improvement of existing drainage to be provided 3 unit control gates at MDC-2. Extension of canal at Lateral I-2.	To prevent frequent flooding of the area from MDC-2 (target area 46ha) Service area of Tafia IA
7	Construction of the farm canal (MFD, SFD) and turn out and farm structure Lateral D (1- unit Turn out; 4.80 km MFD) Lateral D-1 (2.5 km. MFD) Lateral D-4 (2- units T.O; 3 km. MFD) Lateral C (3.4 kms. MFD) Lateral A-2 (1.20 kms. MFD) Lateral A (2.50 kms. MFD) Lateral A1-1 (1- unit T.O; 2.00 kms. MFD)	Some of the area after the construction of MDC-1 was not irrigated due to lack of irrigation facilities. Service area of Nasf IA Nasf IA Mrisia div. 5 IA Kipan IA Mansapa IA Basbia IA Morning light IA
8	Rehabilitation/improvement of the service roads along canals (141.191 km)	Most of the service roads for OM of the irrigation facilities were damaged due to earth road.
9	Rehabilitation of canal structures (Steel gates for Head gates and Turn-outs)	Some of gates and turn-outs lack lifting mechanism, steel plate frames and other gates accessories which are vital for O&M especially in water distribution activities.
10	Improvement of the canal by lining MC-2 (no lining portion): 2.0 km RMC-1 (no lining portion): 0.980 km. Laterals (unlined canal): 10 km	To enhance smooth delivery and distribution of water to irrigated areas and reducing water convey loss, unlined canals will be lined.

Source: JICA Survey Team

2) Improvement of Irrigation Facilities Constructed under MMIP II

PMO want to improve the Lateral canals to concrete lining canal for reducing the load of maintenance. In addition, when NIA will select the **Case-2** plan which target area is all irrigable area of 6,590 ha in LMSA with constructing all irrigation canals and all drainage canals, the remaining budget will be insufficient to construct all irrigation canals and drainage canals including indirect cost such as Institution Development, Social Preparation, Right of Way, Procurement by Government, and Field Support, Supervision & Monitoring (FSSM). At first the countermeasure for the damage of irrigation

canals by flood will be canceled. Moreover, some drainage canal will be canceled. Downstream portion of some irrigation canals may be canceled to adjust construction cost in the remaining budget, if the construction cost will be increase due to price escalation. Cancelled component will be picked up to construct in other project.

Table 4.3.14 Proposed Improvement of Irrigation/ Drainage System Constructed under MMIP II

No	Proposed Item	Description
1	Upgrading of Lateral Canal in UMSA, LMSA and PESA	Canal Lining will be introduced to Lateral canals to reduce the maintenance load. Lateral Canals at LMSA (Total Length = 22 km) Lateral Canals at LMSA (Total Length = 82 km) Lateral Canals at PESA (Total Length = 8.8 km)
2	Countermeasure for the damage of irrigation canals by flood	1) Raising height of canal embankment, 2) slope protection on the slope of embankment, 3) concrete lining inside canal and 4) replacement to the concrete flume canal at end portion of Lateral canals and field canals from the earth canal.
3	Construction of the cancelled works which are planned to construct under MMIP II	D/S portion of irrigation canals and canal structures Some drainage canals and drainage structures Improvement of maintenance road
4	Rehabilitation of damaged irrigation and drainage facilities constructed under MMIP II	Some of the facilities will be damaged after starting operation for some years and will be repaired. In case of minor damage, it will be repaired by MRIS maintenance office by using annual budget In case of large damage, It will be rehabilitated of replaced

Source: JICA Survey Team

3) Procurement of Maintenance Machineries for MMIP

The MRIS Management Office has their own machinery for maintenance of irrigation canals and drainage canals including service road. According to the MRIS Management Office, with the existing equipment, they could not accommodate all repair works and rehabilitation in the operation & maintenance of all present service roads. Therefore, additional maintenance machinery was requested to the JICA survey team during first field survey period in 2017. Evaluated and considered the condition after the completion of the project, the JICA study team recommends the additional number and maintenance machinery, which shall be procured by future project, as future plan as shown in Table 4.3.15.

Table 4.3.15 Procurement Plan of Maintenance Machinery

No	Item	Specification	unit	Quantity	Remark
1	Dump Truck	332HP(246kW), Loading Capa. 10 ton	unit	6	NIA's Request
2	Hydraulic Excavator	Bucket 0.8m3(0.6m3), 20 ton	unit	1	NIA's Request
3	Long Armed Hydraulic Excavator	Bucket 0.4m3(0.3m3), 22 ton	unit	1	NIA's Request
4	Motor Grader	120 HP (89kW), 10 ton	unit	1	NIA's Request
5	Wheel Loader (Front-End Loader)	Bucket 1.3~1.4m3, 6.9 ton	unit	1	NIA's Request
6	Compactor (Tamping Roller)	10 ton, Vibratory	unit	1	NIA's Request
7	Track Dozer	90HP (67kW), 10 ton	unit	1	Recommend
8	Hydraulic Excavator	Bucket 0.28m3(0.20m3), 7 ton	unit	4	Recommend
9	Steel Wheel Static Roller	76HP (56kW), 3 Wheels, 10~12t	unit	1	Recommend
10	Vibratory Roller	Hand Guide, 12HP (9kW), 0.6t	unit	2	Recommend
11	Vibratory Plate Compactor	4HP (3kW), 0.06t	unit	2	Recommend
12	Forklift	41HP(30kW), Loading Capa. 2.0 ton	unit	1	Recommend
13	Generator Set	20 kVA	unit	2	Recommend
14	Concrete Mixer	HP10 (7.5kW), 0.35m3	unit	1	Recommend
15	Concrete Mixer	HP15 (11kW), 0.20m3	unit	1	Recommend
16	Jeep	4 Wheel Drive	unit	2	Recommend
17	Pick-up	2t	unit	2	Recommend
18	Farm Tractor	HP24 (718kW), Crawler (Rear Wheel)	unit	1	Recommend
19	Track Dozer	90HP (67kW), 10 ton	unit	1	Recommend

Source: JICA survey team
Note: Item of maintenance machinery and number is added by JICA survey team based on the original request

4.4 Distribution Infrastructure Improvement and Upgrading

Roads in and around the Project area consist of national road, provincial road, municipal road and barangay road. In addition to these roads controlled by DPWH and LGUs, there are canal maintenance roads running in parallel with the irrigation canals under NIA. In fact, the canal maintenance roads could contribute to facilitating rural mobility as has been observed in the MMIP I area. Canals are by nature constructed by an embankment, whereby the maintenance roads are automatically raised up from the ground, able to be free from inundation.

In addition to above roads, the MMIP II is to construct access road, or so-called intra-site road, which can work as farm-to-market road to easily haul agricultural produce from the farmlands out to major towns, e.g. Pikit, Kabacan, Midsayap, etc., via the provincial and national roads. Such access road could of course function as barangay road in facilitating transport of goods and movement of people for the development of rural economy as a whole.

4.4.1 Construction Area and Expected Influence of Canal Maintenance Road

Table 4.4.1 summarizes the length of canals constructed and to be constructed within MMIP II area. The same lengths are allocated to the maintenance roads, and therefore, there will be total length of canal maintenance roads of 60 km for the main canal and 82 km for the lateral canals under the construction plan of **Case-1**, meanwhile, the length of the former and the latter are to be 72 km and 109 km in **Case-2** plan. Road lengths within LMSA are 23 km and 46 km, respectively for the main canal (MC 2 & MC 3) and laterals, totaling to 69 km under the Case-1, and the Case-2 gives 34 km, 73 km and 107 km in order of above (see Table 4.4.1).

Table 4.4.1 Canal Maintenance Road and Density

No.	Service Area	Canal Type	Length, km			Irrigable area (ha)	Road Density, km/sq.km	
			Case-1 *1)	Case-2 *2)	Difference		Case-1 *1)	Case-2 *2)
1	Upper Malitubog	Main Canal	24.65		-	2,958	**1.94**	
		Laterals	23.91		-			
2	UM Ext.	Main Canal	5.36		-			
		Laterals	3.36		-			
3	Pagalungan Ext.	Main Canal	7.44		-	988	**1.63**	
		Laterals	8.67		-			
4	Lower Malitubog (LMSA)	Main Canal (No.2)	11.60	22.79	11.19	6,590	**1.05**	**1.63**
		Main Canal (No.3)	11.39	11.39	0.00			
		Laterals	46.46	73.10	26.64			
	MMIP II	**Main Canal**	**60.44**	**71.62**	**11.19**	10,536	**1.36**	**1.71**
		Laterals	**82.40**	**109.04**	**26.64**			
	Grand total		**142.84**	**180.66**	**37.83**			

*1) Case-1: Some parts of Main Canals and Laterals, which would be submerged in rainy season, should not be constructed.
*2) Case-2: All of Main Canals and Laterals should be constructed as planned.
Source: NIA-PMO, JICA Survey Team

Table 4.4.2 Public Roads Available within Pikit Municipality Area

Road Name	No.	Pavement Type and Road Length (as of 2018)					Density
		Concrete (km)	Asphalt (km)	Gravel (km)	Earth (km)	**Total (km)**	**km/sq.km**
National Road	2	12.5	0.0	0.0	0.0	12.5	**0.04**
Provincial Road	14	3.9	2.0	43.3	18.8	67.9	**0.23**
Municipal Street	35	8.8	1.2	10.3	3.1	23.4	**0.08**
Barangay Road	71	26.2	1.0	167.4	45.0	239.6	**0.81**
Total	**122**	**51.4**	**4.2**	**221.0**	**66.9**	**343.4**	**1.16**

Note; Area of Pikit municipality is 295.13 sq.km (source: UNOCHA)

Table 4.4.2 shows the available public road already constructed in Pikit municipality. The road density comes to 1.16 km per sq.km while those new roads of canal maintenance will add to a total of 181 km

with the road density of 1.71 km per sq.km. It means that the construction of canal maintenance roads would almost double the road density within the irrigable areas of MMIP II. This new road arrangement with the construction of main and lateral canals would greatly facilitate the rural economy.

4.4.2 NIA's Design Policy of Canal Maintenance Road

The designs of all types of highways in Philippines should be based on the DPWH Design Guidelines and DPWH Department Orders, which have referred to the current AASHTO (American Association of State Highway and Transportation Officials) design publications. The part of the design policy of canal maintenance road has also been complied with the DPWH Design Guidelines, namely AASHTO methods. Meanwhile, another part of the design policy, which arises from special conditions of canal maintenance road, has been led by NIA's own design views.

1) Design of Gravel Pavement

NIA has adopted the gravel pavement mainly for canal maintenance roads, and the thickness of gravel layer should be determined based on the DPWH Design Guidelines. In comparison with asphalt pavement, the thickness of gravel pavement layer is not so critical, since the small amount of surface deformation can be tolerated in such gravel roads. The important characteristics of gravel pavement surface are as follows:

- ✓ Resist rutting, wearing, raveling and corrugation,
- ✓ Present a smooth riding surface for vehicles, and
- ✓ Possess adequate tire/ soil friction, so that vehicles will not skid and driving wheels will not spin.

Table 4.4.3 shows the minimum thickness of gravel pavement in accordance with traffic volume and the material underneath (subgrade soil). The quality of canal embankment material (soil) should be equivalent to the A4 - A7 class shown in Table 4.4.4, and the traffic volume of canal maintenance road is supposed to be less than 200 vehicles per day in both directions. Accordingly, the thickness of gravel pavement of canal maintenance road is recommended to be 200mm as given of the following:

Table 4.4.3 Recommended Thickness of Gravel Pavement

Traffic Volume in Both Directions (per day)	Classification of Subgrade Soil *	Recommended Minimum Thickness of Gravel Pavement
< 200	A1, A2, A3 soils or CBR > 7	150 mm
	A4,A5,A6,A7,soils or CBR is between 3 and 7	**200 mm**
> 200	A1, A2, A3 soils or CBR > 7	200 mm
	A4,A5,A6,A7,soils or CBR is between 3 and 7	250 mm

*CBR tests would not be conducted under the construction supervision by NIA
Source: DPWH Design Guidelines, Criteria and Standards (Volume 4, Highway Design, 2015)

Table 4.4.4 Soil Classification in relation to Road Design

Soil Classification	Soil Type	Result of Sieve Analysis *1 (Grain Size Analysis of Soil)	Soil Characteristics in Fraction Passage of No.40 Sieve *2	General Subgrade Rating
A1 class	Stone fragment, gravel and sand	(1) A1-a class No. 10: Max. 50%, No.40: Max. 30%, No.200: Max. 15% (2) A1-b class No.40: Max. 50%, No.200: Max. 25%	Plastic limit: Max.6%	Excellent to good
A2 class	Silty or clayey gravel and sand	(1) A2-4 class No.200: Max. 35% (2) A2-5 class No.200: Max. 35% (3) A2-6 class No.200: Max. 35% (4) A2-7 class No.200: Max. 23%	(1) A2-4 class: Liquid limit; Max.40% Plastic limit; Max.10% (2) A2-5 class: Liquid limit; Min.41% Plastic limit: Max.10% (3) A2-6 class: Liquid limit; Max.40% Plastic limit; Min.11% (4) A2-7 class: Liquid limit; Min.41% Plastic limit; Min.11%	Excellent to good

Soil Classification	Soil Type	Result of Sieve Analysis *1 (Grain Size Analysis of Soil)	Soil Characteristics in Fraction Passage of No.40 Sieve *2	General Subgrade Rating
A3 class	Fine sand	No.40: Min. 51%, No.200: Max. 10%	NP (Non-plastic)	Excellent to good
A4 class	Silty soil	No.200: Max. 36%	Liquid limit: Max. 40% Plastic limit: Max. 10%	Fair to poor
A5 class	Silty soil	No.200: Max. 36%	Liquid limit: Min. 41% Plastic limit: Max. 10%	Fair to poor
A6 class	Clayey soil	No.200: Max. 36%	Liquid limit: Max.40% Plastic limit: Min. 11%	Fair to poor
A7 class	Clayey soil	No.200: Max. 36%	Liquid limit: Min. 41% Plastic limit: Min. 11%	Fair to poor

*1: Sieve Analysis is conducted by using various mesh sized sieves, e.g. No.10 sieve (2.00mm), No.40 sieve (0.42mm), and No.200 sieve (0.074mm) etc. And the ratio (percentage) of various grain sizes, which means the content of soil, will be given by this analysis.
*2: Result of liquid limit test and plastic limit test (%, water content)
Source: AASHTO

There are some borrow areas (borrow pits) of embankment material (soil) in and around the MMIP II project site, and the quality of the embankment material should be examined in each borrow area. In addition, the quality control of soil (e.g. reduce water content by temporary stockpiling, etc.) should be considered according to the soil conditions in those borrow areas.

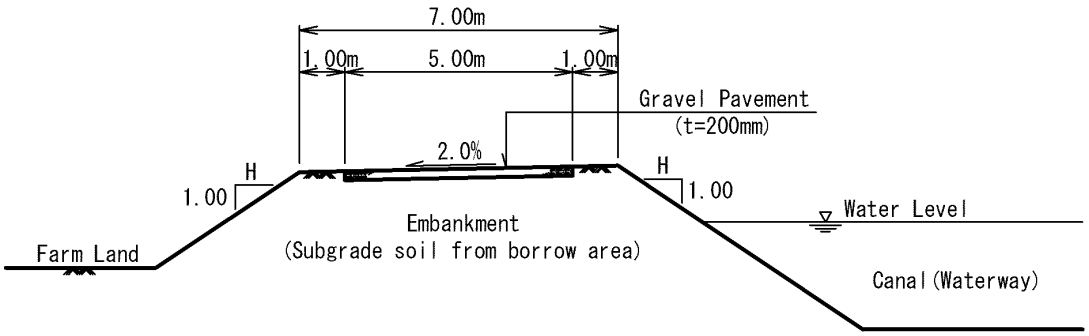
2) Typical Cross Section of Canal Maintenance Road

NIA engineering section provides 4 typical cross sections of canal maintenance road as its NIA's design standard. The roadway width and the shoulder width of each of the cross sections are regulated by the scale of canal, which should vary according to canal design discharge (see Table 4.4.5). The large scaled canals need heavy equipment (e.g. back-hoe, long-armed back hoe and dump truck, etc.) for maintenance works, hence the roadway width should be sufficient for the passage of the heavy equipment. Meanwhile, the maintenance works for small scaled canals require small equipment (e.g. mini-back hoe and light truck, etc.) or human power only, so that the roadway width can be narrower than the large scaled one.

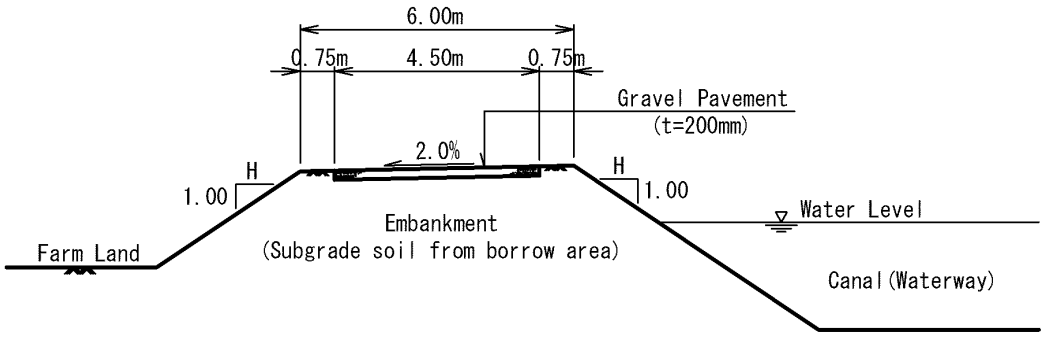
Table 4.4.5 Width of Canal Maintenance Roads

Canal Design Discharge (Q)	Width of Canal Maintenance Roads		
	Roadway Width	Shoulder Width	Total Width
Q > 30 (m3/s)	5.00m	1.00m (both side)	7.00m
Q = 30 to 10 (m3/s)	4.50m	0.75m (both side)	6.00m
Q = 10 to 0.3 (m3/s)	3.00m	0.50m (both side)	4.00m
Q < 0.3 (m3/s)	2.00m	0.50m (both side)	3.00m

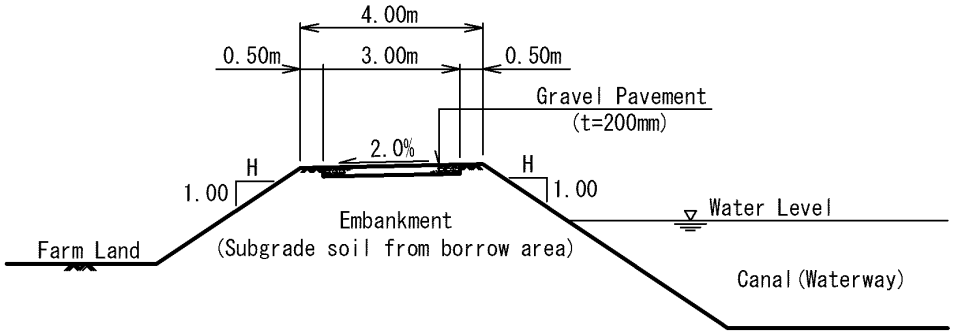
Source: NIA-PMO, JICA Survey Team



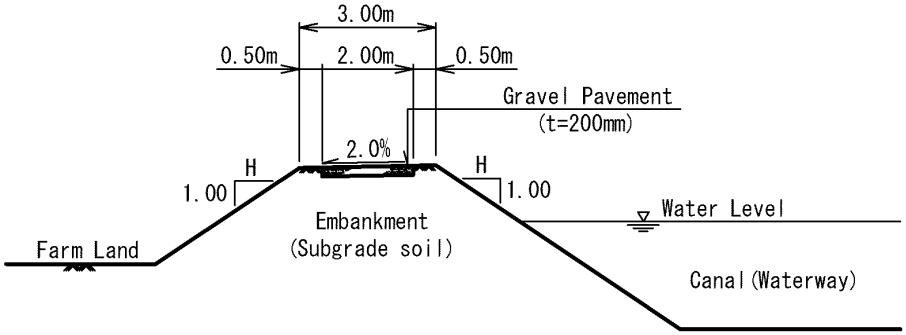
(a) Canal Design Discharge: Q>30 (m3/s)



(b) Canal Design Discharge: Q=30 to 10 (m3/s)



(c) Canal Design Discharge: Q=0.3 to 10 (m3/s)



(d) Canal Design Discharge: Q<0.3 (m3/s)

Figure 4.4.1 Typical cross Section of Canal Maintenance Roads

Source: NIA-PMO, JICA Survey Team

Generally, roadway cross slope is slightly to be slanted from the road center to the both sides (convexity shape) in order to drain the road-surface water (rainwater etc.). However, the crossing gradient of canal maintenance road keeps 2.0%, down from the canal side (water side) to farm land side in order to prevent the road-surface water from flowing into the waterway/ canal section. Figure 4.4.1 shows the typical cross sections of canal maintenance roads by NIA's own design standard.

The cross slope "H", indicated in Figure 4.4.1, varies according to the geology of foundation, construction method and embankment (or cutting) height. NIA's design standard indicates 1.5 of "H" in case that the canal dykes are to be constructed by embankment. Meanwhile, 1.0 of "H" is applied in case that the canal dykes are constructed by cutting. The geology of the construction site consists mainly of sandy soil and clayey soil. Therefore, the "H", given by NIA's design standard, should be

appropriate even comparing with a Japanese design standard[1].

4.4.3 Network of Access Road (Intra-site Road) and Land Acquisition

In general, canals are aligned from upstream to downstream, namely, from higher elevation to lower elevation. This implies that canal maintenance road runs also together from upstream to downstream areas. Therefore, there would be more roads, canal maintenance roads, perpendicular to the topographic contours while less roads connecting/ bisecting those canal maintenance roads. In this regard, the MMIP II project is to construct some access roads/ intra-site roads basically perpendicular to the canals.

In fact, NIA-PMO has already constructed one access road in UMSA and is constructing another access road within the PESA as of 2017-2018, both of which are aligned bisecting the canals. Same concept has been applied in LMSA too. In the LMSA, following 3 access roads are recommended to construct under the Case-2 plan, and the total length comes to 18.45 km composed of 1.65 km improvement of existing one (E-1 Section), and 18.80 km of new construction. Meanwhile, North to South Access Road-1 (N-2 Section) is not to be constructed under the Case-1 plan, since this section would be in the inundated area during the rainy season (see Table 4.4.6).

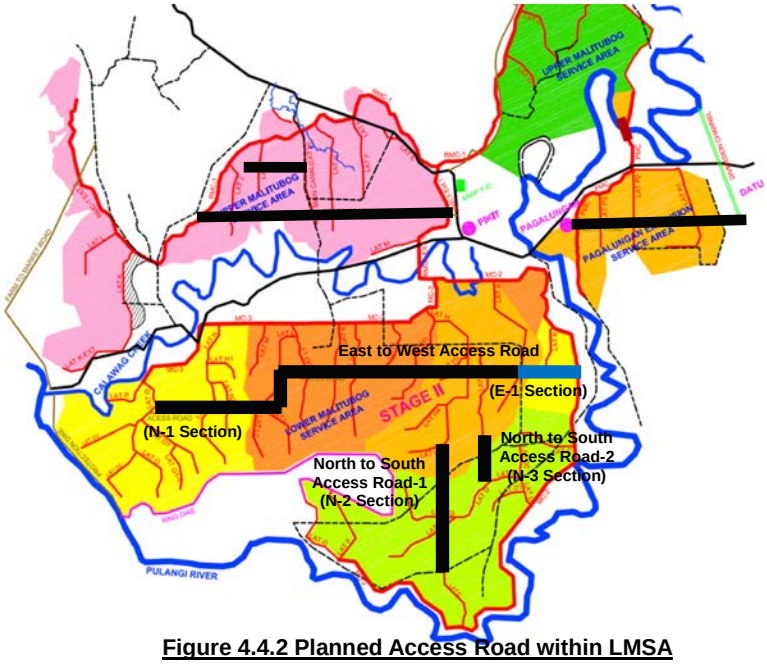


Figure 4.4.2 Planned Access Road within LMSA
Source: NIA-PMO, JICA Survey Team

Table 4.4.6 Access Road to be Constructed within Upper Malitubog Service Area

(1) Construction Plan of Case-1

No.	Road Name	Section of Access Road	Station	Road Length	Width of Acquisition *	Land Acquisition
1-1.	East to West Access Road	E-1 Section (Widening of Existing Road)	No.0+000 ~No.1+650	1,650m (1.65km)	W=2.5 (m) × 2 = 5.0(m) (widening of both sides)	8,250 sq. m
1-2.		N-1 Section (New Construction)	No.1+650 ~No.13+450	11,800m (11.80km)	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	106,200 sq. m
2.	North to South Access Road-1	N-2 Section (New Construction)	No.0+000 ~No.3+500	Non-construction (Located in inundated area)		
3.	North to South Access Road-2	N-3 Section (New Construction)	No.0+000 ~No.1+500	1,500m (1.50km)	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	13,500 sq. m
Total			-	**14,950m (14.95km)**	-	**127,950 sq. m (12.80ha)**

[1] In a Japanese design standard for embankment and slope cutting, 1.5 – 1.8 of H is given in case of embankment less than height 5m with bank materials of sandy soil, clayey soil, gravel-sandy soil, while in case of slope cutting, 0.8 – 1.2 is given in case of less than 5m cutting height.

(2) Construction Plan of Case-2

No.	Road Name	Section of Access Road	Station	Road Length	Width of Acquisition *	Land Acquisition
1-1.	East to West Access Road	E-1 Section (Widening of Existing Road)	No.0+000 ~No.1+650	1,650m (1.65km)	W=2.5 (m) × 2 = 5.0(m) (widening of both sides)	8,250 sq. m
1-2.		N-1 Section (New Construction)	No.1+650 ~No.13+450	11,800m (11.80km)	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	106,200 sq. m
2.	North to South Access Road-1	N-2 Section (New Construction)	No.0+000 ~No.3+500	3,500m (3.50km)	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	31,500 sq. m
3.	North to South Access Road-2	N-3 Section (New Construction)	No.0+000 ~No.1+500	1,500m (1.50km)	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	13,500 sq. m
Total			-	**18,450m (18.45km)**	-	**159,450 sq. m (15.95ha)**

*The width of "2.5m" in E-1 section includes widened road way, shoulder, side ditch and the space for embankment & cutting. The width of "7.0m" in N-1~N3 consists of roadway width and shoulder (both sides). The width of "1.0 (m)×2" in N-1~N3 means the space for the side ditch, embankment and cutting (both sides).

Source: NIA-PMO, JICA Survey Team

4.4.4 Principle of Design for Access Road (Intra-site Road)

1) Pavement Type of Access Road

Table 2.5.2 in "Chapter 2, 2.5.1 Roads in and around the Project area (Pikit Municipality)" shows the road length and the share (percentage) of 4 pavement types which are put on four categorized road (National Road, Provincial Road, Municipality Road and Barangay Road) in Pikit Municipality. Table 2.5.2 indicates that share of the concrete road was increased by 5% (from 10% to 15% of the whole roads) from year 2015 to 2016. That is to say, gravel and earthen road have been upgraded to concrete road, meanwhile, the share of asphalt road kept only 1% of the whole roads from year 2015 to 2016.

Following situations, related to the construction industry in Pikit Municipality, could be the main obstacles in promoting the asphalt road. As a result, gravel and earthen roads have been widely upgraded to concrete road.

- ✓ Local contractors operating in around Pikit and Midsayap areas have enough experience for PCCP (Portland Cement Concrete Pavement) construction,
- ✓ The construction method of asphalt pavement is more complicated than the PCCP,
- ✓ There are few local contractors which have specialized equipment for asphalt pavement (asphalt finisher and asphalt distributor etc.), and
- ✓ Contractor could hardly get the material of asphalt pavement (bitumen is imported from foreign countries).

Moreover, totaled lifetime cost (construction/ maintenance/ rehabilitation cost, etc.) of asphalt road tends to be larger than the concrete road thereof. Therefore, the location to be planned for asphalt road should be determined by considering wider public benefits and the projection of future traffic demands. In general, DPWH and LGUs are to lay the asphalt road at heavy traffic portions and main roads which lead to the important institutions, e.g. hospitals and schools. In view of this situations, the pavement type of access roads in MMIP II area should be concrete pavement (PCCP).

2) Typical Cross Section of Access Road

The maintenance works of access roads will be transferred to LGUs upon completion of the Project. Since the road design standards of LGUs have followed the design criteria of DPWH, the design of access roads should be conducted according to the equivalent design criteria. DPWH Design Guideline indicates that there are three major types of pavement in the Philippines, typed as "Flexible (or Asphalt

Pavement)", "Rigid (or Concrete Pavement)", and "Unbound, gravel surfaced, unsealed or unpaved road (usually restricted to local rural access or temporary road)". Incidentally, the third pavement type is considered to be the subset of the "Flexible" road. The access roads are classified as "Rigid (Concrete Road)", and the pavement design should therefor follow the DPWH's design criteria for concrete pavement.

Since the functions of access roads are equivalent to those of farm-to-market roads, they are classified as the farm-to-market roads. The minimum design standards for the farm-to-market road were prescribed by DPWH's Department Order in 2014 (Order No.11). Table 4.4.7 and Figure 4.4.3 show the design elements and typical cross section of farm-to-market road (as part of the above-mentioned Order).

Table 4.4.7 Minimum Design Standards for Farm-to-Market Road (Access Road)

Design Element	Requirements
Pavement Type	Portland Cement Concrete Pavement (PCCP)
Pavement Width	Minimum of 4.0m for two lane (Average daily traffic of less than 200)
Pavement Thickness	Minimum of 150mm (6 inches)
Shoulder Width	Minimum of 1.5m
Material of Shoulder	Gravel Surfacing
Roadway Cross Slope	1.50%
Radius of Horizontal Curve	Minimum of 30m
Length of Vertical Curve	Minimum of Length of 60m
Design Speed	30 (km/ hr) for All Terrain Type

Source: DPWH (Department Order No.11, Series of 2014), JICA Survey Team

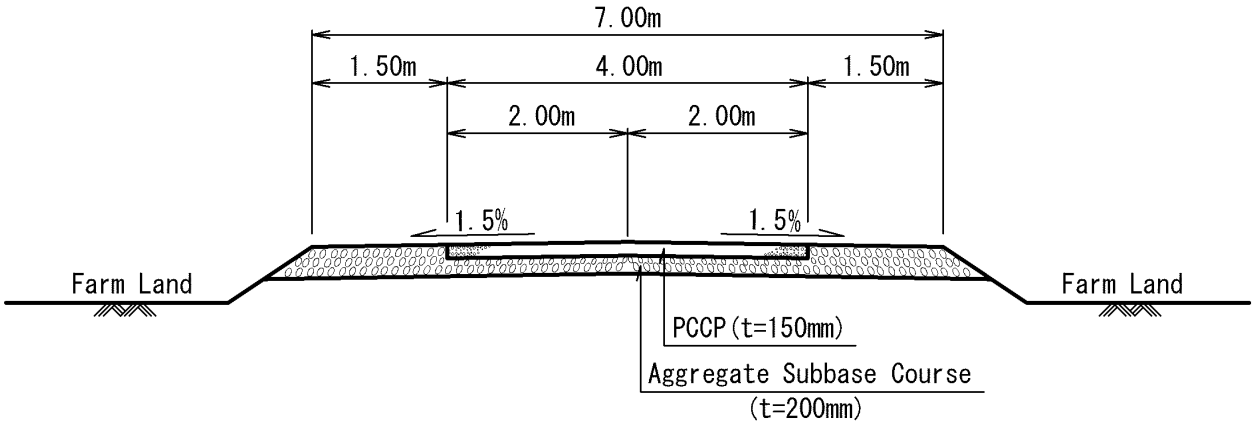


Figure 4.4.3 Typical Cross Sectoin of Farm to Market Road (Access Road)

Source: DPWH (Department Order No.11, Series of 2014), JICA Survey Team

3) Design of Concrete Pavement Joint

Joints are placed in concrete pavement to control cracking and to facilitate construction. They divide the concrete pavement (concrete slabs) for the efficient construction, delineating the traffic lane and accommodating the slab movements. There are three types of joint which are commonly used in concrete pavement. Functions of the three typed joints are as follows:

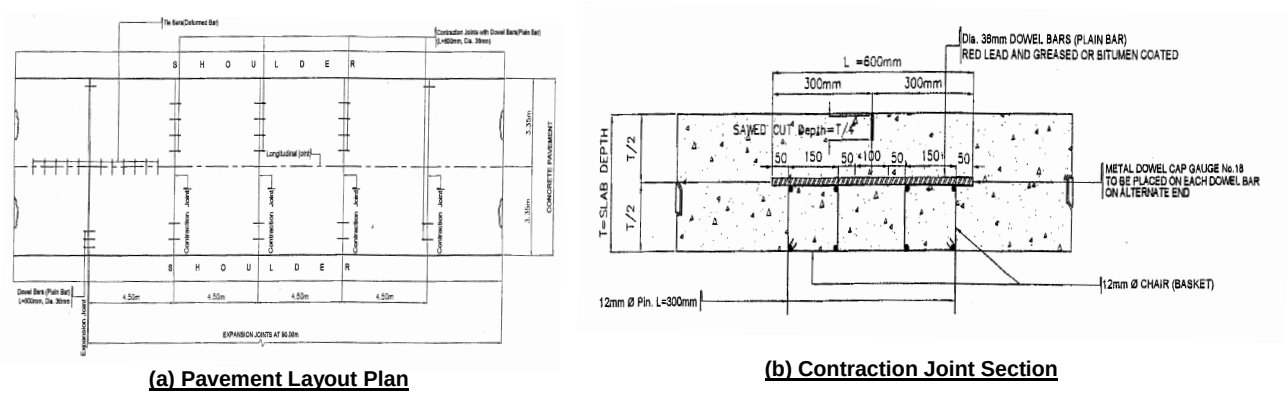
- ✓ "Contraction Joint" is intended to control cracking of concrete slab,
- ✓ "Construction Joint" allows for the interruption of concrete placement, and also functions as the planed longitudinal separations between adjacent lanes and so on,
- ✓ "Isolation (Expansion) Joint" is used to allow relative movement between adjacent structures or pavements.

Further, following design standards and figures were prescribed by DPWH's Department Order in 2014 (Order No.40).

1) All weakened plane joints (contraction joints at every 4.5m and expansion joints at every 90m) shall be provided with dowels on chair (see Annex "1" of Figure 4.4.4).

2) For pavement re-blocking, dowels and tie bars shall be provided at transverse construction joint and longitudinal joint, respectively. Holes of at least 10mm diameter greater than the design dowel bar diameter shall be drilled on existing concrete pavement (see Annex "2" of Figure 4.4.5).

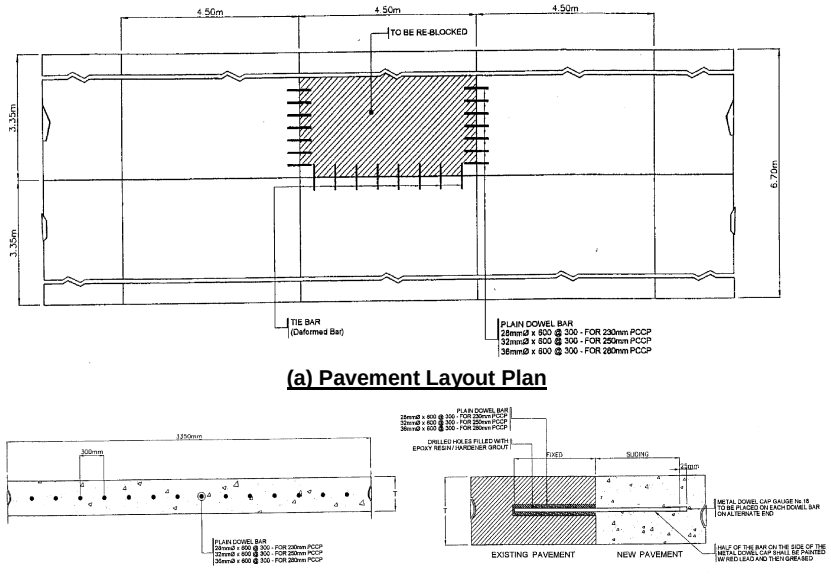
3) For pavement re-blocking of more than one adjacent blocks (along longitudinal direction), dowels on chairs as requested in item "1)" shall be provided at transverse joint between two adjacent new pavement slabs.



(a) Pavement Layout Plan **(b) Contraction Joint Section**

Figure 4.4.4 Annex "1" of DPWH Department Order (No.40 in 2014)

Source: DPWH (Department Order No.40, Series of 2014)



(a) Pavement Layout Plan

(b) Contraction Joint Section

Figure 4.4.5 Annex "2" of DPWH Department Order (No.40 in 2014)

Source: DPWH (Department Order No.40, Series of 2014)

4.4.5 Arrangement Plan of Bridges along Access Roads

"East to West Access Road" will intersect at 12 irrigation canals and 10 drainage canals. "North to South Access Road-1 & Road-2" will also intersect at several drainage canals and irrigation canals.

Moreover, these 3 access roads are supposed to intersect at a large number of small scaled farm drains which are extended all over the Project area. The types and materials of the crossing structure of access roads will be e.g. concrete slab bridge, steel girder bridge, concrete box culvert, conduit (concrete pipe), etc. should be determined based on the detailed survey and past construction records.

Generally, large scale irrigation canals and drainages require the concrete or steel girder bridges due to the safe flow of irrigation water, drainage water and flood water. Concrete box culvert and conduit (concrete pipe) will be constructed at comparatively small and middle scaled canals & drainages in the Project area. Most of the small scaled farm drains will be provided with small conduit (concrete pipe) where they intersect the access roads. Table 4.4.8 and Figure 4.4.6 show the location and planned structure type of the bridges in the access roads under the Case-1 plan, and Table 4.4.9 and Figure 4.4.7 show the Case-2:

Table 4.4.8 List of Bridge along Access Road (Construction Plan of Case-1)

No.	Location of Bridge		Crossing Canal / Drainage				Supposed Structure Type of Bridge *2
	Road Name	Station No.	Canal / Drainage	Design Discharge	Canal Bottom	Canal Depth	
EW-1	East to West Access Road	No.0+440	Lateral-B	0.125(m3/s)	0.60(m)	0.65(m)	Concrete slab bridge or concrete box culvert
EW-2		No.0+800	MDC-A	2.461(m3/s)	3.10(m)	1.24(m)*1	Concrete or steel bridge
EW-3		No.1+240	Lateral-A	0.278(m3/s)	0.70(m)	0.75(m)	Concrete slab bridge or concrete box culvert
EW-4		No.1+680	LDC-A2-a	0.103(m3/s)	0.60(m)	0.60(m)	Concrete slab bridge or concrete box culvert
EW-5		No.2+280	Lateral-H3	0.175(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-6		No.2+810	Lateral-H	0.385(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-7		No.3+300	Lateral-H2	0.035(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-8		No.3+970	LDC-D1	1.212(m3/s)	2.20(m)	0.88(m)*1	Concrete or steel bridge
EW-9		No.4+380	Lateral-H1	0.125(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-10		No.4+880	LDC-D3-1	0.705(m3/s)	2.00(m)	1.10(m)*1	Concrete or steel bridge
EW-11		No.5+740	LDC-D3	0.551(m3/s)	1.80(m)	0.72(m)*1	Concrete or steel bridge
EW-12		No.6+220	Lateral-J	0.180(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-13		No.6+530	MDC-E	0.773(m3/s)	2.10(m)	0.84(m)*1	Concrete or steel bridge
EW-14		No.6+810	Lateral-K	0.145(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-15		No.7+480	MDC-F	0.889(m3/s)	2.00(m)	0.80(m)*1	Concrete or steel bridge
EW-16		No.7+700	Lateral-L1	0.085(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-17		No.8+020	MDC-G	0.459(m3/s)	1.70(m)	0.66(m)*1	Concrete or steel bridge
EW-18		No.10+010	Lateral-L	0.095(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-19		No.10+470	MDC-H	3.909(m3/s)	3.60(m)	1.44(m)*1	Concrete or steel bridge
EW-20		No.10+980	LDC-H3	0.200(m3/s)	1.10(m)	0.44(m)*1	Concrete slab bridge or concrete box culvert
EW-21		No.11+150	Lateral-N2	0.035(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-22		No.11+780	Lateral-N	0.529(m3/s)	0.90(m)	0.90(m)	Concrete slab bridge or concrete box culvert
NS-1	North to South Access Road-1	No.0+900	MDC-C	Non-construction (Located in inundated area)			
NS-2		No.2+210	Lateral-D3				
NS-3		No.2+550	Lateral-D				
NS-4	North to South Access Road-2	No.0+540	LDC-C1	1.523(m3/s)	2.00(m)	1.01(m)*1	Concrete or steel bridge
NS-5		No.0+920	LDC-C3	1.940(m3/s)	1.50(m)	1.62(m)*1	Concrete or steel bridge

*1: Water depth calculated by hydraulic analysis (not including freeboard).
*2: Types and construction materials of crossing structures should be determined based on the detailed survey and past construction records etc.
Source: NIA-PMO, JICA Survey Team

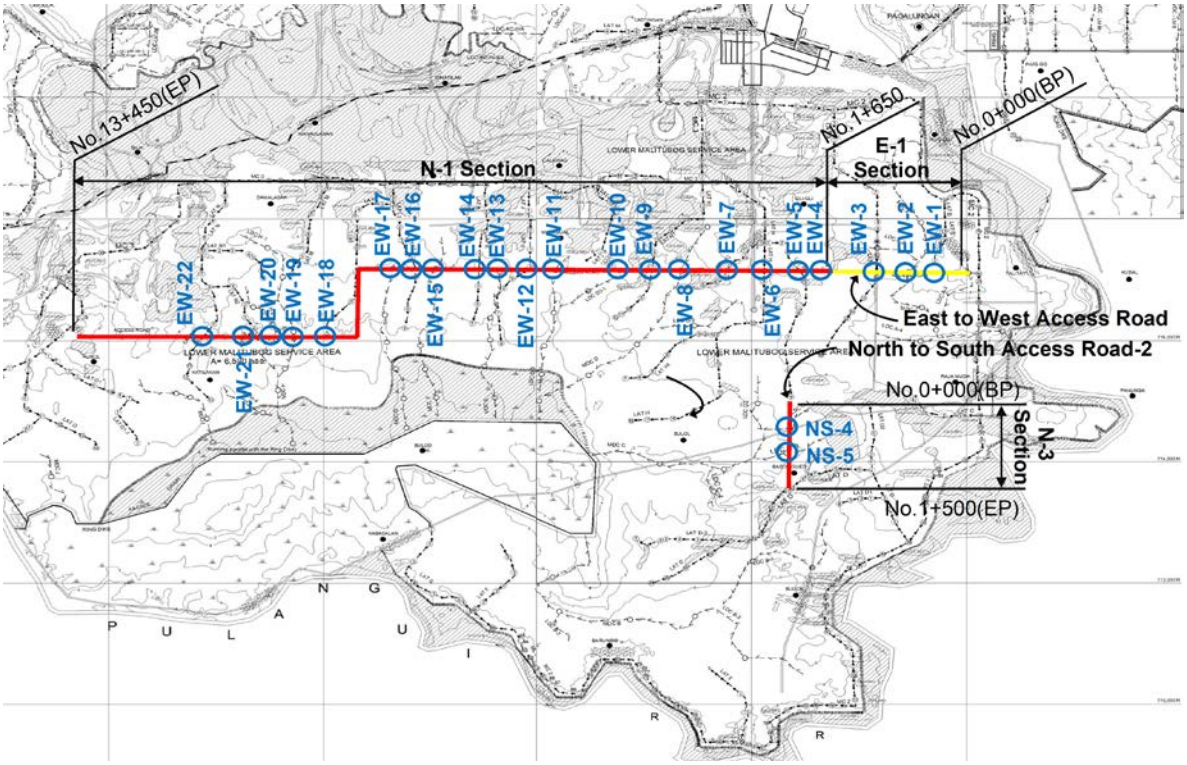


Figure 4.4.6 Location Map of Access roads and Bridges (Construction Plan of Case-1)
Source: JICA Survey Team

Table 4.4.9 List of Bridge along Access Road (Construction Plan of Case-2)

