

# Initial Environmental Examination

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March 2018

Myanmar: Climate-friendly Agribusiness Value  
Chain Sector Project

DML2 Minor Canal Rehabilitation Subproject  
Kyi Ywa Village, Pakokku, Magway Region

Prepared by Ministry of Agriculture, Livestock and Irrigation for the Asian Development Bank.

## **CURRENCY EQUIVALENTS**

(As of 26 March 2018)

Currency unit	–	Myanmar Kyat (MK)
MK1.00	=	\$0.000753
\$1.00	=	MK1,328.00

## **ABBREVIATIONS**

CEMP	-	contractor's environmental management plan
CFAVCP	-	Climate-friendly Agribusiness Value Chains Sector Project
CSA	-	climate smart agriculture
CDZ	-	Central Dry Zone
EARF	-	environmental assessment and review framework
ECD	-	Environmental Conservation Department
EIA	-	environmental impact assessment
EMP	-	environmental management plan
GHG	-	greenhouse gas
GRM	-	grievance redress mechanism
GWP	-	global warming potential
JICA	-	Japan International Cooperation Agency
IEIA	-	initial environmental impact assessment
IPM	-	integrated pest management
IWRUMD	-	Irrigation and Water Resources Utilization Management Department
MIC	-	Myanmar Investment Commission
MOU	-	Memorandum of Understanding
MOALI	-	Ministry of Agriculture, Livestock and Irrigation
MOC	-	Ministry of Commerce
MONREC	-	Ministry of Natural Resources and Environmental Conservation
MOF	-	Ministry of Finance
MOLF	-	Ministry of Livestock and Fisheries
MRF	-	Myanmar Rice Federation
MSWRR	-	Ministry of Social Welfare, Relief and Resettlement
NCDP	-	National Comprehensive Development Plan
PCO	-	public complaints officer
PMU	-	project management unit
PMIC	-	project management implementation consultants
PPTA	-	project preparatory technical assistance
PPCU	-	Project Public Complaint Unit
REA	-	rapid environmental assessment
SPS	-	Safeguard Policy Statement
SPFS	-	subproject feasibility study
TOR	-	terms of reference
WUGs	-	water user groups

## **NOTE**

In this report, "\$" refers to United States dollars

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## I. EXECUTIVE SUMMARY

### A. Background

1. The Asian Development Bank (ADB) approved a Project Preparation Technical Assistance (PPTA) for the Climate-friendly Agribusiness Value Chains Sector Project (CFAVC), with funding support from Japan's Asia Clean Energy Fund and the Canadian Climate Change Fund for the Private Sector in Asia. The project is a regional initiative covering Myanmar, Lao PDR and Cambodia. This document concerns the Initial Environmental Examination (IEE) for the DML2 Minor Canal Rehabilitation Subproject in Kyi Ywa Village, Pakokku, Magway Region. The Ministry of Agriculture, Livestock and Irrigation (MOALI) serves as the executing agency for the project in Myanmar.

2. The CFAVC project will enhance rural household incomes and agricultural competitiveness by improving agricultural production infrastructure and the efficiency and technologies used in post-harvest practices and processing for rice, pulses and beans, and sesame. It will also support various agribusiness policies aimed at improving the quality of agricultural inputs, in developing codes of practices and standards applied to various agribusiness activities, and in creating an enabling environment for agribusinesses to conduct business more efficiently and profitably

### B. Project Components

3. A long list of candidate subprojects was developed during the course of the PPTA, and a range of selection criteria developed to identify preferred ones before finalizing. The project has three major outputs:

4. **Output 1: Critical agribusiness value chain infrastructure improved and made climate resilient.** It involves infrastructure improvements to increase farm productivity and crop diversification, enhance quality of agricultural products, and increase incomes for value chain stakeholders. Key activities include:

- (i) Upgrading infrastructure (irrigation, drainage, buildings, farm and post-harvest machinery and equipment, seed testing equipment, agrometeorological stations, etc.) in 10 Department of Agriculture (DOA) seed farms<sup>1</sup> for production of improved and/or climate resilient seed, for sale to private producers of certified seeds and eventually benefitting 167,000 farmers;
- (ii) Renovating at least 130 km of tertiary canals, rehabilitating 15 community ponds and reservoirs, constructing at least 8000 shallow tube wells with some of them linked to drip and sprinkler technologies, and small-scale pumping to bring an additional 13,000 ha under irrigation benefitting at least 35,000 households;
- (iii) Rehabilitating at least 300 km of farm feeder roads to climate resilient condition to provide improved farm connectivity to markets and enable enhanced farm mechanization; and

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<sup>1</sup> Seed farms of the Department of Agricultural Research (DAR), including the Oilseed Crops Research Center in Magway, may be supported, subject to availability of funds.

- (iv) Upgrading the safety and quality testing equipment and instrumentation in MOALI Plant Protection Division's Pesticide Testing Laboratory and Food Safety Testing Laboratory, and the Ministry of Commerce (MOC) Commodity Testing and Quality Management (CTQM) Laboratory to meet ISO 17025 standards, and providing food safety testing kits to DOA plus the private sector.
- 5. The project will support DOA seed farms in promoting (i) strong links with the private sector, (ii) marketing, and (iii) business development services.
- 6. The lead seed growers and seed producer associations near DOA seed farms will be encouraged to be integrated under a public-private partnership for seed multiplication being launched by the Livelihoods and Food Security Trust Fund (LIFT) to ensure a guaranteed market for lead seed growers.
- 7. The project will support the formation of water user groups (WUGs) in the project area and train WUGs to operate and maintain minor canals, community reservoirs and other water management infrastructure.
- 8. **Output 2: Climate smart agriculture and agribusiness promoted.** This output will strengthen technical and institutional capacity to integrate climate change concerns into agriculture, and help farmers and agribusinesses to enhance productivity while addressing climate change impacts. Key activities include:
  - (i) Deploying climate resilient varieties of rice, beans, pulses and oilseeds;
  - (ii) Strengthening capacity of seed growers and farmer groups, agro-dealers, and regional government staff on appropriate climate smart agriculture (CSA) technologies, certified seed production, farm mechanization and good agricultural practices (GAP), and agribusinesses on business plan development, good manufacturing practices (GMP) and HACCP [Hazard Analysis Critical Control Points] standards, value addition and food quality and safety improvement; and
  - (iii) Facilitating access to agricultural inputs (climate resilient seeds and varieties, agrochemicals), farm mechanization services and off-farm rural livelihood opportunities, principally through establishing an agricultural digital finance scheme to benefit at least 35,000 smallholders.
- 9. The project will train farmer groups, laboratory staff, and agribusinesses in operations and maintenance (O&M) of infrastructure built under output 1.
- 10. The project will identify smallholder beneficiaries through "common interest groups" utilizing community-driven development (CDD) processes.
- 11. **Output 3: Enabling environment for climate friendly agribusiness enhanced.** Under this output, the project will invest in the creation of an enabling policy and regulatory environment for agribusinesses, the identification of opportunities for private sector engagement in climate change mitigation and adaptation, and provision of improved market information services. This output will facilitate harmonization of standards, public-private partnerships, and green financing. Key activities include:

- (i) Establishing an agribusiness policy cell within MOALI's Department of Planning (DOP) for agribusiness policy and standards formulation (including farm-gate standards and codes of practice,<sup>2</sup> research, analysis, and advocacy, in collaboration with MOC;
- (ii) Raising awareness and capacity of financial institutions to support climate friendly agribusinesses and enhance access to financial services; and
- (iii) Enhancing market and credit information networks, and the delivery of land administration services and in project areas, in collaboration with FAO, through building capacity of DALMS, regional and township administrations for land management planning, and creating demand for such services at village level.

12. A long list of candidate subprojects was developed during the course of the project preparatory technical assistance (PPTA), and a range of selection criteria developed to identify preferred ones before finalizing.

13. This initial environmental examination (IEE) deals with typical tertiary canal infrastructure rehabilitation for climate-smart on-farm water management for farmer groups close to Pakokku Township (for the farmers who benefit from improved water and inputs). It is a representative of projects which can be replicated in other project areas in the Central Dry Zone (CDZ) of Myanmar.

### **C. The Initial Environmental Examination Report**

14. Based on the ADB's Rapid Environment Assessment Checklist (Appendix I), the subproject is classified as Category B, requiring the preparation of this IEE report. However, this assessment is borderline and the project could be classified as Category B as the environmental impacts are minimal. However, in order to be precautionary, and to provide an IEE template for future Category A projects (since this is the only IEE produced, since the other two representative subprojects are classed as Cat C and only Environmental Codes of Practice produced) the Category B categorization can remain. Such projects are judged to have some adverse environmental impacts, most of which is occurring during construction phase, but of lesser degree and/or significance than those for Category A projects. The objectives of this IEE are to:

- (i) describe the existing natural and socio-economic resources in and surrounding the project area;
- (ii) identify and assess potential significant impacts based on existing environmental conditions including during project pre-construction, construction, and operation and maintenance (O&M) stages;
- (iii) identify and recommend mitigation measures to minimise any potential impacts caused by project activities;
- (iv) undertake public consultation to present subproject environmental issues to project stakeholders and local people of the subprojects' areas and to collect community concerns; and

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<sup>2</sup> Example to prevent pest infestation and reduce mycotoxins in drying and storage facilities, and adopt market-driven, end-product export standards for processors.

- (v) develop an environmental management plan (EMP) (Table 14) and an environmental monitoring plan (Table 15) with cost estimates during construction and operation stages to guide subproject implementation.

15. This IEE was prepared following the ADB Safeguard Policy Statement (SPS) (2009), the 2003 ADB Environmental Assessment Guidelines and relevant environmental policies, and guidelines of the government of Myanmar.

#### **D. Assessment Findings**

16. **During pre-construction:** The issues related to project location encompass the rehabilitation of the existing water management structures which include design and cost estimation of the brick mortar lining (three sides) of the existing minor L2 canal (1.0 km).

17. **During construction:** The major issue during construction concern compliance with the EMP regarding off-farm and on-farm water management initiatives, ensuring site cleanliness, careful treatment of spoil from excavation and canal rehabilitation, and protection to existing water quality and vegetation.

18. **Post-construction,** the main concern is the management and maintenance of the subproject infrastructure, which will require a systematic approach. This needs to be facilitated through effective ownership by water user groups (WUG) operating at off-farm level for the renovated canal. In addition the level of fertilizer and pesticide residues could be expected to increase, and if not managed appropriately, can have possible harmful effect on water quality, public health and ecological balance in soils. These impacts would be mitigated through improving local capacity through training on appropriate and effective use of fertilizer, growth accelerants which promote a dual production cycle, and pesticides.

19. **Greenhouse gas emissions** from the increased area of paddy: These emission rates are calculated for the Project area and converted into equivalent levels of CO<sub>2</sub> using the following formula: *Global warming potential (GWP) = CO<sub>2</sub> emissions + CH<sub>4</sub> emissions\*21 + N<sub>2</sub>O emissions\*310.*

20. **Irrigation Water Demand Increase:** Adaptation to predicted future increases in irrigation water demand in the subproject will be important and will be included in the TOR as a responsibility of the International Environmental Safeguards Specialist to complete for the specific subproject location.

21. **Rapid Environmental Assessment:** The initial Rapid Environmental Assessment (REA) for this subproject identified a low climate risk, compared to an overall project risk based on the AWARE classification of medium risk. The PPTA has completed a Climate Risk Assessment and Management document, tabled as a separate document.

#### **E. Mitigation Measures**

22. The above impacts will be measured to mitigate through good design of infrastructure and also by the rigorous application of social safeguards in the form of resettlement plans (RPs) following ADB and Government of Myanmar (GoM) policies strictly.