No.	Location of Bridge		Crossing Canal / Drainage				Supposed Structure Type of Bridge *2
	Road Name	Station No.	Canal / Drainage	Design Discharge	Canal Bottom	Canal Depth	
EW-1	East to West Access Road	No.0+440	Lateral-B	0.125(m3/s)	0.60(m)	0.65(m)	Concrete slab bridge or concrete box culvert
EW-2		No.0+800	MDC-A	2.461(m3/s)	3.10(m)	1.24(m)*1	Concrete or steel bridge
EW-3		No.1+240	Lateral-A	0.278(m3/s)	0.70(m)	0.75(m)	Concrete slab bridge or concrete box culvert
EW-4		No.1+680	LDC-A2-a	0.103(m3/s)	0.60(m)	0.60(m)	Concrete slab bridge or concrete box culvert
EW-5		No.2+280	Lateral-H3	0.175(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-6		No.2+810	Lateral-H	0.385(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-7		No.3+300	Lateral-H2	0.035(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-8		No.3+970	LDC-D1	1.212(m3/s)	2.20(m)	0.88(m)*1	Concrete or steel bridge
EW-9		No.4+380	Lateral-H1	0.125(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-10		No.4+880	LDC-D3-1	0.705(m3/s)	2.00(m)	1.10(m)*1	Concrete or steel bridge
EW-11		No.5+740	LDC-D3	0.551(m3/s)	1.80(m)	0.72(m)*1	Concrete or steel bridge
EW-12		No.6+220	Lateral-J	0.180(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-13		No.6+530	MDC-E	0.773(m3/s)	2.10(m)	0.84(m)*1	Concrete or steel bridge
EW-14		No.6+810	Lateral-K	0.145(m3/s)	No drawings		Concrete slab bridge or concrete box culvert
EW-15		No.7+480	MDC-F	0.889(m3/s)	2.00(m)	0.80(m)*1	Concrete or steel bridge
EW-16		No.7+700	Lateral-L1	0.085(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-17		No.8+020	MDC-G	0.459(m3/s)	1.70(m)	0.66(m)*1	Concrete or steel bridge
EW-18		No.10+010	Lateral-L	0.095(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-19		No.10+470	MDC-H	3.909(m3/s)	3.60(m)	1.44(m)*1	Concrete or steel bridge

No.	Location of Bridge		Crossing Canal / Drainage				Supposed Structure Type of Bridge *2
	Road Name	Station No.	Canal / Drainage	Design Discharge	Canal Bottom	Canal Depth	
EW-20		No.10+980	LDC-H3	0.200(m3/s)	1.10(m)	0.44(m)*1	Concrete slab bridge or concrete box culvert
EW-21		No.11+150	Lateral-N2	0.035(m3/s)	No drawings		Concrete box culvert or conduit (concrete pile)
EW-22		No.11+780	Lateral-N	0.529(m3/s)	0.90(m)	0.90(m)	Concrete slab bridge or concrete box culvert
NS-1	North to South Access Road-1	No.0+900	MDC-C	6.657(m3/s)	3.50(m)	2.24(m)*1	Concrete or steel bridge
NS-2		No.2+210	Lateral-D3	0.438(m3/s)	1.00(m)	0.80(m)	Concrete slab bridge or concrete box culvert
NS-3		No.2+550	Lateral-D	0.317(m3/s)	0.90(m)	0.80(m)	Concrete slab bridge or concrete box culvert
NS-4	North to South Access Road-2	No.0+540	LDC-C1	1.523(m3/s)	2.00(m)	1.01(m)*1	Concrete or steel bridge
NS-5		No.0+920	LDC-C3	1.940(m3/s)	1.50(m)	1.62(m)*1	Concrete or steel bridge

*1: Water depth calculated by hydraulic analysis (not including freeboard).
*2: Types and construction materials of crossing structures should be determined based on the detailed survey and past construction records etc.
Source: NIA-PMO, JICA Survey Team

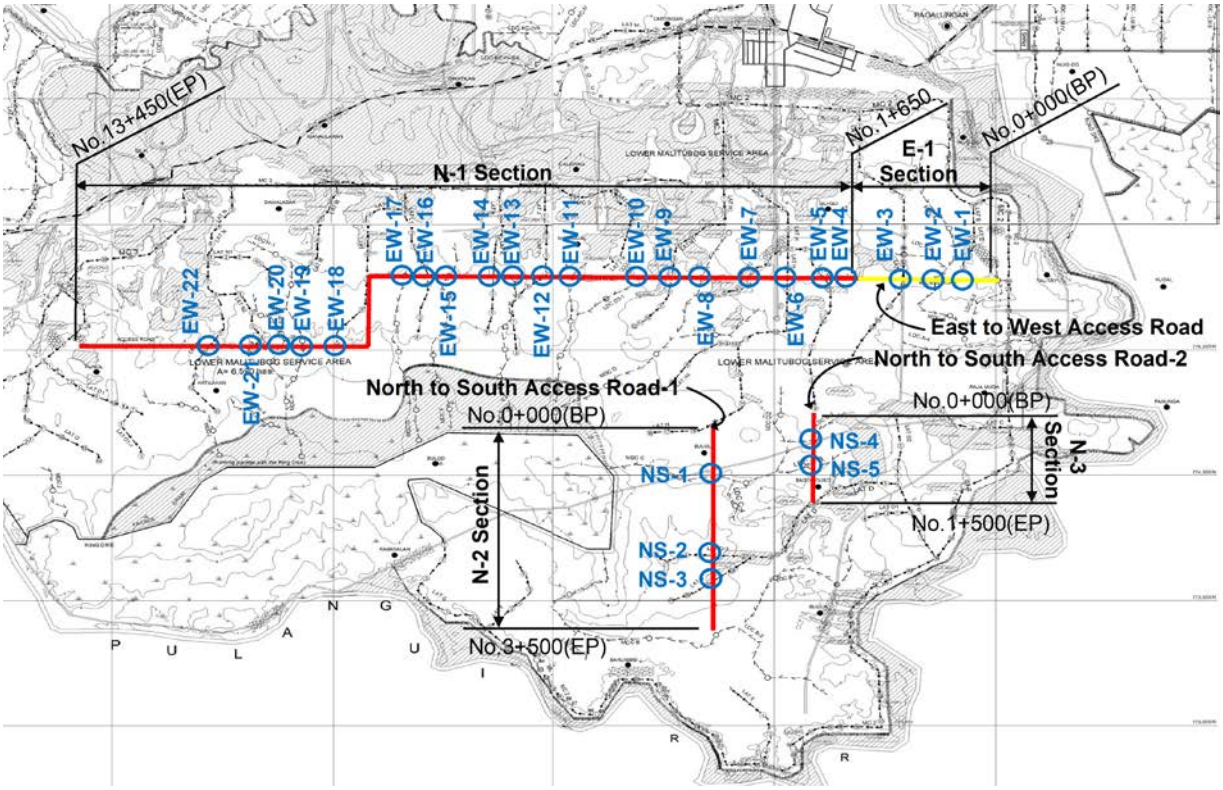


Figure 4.4.7 Location Map of Access roads and Bridges (Construction Plan of Case-2)
Source: JICA Survey Team

CHAPTER 5 PROJECT COST AND IMPLEMENTATION ARRANGEMENT

This chapter discusses the project cost by component and necessary implementation arrangement. The cost consists of direct works, in-direct cost including administration cost, physical contingency and price contingency for inflation, etc. In fact, there are several project components and the implementation modality should vary from one to another such as direct force account, local competitive bidding, etc. It is, however, noted that since ODA loan request was withdrawn, all the project components and related activities are to be planned within GOP budget arrangement as below: **(It is noted that non-disclose information for 3-year is included in this chapter as procurement by the Philippines government is scheduled.)**

5.1 Project Components Selected and Implementing Departments

Through the afore-mentioned discussions in Chapter 4, the project components have been identified with sub-components. The agencies to be involved in implementing the project components are basically NIA being the principal player, a Government owned and controlled cooperation placed under the Office of the President, and ATI which is controlled by Department of Agriculture (DA). Following table summarizes the project components/ sub-components which are to be financed by GOP budget together with the relevant responsible agencies to implement:

Table 5.1.1 Project Components by Implementing Agencies

No.	Component	Sub-component	Agency
1	Irrigation and Drainage Development	1-1. Construction of MC 2 1-2. Construction of Lateral Canals under MC 2 1-3. Construction of MDCs 1-4. Construction of LDC 1-5. Construction of FAÇADE drain 1-6. Flood Protection Works (canal slope protection, etc.) 1-7. Urgent Works for MMIP I Area (gates and drainages, etc.)	NIA
2	Distribution Infrastructure Improvement	2-1. Access Road (intra-site road) Construction 2-2. Bridge Construction (along access road)	NIA
3	Agriculture & Extension Development	3-1. Technical Assistance for Irrigated Rice Production 3-2. Enhancement of Agriculture Extension Services at Municipality Level 3-3. Development of Seed Production	ATI
4.	Other Related Activities	4-1. Parcellary Mapping/ Survey 4-2. Institutional Development Program (IA establishment) 4-3. Field Support for Supervision and Monitoring 4-4. Project Service Facilities 4-5. Detailed Engineering 4-6. Other Administrative Works	NIA
MMIP III	In future, to be required	III-1. Rehabilitation of MMIP I Area (MSA & UMSA) III-2. Improvement of MMIP II Area (UMSA, LMSA and PESA) III-3. Procurement of Machineries (for maintenance)	NIA

Note: As a project item/cost, not only the above components but also other relevant expenses should be considered such as price escalation, physical contingency, land acquisition, VAT, etc.; however since the above tale shows only the direct major components to be undertaken by the implementing agencies, those are not indicated.
Source: JICA Survey Team

As shown above, there are mainly 3 components under MMIP II; namely, 1) irrigation and drainage development, 2) distribution infrastructure improvement, and 3) agriculture & extension development. The former 2 components should be undertaken by NIA while the last one, agriculture & extension development, is to be conducted by ATI of DA. In addition to those components, there are other related activities as follows (see item 4 in the above table):

4-1. Parcellary Mapping/ Survey: In this item, all the irrigable service areas with land owners are to be identified plot by plot, which will be the basis of the firmed-up area upon completion of the construction and also the basis of the formation of IAs,

4-2. Institutional Development Program: In this activity, Irrigators Association (IA) will be established and necessary trainings will be provided to the IA members such as organizational operation, leadership installment, financial and administrative capacity building, water utilization for irrigation, etc.,

4-3. Field Support for Supervision and Monitoring: In this item, construction supervision, including procurement of motorbikes and fuel/ lubricant, will be conducted by NIA-PMO in order to monitor and control the project implementation,

4-4. Project Service Facilities: Under this activity, field offices with necessary equipment/ furniture will be constructed, which will be utilized as gate keeper stand-by field office, and also gathering venue for the IAs to be established,

4-5. Detailed Engineering: In this activity, NIA-PMO's detailed engineering works including necessary surveys will be conducted, which may cover the remaining detail design works for the irrigation & drainage system of Lower Malitubog Service Area (LMSA), and minor structures to be required, and

4-6. Other Administrative Works: In this activity, NIA-PMO's general administrative works including procurement of contractors will be conducted.

Completed facilities of irrigation and drainage will be operated and maintained by NIA, in collaboration with IAs, as have been so practiced. On the other hand, the maintenance of distribution infrastructure upon completion is not clear as at now. Basically, such rural roads, or farm-to-market roads, can and should be handed over to Local Government Units (LGUs), specifically saying the municipality government, upon the completion. However, municipalities who do not have enough budget to maintain such rural infrastructure may refuse to take them over as have been experienced in NIA constructed access roads (intra-roads). In this case, NIA will have to operate and maintain such access/ rural roads even after the completion of such roads.

Agriculture and extension development activities will be undertaken by ATI since ATI had been engaged in the agriculture extension services within the MMIP I area. The extension services rendered under MMIP I was funded by JICA's Yen Loan Technical Assistance program, and even as of now ATI still continues such extension activities with the government fund. The office in charge of extension services is an outreach ATI office located in Kabacan controlled by Region XII ATI office. This outreach office is planned to provide agriculture extension services to not only the MMIP I area but also MMIP II area.

Further in addition to above, this Survey recommends such works as; 1) Rehabilitation of MMIP I Area (MSA & UMSA), 2) Improvement of MMIP II Area (UMSA, LMSA and PESA), and 3) Procurement of Machineries (for maintenance) for future works. Right now, there will be no ODA loan assistance, and therefore the remaining works should all be managed/ completed within the NEDA approved budget, so that these additional works are not included in the MMIP II works, and thus recommended as MMIP III in future.

5.2 Implementation Modality by Component

To implement the project components and sub-components, the best implementation modality should be applied, e.g. direct force account, contractor/ supplier through local competitive bidding, contractor/ supplier through international competitive bidding, direct shopping, etc. One thing noted is that contractors interested in undertaking civil works in very much security concerned areas may be few in the Philippines as have been already experienced under the on-going construction works. With this in mind, Table 5.2.1 proposes the implementation modality for each of the sub-components, e.g., by direct force account (DFA), and local competitive bidding (LCB):

Table 5.2.1 Project Components and Implementation Modality

No.	Component	Sub-component	Procurement
1	Irrigation and Drainage Development (NIA)	1-1. Construction of MC 2	LCB
		1-2. Construction of Lateral Canals under MC 2	LCB
		1-3. Construction of MDCs	LCB
		1-4. Construction of LDCs	LCB
		1-5. Construction of FAÇADE drain	LCB
		1-6. Flood Protection Works (canal slope protection, etc.)	LCB
		1-7. Urgent Works for MMIP I Area (gates and drainages etc.)	DFA/LCB
2	Distribution Infrastructure Improvement	2-1. Access Road (intra-site road) Construction	LCB
		2-2. Bridge Construction (along access road)	LCB
3	Agriculture & Extension Development	3-1. Technical Assistance for Irrigated Rice Production	DFA
		3-2. Enhancement of Agriculture Extension Services at Municipality Level	DFA
		3-3. Development of Seed Production	DFA
4	Other Related Activities	4-1. Parcellary Mapping/ Survey	DFA
		4-2. Institutional Development Program (IA establishment)	DFA
		4-3. Field Support for Supervision and Monitoring	DFA
		4-4. Project Service Facilities	DFA
		4-5. Detailed Engineering	DFA
		4-6. Other Administrative Works	DFA
MMIP III	In future, to be required	III-1. Rehabilitation of MMIP I Area (MSA & UMSA)	LCB
		III-2. Improvement of MMIP II Area (UMSA, LMSA and PESA)	LCB
		III-3. Procurement of Maintenance Machineries	ICB/LCB

Source: JICA Survey Team

In proposing the implementation modality above, following were taken into consideration:

1) Canal construction, both main and laterals, drainage construction and access road construction can be handled by local contractors, and therefore LCB can be applied in those civil works. Note that the contractors currently engaged are of small scale coming from local areas such as Midsayap, Kabacan, etc. Taking into account the delayed progress in the current works, the local contractors should be widely invited including Davao based ones. With regards to qualification of the contractors, post-qualification method can be applied in these LCB, in which one-stage two-envelope bidding should be conducted.

2) Direct force account works can be applied to such support activities as; parcellary map updating, institutional development, field support for supervision and monitoring, establishment of project service facilities, detail engineering by NIA-PMO, and also the agriculture and extension development activities to be undertaken by ATI (refer to the 4-1 to 4-6 of Other Related Works and also 3-1 to 3-3 of Agriculture and Extension Development in above Table 5.2.1).

5.3 Implementation Schedule

5.3.1 Seasonal Implementation Schedule

Though the annual rainfall recorded at Pikit does not amount much, only approximately 900 mm per annum (National Centers for Environmental Prediction: NCEP, US), the rain falls almost throughout year. During monsoon season from May to October, about 80 to 100 mm monthly rainfall appears while during dry season approximately 40 to 60 mm monthly rainfall can be expected. This condition in that rain falls almost throughout year makes workability very low, and during peak rainy season civil works can hardly be undertaken.

In addition, inundation starts taking place at around May/June from the south-boundary of LMSA, flooded from the Pulangi river, and progresses towards mid and northern parts of the LMSA.

Therefore, during the rainy season, southern part of Main Canal No.2 (MC 2) to be constructed in the most east-south part of LMSA will be impossible. The civil works carried out along the southern boundary as wells as lower parts of LMSA are therefore given very short period of time for the construction.

Taking into account the above condition, following seasonal implementation schedule is presented as;

1) Construction woks should be conducted from September to the following year's May though there will be difficulties in September to November to engage the contractors in full construction works. During this period of September to November, mobilization and preparation works should mostly be arranged.
2) Most south-eastern part of MC 2 and also canals/ drainages located in southern parts of LMSA will be implemented probably from December to only the following year's March, total 4 months construction period per annum. This is because the construction sites are located along the Pulangi river, and therefore the magnitude of inundation and flooding in these areas could be bigger, resulting in shorter period of construction time.
3) Other supportive works such as IA establishment and parcellary map updating can be done almost throughout year including agriculture and extension development activities though there will be difficulties to access the mid and lower parts of LMSA during the rainy season.

Table 5.3.1 Seasonal Implementation Schedule

Component	Agency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	100mm / 50mm / 0mm												
1. Irrigation and Drainage Development													
(1) Construction of MC 2/ Laterals under MC 2	NIA												
(2) Construction of MDCs/ LDCs/ FAÇADE drain	NIA												
(3) Flood Protection Works (canal slope protection, etc.)	NIA												
(4) Urgent Works for MMIP I Area (Gates and drainages etc.)	NIA												
2. Distribution Infrastructure Improvement	NIA												
3. Agriculture & Extension Development Activities	ATI												
4. Other Supportive Activities (IA establishment, etc.)	NIA												

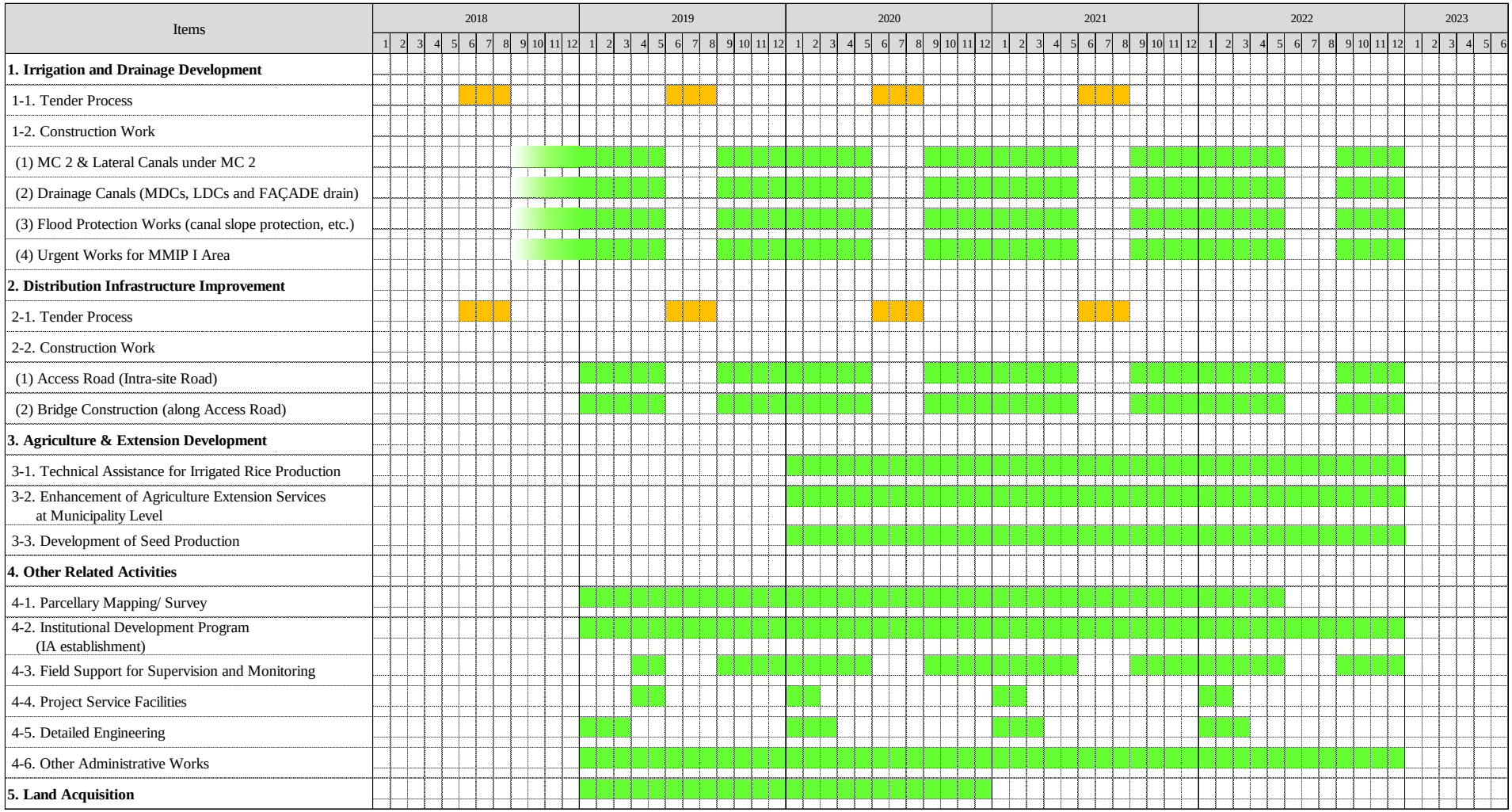
Source: JICA Survey Team

Construction/ implementation can be done.

5.3.2 Overall Implementation Schedule by Component

Total period of the implementation is defined by, in general, the biggest component undertaken in the Project in terms of work volume as well as by such activities requiring longer implementation period, e.g. institutional development (IA establishment) and agriculture and extension development. Total implementation period is therefor set at 4 years starting from 2019 onwards with reference to the implementation speed/ progress which have been experienced in the on-going MMIP II construction works (see Table 5.3.1).

Table 5.3.2 Implementation Schedule by Component/ Sub-component (MMIP II)



Source: JICA Survey Team

5.4 Cost Estimation and Disbursement, and Step-wise Implementation

5.4.1 Basis of Cost Estimation

In the previous chapters, series of project components and sub-components have been identified and the implementation plans and schedule have been formulated. This sub-chapter stipulates cost estimation by component, and the manner of the estimation is summarized below:

- ✓ Irrigation and Drainage Development: Major costs are the construction of Main Canal No.2, its lateral canals, other remaining irrigation canals and drainage canals, etc. The costs were referred to those ones set by NIA-Regional Office and NIA-PMO and already applied in the on-going construction contracts.
- ✓ Distribution Infrastructure Improvement (Access Road and Bridge Construction): NIA-PMO is to construct the access road and bridge along the access road, and therefore the relevant costs were estimated based on those ones set by NIA-Regional Office and NIA-PMO and already applied in the past road (intra-road) construction/ improvement works within the MMIP. The cost estimation is made on basis of quantities estimated and relevant unit prices applied by NIA-Regional Office/PMO. The major cost for the access road construction is for the concrete-pavement.
- ✓ Agriculture and Extension Development: Major costs are establishment of demonstration farms and related logistics support for the extension field workers. Trainings to municipality agricultural staff and production of dissemination materials are also included in this cost estimation of the agriculture extension. A set of extension team is arranged, who is composed of ATI staff and contractual-basis extension staff. The extension staff are in charge of frontline extension to the famers upon trainings completed by the subject matter specialist stationed in regional office.

Direct costs under this Project are composed of; direct civil and structure construction cost, demonstration farm establishment cost with necessary logistics cost, construction of offices/ housing unit, and other supportive activities including IA establishment, while in-direct cost shall cover price escalation, physical contingency, land acquisition and compensation when required, and VAT. The in-direct costs under this Project are estimated as follows including exchange ratio;

- ✓ Exchange Rate: 1) US$ 1 = ¥ 108.81, 2) US$ 1 = PHP 52.57, 3) PHP 1 = ¥ 2.07
- ✓ Price Escalation Rate: 1) Foreign Currency Portion: 1.7%, 2) Local Currency Portion: 1.9%
- ✓ Physical Contingency: Construction: 5.0%
- ✓ Rate of Tax: 1)VAT: 12.0%, 2) Import Tax: 0.0%
- ✓ Rate of Administration Cost: 5.0% (including detail design)

1) Foreign exchange ratios are set at 108.81 Yen against one US dollar and PHP 52.57 against one US dollar, accordingly 2.07 Yen per one PHP, applied as of the values of June 2018.

2) Price escalation for foreign currency portions of direct cost is set at 1.7% of inflation index while the price escalation of local currency portions to be 1.9% of inflation index estimated as the average of construction materials whole sale price index in the years of 2014[1], 2016, 2017. Note that the price escalation is applied for the direct construction cost, and when needed machineries procurement cost, latter of which is also a part of the direct cost.

3) Physical contingency is set at 5.0% to be applied both for foreign and local portions and also for all the direct cost such as construction costs and when needed procurement costs. This physical contingency ratio is applied over the direct cost plus the above price escalation cost.

4) VAT is set at 12% as practiced in the Philippines while import tax is set at 0.0% according to

[1] the inflation index in year 2015 was minus 0.708%, and therefore it was omitted to estimate the past average.

information given by JICA Headquarters.

5) Administration cost covers salaries of government staff engaged in the Project including various allowance, depreciation cost for existing machineries that the NIA-PMO owns, maintenance cost of machineries, equipment, offices, material management cost, etc. The ratio of the administration cost is set at 5.0% over the direct costs and also those price escalation and physical contingencies.

5.4.2 Cost Estimation

1) Costs of Case-1 and Case-2

The Project cost is estimated by component, which consists of; 1) irrigation and drainage development, 2) distribution infrastructure improvement, 3) agriculture & extension development, 4) other related activities (including detail design and administration cost, etc.), 5) land acquisition, 6) VAT, 7) price escalation, and 8) physical contingency. The construction plan of "1) irrigation and drainage development", which is to install the irrigation and drainage facilities in LMSA, has two options, so-called Case-1 and Case-2. The main canals and lateral canals, which will be very much affected by flood in rainy season, will not be constructed in Case-1, while the construction plan of Case-2 covers all the main canals and lateral canals as per NIA-PMO original plan. The all the planned drainage canals (main/ lateral/ Façade drain) should be constructed in both Case-1 and Case-2.

The difference of direct cost between Case-1 and Case-2 should affect the other related works and indirect costs. The total project cost of Case-1 arrives at [redacted] PHP ([redacted] JPY), out of which direct cost amounts to [redacted] PHP ([redacted] JPY), and indirect cost amounts to [redacted] PHP ([redacted] JPY) composed of land acquisition, VAT, price escalation and physical contingency (see Table 5.4.1). On the other hand, the total project cost of Case-2 arrives at [redacted] PHP ([redacted] JPY), out of which direct cost amounts to [redacted] PHP ([redacted] JPY), and indirect cost shares [redacted] PHP ([redacted] JPY) composed of land acquisition, VAT, price escalation and physical contingency (see Table 5.4.1). The physical implementations of both cases will be carried out over 4 years (from 2019 to 2922) as shown in Table 5.4.2.

Table 5.4.1 Summary of the Project Cost (Case-1 & Case-2)

Particulars	Project Cost			
	Case-1		**Case-2**	
	Million PHP	Million JPY	Million PHP	Million JPY
A. Direct Cost				
1. Irrigation and Drainage Development				
1-1. Construction of the MC-2	[redacted]	[redacted]	[redacted]	[redacted]
1-2. Construction of the Lateral under MC-2	[redacted]	[redacted]	[redacted]	[redacted]
1-3. Construction of the Main Drainage (MDC)	[redacted]	[redacted]	[redacted]	[redacted]
1-4. Construction of the Main Drainage (LDC)	[redacted]	[redacted]	[redacted]	[redacted]
1-5. Construction of FAÇADE DRAIN	[redacted]	[redacted]	[redacted]	[redacted]
1-6. Flood Protection Works (canal slope protection, etc.)	[redacted]	[redacted]	[redacted]	[redacted]
1-7. Urgent Works for MMIP I Area				
(1) Supply and delivery of steel gates	[redacted]	[redacted]	[redacted]	[redacted]
(2) Drainage Structures	[redacted]	[redacted]	[redacted]	[redacted]
2. Distribution Infrastructure Improvement				
2-1. Access Road (Intra-site Road) Construction	[redacted]	[redacted]	[redacted]	[redacted]
2-2. Bridge Construction (along Access Road)	[redacted]	[redacted]	[redacted]	[redacted]
3. Agriculture & Extension Development				
3-1. Technical Assistance for Irrigated Rice Production	[redacted]	[redacted]	[redacted]	[redacted]
3-2. Enhancement of Agriculture Extension Services at Municipality Level	[redacted]	[redacted]	[redacted]	[redacted]
3-3. Development of Seed Production	[redacted]	[redacted]	[redacted]	[redacted]
4. Other Related Activities				
4-1. Parcellary Mapping/ Survey				
(1) Parcellary Survey	[redacted]	[redacted]	[redacted]	[redacted]

Particulars	Project Cost			
	Case-1		Case-2	
	Million PHP	Million JPY	Million PHP	Million JPY
(2) Construction Survey				
4-2. Institutional Development Program (IA establishment)				
(1) On-Farm Development				
(2) IA Strengthening/Organizing				
4.3. Field Support for Supervision and Monitoring				
4-4. Project Service Facilities				
4-5. Detailed Engineering				
4-6. Other Administrative Works				
Total of Direct Cost (A)				
B. Indirect Cost				
Land Acquisition				
VAT				
Price Escalation				
Physical Contingency				
Total Indirect Cost (B)				
Total Project Cost (A) +(B)				

Exchange Rate: 2.07 JPY/ PHP, Source: JICA Survey Team

*/ Flood protection works are not considered in the Case-1 since most of the canals are to be constructed within the area less/ least affected by flood while it was well considered in the Case-2 as Case-2 is to construct all the canals as per NIA-PMO original design.

Table 5.4.2 Disbursement of the Project (Case-1 & Case-2)

Year	Annual Budget					
	Case-1			Case-2		
	(million PHP)	(million JPY)	Ratio	(million PHP)	(million JPY)	Ratio
2019						
2020						
2021						
2022						
Total						

Exchange Rate: 2.07 JPY/ PHP

Source: JICA Survey Team

2) Comparison between NIA Estimation and JICA Estimation for Case-1 and Case-2

NIA started the MMIP II project from the current year of 2011 (CY2011) with estimated total project cost of 5,444.85 million PHP (NEDA approved project cost). Table 5.4.3 shows the yearly allotment of project cost from CY2011 to as at CY2018, and total allotment of the project cost amounts to [redacted] PHP till the end of fiscal year 2018 (December 2018). Therefore, NIA is supposed to complete the remaining works of MMIP II project by using the balance of [redacted] PHP.

Table 5.4.3 MMIP II Project Cost (NIA Estimation)

Construction Year (CY)	Targeted Area	Project Cost (Yearly Allotment)	
CY 2011	UMSA		PHP
CY 2012	UMSA		PHP
CY 2013	UMSA		PHP
CY 2014	UMSA		PHP
CY 2015	LMSA		PHP
	PESA		
CY 2016	LMSA		PHP
CY 2017	LMSA		PHP
CY 2018	LMSA		PHP
	Total (CY2011~2018)		PHP
	Overall Cost (NIA Estimation/ NEDA approved cost)		PHP
	Balance		**PHP**

Source: NIA PMO

Though the project costs of Case-1 and Case-2 estimated by JICA Team include sufficient budget for "Distribution Infrastructure Improvement (access road & bridge)" and also "Agriculture & Extension Development", the NIA's estimation is mostly composed of civil works and other related works only relevant to the irrigation and drainage works. Further, the project cost of Case-2 estimated by JICA Team includes the necessary cost of "Flood Protection Works, e.g. canal slope protection works", which prevents the canal slopes from being damaged by floods. This cost is not included in NIA's estimation.

Table 5.4.4 shows the available budget for remaining civil works for the MMIP II project area (PHP), and the comparison between the remaining budget and the JICA Team's estimation for the both Case-1 and Case-2 by scope of the components covered. Note that indirect costs have been proportionally included into the relevant direct costs for the Case-1 and Case-2. The table indicates the following:

- ✓ The project cost of Case-1 estimated by JICA team is smaller than that of the remaining budget due to reduction of the scope of construction for irrigation canals, for which canal network is to be constructed only within the area not much affected by flooding. Excluding the agriculture component, required cost to complete the Case-1 amounts to PHP, which is only % of the remaining budget. Even with the agriculture component included, the required budget comes to PHP, which is manageable within the remaining budget (% of the remaining budget).
- ✓ On the other hand, the cost of Case-2 comes to PHP even only for the construction of irrigation and drainage canals, which is already beyond the remaining budget by % (PHP over). The JICA team is of the opinion that Case-2 should be implemented with at least some flood protection works such as canal slope protection, concrete flume introduction to on-farm ditches, sluice gates introduction along the Pulangi river, etc. With this flood protection works, the required amount arrives at PHP, already exceeded by about % (PHP over). Then, with the road and bridge construction, the required cost will exceed by % (PHP over). Further, with the agriculture component, the total required cost comes to PHP, exceeded by % (PHP over).

Table 5.4.4 Estimated Project Cost for Remaining Civil Works in MMIP II Project Area

Basis of Estimation		Project Cost *1 (million PHP)	Ratio	Difference	Remarks
Remaining Budget				-	Balance of Allotment Budget (see Table 5.4.3)
JICA Team's Estimation	Case-1	( ) *2		-	NIA Portion (Irrigation & Drainage Facilities) only *3
		( )		( )	+ Road and Bridge
		( )		( )	+ Agriculture Component
	Case-2	( )		-	NIA Portion (Irrigation & Drainage Facilities) only (without Flood Protection Works *3)
		( )		( )	NIA Portion (Irrigation & Drainage Facilities) only (including Flood Protection Works *4)
		( )		( )	+ Road and Bridge
		( )		( )	+ Agriculture Component

*1: Including "Other Related Works" and "Indirect Works (Land Acquisition, VAT, Physical Contingency and Price Escalation)"
*2: shows difference between the cost and the remaining budget.
*3: "Flood Protection Works" are not considered in Case-1
*4: Flood Protection Works: Canal Slope Protection, Concrete Flume Introduction, Sluice Gates Introduction along the Pulangi River etc.
Source: NIA PMO, JICA Survey Team

3) Cost of MMIP III

Some of the irrigation facilities constructed in MMIP I area and constructed in early stage of MMIP II area have been deteriorated, and thus require some rehabilitation/ improvement works. With this situation, the rehabilitation/ improvement project, so-called "MMIP III Project", should be planned to implement in the near future. MMIP III Project should be composed of 3 major works, such as "Rehabilitation of MMIP I Area (MSA & UMSA)", "Improvement of MMIP II Area (UMSA, LMSA and PESA)", and "Procurement of Machineries (for maintenance)". The current status of lacking the maintenance machineries would prevent sound maintenance works burdened by flooding. Therefore, sufficient number of machineries should be procured in the MMIP III Project.

The total project cost for the MMIP III arrives at [redacted] PHP ([redacted] JPY), out of which direct cost amounts to [redacted] PHP ([redacted] JPY), and indirect cost shares [redacted] PHP ([redacted] JPY) composed of VAT, physical contingency and administration cost (see Table 5.4.5). Since the project implementation schedule has not yet been fixed, this project cost does not include the price escalation cost.

Table 5.4.5 Summary of the Project Cost of MMIP III Project

Particulars	Procurement Method	Project Cost	
		Million PHP	Million JPY
A. Direct Cost			
III-1. Rehabilitation of MMIP I Area (MSA & UMSA)	LCB	[redacted]	[redacted]
III-2. Improvement of MMIP II Area (UMSA, LMSA and PESA)	LCB	[redacted]	[redacted]
III-3. Procurement of Machineries (for maintenance)	ICB/LCB	[redacted]	[redacted]
Total of Direct Cost (A)	**-**	[redacted]	[redacted]
B. Indirect Cost			
VAT	-	[redacted]	[redacted]
Physical Contingency	-	[redacted]	[redacted]
Administration Cost	-	[redacted]	[redacted]
Total Indirect Cost (B)	**-**	[redacted]	[redacted]
Total Project Cost (A) +(B)	**-**	[redacted]	[redacted]

Exchange Rate: 2.07 JPY/ PHP
Source: JICA Survey Team

5.4.3 Step-wise Implementation

As afore-mentioned, remaining budget at the end of 2018 is estimated at [redacted] PHP, and as a matter of fact this budget can cover the required cost of Case-1 only. Also, from the view point of maintenance of the irrigation facilities in the LMSA, Case-1 is much easier than that of Case-2 since the canal network of Case-1 is to be installed within the area less or minimally affected by flooding. Therefore, JICA team recommends NIA central office to go with Case-1 and complete the MMIP II as soon as possible with the remaining available budget.

Though the Case-1 is the highly recommend plan by the JICA team, should NIA want to proceed to Case-2 in that the canal network is to be constructed as per the original NIA-PMO design keeping the designed irrigable area of 6,590 ha, there should of course be another budget arrangement. Taking into account this additional budgetary requirement, the JICA team recommends NIA Central Office to implement Case-1 first, and then proceed by step-wise implementation as indicated in the following:

- ✓ First priority should be to complete the Case-1 construction including roads and bridges and also together with agriculture components. All the components under Case-1 require [redacted] PHP, which can be managed within the available remaining budget of [redacted] PHP.
- ✓ With another budget arrangement of [redacted] PHP, NIA may proceed to Case-2 should NIA intend so. In this case, agriculture component should also be included, requiring total [redacted] additional budget. If there is an opportunity of arranging further additional [redacted] PHP, NIA

may implement Case-2 works together with MMIP III, requiring total [redacted] PHP.

Table 5.4.6 Preliminary Plan of Step-wise Implementation towards Case-2 and MMIP III

Remaining Budget	Project Cost *1 (million PHP)			Remarks
	Case-1 (First Priority)	Case-2 (2nd stage)	MMIP III	
1,453.50 Million PHP	[redacted] *2	-	-	Irrigation & Drainage + Road and Bridge, *3
	[redacted]	-	-	+ Agriculture Component
	-	[redacted]	-	NIA Portion (Irrigation & Drainage Facilities) only (including Flood Protection Works *4)
	-	[redacted]	-	+ Road and Bridge
	-	[redacted]	-	+ Agriculture Component
	-	-	[redacted]	Rehab of MMIP I, Improvement of MMIP II, and procurement of maintenance machineries.
-	-	[redacted]		Combine Case-2 and MMIP III

*1: Including "Other Related Works" and "Indirect Works (Land Acquisition, VAT, Physical Contingency and Price Escalation)"
*2: shows difference between the cost and the remaining budget.
*3: "Flood Protection Works" are not considered in Case-1
*4: Flood Protection Works: Canal Slope Protection, Concrete Flume Introduction, Sluice Gates Introduction along the Pulangi River etc.

5.5 Institutional Setup for Project Implementation

5.5.1 Agencies Concerned and Implementation Capacities at the Central Level

National Irrigation Administration (NIA) is the implementing agency of the MMIP II (the Project). NIA was created under Republic Act (RA) 3601 on 22 June 1963. NIA is one of the government owned corporations with approximately 9,000 permanent staff as of May 23, 2017. Aside from the permanent position staff, there are about 400 staff engaged in maintenance and other operation, and contractual of about 4,000 staff, totaling to 14,000 staff as of now.

Figrue 5.5.1 shows the NIA's organization structure, in which the headquarters consists mainly of Engineering and Operations Sector and Administration and

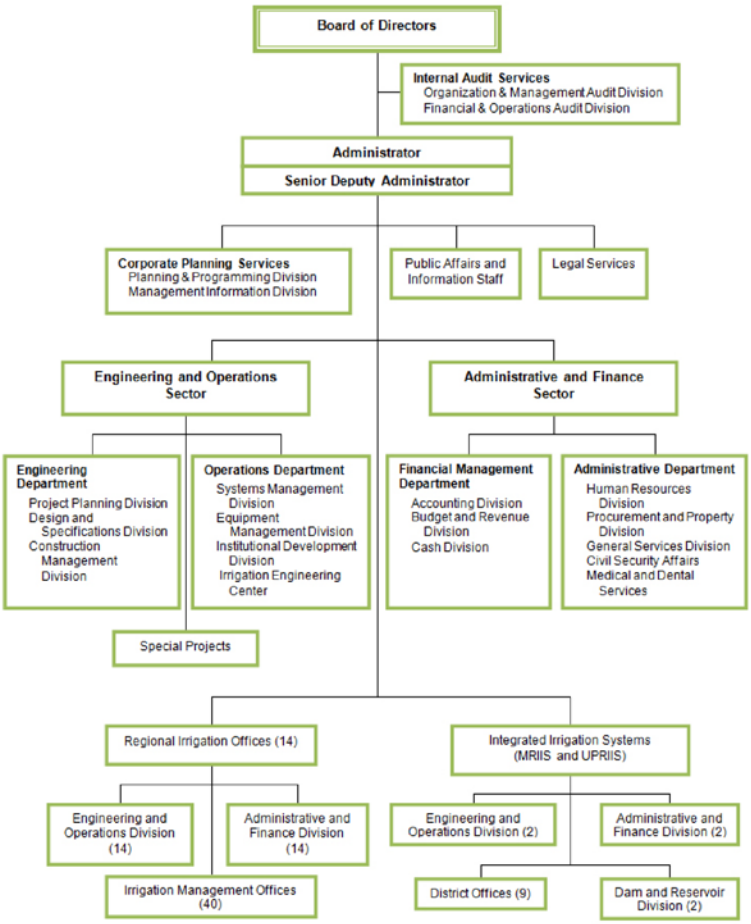


Figure 5.5.1 NIA Organizational Structure
Source: NIA Headquarters

Finance Sector. Under the former Engineering and Operations Sector, there are 2 departments; namely, Engineering Department and Operations Departments. Further down the Engineering Department, there are 3 divisions such as Project Planning Division, Design and Specifications Division, and Construction Management Division (CMD). Since MMIP II is an on-going project, the NIA-PMO is supposed to report to the CMD of the Engineering Department.

There are 14 regional offices, each of which is composed, similarly to that of the Headquarters, of Engineering and Operations Division and Administrative and Finance Division. The MMIP is located within the jurisdiction of NIA Regional Office No. XII. Under the regional office, there are irrigation management offices, which are directly engaged in the operation and maintenance of completed irrigation systems. It means that, for example, MMIP I is now under one of the irrigation management offices of NIA Region XII, called Cotabato Irrigation Management Office located in Kidapawan town, about 52 km east from the Pikit town.

Further, there is a field office called Maridagao River Irrigation System office, which is controlled by the Cotabato Irrigation Management Office. This field office is the front-line in-charge of operation and maintenance of the completed irrigation systems such as Maridagao Service Area of MMIP I, Upper Malitubog SA completed under MMIP I and a part of the UMSA completed under MMIP II as of July 2017. As such, upon completion of parts of MMIP, such completed parts have been transferred from NIA-PMO in charge of the construction to the respective management office.

Table 5.5.1 shows the staff assignment at the NIA headquarters. In the HQs, there are total 717 staff composed of 421 monthly/ permanent positions, daily/ casual positions, and contract of service positions. With regards to the Construction Management Division, there are in fact only 36 staff composed of 14 monthly/ permanent positions and 22 daily/ casual positions.

Table 5.5.1 NIA Headquarters Staffing as at May 31, 2017

Division/ Position	Vacant Positions	Monthly/ Permanent Positions	Daily/ Casual Position	Contract of Service Positions	Total	Filled Positions
Office of the Corporate Board Secretary	1	2	-	-	3	2
Internal Audit Services	7	18	8	0	33	26
Office of the Administrator	6	9	3	3	21	15
Office of the Senior Deputy Administrator	1	6	-	-	7	6
Corporate Planning Services	5	23	11	1	40	35
Public Affairs and Information Staff	5	5	8	-	18	13
Legal Services	2	9	1	-	12	10
Office of the Deputy Administrator for E&O	2	6	-	-	8	6
Engineering Department						
Office of the Depart Manager – Eng. Dept	1	2	1	-	4	3
Construction Management Division	3	14	22	-	39	36
Design and Specifications Division	7	13	15	-	35	28
Project Planning Division	3	24	22	3	52	49
Operations Department						
Office of the Depart Manager – Ope. Dept	1	2	2	-	5	4
Institutional Development Division	1	15	4	2	22	21
Irrigation Engineering Center	3	17	3	-	23	20
Equipment Management Division	2	12	7	-	21	19
Systems Management Division	2	18	7	1	28	26
Office of the Deputy Administrator for A&F	2	6	3	-	11	9
Financial Management Department	18	44	16	0	78	60
Administrative Department	21	59	54	6	140	119
Commission on Audit (COA)	-	-	3	-	3	3
Office of the Ombudsman	-	-	1	-	1	1
TOTAL	**116**	**421**	**274**	**22**	**833**	**717**

Source: NIA Headquarters, as of May 31, 2017

Table 5.5.2 summarizes the budget allocated to NIA for the last 8 years. NIA's projects are composed of local funded projects, foreign assisted project, international agency projects, and other sources while NIA's programs are those of feasibility study, detailed engineering, pre-engineering activities, restoration/ rehabilitation/ repair of irrigation system, improvement of service roads, heavy equipment procurement, irrigation management transfer support services, environmental impact statement, climate change adaptation works etc. Note that the program budget before the year 2014 was not available, and therefore the budgets before that year show only the project budget.

Table 5.5.2 NIA's Financial Statement by Project and Program

Fiscal Year	NIA's Projects 1)					NIA's Programs 2)				Total (1)+(2)
	Local Fund Projects	Foreign Assisted Projects	International Agency Projects	Other Source	Sub-total (1)	General Administration and Support	Support to Operations	Operations	Sub-total (2)	
2010	10,815,986	4,144,324	661,613	-	15,621,923	NA			NA	15,621,923
2011	7,837,623	5,448,431	448,985	2,433,671	16,168,710	NA			NA	16,168,710
2012	20,328,649	4,125,403	609,756	-	25,063,808	NA			NA	25,063,808
2013	23,314,142	4,015,153	-	-	27,329,295	NA			NA	27,329,295
2014	14,253,209	2,479,215	-	-	16,732,424	-	-	4,379,425	4,379,425	21,111,849
2015	15,424,674	2,278,699	-	-	17,703,373	1,642,973	575,481	8,828,614	11,047,068	28,750,441
2016	10,860,750	3,757,074	-	-	14,617,824	7,288,561	563,285	10,273,514	18,125,360	32,743,184
2017	9,554,575	3,170,129	-	-	12,724,704	10,711,537	140,500	14,799,700	25,651,737	38,376,441

Source: NIA Headquarters, May 2017

Figure 5.5.2 illustrates the NIA's budgets for projects and programs (program budges before 2014 were not available). As is shown, the project budget once peaked in 2013 with an amount of 27 billion PHP, after which the budget started decreasing. Instead, program budget has been increasing year by year. As of year 2017, the program budget amounts to 25.7 billion PHP while that of projects marks 12.7 billion PHP, totaling to 38.4 billion PHP.

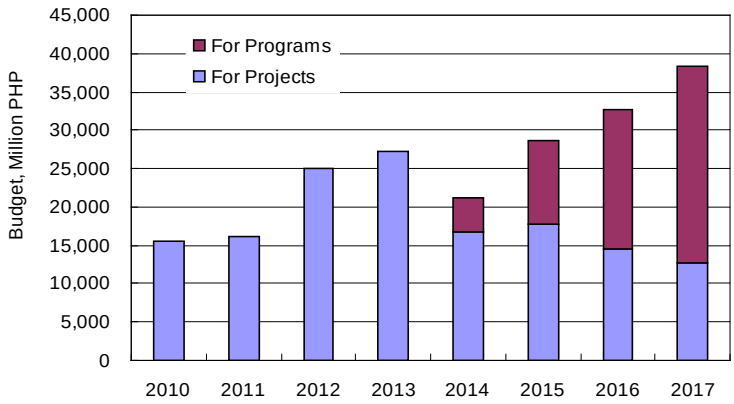


Figure 5.5.2 NIA's Project and Program Budgets
Source: NIA Headquarters (May 2017)

In fact, taking into account the annual budget scale for projects marking around 12 to 14 billion PHP for the last 2 years, the remaining works of MMIP II project, requiring maximum annual disbursement of 720 – 820 million PHP (see Table 5.4.2), could be managed by NIA from the view point of budget disbursement since it shares only around 6%. On the proposed MMIP III Project, the project cost is estimated at 450 million PHP (see Table 5.4.5). If the construction is planned to complete within 2 years, one-year disbursement should be around 230 million PHP, which is less than 2% of the NIA's annual project budget. Thus, from the financial disbursement view, NIA will be able to manage the remaining works of MMIP II as well as the works of MMIP III.

5.5.2 Agencies at the Regional and Field Level

NIA has its regional office, and the structure of the regional office is basically same as that of the NIA HQs with some simplified cadres. For example, the regional office is structured with 2 divisions of Engineering & Operation Division and Administrative and Finance Division (at the HQs level, these 2 divisions are called Sector). Under the Engineering & Operation Division, there are 5 sections such as Planning & Design Section, Construction Management Section, Operation Section, Institutional Development Section, and Equipment Management Section.

Under the regional office, there are irrigation management offices directly in charge of operation and management of completed irrigation systems[2]. The structure here is basically same as that of the regional office with some simplified layers. Namely, under the head of irrigation management office, called Division Manager, there are 4 sections such as Institutional Development Section, Engineering Section, Operation and Maintenance Section, and Administration and Finance Section.

The Operation and Maintenance Section of the irrigation management office undertakes the frontline responsibility for O&M of completed irrigation systems. In case of Cotabato Irrigation Management Office, the Operation and Maintenance Section should oversee total 4 irrigation systems, and therefore [redacted] principal engineers are assigned to lead each team in operating and maintaining the irrigation systems. One of the 4 irrigation systems is, in fact, the Maridagao River Irrigation system, which include Maridagao Service Area (MMIP I), Upper Malitubog Service Area (MMIP I), and Upper Malitubog Service Area completed under MMIP II.

Table 5.5.3 summarizes the staff allocation of the Region XII office and Cotabato Irrigation Management Office. There are [redacted] staff in the NIA Region XII office, out of which [redacted] are in the manager's office, [redacted] in the Engineering and Operation Division and [redacted] in the Administrative & Finance Division. Note that the number of whole staff in the Region XII including the subordinate irrigation management offices comes to [redacted]. With regard to the Cotabato Irrigation Management Office, there are total [redacted] staff under the Division Manager. The Maridagao River Irrigation System is manned with a total of [redacted] staff.

Table 5.5.3 NIA's Staff Allocation in Regional XII and Cotabato Irrigation Management Office

Division/ Section	Authorized	Filled Positions
NIA Region XII		
Office of the Regional Manager (Region XII)	[redacted]	
Engineering and Operation Division	[redacted]	
Planning and Design Section	[redacted]	
Construction Management Section	[redacted]	
Operation Section	[redacted]	
Institutional Development Section	[redacted]	
Equipment Management Section	[redacted]	
Sub total of Engineering and Operation Division	[redacted]	
Administrative & Finance Division	[redacted]	
Finance Section	[redacted]	
Administrative Section	[redacted]	
Sub total of Administrative & Finance Division	[redacted]	
Total of NIA Region XII	[redacted]	**Grand total is [redacted] for the region**
Cotabato Irrigation Management Office		
Office of the Division Manager	[redacted]	
Engineering Section	[redacted]	
Administrative and Finance Section	[redacted]	
Operation Maintenance Section		
Kabacan River Irrigation System (RIS)	[redacted]	
Libungan RIS	[redacted]	
M'lang-Masila RIS	[redacted]	
Maridagao RIS	[redacted]	**In charge of MMIP completed area**
Total of Cotabato Irrigation Management Office (Region XII)	[redacted]	

Source: NIA Region XII and Cotabato Irrigation Management Office, May, 2017

5.5.3 NIA MMIP II Project Management Office (PMO)

NIA MMIP II PMO is in charge of the on-going construction works of MMIP II. PMO is directly

[2] There are total 4 irrigation management offices under Region XII office; namely, Cotabato Irrigation Management Office (IMO), South Cotabato-Sarangani IMO, Sultan Kudarat IMO, Maguindanao-Lanao Del Sur-Basilan-Sulu-Tawi-Tawi IMO.

under Engineering and Operation Sector of the central office. Though the PMO structure is basically similar to that of central office, it is simplified as there are only 2 divisions under the Project Manager; Administrative and Finance Division and Engineering Division as shown in the Figure 5.5.3. The MMIP II PMO is located in Midsayap, opposite side of the Region XII Office, and there are as of May 30, 2017, [redacted] staff in total composed of [redacted] monthly co-terminous, [redacted] casual employment and [redacted] service/ job contracts.

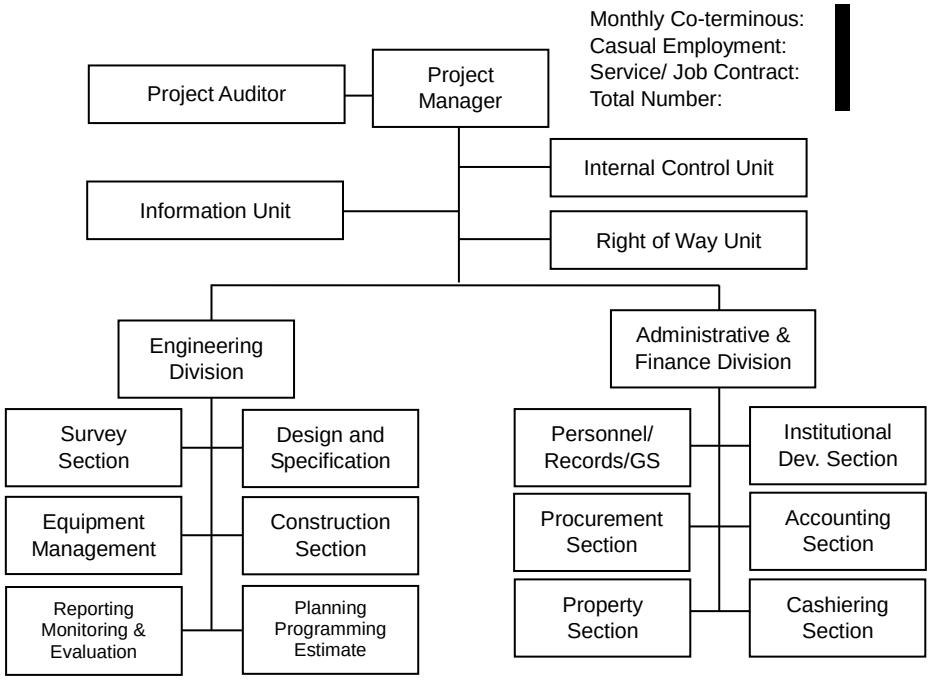


Figure 5.5.3 Organizational Structure of MMIP II PMO

Source: NIA MMIP II PMO

5.5.4 Implementation Arrangement for the Remaining MMIP II

In implementing the remaining works of MMIP II, there should be an institutional arrangement, which should of course be established based on the existing on-going organizational set up. To complete the implementation of the remaining works of MMIP II, setting up of Steering Committee (SC) at the NIA central level, comprising of 5 divisions of NIA and ATI central office, and coordination mechanism with the PMO being the center at the site level, comprising of the relevant organizations, should be as in the Figure 5.5.4:

This SC/PMO arrangement is proposed, as afore-mentioned, basically with reference to that of the on-going MMIP II. The major difference from the on-going arrangement is the inclusion of Agriculture Training Institute (ATI) at the central level since ATI is to be engaged in agriculture and extension development activities to be conducted within the MMIP area. The SC should be chaired by the Administrator and the secretariat should be the manager of Engineering Department. Also, JICA Philippines office may participate to follow up the implementation of MMIP II.

With the foregoing, the SC is to facilitate smooth project implementation through proper budget allocation, provision of necessary technical guidance, and control of budget expenditures. The SC has responsibility and authority on all activities such as planning, coordination between divisions, management at the central level, etc. Also, SC has the authority to supervise financial and accounting section as well in order to secure sufficient financial resources and appropriate payment for smooth project implementation. In addition, two working groups will be established at the SC, namely;

1) Accounting & Disbursement Management Group: Accounting & Disbursement Management

Group takes responsibility of managing the accounting and disbursement status and internal procedure based on the report from the PMO. Accounting & Disbursement Management Group will be comprised of members of Accounting Division and Budget and Revenue Division of the NIA central office.

2) Project Monitoring & Evaluation Group: A project monitoring report should be compiled as per NIA's internal procedure. In order to monitor the project progress and to ensure preparation of the monitoring report without delay, the Project Monitoring & Evaluation Group manages the necessary internal procedures for the preparation of the report. The Project Monitoring and Evaluation Group should be comprised of members of Construction Management Division.

At the field level, though the current PMO structure can be retained as it is, there should be an explicit coordination mechanism which should include MILF task force, municipalities, e.g. Pikit Municipality, NIA Region XII office with Cotabato Irrigation Management Office and ATI Region XII office with the outreach office of ATI located in Kabacan. MILF task force, with municipalities, will coordinate NIA-PMO in the issues of security as well as contacting the beneficiary and project to-be-affected peoples. Cotabato IMP under the Region XII office will take-over the irrigation system upon completion, and the ATI outreach office (Kabacan), controlled by its Region XII office (Tantangan), will provide agriculture extension services to the beneficiary farmers.

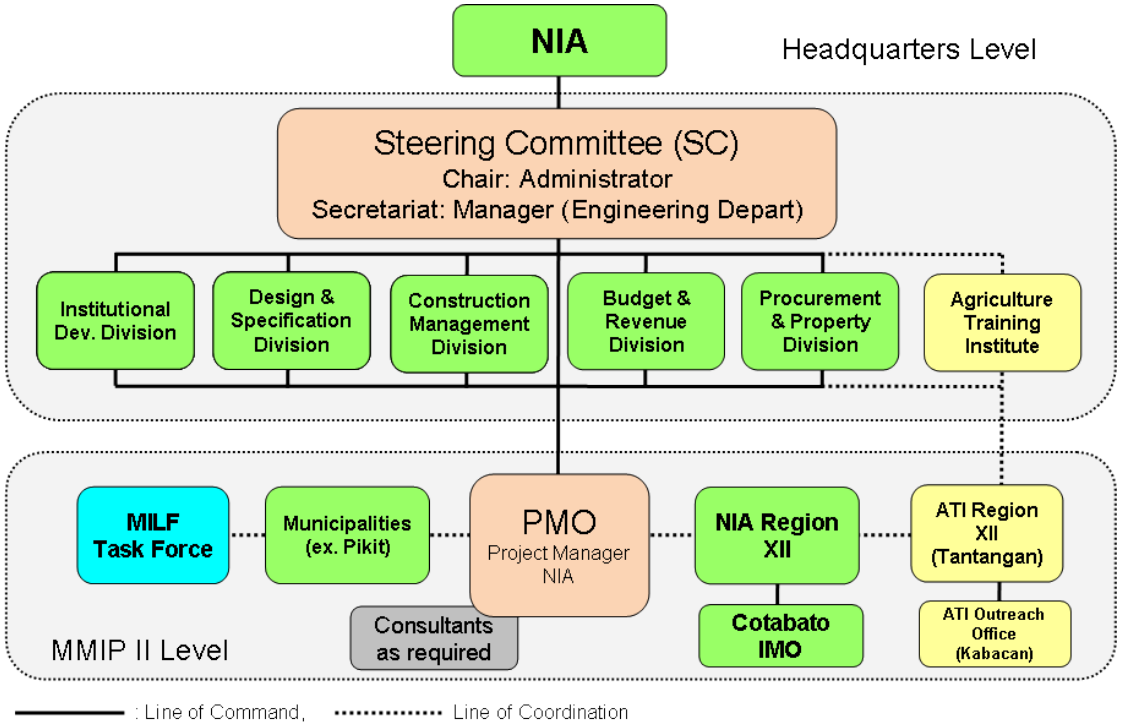


Figure 5.5.4 Project Implementation Arrangement
Source: JICA Survey Team

CHAPTER 6 PROJECT EVALUATION

6.1 Condition, Methodology and Evaluation Cases

In this chapter, an economic evaluation is performed to determine the economic viability of the Project. In order to examine the proposed project plan, internal rate of return is calculated as the economic indicator. Net present value and B/C are also calculated as supplemental indices. The methodologies and results are shown as follows: **(It is noted that non-disclose information for 3-year is included in this chapter as procurement by the Philippines government is scheduled.)**

6.1.1 Basic Condition and Assumptions

1) Referring to other similar projects in the irrigation/agriculture sector, the economic life of the project related to agriculture production is designed as 30 years. It means that economic evaluations are encoded over this period of 30 years considering the initial investments including operation and maintenance costs to accrue.
2) Project cost and benefit are calculated in Philippines Peso (Php). All cost and benefit are calculated adopting the level of June 2018 price, standardized by using consumer price index (CPI) and construction materials wholesale price index (CMWPI).
3) For the operation and maintenance cost calculation, one (1) percentages for Case-1 and two (2) percentage for Case-2 of the total costs are applied. The Cases are detailed in Chapter 6.1.2.
4) In the evaluation, the foreign exchange rate of 1 Php = 2.07 JPY is applied as of June 2018.
5) As per the Social Discount Rate in the Philippine, according to NEDA, generally 10% is applied with practices of similar investment projects in the irrigation/agriculture sector in the Country. In this economic evaluation, the EIRR should therefore be more than 10% or more, otherwise the investment cannot be justified.
6) Transfer costs such as import tax, VAT, and interests are eliminated from the economic cost. Also, price contingency (inflation) cost is not counted in the economic evaluation, while physical contingency is counted in the evaluation.
7) Table 6.1.1 shows conversion factors which are applied to estimate economic costs/prices. Note that conversion factors are not standardized in Philippines, so that the Standard Conversion Factor (SCF) which was employed in “Philippine Rural Development Project”; World Bank, 2014, is applied in this economic evaluation (see Table 6.1.1).

Table 6.1.1 Applied Conversion Factors

Particulars	Factor	Reference
Standard Conversion Factor (SCF)	0.90	Philippine Rural Development Project, World Bank, 2014
Skilled Labor	1.00	Assumed placed under competitive market
Unskilled Labor/ Family Labor	0.60	Philippine Rural Development Project, World Bank, 2014

Source: JICA Survey Team

6.1.2 Cases for Project Evaluation

Basic Cases: There are two cases to be analyzed in the evaluation. In Case-1, by constructing only part of the irrigation canals with all drainage, the irrigation water would be supplied for a part of LMSA. On the other hand, in Case-2, by constructing all irrigation canals and drainage canals as per the original design for Lower Malitubog Service Area (LMSA), the LMSA can be benefitted during dry season (note that during rainy season, parts of LMSA would be affected by flooding):

Table 6.1.2 Cases for Project Evaluation

Case	Notation	Beneficial Areas	Detail
Case-1	C1	Part of LMSA	Construct only part of the irrigation canals with all drainages
Case-2	C2	Whole Area of LMSA	Construct all irrigation canals and drainage canals

Source: JICA Survey Team

The Target Area: The MMIP II Service Areas, total 10,536 ha, is composed of Upper Malitubog Service Area (UMSA) and LMSA. The originally requested ODA target area was the most eastern part of LMSA (2,133ha). Then, the initial target area of this economic analysis covered only the eastern part of LMSA, since the economic analysis aimed to evaluate the economic validity of the ODA project area requested. However, NIA decided to withdraw the MMIP II project from its proposal to be funded by Japan ODA financing, as NIA believes that the remaining balance is too inconsequential to be funded by the ODA loan. Therefore, the economic analysis of the ODA project is no longer necessary. Instead, the economic analysis is done on costs and benefits occurred from NIA's on-going and planned project. In this respect, the Target Area should be LMSA or entire MMIP II Service Area.

Flood Affection Scenario: In rainy season, parts of the Target Service Area are free from flooding, while other parts of the areas are probably affected by flood. The expected flooded areas with 0.5 to 1.0 m inundation are out of target irrigable area in the rainy season. On the other hand, flooded areas of up to 0.5 m could still be considered as a part of target irrigable area, yet the production would be affected by floods. The losses due to the flooding are assumed based on four scenarios; 1) no damage scenario (0% loss in yield; notified as "D00"), 2) partially damaged scenario (30% loss; notified as "D30"), 3) half damaged scenario (50% loss; notified as "D50"), and 4) almost-totally damaged scenario (80% loss; notified as "D80"). The economic analysis is to be conducted by each of the scenarios as sensitivity analysis. To judge economic feasibility of the Project, 30% reduction cases are applied as the "benchmark" case.

In summary, there are four flood damaged scenarios under each of the two cases. It means that there are eight cases in total to be analyzed in the evaluation. In each of eight cases, two target areas are considered i.e. LMSA and entire MMIP II. Table 6.1.3 shows evaluation cases of the Projects in LMSA areas (notified as "LM"). On the other hand, Table 6.1.4 shows evaluation cases in MMIP II whole area (notified as "M2"). In total, therefore, there are 16 cases to be evaluated:

Table 6.1.3 Evaluation Cases Only for LMSA Area

Case	Crop	Dry Season			Wet Season			Total Production (ton)
		Planted Area (ha)	Yield (ton/ha)	Production (ton)	Planted Area (ha)	Yield (ton/ha)	Production (ton)	
-	**Without Project**							
-	Rice (rain-fed)	457	1.7	777	367	1.7	624	1,401
-	Corn	795	2.1	1,670	1,087	2.1	2,283	3,953
C1	**With Project (Case-1)**							
C1-LM-D00	Rice (Irrigated)	3,688	4.7	17,334	2,810	4.7	13,207	30,541
C1-LM-D30	30% reduction	3,688	4.7	17,334	870	4.7	4,089	27,631
					1,940	3.2	6,208	
C1-LM-D50	50% reduction	3,688	4.7	17,334	870	4.7	4,089	25,885
					1,940	2.3	4,462	
C1-LM-D80	80% reduction	3,688	4.7	17,334	870	4.7	4,089	23,169
					1,940	0.9	1,746	
C2	**With Project (Case-2)**							
C2-LM-D00	Rice (irrigated)	6,590	4.7	30,973	3,810	4.7	17,907	48,880
C2-LM-D30	30% reduction	6,590	4.7	30,973	870	4.7	4,089	44,470
					2,940	3.2	9,408	
C2-LM-D50	50% reduction	6,590	4.7	30,973	870	4.7	4,089	41,824
					2,940	2.3	6,762	
C2-LM-D80	80% reduction	6,590	4.7	30,973	870	4.7	4,089	37,708
					2,940	0.9	2,646	

Source: JICA Survey Team

Table 6.1.4 Evaluation Cases for all MMIP II Area

Case	Crop	Dry Season			Wet Season			Total Production (ton)
		Planted Area (ha)	Yield (ton/ha)	Production (ton)	Planted Area (ha)	Yield (ton/ha)	Production (ton)	
-	**Without Project**							
-	Rice (rain-fed)	731	1.7	1,242	587	1.7	997	2,240
-	Corn	1,271	2.1	2,669	1,738	2.1	3,650	6,319
C1	**With Project (Case-1)**							
C1-M2-D00	Rice (Irrigated)	7,634	4.7	35,880	6,756	4.7	31,753	67,633
C1-M2-D30	30% reduction	7,634	4.7	35,880	4,816	4.7	22,635	64,723
					1,940	3.2	6,208	
C1-M2-D50	50% reduction	7,634	4.7	35,880	4,816	4.7	22,635	62,977
					1,940	2.3	4,462	
C1-M2-D80	80% reduction	7,634	4.7	35,880	4,816	4.7	22,635	60,261
					1,940	0.9	1,746	
C2	**With Project (Case-2)**							
C2-M2-D00	Rice (irrigated)	10,536	4.7	49,519	7,756	4.7	36,453	85,972
C2-M2-D30	30% reduction	10,536	4.7	49,519	4,816	4.7	22,635	81,562
					2,940	3.2	9,408	
C2-M2-D50	50% reduction	10,536	4.7	49,519	4,816	4.7	22,635	78,916
					2,940	2.3	6,762	
C2-M2-D80	80% reduction	10,536	4.7	49,519	4,816	4.7	22,635	74,800
					2,940	0.9	2,646	

Source: JICA Survey Team

6.2 Economic Term of Project Cost and Benefit

6.2.1 Economic Term of Project Cost

The project costs are composed of foreign currency and local currency portions. Both foreign and local currency portions are further categorized into direct and indirect cost. As for direct cost, it is divided into skilled labor, unskilled labor, and other material portions to apply appropriate conversion factors. As indirect costs, physical contingency, land acquisition cost, and administration costs are taken into account as economic cost. Note that other indirect costs such as price escalation, interests, import tax and VAT are not included in the economic cost, because they can be assumed to be neutral on economic analysis, and negligible.

Regarding the costs that have been already expended by the year 2018, they should be converted into current price level, by using construction materials wholesale price index. On the other hand, the costs from 2019 are evaluated at the current price level. Table 6.2.1 – Table 6.2.5 show financial and economic costs after the conversion:

Table 6.2.1 Financial and Economic Cost (Case 1; LMSA), Million Peso

Component	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction Cost						
Other Material						
Skilled Labor						
Unskilled Labor						
Land Acquisition						
Consultant Fee						
Administration Fee						
Base Cost						
Physical Contingency						
BC+PhC						

Source: JICA Survey Team; the Cost Includes irrigation canals, drainage, and agriculture extension works.
Note: The costs that has already expensed by 2018 are converted into current price level by using CMWPI

Table 6.2.2 Financial and Economic Cost (Case 2; LMSA), Million Peso

Component	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction Cost						
Other Material						
Skilled Labor						
Unskilled Labor						
Land Acquisition						
Consultant Fee						
Administration Fee						
Base Cost						
Physical Contingency						
BC+PhC						

Source: JICA Survey Team; the Cost Includes irrigation canals, drainage, and agriculture extension works.
Note: The costs that has already expensed by 2018 are converted into current price level by using CMWPI

Table 6.2.3 Financial and Economic Cost (Case 1; MMIP II), Million Peso

Component	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction Cost						
Other Material						
Skilled Labor						
Unskilled Labor						
Land Acquisition						
Consultant Fee						
Administration Fee						
Base Cost						
Physical Contingency						
BC+PhC						

Source: JICA Survey Team; the Cost Includes irrigation canals, drainage, and agriculture extension works.
Note: The costs that has already expensed by 2018 are converted into current price level by using CMWPI

Table 6.2.4 Financial and Economic Cost (Case 2; MMIP II), Million Peso

Component	Financial Cost			Economic Cost		
	FC	LC	Total	FC	LC	Total
Construction Cost						
Other Material						
Skilled Labor						
Unskilled Labor						
Land Acquisition						
Consultant Fee						
Administration Fee						
Base Cost						
Physical Contingency						
BC+PhC						

Source: JICA Survey Team; the Cost Includes irrigation canals, drainage, and agriculture extension works.
Note: The costs that has already expensed by 2018 are converted into current price level by using CMWPI

6.2.2 Economic Term of Project Benefit

The project benefits are composed of two major sources; the first one is 1) the yield increase owing to additional water supply and agriculture extension activities, and the second one is 2) the cultivation area increase after adequate irrigation water to be availed. The project benefit is calculated as the difference of aggregated net benefits between with and without project.

As per former benefit, it can be a natural assumption that the current yield level under rain-fed cultivation will be increased immediately upon the construction up to the average irrigated rice level, i.e., 3.4 ton per ha. Further yield increase up to the target yield level, i.e., 4.7 ton per ha, is supposed to be achieved through agriculture extension. Such extension activities may need several years; 0% in the

first year of the construction completion (assumed that extension is still in the preparation stage), 30% in the 2nd year (assumed that even extension have been commenced, farmers have not applied the technology yet), 60% in the 3rd year, and 100% in the 4th years and onwards after the completion of the Project. Table 6.2.5 illustrates applied target yields by means of extension.

Table 6.2.5 Applied Target Yields of Extension by Year

Year of Extension	Before Construction		1st Year After construction		2nd Year After construction		3rd Year After construction		After Extension	
Season	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy
Percentage, %	0%	0%	0%	0%	30%	30%	60%	60%	100%	100%
Yield Level, ton/ha	2.5	2.5	3.4	3.4	3.8	3.8	4.2	4.2	4.7	4.7

Source: JICA Survey Team.

Note: The Yield Level Difference from "Before Construction" up to "1st Year" is equivalent to the gap between averages of rain-fed paddy and irrigation paddy.

Currently, the dominant crops in the unirrigated areas of the LMSA are rain-fed paddy and corn. With the project, these crops are supposed to be substituted by irrigated rice as MMIP I area has experienced. In fact, according to cost and return calculations based on the results of household survey conducted by the JICA Team, 2017, generally, irrigated rice seems to be more profitable than rain-fed paddy and corn. To illustrate this, one may compare net profits of Table 6.2.2 and Table 6.2.3. Differences of profits between irrigated and rain-fed paddy are 13,619 (=32,668-19,049) pesos, and 22,234 (=32,668-10,434) pesos for paddy and corn, respectively, in financial terms.

Further yield increase can be expected with extension activities implemented. The SAPROF report (May 2007) proposed that the target yields which can be accomplished after the irrigation facilities completion were 4.95 ton per ha and 4.77 ton per ha, in dry season and rainy season, respectively. According to the previous report, a realistic assumption is that the yields in target areas can potentially increase up to 4.7 ha[1].

Assumption mentioned above implies that the farmers can get more income even at the same size of cultivation. Moreover, it is expected that the cultivation area would be increased after supply of adequate irrigation water, as shown in Table 6.1.3 and Table 6.1.4. The additional income due to the cultivation area increase is the second major project benefits.

Table 6.2.6 Cost and Return Calculation for Rain-fed Crops

Items	Financial Price		Economic Price	
	Rain-fed Paddy	Corn	Rain-fed Paddy	Corn
Yield	1.7	2.1	1.7	2.1
Farm-gate Price, 2018 Price Level	17.2	11.1	15.6	10.0
Gross Profit	29,274	23,614	26,347	21,252
Total Cost , 2018 Price Level	10,225	13,180	8,787	10,361
Net Profit	19,049	10,434	17,560	10,892
Return Ratio	65.1%	44.2%	66.6%	51.2%

Source: JICA Survey Team based on household survey conducted in June 2018.

Note 1) Farm-gate Prices are converted to June 2018 price level by applying Consumer Price Index (CPI)
2) Farm-gate Price of irrigated paddy is referred data collected from Philippines Statistic Authority June 2018.
3) Manipulated Cost is not taken into account for financial cost.
4) Tax and Interest payment are not considered in economic cost because it is zero-sum on viewpoint of national economy.

[1] In fact, YLTA Terminal Report prepared by ATI suggests that the yields of irrigated paddy were 5.52 ton/ha (dry) and 5.63 ton/ha (wet), averaged 368 farmers from 7 IAs in Phase 1.

Table 6.2.7 Cost and Return Calculation for Irrigated Paddy

Items	Financial Price		Economic Price	
	Irrigated Paddy woTA	Irrigated Paddy wTA	Irrigated Paddy woTA	Irrigated Paddy wTA
Yield	3.4	4.7	3.4	4.7
Farm-gate Price, 2018 Price Level	20.4	20.4	18.4	18.4
Gross Profit	68,988	95,880	62,089	86,480
Total Cost, 2018 Price Level	36,320	50,443	27,728	38,657
Net Profit	32,668	45,447	34,361	47,823
Return Ratio	47.4%	47.4%	55.3%	55.3%

Source: JICA Survey Team Based on Philippine National Statistic Authority 2013, taking simple average of Region XII and ARMM.

Note 1) Farm-gate Prices are converted to May 2018 price level by applying Consumer Price Index (CPI)
2) Manipulated Cost is not taken into account for financial cost.
3) Tax and Interest payment are not considered in economic cost because it is zero-sum on a viewpoint of national economy
4) Assume that net return ratio is constant between wo/TA and w/TA. Based on the assumption, total cost for irrigated paddy with TA is calculated as the product of gross profit and return ratio.

For simplicity, the project benefit owing to irrigation and drainage rehabilitation would accrue at the same proportion of the total budget disbursed till the previous year. Table 6.2.8 and Table 6.2.9 show the benefit generation process by year:

Table 6.2.8 Percentages Indicating Benefit Generation Process by Year (LMSA)

Year	2011	2012	2013	2014	2015	2016	2017	2018
Area Increase	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.2%	22.9%
Yield Increase	0%	0%	0%	0%	0%	0%	1%	8%
Year	2019	2020	2021	2022	2023	2024	2025	After 2026
Area Increase	44.9%	62.3%	69.2%	72.1%	80.7%	92.3%	100.0%	100.0%
Yield Increase	22%	41%	58%	71%	81%	90%	97%	100%

Source: JICA Survey Team

Table 6.2.9 Percentages Indicating Benefit Generation Process by Year (MMIP2)

Year	2011	2012	2013	2014	2015	2016	2017	2018
Area Increase	0.0%	5.6%	11.2%	16.8%	22.5%	31.2%	37.1%	49.4%
Yield Increase	0%	6%	11%	17%	22%	31%	33%	38%
Year	2019	2020	2021	2022	2023	2024	2025	After 2026
Area Increase	63.8%	75.3%	79.8%	81.7%	87.3%	94.9%	100.0%	100.0%
Yield Increase	49%	61%	73%	81%	87%	93%	98%	100%

Source: JICA Survey Team

6.3. Results of Economic Analysis

6.3.1 Calculation of EIRR, NPV and B/C

The result of economic analysis is summarized in Table 6.3.1. As a whole, EIRR of MMIP II performs relatively well; 10.07% as of 30% reduction scenario in Case-1, and 10.73% as of 30% reduction scenario in Case-2, respectively. On the other hand, considering only the part of LMSA, this case is not economically viable; EIRR is 6.57% even as of no reduction scenario in Case 1, and EIRR is 8.19% as of no reduction scenario in Case-2, due to the large unit cost against the beneficial areas compared to other areas.

If flooding would affect more than 50% in production in flooded areas of up to 0.5 m, the project is not economically viable. For example, EIRR is 9.68% as of 50% reduction scenario in Case-1, and 9.07% as of 80% reduction case in Case-1 of MMIP II areas. The result implies that the economic efficiency is sensitive to hydrological situation of the sites.

If one compares “Case-1” and “Case-2” when other conditions are same, EIRRs in Case-2 are always a bit higher than those of Case-1. For example, the EIRRs are 10.07% as of 30% reduction scenario in

Case-1 and 10.73% as of 30% reduction scenario in Case-2 of MMIP II areas. These results may suggest that Case-2, in that irrigation canals are to be constructed as per the original design, could be recommendable in terms of economic efficiency; however, in Case-2, much maintenance works should be expected and therefore NIA should well be prepared for the payment of routine expensive maintenance (maintenance cost of Case-2 is estimated at 2 times that of Case-1).

On the viewpoint of feasibility analysis of NIA, it is better to evaluate entire MMIP II (namely, "M2" cases). According to the results, the EIRR exceeds 10% of social discount ratio in this Country in 30% reduction case that the JICA Team considers as the "benchmark". Then, the conclusion gained through the economic analysis is that the project is economically viable.

Table 6.3.1 Summary of Annual Net Benefit, EIRR, NPV, and B/C

SN	Case	Annual Benefit (Million Php)	IRR (%)	NPV (Million Php)	B/C
1	C1-LM-D00	244.2	6.57%	-787.6	0.74
2	C1-LM-D30	217.7	5.40%	-1,030.6	0.65
3	C1-LM-D50	201.7	4.66%	-1,175.8	0.61
4	C1-LM-D80	176.9	3.43%	-1,402.6	0.53
5	C2-LM-D00	402.2	8.19%	-533.6	0.87
6	C2-LM-D30	364.6	6.96%	-876.9	0.79
7	C2-LM-D50	340.5	6.14%	-1,097.9	0.74
8	C2-LM-D80	302.9	4.79%	-1,441.4	0.65
9	C1-M2-D00	562.2	10.90%	423.6	1.07
10	C1-M2-D30	535.7	10.07%	35.1	1.01
11	C1-M2-D50	519.7	9.68%	-150.8	0.98
12	C1-M2-D80	494.9	9.07%	-440.3	0.93
13	C2-M2-D00	729.7	11.87%	940.8	1.13
14	C2-M2-D30	689.5	10.73%	374.0	1.05
15	C2-M2-D50	665.3	10.18%	91.5	1.01
16	C2-M2-D80	627.7	9.32%	-347.4	0.95

Source: JICA Survey Team Net Present Value is calculated with 10% of Social Discount Ratio

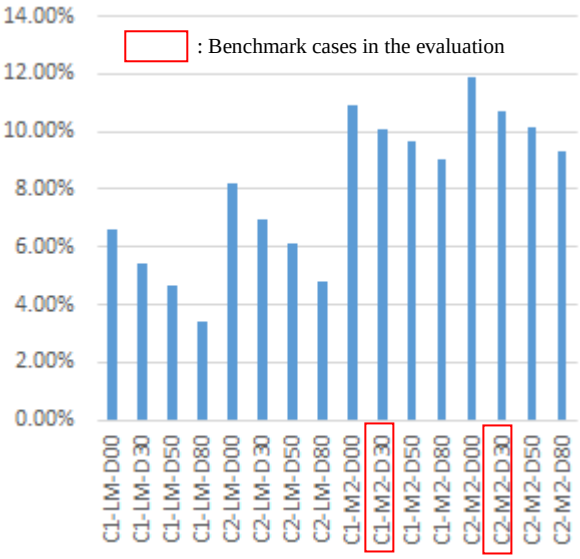


Figure 6.3.1 Comparison of EIRR by Evaluation Case
Source: JICA Survey Team

6.4 Farm Budget Analysis

To analyze project impacts on individual farmer's viewpoints, an farm budgetary analysis has been conducted. The calculation methodologies are shown below:

Firstly, it is assumed that beneficial areas in LMSA under the present condition of total 2,002 ha (in rainy season) would go up to 7,634 ha if part of development plan will be implemented (Case-1), and would further increase to 10,536 ha if all of the development plan will be implemented as per the original plan (Case-2). Dividing the beneficial areas by average farmland areas, the number of beneficiaries is estimated, which are 1,601 Farmer House Holds (FHHs) at present. After the construction completed, the number of beneficiaries of LMSA would be increased to 6,107 FHH (Case-1) and 8,429 FHH (Case-2), respectively.

Total financial net profit is defined as annual total profit for the whole beneficiaries in a year. At the present condition, total financial net profit of 56.1 million Php is generated by 1,601 FHHs. Upon the project implementation completed, two types of major benefits are to be accrued; 1) the yield increase owing to additional water supply and agriculture extension services; and 2) the cultivation area increase after adequate irrigation water to be availed. Thanks to these benefits, such incremental farm incomes would accrue as shown in Row (7) and Row (8) of Table 6.4.1.

Table 6.4.1 Farm Budget Analysis by the Evaluation Case

SN	Case	Beneficial Area without Project (ha) (1)	Beneficial Area after Project (ha) (2)	Average Farmland Area (ha/FHH) (3)	Estimated No. of Farm Household without Project (FHHs) (4)=(1)/(3)	Estimated No. of Farm Household with Project (FHHs) (5)=(2)/(3)	Total Financial Net Profit without Project (Million Php) (6)
1	C1-M2-D00	2,002	7,634	1.25	1,601	6,107	56.1
2	C1-M2-D30	2,002	7,634	1.25	1,601	6,107	56.1
3	C1-M2-D50	2,002	7,634	1.25	1,601	6,107	56.1
4	C1-M2-D80	2,002	7,634	1.25	1,601	6,107	56.1
5	C2-M2-D00	2,002	10,536	1.25	1,601	8,429	56.1
6	C2-M2-D30	2,002	10,536	1.25	1,601	8,429	56.1
7	C2-M2-D50	2,002	10,536	1.25	1,601	8,429	56.1
8	C2-M2-D80	2,002	10,536	1.25	1,601	8,429	56.1

Source: JICA Survey Team

Table 6.4.1 Farm Budget Analysis by the Evaluation Case (Continued)

SN	Case	Financial Annual Benefit sourced from Area Increase (Million Php) (7)	Financial Annual Benefit sourced from Yield Increase (Million Php) (8)	Financial household farming Income without Project (Php/FHH) (9)	Per household Income Increase owing Area Increase (Php/FHH) (10-a)	Per household Income Increase owing Yield Increase (Php/FHH) (10-b)	Financial household farming Income with Project (Php/FHH) (11)
1	C1-M2-D00	414.4	147.8	35,013.2	67,857.6	24,205.7	127,076.4
2	C1-M2-D30	387.8	147.8	35,013.2	63,505.5	24,205.7	122,724.3
3	C1-M2-D50	371.9	147.8	35,013.2	60,894.3	24,205.7	120,113.1
4	C1-M2-D80	347.1	147.8	35,013.2	56,832.3	24,205.7	116,051.2
5	C2-M2-D00	547.5	182.3	35,013.2	64,948.5	21,625.4	121,587.0
6	C2-M2-D30	507.2	182.3	35,013.2	60,169.9	21,625.4	116,808.5
7	C2-M2-D50	483.0	182.3	35,013.2	57,302.8	21,625.4	113,941.4
8	C2-M2-D80	445.4	182.3	35,013.2	52,842.9	21,625.4	109,481.4

Source: JICA Survey Team

Table 6.4.1 Farm Budget Analysis by the Evaluation Case (Continued)

SN	Case	Financial non-Farming Income (Php/FHH) (12-a)	Financial non-Farming Income (Php/FHH) (12-b)	Financial household Income without (13)	Financial household Income with (14)	Ratio b/t with & without Project (16)
1	C1-M2-D00	55,954	45,271	90,967	172,347	1.89
2	C1-M2-D30	55,954	45,271	90,967	167,995	1.85
3	C1-M2-D50	55,954	45,271	90,967	165,384	1.82
4	C1-M2-D80	55,954	45,271	90,967	161,322	1.77
5	C2-M2-D00	55,954	45,271	90,967	166,858	1.83
6	C2-M2-D30	55,954	45,271	90,967	162,080	1.78
7	C2-M2-D50	55,954	45,271	90,967	159,212	1.75
8	C2-M2-D80	55,954	45,271	90,967	154,752	1.70

Source: JICA Survey Team

Dividing the total financial net profit by the numbers of beneficiaries, per farmer household's cropping income is estimated under the present/future conditions, which are shown in Row (9) and (11). However, a typical farmer normally has other income sources. According to the results of household survey conducted by the JICA Team in June 2017, a typical farmer in rain-fed areas earned 55,954 Php from non-cropping e.g. migrant works, livestock breeding and selling being composed of more than half of total income. On the other hand, a typical farmer in irrigable areas earned slightly less amount of non-cropping income i.e. 45,271 Php on average. Considering these, financial household incomes at without/with conditions are estimated and summarized in Row (13) and (14), as a sum of cropping and

non-cropping income.

The result of analysis in Row (16) shows that the potential income increment rate could be 70% to 89% from the present condition upon the project implementation. Since poverty reduction is one of the main agenda of the area, the income improvement should contribute to the regional development as well as to the social unification in the area.

6.5 Proposed Indicators for Project Operation and Effects

Several indicators are proposed in order to measure the project impacts by comparing before- and after-project. There are two types of indicators; namely, operation and effect indicators. Operation indicator aims to measure operational status of the project, while effect indicator aims at measuring generated effects. In other words, after the facility construction by the project, how the improved facilities are utilized properly is evaluated by the operation indicator, and how effects are caused to the beneficiaries by the improved facilities is evaluated by effect indicator.

The proposed operation indicator of Irrigation and Drainage Improvement is "*Total Cultivated Area by the Beneficiaries*" which aims to measure the performance of irrigation and drainage facilities. Further, the effect indicator for irrigation and drainage system aims to monitor how the facilities make effect on beneficiaries and the target area, so the proposed indicator should be the increase in "*Gross Annual Average Farming Income*" per farmer household.

One might think that "*Net Annual Average Farming Income*" reflects the effect more exactly. It is true; however, one of the desirable features as a good effect indicator is "the easiness to collect data", but it is not a trivial work to capture all of farming costs. Therefore, the Team proposes "*Gross Annual Average Farming Income*" as the basic effect indicator, and "*Net Annual Average Farming Income*" is proposed only for a secondary effect indicator.

For agriculture extension component, the effect indicator should be "*Average Yields of Major Crops per Ha*" because yield increase is one of the major expected outcomes of the project and the component should be responsible for it.