23. Mitigation of construction-phase impacts relies heavily on responsibility of works contractors to follow specification clauses specifically designed to minimize noise nuisance, road accident, pollution of air and water and soil erosion, illegal solid waste disposal and waste water discharge, conflict between up-stream and downstream water users, worker safety and sanitation. This mitigation will in turn rely on enforcement by the regional and township PIU (and monitoring by the environmental officer in the project management unit), and also by construction supervision consultants in the PIC.

24. Post-construction mitigation will benefit from capacity building and training under the project to use fertilizers and pesticides efficiently and responsibly, and capacity building to WUGs to maintain the facilities, water management and conflict solution.

## **F. Environmental Management Plan (EMP)**

25. The IEE includes an EMP (Table 14) where the identified environmental impacts and mitigation measures are transformed into an action plan for their proper implementation. The plan includes methods of mitigation, responsibilities, indicators of progress, and frequency and nature of monitoring activities with cost estimates.

26. The provisions of the EMP will be incorporated into tender documents and construction contracts.

## **II. LEGAL AND ADMINISTRATIVE FRAMEWORK**

27. The IEE has been designed to satisfy both ADB and relevant GoM's environmental guidelines and regulations.

### **A. ADB Environmental Requirements**

28. **Safeguard Policy Statement:** On the basis of subproject screening in the feasibility stage, using a rapid environmental checklist, the subproject has been determined to be category B for environmental impacts. This category entails environmental impacts that can be mitigated. This consolidated IEE has been prepared under the provisions of the ADB's SPS (2009) which requires a number of critical considerations, including: (i) project level grievance redress mechanism, including documentation in the EMP; (ii) physical cultural resources damage prevention analysis; (iii) climate change mitigation and adaptation; (iv) occupational and community health and safety requirements, including emergency preparedness and response; (v) economic displacement that is not part of land acquisition; (vi) meaningful consultation and participation; and (vii) an EMP which comprises implementation schedule and (measurable) performance indicators.

29. **Relevant ADB environmental policies and guidelines** used in the preparation of this IEE are:

- (i) Safeguard Policy Statement (SPS). ADB (2009);
- (ii) Operation Manual Bank Policies (BP) on SPS (2009); and
- (iii) Rapid Environmental Assessment Checklist (2013);
- (i) Environment Policy of the Asian Development Bank (2002);
- (ii) Environmental Assessment Guidelines (2003) – Annex 3: Content and Format of Initial Environmental Examination;



- (iii) Environmental Guidelines for Selected Agricultural and Natural Resources Development Projects (November 1991).

30. **Screening and Categorization:** At an early stage of the project, the environmental assessment process will screen and categorize proposed projects based on the significance of potential project impacts and risks. Screening and categorization are undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iv) determine disclosure requirements. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

- (i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
- (ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- (iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
- (iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

31. The REA checklist for the preparation of IEE was completed and verified by international and national environment specialists during the site visits on 12-15 November 2016 in the project areas. The main purpose of the site visits were the following:

- (i) assessment of the existing location and the surrounding environment of the subproject locations and identify if there are sensitive areas, archaeological sites and historical sites located in or near the project area;
- (ii) identify potential environmental and socioeconomic impacts on the proposed construction of irrigation;
- (iii) consultation with the officials and staff of Township Department of Agriculture, Township Department of Environment, Township Department of Water Resource Utilization Management, Township Department of Rural Development and local authorities (villager chief and commune council) about the project; and
- (iv) consultation with communities involved in the project, including those immediate beneficiaries to determine their levels of involvement and specifically discuss and scope relevant environmental issues with them; and
- (v) conduct social perception survey through key informant interviews to stakeholders.

## B. Myanmar Environmental Laws and Guidelines

32. **Environmental Conservation Law:** The importance of environmental protection in Myanmar is recognized in national and local policy, which is in part due to the country being a signatory of various multilateral environmental treaties and agreements. Myanmar's National Environmental Policy of 1994 instituted environmental regulations on the utilization, conservation, and prevention of environmental degradation including water, land, forest, mineral, marine resources, and other natural resources. Following the development of this national policy, the country drafted its Agenda 21 commitment (1997) to implement integrated management of natural resources which provides a blueprint for achieving specific targets on environmentally sustainable development. In 2009, the country's National Sustainable Development Strategy (NSDS) was prepared, marking an important step for Myanmar as this guiding document aims to ensure development remains in harmony with the three main pillars of sustainability: environment, economy and society.

33. The Environmental Conservation Law and the Environmental Conservation Department (ECD) was established in 2012 as an enforcement mechanism to protect and conserve nature. The Environmental Conservation Law proclaimed through a gazette in accordance with the Pyidaungsu Hluttaw Law No. 9/2012 was enacted on the 30th March 2012 with aims to facilitate:

- (i) implementation of the country's National Environmental Policy;
- (ii) systematic integration of environmental conservation in a sustainable development process;
- (iii) healthy and clean environment and conservation of natural and cultural heritage;
- (iv) reclamation of degenerated and disappearing ecosystems;
- (v) management of natural resources for sustainable use;
- (vi) public awareness;
- (vii) international, regional and bilateral cooperation; and
- (viii) collaboration within different government departments and organizations and with non-government organizations, and other stakeholders.

34. The National Environmental Conservation Coordination Committee (NECCC) was formed for effective coordination among stakeholders with the senior officials from various agencies while Environmental Conservation Department (ECD) was created to regulate environmental situations in the country. Environmental quality standards are to be set up by government for monitoring the environmental performance and management throughout the country. Once enacted, these national standards are to be legally adhered to by all development projects implemented in Myanmar. The current status of Environmental Legislation in Myanmar are guided by the following laws and regulations:

- (i) Environmental Conservation Law (2012),
- (ii) Environmental Conservation Rules (2014),
- (iii) National Environmental Quality (Emissions) Guidelines (2015),
- (iv) EIA Procedures (2015),
- (v) MIC Law & Rules & Notification (2013),
- (vi) SEZ Law (2014),
- (vii) The Conservation of Water Resources and Rivers Law (2006),
- (viii) Some relevant Sectoral Laws and Rules: Water Policy, Forest Policy, Forest Law.

35. **Environmental Impact Assessment Process Sub-decree:** The Sub-decree No. 31- 70 of the Environmental Impact Assessment Process dated 29 December 2015 sets out EIA procedures. The main objectives of this sub-decree are:

- (i) To determine an EIA for every private and public project or activity, through review by the ECD (Environmental Conservation Department), prior to the submission for a decision from the government;
- (ii) To determine the type and size of the proposed project(s) and activities, including existing and ongoing activities in both private and public sector prior to undertaking the process of EIA; and
- (iii) To encourage public participation in the implementation of the EIA process and take into account their input and suggestions for reconsideration prior to the implementation of any project.

36. The sub-decree includes an annex which provides a schedule of developments which require IEIA (IEE) or EIA. An excerpt for relevant industries is in Table 1.

**Table 1: List of Projects Requiring an EIA or EIA**

Type and activities of the projects	IEE, Size / Capacity	EIA, Size / Capacity
<b>AGRICULTURE</b>		
Crop, agro-industrial crop (rubber, palm oil, cocoa, coffee, tea, banana, sugarcane, etc.)	Between 200 - 500 hectares (ha)	$\geq 500$ ha
Seasonal Crop (cereals, pulses, roots, tubers, oil-bearing crops, fibre crops, vegetables and fodder crops)	Between 500 - 3000 ha	$\geq 3,000$ ha
Pump irrigation	$< 4,500$ m <sup>3</sup> / day	$\geq 4,500$ m <sup>3</sup> / day
Dam for irrigation	Ht of dam $< 15$ m, catchment area $< 400$ ha	Ht of dam $\geq 15$ m, catchment area $\geq 400$ ha
Dredging work	$< 500,000$ tons	$\geq 500,000$ tons
Road upgrading work (seasonal road to all weather road)	$\geq 50$ km	As determined by the Ministry of Natural Resources and Environmental Conservation (MONREC)
Vegetable Oil Production and Processing Facilities	$\geq 100$ t/d but $< 300$ t/d product and $< 600$ t/d if production is operating a maximum of 90 d/a	$\geq 300$ t/d product or $\geq 600$ t/d if production is operating a maximum of 90 d/a

Source: EIA Procedure Notification of the Government of Myanmar (2015)

37. Since the subproject involves the refurbishment of existing irrigation schemes, it does not require an EIA under Sub-decree No 30 of Annex A, EIA Procedure Notification of GoM, 2015 as screened and classified by ECD. Where the command area is substantially expanded by the refurbishment of a scheme to provide more than 3,000 ha of newly irrigated land or land previously without reliable irrigation, the provisions of the sub-decree will apply. This IEE will therefore be forwarded to MONREC by ECD for approval under the government's requirements.

38. **Environmental Due Diligence:** Although there is no need for an EIA, environmental due diligence and review needs to be carried out and pre-screened by the ECD, and the subproject will undergo the IEE procedure, which consists of environmental investigations and

reporting after which the review and approval process from the ECD, MONREC would follow before project implementation is given approval.

### C. Evaluation Standards

39. **Law on the Management of Pesticides and Fertilizers:** The Procedure Relating to the Pesticide Law was published on 8<sup>th</sup> July 1991. It was prescribed by the Ministry of Agriculture and Forests with the approval of the Government. There are 7 Chapters with 59 clauses with provisions to monitor, control the selection of, storage, transport and use of pesticides in such a manner as to protect people, crops, other biological entities, and the environment.

40. The fertilizer law was published on 1<sup>st</sup> October, 2002. Regulation was announced on 1<sup>st</sup> July 2007 with provisions for the use of appropriate fertilizers which support the conservation of soil and the environment.

41. The Plant Pest Quarantine Law, 1993, renders provisions to control the import of plants, plant products, pests, beneficial organisms and soil; and to prohibit the international transportation of any of the above items which are known to be contaminated, or which have been placed under quarantine. These laws have the following objectives:

- (i) To support a policy promoting the effectiveness potentiality of agriculture sector, for the development of social and national economy;
- (ii) To ensure the safe and effective control of pesticides and fertilizers, whether in consistent with the international standards;
- (iii) To enhance public awareness on the implementation of standard requirements of pesticides and fertilizers for all relevant activities related to these products; and
- (iv) To reduce risks caused by the use of pesticides and fertilizers, for beneficiary of farmers and people in the nationwide, by ensuring food security, food safety, public health, and the sustainability of environment.

42. The scope of these laws shall apply to the management and the implementation of standard requirements for:

- (i) All type of pesticides and fertilizers, raw materials or active ingredients and other compositions of pesticides and fertilizers which are used as inputs in agricultural production.
- (ii) All activities of natural persons or legal entities who are traders, formulators, pests control services operators, advertisers, donors, and users of all types of pesticides and fertilizers.