Table 6.5.1 Proposed Operation and Effect Indicator (Case-1, LMSA)

Operation Indicator		**Effect Indicator**	
Definition: Total Cultivated Area by The Beneficiaries (Ha)		**Definition:** 1. Gross Annual Average Farming Income (Php/Year/Household) 2. Net Annual Average Farming Income (Php/Year/Household)	
Method of Data Collection: Interview to NIA		**Method of Data Collection:** Reference to Farmer Household Survey Result	
Baseline (2018)	**Target (3 years after Completion)**	**Baseline (2018)**	**Target (3 years after Completion)**
Rainy: Paddy 367.0 ha Corn 1,087.0 ha **Dry:** Paddy 457.0 ha Corn 795.0 ha	**Rainy** Paddy 2,810.0 ha **Dry:** Paddy 3,688.0 ha	**1. Gross Profit:** 58,438 Php/FHH **2. Net Profit:** 30,148 Php/FHH **3. Yield** **Paddy:** 2.1 ton/ha **Corn:** 1.7 ton/ha	**1. Gross Profit:** 190,792 Php /FHH **2. Net Profit:** 103,929 Php /FHH **3. Yield** **Paddy:** 3.4 ton/ha (wo TA) **Paddy:** 4.7 ton/ha (w TA)
Remarks: Gross Profit and Net Profit are calculated based on D30 cases; the Target cultivated area of irrigation paddies is the sum of flood unaffected areas and flooded areas of up to 0.5 m			

Source: JICA Survey Team

Table 6.5.2 Proposed Operation and Effect Indicator (Case-2, LMSA)

Operation Indicator		**Effect Indicator**	
Definition: Total Cultivated Area by The Beneficiaries (Ha)		**Definition:** 1. Gross Annual Average Farming Income (Php/Year/Household) 2. Net Annual Average Farming Income (Php/Year/Household)	
Method of Data Collection: Interview to NIA		**Method of Data Collection:** Reference to Farmer Household Survey Result	
Baseline (2018)	**Target**	**Baseline (2018)**	**Target (3 years after**

Operation Indicator		Effect Indicator	
	(3 years after Completion)		**Completion)**
Rainy: Paddy 367.0 ha Corn 1087.0 ha **Dry:** Paddy 457.0 ha Corn 795.0 ha	**Rainy** Paddy 3,810.0 ha **Dry:** Paddy 6,590.0 ha	**1. Gross Profit:** 58,438 Php/FHH **2. Net Profit:** 30,148 Php/FHH **3. Yield** **Paddy:** 2.1 ton/ha **Corn:** 1.7 ton/ha	**1. Gross Profit:** 168,941 Php /FHH **2. Net Profit:** 99,313 Php /FHH **3. Yield** **Paddy:** 3.4 ton/ha (wo TA) **Paddy:** 4.7 ton/ha (w TA)
Remarks: Gross Profit and Net Profit are calculated based on D30 cases; the Target cultivated area of irrigation paddies is the sum of flood unaffected areas and flooded areas of up to 0.5 m			

Source: JICA Survey Team

Table 6.5.3 Proposed Operation and Effect Indicator (Case-1, MMIP)

Operation Indicator		Effect Indicator	
Definition: Total Cultivated Area by The Beneficiaries (Ha)		**Definition:** 1. Gross Annual Average Farming Income (Php/Year/Household) 2. Net Annual Average Farming Income (Php/Year/Household)	
Method of Data Collection: Interview to NIA		**Method of Data Collection:** Reference to Farmer Household Survey Result	
Baseline (2018)	**Target (3 years after Completion)**	**Baseline (2018)**	**Target (3 years after Completion)**
Rainy: Paddy 586.8 ha Corn 1,737.9 ha **Dry:** Paddy 730.6 ha Corn 1,271.0 ha	**Rainy** Paddy 6,756.0 ha **Dry:** Paddy 7,634.0 ha	**1. Gross Profit:** 67,869 Php/FHH **2. Net Profit:** 35,013 Php/FHH **3. Yield** **Paddy:** 2.1 ton/ha **Corn:** 1.7 ton/ha	**1. Gross Profit:** 215,885 Php /FHH **2. Net Profit:** 122,724 Php /FHH **3. Yield** **Paddy:** 3.4 ton/ha (wo TA) **Paddy:** 4.7 ton/ha (w TA)
Remarks: Gross Profit and Net Profit are calculated based on D30 cases; the Target cultivated area of irrigation paddies is the sum of flood unaffected areas and flooded areas of up to 0.5 m			

Source: JICA Survey Team.

Table 6.5.4 Proposed Operation and Effect Indicator (Case-2, MMIP2)

Operation Indicator		Effect Indicator	
Definition: Total Cultivated Area by The Beneficiaries (Ha)		**Definition:** 1. Gross Annual Average Farming Income (Php/Year/Household) 2. Net Annual Average Farming Income (Php/Year/Household)	
Method of Data Collection: Interview to NIA		**Method of Data Collection:** Reference to Farmer Household Survey Result	
Baseline (2018)	**Target (3 years after Completion)**	**Baseline (2018)**	**Target (3 years after Completion)**
Rainy: Paddy 586.8 ha Corn 1,737.9 ha **Dry:** Paddy 730.6 ha Corn 1,271.0 ha	**Rainy** Paddy 7,756.0 ha **Dry:** Paddy 10,536.0 ha	**1. Gross Profit:** 67,869 Php/FHH **2. Net Profit:** 35,013 Php/FHH **3. Yield** **Paddy:** 2.1 ton/ha **Corn:** 1.7 ton/ha	**1. Gross Profit:** 197,108 Php /FHH **2. Net Profit:** 116,809 Php /FHH **3. Yield** **Paddy:** 3.4 ton/ha (wo TA) **Paddy:** 4.7 ton/ha (w TA)
Remarks: Gross Profit and Net Profit are calculated based on D30 cases; the Target cultivated area of irrigation paddies is the sum of flood unaffected areas and flooded areas of up to 0.5 m			

Source: JICA Survey Team

CHAPTER 7 ENVIRONMENTAL AND INDIGENOUS PEOPLE CONSIDERATION

7.1 Project Components

The Project area of MMIP, which starts at the diversion dam established at the Maridagao River, is divided into MMIP I area and MMIP II area. The construction works in MMIP I area was completed in 2011, while those of MMIP II have been started in 2011. MMIP II is further sub-divided into three areas, namely, Upper Malitubog and Lower Malitubog and Pagalungan. Construction works in Upper Malitubog has been already done, while those in Lower Malitubog have been started partly. In southeastern part of Lower Malitubog area, no construction works have begun. In the shaded (diagonal green lines) portion in the figure below, no works have been started, since it was planned to be covered by Japanese ODA loan according to the initial request, however, it is worthy to note that the request was withdrawn by NIA in June 2018.

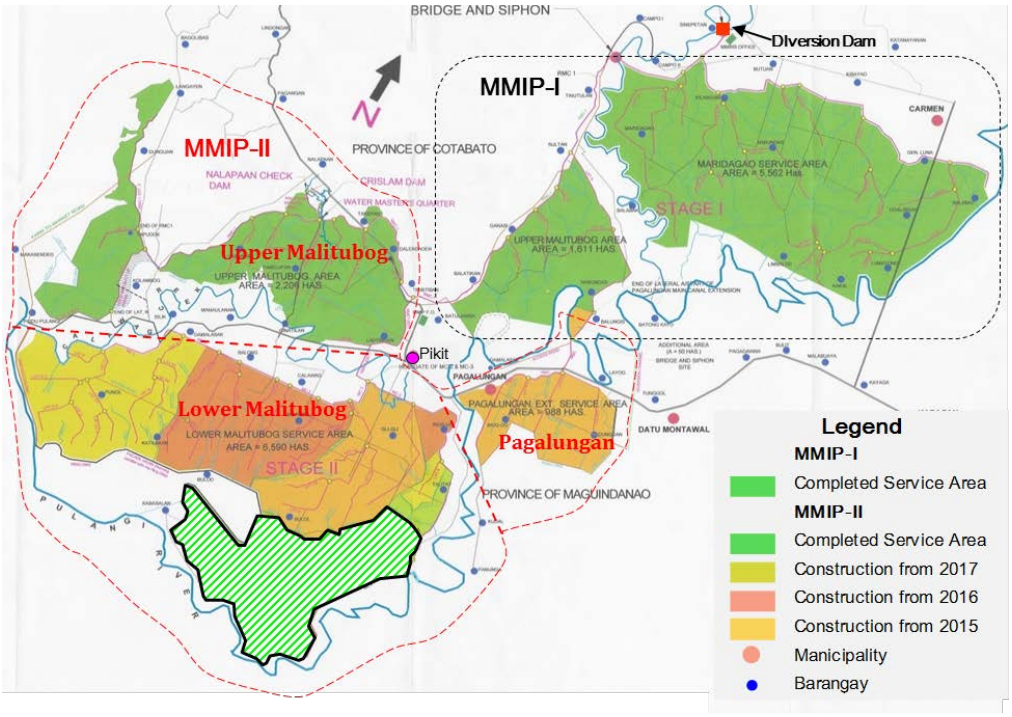


Figure 7.1.1 Location of MMIP II Area

Source: JICA Survey Team (modified from the map "Malitubog Maridagao Irrigation Project" prepared by NIA)

Two cases, namely, Case-1 and Case-2 were examined. Case-1 is to construct some of the parts of the proposed irrigation system and drainage system within the LMSA without dikes, while Case-2 is to construct the whole components of the planned irrigation system and drainage system within the LMSA without the dikes. The proposed project components are to be implemented under the GOP funding. The total lengths of irrigation canals, drainages and access roads are 72,554 m, 75,801 m and 14,950 m, respectively for Case 1 while 107,274 m, 75,801 m and 18,450 m, respectively for Case 2.

7.2 Legislative and Institutional Framework of Environmental Consideration

7.2.1 Legislative and Institutional System for Environmental Impact Assessment

1) Institutional Framework

The Department of Environment and Natural Resources (DENR) is the lead agency mandated under the Executive Order 192 (1987), responsible for the conservation, management, development, and proper use of the country's environment and natural resources. In order to implement the tasks mentioned, six (6) line bureaus were formed as shown in the following figure: 1) Environmental Management Bureau (EMB); 2) Biodiversity Management Bureau; 3); Land Management Bureau; 4)

Forest Management Bureau; 5) Ecosystems Research and Development Bureau and; 6) Mines and Geosciences Bureau to enforce various national environmental laws and policies. Out of those management bureaus, EMB is responsible for environmental impacts assessment.

EMB is responsible for providing advice to the Department Secretary on matters relating to environmental management. Further, it is also mandated to do, formulation of plans and policies and development of appropriate environmental quality standards (water, air and noise), control of pollution and protection of the environment, review and assess Environmental Impact Assessment (EIA) reports, provision of comments or decisions to project proponents and so on.

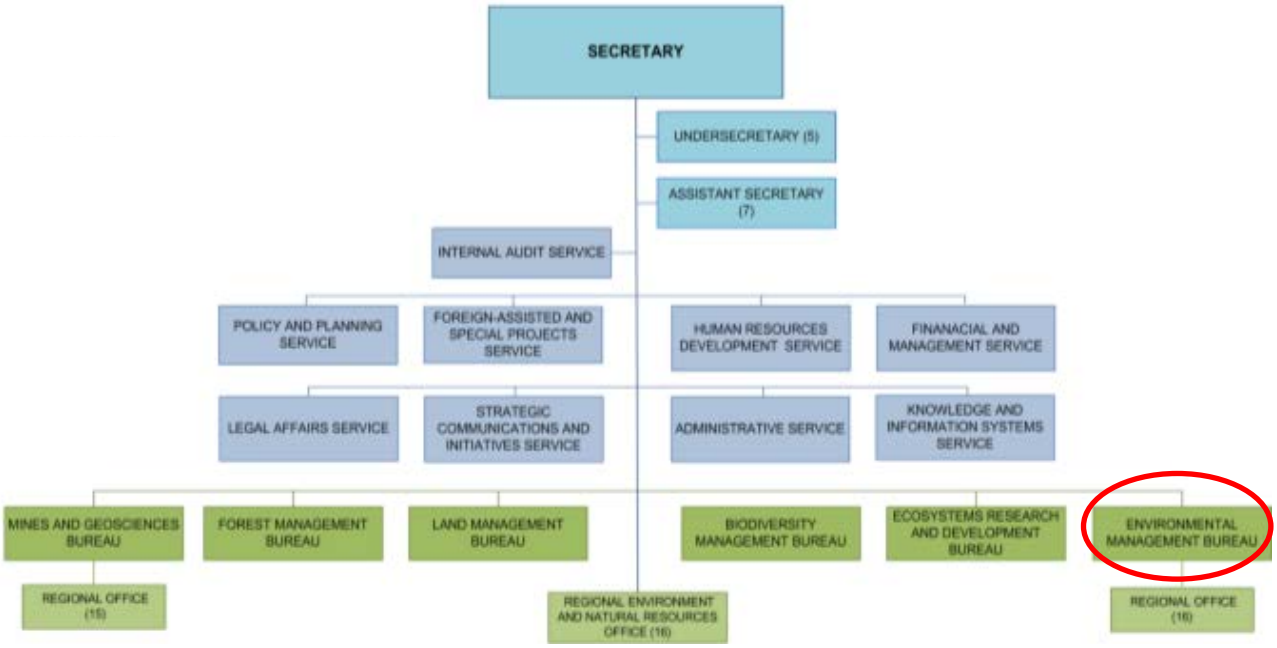


Figure 7.2.1 Organization Chart of DENR

Source: Homepage of DENR as of 2017 June

2) Legal Framework

Legal system for environmental consideration in Philippines was begun with "Presidential Decree (PD) 1151: Philippine Environmental Policy" and "PD 1152: Philippine Environmental Code" in 1977. In general, a series of EIA procedures is called as Environmental Impact Statement (EIS) system in Philippines (PD 1586), and PD 2146 in 1981 specifies Environmental Critical Areas (ECAs) and Environmental Critical Projects (ECPs) as targets of EIS system.

In 1992, "DENR Administrative Order (DAO) No.12" stipulates environmental policy, objectives, and procedure including stakeholder meeting, Environmental Compliance Certificate (ECC) and monitoring. Further, in 2003, "DAO-2003-30: Implementing Rules and Regulations for the Philippine Environmental Impact Statement System" classifies any projects into four categories, namely, Category A, B, C and D. The categorization is determined considering combination of two elements, namely, ECPs and ECAs.

The "Revised Procedural Manual for DAO 2003-30", which was issued in 2007, further sub-divides the category mentioned above into 11 groups based on not only ECPs and ECAs but also progress of the project implementation, namely, "I: New", "II: Existing with ECC but with Proposal for Modification or Resumption of Operation" and "III: Operating Without ECC". Moreover, "Memorandum Circular: Standardization of Requirements and Enhancement of Public Participation in the Streamlined Implementation of the Philippine EIS System", which promotes public participation was issued in 2010. In this manner, the EIS System has been developed gradually for fair

environmetnal consideration.

In 2014, EMB issued Memorandum Circular No. 005 “Revised Guidelines for Coverage Screening and Standardized Requirements” which modifies category classification was issued. The new groups are broadly classified into Category A, B, C and D. The contents of categories are as follows:

Table 7.2.1 Categories of Project Requiring Environmental Examination

Category	Contents
Category A	Any projects which are categorized into ECPs based on PD 2146 and any others declared by laws in Philippines. Project proponent are required to secure ECC.
Category B	Any project not categorized into Category A, however, are deemed to cause significant environmental impacts by being located in ECAs based on PD 2146. Project proponent are required to secure ECC.
Category C	Any projects are intend to enchance the quality of environment or address existing environmental problems. Project proponent are required to secure Certificate of Non-Coverage (CNC).
Category D	Any project which are unlikely to cause significant adverse environmetnal impacts. Those projects are not covered by EIS system.

Source: EMB, 2014, Revised Guidelines for Coverage Screening and Standardized Requirements

Any projects which fall under the Category A and B are further divided into 1) New, 2) Existing and to be expanded, modified and/or rehabilitated, and 3) Operating without ECC, and necessary EIA documents are determined based on the sub-classification. Proponents of Category A projects have to submit EIS to EMB Central Office, while those of other categories projects have to submit necessary EIA documents to the EMB Regional Office (see Table 7.2.1).

It is noted that required documents depend on the project scale according to the Annex A of the Guidelines in 2014 mentioned above. In case of an irrigation project, if benefit area is more than 1,000 ha, an EIS is necessary, while an IEE check list is to be prepared if its beneficial area is 300 ha to 1,000 ha. Morever, if the area is less than 300 ha, only a part of Project Description is needed to be prepared, and the project is classified as Category D, which the project is not covered by the EIS system.

Table 7.2.2 Required Documents, Procedures and Decision Making Organization by Category

Category		Applied to	Documents required for ECC/CNC application	Office to process and decide
A. Environmentally Critical Projects	A-1: New	Co-located projects	Programmatic EIS	EMB Central Officer
		Single project	EIS	EMB Central Officer
	A-2: Existing and to be expanded, modified and/or rehabilitated	Co-located projects	Programmatic EPRMP (in case programmatic monitoring data are available)	EMB Central Officer
	A-3: Operating without ECC	Single project	EPRM in case monitoring data available EIS if no monitoring data are available	EMB Central Officer
B: Non-environmentally Critical Projects	B-1: New	Co-located projects	Programmatic EIS	EMB Regional Office in region where the proposed project is located
		Single project	EIS IEE checklist	EMB Regional Office in region where the proposed project is located
	B-2: Existing and to be expanded, modified and/or rehabilitated	Co-located projects	EPRMP EPRMP checklist	EMB Regional Office in region where the proposed project is located
	B-3: Operating without ECC	Single project	PEPRMP	EMB Regional Office in region where the proposed project is located

Category	Applied to	Documents required for ECC/CNC application	Office to process and decide
C: Environmental Enhancement or Direct Mitigation	Co-located projects or Single project	Project Description (Part I and Part II) (to confirm non-coverage or future classify as either Category A or B)	EMB Regional Office in region where the proposed project is located
D: Not Covered		Project Description (Part I only) Project prior to 1982-Proof of Project Implementation prior 1982 without expansion /alternation/ modification shall also be submitted (if applying for CNC)	EMB Regional Office in region where the proposed project is located

EIS (Environmental Impact Statement): a document of studies on the environmental impacts of a project
PEIS (Programmatic Environmental Impact Statement): a document of comprehensive studies on environmental baseline conditions of contiguous area relating to co-located projects (i.e. industrial estates or economic zones)
IEE (Initial Environmental Examination): a document in checklist or narrative report form
PEPRMP (Programmatic Environmental Performance Report and Management Plan): a document of actual cumulative environmental impacts of co-located projects with proposals for expansions
EPRMP (Environmental Performance Report and Management Plan: a document of the actual cumulative environmental impacts and effectiveness of current measures for single projects that are already operating
PD (Project Description): a standard document of the description of the proposed project
Source: JICA Survey Team

The EIA process begins with the screening of the proposed undertakings, which allows the proponent to determine whether it is covered by the EIS system, and which type of document shall be prepared. If a project is considered as one which can cause significant impacts on the surrounding environment at the screening, the proponent proceeds to the scoping process. Scoping is to be done formally with various stakeholders to determine the Terms of References (TORs) of the EIA study.

After the formal scoping, the EIA study shall be conducted by the consultants/team registered under the EMB. The study results are compiled as an EIA Report[1] and submitted to EMB. Further, review of the EIA report, which normally includes checking of the proponent's compliance to scoping commitments and then substantive review of the documents, is done within 60 business days after the submission; 120

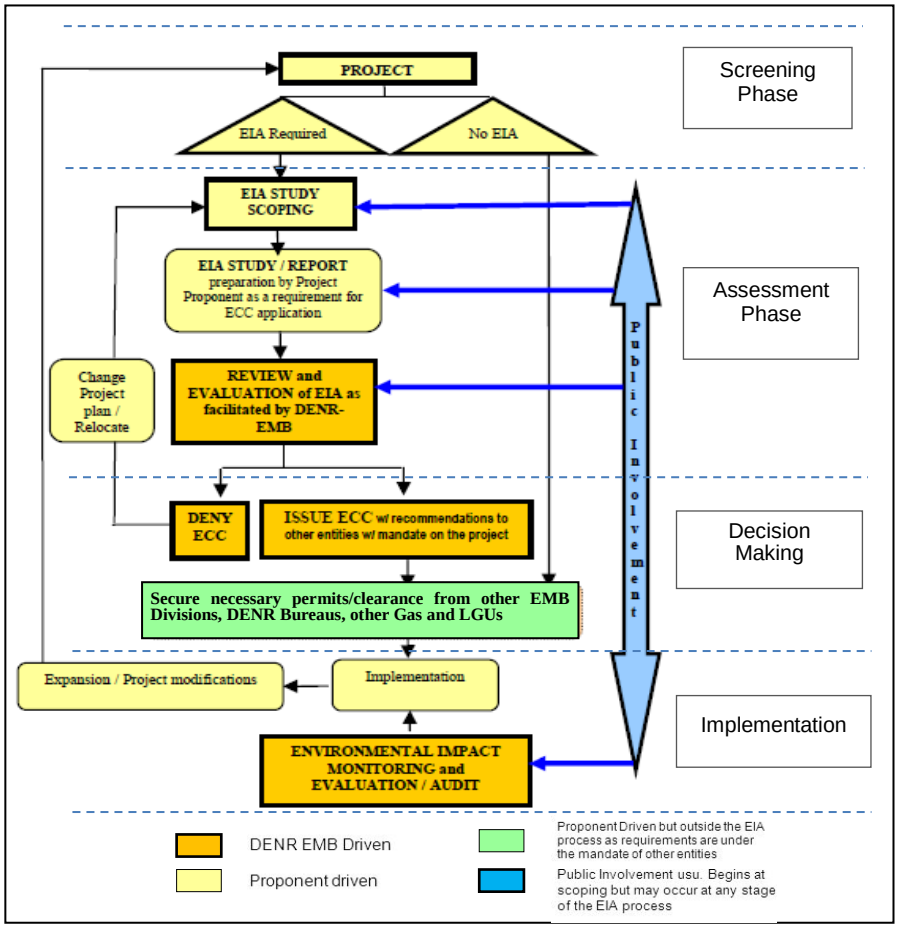


Figure 7.2.2 Process of EIA Document Approval
(Source: Homepage of EMB, partly modified)

[11] EIA report is the generic term, which includes EIS, Project Description and IEE checklist to apply for ECC/CNC in Philippines.

business days after if submitted to the Central Office. Once approved, an ECC is issued within 10 days if it is at the regional office level (see Figure 7.2.2).

If any projects have been stopped more than 5 years, the project proponents have to submit new applications for approval prior to the project resumption. However, if a project satisfies all following conditions, such procedures can be skipped:

- ✓ Compliance Monitoring Report (CMR) had been continuously submitted or an official request for suspension of CMR has been approved by EMB.
- ✓ No request for relief and/or cancellation of ECC has been approved.
- ✓ The resumption of operation will not involve expansion in terms of production capacity or area.
- ✓ The resumption of operation will not involve change or modification in technology/ production method or manufacturing process/operation used.
- ✓ There is no change in ownership or corporate dissolution.

3) Background of ECC Securement of MMIP

The original EIA document for the MMIP II, which was prepared at IEE level[2] during the Detailed Design stage of MMIP II, was submitted to the EMB Regional Office XII in December, 1992. The EIA document does not clearly mention the reason for being IEE level. In 2003 July, the ECC of MMIP II was obtained from EMB Region XII Office[3].

However, the Project could not be implemented due to the security deterioration in the MMIP II target area, and NIA submitted the new IEE Report again and secured the ECC in August 2007, which is the latest ECC for the MMIP II. In 2011, a part of construction works in the Upper Malitubog area, which is a part of the MMIP II area, was started by the Government of Philippines. Given that the project has been suspended less than 5 years, it can be thought that the ECC is still effective for whole MMIP II area including the initially requested ODA target area.

MMIP I, which had been started ahead of MMIP II, did not have submitted EIS prior to the construction works, the project proponent, therefore, submitted the EIS with incurred penalties, to the EMB, and secured the ECC for the MMIP I in November 2003. In 2011, all of the construction works of MMIP I have been completed. The ODA loan, if applied in the MMIP I area, covers only repair of existing facilities such as gravel pavement, lining of canals and so on, which does not accompany expansion of road or route change of existing facilities. Therefore, it can be judged that re-securement of ECC for the rehabilitation works in the MMIP I area is not necessary.

7.2.2 Environmental Standards

Environmental Standards in Philippines are sufficiently developed, and each standard for air pollution, water quality, effluent water quality, noise has been established. RA 8749 (1999) set permissible values for both long term and short term, respectively. National Ambient Air Quality Guideline for Criteria Pollutants is shown as below:

Table 7.2.3 National Ambient Air Quality Guideline for Criteria Pollutants

Pollutant	Short Term			Long Term		
	µg/NCM	Ppm	Time	µg/NCM	Ppm	Time
TSP	230	-	24 hours	90	-	1 year
PM10	150	-	24 hours	60	-	1 year
Sulfur Dioxide	180	0.07	24 hours	80	-	1 year

[2] The title of the EIA document is described as “Environmental Impacts Assessment” in the cover of report, however, there is mention that “the EIA document is prepared at IEE level”.
[3] It was more than 10 years after the IEE submission, however, the reason for such delay is unknown.

Pollutant	Short Term			Long Term		
	µg/NCM	Ppm	Time	µg/NCM	Ppm	Time
Nitrogen Dioxide	150	0.08	24 hours	-	-	-
Photochemical Oxidants	140	0.07	1 hour	-	-	-
As Ozone	60	0.03	8 hours	-	-	-
Carbon Monoxide	35 10	30 9	1 hour 8 hours	-	-	-

Source: An Act Providing For A Comprehensive Air Pollution Control Policy and For Other Purposes (Republic Act No.8749) (1999)

Concerning water quality standard, there are 5 classes for fresh surface waters (lake, river, reservoirs etc.) and 4 classes of sea water depending on the purposes of utilization (DAO No.34, 1991) in the Philippines. Permissible water quality values are various depending on the classes. Water quality criteria for fresh waters are described as follows:

Table 7.2.4 Water Quality Criteria for Conventional and Other Pollutants Contributing to Aesthetics and Oxygen Demand for Fresh Waters

Parameter	Class AA: Public water supply class I	Class A: Public water supply class II	Class B: Recreational water class	Class C: Fishery water, recreational water class II, Industrial water supply class I	Class D (b): Agriculture, industrial water supply class II
Color (PCU)	15	50	(c)	(c)	(c)
Temperature (°C)(d)		3	3	3	3
pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-9.0
DO(e) (%salt) (mg/l)	 70 5.0	 70 5.0	 70 5.0	 60 5.0	 40 3.0
BOD (5-Day 20°C)(mg/l)	1	5	5	7 (10)	10 (15)
Total Suspended Solid (mg/l)	25	50	(f)	(g)	(h)
Total Dissolved Solid (mg/l)	500 (i)	1,000(i)	-	-	1,000(i)
Surfactants (MBAS) (mg/l)	Nil	0.2 (0.5)	0.3 (0.5)	0.5	-
Oil/Grease (mg/l)	Nil	1	1	2	5
NO_3-N (mg/l)	1.0	10	Nr	10(j)	-
PO_4-P (mg/l)	Nil	0.1(k)	0.2(k)	0.4(k)	-
Phenolic Substances as Phenols (mg/l)	Nil	0.002	0.005(l)	0.02(i)	-
Total Coliforms (MPN/100ml) Or Fecal Coliforms (MPN/100ml)	50 (m) 20 (m)	1,000(m) 100(m)	1,000(m) 200(m)	5,000(m) -	- -
Chloride as Cl (mg/l)	250	250	-	350	-
Copper (MPN/100ml)	1.0	1.0	-	0.05 (o)	

(a) Except as otherwise indicated, the numerical limits in Tables 1 and 3 are yearly average values. Values enclosed in parentheses are maximum values.
(b) For irrigation purposes, SAR should have a minimum value of 8 and a maximum value not to exceed 18. Boron should not exceed 0.75 mg/L.
(c) No abnormal discoloration from unnatural causes
(d) The allowable temperature increase over the average ambient temperature for each month. This rise shall be based on the average of the maximum daily temperature readings recorded at the site but upstream of the mixing zone over a period of one (1) month.
(e) Sampling taken between 9:00 AM and 4:00 PM
(f) Not more than 30% increase
(g) Not more than 30 mg/L increase
(h) Not more than 60 mg/L increase
(i) Do not apply if natural background is higher in concentration. The latter will prevail and will be used as baseline
(j) Applicable only to lakes or reservoirs, and similarly impounded water
(k) When applied to lakes or reservoirs, the Phosphate as P concentration should not exceed an average of 0.05 mg/L nor a

maximum of 0.1 mg/L (l). Not present in concentrations to affect fish flavor/taste

(m) These values refer to the geometric mean of the most probable number of coliform organism during a 3-month period and that the limit indicated shall not be exceeded in 20 percent of the samples taken during the same period

(n) For spawning areas for *Chanos chanos* and other similar species

(o) Limit is in terms of dissolved copper nil - Extremely low concentration and not detectable by existing equipment --- Means the standard of these substances are not considered necessary for the present time, considering the stage of the country's development and DENR capabilities, equipment and resources

nr: Means No Recommendation made

Source: DENR Administrative Order No.34, 1990

Allowable noise level in Philippines is stipulated in "National Pollution Control Commission's Memorandum Circular No. 002" (1980). The standard levels are prescribed by period of time and class of areas. The permissible noise standards are described as shown below:

Table 7.2.5 Permissible Noise Standard

Time	Class				
	AA	A	B	C	D
Daytime (9AM-6PM)	50dB	55dB	65dB	70dB	75dB
Evening (6PM-10PM)	45dB	50dB	60dB	65dB	70dB
Night Time (10PM-5AM)	40dB	45dB	55dB	60dB	65dB
Morning (5AM-9AM)	40dB	50dB	60dB	65dB	70dB

Class AA: a section of contiguous area which requires quietness, such as areas within 100 m from school sites, nursery schools, hospitals and special homes for the aged.

Class A: a section or contiguous area which is primarily used for residential purposes.

Class B: a section or contiguous area which is primarily a commercial area.

Class C: a section primarily zoned or used as light industrial area.

Class D: a section which is primarily reserved, zoned or used as a heavy industrial area

Source: National Pollution Control Commission's Memorandum Circular No. 002, 1980

7.2.3 Legal Framework of Land Acquisition

Various laws and guidelines regarding land acquisition and involuntary resettlement have been already established in Philippines. The following describe salient points of the various acts and regulations, which stipulate compensation for land loss or resettlement and necessary procedures in Philippines.

1) Republic Act 7279 (Urban Development and Housing Act of 1992) and its Implementing Rules and Regulations

The mandate of this Act is to uplift the conditions of the underprivileged and homeless citizens in urban areas and in resettlement areas by making available to them decent housing at affordable cost, basic services, and employment opportunities. The government shall establish and develop resettlement sites for informal settlers, including the provision of adequate basic services and community facilities, in anticipation of informal settlers that have to be removed from the right-of-way (ROW) site or location of future infrastructure projects.

2) Republic Act 8974 and its Implementing and Rules and Regulations (2000)

Republic Act 8974, otherwise known as "An Act to Facilitate the Acquisition of Right-of-Way, Site or Location for National Government Infrastructure Projects and for Other Purposes" prescribes new standards for assessment of the value of the land or expropriation proceedings. In order to facilitate the determination of just compensation, the court may consider following matters:

- ✓ The developmental costs for improving the land;
- ✓ The value declared by the owners;
- ✓ The current selling price of similar lands in the vicinity;
- ✓ The reasonable disturbance compensation for the removal and/or demolition of certain improvement on the land and for the value of improvements thereon;
- ✓ This size, shape or location, tax declaration and zonal valuation of the land;

- ✓ The price of the land as manifested in the ocular findings, oral as well as documentary evidence presented; and
- ✓ Such facts and events as to enable the affected property owners to have sufficient funds to acquire similarly-situated lands of approximate areas as those required from them by the government, and thereby rehabilitate themselves as early as possible.

The Act also stipulates that the implementing agency and the owner of the property shall agree on a negotiated sale for the acquisition of right-of-way, site or location for any national government infrastructure project. Also, they shall determine fair market value of the property, subject to review and approval by the head of the agency or department concerned.

Another feature of the Act and Implementation Rules and Regulations, is to make ROW acquisition more acceptable to property owners, which is described in Section 10 that valuation of affected improvements and/or structures to be computed based on replacement cost method. The replacement cost of improvements/structures is defined as "the amount necessary to replace the improvements/structures, based on the current market prices for materials, equipment, labor, contractor's profit and overhead, and all other attendant cost associated with the acquisition and installation in place of the affected improvement/structures".

3) Republic Act No. 7160: "The Act Providing For a Local Government Code" (1991)

No project or program shall be implemented by the government authorities unless the consultations, and prior approval of the *Sanggunian* concerned shall be obtained. Occupants in areas where such projects are to be implemented shall not be evicted unless appropriate relocation sites have been provided, in accordance with the provisions of the Constitution.

4) Republic Act No. 10752 (The Act Facilitating the Acquisition of Right-of-Way Site or Location for National Government Infrastructure Projects, 2016)

The implementing agency may acquire lands for any public infrastructure projects, through negotiation of sale, the right-of-way site or location under the following rules. The implementing agency shall offer to the property owner concerned, as compensation price, the sum of:

- ✓ The current market value of the land;
- ✓ The replacement cost of structures and improvements therein; and
- ✓ The current market value of crops and trees therein.

To determine the appropriate price to be offered, the implementing agency may engage the services of a government financial institution with adequate experience in property appraisal, or an independent property appraiser.

5) Implementing Rules and Regulation (IRR) of RA 10752

Section 18 of IRR of RA10752 (2016) stipulates that each implementation agency shall prepare and implement its own manual of procedures for ROW Acquisition. The manual shall include preparation of Land Acquisition Plan and Resettlement Action Plan. However, when it was enacted in 2016, MMIP II had been already started, and it has not been applied so far. Moreover, NIA is drafting own manual procedure for ROW Acquisition and it is still under development as of July 2018.

7.2.4 JICA Policy for Involuntary Resettlement and Land Acquisition

The key principle of JICA policies on involuntary resettlement is summarized below:

a) Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.

b) When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
c) People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
d) Compensation must be based on the full replacement cost[4] as much as possible.
e) Compensation and other kinds of assistance must be provided prior to displacement.
f) For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.
g) In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
h) Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
i) Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.
j) Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Additional key principle based on World Bank OP 4.12 is as follows.
k) Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.
l) Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.
m) Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.
n) Provide support for the transition period between displacement and livelihood restoration.
o) Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.
p) For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy, inclusive of all the above points, project specific resettlement plan, institutional framework for implementation, monitoring and evaluation mechanism, time schedule for implementation and detailed financial plan as well.

7.2.5 Gap Analysis

As mentioned before, laws/regulations regarding land acquisition and involuntary resettlement in Philippines have been already developed, which do not result in significant gaps with the JICA Guidelines for Environmental and Social Consideration, 2010 (hereinafter referred to as "JICA Guidelines"). Table 7.2.6 analyzes gaps between laws/regulations in Philippines and the JICA Guidelines.

[4] Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

Table 7.2.6 Gap Analysis between Laws in Philippines and the JICA Guidelines

JICA Guidelines	Laws in Philippines	Gap	Measures against gap
1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	"No person shall be deprived of life, liberty, or property without due process of law, nor shall any person be denied the equal protection of the laws." (Article III Section 1 of the Constitution, 1987).	None	-
2. When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken.	An implementing agency shall pay the owner of the property the amount equivalent to the sum of (1) one hundred percent (100%) of the value of the property based on the current relevant zonal valuation of the Bureau of Internal Revenue (BIR); and (2) the value of the improvements and/or structures as determined (Section 4, RA 8974, 2000). The government shall establish and develop squatter relocation sites, including the provision of adequate utilities and services, in anticipation of squatters that have to be removed from the right-of-way or site of future infrastructure projects (Section 9, RA 8974).	None	-
3. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.	Government shall ensure that owners of real property acquired for national government infrastructure projects are promptly paid just compensation (Section 1, RA 8974, 2000). It is necessary to uplift the conditions of the underprivileged and homeless citizens in urban areas and in resettlement areas by making available to them decent housing at affordable cost, basic services, and employment opportunities (Section 2 (a), RA 7279, 1992)	None	−
4. Compensation must be based on the full replacement cost as much as possible.	The implementing agency shall offer to the property owner concerned, as compensation price, the sum of: (1) The current market value of the land, (2) The replacement cost of structures and improvements therein; and (3) The current market value of crops and trees therein (Section 5, RA 10752, 2016). With regard to the taxes and fees relative to the transfer of title of the property to the Republic of the Philippines through negotiated sale, the implementing agency shall pay. Moreover, the capital gains tax, documentary stamp tax, transfer tax and registration fees shall be paid by the proponent (Section 5 (c), RA 10752, 2016).	None	-
5. Compensation and other kinds of assistance must be provided prior to displacement.	No project or program shall be implemented by government authorities unless the consultations (Section 27, RA 7160, 1991). Compensation timing is not clearly mentioned in any laws/regulations, however, Section 6.10 of IRR of RA10752 states that implementation agencies should pay compensation of: 1. affected land (at 50% of the negotiated price). 2. Affected structure (at 70% of the negotiated price) upon the implementation of Sale of Deed. Remaining balance of the price shall be paid upon the transfer of title to the Republic of the Philippines.	The IRR of RA 10752 allows payment by installments instead of paying in full.	All compensations have to be paid to the PAPs before displacement.
6. For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public.	Preparation of a resettlement action plan is listed up as one of ICC REQUISITE DOCUMENTS, where applicable. (NEDA, Investment Coordination Committee Guidelines and Procedures, Annex B, Section 7). Section 18 of IRR of RA 10752 mentions that each implementation agency should prepare manual for ROW acquisition, which stipulates preparation of a RAP.	None	-
7. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in	A project proponent shall explain the goals and objectives of the project, and its environmental impact and the measures. Moreover, no project or program shall be implemented by government authorities unless the consultations (Section 26 and Section 27, RA7160, 1991). In the execution of eviction or demolition orders involving	None	-

JICA Guidelines	Laws in Philippines	Gap	Measures against gap
advance.	underprivileged and homeless citizens, it is needed to notice at least 30days prior to eviction or demolition and to implement adequate consultations on the matter of settlement (Section 28 (1) (2), RA 7279, 1992)		
8. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.	Official documents in Philippines are prepared in English, which means that a series of EIA reports are also to be prepared in English. Still, it is possible to explain the project outline to the Project Affected Persons (PAPs) in Tagalog language or any other local language, which is understandable for the people. All information about the proposed project or undertaking shall be presented by the proponent to the public in a language and manner that are easily understood (Sec 2.0 of Article IV, DENR Ministry Order No. 96-37, 1996).	None	-
9. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.	EIA finding for Environmental Critical Projects shall be presented in a public consultation meeting during the Scoping sessions (DENR, Section 3.2, Memorandum Circular, 2010). Public participation of the stakeholders is to be sustained during EIA Study and project implementation (DENR, Annex 4, Memorandum Circular, 2010). There is no mention to participation in monitoring system by PAPs.	None	A monitoring system the PAPs can join in shall be set up.
10. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	In the event that the owner of the property contests the implementing agency's pre-offered value, the court shall determine the just compensation to be paid the owner (Section 6 (f), RA 10752, 2014). However, there is no mention to set-up of grievance handling mechanism.	There is no law stipulating grievance handling mechanism.	A grievance handling mechanism shall be established for the Project.
11. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits	There is no law/regulation which is applied to the item in Philippines.	There is no system for identification of PAPs at early stage.	A socio- economic survey targeting more than 20% of the PAPs shall be done at early stage.
12. Eligibility of benefits includes, the Project Affected Persons (PAPs) who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.	Government through the National Housing Authority, in coordination with the local government units and implementing agencies concerned, shall establish and develop squatter relocation sites, including the provision of adequate utilities and services, in anticipation of squatters that have to be removed from the right-of-way or site of future infrastructure projects. Whenever applicable, the concerned local government units shall provide and administer the relocation sites (Section 9, RA 8974, 2000). In case of untitled lands or failure to establish ownership over the land, but where improvements are introduced thereon, the apparent property owner may be entitled to compensation for the said improvements subject to Section 6.8 of this IRR of RA 10752.	None	It shall be accordance with laws/regulations in Philippines.
13. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.	"Land swapping" is a process of land acquisition by exchanging land for another piece of land of equal value, which is one of modes of acquisition (Section 3 (j) and Section 10, RA 7279). It is noted that there is no mention to preference of compensation measure, either "land for land" or "cash for land", in any laws/regulations. Probably, it depends on cases.	None	In accordance with willingness of the PAPs, whether cash compensation or land for land compensation shall be determined.

JICA Guidelines	Laws in Philippines	Gap	Measures against gap
14. Provide support for the transition period (between displacement and livelihood restoration)	There is no law/regulation which is applied to the item in Philippines.	There is no law/regulation referring to support during transition period.	According to need, any supports shall be provided.
15. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.	Equitable utilization of residential lands in urban and urban areas is needed with particular attention to the needs and requirements of the underprivileged and homeless citizens. (Section 2 (b) (1), RA 7279, 1992).	None	-
16. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels	Government shall ensure that owners of real property acquired for national government infrastructure projects are promptly paid just compensation (Section 1, RA 8974, 2000). It is necessary to uplift the conditions of the underprivileged and homeless citizens in urban areas and in resettlement areas by making available to them decent housing at affordable cost, basic services, and employment opportunities (Section 2 (a), RA 7279, 1992).	None	-

Source: JICA Survey Team

7.3 General Conditions in and around the Target Area

The MMIP area consisting MMIP I and MMIP II is located in parts of 5 municipalities, namely, Carmen, Kabacan, Pikit, Datu Montawal and Pagalungan. The first 3 municipalities fall in Cotabato province, while the latter 2 municipalities in Maguindanao province (ARMM).

7.3.1 Meteorological Conditions

The project area has a tropical wet climate with no dry or cold season, represented with year-round rainfall. There is not much temperature fluctuation throughout a year, with a bit of increase in March - May which is the right before the onset of rainy season. The minimum monthly temperature is at around 20 Celsius degrees while the maximum one ranges from 33 to 35 Celsius degrees (see Figure 7.3.1).

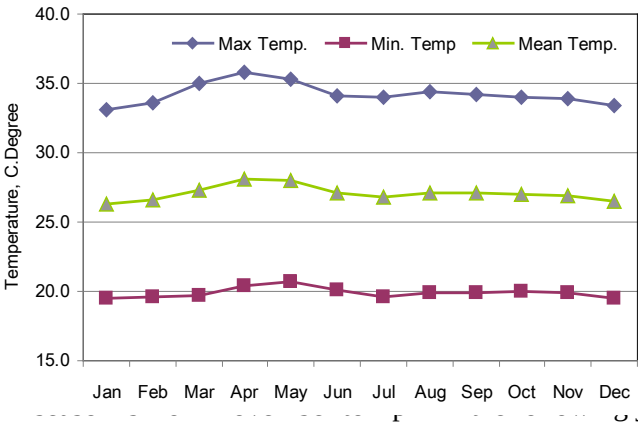


Figure 7.3.1 Monthly Temperature Trend (Pikit Area)

Source: NCEP, US

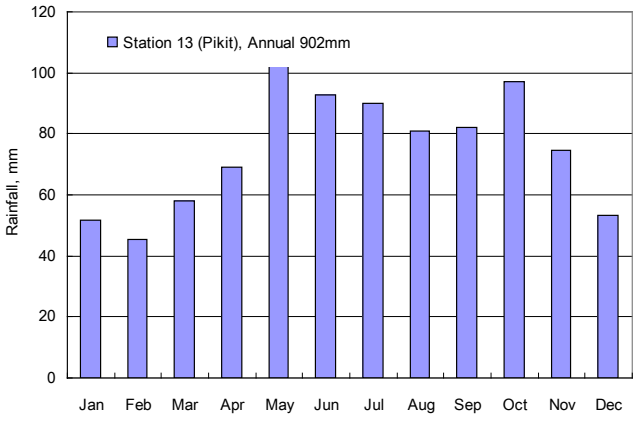


Figure 7.3.2 Monthly Rainfall Trend (Pikit Area)

Source: NCEP, US

7.3.2 Positional Relation between the Target Area, Surrounding Rivers and Liguasan Marsh

Pikit observatory is located at 10 m elevation, and there is a tendency that elevation of northwest side

area of Pikit is high, while that of south side is low (see Figure 7.3.3). The Liguasan marsh consists of open water, wetland, shrub and so on. Liguasan marsh (one of three marshes formulating as called "Liguasan Marsh", see Chapter 2.2.1 in detail) may be partly overlapped with southern part of Lower Malitubog area (see Figure 7.3.4), the boundary of Liguasan marsh is not clear, though.