43. **Law on Water Resources Management:** The Conservation of Water Resources and River Law was adopted by the State Peace and Development Council, The Republic of the Union of Myanmar on 12 October 2006. This law provides procedures for the management of water resources within Myanmar. The purpose of the law is to foster the effective management of the water resources of the Republic of the Union of Myanmar to attain socioeconomic development and the welfare of communities. The law shall determine:

- (i) the rights and obligations of water users;
- (ii) the fundamental principles of water resources management;
- (iii) the institutions in charge of its implementation and enforcement; and

- (iv) the participation of users and their associations in the sustainable development of water resources.
44. Under this law, MoT (Ministry of Transport) is given the duties and powers to facilitate the carrying out of the objectives:
- (i) to conserve and protect the water resources and rivers system for beneficial utilization by the public;
  - (ii) to ensure smooth and safe waterways navigation along rivers and creeks;
  - (iii) To contribute to the development of State economy through improving water resources and river system;
  - (iv) To mitigate and minimize potential environmental impact.
45. **Water Pollution Control:** The National Water Forum 2014 held discussions regarding Water Quality and Pollution Control in 4 States and 6 Regions in Myanmar. The four states were: Chin, Kayah, Shan (S), and Rakhine. Division: Sagaing, Mandalay, Magway, Bago, Ayeyarwaddy, and Yangon of Myanmar. Consensus as to the need for Water Quality and Pollution Control in the entire country and regular water sampling and testing work considered as necessary in all baseline studies of development projects.
46. The purpose of this forum was to disclose the findings from the water quality testing work regarding Arsenic contamination and assessment of the bacteriological quality and some chemical parameter having health significance in the various types of water sources with particular attention given to shallow tube wells and dug wells in the above selected States and Regions of Myanmar. The then proposed National Standards for drinking water supply (1990) was used as a guideline for interpretation and analysis of the results.
47. **Results of the Assessment:**<sup>3</sup> Areas and water sources that are affected by:
- Arsenic:** Ayeyarwaddy, Rakhine, Bago and Shan (S): Shallow tube wells, Deep tube wells and dug wells (1.59% of total samples tested above the limit of 0.05 mg/l)
  - Fluoride:** Bago, Mandalay, Sagaing, Kayah, Ayeyarwaddy: Dug well, shallow tube wells, deep tube wells, ponds, lakes and reservoirs (3.9% of total samples tested above the limit of 1.5 mg/l)
  - Nitrate:** Ayeyarwaddy, Bago, and Sagaing: Shallow tube wells and dug wells (0.12% of total samples tested above the limit of 10mg/l)
  - Faecal Coliform:** all States and Regions surveyed from all water sources including shallow tube wells, surface waters, dug wells, ponds, lakes and reservoirs and gravity flows (33% of total samples tested above the limit of 0/100 ml). Deep tube well are least affected.
48. **Pollution Control initiatives and mitigation measures** were discussed among the participants with relevant projects in its sanitary guidelines:
- Soil water shall be treated before being discharged into a water course or public drain;
  - The effluent quality of the treated soil water shall conform to the following;
    - BOD 50 mg/l (maximum)*
    - COD 100 mg/l (maximum)*
    - SS 50 mg/l (maximum)*

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<sup>3</sup> National Water Forum 2014: Saw Christopher Maung (TWG<sub>4</sub>), "Water Quality and Pollution Control"

- Soil water discharged into YCDC (Yangon City Development Committee) sewer shall be treated to the following effluent quality:  
*BOD 150 mg/l (maximum), COD 200 mg/l (maximum), SS 150 mg/l (maximum)*  
*{Note: BOD value refers to 5 day incubation period at 20°C}*

**Table 2: Guideline Value for Water Runoff, Effluent and Sanitary Discharges**

Sr. No.	Parameter	Unit	Guideline Value
1	5-day Biochemical Oxygen Demand	mg/l	50
2	Ammonia	mg/l	10
3	Arsenic	mg/l	0.1
4	Cadmium	mg/l	0.1
5	Chemical Oxygen Demand	mg/l	250
6	Chlorine (total residual)	mg/l	0.2
7	Chromium (hexavalent)	mg/l	0.1
8	Chromium (total)	mg/l	0.5
9	Copper	mg/l	0.5
10	Cyanide (free)	mg/l	0.1

Source: National Environmental Quality Guidelines, 2015

49. **Drinking Water Quality Standards:** For well water used for domestic purposes, including drinking, the Ministry of Health of the Union of Myanmar issued the National Drinking Water Quality Standards, September 2014 is the evaluation standard. These are summarized in below table:

**Table 3: National Drinking Water Quality Standard**

Sr. No.	Parameter	Unit	Standard
1	pH	mg/l	6.5 - 8.5
2	Turbidity	NTU	5
3	Arsenic	mg/l	0.05
4	Iron	mg/l	1
5	Total Dissolved Solid	mg/l	1000
6	Chloride	mg/l	250
7	Copper	mg/l	2
8	Sulphate	mg/l	250
9	Nitrite	mg/l	3
10	Nitrate	mg/l	50
11	Lead	mg/l	0.01
12	Mercury	mg/l	0.001
13	Coliform	CFU/100ml	0
<i>l = litre; mg = milligram; ml = milliliter</i>			

Source: National Drinking Water Quality Standard, Government of Myanmar, Ministry of Health, 2014.

50. **Solid waste management:** Traditionally, waste collection and disposal in Myanmar have been the responsibility of local municipal authorities. In Yangon, Mandalay and Nay Pyi Taw, autonomous City Development Committees and their Pollution Control and Cleansing

Departments (PCCDs) with their network of administrative branches and sub-units are tasked with solid waste management in municipal areas. In other parts of the country, the respective Township Development Committees under the Local Government manage municipal waste collection and disposal.

51. According to the estimation of the World Bank (2012), the current solid waste generation in Myanmar was 5,616 tonnes / day with the per capita waste generation of 0.44 kg/capita/day. This figure was expected to reach about 21,012 tonnes /day with 0.85 kg/capita/day by 2025<sup>4</sup>

52. Myanmar's environmental conservation law and rules emphasize that the development of national and local waste management strategies are urgently needed. Further to a request for support from MONREC, the International Environmental Technology Centre (IETC) of the United Nations Environmental Programme (UNEP) has been actively working with national and local governments and other institutions to build capacity for waste management and promote the development of conducive policy framework and strategies.

53. **Air Pollution Control:** The National Environmental Quality Guidelines (Emissions) was enacted on 29 Dec 2015. Its purpose is to protect the quality of environment and public health from air pollutants and noise pollution (see tables below). This sub-decree applies to all movable sources and immovable sources of air and noise pollution.

**Table 4: Ambient Air Quality Standards**

Sr. No.	Parameter	Average Period	Guideline Value $\mu\text{g}/\text{m}^3$
1	Nitrogen Dioxide	1-year	40
		1-hour	200
2	Ozone	8-hour daily maximum	100
3	Particulate Matter $\text{PM}_{10}^{\text{a}}$	1-year	20
		24-hour	50
4	Particulate Matter $\text{PM}_{2.5}^{\text{b}}$	1-year	10
		24-hour	25
5	Sulphur Dioxide	24-hour	20
		10-minute	500
<sup>a</sup> Particulate Matter 10 micrometres or less in diameter, <sup>b</sup> Particulate Matter 2.5 micrometres or less in diameter, $\text{m}^3$ = cubic meters, $\mu\text{g}$ = microgram. <i>Note: This standard applied to evaluation of ambient air quality and to monitoring of air pollution status.</i>			

Source: The National Environmental Quality Guidelines (Emissions), 2015.

**Table 5: Maximum Permitted Noise Level in Public and Residential Area (dBA)**

Receptor	One Hour LAeq (dBA) <sup>a</sup>	
	Daytime 07:00 - 22:00	Night time 22:00 - 07:00
	(10:00 - 22:00 for Public Holidays)	(22:00 - 10:00 for Public Holidays)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

<sup>4</sup>[http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What\\_a\\_Waste2012\\_Final.pdf](http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf)

<sup>a</sup> Equivalent continuous sound level in decibels		
Note: This standard is applied to control of noise level of any source of activity that emitted noise into the public and residential areas.		

Source: The National Environmental Quality Guidelines (Emissions), 2015

54. **Silt/Sediment Quality:** For the reuse and disposal of silt from canal cleaning or dredging, there is no government standard. Standards applying to paddy field environments from the People's Republic of China (PRC) and Japan will therefore be referenced.<sup>5</sup> These will include *PRC: GB4284-84 Control standards for pollutants in sludge for agricultural use*, *PRC: GB/T23486-2009 Sludge quality for afforestation in gardens or forests*, and Japan's *Environmental Quality Standards (EQS) for soil pollution, August 1991*.

#### D. Environmental, Health and Safety Guidelines

55. ADB's SPS 2009 applies pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety (EHS) Guidelines.<sup>6</sup> The guidelines provide the context of international best practice and contribute to establishing targets for environmental performance. The air and noise standards in the EHS guidelines will be used to complement the government standards in this document where needed.

56. Occupational and community health and safety, as laid out in the EHS guidelines, will be a cross-cutting assessment for the subprojects.

### III. DESCRIPTION OF THE SUBPROJECT

#### A. The Subproject Area

57. This subproject feasibility study (SPFS) focuses directly on the implementation of Climate-Smart Water Management activities which includes rehabilitation and upgrading of irrigation infrastructure (Direct Minor Canal L2 (DML2)). This subproject is representative of a proposed similar projects. As illustrated in the satellite image below, the DLM2 (at the bottom of the photo) is just to the north east of Pakokku Town.

<sup>5</sup> There are numerous control standards for dredging of sludge. What has been recently used in Myanmar, and is accepted for use in Myanmar is; Japan: Environmental Quality Standards (EQS) for soil pollution, August 1991, and the People's Republic of China (PRC): GB4284-84 Control standards for pollutants in sludge for agricultural use; PRC: GB/T23486-2009 Sludge quality for afforestation in gardens or forests.

<sup>6</sup> <http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>



**Figure 1: Satellite Image Site Plan of the Subproject**

58. The subproject (SP) included the renovation of a tertiary canal (DML2), (Kyi Ywa, Shwe tan dit Village), comprises rehabilitating and modernizing critical infrastructure of small scale irrigation systems in order to increase production, reduce post-harvest losses, monitor and enhance quality and value chain linkages<sup>7</sup>:

**Table 6 - GPS Coordinates of Subproject Water Management Activities**

Activities (SP-FS1)	Water Management	Village	Township	GPS - Coordinates	
a	Irrigation Canal Pumping Project Kyi Ywa	Shwe Tan Dit Village	Pakokku	21°21.296'	095°08.404

59. **SPFS<sup>8</sup> Selection Criteria:** Sites and farming groups for this project activity were selected based on the following selection criteria:

- Renovation of new existing minor canals supplying fields of project supported Farmers' Group or Agricultural Cooperative (AC), led by a lead seed grower who

<sup>7</sup> Note that the subproject originally included a proposed pond (small reservoir) but this has been dropped. One or more tubewells are also likely to be constructed in the area (a site by Kunn village has been identified) but this is subject to a separate feasibility.

<sup>8</sup> Value Chain Fit: More reliable irrigation will give the farmer more cropping choices and diversification. Farmers that are cultivating two crops of paddy (monsoon and winter) have the choice of changing their farming practices and adopting the cultivation of crops such as green mung bean, chick peas, pigeon peas, sesame which require less water and are of more value and climate resilient, with increased cropping intensity due to more reliable irrigation, the supply of agricultural commodities will increase and the value chains will be strengthened.

is practicing CSA and using climate resilient seed varieties of rice, pulses, beans or sesame;

- Renovation of new or existing on-farm ditches linking a minor canal to a farmer's field, owned by a member of a Farmers' Group or AC;
- new or renovating old pond, small reservoir, or tube well that can be or is built on farmland owned by a lead seed grower who practices CSA using climate resilient seed varieties of rice, pulses, beans, or sesame;
- Should be climate resilient with a sustainable supply of water (irrigation / pumping canal) or has sufficient quantity (pond or small reservoir) or yield (tube well);
- It should not be covered by other ongoing or proposed development projects financed by ADB or donor partners;
- It should not cause involuntary resettlement and should require as little land acquisition as possible;
- There is potential for cluster (cooperative) development and beneficiaries to include vulnerable communities, poor and women farmers;
- Should lead to more cropping intensity by cultivation of crops during the summer or winter season.<sup>9</sup>

60. The project activities for the subproject includes:

- Strategic development of tertiary canals and pumping irrigation systems to be linked to on-farm ditches;
- Construction of three-walled brick mortar lining to tertiary canals to prevent seepage and lower maintenance requirements;
- Construct above the bund allowing for water to flow by gravity;
- Fit the tertiary canals with regulating and conveyance structure (gates, check structures) that fit inside the three-walled canal;
- The tertiary canals are to be established on existing farm canals;
- Installation of on-farm ditches linked to tertiary canals.