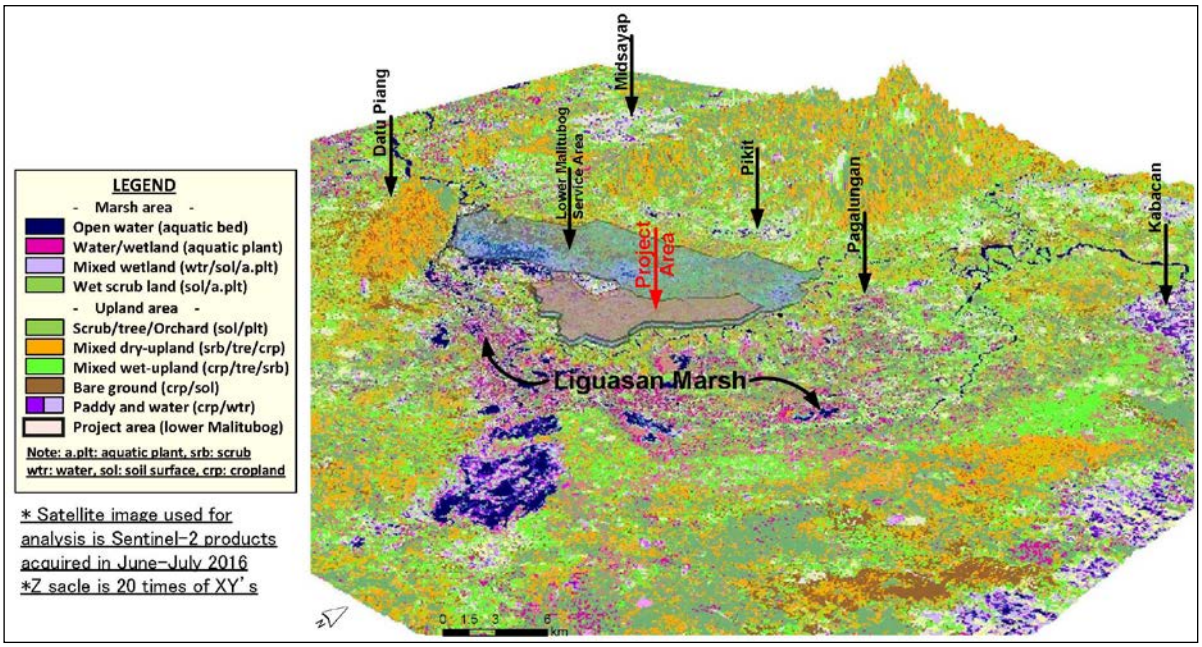


Figure 7.3.3 Three-Dimension Map of Liguasan Marsh (Vegetation Distribution)

Source: JICA Survey Team

The Diversion Dam, which water for MMIP area is diverted from, is located at the north of MMIP I area, and the water source is Maridagao River. This river merges with Pulangi river (sometimes called as Mindanao River since it is one of streams of Mindanao river). Further, Pulangi river flows into Liguasan marsh via Tunggol Bridge, and continuously goes along the southern border of the Lower Malitubog area.

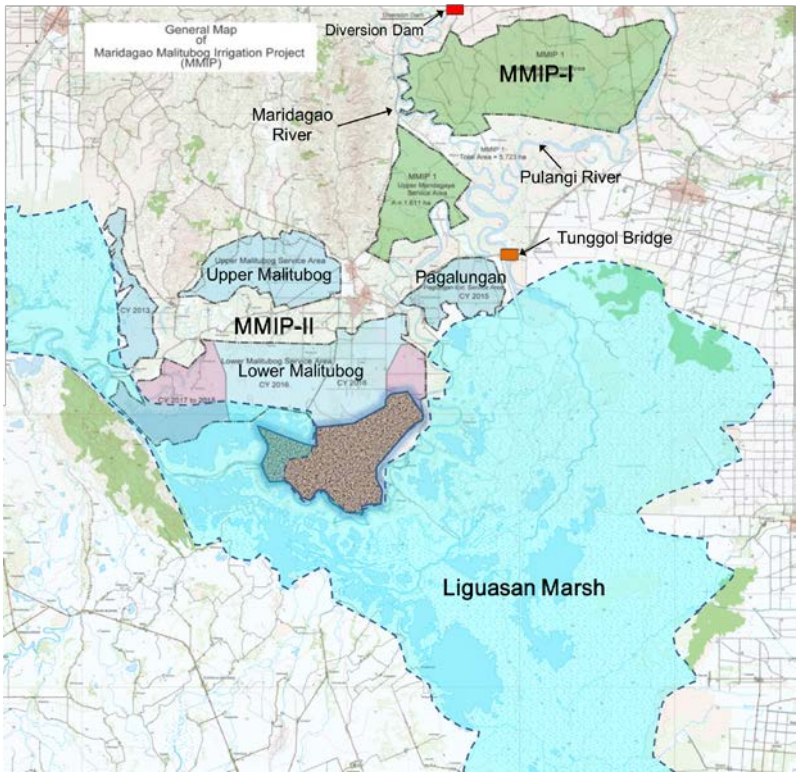


Figure 7.3.4 Location Map of Liguasan Marsh and MMIP Area

Source: JICA Survey Team based on 1/50,000 Topographic Map

It is noted that land use and inundation situation in and around the Lower Malitubog area is drastically changed in dry season and rainy season. Paddy and corn fields extend over southern part of the requested ODA area in dry season, while such area is inundated in rainy season as illustrated in Figure 7.3.5. In addition, the part of Liguasan marsh which may be overlapped with southern parts of the Lower Malitubog area has been already developed for farming and is not

untouched natural land any more.

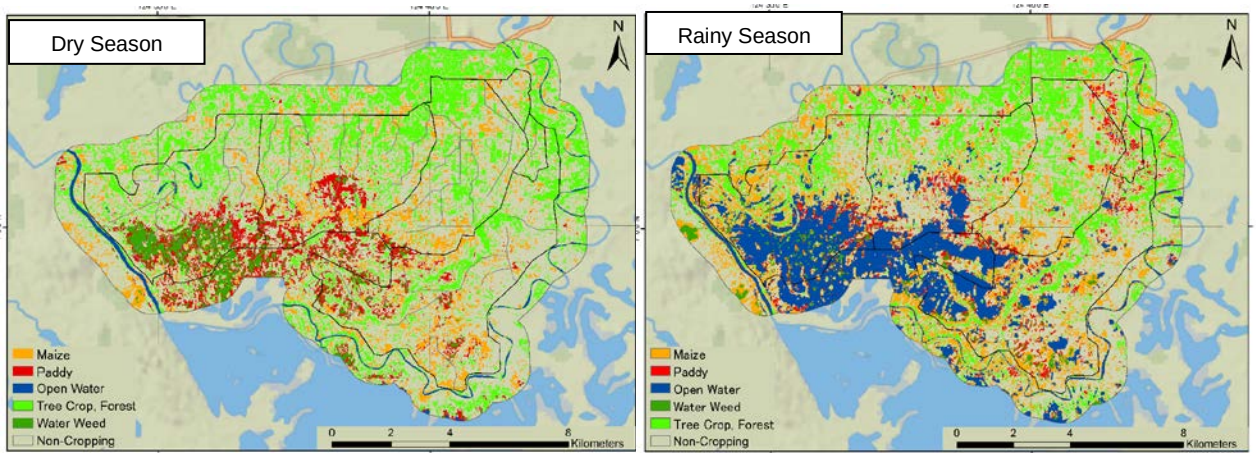


Figure 7.3.5 Land Use of Lower Malitubog Area in Rainy and Dry Seasons

Source: JICA Survey Team

7.3.3 Mindanao River Basin and Pulangi River Basin

The Mindanao River Basin is the second largest river system in the Philippines having a drainage area of 21,503 square kilometers, after the Cagayan river of Luzon and also the second longest river in the Country with a length of approximately 373 km. The river plays an important role for local economy, used mainly in transporting agricultural products. The Mindanao river headstream is in the mountains of Bukidnon Province, where it is called the Upper Pulangi River. Its lower portion, commonly known as the Lower Pulangi, flows into the Liguasan marsh.

Pulangi river meanders across the provinces of Bukidnon, Davao del Sur, Lanao del Sur, Maguindanao and Cotabato (see Figure 7.3.6). Its main river channel has a total stretch of 353.2 km. The river serves as the largest tributary of Mindanao river, drains an area of 4,099 km^2. It flows southwest to the Liguasan marsh, where it becomes the Mindanao river and directs to the west and then northwest. Notable tributaries of the Pulangi river system in the northern highlands are: Maridagao, Mulita, Kulama, Arakan, Kabacan, Manupali, Calabugao and Tigua Rivers.

The Mindanao River Basin is a large dendritic catchment coming from upstream sections of Pulangi (northern section) and

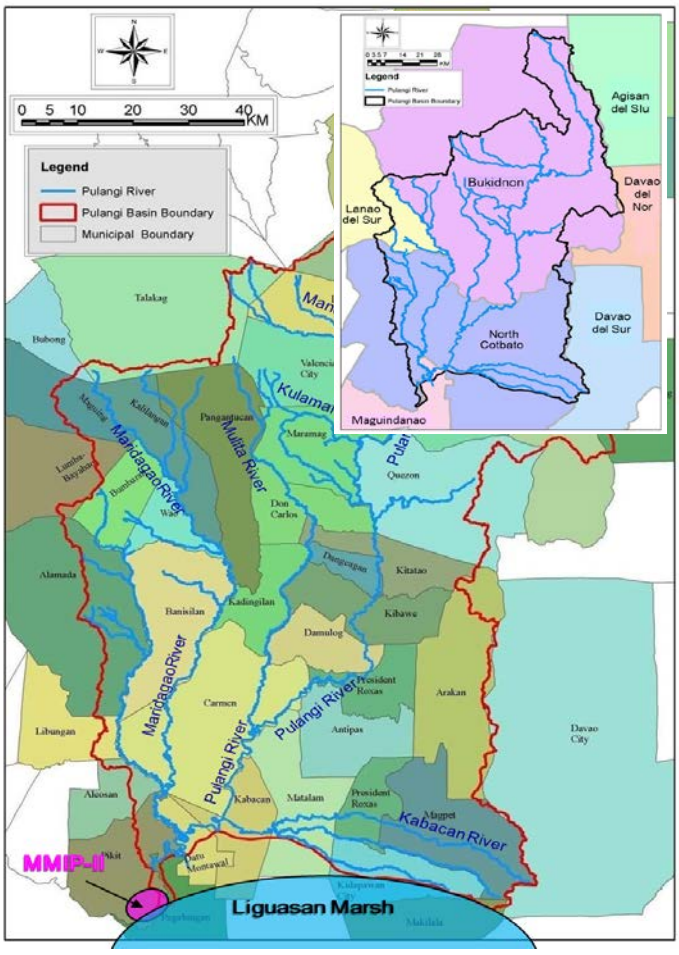


Figure 7.3.6 Main Rivers in Pulangi River Basin

Note1: The map is prepared by JICA Survey Team based on "*Mindanao River Basin Integrated Management and Development Master Plan* Pre- Feasibility Study Of An Integrated Flood Control, River Bank Protection and Rehabilitation Project For Pulangi River"

Note2: The "Pulangi River Basin" in the map is integrated some sub-basins of Mindanao River (see Figure 7.3.7), does not equal of sum of Upper Pulangi Sub-basin and Lower Pulangi Sub-basin.

Source: JICA Survey Team

Ala Valley (southern section) sub-watersheds. These waters enter into the Liguasan marsh and eventually flow into the Illana Bay in Cotabato City (see Figure 7.3.7).

Sub-basin	Catchment area (km^2)
1 Ala Sub- basin	3,496
2 Ambal Simuay Sub-basin	759
3 Arakan Sub-basin	561
4 Banga Sub-basin	916
5 Buluan Sub-basin	1,958
6 Cotabato Sub-basin	1,145
7 Dalika Sub-basin	590
8 Damakling Sub-basin	232
9 Kabacan Sub-basin	934
10 Kulaman Sub-basin	206
11 Libungan Sub-basin	866
12 Lower Pulangi Sub-basin	865
13 Malasila Sub-basin	271
14 Maapag Sub-basin	338
15 Manupali Sub-basin	962
16 Maridagao Sub-basin	2,170
17 M'lang Sub-basin	606
18 Muleta Sub-basin	1,053
19 Tigua Sub-basin	340
20 Upper Pulangi Sub-basin	3,235
21 Buayan-basin	1,620

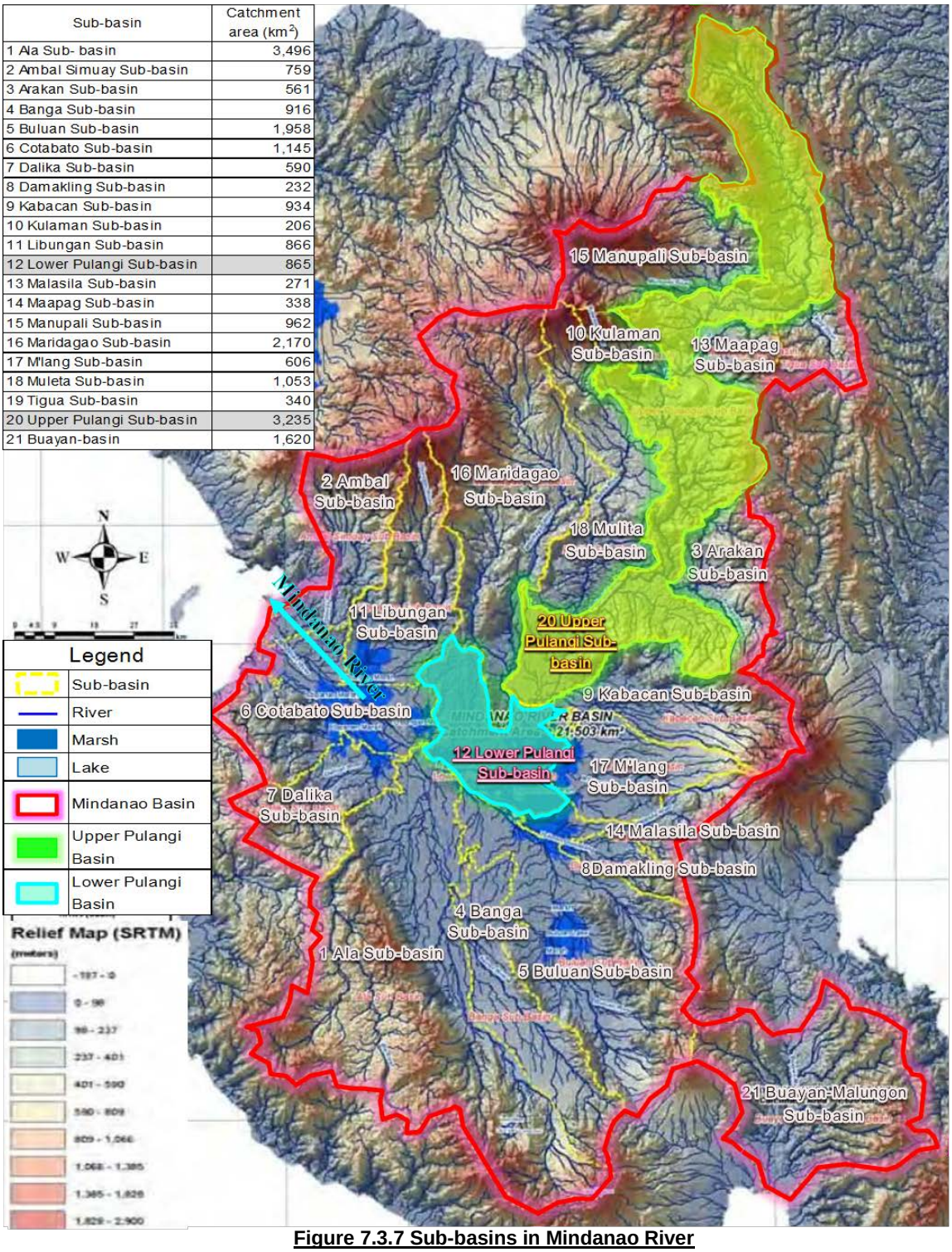


Figure 7.3.7 Sub-basins in Mindanao River

Source: JICA Survey Team

7.3.4 Protected Areas around the Target Area

Based on the RA 7586 (1992)[5], the protected areas to ensure the sustainable use of resources have

[5] Act Providing for the Establishment and Management of National Integrated Protected Areas System, Defining its Scope and Coverage, and for Other Purposes

been identified, and 204 protected areas in total are specified as of 2004 in Philippines.[6] The protected areas consists of; 1) 71 National Parks/Marine Parks and National Marine Reserves, 2) 8 Game Reserve and Bird Sanctuaries, 3) 16 Wilderness Areas, 4) 87 Watershed Forest Reserve, and 5) 27 Mangrove Swamps.

In Region XII, where the target area is located on, there are 5 protected area. The nearest one for the target area is Libungan Forest Reserve, which is around 25km away from the Project area as illustrated in following figure. The Forest Reserve is located on watershed of Libungan river, while the irrigation water for the target area belongs to Lower Pulangi River Basin. Therefore, any development activities in the target area would not cause adverse impacts on the Forest Reserve.

Figure 7.3.8 Location of Protected Areas around the Target Area
Source:http://philgis.org/general-county-datasets/protected-areas

7.3.5 Main Income of MMIP Area

A socio-economic survey to gain baseline values of farm households in MMIP I area and LMSA was implemented by the JICA Survey Team in July 2017. Three villages (Barangay) in MMIP I area and six villages in MMIP II (LMSA) were chosen randomly considering locational balance as shown in Figure 7.3.9. Each 20 households were sampled from each village, as shown in the following table:

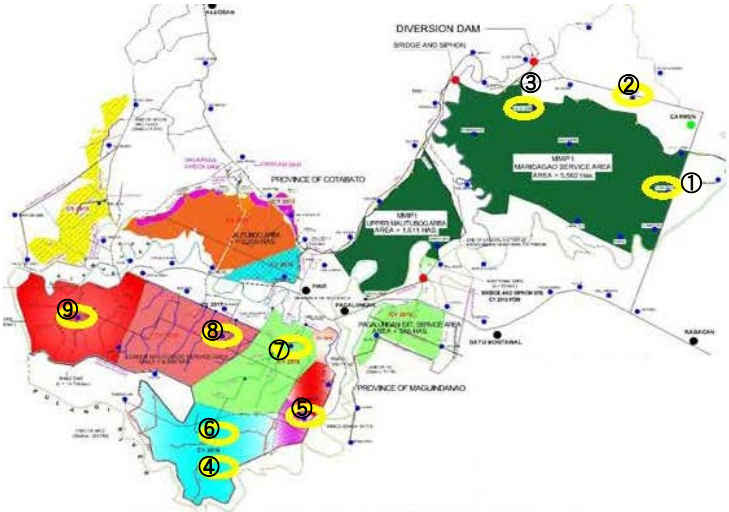


Figure 7.3.9 Location of Target Communities of Socio-economic Survey
Source: JICA Survey Team

[6] Biodiversity Management Bureau," Statistics on Philippines Protected Areas and Wildlife Resources", 2004

Table 7.3.1 Target Villages of Socio-Economic Survey and No. of Interviewed Households

Area	Name of Village	Province	No. of Households Interviewed
MMIP I	1. UGALINGAN	Carmen	20
	2. GENERAL_LUNA	Carmen	20
	3. KIBAYAO	Pagalungan	20
LMSA	4. BOLIOK	Pikit	20
	5. TALITAY	Pikit	20
	6. BAGO-INGED	Pikit	20
	7. GLI-GLI	Pikit	20
	8. MACABUAL	Pikit	20
	9. PUNOL	Pikit	20

Source: JICA Survey Team

The survey revealed that the people in LMSA have various incomes sources such as cropping, aquaculture, migrant work, while the residents in MMIP I area are mainly dependent on farming as shown in Figure 7.3.10. It is probably because that LMSA faces difficulties with crop cultivation due to frequent inundation in rainy season, while MMIP I Area is rarely influenced by flood. Such a situation can lead to a big difference of annual income, more than twice, namely, P206,305 and P88,786 for MMIP I and LMSA, respectively, as shown in Figure 7.3.11.

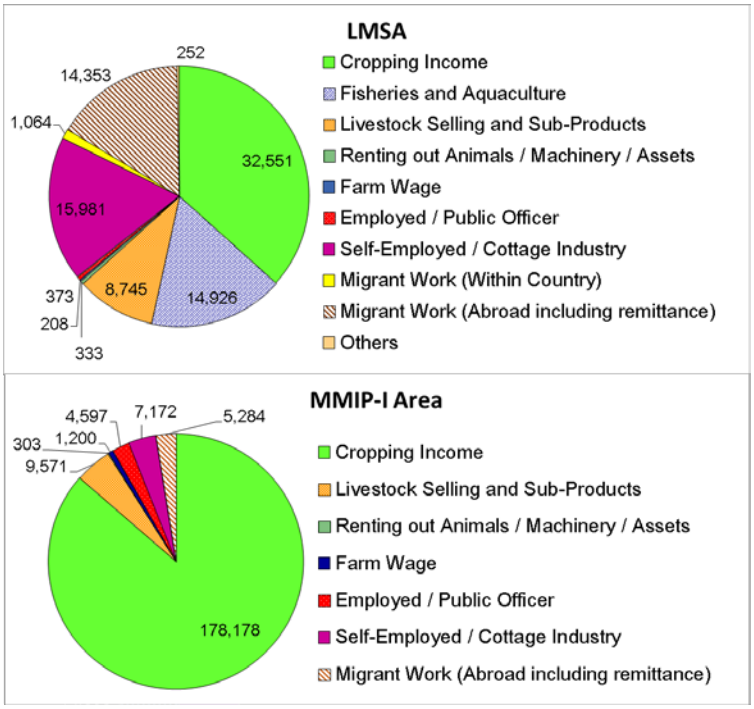


Figure 7.3.10 Income Sources in LMSA and MMIP I Area

Source: JICA Survey Team

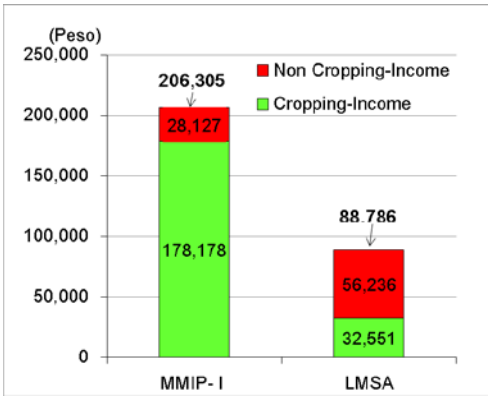


Figure 7.3.11 Annual Income in LMSA and MMIP I Area

Source: JICA Survey Team

7.3.6 Farming in the MMIP II Area

1) Land Use and Planted Crops

Based on the satellite image analysis as of 2015-2016, land occupation percentage by purpose, such as cropped, non-cropped and open water by season in Lower Malitubog, is illustrated in following figure. Only 38% and 35% of the total area were covered by crop planting (sum of paddy, maize and tree crop) in rainy season and dry season, respectively, which implies that land use for agricultural purpose in the area is limited. On the other hand, open water area accounts for 15% of total area in rainy season, while it is 0% in dry season, and it is noted that such high occupation rate of water could be a constraint for agricultural development during rainy season.

There is no statistical data covering only the MMIP area specifically. However, the Project area spreads mainly in Pikit municipality, therefore, farming situation is discussed based on the statistical data of the municipality. In the municipality, paddy and maize are leading crops as shown in following figure and table. Fruits and tree crops, mainly coconut, could be important crops after paddy and corn. The other crops such as root crops, pulses, vegetables, etc. account for only 6% of the total area, and mung-bean, squash, eggplant, bitter-gourd and sugarcane are grown to only some extent in the area. The shares of each crops in Pikit Municipality is illustrated in following table.

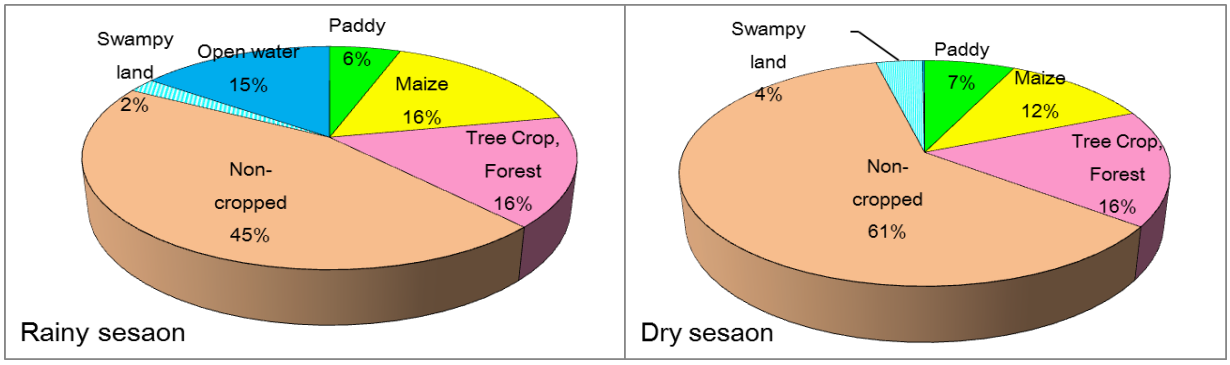


Figure 7.3.12 Land Use in Lower Malitubog Area
Source: JICA Survey Team

Table 7.3.2 Crop Production in Pikit Municipality (Ave. 2014-16)

No	Crop	Harvested Area		Yield	Production
		(ha)	(%)	(ton/ha)	(ton)
1	Paddy, irrigated	1,936.4	9.4	4.5	8,772.6
2	Paddy, rain-fed	3,986.3	19.4	3.5	14,113.4
	Paddy, total	**5,922.7**	**28.8**	**3.9**	**22,886.0**
3	Corn, yellow	1,209.0	5.9	4.2	5,127.1
4	Corn, white	6,184.6	30.0	3.9	23,925.7
	Corn, total	**7,393.6**	**35.9**	**3.9**	**29,052.8**
5	Root crops	76.4	0.4	-	-
6	Mung Bean	556.8	2.7	0.8	445.4
7	Squash	180.2	0.9	2.0	360.4
8	Bitter Gourd	65.3	0.3	3.3	167.0
9	Egg Plant	68.6	0.3	3.0	205.8
10	Miscellaneous vegetables	82.4	0.4	-	-
11	Sugarcane	196.8	1.0	48.0	9,446.4
	Root, vegetables, etc.	**1,226.5**	**6.0**	-	-
12	Coconut	**4,684.3**	**22.7**	**3.6**	**16,863.5**
13	Mango	820.6	4.0	2.5	2,051.5
14	Oil Palm	206.9	1.0	24.0	4,965.6
15	Rubber	109.8	0.5	2.4	263.5
16	Banana	96.0	0.5	14.5	1,392.0
17	Miscellaneous fruits	136.3	0.7	-	-
	Fruits & tree crops, total	**6,053.9**	**29.4**	-	-
	Total	**20,596.7**	**100.0**	-	-

Source: Office of the Provincial Agronomist, Cotabato Province

2) Rice Farming System[7]

A part of MMIP I and MMIP II is located in ARMM, which is the poorest area in the Philippines with poverty incidence ranging from 29.8 percent to 53.7 % in 2009, while poverty incidence for the entire country for the same period is 26.5% (WB, 2013) [8]. Following discusses the rice farming systems in ARMM comparing with those of average of whole Philippines and Region XII.

[7] This sub-chapter is described based on "2013 Costs & Returns of Palay Production, Philippine Statistics Authority"
[8] Source: http://www.worldbank.org/en/results/2013/04/10/philippines-autonomous-region-in-muslim-mindanao-social-fund-project

Average farm size of rice farmers is about 1.6 ha in Region XII, ARMM and entire Philippines. On the other hand, landowner farmer is the majority of rice farmers in the both regions (Region XII: 58% and ARMM: 64%), while the percentage of landowner farmer in the Philippines remains only at 37%, which means that the Region XII and ARMM have advantage in terms of land ownership. However, the percentage of paddy farming in irrigated area in ARMM is only 29%, while those in entire Philippines and Region XII are 61% and 66%, respectively. It means that irrigation system is not well developed in ARMM.

The percentage of rice farmers who own drawing animals (buffalo/cattle) in Region XII and ARMM are 50% and 59%, respectively, while the percentage of the Philippines is 42%. The percentage of 2-wheel tractor owners in Region XII is only 13%, which is almost half of the national average, while the percentage is only less than 4% in ARMM. Such conditions imply agricultural mechanization in ARMM is behind compared with other areas. (Source: 2013 Costs & Returns of Corn Production, Philippine Statistics Authority.)

Urea, ammonium sulphate and NPK (14-14-14) are popular chemical fertilizers among the rice farmers in Region XII and ARMM. In many cases, they much depend on nitrogen fertilizers and do not pay attention to apply the phosphate and the potash. It is, however, considered that the present level of nitrogen provided by the fertilizers might not be sufficient, if the farmers aim to get higher productivity, e.g. 5 – 6 ton/ha. The amount of chemical fertilizers used in ARMM is much lower than the national average as shown in Figure 7.3.13. Concerning amount of pesticide application, data in ARMM is not available, therefore, it can hardly be possible to discuss the matter.

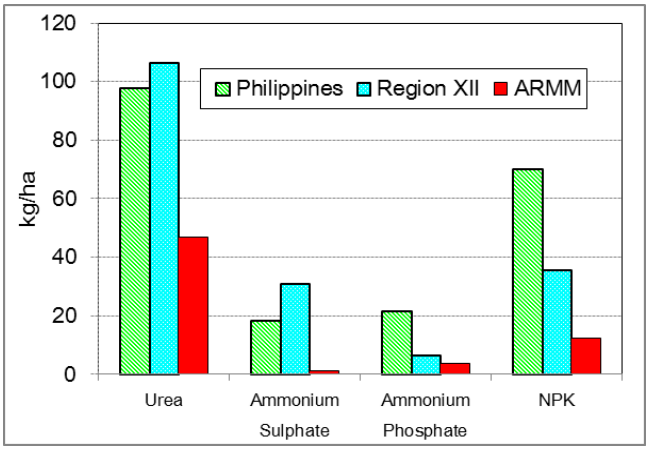


Figure 7.3.13 Amount of Applied Fertilizers for Paddy

Source: 2013 Costs & Returns of Corn Production, Philippine Statistics Authority

3) Corn Farming System[9]

There are two types of corn in Philippines, namely, white corn and yellow one. Concerning farm size, average sizes of corn farmers in Region XII, ARMM and entire Philippines are almost same, 2.24ha, 1.80ha and 2.14ha, respectively. On the other hand, landowner farmer is the majority of corn farmers in ARMM, which accounts for 70% of all of farmers, while those in the Philippines and Region VII remains only 36% and 35%, respectively. The situation implies that the ARMM has advantage in terms of land ownership for corn planting as well as paddy production.

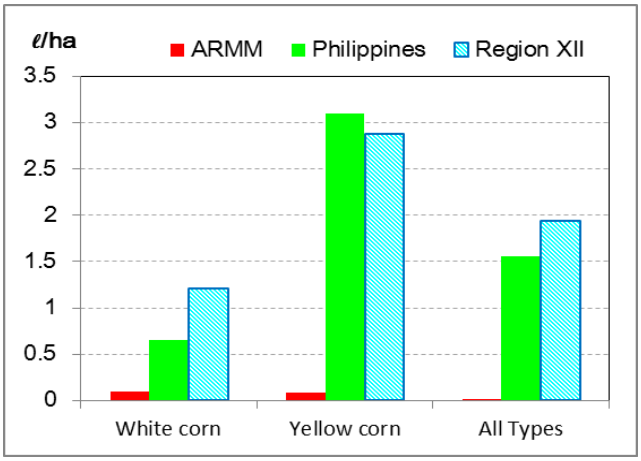


Figure 7.3.14 Amount of Applied Liquid Pesticide for Corn

Source: 2013 Costs & Returns of Corn Production, Philippine Statistics Authority

In case of white corn, most of farmers grow

[9] This sub-chapter is described based on "2013 Costs & Returns of Corn Production, Philippine Statistics Authority"

OPV (Open Pollinated Varieties). While the most majority of the farmers in Region XII grow modern varieties of white corn, the farmers in ARMM prefer much native varieties. On the contrary, hybrid varieties are popular in yellow corn cultivation among the farmers. In Region XII and entire Philippines, the percentages of farmers growing hybrid yellow corn are 75% and 50%, respectively, whereas no farmers grow hybrid varieties even in yellow corn cultivation in ARMM.

As same as the case of rice farmers, urea, ammonium sulphate and NPK (14-14-14) are popular chemical fertilizers among corn farmers in Region XII and ARMM. The situation of chemical fertilizer use is characterized by limited use of organic fertilizers, heavily nitrogen-conscious application, low dependency on the basic dressing. Moreover, as well as paddy, amount of application in ARMM is low compared to them in Philippines and Region XII. Concerning pesticide application, amount of pesticide in ARMM is very limited compared with them in Philippines and Region XII as illustrated in Figure 7.3.14. As a whole, amount of farming inputs in ARMM is deemed to be small, which means that relatively extensive farming is operated at this moment.

7.4 Scoping

Due to the new construction works of irrigation/drainage canals and access roads, some environmental impacts, for instance, air pollution, water pollution, involuntary resettlement/land acquisition are anticipated. Prior to the specific investigation to asses any environmental impacts by the Project, scoping, which narrow down important parameters to be studied, was implemented. Following table discusses the scoping results:

Table 7.4.1 Scoping Result

Items	Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	
1. Air Quality	B-	C	**Construction stage:** Dust and gas emission will be caused, which leads to air pollution in and around the construction site. However, as the area is not densely populated area, the extent of impact is limited. **Operation stage:** Increase of dust and gas emission is expected due to the access road construction, however, surrounding area is mostly used as farmland, which leads to very minor impact. Still, it is needed to confirm current situations.
2. Water Quality	B-	B-	**Construction stage:** Mud water from the construction site will be caused. **Operation stage:** Due to the development of farmland, total amount chemical to be applied can be increased and they can be discharged through drainage from paddy fields, however, the current amount is relatively small compared with average amount at the national level.
3. Waste	B-	D	**Construction stage:** Waste from construction works and labor camps will be generated. **Operation stage:** No waste due to the operation of the constructed facilities is expected.
4. Soil contamination	C	D	**Construction stage:** Oil leakage from construction vehicles and equipment is expected. **Operation stage:** No soil contamination is expected.
5. Noise and Vibration	B-	C	**Construction stage:** Noise and vibration due to construction works are expected. **Operation stage:** Traffic will be increased due to construction of the access roads, which leads to noise and vibration. However, considering surrounding area is generally used as farmland, there is low possibility of severe noise. It is needed to confirm the conditions along the proposed roads.

Items	Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	
6. Ground Subsidence	D	D	**Construction stage /Operation stage:** During construction and operation, ground subsidence will not be caused, since there is no plan to extract ground water.
7. Offensive Odor	D	D	**Construction stage /Operation stage:** Any works to caused offensive odor is not planned.
8. Bottom Sediment	D	D	**Construction stage /Operation stage:** Any works to caused bottom sediment is not planned.
9. Protected Area	D	D	**Construction stage /Operation stage:** There is no protected area in and around the project site.
10. Groundwater	D	D	**Construction stage /Operation stage:** Use of groundwater is not planned for the Project, which results in no damage to groundwater.
11. Hydrological Situation	C	B-	**Construction stage:** During the construction, no water intake is planned. However, construction of canal embankment can prevent water drainage, which can lead to inundation. **Operation stage:** The entire MMIP plans to intake water, around 30 m^3/s, at the existing diversion dam (just upstream of MMIP I area) in dry season. The resource of the dam is Maridagao River, and the river discharge will be reduced. However, the river flows into Pulangi river at 10 km downstream of the Diversion Dam. Pulangi River has sufficient discharge, around mean discharge 200-300 m^3/s at the confluence of Pulangi and Kabacan through the year[10], and the water intake at the Diversion Dam will not cause significant impact on the discharge of Pulangi River. Liguasan Marsh (one of three marshes) extends over from around 5 km downstream of the influent point between Pulangi River and Maridagao River. Given that not only Pulangi River but also Malasa River and other rivers flow into the marsh, intake of 30 m^3/s water will not cause severe hydrological impact on the marsh.
12. Ecosystem	D	C	**Construction stage** Lands in and around the construction sites have been already developed for agricultural purpose and there is no virgin nature to be damaged by the Project. **Operation stage:** Construction of canals, drainages and access roads and water intake will not give a damage to Liguasan Marsh. However, detailed survey of the current ecosystem in the Marsh is necessary to confirm the current conditions, probably, the impacts by the Project will be limited, though.
13. Topography and Geographical features	D	D	**Construction stage:** Construction materials will be sold by the private land owners to the contractors directly, instead of establishment of a borrow area, and negative impact on topography and geographical features is not expected. **Operation stage:** There is no topographic change, once operation is started.
14. Involuntary Resettlement/ Land Acquisition	B-	D	**Before construction stage:** For the purpose of the construction of roads, canals and drainages, resettlement and land acquisition are expected. The construction will be done by using budget of GoP, and it is recommended to compensate the PAPs for the impacts incurred. **Construction/Operation stage:** No impacts are expected.
15. The poor	C	C	**Construction/Operation stage:** It is needed to confirm the situations by the field survey and hearing from the governmental staff and the people concerned.
16. Indigenous and ethnic people	C	C	**Before construction/Operation stage:** Field based investigation to testify the absence/existence of indigenous people shall be implemented.

[10] Mindanao Development Authority, River Basin Control Office and Office of Civil Defense, "Mindanao River basin integrated management and development master plan, Master Plan Report Volume II"

Items	Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	
17. Livelihood/local economy	B^-/B^+	B^+	**Construction stage:** Given that the Project will provide job opportunities as construction labors for the local people, positive impacts are expected. On the other hand, the Project will cause negative impacts on some people whose land will be acquired. **Operation stage:** Stable agricultural production can be performed due to stable irrigation water supply and shortening inundation period.
18. Land use and local resource utilization	B^-	D	**Construction stage:** It is needed to acquire lands for construction of canals, roads and drainages, which would change current land use. **Operation stage:** No negative impact on land use and local resource utilization is expected.
19. Water Usage or Water Rights and Rights of Common	D	B^+	**Construction stage:** The construction works will not give a change of water usage system or water use rights. **Operation stage:** Due to increase of water diversion for the LMSA, discharge of Maridagao River will be reduced. However, right bank area of Maridagao River is mountainous area where upland crops are partly cultivated without using irrigation system, while left bank area has been irrigated by lateral canals under MMIP I. Thus, no negative impact on water usage by the MMIP II is expected. In the beneficiary area, irrigation system will be introduced, which enables stable access to the irrigation water for the beneficiaries, and existing water rights will not be spoiled by the Project.
20. Existing Social Infrastructures and Services	B^-	B^+/B^-	**Construction stage:** Due to increase of construction vehicles, traffic jam can be caused. **Operation stage:** Due to widening existing roads and new road construction, the people access to road more easily than before, while traffic would be increased.
21. Social Institutions	C	C	**Construction/Operation stage:** It is needed to confirm current conditions by the field survey and hearing from the governmental staff and the people concerned.
22. Misdistribution of Benefit and Damage	B^-	D	**Before construction stage:** Some land owners will lose their farmlands, while others are informed of the Project benefit, which may cause feeling of inequality for the PAPs. **Operation stage:** Construction of access roads, irrigation canals and drainages will not cause negative impacts on non-beneficiaries, which will not lead to misdistribution of benefit and damage.
23. Conflict	D	B^-	**Construction /Operation stage:** Any conflicts between the beneficial area and affected area are not expected, as far as sufficient compensation to the affected persons is provided. **Construction /Operation stage:** Due to the Project, stable irrigation water will be supplied to the beneficial area. There is a concern that uneven water distribution can lead to a conflict in the beneficiary area.
24. Cultural Heritage	C	C	**Construction /Operation stage:** It is needed to confirm by the field survey.
25. Land Scape	D	D	**Construction /Operation stage:** The areas in and around the project sites are mainly farmlands, therefore, special land scape to be reserved is not identified.
26. Gender	D	D	**Construction /Operation stage:** Negative impact on women is not expected.
27. Rights of the Child	D	D	**Construction /Operation stage:** Negative impact on children is not expected.

Items	Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	
28. Hazards (Risk), Infectious Diseases such as HIV/AIDS	B-	D	**Construction stage:** There is a possibility that infectious disease HIV/AIDS could be caused by employment of workers from other areas. It is needed to confirm other cases. **Operation stage:** After the construction works, no disease is expected.
29. Work Environment	B-	D	**Construction stage:** There is a concern of work accidents at the construction sites. It is needed to comply with the labor code for safety. **Operation stage:** No labor environmental change in the beneficial area is expected, since irrigation farming has been operated in the area.
30. Accident	B-	B-	**Construction stage:** There is a concern of traffic accident increase in and around the construction sites. **Operation stage:** Due to the access road construction, there can be some traffic accidents.
31. Transboundary Impact, Climate Change	D	D	**Construction stage:** Large amount of greenhouse gas, which can cause climate change, will not be emitted by the Project. **Operation stage:** The rivers concerned to the Project, finally merge into Mindanao River, which flow into the sea. There is no international river concerned.

*Further studies are needed for the highlighted environmental items.
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

Based on the discussion in Table 7.4.1, for the parameters which can cause negative and unknown impacts, necessary environmental studies to assess environmental impacts and their extent are examined. Those studies are to be implemented through desk study, field survey, interviews to governmental staff concerned and the people in and around the Project area as in the following table:

Table 7.4.2 Terms of Reference for Environmental Examination

Environmental parameters	Study item	Method
1.Air quality	• Confirmation of environmental standard in Philippines • Examination of anticipated impacts during the construction stage	• Confirmation of environmental standards in Philippines • Field survey and observation in the target area (distribution of houses, hospital and schools in and around the project sites) • Data collection of similar projects
2.Water quality	• Confirmation of environmental standard in Philippines	• Confirmation of environmental standards in Philippines • Field survey • Data collection of similar projects
3.Waste	• Examination of waste disposal	• Data collection of similar projects for waste management • Confirmation of environmental standards in Philippines
4. Soil Contamination	• Examination of anticipated impacts during the construction stage	• Data collection of similar projects
5.Noise and vibration	• Confirmation of environmental standards • Noise and vibration by the Project	• Confirmation of environmental standards in Philippines • Field survey (distribution of houses, hospital and schools in and around the project sites) • Data collection of similar projects

Environmental parameters	Study item	Method
11.Hydrological situations	• Confirmation of the current hydrological conditions • Examination of the possibility of hydrological change	• Data collection of water discharge of rivers concerned to the Project • Field observation • Examination of change of water depth and area of Liguasan Marsh
12.Ecosystem	• Ichthyological and bird survey targeting Liguasan Marsh • Desk study of ecosystem in the Liguasan Marsh	• Desk study of the ecosystem in the Liguasan Marsh • Field survey on range of fish and birds in Liguasan Marsh
14. Involuntary resettlement and land acquisition	• Identification of areas to be resettle and acquired • Preparation of a full-scale RAP or an abbreviated RAP depending on the result of case studies	• Review of laws and decrees regarding involuntary resettlement and land acquisition in Philippines • Identification of affected area and PAPs • Confirmation of land use of the area and existing structures to be affected
15.The poor	• The poor in and around the project area	• Identification of the affected area • Site survey and interview to the people • Hearing to the governmental organization concerned
16.Indigenous people/minority people	• Indigenous people/minority people in and around the project area	• Review of laws and decrees regarding indigenous people in Philippines • Identification of the affected area • Implementation of the field based investigation • Hearing to the governmental organization concerned
17.Livelihood/local economy	• Identification of affected area by involuntary resettlement and land acquisition	• Identification of the affected area • Confirmation of land use of the area and existing structures to be affected
18.Land use and local resource utilization	• Examination of area to be acquired	• Review of laws and decrees regarding land acquisition in Philippines • Identification of the affected area • Confirmation of current land use of the area to be affected
19.Water usage or water rights and rights of common	• Confirmation of water distribution system of Maridagao River	• Hearing to the governmental organization concerned • Site survey and interview to the people • Data collection of other similar projects
20.Existing social infrastructure and services	• Traffic jam due to the construction works	• Confirmation of road conditions around the construction sites • Data collection of other similar projects
21. Social Institutions	• Confirmation of Irrigator's Association and other institutions	• Hearing to the governmental organization concerned • Interview to the leaders of such social institutions
22.Misdistribution of benefit and damage	• Identification of areas to be resettle and acquired	• Identification of affected areas • Confirmation of land use of the area and existing structures to be affected • Data collection of similar projects
23.Conflict	• Possibility of conflict due to misdistribution of benefit and damages	• Data collection of other similar projects • Site survey and interview to the people • Hearing to the governmental organization concerned
24. Cultural heritage	• Cultural heritage in and around the project sites	• Identification of affected area • Confirmation of existing structures to be affected • Site survey and interview to the people • Hearing to the governmental organization concerned
28.Hazard (Risk) Infectious diseases such as HIV/AIDS	• Possibility of inflectional diseases occurrence by hiring of labors	• Data collection of other similar projects
29.Work environment including safety	• Possibility of accident	• Data collection of other similar projects
30.Accident	• Possibility of accident	• Data collection of other similar projects

*The number of each item in table above is unified with that in Table 7.4.1 Scoping Result.
Source: JICA Survey Team

7.5 Results of Environmental Examination

7.5.1 Ecological Survey

Following the Terms of Reference indicated in Table 7.4.2, a series of ecological survey in Liguasan Marsh was done in and around the Lower Malitubog Area in July 2017. 15 points were established as the fish sampling points as illustrated in following figure, and the caught fish species were identified. Moreover, interview survey was also implemented to gain further information related to fish range.