#### **IV. DESCRIPTION OF ENVIRONMENT**

##### **A. Location, Natural Features, Land use & Geopolitical Data**

61. Introduction: A primary issue related to the environment is that the subproject is located in CDZ, where it is estimated that approximately one-quarter of the country's population live. The following Figure 1 illustrates the CDZ which covers more than 54,000km, encompassing 58 townships which span from lower Sagaing region, to the western and central parts of Mandalay region and most of Magway region. The CDZ is situated in the shadow of the Rakhine mountain range, and it is the climate and climatic characteristics which are of great significance to the CFAVCS. The CDZ receives limited rains compared to country averages and at the same time climate in the CDZ is not homogenous across the area, with conditions ranging from semi-arid (and even arid) in certain areas to semi-humid in others. Dry spells during the rainy season are frequent, but their intensities vary geographically and over time. Insufficient rain is not the only potential hazard, however, as decreasing forest cover and soil erosion place communities at

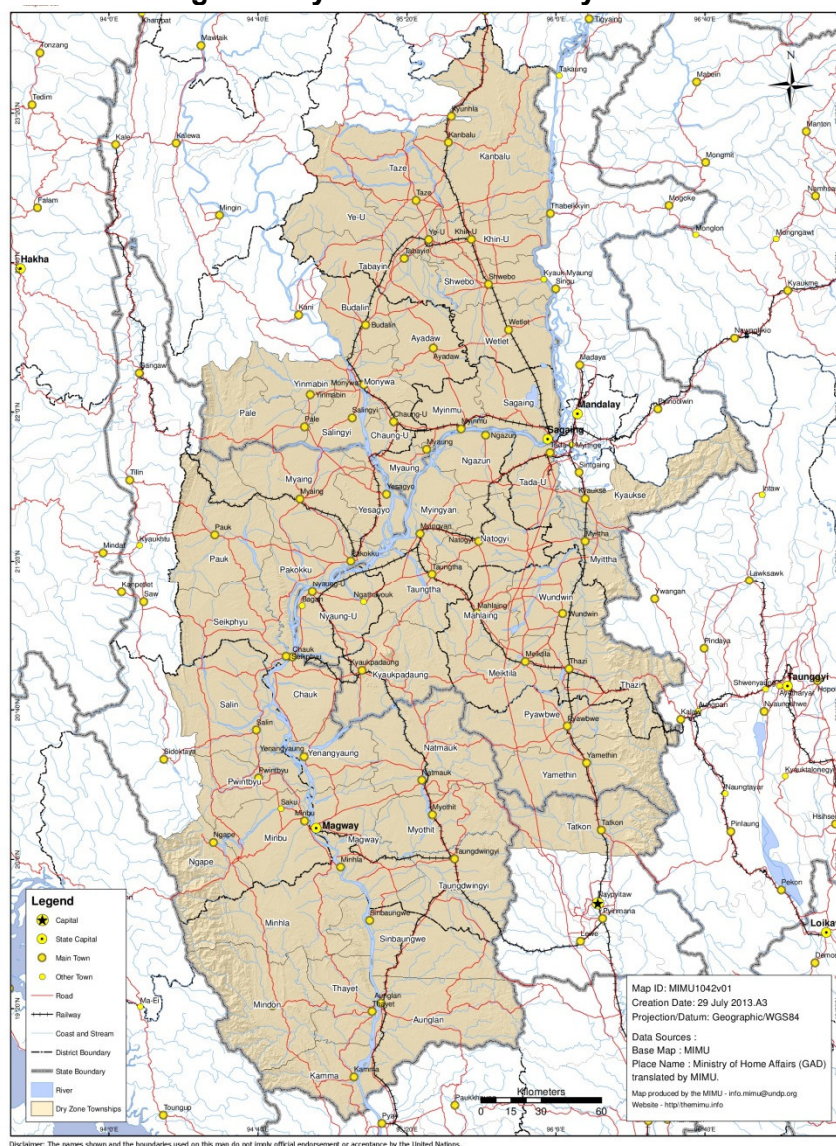
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<sup>9</sup> Climate Change Fit: improving water use efficiency is an element of the Climate Smart Agriculture approach, making agriculture more climate resilient to cope with the variability of climate, particularly changing rainfall pattern, alternative irrigation subprojects will include sufficient water resources for cultivating wet dry paddy practices

greater risk of localized flash floods during times of heavy rain. The dry zone is particularly affected by food security issues.<sup>10</sup>

69. The CDZ is an environment which has been identified as one which can be expected to experience an increase in uncharacteristic weather events, attributed to the impact of climate change. Agricultural practices including cultivation practices, varietal selection and irrigation can all be improved to assist in the adaptation to these phenomena.

**Figure 2 Myanmar “Central Dry Zone”**



70. The land on which the subproject is situated is predominantly flat plains adjacent the Ayeyarwaddy River some five kms from the Pakokku Town in the CDZ area at an average

<sup>10</sup> <http://themimu.info/special-interest-region/dry-zone>



altitude of 65 m above mean sea level<sup>11</sup>. The area has been established as a cropping area. There are mountain ranges (Tant Kyit and Tat Ma) at the west of the plains.

71. **Soils.** Soils are basically sandy clay loams with some variance across the area. Top soil depth varies from 150-200mm with a heavier clay loam base as the 'B' profile. Farmers describe the soils as free draining, with the exception of one particularly bad low-point where numerous farmers suffer loss of crops due to inundation, which are becoming more frequent due to greater intensity of rainfall during monsoon. Traditionally farmers have used introduction of organic fertilizer for the cropping

72. **Vegetation.** The farming areas have been established for many generations and remnant vegetation exists on the perimeter of cropping areas and along low-lying drainage lines. The farmers report no shortage of available vegetation for fuel wood. There is no delineated vegetation areas dedicated for habitat and the nearest "protected area" is approximately 200 km away. The native trees of Pakokku are Than, Dehat, Nebé, Shah, Htaukkyat, Toddy, Kokko, Tamarine, Neem, Mango, Custard, Gauva and Letpan trees.

73. **Farming enterprise / size etc:** The individual farm sizes vary considerably from 1.0 acre to 35 acres. For generations the farming focused upon cropping, with almost 100% of product targeted for sale in Pakokku to markets and traders. In 2003 a major canal was introduced to the area and as a result the farmers were told to introduce the growing of paddy, despite the soils not being suitable. This decision was rescinded after 2-3 years and now paddy occupies a small area. Like the rest of the country, the number of rice varieties grown has gone from a large number down to 2 to 3. These changes have been driven by length of growing season (the range of which can vary from 90 to 150 days) and the taste. Manaw Thuka variety is by far the most popular. Major crops include green pigeon pea, ground nut, black bean, paddy (Manaw Thuka), green gram, black sesame. The split between domestic use and market sales vary with some household's selling almost 100% and then purchasing for home consumption.

74. **Fertilizer / Pesticide / Insecticide:** Agents for "control" of insect pests in crops have been adopted following recommendation from the DOA.

75. **Noise Level** – The sub project areas in Pakokku township, being a rural area of paddy land and residential homes, is quiet as witnessed by the consultant team during their site visits and analysed that the local acoustic levels do not exceed the permissible level of 55 dB(A) for residential, institutional and open land areas.

76. **Water Quality** – The tube wells in the sub project areas of Kyi Ywa and Kun Ywa yield clear, fresh water according to local respondents and visual inspection of tube wells water by the consultant team during site visits during Nov 2016. The local inhabitants drink their tube wells water and also use it for domestic purposes. The Ayeyarwaddy River water is pumped and distributed by canals to grow rice, pulses and beans. The quality of canal water is soft water. But not sufficient for some household needs in Kyi Ywa Village because of the nature of soil being sandy soil and canals not lined as yet<sup>12</sup>. Water Samples from the Ayeyarwaddy River at Pakokku were analysed for their physical and chemical parameters of health significance at the Government Laboratory of the Irrigation Department, MOALI during 2010 – 2011 and were

<sup>11</sup> Pakokku Township Administrative Annual Report, 2016.

<sup>12</sup> Appendix 2: List of Meeting Participants Project area

found to have pH within 7.1 to 7.3 with turbidity ranging from 2 – 10 NTU. According to United States Department of Agriculture Classification of Irrigation Water, the Ayeyarwaddy river water at Pakokku is classified as C1-S1 (Low salinity hazard class and low sodium hazard class) which is of good water quality; suitable for irrigation purposes.<sup>13</sup> During construction phase of the project, appropriate drainage systems should be monitored to avoid any potential pollutant from affecting the downstream water body of the Ayeyarwaddy River.

77. **Air Quality** – The air is fresh, natural and healthy in the sub project areas as the area is rural and hardly any pollutants from factories, buses and traffic are present. However, when the proposed project commences, monitoring of the air quality should be administered for its construction phase and mitigation measures duly applied for the control of expected potential air pollution caused by particulate matter from dust and heavy equipment.

78. **Climate Change** - there is a strong farmer perception that temperatures in the dry season period are getting hotter, that rainfall is becoming more intense, and that the arrival of the wet season is not as predictable, both getting later and later and more concentrated with the finish not altering to the same degree.

79. **Rainfall** - Pakokku's wet year annual rainfall is 1013 mm and dry year annual rainfall is 379 mm. This means that Pakokku has irregular fluctuation of rainfall intensity during the span of 23 years (1988-2012). The average monthly rainfall pattern is described in Table 7, Figures 2 and 3, respectively.

**Table 7: Monthly Rainfall in mm at Pakokku (Mean Year, Wet Year, Dry Year with season)**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	Dry Season				Pre Monsoon			Monsoon			Post Monsoon		
Mean Year	1	1	6	13	100	83	46	92	109	120	24	4	599
	21				229			321			28		599
Wet Year	0	0	3	25	107	98	82	271	166	251	0	13	1013
	28				287			687			13		1013
Dry Year	0	0	0	1	51	44	15	126	76	46	22	0	379
	1				109			248			22		379

<sup>13</sup> Appendix 5: Analyses of Ayeyarwaddy River Water at Pakokku

Figure 3: Annual Rainfall Pattern at Pakokku

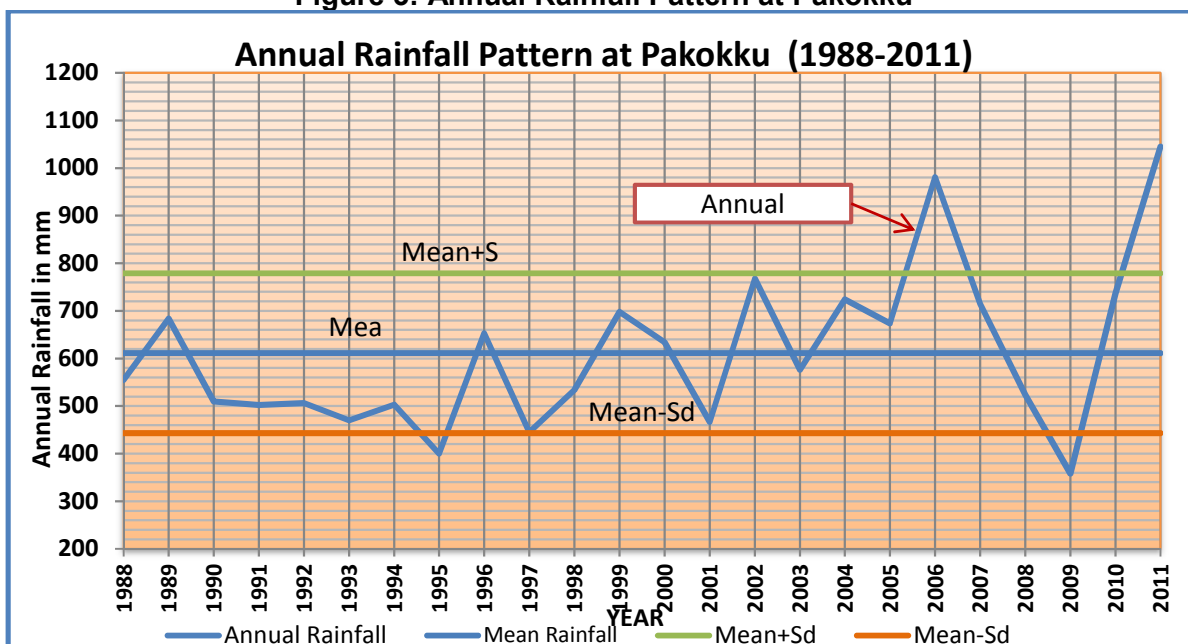
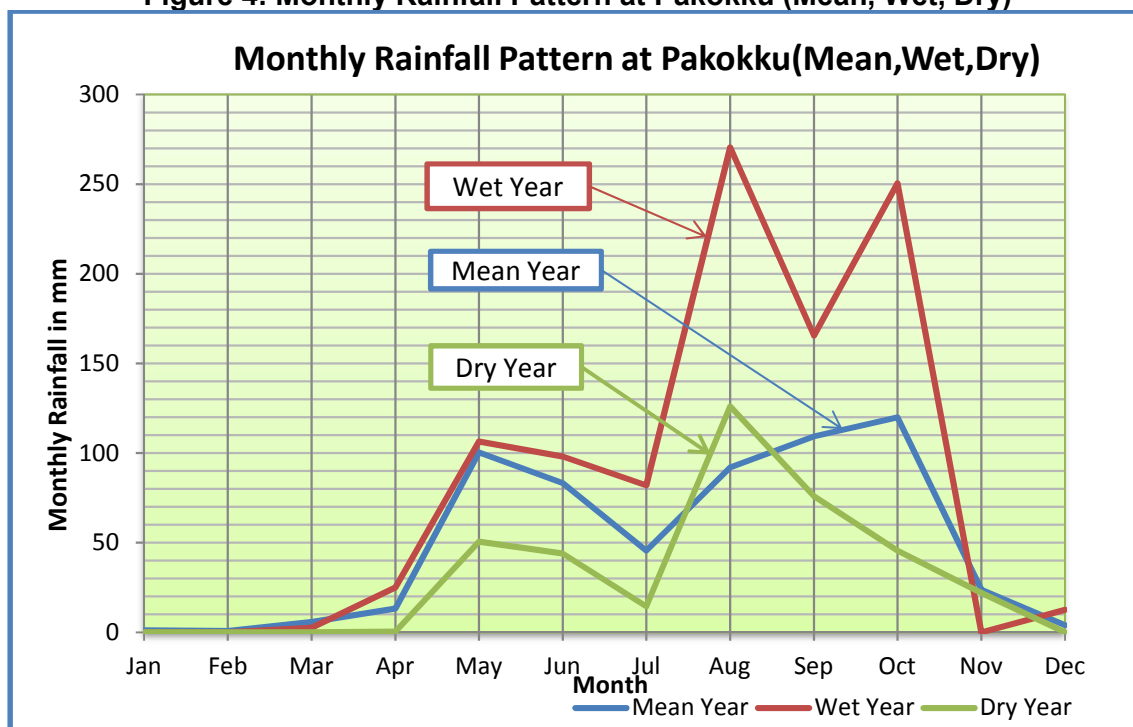


Figure 4: Monthly Rainfall Pattern at Pakokku (Mean, Wet, Dry)



Source: Myanmar Meteorological and Hydrology Department.

**Table 8: Pakokku Geopolitical Information**

Provincial Township	Pakokku
Provincial area	1,258 km <sup>2</sup>
Landscape	Mostly plain area with Tant Kyi (317 m) and Tat Ma (343.5 m) Mountain Ranges at West of Pakokku
Total Population	316,811 persons
Population Density	232 persons/km <sup>2</sup>
Population age over 18years	215,547 persons (Men: 97,816 Women: 117,731)
Temperature	19.8 °C - 28.1 °C (Average: 23.8 °C) {1971-1981 data} 15 °C - 43 °C (Average: 29 °C {2016 data } tbc, Max Temp on site: 45
Rainfall	1,045 mm/year (2011)

Source: Pakokku Township Administration Annual Report 2015, Meteorological and Hydrology Department, MOALI.

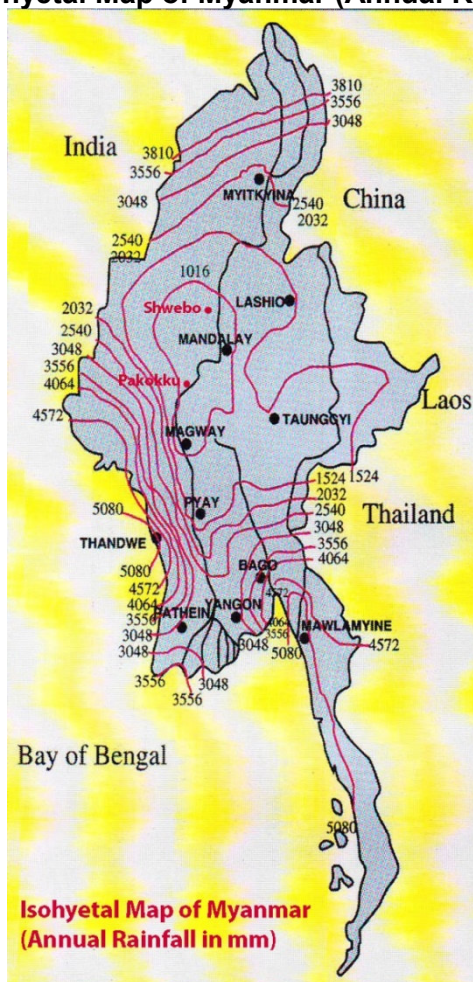
## **E. Broader Environmental Setting**

80. The following section outlines detail regarding national environmental setting and the background into which the subproject will be operating.

81. **Climate:** The climate in Myanmar is tropical monsoon with three seasons: wet, dry and hot season. The monsoon pattern controls the climate in Myanmar. During the wet season, the southwest monsoon is from May to October when about 80% of the rainfall occurs. The dry season is from November to January, which is dry and cool with North Easterly winds. During the months of Feb to April, the weather is hot, dry and less humid with particularly high potential transpiration demands (hot season).

<sup>14</sup> Environmental Survey on site was done in Kyi Village, Pakokku Township, CDZ on 12-14 November 2016.

**Figure 5 - Isohyetal Map of Myanmar (Annual Rainfall in mm)**



Source: DAP, MOAI, "Myanmar Agriculture at a Glance"

82. **Climate Change Scenarios:** Myanmar has been experiencing climate variability effects for decades and has been exposed to various climate hazards such as cyclone, heavy rain, flood, extreme temperatures, drought and sea level rise. Adaptation to climate change indicates the need for increase in infrastructure specification against the increased chances of such cyclones. It has been identified that climate change has been occurring in the country, manifest by decreasing southwest monsoon duration, increasing cyclone seasons, and increasing landfall frequency on the Myanmar coast. The rural areas are the hardest hit. As mentioned above, Cyclone Nargis hit in May 2008 - a Category 3 or minimal Category 4 hurricane (with sustained winds of 130 mph and gusts of 150-160 mph), producing devastating floods that were probably the worst ever in Myanmar's recorded history<sup>15</sup>. It is likely that wet season rainfall intensity will continue to increase in the future, and then might decrease again after 2050. However, under high emission scenarios, the direction of change will be expected to reverse<sup>16</sup>.

83. In the period from 1988 to 2000, the monsoon duration was shortened by about three weeks in the northern part and by one week in other parts of Myanmar compared to the 1951 -

<sup>15</sup> Myanmar's NAPA (National Adaptation Program of Action) to Climate Change 2012 Report.

<sup>16</sup> IPCC (Intergovernmental Panel on Climate Change), "Special Report on Emissions Scenarios" (SRES)



2000 average. The year 2009 was an El Nino year with decreased annual rainfall, with heavy rains in some areas and with drought in others<sup>17</sup>. Moreover, 2016 was considered as an El Nino year and most models from major climate centers indicate the tropical Pacific Ocean will continue to gradually warm over the next 6 months, and there is an increasing chance that weak El Niño conditions could develop in the second half of 2017.<sup>18</sup>

84. **Topography:** Myanmar is a forest-clad mountainous country, with plateaus, valleys and planes. It can be divided as four ecological categories such as (1) Mountainous Region, (2) Central Dry Zone, (3) Ayeyarwaddy Delta and (4) Coastal Zone. The project site—has an average altitude of 65 m above mean sea level and is positioned on flat land adjacent to the Ayeyarwaddy at the East and mountain ranges in the west {Tant Kyit mountain range (317m) and Tet Ma mountain range (344m)}

85. **Graphology and Seismology:** The Republic of the Union of Myanmar is the largest country on the main land of South East Asia. Myanmar shares borders with Thailand, Laos, China, India, and Bangladesh. Its coast line stretches 2832 km from the west to the south along the bay of Bengal and the Andaman Sea. The total land area of Myanmar is about 676,578 km<sup>2</sup> (or 67.66 million hectares) and current land use in Myanmar 2011 status stood as follows:

- (i) Forest cover: 48.16%,
- (ii) Arable and permanent crop: 18.75%, and
- (iii) Other land: 33.09%.<sup>19</sup>

86. Myanmar is endowed with rich natural resources, abundant water resources and cultivable land and favourable climate before the onset of the climate change effect, which became so evident during the 2008 "Nargis" Cyclone that damaged vast ecosystem services, habitat and human lives in the Ayeyarwaddy Delta. However, the proposed project area is situated in the flat land areas of Pakokku Township. It is significant that the focus group discussions at the project sites (12-15 Nov 2016) revealed that the area had not experienced any floods or cyclonic effect from the Nargis.