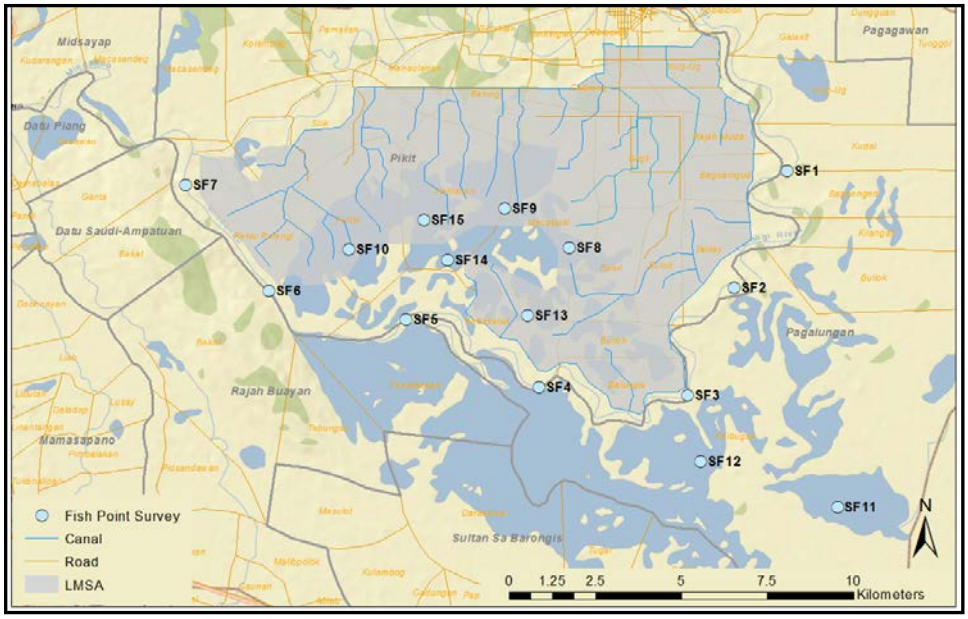


Figure 7.5.1 Fish Survey Points

Source: JICA Survey Team

Source: JICA Survey Team

As of July 2017, the surveyed area was inundated, and water depth of the survey points was around 3-4 m. The area around the survey points is vegetated in general, partly with coconut, bamboos, water hyacinth, banana, bamboo, while structures are rarely identified. Following photos illustrate current conditions in the survey points.

Concerning bird survey, both spot-survey and transect survey were applied to identify bird species in the area. The spot survey was implemented at 99 points, while 22 survey lines which have various length were established as the transect survey (see Figure 7.5.2). In addition to the surveys at the field, some interviews to the people were also done to gain further information related to fish and birds in the marsh.

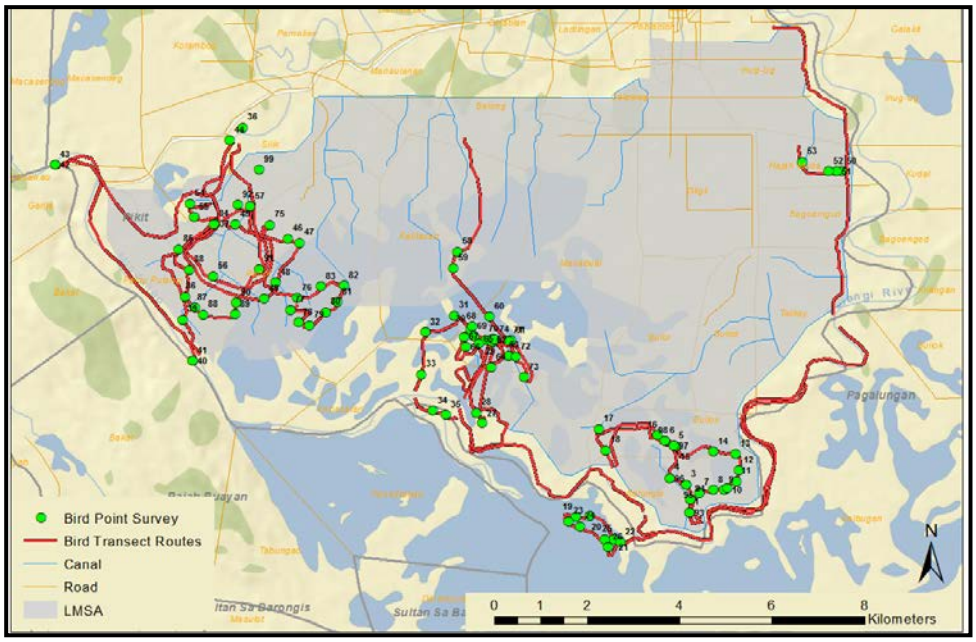


Figure 7.5.2 Bird Survey Points and Transect Routes

Source: JICA Survey Team

1) Fish Survey Results

Ten fish species were identified by the spot-survey while two species were done by the interviews, in other words, 12 species in total were identified. It is unveiled that *Oreochromis niloticus* (Nile tilapia), *Channa striata* (Mudfish) and *Cyprinus carpio* (Common carp) are dominant, especially, the number of *Oreochromis niloticus* (Nile tilapia) is very big. Regarding *Anguilla sp.* (Eel), *Mesopristes sp* (Cross-Barred Grunter) and *Mesopristes sp* (Cross-Barred Grunter), only one was caught, respectively. The identified fish species are shown in Table 7.5.1 and Figure 7.5.3.

Anguilla Anguilla (European eel)

Cyprinus carpio (Common Carp)

Oreochromis niloticus (Nile Tilapia)

Channa striata (Mudfish)

Barbodes sirang (Sirang)

Source: JICA Survey Team

Table 7.5.1 Identified Fish Species

Fish species	No. of caught fish	No. of caught sites	Category in IUCN Red list
1. *Cyprinus carpio* (Common Carp)	79	13 sites	VU: Vulnerable
2. *Channa striata* (Mudfish)	54	7 sites	LC: Least concern
3. *Helostoma temminckii* (Kissing Gourami)	15	7 sites	LC: Least concern
4. *Oreochromis niloticus* (Nile Tilapia)	198	All 15 sites	Not categorized in IUCN Red List
5. *Anguilla sp.* (Eel)	1	1 site	CR: Critically Endangered
6. *Anabas testudineus* (Climbing Perch)	7	3 sites	Not categorized in IUCN Red List
7. *Barbodes sirang* (Sirang)	32	5 sites	VU: Vulnerable
8. *Mesopristes sp* (Cross-Barred Grunter)	3	1 site	LC: Least concern
9. *Hypostomus placostomus* (Janitor fish /Suckermouth catfish)	4	2 sites	Not categorized in IUCN Red List
10. *Clarias batrachus(Catfish)*	3	1 site	LC: Least concern
11. *Labeo rohita* (Indian rohu carp)			LC: Least concern
12. *Trichopodus pectoralis* (Siamese gourami)			LC: Least concern

CR: facing an extremely high risk of extinction in the wild, **EN**: facing a very high risk of extinction in the wild, **VU**: facing a high risk of extinction in the wild, **NT**: qualifying for or is likely to qualify for a threatened category in the near future, **LC**: not qualify for CR, E, VU and NT, widespread and abundant taxa are included in this category.
Source: JICA Survey Team
IUCN: International Union for Conservation of Nature
Remarks: Highlighted species are listed as daggered in IUCN Red list. DENR Administrative Order No. 2004-15 specifies endangered species to be conserved, however, no fish species is listed in the Order.
Source: JICA Survey Team

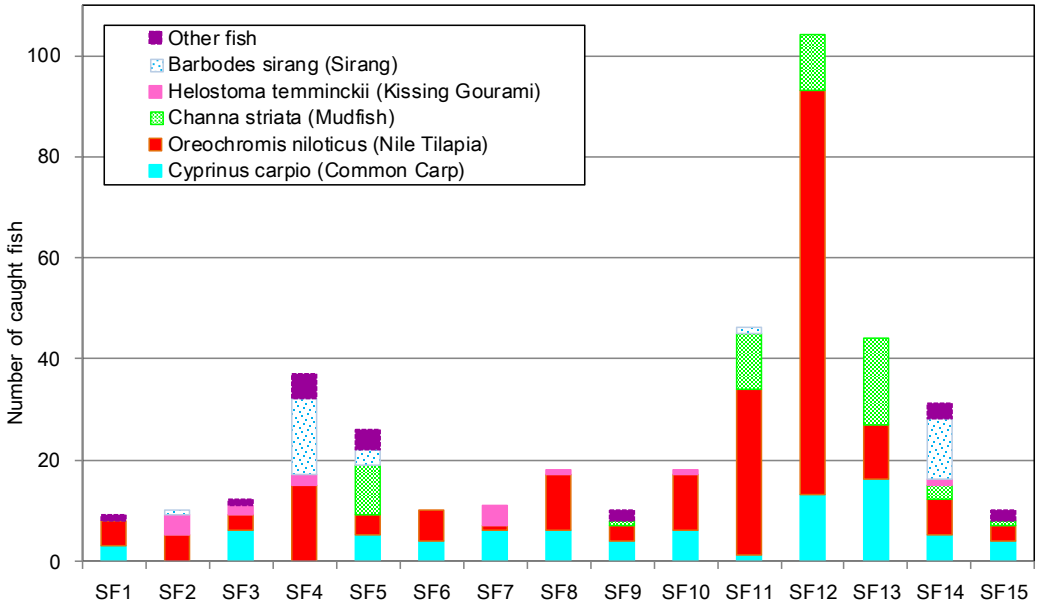


Figure 7.5.3 Fish Population and Species by Spot
Source: JICA Survey Team

In 1998, an ecological survey was implemented by NEDA Region XII Office in 1998 and the results were compiled as the "Liguasan Marsh Development Master Plan 1999-2025". According to the survey in1998, 33 fish species have ranged in Liguasan Marsh, while 12 species were identified as of July 2017. Following table compares the identified fish species in 1998 and 2017.

Table 7.5.2 Identified Fish Species in 1998 & 2017 and Impacts of Introduced Species

No	Name of Fish Species	Identified in 1998	Identified in 2017	Impact
1	*Anabas testudineus* (Climbing perch)	○	○	Beneficial
2	*Anguilla celebesensis (*Celebes eel*)*	○	None	
3	*Anguilla marmorata (*Marbled Eel*)*	○	None	
4	*Anguilla pacifica (*Blackhead eel*)*	○	None	
5	*Anguilla spengeli (Short fin eel)*	○	None	
6	*Anguilla spp.* (Eel)	None	○	

No	Name of Fish Species	Identified in 1998	Identified in 2017	Impact
7	*Barbodes sirang* (Sirang)	None	○	
8	*Channa striata (Ophicephalus striatus) (*Mudfish*)*	○	○	Invasive
9	*Chanos chanos* (Milkfish)	○	None	
10	*Clarias batrachus(Catfish)*	○	○	Invasive
11	*Clarias gill (*EeLeast Concernatfish*)*	○	None	
12	*Clarias microcephalus(*Freshwater catfish*)*	○	None	
13	*Ctenogobius criniger (*Gobby*)*	○	None	
14	*Cyprinus carpio* (Common carp*)*	○	○	Beneficial
15	*Glossogobius biocellatus (*Sleeping goby*)*	○	None	
16	*Glossogobius celebius (*Rock goby*)*	○	None	
17	*Glossogobius giurus (*White goby*)*	○	None	
18	*Hypophtalmichthys molitrix* (Silver carp)	○	None	Beneficial
19	*Helostoma temminckii* (Kissing gourami)	○	○	Beneficial
20	*Hypostomus placostomus* (Janitor fish /Suckermouth catfish)	None	○	
21	*Illana bicirrhosa*(Goby)	○	None	
22	*Labeo rohita* (Indian rohu carp)	○	○*	Beneficial
23	*Liza subviridis (Mugil sp.)* (Freshwater mullet*)*	○	None	
24	*Liza viagiensis* (Liza viagiensis)	○	None	
25	*Lutjanus sp.*(Snapper)	○	None	
26	*Megalops sp.*(Tarpon)	○	None	
27	*Mesopristes sp* (Cross-Barred Grunter)	None	○	
28	*Oreochromis mossambicus* (Mozambique tilapia)	○	None	Beneficial
29	*Oreochromis niloticus* (Nile tilapia)	○	○	Beneficial
30	*Osphronemus gourami (Giant gourami)*	○	None	Beneficial
31	*Puntius binotatus* (Common barb)	○	None	
32	*Puntius javanicus (*Javanese barb*)*	○	None	
33	*Scatophagus argus (*Scats/spotted butterfly fish*)*	○	None	
34	*Therapon cancellatus* (Mesopristes cancellatus)	○	None	
35	*Tilapia rendalli* (Tilapia rendalli)	○	None	
36	*Tilapia zilli* (Tilapia zilli)	○	None	
37	*Trichopodus pectoralis* (Siamese gourami)	○	○*	
Total		33	12	

* *Labeo rohita* (Indian rohu carp) and *Trichopodus pectoralis* (Siamese gourami) range in the marsh according to local fisher folks, however, they are not identified by the survey in 2017.
**Hatched fish species are endangered according to the IUCN Red list.
Source: 1) NEDA Region XII, 1998, The Liguasan Marsh Development Master Plan 1999-2025
2) JICA Survey Team, 2017
3) Rafael D. Guerreoro III, 2014, Philippine Journal of Science 143 (1), Impacts of Introduce Freshwater Fishes in the Philippines (1905-2013): A Review and Recommendations

In Philippines, various fish species have been introduced to inland water area for food, ornamental purpose, recreational fishing and mosquito control. Some of them are beneficial for income improvement, while others are invasive for epidemic species. Out of commonly identified fish species by the survey, two fish species, namely, *Channa striata (Ophicephalus striatus)* (Mudfish) *and Clarias batrachus* (Catfish) are classified as "invasive" as shown in table mentioned above.

It is noted that Regional Fisheries Training and Fisher folk Coordination Center (under the Bureau of Fisheries and Aquatic Resources XII) has produced and dispersed fingerings of *Oreochromis niloticus* (Nile tilapia) to Local Government Units, fisher folk groups and individuals since 2002 every year. In 2017, Nile tilapia was released to inland waters, which means that the certain amount of the fish species reach to Liguasan Marsh by such activities of human beings. Considering those situations, it is probably difficult to know original fish ecosystem of the Liguasan Marsh at this moment.

Due to the Project, the conditions of Liguasan Marsh will not be changed, given that inundated area of the Marsh is seasonally and annually changed drastically even now. Southern part of the LMSA is inundated for only 0-20% of a year (=0 to 73 days per year). It means that the area is dried up most of the year and seasonal change is very big. Under such severe condition, the fish have survived so far.

The proposed construction works will not cause significant hydrological change, which leads to minor impact on the fish eco-system. However, there is a possibility that excessive fish catch and exotic fish introduction can lead to change of fish eco-system in the marsh, and balanced management is recommended.

2) Birds Survey Result

In total, 63 bird species were identified by the spot-survey, transect survey and interview to the people in July 2017 (see Appendix VII). They are mainly, *Ardeola speciosa* (Javan Pond Heron), *Ardea purpurea* (Purple Heron), *Ixobrychus sinensis* (Yellow Bittern), *Halias turindus* (Brahminy Kite), *Himantopus himantopus* (Black-winged Stilt), *Merops philippinus* (Blue-tailed Bee-eater) and *Gallinula chloropus* (Common Moorhen). The survey did not observe *Haliastur indus* (Philippine duck) and *Anhinga melanogaster* (Oriental darter) at the field, while the NEDA study did them in 1998. However, some key informants positively identified them in the survey area, therefore, these species are also included in the 63 bird species above. 53 species were identified by NEDA in 1998, and 23 species are common in the both survey results.

Merops philippinus *(Blue-tailed Bee-eater)*

Himantopus himantopus (Black-winged stilts)

Halias turindus *(Brahminy Kite)*

Gallinula chloropus (Common Moorhen)

Source: JICA Survey Team

Out of identified species by the survey in 2017, *Haliastur indus* (Philippine duck) and *Anhinga melanogaster* (Oriental darter) are classified endangered species in the IUCN Red List. According to the people interviewed, Philippine duck is rarely observed recently, and they attribute the decline of the bird to hunting. IUCN also mentions that hunting is a major threaten for the species. Apart from those two species, DAO 2004-15 classifies five species out of 63 species identified, namely, *Haliastur indus* (Brahminy Kite) and so on to those which trade must be controlled. These endangered bird species are shown in following table.

Table 7.5.3 Endangered Bird Species Identified by the Survey

No	Name of Fish	IUCN Red list	DAO 2004 (As of 2014)
1	*Haliastur indus (*Brahminy Kite*)*	LC: Least Concern	EN II
2	*Elanus caeruleus(*Black-winged Kite*)*	LC: Least Concern	EN II
3	*Circus melanoleucos (*Pied Harrier*)*	LC: Least Concern	EN II
4	*Anas luzonica (Philippines duck)**	VU: Vulnerable	VU
5	*Anhinga melanogaster* (Oriental Darter)*	NT: Near Threatened	VU
6	*Loriculus philippensis(*Philippine Haninging-parrot*)*	LC: Least Concern	EN (II)
7	*Bolbopsittacus lunulatus (*Guaiabero*)*	LC: Least Concern	EN (II)

EN I: species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances
EN II: species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival
*Philippine duck and Oriental darter were not identified by the spot and transect survey, however, they are observed by the people.
Source: JICA Survey Team

Halias turindus (Brahminy Kite) and *Elanus caeruleus* (Black-winged Kite) were observed in plural survey points and transect routes, while *Circus melanoleucos* (Pied Harrier), *Loriculus philippensis* (Philippine Haninging-parrot) and *Bolbopsittacus lunulatus* (Guaiabero) were identified at very limited sites. However, the Project, construction of irrigation canal, drainage and access roads in LMSA is not expected to give a severe damage to habitat of those birds. Rather than the impacts by the Project, hunting of those bird species is probably a bigger issue to be managed.

7.5.2 Water Quality Test

Water samples were taken at the 15 points as well as the fish survey for the laboratory test to understand current water quality conditions as illustrated in following figure. The result of water quality check is compiled in Table 7.5.4.

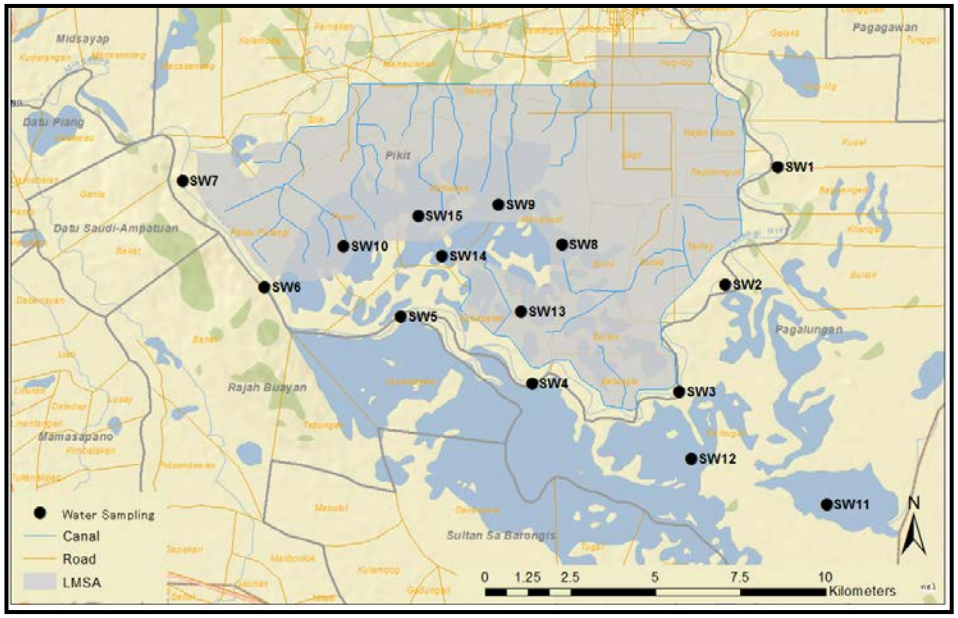


Figure 7.5.4 Water Sampling Points
Source: JICA Survey Team

Table 7.5.4 Water Quality Check Result

Sampling point	Trial	Sampling Date	pH	Temperature (˚C)	EC (µS/cm)	TDS (mg/l)	DO (ppm)	BOD (ppm)	COD (ppm)	Water Depth (m)
1	1 2	7/16/2017	7.96 8.05	28.2 28.6	282 286	176 173	4.12 4.43	10.6 10.4	36.7 36.7	4.1
2	1 2	7/17/2017	8.32 8.24	27.3 26.8	269 274	169 175	4.02 4.19	10.3 10.3	52.0 52.0	3.6

Sampling point	Trial	Sampling Date	pH	Temperature (˚C)	EC (μS/cm)	TDS (mg/l)	DO (ppm)	BOD (ppm)	COD (ppm)	Water Depth (m)
3	1 2	7/18/2017	8.02 8.11	27.8 27.5	278 272	182 184	3.69 3.83	10.3 10.2	24.4 27.5	4.2
4	1 2	7/9/2017	7.68 7.57	27.6 27.8	253 252	189 183	4.45 4.40	10.5 10.6	3.0 6.1	3.2
5	1 2	7/10/2017	7.72 7.66	27.2 27.6	271 261	191 182	4.46 4.36	10.8 10.7	3.0 3.0	4.1
6	1 2	7/19/2017	7.89 8.01	27.6 28.1	283 289	186 181	4.63 4.47	10.1 10.0	43.9 40.8	2.3
7	1 2	7/20/2017	8.17 8.28	27.3 27.7	279 281	186 191	4.11 4.17	10.0 9.9	18.8 15.7	4.7
8	1 2	7/12/2017	8.19 8.13	31.1 31.5	258 267	182 185	4.84 5.06	10.7 10.7	58.1 58.1	3.6
9	1 2	7/3/2017	7.87 7.73	28.4 28.6	260 266	178 190	4.49 4.57	10.1 10.0	41.6 38.4	3.6
10	1 2	7/12/2017	7.76 7.75	33.7 32.8	374 290	263 205	4.46 4.65	10.4 10.3	27.5 27.5	3.4
11	1 2	7/7/2017	7.79 7.62	31.9 27.6	428 446	338 285	4.43 4.38	10.3 10.3	9.6 9.6	1.5
12	1 2	7/8/2017	7.92 7.80	27.7 27.7	324 290	234 210	4.39 4.43	10.6 10.5	3.2 3.2	4.0
13	1 2	7/11/2017	7.88 7.78	27.0 27.3	248 243	173 170	4.53 4.50	10.3 10.3	52.0 48.9	6.7
14	1 2	7/4/2017	8.11 8.00	23.7 27.4	281 263	196 193	4.65 4.53	10.2 10.1	51.2 48.0	4.0
15	1 2	7/5/2017	7.83 7.63	27.9 28.3	252 258	188 192	4.52 4.51	10.0 9.9	48.0 44.8	3.8
Standard in Philippines* (DAO No.34, 1991)			6.5-8.5			<1,000	>3.0 >5.0	<7.0 <10.0		

*1 Permissible threshold value of TDS is 1,000mg/l and less for Class C.
*2 Permissible threshold values of DO are 5mg/l and 3mg/l and more for Class C and Class D.
*3 Permissible threshold values of BOD are 7mg/l and 10mg/l and less for Class C and Class D.
Source: JICA Survey Team

According to the result, water salinity of the samples is within the standard set by DAO No.34, 1991, which is mentioned in Table 7.2.4. On the other hand, values of DO in some samples are not within the standard, while all of samples' BOD values exceed the standard. The reason for this situation is not clear, however, it is probably because that the water is stagnant with limited fresh water flow, considering that there are few houses discharging effluent around the sampling points. The Project in LMSA will not change the hydrological conditions, which leads to minor impacts on water quality.

7.6 Environmental Evaluation

1) Air Pollution

During construction stage, major construction machineries to be used are excavator, dozer, roller, loader, truck, and trailer truck. These machineries emit exhaust gasses to some extent. Moreover, dust may be generated by the construction works. However, the targets sites are located on along farmlands with few residential houses. Therefore, the expected impacts by the Project are not very significant.

Concerning operation stage, emission from vehicles will be increased due to the access road construction and increase of traffic. However, the proposed roads will pass through the areas where farmlands stretch widely with small number of houses. Moreover, busy season will be limited to planting and harvesting seasons. Therefore, the problem of air quality is expected to be minor.

2) Water Pollution

During the construction works, turbid water may be generated from construction sites; however, it can be caused only during the construction period. The level of the turbidity is not expected to be

significant and it is possible to establish sedimentation pond to minimize the mud water discharge. Therefore, such water pollution can be managed to the acceptable level, and it is not considered as a major issue.

As the water quality test shows, water quality in and around LMSA is almost equivalent to Class C, which is suitable for fishery, and it means that current water quality can be regarded as not very clean. Concerning application of chemical fertilizer and pesticide, amount of those materials will be increased after the Project. However, given that current amount of fertilizer and pesticide application is relatively small compared with national average as discussed in Chapter 7.3.6, expected negative impacts by the Project could not be very severe. Still, it is needed to organize training concerning proper application of fertilizers and pesticides.

3) Waste

Wastes, namely, excavation of soils will be generated during construction and it can be reused for the backfilling of embankment. Even after having re-used such waste, there may be a possibility that some excessive wastes still remain, in such case, remaining soil can be dumped along the canal. Other remaining materials shall be disposed at specified sites. In addition, waste from the labor camp will be generated, and it should be classified and disposed based on regulations in Philippines. Such waste generation will be limited to only construction stage.

4) Soil Contamination

At the construction stage leakages of liquids, such as oil and fuel, from the vehicles and other equipment could take place. However, this impact is short term, relatively low. Regular check of the construction vehicles is necessary to prevent oil leakage.

5) Noise/Vibration

Noise and vibration will be caused by the construction works and increase of traffic; however, the proposed canals, drainages and access roads are located on along farmlands and the number of residential houses in the area is limited. Therefore, noise and vibration generated from the works will not be significant.

In operation stage, noise/vibration will be increased compared with before due to establishment of the access roads and increase of traffic. However, as mentioned, the new roads will pass through farmlands instead of residential area, which will lead to minor impacts.

6) Hydrological Situations

During construction stage, there is a possibility that constructed embankment of canal can prevent water flow of small waterbodies such as creeks and streams within the inundated area for several days. Thus, it is needed to establish cross-drains in and around the site prior to the construction works to avoid negative effect to natural water bodies and inundation.

Amount of water intake at the diversion dam will be increased, which will reduce Maridagao River discharge. However, Maridagao River flows into Pulangi River soon, and severe hydrological change is not expected. On the other hand, construction of canals and drainages by the Project will shorten inundation period at the beginning of dry season, which will not cause dynamic change of water flow. The Liguasan Marsh and its surrounding inundated area change its size seasonally and annually at this moment, and expected change by the Project is minor compared with such changes. Therefore, it can be said that significant impact on hydrological situations by the Project will not be caused.

7) Ecosystem

As mentioned in Chapter 7.5.1, some rare fish species range in and around Liguasan Marsh. However, the construction of proposed facilities will not disturb migration of fish including rare species such as European eel, and habitat of other fish, considering that hydrological situations will not be changed significantly. *Barbodes sirang* is native in Philippines, and one of major threats on the fish is the fishing style by using dynamite or poison, which can kill all of them including fly according to IUCN. It is, thus, such fishing method should be controlled at first apart from the Project implementation.

Concerning bird species, it is also necessary to control illegal hunting to conserve endangered species such as Philippine duck and *Anhinga melanogaster* (Oriental Darter). Moreover, construction of canals, drainages and access roads will not disturb habitat area of birds, and it is judged that negative impacts on ecosystem of the Project will be minor.

8) Involuntary Resettlement and Land Acquisition

Detail situations are described in Chapter 7.10. Some lands had been acquired for the Project by NIA, and compensation for damage to crops/structures had been partly provided. On the other hand, identification of PAPs and damaged crops/structures in the area, where construction works will be started since 2019, has not been commenced. The PAPs, except only one household in MMIP I area, have not agreed at the proposed compensation rates for land loss. It is recommended for NIA-PMO to have meetings with PAPs to negotiate agreeable compensation rates, and to pay compensation for land loss prior to the construction works. Moreover, it is also recommended to pay compensation for land loss due to drainage construction, it is not planed at present, though.

9) The Poor

The socio-economic survey (JICA Survey Team, 2017) revealed that the average household income in LMSA is P88,786 (see Chapter 7.3.5), and the amount is between average ones in Region 12 and ARMM area, namely, P193,438 and P85,514, respectively. Average income per capita can be estimated at P16,912, when 88,786 mentioned above is divided by 5.25, average number of family members per household. The Philippines Statistics Authority sets the poverty line at P21,025 and P21,563 per capita for the Region 12 and ARMM, respectively, under the condition, the living standard in LMSA is categorized into “poor”. Still, given that the Project contributes to farming improvement, the Poor will not be negatively influenced by the Project.

10) Indigenous People/Minority People

Detail study results on indigenous people/minority people are mentioned in Chapter 7.11, and it is revealed that indigenous people who continue their unique and traditional life style are not identified in the MMIP area. Therefore, negative impact on such people is not expected.

11) Livelihood/Local Economy

Due to the canal construction, the people can operate irrigation farming in dry season, which leads to stable crop cultivation. Moreover, they have to wait for dry-up of their farmlands for a while at the beginning of dry season at this moment, however, the period for waiting can be shortened due to the drainage construction. As a whole, crop productivity will be improved after the construction works. In addition, the beneficiaries of MMIP I recognize that the increase of agricultural potential and establishment of access roads by MMIP I also have improved various public services including non-agricultural sectors (JICA Survey Team, 2017). Implementation of MMIP II is also expected to contribute to improvement of entire local economy.

12) Land Use and Local Resource Utilization

As discussed, land acquisition is necessary for the Project implementation, and it is needed to pay fair compensation for land loss. On the other hand, LMSA is generally used as farmland at this moment, main purpose of land use will not be changed by the Project.

13) Water Usage/ Water Rights

At the diversion dam, it had been planned to divert water for both MMIP I area and MMIP II area from the beginning, and the water diversion for LMSA has been already accepted. Therefore, it is not necessary to acquire new water right, and existing water right will not be spoiled by MMIP II.

14) Existing Social Infrastructure and Services

During the construction works, it is expected that traffic jam will be caused by the increase of construction vehicles, and actually, transportation becomes busy in some parts of LMSA, where the construction works are on-going. In operation period also, traffic will be busy due to the construction of access roads, however, the extent of traffic jam will not very significant considering that areas along the proposed roads are used as farmlands at this moment.

15) Social Institutions

There are 21 groups in LMSA, and they are categorized into social welfare (12 groups), farming (8 groups) and education (one group) in terms of purpose of the group. Those groups have experiences to be supported by the government so far, which means that these institutions are ready for functioning in the process of irrigation management transfer after the MMIP II completion. In addition, Irrigator's Association (IA) were set up by the governmental support in the MMIP I area, and the people recognize that the organizations function actively for water management after a series of training sessions (JICA Survey Team, 2017). Therefore, MMIP II would give positive impacts on the area by new organization establishment[11] and collaboration with existing groups.

16) Misdistribution of Benefit and Damage

Due to the Project, farm income would be stable by irrigation farming in dry season, while the PAPs will lose their farmlands and crops, which leads to misdistribution of benefit and damage. It is, thus, payment of compensation to the PAPs is very important to minimize such misdistribution.

17) Conflict

One of negative impacts by MMIP I, which were identified by the people, is increase of conflict on water distribution within a Barangay due to irrigation service commencement (JICA Survey Team, 2017). The same issue can be caused in LMSA also, it is, thus, necessary to take countermeasures. For instance, establishment of IA, rule setting for even water distribution, organization of training sessions by NIA and so on are to be practiced.

18) Cultural Heritage

Municipality of Pikit has a cultural heritage, namely, Fort of Pikit, which was built in 1893 by the Spanish Colonial Government. The National Historical Commission of the Philippine had declared the fort as a National Historical Landmark in March 2012. Except for Fort of Pikit, there is no cultural heritage in and around the LMSA.

[11] In LMSA, 13 Irrigators Associations have been established and 8 more associations are to be established.

19) Hazard (risk) of Infectious Diseases such as HIV/AIDS

There will be a number of labors hired during the construction stage. Under such situation, there may be a possibility of extending infectious diseases such as TB, and HIV/AIDS among the labors, though with reference to similar construction works, no noticeable examples have been reported so far. It is needed to always pay attention to the labors' health condition. Also, awareness creation on HIV/AIDS shall be made among the labors.

20) Work Environment /Accidents

There is a possibility of some accidents by the construction works and traffic accidents. Therefore, safety measures should be addressed prior to the commencement of the Project. It is needed to make a schedule to assign enough number of watchmen to avoid accidents. In addition, pre-explanation to workers employed at sites should be made well, so that the works will be done in a safe manner. In operation period also, there is a possibility that the number of traffic accidents is increased due to access road construction.

Table 7.6.1 Environmental Evaluation

Items	Scoping		Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	Before and during construction	Operation stage	
1. Air Quality	B-	C	B-	D	**Construction stage:** Dust and gas emission will be caused, which leads to air pollution in and around the construction site. However, as the area is generally farming area, the extent of impact is limited. **Operation stage:** Increase of vehicles is expected due to the access road construction, however, the purpose is transportation of harvested crops, and the proposed roads will pass through farmlands and cross some rural roads where houses are located on. Thus, issue of air quality will be negligible for the surrounding people.
2. Water Quality	B-	B-	B-	B-	**Construction stage:** Mud water from the construction site will be caused. **Operation stage:** Due to the development of farmland, total amount pesticides/fertilizers to be applied can be increased, however, the current amount is small compared with average amount at the national level, and the Project will not cause a severe problem.
3. Waste	B-	D	B-	N/A	**Construction stage:** Waste from construction works and labor camps will be generated. **Operation stage:** No waste due to the operation of the constructed facilities is expected.
4. Soil Contamination	C	D	B-	N/A	**Construction stage:** Oil leakage from construction vehicles and equipment is expected. **Operation stage:** Negative impact on soil is not expected.

Items	Scoping		Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	Before and during construction	Operation stage	
5. Noise and Vibration	B-	C	B-	D	**Construction stage:** Noise and vibration due to the construction works are expected. **Operation stage:** Traffic will be increased by the access road construction, however, the proposed roads will pass through farmlands and across some rural roads where some houses are located on along. Thus, noise/vibration will not be a big issue for the surrounding people.
6. Ground Subsidence	D	D	N/A	N/A	**Construction stage /Operation stage:** During construction and operation, ground subsidence will not be caused, since there is no plan to use ground water.
7. Offensive Odor	D	D	N/A	N/A	**Construction stage /Operation stage:** Any works to cause offensive odor is not planned.
8. Bottom Sediment	D	D	N/A	N/A	**Construction stage /Operation stage:** Any works to caused bottom sediment is not planned.
9. Protected Area	D	D	N/A	N/A	**Construction stage /Operation stage:** There is no protected area in and around the project site.
10. Ground Water	D	D	N/A	N/A	**Construction stage /Operation stage:** Use of groundwater is not planned for the Project, which results in no damage to groundwater.
11. Hydrological Situation	C	B-	B-	D	**Construction stage:** During the construction stage, construction of embankment can prevent drainage or water flow of natural waterbodies, which leads to inundation around the construction site. **Operation stage:** Construction of canals and drainages will not cause dynamic change of water flow. Furthermore, size and extent of Liguasan Marsh are changed seasonally and annually, and expected change by the Project is minor. It is, thus, significant impact on hydrological situations would not be caused.
12. Ecosystem	D	C	N/A	D	**Construction stage** Lands in and around the construction sites have been already developed for agricultural purpose and there is no virgin nature to be damaged by the Project. **Operation stage:** Fish and birds in and around Liguasan Marsh will not be influenced by the Project, considering no dynamic change of hydrological condition.
13. Topography and Geographical Features	D	D	N/A	N/A	**Construction stage:** Current farmlands are to be changed into canals, drainages, and roads. However, it is change of land use, not a topographical change. **Operation stage:** Once operation is started, not change will be caused.
14. Involuntary Resettlement/ Land Acquisition	B-	D	B-	N/A	**Before construction stage:** For the Project implementation, land acquisition, and damage to standing crops/structures are expected. Since some construction works have been started by NIA prior to payment for the land loss. It is requested for NIA to reach agreement with the PAPs for compensation rates and to finalize payment very soon. **Construction/Operation stage:** No impacts are expected.

Items	Scoping		Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	Before and during construction	Operation stage	
15. The poor	C	C	D	D	**Construction/Operation stage:** Negative impacts on the poor are not expected.
16. Indigenous and Ethnic People	C	C	D	D	**Before construction/Operation stage:** It was confirmed that there is no overlap between the entire MMIP site and the said Ancestral Domain (see Figure 7.11.2). No influence on indigenous people is expected.
17. Livelihood/Local Economy	B^-/B^+	B^+	B^-/B^+	B^+	**Construction stage:** Given that the Project will provide job opportunities as construction labors for the local people, positive impacts are expected. On the other hand, the Project will cause negative impacts on some people whose land will be acquired. **Operation stage:** Stable agricultural production can be performed due to stable irrigation water supply.
18. Land Use and Local Resource Utilization	B^-	D	B^-	N/A	**Construction stage:** It is needed to acquire lands for construction of canals, roads and drainages, which would change current land use. **Operation stage:** No negative impact on land use and local resource utilization is expected.
19. Water Usage or Water Rights and Rights of Common	D	B^-/B^+	N/A	B^-/B^+	**Construction stage:** The construction works will not give a change of water usage system or water use rights. **Operation stage:** Due to canal construction, the people will be able to access to irrigation water. However, conflict as for water distribution could be caused.
20. Existing Social Infrastructures and Services	B^-	$B+/B^-$	B^-	$B+/B^-$	**Construction stage:** Due to increase of construction vehicles, traffic jam can be caused. **Operation stage:** Due to construction of access roads, the people access to road more easily than before, while traffic will be increased.
21. Social Institutions	C	C	D	D	**Construction stage:** No negative impact is expected. **Operation stage:** There are some organizations, e.g., for social welfare, agriculture, education and so on. Those will not be negatively influenced by the Project. IA will function in MMIP II area, and it is expected to contribute to farming improvement.
22. Misdistribution of Benefit and Damage	B^-	D	B^-	D	**Before construction stage:** Some land owners will lose their farmlands, while others are informed of the Project benefit, which may cause feeling of inequality. It is, thus, needed to provide sufficient compensation. **Operation stage:** Due to the Project, the beneficiaries can enjoy the profit, while others whose farmland can be inundated are unhappy with the situations.
23. Conflict	D	B^-	N/A	B^-	**Construction stage:** Due to the construction works, conflict between the beneficial area and affected area is not expected. **Operation stage:** There is a possibility that any conflicts on water distribution are caused within a Barangay, considering the case of MMIP I area.

Items	Scoping		Evaluation		Reason for Evaluation
	Before and during construction	Operation stage	Before and during construction	Operation stage	
24. Cultural Heritage	C	C	D	D	**Construction /Operation stage:** There are no cultural heritages to be damaged by the Project.
25. Land Scape	D	D	N/A	N/A	**Construction /Operation stage:** The areas in and around the project sites are mainly farmlands, therefore, special land scape to be reserved is not identified.
26. Gender	D	D	N/A	N/A	**Construction /Operation stage:** Negative impact on women is not expected.
27. Rights of the Child	D	D	N/A	N/A	**Construction /Operation stage:** Negative impact on children is not expected.
28. Hazards (Risk), Infectious Diseases such as HIV/AIDS	B-	D	B-	N/A	**Construction stage:** There is a possibility that infectious disease HIV/AIDS could be caused by employment of workers from other areas. **Operation stage:** After the construction works, no disease is expected.
29. Work Environment	B-	D	B-	N/A	**Construction stage:** There is a concern of accident at the construction sites. It is needed to comply with the labor code for safety. **Operation stage:** No labor environmental change in the beneficial area is expected, since irrigation farming has been operated in the area.
30. Accident	B-	B-	B-	B-	**Construction stage:** There is a concern of traffic accident at the construction sites. Moreover, there is a concern of accident to construction of canals, which will be very limited. **Operation stage:** Due to the access road construction, there can be some traffic accidents.
31. Transboundary Impact, Climate Change	D	D	N/A	N/A	**Construction stage:** Large amount of greenhouse gas, which can cause climate change, will not be emitted by the Project. **Operation stage:** The rivers concerned to the Project, finally merge into Mindanao River, which flow into the sea. There is no international river concerned.

*Environmental impacts are anticipated for the highlighted environmental items.
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

7.7 Mitigation Measures and Cost

Some adverse effects by the project, e.g., air pollution, wastes, noise/vibration are anticipated before construction stage/construction stage and operation stage. For the purpose of alleviation of such negative impacts by the Projects, following countermeasures shown in tables below are recommended to be done.

Table 7.7.1 (1) Mitigation Measures to/against the Negative Impacts: Before Construction/Construction Stage

Negative impact	Alleviating or avoiding measures	Responsible Agency	Cost
1. Air Pollution Exhaust gas emission takes place. Dust occurs during the passage of	• Conduct regular check and full maintenance of construction machineries and vehicles. • Spray water in and around entrances of construction	NIA	Included in construction cost

Negative impact	Alleviating or avoiding measures	Responsible Agency	Cost
construction vehicles.	sites and on the road, along which machineries are to move.		
2. Water Pollution Mud water can be discharged into downstream.	• Prevent turbid water from going down by establishment of sedimentation pond	NIA	Included in construction cost
3. Wastes Excavated earth evolves from some construction works and waste scrap pieces from construction works.	• Dispose wastes such as used drums for the works according to construction regulation in Philippines • Dumping of soil along the canals, drainages and roads	NIA	Included in construction cost
4. Soil Contamination	• Conduct regular check and full maintenance of construction machineries and vehicles. • Ensure to minimize oil leakage in case of oil charge	NIA	Included in construction cost
5. Noise/ Vibration During construction work, noise/ vibration evolve from the operation of back-hoes and passage of trucks., etc.	• Refrain construction work at night in such areas where residential quarters are located.	NIA	Included in construction cost
11. Hydrological Situation	• Establishment of drainage system in and around the construction site for smooth drainage prior to the construction of irrigation canals	NIA	Included in construction cost
14. Land Acquisition	• Compensation for the land loss and damaged crops/structures to the affected persons	NIA	Covered by budget of NIA
17.Livelihood/Local Economy	• Compensation for the land loss and damaged crops/structures to the affected persons	NIA	Covered by budget of NIA
20. Existing Social infrastructure and Services Traffic jam will be caused.	• Prepare a schedule which deconcentrates vehicle operation	NIA	Included in construction cost
22. Misdistribution	• Compensation for the land loss and damaged crops/structures to the affected persons	NIA	Covered by budget of NIA
28. Hazards (Risk) of Infectious Diseases such as HIV/AIDS During construction stage, infectious diseases such as TB and HIV/AIDS may take place among the workers.	• Pay attention to the workers' health condition • Awareness creation on HIV/AIDS among the workers and recommend them to voluntary check the status of HIV/AIDS.	NIA	Included in construction cost
29. Work Environment 30. Accident During construction work, traffic and/or site-work accidents may take place.	• Identify if there is too tight operation schedule or not, and if so rectify it. • Place traffic control staff along the construction roads. • Explain contents of the work to the workers with necessary care taking for their safety prior to the start of the work, and make daily confirming safe meeting before starting the work.	NIA	Included in construction cost

Source: JICA Survey Team

Table 7.7.1 (2) Mitigation Measures to/against the Negative Impacts: Operation Stage

Negative impact	Alleviating or avoiding measures	Responsible Agency	Cost
2. Water Pollution Water quality deterioration by improper application of fertilizers and pesticides	• Training of municipality officers and farmers • Demo-farm setting to demonstrate proper fertilizer application	ATI	Covered by ATI budget*
19. Water Usage or Water Rights and Rights of Common 23. Conflict Conflict as for water distribution can be caused	• Establishment of IA • Rule setting as for water distribution • Assignment of water tenders	NIA	Covered by NIA budget

*ATI can cover the budget as far as ODA loan is provided.