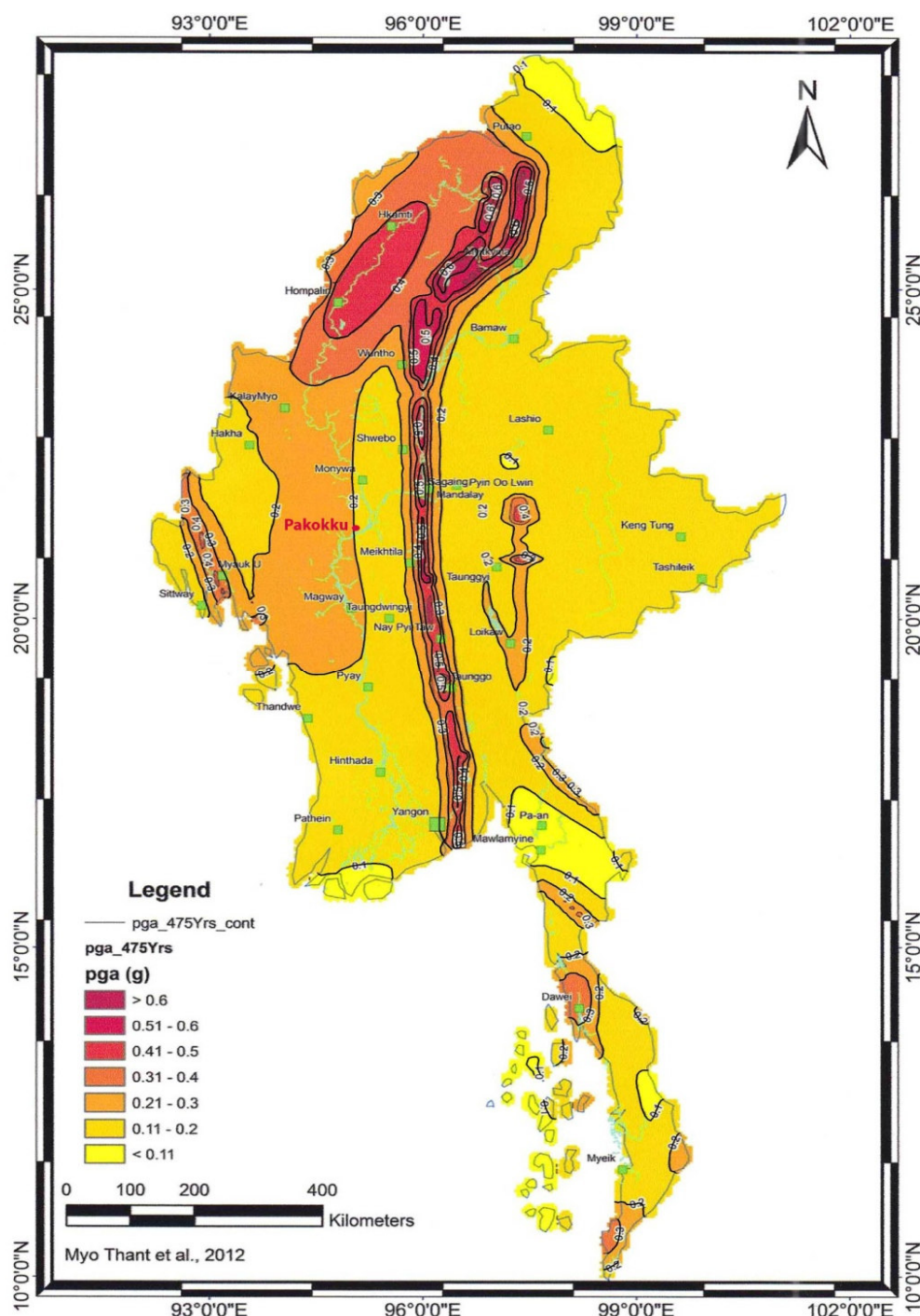
87. **Seismology:** The figure on the next page presents the Probabilistic Seismic Hazard Map of Myanmar and illustrates a 10% probability of exceedance in 50 years (475 years current interval). The seismic hazard is described in term of peak ground acceleration (PGA) in firm rock. The Sagaing Fault line of Myanmar passes through Mandalay, including some parts of the CDZ (Central Dry Zone), Naypyidaw, Bago and Yangon Regions. However, Pakokku Township lies between 0.11-02 PGA, which is of low seismic hazard category.

<sup>17</sup> THA 2015 International Conference on Climate Change and Water & Environment Management in Monsoon Asia, presentation by Win Naing Tun, "Climate Change in Myanmar and Central Dry Zone."

<sup>18</sup> ASEAN Specialised Meteorological Centre (ASMC).

<sup>19</sup> 2015 UN-Water Annual International Zaragoza Conference, 15-17 Jan 2015, "Case Study: Integrated Water Resources Management in Myanmar."

**Figure 6 - Probabilistic Seismic Hazard Map of Myanmar**



Source: Myo Thant et al, 2012, Myanmar Earthquake Committee

88. **Floods and Extreme Weather Events:** Flooding is a regular phenomenon in Myanmar, especially in the Ayeyarwaddy Deltaic Regions, with rainfalls commonly exceeding 500 mm per month in the rainy season. However the subproject area has no record on heavy flood events; except Pakokku flooding during 2012, where the excessive rain water flooded the "Shwe Chaung" resulting in inundation of the low lying areas.

## F. Biological Resources

89. **Protected areas; Forests & Wildlife:** Myanmar possesses a great extent of biological diversity<sup>20</sup>:

- (i) Marine biodiversity in the coastal areas;
- (ii) Coastal and inland mangrove;
- (iii) Tropical evergreen forests in the south;
- (iv) Moist deciduous, dry deciduous forests;
- (v) Dry and sub-humid land in the central; and
- (vi) Snow-capped mountains in the far north.

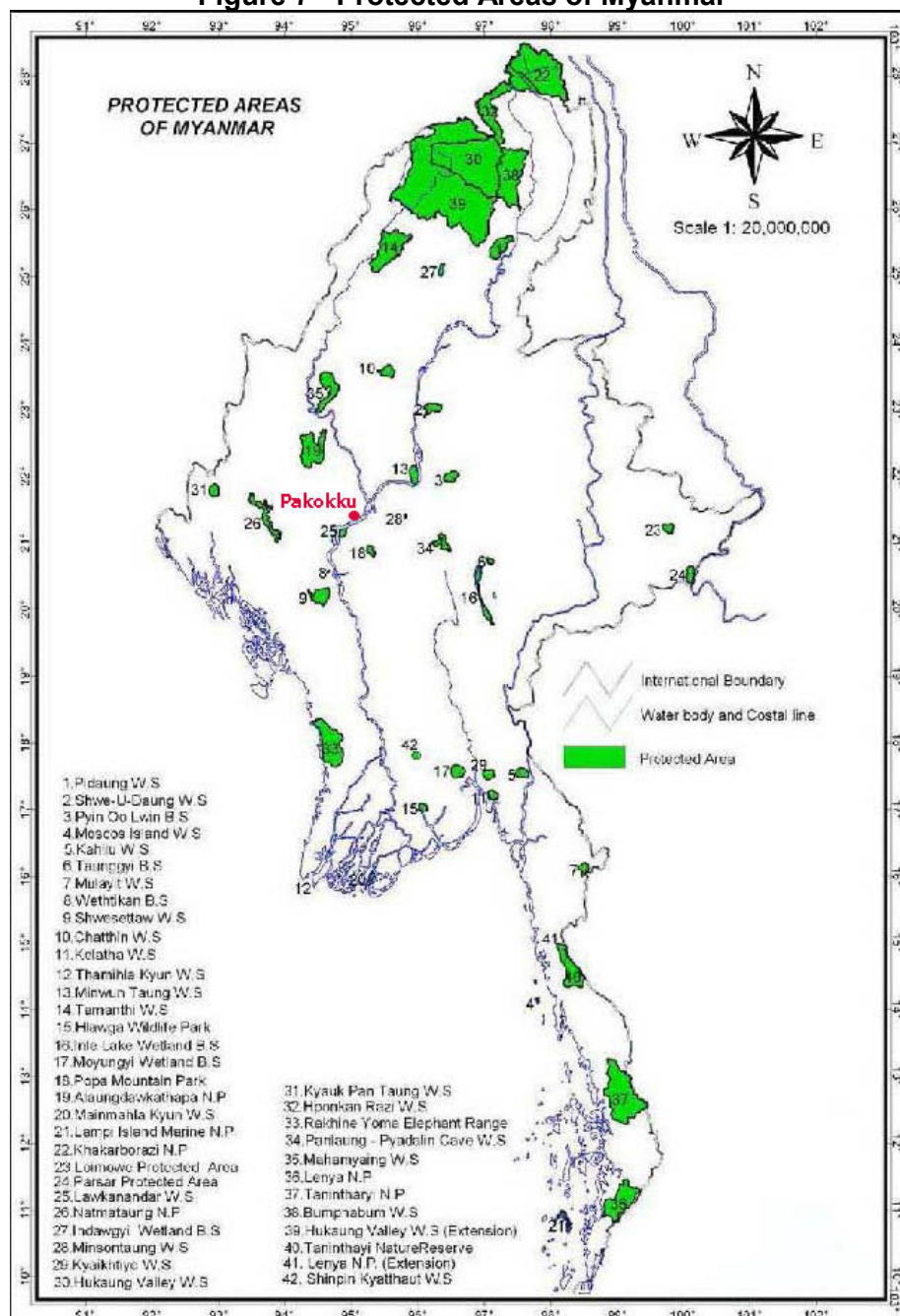
90. Protected areas in Myanmar are under control by MONREC. Legislation relevant to biodiversity conservation includes:

- (i) Elephant Preservation Act, 1879;
- (ii) The Wild Bird and Animals Protection Act, 1912;
- (iii) The Wildlife Protection Act, 1936;
- (iv) Forest Law, 1992;
- (v) The Protection of Wildlife and Conservation of Natural Areas Law, 1994;
- (vi) Forest Policy, 1995; and
- (vii) Rules relating to the Protection of Wildlife and Conservation of Natural Areas, 2002.

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<sup>20</sup> Thein Aung, AD, Nature and Wildlife Conservation Division, Forest Department, "Status of Biodiversity Conservation in Myanmar"

Figure 7 - Protected Areas of Myanmar



Source: Adopted from

[https://en.wikipedia.org/wiki/List\\_of\\_protected\\_areas\\_of\\_Myanmar#cite\\_note-8](https://en.wikipedia.org/wiki/List_of_protected_areas_of_Myanmar#cite_note-8)

91. While nominally there are forty-two (42) protected and wildlife conservation areas which have been administered since 1879 by the relevant forest department of that time, in 2002 the rules relating to the protection of wildlife and conservation of natural areas gives three categories of natural protected areas (with their purpose) as:

(i) National Park (Natural Park);

- (ii) Wildlife sanctuary – wildlife preservation and protection, wildlife park, mountain park;
- (iii) Protected landscape – protected scenic view areas to be maintained as scenic spots for leisure and tourism.

92. Law for the projected areas embodies that every protected area shall be protected and controlled from any negative impacts of every human activity. Every development project proposed in the protected areas will be banned except those which are approved by ECD (Environmental Conservation Department) in terms of benefits to natural resource conservation and management purposes. (A table of protected areas in Myanmar appears as Appendix II).

93. Although the project is not located within any designated protected areas it is observed that one great difficulty in Myanmar is that governance over protected areas is a challenge, and routinely there is opportunity for flagrant disregard for laws and regulation to go either undetected or unenforced. Capacity and achievement in the area of resource protection has been highly contentious for numerous decades. Protected Areas that are within 300 km of the project site, Pakokku, are as follows and shown in the figure below:

- (i) Popa Mountain Park (Located as no. 18 in Figure 7 - Protected Areas of Myanmar);
- (ii) Lawkananda Wildlife Sanctuary (No. 25 in Figure 7 - Protected Areas of Myanmar);
- (iii) Minsontaung Wildlife Sanctuary (No. 28 in Figure 7 - Protected Areas of Myanmar).

94. **Water Resources:** Myanmar has many rivers and surface water bodies. The Ayeyarwaddy, Chindwin, Salween and Sittaung rivers are the four main rivers which flow across the country from north to south. The Ayeyarwaddy River is the largest river and most important waterway. It runs through Myanmar with a total length of 2169 km and about 86% of the country's land lies in the Ayeyarwaddy catchment area. The Inle Lake is the largest freshwater lake in Myanmar with a size of about 642 km<sup>2</sup> in dry season and increases to 9,000 km<sup>2</sup> in wet season. Thus, there is access to substantial surface water resources from the inflow from upstream countries and the internally generated flow. For the groundwater resource, this is extensive and abundant in the country and is estimated to contain 495 billion km<sup>3</sup> (or 495 km<sup>3</sup>)<sup>21</sup>.