7.8 Monitoring Plan

Anticipated environmental impacts are expected in before construction/construction phase and operation phase, and thus related monitoring implementation is necessary in those phases. Recommended monitoring format is as follows:

Table 7.8.1 Recommended Monitoring Plan

(1) Pre-construction stage

(a) Public Consultation

No.	Date	Place	Contents of the consultation/ main comments and answers	Responsible Organization
1				NIA
2				NIA

(b) Progress of land acquisition

Land Acquisition Activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the Quarter	Till the Last Quarter	Up to the Quarter	Till the Last Quarter	Up to the Quarter		
Preparation RAP*									NIA
Employment of Consultants		Man-month							NIA
Implementation of Census Survey (including socioeconomic survey)									NIA
Approval of RAP			Date of Approval:						NIA
Finalization of PAPs List		No. of PAPs							NIA
Progress of Compensation Payment		No. of PAHs							NIA
Lot 1		No. of PAHs							NIA
Lot 2		No. of PAHs							NIA
Lot 3		No. of PAHs							NIA
Progress of Land Acquisition (all lots)		Ha							NIA
Lot 1		Ha							NIA
Lot 2		Ha							NIA
Lot 3		Ha							NIA

*Preparation of RAP is not a must for NIA, however, it is recommended to do that for proper compensation for land acquisition.
PAHs: Project affected households

(2) Construction Stage

(a) Response and actions by the government

Monitoring Item	Monitoring Results during Report Period	Responsible Organization
Number and contents of formal comments made by the public		NIA
Number and contents of responses from the people		NIA

(b) Pollution

- Air Pollution

Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards	Referred IFC Guidelines	Remarks (Measurement Point, Frequency, Method, etc.)	Responsible Organization
At construction site							
SO_2	[µg/m^3] 24 hr			180	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)	Once per month	NIA
PM10	[µg/m^3] 24 hour			150	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)	Once per month	NIA
NO_2	[µg/m^3]			150 (24hr)	200 (hour)	Once per month	NIA
Ox	[µg/m^3] 8 hours daily max			60	100	Once per month	NIA
TSP	[µg/m^3] 24 hr			230	None	Once per month	NIA
Photochemical Oxidants	[µg/m^3] Hour			140	None	Once per month	NIA
Carbon Monoxide	[µg/m^3] 1 hour 8 hours			35 10	None	Once per month	NIA

- Maintenance of heavy machine

Type of machine	Kinds of disorder	Measures taken	Monitoring date	Responsible Organization
Hydraulic Excavator			Every day	Contractor
Hydraulic Breaker			Every day	Contractor
Track Dozer (Bulldozer)			Every day	Contractor
Wheel Loader			Every day	Contractor
Earth Work Vibration Roller			Every day	Contractor
Agitator Truck (Concrete Mixer Truck)			Every day	Contractor
Lowbed semi-Trailer Truck			Every day	Contractor
Dump Truck			Every day	Contractor
Concrete Pump Truck			Every day	Contractor
Workshop Equipment			Every day	Contractor

- Water pollution

Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards	Referred IFC Guidelines (sanitary sewage water)	Remarks (Measurement Point, Frequency, Method, etc.)	Responsible Organization
Total Suspended Solid	mg/l			Not more than 30 mg/L increase*	<50	Once per month	NIA

*for Class C: Fishery water, recreational water class II, Industrial water supply class II

- Noise / Vibration

Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standards	Referred IFC Guidelines	Remarks (Measurement Point, Frequency, Method, etc.)	Responsible Organization
Noise	dB			<55 (daytime) <45 (night)	<55 (daytime) <45 (night)	Once per month	NIA

(c) Natural environment

Environmental parameter	Monitoring results	Measures taken	Monitoring date	Responsible Organization
Wastes Waste from the construction site shall be disposed at the specified sites following regulations			Every day	NIA
Hydrological situations Check of drainage from construction site			Every day	Contractor

(d) Social environment (Traffic Jam)

Environmental parameter	Monitoring results	Measures taken	Responsible Organization
Number of complaint about traffic jam			NIA

(e) Working environment (Include working safety)/ Accident

Environmental parameter	Monitoring results	Measures taken	Monitoring date	Responsible Organization
Safety check for carrying the heavy machineries into the work area.			First time of the construction work.	NIA
Safety check for refueling car accessing the work sites.			Every day	NIA
Safety check for carrying-out of the heavy machineries from the work sites.			Last time of the construction work	NIA
Checking of the heavy machineries if keeping correct routes and speed.			Every day	NIA
Installation of project sign board around the field.			First time of the construction work.	NIA

(f) Hazards (Risk) of Infectious diseases such as HIV/AIDS

Environmental parameter	Monitoring results	Measures taken	Monitoring date	Responsible Organization
Pay attention to the workers' health condition.			Every day	NIA
Arrange with the township health office to carry out awareness creation on HIV/AIDS among the workers.			Once half a year	NIA

Source: the Survey Team (2016)

(3) Operation Stage

(a) Response and actions by the government

Comments and response	Monitoring results	Measures taken	Frequency	Responsible Organization
Number and contents of comments from the people, especially following matters: ● Even water distribution ● Conflict management				NIA
Number and response to the comments from the government				NIA

Remarks: The format is to use for recording and reporting how the government (implementation agency) takes measures against any issues by the Project.

(b) Natural Environment

Environmental Parameter	Monitoring results	Measures taken	Frequency	Responsible Organization
Water pollution due to improper application of pesticides and fertilizers ● Regular training for proper application of pesticides and fertilizers				NIA

Source: JICA Survey Team

7.9 Stakeholder Meeting

In the process of land acquisition for MMIP II, stakeholder meetings were organized several times to explain the Project and compensation policy since 2016 as shown in following table. It is noted that there should be more stakeholder meetings which have been organized by NIA PMO, however, no record is provided.

Table 7.9.1 Date and Target Barangay of Stakeholder Meeting

Date	Target Barangay	Municipality
July 23, 2014	Bulod	Pikit
July 9, 2015	Gligli	Pikit
Jan. 20, 2016	Macabual	Pikit
Jan. 26, 2016	Damalasak	Pikit
Jan. 27, 2016	Balong	Pikit
Jan. 28, 2016	Manaulanan	Pikit
Feb.5, 2018	Talitay	Pikit

*Participants numbers of male and female are 84 and 19, respectively.
Source: MMIP PMO

Minutes of each stakeholder meeting have not been prepared, however, main questions from the participants and answers are as follows:

Q1. What are the processes if the affected lot is not tilted?
A1. It is necessary to title at first, since payment is done based on the title.

Q2. We are tenant farmers, can we claim the compensation?
A2. You have right to claim only for damage to permanent crops you have planted.

Meeting in Barangay Macabual
Source: NIA-PMO

Q3. How much compensation for permanent crops?
A3. There are tariff issued by the Provincial Assessors office. We will pay for damaged permanent crops based on the tariff.

Q4. Has this Project already been authorized by MILF?
A4. The Project has a clearance with MILF before the Project starts.

Q5. I am not an owner but I am titled the lots and it was justified by the previous Barangay Captain. Is it possible for me to get the compensation for the crop damage?
A5. Follow-up if there are still chances to justify the ownership by the ex-captain.

7.10 Resettlement and Land Acquisition

7.10.1 Construction Progress

The construction of MMIP II in UMSA has been completed in 2014, and the construction has been on-going in the areas of PESA and mid-eastern part of LMSA since 2015, mid-part of LMSA since 2016, and western part of LMSA since 2017 as illustrated in following figure. Prior or in parallel with the physical construction, land acquisition has been progressing, and compensation for land loss and damaged crops/structures is still under the progress as well.

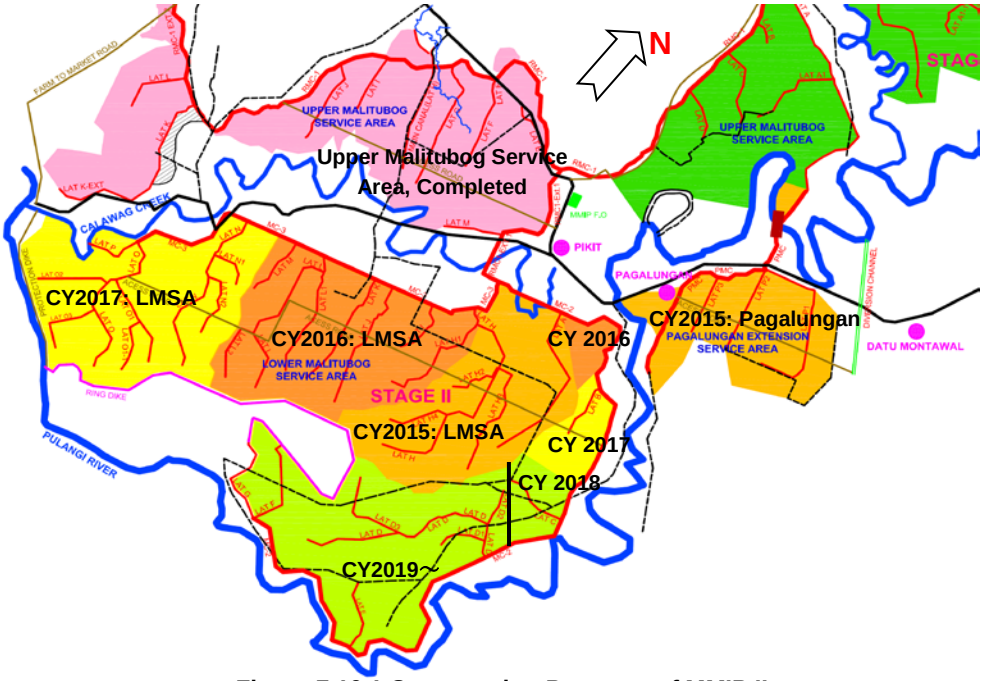


Figure 7.10.1 Construction Progress of MMIP II

Source: NIA-PMO, MMIP II

7.10.2 Land Acquisition

Components which need land acquisition are construction of main canal, lateral canals, drainages and access roads (intra-site road). Concerning the borrow area for the construction materials, the contractor will purchase the materials from the land owners through an agreement, therefore, land acquisition for the borrow area is not needed. Following tables show acquired area for each component. Construction works have been on-going in some parts of LMSA, and affected persons and damaged structures have been identified and compensated partly by NIA-PMO. However, the most southeastern part of LMSA had been initially planned to be covered by Japanese ODA loan (to be constructed after 2019), and no survey for identification of affected persons and structures has been implemented to date:

Concerning irrigation canals, areas to be acquired for **Case-1** and **Case-2** are 133 ha and 185 ha, respectively. As for drainages, there is no difference of length between both cases, and the acquired area will be 52 ha. Regarding access roads, N-2 will be excluded in **Case-1** due to flooding, therefore, acquired area will be 13 ha and 16 ha for **Case-1** and **Case-2**, respectively as shown in following tables:

Table 7.10.1 Land Acquisition Area in LMSA

Works	Area Required (ha)		
	Case-1	Case-2	Remarks
1. Irrigation Canals (LMSA)	133	185	Table 7.10.2
3. Drains (LMSA)	52	52	Table 7.10.3
4. Access Road (LMSA)	13	16	Table 7.10.4
Total	**198**	**253**	

Source: NIA-PMO, JICA Survey Team

Case-1: Construct some parts of the planned irrigation system and some parts of the drainage system within LMSA

Case-2: Construct the whole irrigation system and drainage system within LMSA

Source: JICA Survey Team

Table 7.10.2 Land Acquisition Area for Main and Lateral Canals in LMSA

No.	Canal Name	Case-1		Case-2	
		Length (m)	Area to be Acquired (ha)	Length (m)	Area to be Acquired (ha)
1	RMC-2	11,600	39.09	22,789	63.51
2	RMC-3	11,386	28.66	11,386	28.66

No.	Canal Name	Case-1		Case-2	
		Length (m)	Area to be Acquired (ha)	Length (m)	Area to be Acquired (ha)
3	LATERAL A	4,442	6.24	4,442	6.24
4	LATERAL B	1,369	1.61	1,369	1.61
5	LATERAL C	1,677	2.12	1,677	2.12
6	LATERAL D	4,640	9.62	6,341	11.85
7	LATERAL D-1	1,299	1.33	1,299	1.33
8	LATERAL D-2	2,250	1.17	2,250	1.17
9	LATERAL D-3	2,288	2.41	2,288	2.41
10	LATERAL E	0	0.00	1,948	2.14
11	LATERAL F	0	0.00	1,990	2.33
12	LATERAL G	0	0.00	2,653	2.71
13	LATERAL H	5,987	8.79	5,987	8.79
14	LATERAL H-1	3,037	3.68	3,037	3.68
15	LATERAL H-2	1,248	1.19	1,248	1.19
16	LATERAL H-3	3,007	3.23	3,007	3.23
17	LATERAL H-4	1,606	1.60	1,606	1.60
18	LATERAL I	1,648	1.70	1,648	1.70
19	LATERAL J	1,200	1.43	2,849	3.02
20	LATERAL K	1,300	1.67	2,302	2.78
21	LATERAL L	2,360	4.10	2,360	4.10
22	LATERAL L-1	1,000	1.18	2,114	2.36
23	LATERAL M	1,702	1.82	1,702	1.82
24	LATERAL N	2,500	3.81	3,510	4.78
25	LATERAL N-1	1,120	1.34	1,120	1.34
26	LATERAL N-2	1,000	1.19	1,921	1.90
27	LATERAL O	1,400	2.34	4,542	6.79
28	LATERAL O-1	0	0.00	2,320	2.83
29	LATERAL O1-1	0	0.00	1,077	1.16
30	LATERAL O-2	0	0.00	1,210	1.62
31	LATERAL O-3	0	0.00	1,794	2.29
32	LATERAL P	1,488	1.71	1,488	1.71
Total		**72,554**	**133.03**	**107,274**	**184.77**

Source: NIA-PMO

Table 7.10.3 Land Acquisition Area for Main and Lateral Drains in LMSA

No.	Drainage Name	Case-1		Case-2	
		Length (m)	Area to be Acquired (ha)	Length (m)	Area to be Acquired (ha)
1	LDC A1	547	0.21	547	0.21
2	LDC A2	1,079	0.48	1,079	0.48
3	LDC A3	1,275	0.46	1,275	0.46
4	LDC A4	882	0.49	882	0.49
5	LDC B1	2,746	1.53	2,746	1.53
6	LDC B2	1,941	0.97	1,941	0.97
7	LDC B3	651	0.26	651	0.26
8	LDC C1	1,082	0.47	1,082	0.47
9	LDC C2	874	0.36	874	0.36
10	LDC C3	1,161	0.61	1,161	0.61
11	LDC C4	689	0.28	689	0.28
12	LDC D1	1,760	0.79	1,760	0.79
13	LDC D2	1,220	0.46	1,220	0.46
14	LDC D3	940	0.32	940	0.32
15	LDC F	3,116	1.62	3,116	1.62
16	LDC H1	1,824	0.83	1,824	0.83
17	LDC H2	1,091	0.52	1,091	0.52
18	LDC H3	883	0.22	883	0.22
19	LDC H4	896	0.27	896	0.27
20	MDC-A	4,540	2.88	4,540	2.88
21	MDC-B	4,294	4.29	4,294	4.29
22	MDC-C	2,871	2.65	2,871	2.65
23	MDC-D	2,412	1.83	2,412	1.83

No.	Drainage Name	Case-1		Case-2	
		Length (m)	Area to be Acquired (ha)	Length (m)	Area to be Acquired (ha)
24	MDC-E	2,562	1.07	2,562	1.07
25	MDC-F	3,116	1.62	3,116	1.62
26	MDC-G	2,871	1.07	2,871	1.07
27	MDC-H	2,296	1.67	2,296	1.67
28	MDC-I	1,908	0.84	1,908	0.84
29	MDC-J	1,066	0.37	1,066	0.37
30	FAÇADE DRAIN	14,748	22.68	14,748	22.68
31	KALAWAG CREEK	8,460	0.00	8,460	0.00
Total		**75,801**	**52.12**	**75,801**	**52.12**

*MDC-K is also planned in LMSA, however, the length has not been fixed since it is still surveyed, and it is omitted.
**Area of Kalawag Creek is public land at this moment, and land acquisition is not necessary.
Source: NIA-PMO, JICA Survey Team

Table 7.10.4 Possible Land Acquisition Area for Access Roads in LMSA

No.	Road Name	Section of Access Road	Widening	Road Width	Case 1		Case 2	
					Length (m)	Land Acquisition (ha)	Length (m)	Land Acquisition (ha)
1	East to West Access Road	Access Road (E-1) (Existing Road) 1)	W=2.5 (m) × 2 (side)	W=2.5(m) x 2=5.0 (m) (widening both sides)	1,650	0.825	1,650	0.825
2		Access Road (N-1) (New Construction)	-	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	11,800	10.620	11,800	10.620
3	North to South Access Road-1	Access Road (N-2) (New Construction)	-	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	0	0	3,500	3.150
4	North to South Access Road-2	Access Road (N-3) (New Construction)	-	7.0 (m) +1.0 (m)×2 (both sides)=9.0 (m)	1,500	1.350	1,500	1.350
Total					**14,950**	**127.950**	**18,450**	**159.450**

Source: JICA Survey Team

The Project will be implemented by GOP, and preparation of a Resettlement Action Plan for the Project is not shouldered by the JICA Team. It means that the Survey does not cover identification of the PAPs, socio-economic survey of the PAPs, estimation of compensation cost, organization of public consultation meetings and so on. They are to be done by NIA-PMO in future.

Column: Progress of Compensation in LMSA by NIA

NIA-PMO prioritizes irrigation canal construction, parallel to the construction, identification of PAPs and compensation for damage to crops and structures by canal construction is on-going. However, the most southeastern part of LMSA has been initially planned to be covered by Japanese ODA loan. There is no construction or hauling of materials in this area, hence, as of to date there is no identification survey of PAPs done yet, more so compensation.

As for access road construction, the route for the access road is at the proposal stage as of July 2018, and it is still yet to be surveyed for alignment and design. Therefore, identification of PAPs, compensation rate setting, payment, explanation to the PAPs and so on for access road construction have yet to be done either to date.

Concerning drainage, affected structures/crops and PAPs identification are on-going, however, the final evaluation of which is still pending. According to the PMO however, it is their “practice” that PAPs are compensated on the affected crops and structures that will be damaged during the construction of the drainages; but no compensation for the acquisition of land itself.

1) Identification of Affected Persons

PAPs were identified by means of various information from LGU (Pikit) and Tax Declaration Office.

As of July 2018, 2,564 sites[12] and 110 residential structures are identified as affected. However, affected persons by construction of Lateral C, D, D-1, D-2, D-3, E, F and G have not been identified yet, since it had been planned to be covered initially by Japanese ODA loan (NIA-PMO planned the PAPs in this area would be identified under this JICA survey).

2) Socio-economic Survey

As of July 2018, a socio-economic survey targeting PAPs in MMIP II area has not been done, while it was implemented in MMIP I area. The PMO referred to the secondary data which were collected by other social surveys in MMIP II area.

3) Payment of Compensation

3.1) Compensation for damage to standing crops and structures

For irrigation canal construction in LMSA, 2,564 plots of damaged crops and 110 structures were identified as affected so far, and MMIP-PMO has already paid compensation for crop damage covering 1,261 plots and 54 structures, namely, around half of all affected crops/structures.

Identified crops to be compensated are mainly rice, corn, banana, nipa and so on, and the total area of damaged crops is 103 ha. The numbers of damaged major trees are 87,620, 13,638, 2,801 and 6,612 for banana, coconut, gemelina and nipa, respectively. On the other hand, damaged areas of rice and corn are 7.2 ha and 4.2 ha, respectively. Payment for the damaged crops and structures is still under progress as of July 2018, it is because that: 1) compensation rate is still under negotiation, and 2) official approval for payment is partly still under processing.

Regarding annual crop, NIA-PMO explained to PAPs that if possible not to plant crops, especially when there is Notice to Proceed issued to contractors. However, it is a usual scenario, especially during rainy season, when mobilization of contractors is delayed and in the same way, construction is delayed, farmers would take advantage of the availability of water and hence, planted rice and corn. And when the time comes when contractors mobilize, the crops are already maturing; hence, farmers would seek for compensation.

Some households have already shifted their residential structures. In general, they can re-construct their structures within their home compound area or its' nearby, and they do not have to resettle other unfamiliar places. They have been paid for damage to structures and they are waiting for compensation for land loss.

Location of the residence (within dot line) before demolition (left) and newly constructed house (right) of a project affected household along Main Canal 2. They are located on within the compound of the affected household.

Source: JICA Survey Team

[12] It is number of vouchers of compensation payment, not that of PAPs, which means that a person might be compensated for plural sites/structures.

3.2) Compensation for land loss

None of compensation for land loss has been finished as of July 2018. The reason for this situation is as follows:

- ✓ An evaluation survey of land value was implemented in 2003 to estimate compensation rates for irrigation facility construction, and it was revealed that actual land price varies from P11.32 - P12.5 per square meter, which is described in "ROW Committee Resolution No. 2003-01". However, determined compensation rates for land loss for paddy field and other crop field were P10.5 and P7.5 per m^2, respectively, which were much less than actual ones. Still, the amounts are applied as the compensation rates even in 2018, which is not acceptable for the PAPs.
- ✓ Only one person in Upper Malitubog Area has agreed the rates and has been paid, which means that the construction works of canals in MMIP II have been started prior to the compensation payment for land loss. It is noted that at that time, installment of compensation is allowed in Philippines, and such a condition may not be a big issue on the ground level, thus the PAPs are waiting for compensation for land loss.

The situations mentioned in the column above are not against current laws/regulations in Philippines. Moreover, the most concern for the PAPs is compensation for damage to crops, rather than that for land loss, according to the Head of PMO. However, given that it is a principle of the JICA Guidelines to provide compensation for any losses due to projects prior to land acquisition and resettlement, such situations are to be improved. It is recommended for NIA-PMO to negotiate with the PAPs to settle downs the matter.

7.11 Indigenous People Consideration

7.11.1 JICA's Safeguard Policy on Indigenous Peoples

The Law No. 91 of 1993, THE BASIC ENVIRONMENT LAW of Japan stipulates that the Japanese Government shall take necessary measures to ensure proper environmental and social considerations not only within the country but also in implementing international cooperation in the areas outside Japan[13]. In line with the provision of the said law, the Japan International Cooperation Agency (JICA) has been applying its Guidelines for Environmental and Social Considerations to its technical and financial assistance projects.

According to the said JICA Guidelines, JICA tries to avoid any adverse impact of projects on Indigenous Peoples (IPs), among any other peoples, and when it is impossible to avoid it, the JICA will fully respect IPs' rights in relation to land and resources. To this end, the consent on such a project by the IPs to be affected should be sought through "free, prior and informed consultations", and an Indigenous People Plan (IPP) must be prepared with the contents listed up in table below.

Table 7.11.1 Outlines of Indigenous Peoples Plan (IPP)

CONTENTS	
1	A review of the *legal and institutional framework* applicable to IPs ► Legal instruments of the Philippines ► JICA Guidelines for Environmental and Social Considerations

[13] Article 35 Considerations in Implementation of International Cooperation and Others of the Law No.91 of 1993. "The Basic Environment Law"

1. The State, in implementing international cooperation, shall make efforts to consider global environmental conservation etc. in the areas where the international cooperation is implemented.
2. The State shall make efforts to take necessary measures e.g. providing information to corporations, so that the corporations can properly consider global environmental conservation etc. in the areas outside Japan where these corporations conduct their business activities.

(Source: http://www.env.go.jp/en/laws/policy/basic/index.html [Accessed on 29th of June, 2018])

CONTENTS	
2	B*aseline information* on: ► the demographic, social, cultural and political characteristics of the affected IPs' communities; ► the land and territories that they have traditionally owned or customarily used or occupied; and ► the natural resources on which they depend.
3	Preparation for the consultations: ► Results of identification of *key project stakeholders* among the affected IPs' communities; ► Results of identification of *culturally appropriate process for consulting with the IPs* at each stage of project preparation and implementation
4	*Results of the free, prior and informed consultation with the IPs* to be affected on the potential adverse and positive effects of the project during the project preparation, including: ► Results of an analysis of the relative vulnerability of the IPs' communities to be affected; ► Results of identification and evaluation of necessary measures to avoid, minimize, mitigates adverse effect and to compensate for such effect; and ► Results of identification and evaluation of necessary measures for IPs to receive culturally appropriate benefits under the project.
5	*A framework for ensuring free, prior and informed consultation with the affected IP's communities during the project implementation*
6	*An Action Plan of measures to ensure that the IPs receive social and economic benefits*, including the capacity development of the implementing agencies, if necessary
7	*An Action Plan of measures to avoid, minimize, mitigate or compensate for those identified adverse effects*
8	*Cost estimates and Financing plan* for the implementation of IPP
9	*Grievance procedures to address grievances by the affected IPs' commu*nities arising from project implementation
10	*Mechanisms for monitoring, evaluation and reporting* on the implementation of IPP

Sources: JICA. 2010. JICA Guidelines for Environmental and Social Considerations.
World Bank. 2005. Operational Policy / Bank Procedures on Indigenous Peoples (OP/BP 4.10)

7.11.2 Scope of the Survey on Indigenous Peoples

The following are the assignments given to the Survey Team to clarify on IPs:

(a) To confirm the existing legal instruments and government structure regarding the protection or promotion of IPs' rights;
(b) To confirm the presence of IPs in the target project site for possible Japanese ODA Loan[14] assistance;
(c) To collect basic information on the IPs concerning the originally requested project site for Japanese ODA Loan, such as: population; social, cultural and political features; and land and resources, which are traditionally utilized by the IPs whose presence in the target project site is confirmed;
(d) To identify appropriate means for the consultation with the concerned IPs for the objectives of stakeholder analysis and of the preparation, implementation and monitoring of the project to be implemented; and
(e) To identify possible positive and negative impacts on the concerned IPs by the implementation of the project, by clarifying the number of IPs to be affected, features of impact, means of livelihoods of the IPs to be affected, their land or resource use, and their means of communication with outside of the community.

The Survey Team was engaged in above assignments, and since it was turned out that is no presence of IPs to be adversely affected by the implementation of the project, as a result of the assignment (b), there was no need to undertake the remaining assignments (c), (d) and (e). The following is the summary of results of the assignments (a) and (b).

Note that the ODA request was officially withdrawn by the Philippines government officials during an economic cooperation joint meeting held on June 21, 2018, and results of this IP survey would service

[14] According to the Special Assistance for Project Formation (SAPROF) for MMIP II, it was believed that one Indigenous tribe, the Aromanen-Manobo tribe, was present in Pikit and Carmen Municipalities of Cotabato Province.

Philippines internal procedural approval on IPs issues.

7.11.3 Related Legal Instruments and Government Structure of the Philippines

1) Related Legal Instruments

Both the 1987 Constitution of the Republic of the Philippines and the Republic Act No. 8371, Indigenous People's Rights Act (IPRA) of 1997 respect Indigenous People's rights, and the latter also gives the legal backing to the establishment of the National Commission on Indigenous Peoples (NCIP), as government authority to protect and promote IP's rights. NCIP, in the sought of its mandates, has issued several guidelines to define related concepts and terms, as well as to establish the procedure of request, complaints, investigation and consultation. Relevant legal instruments of the Republic of the Philippines on IP's rights are listed in the following table:

Table 7.11.2 Legal Instruments on Indigenous People's Rights of the Philippines

Classification	Year	No.	Official Title	Remark
Constitution	1987	N/A	The Constitution of the Republic of the Philippines	The Constitution recognizes the rights of IPs to their Ancestral Domains(ADs), their lands and resources. Moreover, it respects their basic rights and their beliefs, customs and traditions tied to the land.
Republic Act	1997	8371	An Act to recognize, protect and promote the rights of Indigenous Cultural Communities/ Indigenous Peoples, creating the National Commission on Indigenous Peoples, establishing implementing mechanisms, appropriating funds therefore, and for other purposes	This Act is known as "The Indigenous Peoples' Rights Act of 1997" (IPRA) and recognizes the Indigenous Peoples' rights to ADs and self-governance. In addition, this Act justifies the establishment of the National Commission on Indigenous Peoples (NCIP) to protect the IP's rights.
NCIP Administrative Order	1998	No.1	Rules and regulations implementing Republic Act No. 8371, otherwise known as "The Indigenous Peoples' Rights Act Of 1997"	Rules and Guidelines to crystalize how to implement the 1997 IPRA on the ground
	2012	No.1	The Indigenous Knowledge Systems and Practices (IKSPs) and Customary Laws (CLs) Research and Documentation Guidelines	
	2012	No.2	The General Guidelines on the Confirmation of Indigenous Political Structures and the Registration of Indigenous Peoples' Organizations	
	2012	No.3	The Revised Guidelines on Free and Prior Informed Consent (FPIC) and related processes	
	2012	No.4	Revised Omnibus Rules on Delineation and Recognition of ADs and Ancestral Lands	

Source: Republic Act No. 8371

This JICA Survey adopts the following definition of IPs, which is provided by the Republic Act No. 8371 of 1997, IPRA, and it reads:

> *"a group of people or homogenous societies identified by self-ascription and ascription by others, who have continuously lived as organized community on communally bounded and defined territory, and who have, under claims of ownership since time immemorial, occupied, possessed and utilized such territories, sharing common bonds of language, customs, traditions and other distinctive cultural traits, or who have, through resistance to political, social and cultural inroads of colonization, non-indigenous religions and cultures, became historically differentiated from the majority of Filipinos. ICCs/IPs shall likewise include peoples who are regarded as indigenous on account of their descent from the populations which inhabited the country, at the time of conquest or colonization, or at the time of inroads of nonindigenous religions and cultures, or the establishment of present state boundaries, who retain some or all of their own social, economic, cultural and political institutions, but who may have been displaced from their traditional domains or who may have resettled outside their ancestral domains".*

In addition to the above definition of IPs, the definitions of other important and relevant terms, such as "Ancestral Domains (ADs)", "Ancestral Lands", "Certificate of Non-Overlap", "Certification Precondition", "Field-Based Investigation", "Free and Prior Informed Consent", "Indigenous Cultural Community / Indigenous Peoples", "Indigenous elder / leader", and "Time Immemorial" are also found in the same Republic Act No. 8371 of 1997, IPRA or in the NCIP Administrative Order No. 3, Series of 2012. The Preparatory Survey has adopted the definitions of these terms in the survey to meet the scope mentioned above.

2) Government Structure: National Commission on Indigenous Peoples (NCIP)

NCIP was established upon the enactment of the Republic Act of No. 8371 of 1997, IPRA, with the mission to "formulate and implement policies, plans and programs for the recognition, promotion and protection of the rights and well-being of IPs with due regard to their ADs and lands, self-governance and empowerment, social justice and human rights, and cultural integrity".

In particular, NCIP ensures the land rights of IPs by issuing the Certificate of Ancestral Domain Title/ Certificate of Ancestral Land Title (CADT/CALT), after conducting assessments by themselves upon the submission of applications by IPs. NCIP also recognizes indigenous political structures, based on the actually functional systems on the ground, which are commonly accepted justice systems, conflict resolution mechanisms, peace-building processes, and customary laws. NCIP also supports IPs to establish and control their educational systems and to protect indigenous knowledge systems and practices.

The target area for the Japanese ODA Loan originally requested belongs to the Lower Malitubog Service Area (LMSA), and the entire LMSA is located in the jurisdiction of the NCIP Regional Office of Region XII.

7.11.4 Screening of the Presence of IPs and ADs to be affected

1) Overview of IPs

Since there is no reliable data of the population of IPs in the Philippines, accurate figures of their populations at any level in the Country are unknown. However, according to results of a survey conducted by NCIP, the population of IPs at the national level could be estimated at between 12 and 15 million, constituting almost 10 to 15% of the total population of the Country. The IPs are classified into 110 ethno-linguistic groups, spreading over 65 out of the 78 provinces in the Country, with a concentration in Mindanao (61%) and Northern Luzon (Cordillera Administrative Region, 33%) .

As afore-mentioned, the IPs are concentrated in Mindanao sharing as much as 61%. In Mindanao, it has been confirmed the presence of Muslim IPs and other IPs who are neither Muslim nor Christian (called Lumad), in addition to settlers who are mainly Christians and originally from outside Mindanao Island.

2) Recognition on the Presence of IPs by Key Stakeholders

Key local stakeholders for the implementation of MMIP II asserted that there is no presence of IPs in the area for which Japanese ODA Loan was originally requested. Upon consulted in different occasions, the Coordinator of the Moro Islamic Liberation Front (MILF) for the Task Force formed for the Preparatory Survey on MMIP II, the officials of the PMO of MMIP of the National Irrigation Authority (NIA-PMO) and the Pikit Municipal Officers, respectively, stated that there is no presence of IPs in the target area for the requested Japanese ODA Loan. Having such statements by the key local stakeholders, the Survey Team contacted NCIP to confirm non-presence of IPs to be affected by the implementation of MMIP II in the concerned area.

3) Free and Prior Informed Consent Process for IPs, including the Field-Based Investigation Process

The contents of the NCIP Administrative Order No. 3, Series of 2012 are the "Revised Guidelines on Free and Prior Informed Consent (FPIC) and related processes". This illustrates details of the FPIC process stipulated by the Republic Act No. 8371 of 1997, IPRA. The entire FPIC process is practically consisting of two parts: before and after the Field-Based Investigation (FBI) Process, as shown in Figure 7.11.1.

The application to start the FPIC process should be submitted by the appropriate regulatory agency or unit of government or by the proponent, who are owners of plan, project, program or activity to the NCIP Regional Office that has jurisdiction over the area where the concerned plan, project, program or activity are to be undertaken. Upon the receipt of such an application, the NCIP Regional Director assigns the FBI team by issuing a memorandum to start the process.

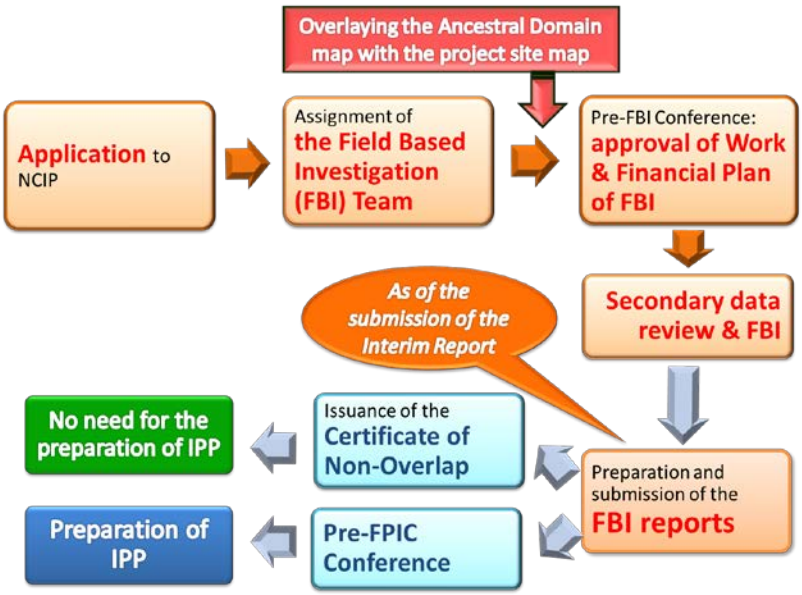


Figure 7.11.1 FBI Process & Preparation of IPP

Source: NCIP. 2012. Administrative Order No. 3

The purpose of the FBI is to determine: 1) whether or not the plan, program, project or activity overlaps with, or affects an ancestral domain; 2) the extent of the affected area; and 3) the Indigenous Cultural Communities (ICCs)/ IPs whose FPIC is to be obtained. To this end, the FBI team is tasked to fulfil the following duties;

1) Consult with the Ancestral Domain (AD) representatives, if applicable;
2) Conduct the pre-FBI Conference and along with the proponent, prepare the Work and Financial Plan (WFP) for FBI;
3) Undertake FBI to determine the particular area that will be affected, including the projection of the indorsed technical description/geographic coordinates in the AD, the probable effects of the plan, program, project or activity, and the number of ICCs/IPs that will be affected,
4) Identify the elders/leaders and determine presence of disputes/conflict with adjacent ancestral domain/s;
5) Prepare, under oath, and submit a report with recommendations to the Regional Director;
6) Liquidate all funds handled in accordance with standard accounting and auditing rules and regulations; and
7) Perform such other functions as may be directed by higher authorities.

The FBI team shall develop WFP of the FBI process, and once an agreement on WFP is made among the key stakeholders through the pre-FBI Conference, the FBI team can actually start to undertake their literature review and investigation on the ground. The FBI team should submit the FBI report to the NCIP Regional Director at the end of the FBI process, so that the Regional Director takes necessary actions in accordance with the conclusion of the FBI report.

If the FBI report concludes that there is no presence of ADs and IPs to be affected by the implementation of the concerned plan, program, project or activity, the Regional Director of the NCIP can issue the Certificate of Non-Overlap (CNO) and there will be no need to develop IPP. To the contrary, if the FBI report concludes that there are ADs or IPs to be affected, the NCIP Regional Director assigned the FPIC team to go through the FPIC process with the concerned IPs. Eventually, IPP shall be prepared and implemented to ensure that the IPs to be affected will receive social and economic benefits, while those adverse effects on the same IPs will be avoided, minimized, mitigated or compensated.

7.11.5 Results of the Field Based Investigation

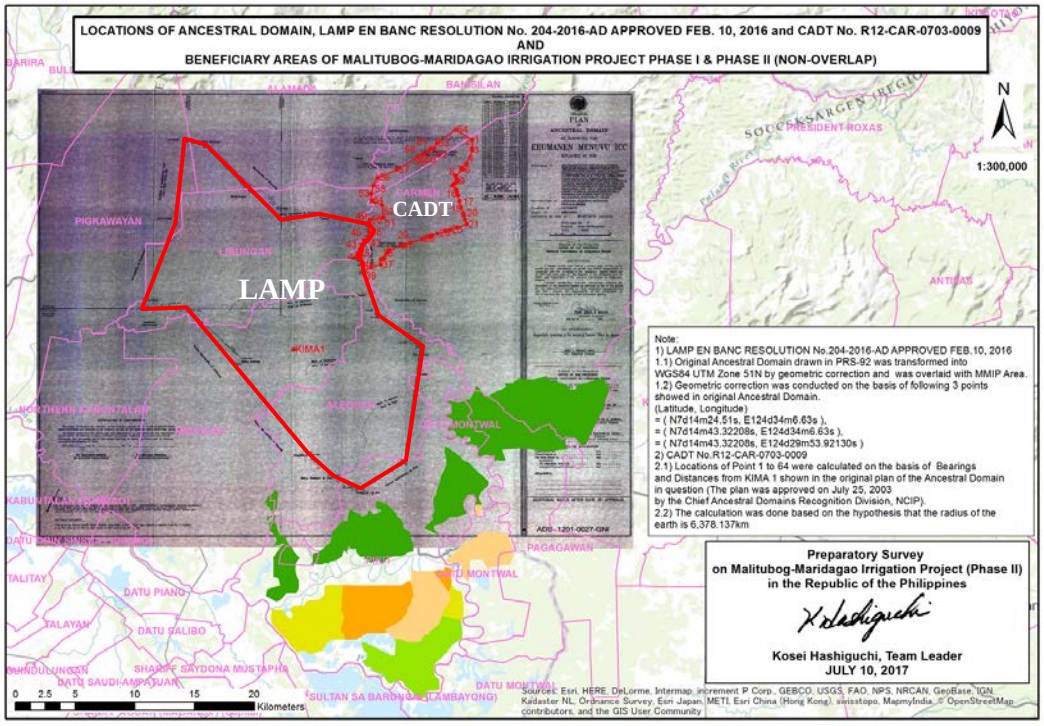
Upon contacted by the Survey Team at the end of May 2017, NCIP decided to take the Field-Based Investigation (FBI) process for the target area initially requested for Japanese ODA Loan within LMSA through its Regional Office in Region XII. After going through the FBI process, on July 5 of 2017, the FBI report was submitted to the NCIP Regional Director of the Region XII by the leader of the FBI team, with the conclusion that there is no AD and IP in the target area to be affected by the implementation of the project. The actual FBI process took place as follows:

On May 29, 2017, the Director of the NCIP Region XII appointed the three officials at the regional level to form the ad-hoc FBI team. The FBI team and the Survey Team agreed to overlay the map of the target project site with the maps of two different ADs which are located nearby of the target project site. The results of the overlaying the map is shown in Figure 7.11.2. It clarifies that the target project site remains away from the two ADs, and there is no overlap between the target project site and the two ADs.

Concurrently, the FBI team convened the pre-FBI Conference on June 29, 2017 by inviting two indigenous leaders from the ADs mentioned above. Representatives from NIA-PMO and the JICA Team have also attended the same conference in order to inform the conference of the objectives and contents of MMIP II. As a result of the pre-FBI Conference, WFP for FBI was agreed by all the participants.

Subsequently, the FBI team conducted FBI in accordance with WFP, with financial and logistical support from the JICA Survey Team, and the FBI team prepared the FBI report based on the findings from FBI, and submitted it to the NCIP Regional Office XII for the approval on July 5, 2017. The said FBI report concluded as follows:

1) The Proposed project sites under MMIP II traversing Barangays Baguinged, Barungis, Buliok, Bulol, Kabasalan, Rajah Muda and Talitay all in the Municipality of Pikit, Cotabato are outside Ancestral Domain of Indigenous Cultural Communities/ Indigenous Peoples as per projection with the CADT maps and actual site inspection together with CADGT representatives;
2) There are no Indigenous Cultural Communities/ Indigenous Peoples present in the afore-said areas that will be affected during the implementation of the said Project;
3) The said Barangays are patently Bangsamoro territory;
4) The said Barangays are very suitable for rice production and it is highly recommended that an irrigation system will be implemented in the area; and
5) The Barangay Official/ Representatives expressed full support and cooperation on the role of concerned Barangay Officials and members of the community in the realization of the Malitubog-Maridagao Irrigation Project –II (MMIP II) that will surely address the food security in the area and in the Region as whole.



Note: KIMA 1 is the base point to locate the AD of CADT: 7° 12' 50.90295"N, 124° 34' 42.67226"E, Northing 797771.6801, Easting 453282.1548, Location Kimango.

Figure 7.11.2 Non-overlap among the Ancestral Domain, LAMP, CADT No. R12-CAR-0703-0009 and the Entire MMIP Site

Source: NCIP Region XII and NIA-PMO

Since it was confirmed that there is no presence of ADs and IPs to be affected by the implementation of the project in the target project site initially requested for Japanese ODA Loan, through the FBI process, there is no need to prepare IPP and to go through the FPIC process within the framework of this Preparatory Survey.

7.12 Recommendation

As discussed so far, some environmental impacts will be caused by the Project. However, the extent of impacts is not very significant, since the proposed components will not cause dynamic change of hydrological conditions. Still, it is noted that some bird species are threatened by hunting, and it is requested to control such illegal activity regardless of the Project. On the other hand, land acquisition and damage to standing crops/structures are caused for construction works and compensation is on-going. However, the PAPs have not accepted the proposed compensation rates for land loss due to its low amount. As a result, the construction works were started and are on-going without payment of compensation for land loss. It is recommended to negotiate with the PAPs to fix the compensation rates and to finalize the payment.

NIA-PMO has already organized a series of stakeholder meetings to explain the Project for the local residents so far. However, they did not prepare minutes of meetings including participant's lists in writing[15]. It is very important to keep records of such discussions in case any troubles are observed, and it is recommended to make minutes with participant lists when NIA-PMO organizes stakeholder meetings.

[15] Participants list for Feb 5 2018 has been prepared.

CHAPTER 8 GLOBAL ISSUES

This chapter discusses the proposed components in relation to such global issues as poverty reduction, climate change, and gender. It means that this chapter explores the possibility of: 1) reduction of poverty for the beneficiaries covering both direct beneficiaries and indirect-beneficiaries, 2) mitigating or coping with negative impacts of climate change, and 3) relevance to gender significance:

8.1 Poverty Reduction

Following table shows the poverty ratios of 5 years from 1991 to 2015 and Figure 8.1.1 shows the poverty ratios in 2015 by region. For the Region XII and ARMM, the poverty ratios of Cotabato province and Maguindanao province are also indicated where the MMIP site falls in. In fact, the poverty ratios of Region XII and that of ARMM are very high, especially the ratio of ARMM/ Maguindanao is the highest in the Philippines; almost 3 times higher than that of whole nation, about 48% vs. 16.5% in 2015. Region XII is also ranked at the 2nd lowest group with Regions VIII, X and Caraga.

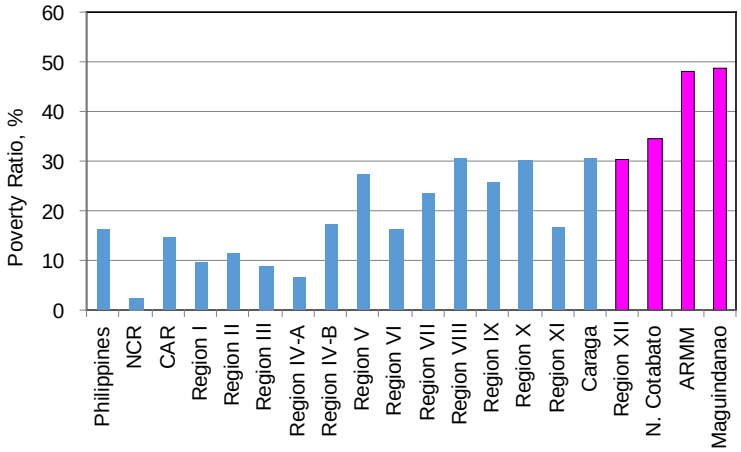


Figure 8.1.1 Poverty Ratio by Region (2015)

Source: National Statics Authority

Table 8.1.1 Poverty Ration by Region in Philippines (1991 – 2015)

Region/Province	Poverty Incidence among Families (%)				
	1991	2006	2009	2012	2015
Philippines	29.7	21.0	20.5	19.7	16.5
NCR	5.3	2.9	2.4	2.6	2.7
CAR	36.7	21.1	19.2	17.5	14.9
Region I	30.6	19.9	16.8	14.0	9.6
Region II	37.3	21.7	20.2	17.0	11.7
Region III	18.1	10.3	10.7	10.1	8.9
Region IV-A	19.1	7.8	8.8	8.3	6.7
Region IV-B	36.6	32.4	27.2	23.6	17.4
Region V	48.0	35.4	35.3	32.3	27.5
Region VI	32.3	22.7	23.6	22.8	16.6
Region VII	38.2	30.7	26.0	25.7	23.6
Region VIII	42.3	33.7	34.5	37.4	30.7
Region IX	36.4	40.0	39.5	33.7	26.0
Region X	42.6	32.1	33.3	32.8	30.3
Region XI	34.1	25.4	25.5	25.0	16.6
Caraga	48.5	41.7	46.0	31.9	30.8
Region XII	47.4	31.2	30.8	37.1	30.5
Cotabato	NA	25.6	23.4	44.8	34.5
ARMM	26.9	40.5	39.9	48.7	48.2
Maguindanao	NA	46.4	43.3	54.5	48.8

Source: Philippine Statistics Authority, 2016

Worse, the poverty ratios of Region XII and ARMM, including North Cotabato and Maguindanao, have not significantly reduced, or rather once increased in the year 2012. This trend is very much contrary to most of the other parts of Philippines. Though the overall poverty ration of Philippines has reduced from 29.7% in 1991 to 16.5% in 2015, by as much as 13.2 % over the 24 years, the ratios for Region XII and ARMM, including Cotabato and Maguindanao, have not reduced at all.

For example, ARMM started with relatively lower poverty ratio, 26.9% in 1991, and it has almost continuously increased reaching almost 50% nowadays. Maguindanao has followed almost the same

trend of ARMM with somewhat higher poverty incidences. Region XII started, on contrary, with higher poverty ratio with 47.4% in 1991, and reduced towards the year 2006, after which however the reduction of the poverty ratio had stopped. The poverty ratio has been more than 30% for the Region XII.

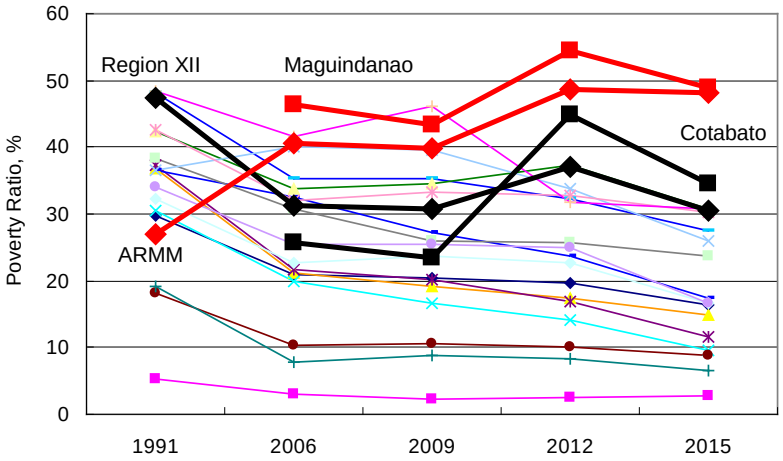


Figure 8.1.2 Trend of Poverty Ratio by Region (1991-2015)
Source: National Statics Authority

There are components which can raise the income of the beneficiaries through the increase of production of agricultural produces; namely, 1) irrigation and drainage development, and 2) agriculture and extension development. For these components, increase of the farm budgets is estimated as follows by comparing the before-after projects, showing approximately an increase of 70 - 89% in the farm budget (Table 8.1.2.); thus, the Project will contribute to mitigating the poverty of the beneficiaries:

Table 8.1.2 Estimated Farm Budget comparing the Before-After Projects

SN	Case	Estimated No. of Farm Household without Project; MMIP II Area overall (FHHs)	Estimated No. of Farm Household with Project; MMIP II Area overall (FHHs)	household Income without Project (Php/FHH)	household Income with project (Php/FHH)	Ratio b/t with & without Project, (%)
Case-1 (irrigation canals to be constructed within areas where inundation is not more than 50cm)						
1	C1-M2-D00	1,601	6,107	90,967	172,347	1.89
2	C1-M2-D30	1,601	6,107	90,967	167,995	1.85
3	C1-M2-D50	1,601	6,107	90,967	165,384	1.82
4	C1-M2-D80	1,601	6,107	90,967	161,322	1.77
Case-2(irrigation canals to be constructed as per the original plan covering whole LMSA)						
5	C2-M2-D00	1,601	8,429	90,967	166,858	1.83
6	C2-M2-D30	1,601	8,429	90,967	162,080	1.78
7	C2-M2-D50	1,601	8,429	90,967	159,212	1.75
8	C2-M2-D80	1,601	8,429	90,967	154,752	1.70

Source: The Survey Team, the detailed calculation is shown in Chapter V

8.2 Climate Change

8.2.1 Climate Change Review and Future Simulation

Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) had conducted a climate change simulation by using PRECIS model[1] and shared the results in February 2011[2]. The simulation, as the first step, reviewed about past 60 years climate change according to the actual records observed from 1951 to 2009 with the average for the period of 1971 – 2000 as the reference value. The key findings from the actual records are summarized as follows:

1) There has been an increase in annual mean temperature by 0.57 °C, meaning about 0.1 °C

[1] PRECIS stands for 'Providing Regional Climates for Impact Studies' model, which was developed by the UK Met Hadley Centre in the United Kingdom to facilitate impact, vulnerability and adaptation assessments in developing countries where capacities to do climate modeling are still not fully developed or do not exist.
[2] In 2009, the Government of the Philippines initiated the implementation of the Millennium Development Goals Fund (MDGF) Joint Programme entitled "Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change". It was a three-year program funded by the Government of Spain through the United Nations Development Program (UNDP) Philippines and the various UN agencies (UNEP, FAO, WHO, UN Habitat, and others). Under this program, the climate change simulation was conducted.

increase per decade (see Figure 8.2.1);

2) In terms of maximum and minimum temperatures, the increases have been 0.35 °C and 0.94 °C;

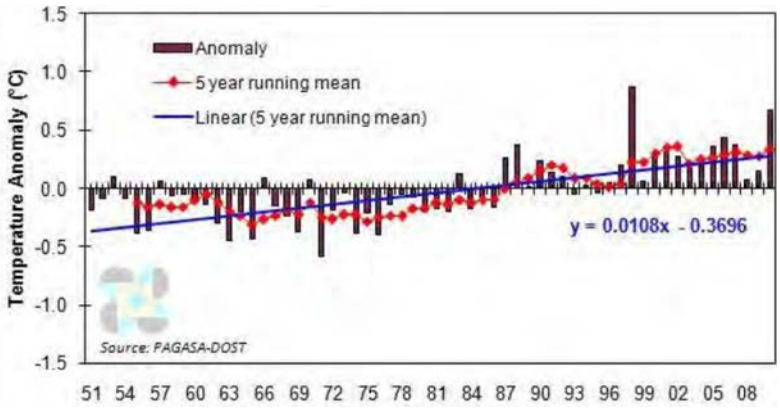


Figure 8.2.1 Trend of Annual Mean Temperature with Anomalies in the Philippines Based on 1971-2000 Normal Values
Source: PAGASA-DOST, Feb. 2011

3) Results of analysis of trends of tropical cyclone occurrence/ passage within the so-called Philippine Area of Responsibility (PAR) show that an annual average of 20 tropical cyclones cross the PAR per year with strong multi-decadal variability, that there still is no indication of increase in the frequency as shown in Figure 8.2.2. It is noted that in general frequency of tropical cyclones in Mindanao are few as compared to other parts of the Philippines, and further there may be a slight trend of the occurrence of cyclones being fewer.

4) The analysis of trends of extreme daily temperatures and extreme daily rainfall indicate significant increase in number of hot days but decrease of cool nights, and those of rainfall in terms of extreme rainfall intensity and frequency are not clear, both in magnitude (by what amounts) and direction (whether increasing or decreasing), with very little spatial coherence.

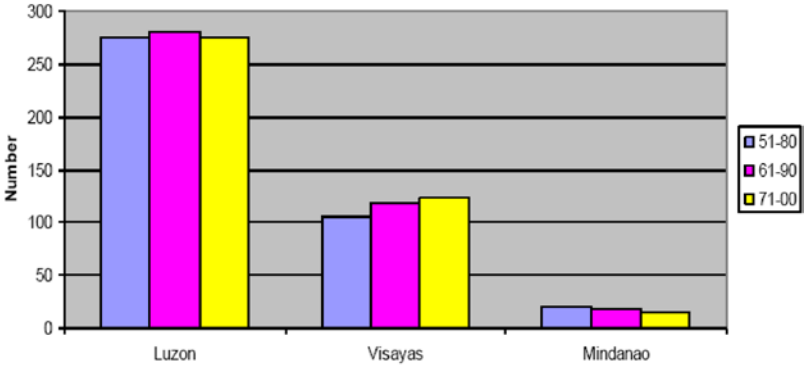


Figure 8.2.2 Decadal Changes in Intense Tropical Cyclone Occurrence in the Three Main Islands in the Philippines (1951-2000)
Source: PAGASA-DOST, Feb. 2011

Following the examination of past actual records as above-summarized, PRECIS model simulated future climates in 2020 and 2050 under the mid-range climate change scenario[3]. The simulation results were presented in detail for the sole reason that future climates in the next 30 to 40 years will be greatly influenced by the past greenhouse gas emissions already there (i.e., lifetimes of carbon dioxide are estimated at a hundred years or more). The key findings for the simulation are:

1) All areas of the Philippines will get warmer, more so in the relatively warmer summer months;

2) Annual mean temperatures (average of maximum and minimum temperatures) in all areas in the Country are expected to rise by 0.9 °C to 1.1 °C in 2020 and by 1.8 °C to 2.2 °C in 2050;

3) Likewise, all seasonal mean temperatures will also have increases in the two-time slices of dry

[3] In fact, three of the emission scenarios developed by the Intergovernmental Panel on Climate Change in its Special Report on Emission Scenarios (IPCC SRES) were chosen to run the PRECIS model; namely, A2 (high-range), A1B (mid-range), and B2 (low-range). However, in the PAGASA report, the mid range simulation results (A1B) were only highlighted because the future climates in the next 30-40 years will be greatly influenced by the past emissions, principally due to the long lifetimes of carbon, hence this chapter also refers to only the A1B scenario simulation results.

and wet seasons, and these increases during the four seasons, e.g., DJF[4], MAM, JJA and SON, are quite consistent in all the provinces;

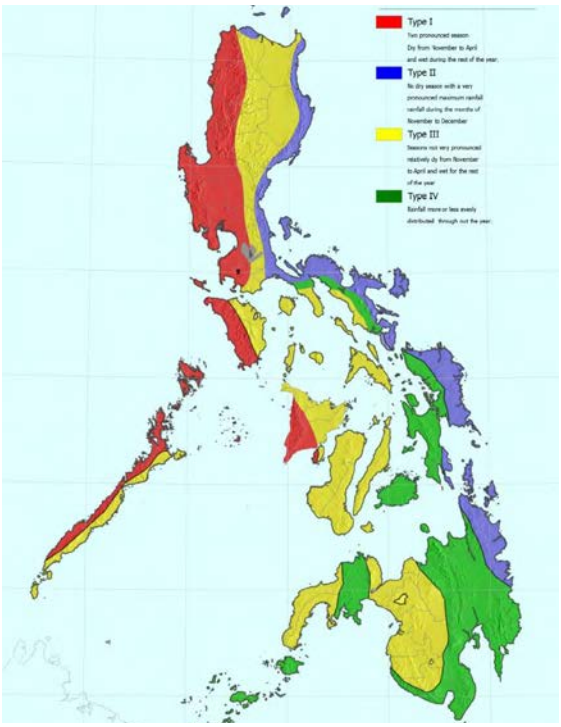
4) In terms of seasonal rainfall change, generally, there is a substantial spatial difference in the projected changes in rainfall in 2020 and 2050 in most parts of the Philippines, with reduction in rainfall in most provinces during the summer season (MAM) making the usually dry season drier, while rainfall increases are likely in most areas of Luzon and Visayas during the southwest monsoon (JJA) and the SON seasons, making these seasons still wetter, and thus with likelihood of both droughts and floods in areas where these are projected;

5) The northeast monsoon (DJF) season rainfall is projected to increase, particularly for areas characterized by Type II climate (shown along eastern seashores of the Philippines, see box right) with potential for flooding enhanced;

6) During the southwest monsoon season (JJA), larger increases in rainfall is expected in provinces in Luzon (0.9% to 63%) and Visayas (2% to 22%) but generally decreasing trends in most of the provinces in Mindanao in 2050;

7) However, projections for extreme events in 2020 and 2050 show that hot temperatures (indicated by the number of days with maximum temperature exceeding 35 °C) will continue to become more frequent, number of dry days (days with less than 2.5 mm of rain) will increase in all parts of the Country and heavy daily rainfall (exceeding 300 mm) events will also continue to increase in number in Luzon and Visayas.

Classification of climate in the Philippines:
The classification in the Philippines uses the Corona's four climate types (Types I to IV), based on monthly rainfall received during the year. A province is considered to have Type I climate if there is a distinct dry and a wet season; wet from June to November and dry, the rest of the year. Type II climate is when there is no dry period at all throughout the year, with a pronounced wet season from November to February. On the other hand, Type III climate is when there is a short dry season, usually from February to April, and Type IV climate is when the rainfall is almost evenly distributed during the whole year. The western part of Mindanao falls in Type III while mid to eastern parts of Mindanao dose in Type VI climate zone. The MMIP area falls somewhat in between the Type III and Type IV.



Summarizing the above climate change in future over the Philippine islands, Figure 8.2.3 shows the projected seasonal (3-month) temperature increase in 2020 and in 2015. Mindanao island, where the MMIP II project is located, indicates bigger temperature increase as compared to other parts of the Philippines. In addition, the increase shows up bigger during the periods of March-April-May and June-July-August.

Concerning the 3-month seasonal rainfall shown in Figure 8.2.4, Mindanao island area clearly shows that at the year 2020 the seasonal rainfall increases in December – February, very much decreases from March to May, decreases from June to August and a little decreases from September to November. A the year 2050, the trend is more or less same as those of year 2020 though it is more intensified in the trend of increase or decrease.

[4] DJF means December, January, and February, and MAM, JJA and SON are as well, namely 3-month period is grouped in one season.

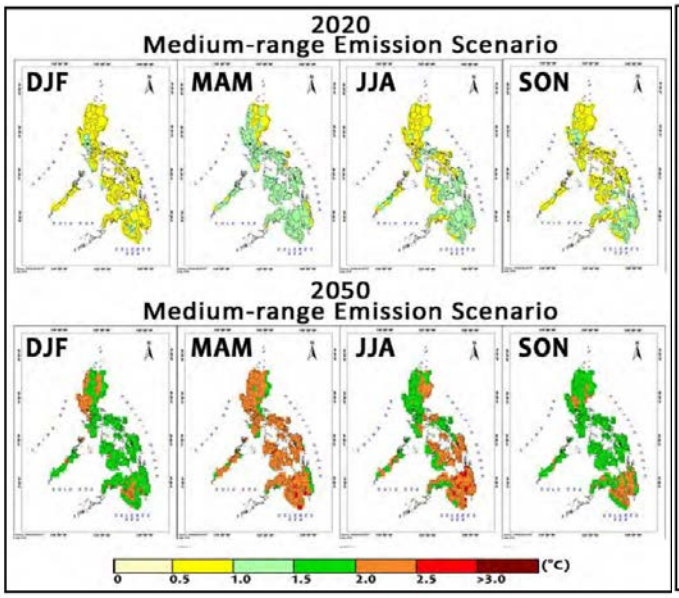


Figure 8.2.3 Projected Seasonal Temperature Increase
Source: PAGASA-DOST, Feb. 2011

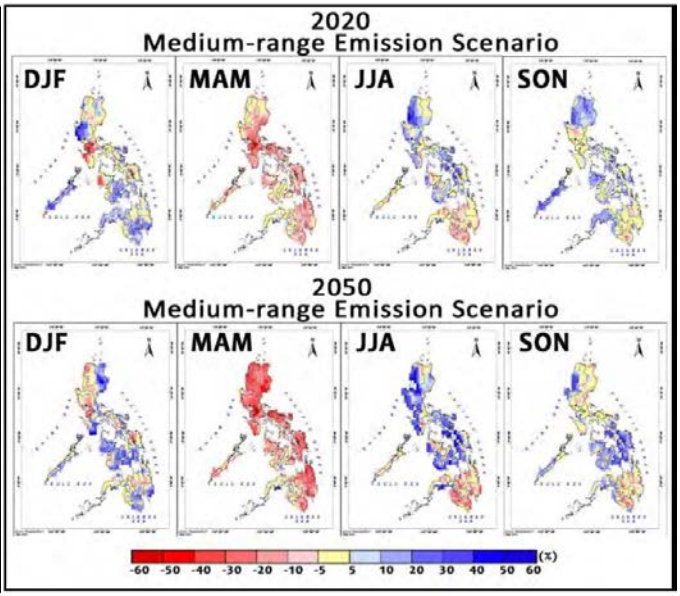


Figure 8.2.4 Projected Seasonal Rainfall Increase, %
Source: PAGASA-DOST, Feb. 2011

PAGASA's report further elaborates the climate change in terms of temperature and rainfall by region and by major province. Since MMIP II area falls mostly in Cotabato province and partly Maguindanao province, ARMM, following tables excerpt seasonal (3-month) temperature increase and rainfall change for the Cotabato and Maguindanao area; Table 8.2.1 for temperature change and Table 8.2.2 for rainfall change. From those tables, following area deduced;

From the average temperature of 1971 – 2000, the temperature increases by about 1 °C or a little more than that for the both Cotabato and Maguindanao at the year 2020, and further by about 2 °C or more than that at the year 2050. With respect to rainfall, it is to increase from September to February at the year 2020 while the rainfall from March to August is to decrease for both Cotabato and Maguindanao area. At the year 2050, the rainfall from September to November now changes to decrease, and further the rainfall for December to February of Maguindanao also decreases.

Table 8.2.1 Seasonal Temperature Increases in 2020 and 2050 under Medium-range Emission Scenario

Province	Particulars	DJF	MAM	JJA	SON
Cotabato	1971-2000, observed, °C	26.8	27.9	27.0	27.1
	Change in 2020, °C	1.0	1.3	1.2	1.1
	Change in 2050, °C	2.1	2.5	2.4	2.1
Maguindanao	1971-2000, °C	27.6	28.3	27.5	27.6
	Change in 2020, °C	1.0	1.2	1.2	1.1
	Change in 2050, °C	2.1	2.3	2.4	2.1

Source: Climate Change in the Philippines, Feb. 2011, PAGASA

Table 8.2.2 Seasonal Rainfall Change in 2020 and 2050 under Medium-range Emission Scenario

Province	Particulars	DJF	MAM	JJA	SON
Cotabato	1971-2000, observed, mm	235.4	353.2	572.5	486.0
	Change in 2020, %	14.8	-5.9	-6.1	1.6
	Change in 2050, %	8.1	-4.5	-8.7	-4.2
Maguindanao	1971-2000, mm	293.8	369.4	661.5	562.2
	Change in 2020, %	7.2	-6.3	-7.2	0.3
	Change in 2050, %	-1.1	-4.6	-7.4	-3.6

Source: Climate Change in the Philippines, Feb. 2011, PAGASA

Further, Table 8.2.3 summarizes the frequency of extreme events for the past (1971 to 2000) and same

30 years with the mid year of 2020 and 2050. Note that the simulation result at Cotabato is not available, and therefore superseded by General Santos located in South Cotabato. The table shows clearly that there will be many hotter days, more than 35 °C, in future. Dry days where there is no rainfall would also increase in general. Torrential rainfall days do the same especially in Maguindanao area.

Table 8.2.3 Frequency of Extreme Events in 2020 and 2050 under Medium-range Emission Scenario

Province	Particulars	No. of days w/ Tmax > 35	No. of Dry Day	No. of Days w/ Rainfall > 150m
South Cotabato (General Santos)	1971-2000, observed	1,397	8,704	1
	2020, Projected	3,748	7,526	1
	2050, Projected	6,430	8,052	2
Maguindanao (Cotabato)	1971-2000, observed	383	3,516	2
	2020, Projected	3,382	5,471	10
	2050, Projected	5,994	5,788	5

Note: the number of counts is made for a period of 30 years covering both earlier and later years from 2020, and 2050.
Source: Climate Change in the Philippines, Feb. 2011, PAGASA

8.2.2 Project Intervention in the Climate Change

Major issues relating to climate change are probably: 1) temperature increase and 2) less amount of dry season (September to February) rainfall at the long run of year towards 2050 though the seasonal rainfall amount in the coming near 2020 is to increase, based on the past review of the climate change as well as the simulation result covering up to 2050.

A rise of 1 – 2 ºC combined with lower solar radiation has a potential to cause rice spikelet sterility (i.e. infertile rice seeds). In general, rice becomes sterile if the paddy is exposed to temperature above 35 ºC for more than one hour during flowering and consequently produces no grain[5]. Furthermore, higher temperatures would increase the incidence of crop diseases, insect pests and rodents. To avoid this sterility associated with high temperature, there should be a new variety, which can stand against the high temperature or otherwise the flowing and pollination should be made during not-day time but during early morning time. This kind of research is not included in the components proposed under this Project. This kind of research could better be undertaken by an international institute, e.g. IRRI.

On the other hand, the major component of MMIP II, the irrigation and drainage development, can cope with or at least mitigate the impact of climate change concerning anomalies of the rainfall pattern. The change of the monsoon season could be very much associated with intensive rainfall pattern, meaning the rain tends to fall at once with severer intensity, often resulting in torrential rain and flood, as has been already observed. The component of irrigation and drainage construction would work in mitigating this climate change, rainfall and monsoon season pattern change.

As per its nature, irrigation system to be developed would be able to supply on-time water at the onset of monsoon season which is predicted becoming unstable. The irrigation systems developed are expected to provide supplemental water to the unstable rainfall during monsoon season, and accordingly the developed system would contribute to mitigating and coping with the negative impact of climate change, especially the unstable rainfall pattern.

Irrigation water during monsoon season is supplemental to the rainfall, while the irrigation during the dry season is the essential one. The headworks to withdraw irrigation water are constructed on the Maridagao river, and there is no storage reservoir in the upstream. It means that the water availability

[5] Referred to in the UNEP report 'Myanmar's National Adaptation Programme of Action (NAPA) to Climate Change (2012), Karim, Z., 1996. Agricultural Vulnerability and Poverty Alleviation in Bangladesh. In Climate Change and World Food Security, T.E. Downing (Ed.), NATO ASI Series, 137. Springer-Verlag, Berlin, Hiedelberg, 1996. pp. 307-346.

at the intake point is fully dependent on the rain falling in the catchment area. As obviously practiced, the water in the river for irrigation purpose is more than enough during the rainy season while that during dry season may become critical if the replenishing rainfall during the dry season becomes very marginal.

With the afore-mentioned Table 8.2.2, rainfall during monsoon season will decrease by 5 – 9 % which could work, in general, in reducing flooding/ inundation. On the other hand, dry season's rainfall in year 2020 is not so changed from the observed records from 1971 to 2000, or rather it is increased, and the rainfall is to decrease in the long run, say in the year 2050. This trend may imply that the dry season's river water may be reduced in the long-run, so that water management with water saving irrigation technology may have to be introduced.

Concerning the dry season's rainfall decrease, there is still an opportunity for keeping dry season irrigation as it has been. Cotabato rainfall from December to February still shows 8.1 % increase even in year 2050 (see Table 8.2.2). As is well known, paddy cultivation needs the maximum amount of irrigation water during the land preparation period, which means if the dry season paddy cultivation could start as early as the time right after the harvest of monsoon season paddy, there could be still enough amount of water in the river, or even more amount of water than the present condition due to the increased rainfall from December to February in future.

8.3 Gender

8.3.1 Current Gender Conditions in the Philippines

1) In the Philippines

According to JICA[6], the Philippines is one of those six countries in the world, which have been able to significantly narrow gender gaps in education and health indicators. The values of economic indicators for women continue improving and women are achieving income equality for similar works. Based on what was mentioned above, the Philippines is the only country in the world where both women and men equally play in senior management roles in the society. Women have marked their salient achievements in different areas, including academic, professional, political and legislative areas.

However, at the same time, there are women suffering from sex and gender based abuses, such as domestic violence, economic disadvantages, discrimination at the workplace, exploitation as migrant workers, and adverse impact brought about by the intermittent wars in conflict affected areas. As in most countries affected by armed conflict, women and children make up the great majority of the displaced population in the Philippines. The intermittent wars affect women's livelihood, health, education and family life, among other things.

The Philippine Commission on Women (PCW) is the National Machinery[7] on women and gender equality concerns. The PCW was formerly known as the National Commission on the Role of Filipino Women (NCRFW) until August 14, 2009. This was the date that NCRFW was renamed as PCW and its mandate was expanded by the enactment of Republic Act 9710, Magna Carta of Women (MCW).

Women's concerns were positioned at the heart of the government agenda with the integration of the gender equality principle in the 1987 Philippine Constitution. It was during this period, that the first Philippine Development Plan for Women (PDPW), 1989-1992 was adopted, and enacted shortly was the "Women in Nation-Building Act" (RA 7192), which promotes the integration of women as full and equal partners of men in development and nation-building.

[6] JICA. 2008. Gender Profile of the Philippines.
[7] http://www.gender.go.jp/english_contents/about_danjo/lbp/basic/toshin-e/org-e.html
http://www.un.org/womenwatch/daw/news/natlmach.htm

The Philippine Plan for Gender-Responsive Development (PPGD) 1995-2025 was adopted as the country's main vehicle for implementing the 1995 Beijing Declaration and Platform for Action (PFA). In order to operationalize the PPGD, the Framework Plan for Women (FPW) was developed in 2001, whose three priority areas are; 1) promotion of women's economic empowerment, 2) protection and advancement of women's rights, and 3) promotion of gender responsive governance.

Another milestone achievement was the passage of the legislation on the Gender and Development (GAD) Budget. The GAD Budget provision mandated all government agencies and instrumentalities including local government units (LGUs) to allocate a minimum of five percent (5%) of their total appropriations for GAD programs and project. This policy has since been incorporated annually in the General Appropriations Act (GAA), though revisions have been made to ensure effective implementation of the GAD budget policy.

2) In Mindanao, especially in Cotabato and Maguindanao Provinces

According to the Mindanao Commission on Women, the Moro and Lumad women are the poorest and most disadvantaged among the Mindanao population, affected by conflicts. Bride abduction, forced marriage and payment of bride price still persist as part of the culturally sanctioned practices in Mindanao. Further, cases of other forms of sexual violence are often reported in Mindanao, especially those in the remote areas.

In addition, poor access to public basic services has negatively affected women and children. For instance, the rate of government health practitioners serving the population, and the rate of births at the health facilities are lower than the national average as illustrated in Tables 8.3.1 to 8.3.4 below:

Table 8.3.1 Distribution of Government Doctors, Dentists, Nurses and Midwives per Region, 2008

Region	Population	Doctors	Dentists	Nurses	Midwives	Doctors /10,000 pop.	Dentists per 10,000 pop.	Nurses /10,000 population	Midwives /10,000 pop.
Philippines	88,566,732	2,838	1,891	4,576	17,437	0.32	0.21	0.52	1.97
Mindanao	21,586,741	581	331	1,009	4,492	0.27	0.04	0.11	0.51
Region 9	3,230,094	100	44	203	697	0.31	0.14	0.63	2.16
Region 10	3,952,437	138	74	241	1,052	0.35	0.19	0.61	2.66
Region 11	4,159,569	75	69	127	743	0.18	0.01	0.01	0.08
Region 12	3,830,500	113	56	194	878	0.30	0.01	0.02	0.10
Region 13	2,293,346	79	58	114	615	0.34	0.01	0.01	0.07
ARMM	4,120,795	76	30	130	507	0.18	0.00	0.01	0.06

Source: Cetrángolo et.al. 2013. Health Care in the Philippines: Challenges and Ways Forward

Table 8.3.2 Normal Type of Deliveries by Place

Area	TOTAL	NORMAL TYPE OF DELIVERIES							
		Total	%	Home	%	Health Facility	%	Other place	%
Philippines	1,904,528	1,785,906	93.77%	243,240	13.62%	1,526,965	85.50%	15,701	0.88%
Mindanao	489,291	460,172	94.05%	101,618	22.08%	350,771	76.23%	7,783	1.69%
Region 9	69,488	68,593	98.71%	10,013	14.60%	54,547	79.52%	4,033	5.88%
Region 10	104,965	89,756	85.51%	15,287	17.03%	73,186	81.54%	1,283	1.43%
Region 11	95,631	88,207	92.24%	13,943	15.81%	72,302	81.97%	1,962	2.22%
Region 12	90,254	85,476	94.71%	17,962	21.01%	67,159	78.57%	355	0.42%
Region 13	56,177	55,364	98.55%	5,780	10.44%	49,470	89.35%	114	0.21%
ARMM	72,776	72,776	100.00%	38,633	53.08%	34,107	46.87%	36	0.05%

Source: Epidemiology Bureau. Department of Health. Field Health Service Information System, Annual Report 2015

Table 8.3.3 Livebirths attended by Medical Doctors, Public Health Nurses and Midwives

Area	Total Livebirths	Livebirth attended							
		Total Livebirths attended by formal health practitioners		by MD		by PHN		by Midwives	
	Total	Total	%	Total	%	Total	%	Total	%
Philippines	1,861,894	1,600,367	85.95%	900,527	48.37%	31,799	1.71%	668,041	35.88%
Mindanao	491,190	407,642	82.99%	203,344	41.40%	10,148	2.07%	194,150	39.53%
Region 9	71,690	60,961	85.03%	27,960	39.00%	3,588	5.00%	29,413	41.03%
Region 10	104,685	91,221	87.14%	57,645	55.07%	777	0.74%	32,799	31.33%
Region 11	95,631	80,779	84.47%	46,924	49.07%	813	0.85%	33,042	34.55%
Region 12	89,902	74,884	83.30%	28,752	31.98%	1,388	1.54%	44,744	49.77%
Region 13	56,165	50,905	90.63%	31,208	55.56%	1,461	2.60%	18,236	32.47%
ARMM	73,117	48,892	66.87%	10,855	14.85%	2,121	2.90%	35,916	49.12%

Source: Epidemiology Bureau. Department of Health. Field Health Service Information System, Annual Report 2015

Table 8.3.4 Livebirths attended by Traditional Birth Attendants and Others

Area	Livebirths attended						Livebirths not attended	
	Total Livebirths attended by informal attendants		by Hilot/TBA		by others			
	Total	%	Total	%	Total	%	Total	%
Philippines	181,719	9.76%	167,777	9.01%	13,942	0.75%	79,808	4.29%
Mindanao	79,050	16.09%	72,863	14.83%	6,187	1.26%	4,498	0.92%
Region 9	9,086	12.67%	8,446	11.78%	640	0.89%	1,643	2.29%
Region 10	13,464	12.86%	12,128	11.59%	1,336	1.28%	0	0.00%
Region 11	14,852	15.53%	12,751	13.33%	2,101	2.20%	0	0.00%
Region 12	15,018	16.70%	13,645	15.18%	1,373	1.53%	0	0.00%
Region 13	5,260	9.37%	5,088	9.06%	172	0.31%	0	0.00%
ARMM	21,370	29.23%	20,805	28.45%	565	0.77%	2,855	3.90%

Source: Epidemiology Bureau. Department of Health. Field Health Service Information System, Annual Report 2015

To show part of the reality in which women and men of (Northern) Cotabato and Maguindanao Provinces, the 2009 Gender Development Index of both the provinces and values of related indicators are shown in Table 8.3.5 below. The values of all the indicators listed in the table show that the situation in Maguindanao was worse in general than that of (North) Cotabato.

Table 8.3.5 Gender Development Index 2009 for Cotabato and Maguidanao Provinces

Province	GDI 2009		Life expectancy at birth 2009		Mean years of schooling 2008		Expected years of schooling 2008	
	Rank	Value	Male	Female	Male	Female	Male	Female
Northern Cotabato	51	0.472	68	58	7	8	11	12
Maguindanao	68	0.543	66	61	6	6	10	11

Province	Estimated earned income (PPP NCR 2009 pesos) 2009		Estimated earned income (PPP US$) 2009		HDI rank minus GDI rank
	Male	Female	Male	Female	
Northern Cotabato	47,106	24,054	1,554	793	-13
Maguindanao	29,663	17,781	1,066	639	2

Source: Human Development Network. 2013. 2012/2013 Philippine Human Development Report

The Cotabato Provincial Office has been addressing gender gaps in the province. The Office has been supporting women in different aspects, and some of the achievements are reported as follows as at mid 2017:

a) There is a favorable environment for women to participate in politics. Actually, the incumbent Governor, Vice Governor and some board members of the Cotabato Province are women and there are other female local political leaders, too.
b) They have access to education, trainings and seminars conducted by the government.
c) During public consultation of projects, the attendance of women is a must.

d) Health services for women are also subsidized by the provincial government.

e) Women also have access to credit, especially to micro lending.

f) Household chores like farming activities are also shared between men and women.

g) Women organizations in the province such as Kalipunan ng mga Liping Pilipina (KALIPI), Rural Improvement Clubs (RIC) and others are supported by the Provincial Government.

In addition, it is said that women can be a hope for conflict prone communities. According to Dwyer and Cagoco-Guiam, in Mindanao, Muslim women leaders traditionally play a mediator's role in community conflict cases.

8.3.2 Gender Mainstreaming in the Proposed Components

A quick research was conducted in July 2017 with the Municipal Agriculturist Offices of Pikit of Cotabato Province and Pagalungan of ARMM to understand gender gaps in farming activities in the LMSA. Table 8.3.6 below illustrates the distribution of labor by gender in farming activities recognized by Municipal Agriculturist Offices of Pikit and Pagalungan. Both the offices provided us with the same answers, and the only difference in their answers is who buys chemical inputs for farming as shown below:

Table 8.3.6 Distribution of Roles by Gender in Farming Activities

Particulars				Pikit			Pagalungan		
				Men only (✔)	Women only(✔)	Either or both (✔)	Men only (✔)	Women only(✔)	Either or both (✔)
1	Decisions	Land use		✔			✔		
2		Purchase of farming inputs	Labor	✔			✔		
3			Chemicals	✔			✔		
4			Equipment/machinery	✔			✔		
5		Commercialization (when, to where, to whom, how much, by which means, selling the produces)		✔			✔		
6		Others (Specify) – Post Harvest Activities such as Hauling, Drying & Milling		✔			✔		
7	Practice	Preparation of lands		✔			✔		
8		Purchase of farming inputs	Labor	✔			✔		
9			Chemicals			✔	✔		
10			Equipment/machinery	✔			✔		
11		Sowing		✔			✔		
12		Trans-planting				✔			✔
13		Watering		✔			✔		
14		Manual control of weeds				✔			✔
15		Application of fertilizers/pesticides		✔			✔		
16		Harvesting				✔			✔
17		Post-harvest treatments (Hauling, Drying & Milling)		✔			✔		
19		Marketing				✔			✔
20		Sales of the produce				✔			✔
21		Others (Value Adding to the product such as cooking of rice delicacies for additional income)			✔			✔	

Source: Municipal Agriculturalist's Office of Pikit and Pagalungan

Both the offices responded that men and women share works in farming, and there is a clear division of labors by gender. The criterion applied for the division of labor is the extent, to which physical power is required. Those works requiring more physical power are done by men, while other works requiring less physical power are done by both men and women or by either men or women. On the other hand, food processing to add value to their agricultural produce is done only by women. This criterion is common among farmer households in the project area, irrespective of their religion. Muslim women also play their roles in farming just like Christian women do.

However, all the major decisions on farming activities are made only by men in both the

Municipalities. This means that women do not have control in the farming activities and just offer their labor following the decision by men. Such division of labor by gender and concentration of decision-making power only in men should be considered in the operation and maintenance of the irrigation facilities through the formation and operation of Irrigators Associations (IA), as well as in the planning and implementation of the agricultural component of MMIP II.

Table 8.3.7 below illustrates the female ratio in IA by service area. The table shows that female ratio of MMIP II is higher than that of MMIP I regarding the total members in IA; however, their ratios are around 5% to 10% only. In terms of number of female in board members, there are several women as board members in a few IAs but most of the IAs have only one woman or otherwise NIL woman in the board member:

Table 8.3.7 Female Ratio in IAs of MMIP

Service Area	Female Ratio of Total (%)	Female Ratio in Board Members (%)
MMIP I/MSA	5.79	5.00
MMIP I/UMSA	5.73	9.09
MMIP II/UMSA	9.41	8.79
LAGUNDI PAMBUA* (MMIP II/UMSA)	47.95	11.11
MMIP II/ PESA	10.12	4.35
MMIP II/LMSA	8.61	5.74
TOTAL	9.23	6.42

Note*: LAGUNDI PAMBUA is one of IAs and it has much larger number of women than others.
Source: NIA-PMO

The Philippine Plan for Gender-Responsive Development (1995-2025) contains the long-term vision of women's empowerment and gender equality, and the Gender and Development (GAD) Budget Policy authorizes government agencies, municipalities, state universities and etc. to utilize at least 5% of their annual budget for GAD related activities. The Philippines placed 10th out of 144 countries in the global gender gap index in 2017 but there may be still some gaps especially in rural area, e.g. MMIP area.

On the other hand, the female ratio of total members in LAGUNDI PAMBUA, which is one of IAs, is high and it shares almost as much as half. It can be said that other IAs must have potential to increase their female members. Then, there should be such rule in establishing IA's management board by including women at least 30% or more, so the decision could also refer to the women's intent/ voice.

CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

This Survey was initiated by a request for ODA loan financing as of January 2017 on the remaining (untouched) areas of MMIP II. However, with recognition not feasible technically and financially to construct protection and ring dykes protecting the Lower Malitubog Service Area (LMSA) from the floods of Pulangi river, NIA as well as the Government of Philippines have decided to withdraw the request and instead push through the MMIP II project on its own government budget. With this decision, the JICA Team summarizes the survey results, as conclusion, given of the following: **(It is noted that non-disclose information for 3-year is included in this chapter as procurement by the Philippines government is scheduled.)**

1) The flood protection and ring dykes originally designed by NIA-PMO should NOT be constructed from the view point that;

   1.1) As the foundation, on which protection and ring dykes are planned to be constructed, is expected to be very soft, the NIA designed ring dyke having around 7 m height would require consolidation settlement, probably reaching as much as 1.5 m and, in the worst case, would cause potential circular sliding through the foundation if no foundation treatment were to be done. Even if foundation treatment were to be done, such treatment would entail huge construction cost, say approximately [redacted] PHP, which apparently indicates economic non-viability.

   1.2) In addition to above, dikes, if constructed, would give on the Liguasan March such impacts of; 1) enlarging the inundation area by 19% - 34%, and 2) raising water level by 65 – 81 cm depending on the return-period (2, 10, 20, 30, 50 and 100 years) according to the flood simulation. This would cause resettlements of the houses on the left bank of the Pulangi river, or at least should provide a means of raising the floor of the houses. The dikes, if constructed, would thus cause social and environmental issues to the existing natural conditions and also on the people's life and livelihood.

   1.3) Further in addition, rain falling on the LMSA would cause inland ponding, inundating as much as 50% (80%) of the LMSA during rainy season under 2 (30) - year return period. With 30 nos of drainage sluice gates, each H2m x B2m, at a cost of [redacted] Php, the inundation would be released in November, enabling the dry season paddy cultivation under 2-year return period (50 gates under 30 years return period), yet large portions of the LMSA, say 50 – 80%, would anyway have to give up the rainy season's cultivation. If drainage pumps were to be installed, even the rainy season paddy could be cultivated; however it would need an additional cost of [redacted] Php under 10 years return period, not economically feasible.

   1.4) If dredging were to be tried on the Pulangi river in order to enlarge the flow capacity of the river, namely, mitigating the flood to the LMSA, a scale of 500m expansion of the river almost all along the target sections (94 km) would enable the LMSA almost free from the flooding. However, this measure would require 345 million CUM removal at a huge cost of [redacted] Php for the direct cost only. Besides, partial dredging for only the bottleneck area (13km reach), at which the width of Pulangi river becomes very narrow located at about 6-7 km downstream from the most western part of LMSA, was examined; however, it was revealed that even 500m expansion could have limited effects such as 198 ha, 206 ha, and 339 ha increases of beneficial area under 100-year, 30-year and 2-year return periods, respectively, with huge investments of [redacted] Php, [redacted] Php and [redacted] Php.

2) Without flood protection and ring dykes, there should be two options in terms of developing the canal network of the LMSA as to; 1) Case-1 limiting the canal network within the beneficial area

less/least affected by inundation (2,810 ha for rainy season and 3,688 ha during dry season), or 2) Case-2 constructing the canal network as per the NIA-PMO original design (original 6,590 ha cultivable during dry season while only 3,810 ha cultivable for rainy season). This Survey recommends the first option (Case-1) with the following reasons:

2.1) In the case of constructing all the canal network in LMSA as per the NIA-PMO original design (Case-2), there should be at least some flood protection works, e.g. canal slope protection, concrete flume introduction, etc., applied to strengthen the mid-terminal points of the canal network flooded every year. This flood protection works would require an additional direct cost of [redacted] Php at least, which unfortunately would go beyond the originally NEDA approved budget. Further, maintenance cost for the Case-2 will be much higher than that of Case-1, approximately twice higher maintenance cost per unit area than that of Case-1.

2.2) In fact, EIRR showed higher return in the Case-2 than Case-1 as 11.87% vs. 10.90%, 10.73% vs. 10.07%, 10.18% vs. 9.68%, 9.32% vs. 9.07% respectively in the cases of NIL damage for wet season paddy, 30% damage, 50% damage and 80% damage for the whole MMIP II area. These EIRRs are however not much different each other, and thus the JICA Team would recommend the canal network development of Case-1 for which the canals are to be constructed mostly within the less/least flooded area and thus maintenance works would be much easier than that of Case-2. It is also indicated by comparing the maintenance costs of Case-2 and Case-1; the former unit cost per ha being almost double than that of the latter, again indicating easier maintenance works in terms of financial arrangement for the Case-1.

3) Though the JICA team recommends the Case-1 as afore-mentioned, should NIA want to develop all the LMSA with the Case-2 investment, JICA team would recommend a step-wise development, in that anyway NIA should complete MMIP II as early as possible with the Case-1 investment which is manageable within the available remaining budget, and then in future proceed to the Case-2 investment given additional budget.

4) Some of the facilities of MMIP I had been constructed already more than 20 years, requiring certain level of rehabilitation/ repair though lack of budgets has been hindering such rehabilitation works. Especially, gates installed on the headworks are out of order as of 2017, risking the structural stability during high flood season. NIA should prepare for enough budget to carry out necessary rehabilitation and/or improvement works, which may be named as MMIP III. This MMIP III investment may be combined with Case-2 investment.

5) Concerning environmental consideration, land acquisition is necessary for the Project implementation, however, as discussed in Chapter 7, almost all of the Project Affected Persons (PAPs) have not accepted the proposed compensation rates for the land loss due to their low amounts, which were fixed in 2003 and being applied even at this moment. As a result, the construction works were started and are on-going without payment of compensation for the land loss. It is recommended to negotiate with the PAPs to fix acceptable compensation rates and to finalize the payment.