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<sup>21</sup> Myint Thein, AD, Irrigation Department, "Water Resources Potential of Myanmar"

**Table 9 - Potential Water Resources in Myanmar**

<b>Potential Water Resources in Myanmar</b>				
<b>River Basin Number</b>	<b>Name of the River Basin</b>	<b>Drainage area (1000 * km<sup>2</sup>)</b>	<b>Surface water (km<sup>3</sup>)</b>	<b>Ground water (km<sup>3</sup>)</b>
I	Chindwin	115.3	141.293	57.578
II	Upper Ayeyarwady	193.3	227.920	92.599
III	Lower Ayeyarwady	95.6	85.800	153.249
IV	Sittoung	48.1	81.148	28.402
V	Rakhine State	58.3	139.245	41.774
VI	Taninthari Division	40.6	130.927	39.278
VII	Thanlwin	158.0	257.918	74.779
VIII	Mekong	28.6	17.634	7.054
	<b>Total</b>	<b>737.8</b>	<b>1081.885</b>	<b>494.713</b>

Source: Myint Thein, AD, Irrigation Department, "Water Resources Potential of Myanmar"



**Figure 8 - Map of Myanmar and Main Water Resources System**



Source: Adapted from [www.mapsofworld.com](http://www.mapsofworld.com)

95. **Fisheries and Aquatic Environment:** Aquatic ecosystem within the subproject was studied during focus group discussions and field visits on site. The majority of the respondents informed that their villages do not have any fisherman. They are all farmers and crop growers. However, the youths of the villages sometimes go fishing with rod and ordinary fish bait in the nearby ponds in their leisure time. Most of the fish harvested in the CDZ area is fresh water fish such as cat fish, Nga Kyinn, Nga Shint, Nga Kone Ma, Nga Sin Set, Nga Zin Yine, Nga Loo, Nga Pat, Nga Phan Wine and Shrimp.

96. Based on the Fifth National Report to the United Nations Convention on Biological Diversity, March 2014 of the Republic of the Union of Myanmar, the Biological Diversity in Myanmar is immense as it is home to a wide range of habitats and wildlife with numerous differing landscape and seas capes. However, a nation-wide comprehensive survey of flora and

fauna has not been possible to date; most of the scientific work on biodiversity has been project or site based. Nevertheless, several new species has been discovered within these sites. Select species discovered since 2009 (after the publication of the fourth national report) are presented in Table 9 below. There are 310 fresh water fish species and 465 Marine fish species recorded in Myanmar.

**Table 10: Number of Recorded Biodiversity Species in Myanmar**

Species group		Number of species		Remark
		Current Status	4 <sup>th</sup> National Report	
Plant (Gymnosperms and Angiosperms)		11,824	11,800	+24
Mammals		252	251	+ 1
Bird		1056	1056	—
Reptile	<i>Snakes</i>	172	153	+ 19
	<i>Lizards</i>	87	87	—
	<i>Turtles and tortoises</i>	32	32	—
	<i>Crocodiles</i>	4	4	—
Amphibian	<i>Frogs and toads</i>	116	79	+ 37
	<i>Caecilians</i>	2	2	—
	<i>Salamanders</i>	1	1	—
Fish	<i>Fresh water fish</i>	310	310	—
	<i>Marine fish</i>	465	465	—

Source: Myanmar, "Fifth National Report to the United Nations Convention on Biological Diversity", March 2014

## **G. Socio-Economic Status**

97. Pakokku Township is in Magwe Region. It is situated at the east bank of the Ayeyarwaddy River in the Central Dry Zone area of Myanmar. It is an economically vibrant township with the majority of inhabitants earning their livelihood from agriculture, livestock breeding, industry and marketing. It is a hub area, where the railway, roads and waterway meet, resulting in business opportunities contributing to the local and national economy. The Pakokku Bridge, the longest in Myanmar, across the Ayeyarwaddy River, connects the cities from the east to west, and north to south of Myanmar. Because of this bridge, transportation to the Chin States and to border areas with India in the West; and to China in the East; is made accessible.

98. There is an Industrial Zone established in Pakokku Township and many factories and industries are operating in this area. The main agricultural product of Pakokku is pulses, beans and sesame.

99. Land Use Statistics: The Pakokku Township uses 44.04% of its total land area for agricultural purposes and 1.39% for Industry. The table below shows the detailed land use acreage of Pakokku Township.



**Table 11: Land Utilization in Pakokku**

<b>Sr. No.</b>	<b>Description</b>	<b>Area (acres)</b>	<b>% Percentage</b>
1	Net Sown area {(a) Paddy Land (b) Upland (Cultivation) (c) Alluvial Land (d) Garden (e) Hilly-Land}	136947 {873 114382 21575 107 -	44.04%
2	Unsown area (a) Paddy Land (b) Upland (c) Alluvial Land (d) Garden (e) Hilly-Land	10} - 10 - - -	
3	Pasture Land	-	
4	Industrial Land	4322	1.39%
5	Urban Land	2167	0.7%
6	Rural Land	6313	2.03%
7	Other Land	45202	14.54%
8	Reserved and Protected Area	27520	8.85%
9	Jungle Land	30681	9.87%
10	Virgin Land	2126	0.68%
11	Uncultivable Land	55659	17.9%
<b>TOTAL</b>		<b>310937</b>	<b>100%</b>

Source: Respective Township General Administrative Office

## **V. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES**

100. This section presents the potential environmental impacts of the project during pre-construction, construction and operation phases and the recommended mitigation measures to address the environmental impacts. The analysis of the environmental impacts is focused on the civil works associated with the Climate Smart Water Management in the project areas.

101. **Potential Environmental Impacts** have been assessed during the site visits by the consultant team. During construction phases of all sub projects including canal lining works, potential adverse impacts on air pollution and noise levels are expected due to excavation, dredging, spoil handling and waste disposal.

### **A. Positive Impact and Environmental Benefits**

102. The renovation of canals with brick masonry lining will provide irrigation which will improve crop productivity and promote diversification.

103. The improved water control and management will enable the communities to improve upon their management of drought. Training on irrigated agriculture practice will improve farmers' knowledge on soils and appropriate responses, field improvement and preparation for irrigation, field water management, and maintenance of the climate smart water management irrigation system, which strengthens the adaptive capacity of farmers to climatic variability.

104. Through the enhancement of agricultural activities and local incomes, in-migrant employment can potentially benefit members of local communities who will migrate for prospective work. Additionally some migrant employment will return home on the basis of improved agricultural opportunities in the district, and face improved chances to find a local job.

### **B. Environmental Measures during Pre-Construction Phase**

105. During the project design, anticipated environmental impacts includes as follows:

106. **Overall Design:** Three overall positive environmental issues are expected to result from the sub project development. First, the need to maintain flows level from the connection to the farms. Second, the irrigation system will be connected on existing farm land; however the obstructions of private land acquisition and properties should be considered too to avoid or mitigate any possible impact. Thirdly, quality of the design, particularly climate change considerations is very necessary. The design will allow water to be diverted to farm areas during dry / drought periods. It will also allow for greater water availability for domestic animal and people.

107. On the climate smart water management subproject site there are no significant environmental concerns regarding the location, because the project is only an improvement / impervious lining of the canal, with drainage type system which is already in existence in the farm area. In addition, no protected area exists in the subproject areas.

108. **Local Ecological Features:** The existing irrigation site is located outside all of the protected areas. The surrounding land use is predominantly flat plain area of paddy / crop land. Thus, the potential impact on local ecological features is not envisaged.

### **1. Impacts and Mitigation Measures during the Construction Phase**

109. **Contractor Performance and Site Management:** The EMP will be implemented by a contractor who will be obliged, under the terms of the Contractor's Environmental Management Plan (CEMP), to avoid and/or minimize potential negative impacts. To ensure that construction contractors are able to implement the mitigation measures effectively, the PMU will put in place the following arrangements: (i) environmental specifications will be included in the bidding documents to contractors; (ii) an appropriate environment section describing standards and responsibilities will be included in the terms of reference for bidders; and (iii) clauses referencing the EMP mitigation provisions and monitoring plans will be written into the construction contracts. Following the award of construction contracts, the successful contractor will prepare a CEMP which will include the Site Environmental Management and Supervision Manual, including an emergency preparedness and response plan for construction emergencies and site

environmental health and safety plan, for approval by the PMU (via the PIU). The contractor will prepare quarterly report on environmental management to the PMU (via the PIU).

**110. Summary of potential impacts:** The potential impacts identified about which the contractor will need to take precaution concern the management of spoil from excavation (which is considered low), dust from construction and transportation work (about which mitigation measures have been drawn up), possibility of flooding during the wet season and human and solid waste from the construction team. The potential negative scope of these environmental concerns are not considered to be unmanageable if the contractor follows the procedures outlined.

**111. Institutional Arrangements:** The role of executing agency (EA) will be the responsibility of MOALI and therefore oversee overall management, coordination and reporting and obtaining ADB and government approval where required. The PMU responsible for preparing environmental safeguards documents (categorization forms, IEE where applicable etc.), implementation of the EMP, as well as monitoring and reporting to the EA. The PMU under MOALI will appoint an ESO with environmental management duties working in collaboration with and under direction from the PMIC.

**112. The PMU's ESO** will be specifically focused upon: (i) assistance to the PMU to implement the provisions of the EARF for each subproject; (ii) providing training to provincial environmental safeguards focal points to facilitate implementation of the EARF, IEE and EMP; (iii) consolidating the categorization of subprojects for submission to ADB; (iv) working with the provincial environmental safeguards focal points to implement the project GRM; and (v) reviewing the semi-annual environmental monitoring reports (prepared by the consultant) and submitting these to the ADB. Detailed TOR of the SO is included in the EARF.

**113. Supervision of site activities** will be the responsibility of the relevant ministry at the regional level. In this subproject, Magwe regional MOALI will be responsible for supervision of site activities, and will assign an environmental safeguards focal point to (i) oversee implementation of the EMP and monitoring plan of the subproject; (ii) screen the subproject for environmental impacts; (iii) categorize the subproject for environment; and (v) provide input as required to semi-annual environmental monitoring reports.

**114. Erosion:** On-site actions by the contractor including excavation during heavy rain events could be the cause of erosion. It is the contractor responsibility to ensure that all precautions are taken to minimise the possibility of soil erosion on the site.

**115. Consultants (International and National)** will provide technical assistance and training, (the TOR for their inputs are also tabled in the EARF).

**116.** The ADB will review documents, conduct missions and provide guidance to the project.

**117. Protected Areas:** All protected areas listed are out of the proposed subproject sites. No significant natural terrestrial or aquatic habitats exist and natural biodiversity comprises only common wildlife living among humans in agricultural regions, domesticated animals and feral pests and rodents. There will be no significant loss of native flora and fauna as a result of the Project.

**118. Cultural Heritage:** During construction, contractor will ensure that any local cultural sites (including shrines, graves, and other belief) will be kept clear of construction material and

protected from other disturbance. Access to these sites will not be impeded, and after construction is finished any disturbed surroundings will be restored to pre-construction standards. If there is any issue, related to this matter must be informed to PMU immediately.

119. **Construction camps:** The construction contractors will establish offices and work camps at the site works which may generate solid waste in unsanitary condition as well as wastewater at the site. Therefore, proper disposal of this waste is essential to avoid environmental pollution which could in turn be a health hazard to workers and the community. It will be the responsibility of the construction contractors to provide toilets with pump-out and disposal facilities and sufficient waste bins at strategic locations and ensure that they are (i) protected from **birds** and vermin, (ii) emptied regularly (using the nearest a landfill or site which is allowed by the local authority), and (iii) do not overflow. Construction contractors will also assume responsibility, as outlined in the CEMP, for ensuring that all workers on site will be familiar with the possibility of transmitted diseases. The contractors will clean the camps areas after moving or completion of works.

120. **Worker Safety and Health:** It is the responsibility of the contractor to be pro-active to ensure occupational health and safety issues are managed in a thorough manner. The approach and procedures required will be incorporated into the CEMP and implementation will become **the** responsibility of all workers and management.

121. **Hazardous and polluting materials:** Construction material handling and disposal guidelines and directions that include spill responses will be prepared and implemented as part of the CEMP & Site Environmental Management and Supervision Manual of each construction site. The following measures will be taken to prevent pollution of soil and surface water/**groundwater**: (i) storage facilities for fuels, oil, cement, and chemicals will be within secured areas on impermeable surfaces, provided with bunds and clean-up installations; (ii) vehicles and equipment will be properly staged in designated areas to prevent contamination of soil and surface water; (iii) vehicle, machinery, and equipment maintenance and re-fuelling will be carried out in such a way that spilled materials do not seep into the soil; (iv) oil traps will be provided for service areas and parking areas; and (v) fuel storage and refilling areas will be located at least 50 m from construction sites and will be protected by temporary drainage bunds to contain spills.

122. **Air pollution:** During construction, some heavy and light machinery will be used that they will **generate** gases including  $\text{CO}_x$ ,  $\text{NO}_x$ , etc. This will be minimized by the use of routine equipment checking and maintenance to meet a high standard and to ensure efficient fuel burning and quality. Vehicle and site emissions will be in compliance with the National Environmental (Emission) Guidelines, Myanmar, 2015.

123. **Traffic:** It is critical that contractor ensures that traffic management in and out of the construction site is attended to with care during construction phase, ensuring that the community and the neighbourhood is not put at risk from traffic.

124. **Dust:** An adverse environmental impact could occur during the construction phase in case of improper construction management of building materials which generate air-borne dust from transportation or during construction, but is not likely significant. Water shall be sprayed during construction if the construction zone will be located within 50 m from residential areas such as village, hospital, school and so on to ensure that dust is minimized throughout the construction zone.

125. **Noise:** The transport of material, aggregate, concrete and waste material to and from sites will also cause noise impacts along the haulage routes. Activities with intensive noise levels will not only have an impact on the residents, but may also cause injury to construction workers operating the equipment. Noise can be expected during construction due to construction machinery operation and transport activities. Construction activities will involve haulage vehicles, drilling machinery and other machinery.

126. **Conflict:** It is the responsibility of the Contractor to be pro-active in addressing any issues of potential conflict among workers and with the community.

## 2. Environmental Impact and mitigation measures during Operation

127. **Inadequate O&M:** Poor and inadequate operation and maintenance (O&M) of the CSA Water Management irrigation systems could cause unintended adverse environmental impacts. Establishment and operation of WUC (Water User Committee) is part of the project design and support. The WUC and Water User Groups (WUGs) need to be improved in their capacity on technical aspects including maintenance, quality of management and conflict resolution. A WUC is the governing board, normally comprising chairman, deputy chairman, secretary and treasurer. A WUG is charge of undertaking or ensuring the key activities - operation and maintenance and is also involved in collecting irrigation service fee. The project/PMU will support Irrigation and Water Resources Utilization Management Department (IWRUMD) and DOA and WUCs through a technical assistance to strengthen overall water management capacity of WUCs.

128. **Water pollution and chemical fertilizer uses:** The benefits resulting from the project's irrigation and drainage facilities will accrue to the beneficiaries through both intensification and expansion of agriculture in the areas. With an increase in agriculture comes a potential increase in the use of agricultural chemicals.

129. The primary objective of the Project is to provide supplementary wet season irrigation and dry season irrigation. While the additional irrigation area during dry season will be increased, it is also expected that additional chemical use will follow environmental consideration, especially about the toxic chemical used must be considered. All kinds of fertilizer use must meet Myanmar chemical use standard, complying to the Fertilizer Law, 2002. Capacity building for farmers in CSA is required.

## 3. Environmental Health and Safety

130. **Worker Safety and Health:** The installation of the CSA Water Management Irrigation System is a simple exercise and limited worker safety and health issues could be expected to arise as a result.

131. Measures to protect the community will include:

- (i) Planning construction activities so as to minimize disturbances to residents, utilities and services.
- (ii) Implementing safety measures around the construction sites to protect the public, including warning signs to alert the public to any potential safety hazards, and barriers to prevent public access to construction sites and unsafe areas.

132. Measures to ensure occupational health and safety will include:

- (i) Contractors shall be required by the PMU to ensure that their workers and other staff engaged in the proposed constructions are in a safe environment.
- (ii) Following the award of construction contracts, contractors will prepare site environmental health and safety plan for approval by the PMU (through the PIU).
- (iii) Contractors shall ensure that: (a) all reasonable steps are taken to protect any person on the site from health and safety risks; (b) the construction site is a safe and healthy workplace; (c) machinery and equipment are safe; (d) adequate training or instruction for occupational health and safety is provided; (e) adequate supervision of safe work systems is implemented; (f) means of access to and egress from the site are without risk to health and safety, (g) protected equipment such as gloves, face masks etc. is provided by contractors to ensure that all workers are in safety.

#### 4. Unanticipated Impacts during Construction and Operation

133. If any unanticipated impacts become apparent during project implementation, the PMU will (i) inform and seek ADB's advice; (ii) assess the significance of such unanticipated impacts; (iii) evaluate the options available to address them; and (iv) prepare or update the IEE including EMP. ADB will help the PMU mobilize the resources required to mitigate any adverse unanticipated impacts or damage.

#### 5. Climate Change Impact Assessment

134. The environmental risks from climate change need to be addressed in two different but complementary ways: (i) consideration of greenhouse gas emissions; and (ii) adaptation to safeguard infrastructure against the effects of future climate change.

135. **Greenhouse Gas Emissions:** Net greenhouse gas emissions from the project will derive from GHGs emitted by agricultural activities – in particular the CH<sub>4</sub>, N<sub>2</sub>O and CO<sub>2</sub> emissions from rice paddy flooding and cultivation. The project's water management activities for irrigation of rice, pulses and beans in the project areas may also produce some amount of those above GHGs. The greenhouse gas emissions from rice paddy fields have been studied in the South East Asian Nations, and also other Asian nations. Myanmar (Burma) has 6.19 million hectares of harvested paddy area with Methane 2.7 TgCH<sub>4</sub>y<sup>-1</sup>, Nitrous Oxide 1.1 GgN<sub>2</sub>Oy<sup>-1</sup>, and Carbon equivalent 57 TgCO<sub>2</sub>y<sup>-1</sup> emission of GHG from rice agriculture (Table 12).<sup>22</sup>

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<sup>22</sup> M.A.K. Khalil et al, "Emissions of Greenhouse Gases from Rice Agriculture"

**Table 12: GHG Emissions from Rice Paddy**

	Paddy area <sup>1</sup> (10 <sup>6</sup> ha)	Methane (Tg CH <sub>4</sub> y <sup>-1</sup> )	Nitrous oxide (Gg N <sub>2</sub> O y <sup>-1</sup> )	Carbon equiv. (Tg CO <sub>2</sub> y <sup>-1</sup> )
Bangladesh	11.2	3.4	2.0	72
Bhutan	0.013	0.0035	0.0037	--
Brunei	0.001	0.0027	--	--
Burma	6.19	2.7	1.1	57
Cambodia	1.90	0.93	0.41	20
China	30.7	5.1	23	114
India	43.5	15	8.3	318
Indonesia	11.8	3.4	1.9	72
Japan	1.80	0.28	0.43	6
Korea, N	0.555	0.061	0.13	1
Korea, S	1.13	0.16	0.24	3
Laos	1.29	0.44	0.17	9
Malaysia	0.828	0.28	0.073	6
Nepal	1.74	0.61	0.52	13
Pakistan	2.59	1.0	0.60	21
Papua New Guinea	---	--	--	--
Philippines	4.00	1.6	0.41	34
Singapore	0.008	0.0021	--	--
Thailand	9.52	3.4	1.6	72
Vietnam	7.03	6.3	0.41	132

<sup>1</sup> Harvested area.

136. Myanmar's mean surface temperature has increased by about 0.8°C since 1960, and that it will continue to increase at a rate of between 0.013°C and 0.036°C per year up to 2099. The rate of temperature increase will be higher in low altitude areas such as the deltaic areas which are between 10 and 20 m ASL. Under elevated CO<sub>2</sub> with low rate of emission scenarios (SRESB1)<sup>23</sup>, it is likely that wet season rainfall will continue to increase in future, and then might decrease again after 2050.

137. An increase in the temperature is likely to affect agricultural productivity. According to the International Rice Research Institute, rice grain yields decline by 10% for each 1°C increase in minimum (night) temperatures during the growing period in the dry season.

138. **Adaptation to Future Climate Change.** Climate change is expected to alter the current runoff and rainfall regimes. Climate change assessments for Myanmar indicate greater but more variable rainfall, increased crop water demand, more frequent and severe floods, droughts and wind storms.

139. Most of the increase in average annual rainfall predicted by models is expected to occur in the already wet months of the year, with only a minor or no increase over the dry season. The higher temperatures will increase crop water demands. These climate changes have the potential to influence both dry and wet season flow in the project areas as well.

140. For further details on climate change and CO<sub>2</sub> mitigation see the separate climate change assessment report.

<sup>23</sup> IPCC's Special Report on Emission Scenarios (SRES) has four scenarios A1, A2, B1 and B2 describing differing emission rates and geopolitical settings. In summary; A is economics driven rather than environmental; B is more environmentally drive. 1 is countries operating in concert; 2 is countries pursuing their own aims.

## VI. INFORMATION DISCLOSURE, CONSULTATION & PARTICIPATION

141. The overall objectives of the consultations and stakeholders meetings were to obtain the views and ideas regarding development status and constraints, and possible opportunities to resolve those constraints through the subproject and related interventions and to duly reflect those in the plan to be prepared. This is to improve the design, construction, and O&M and to take initiatives accordingly in order to derive a maximum output from the subproject through which the livelihood at grassroots level could be improved.

142. **Consultation:** There have been two stages of consultation conducted; (a) firstly at an early stage of project development (Oct - Nov 2016), and then (b) focused consultation and discussion regarding this IEE with the beneficiary community (August 2017). Although there are no significant environmental impacts anticipated from the project, it is important that there be a thorough sharing of the current known information, and the need for a water extraction plan to be raised with the community.

143. During Oct - Nov 2016, the meetings were conducted with relevant local government departments: Department of Agriculture (DOA), Irrigation and Water Resources Utilization Management Department (IWRUMD), Department of Agricultural Research (DAR), and also with local administration officers, village heads, farmer groups and seed farm managers. The main purpose was to evaluate positive and negative impacts of the subproject. The summary of the key issues raised during the meetings in the table below.

144. Details for the two stages of consultation appear as Appendix III and Appendix V.

**Table 13: Summary of the key issues that were raised during community meetings**

	Key Issue	Method to Address
Kyi Village, Pakokku Township	<ul style="list-style-type: none"> <li>The soil in the area being sandy, the irrigation water seeps into the soil so that the farmer could not get enough irrigation water especially during the dry periods. The existing canals need impervious lining to prevent wastage of irrigation water.</li> </ul>	<ul style="list-style-type: none"> <li>Renovation of existing earthen canal with three sides lining of impervious material such as brick mortar lining.</li> </ul>
	<ul style="list-style-type: none"> <li>Kyi Ywa farmers produce clean products (extracted impurities / dust, etc.). However, could not get good price, often monopolized by collectors and traders</li> </ul>	<ul style="list-style-type: none"> <li>To facilitate for improved value chain agriculture by liaising with traders and farmers: project intervention</li> </ul>
	<ul style="list-style-type: none"> <li>Climate change effect: weather getting hotter and hotter. Rainfall pattern changing and crop pattern also have to adjust</li> </ul>	<ul style="list-style-type: none"> <li>Introduce CSA and capacity building about correct use of fertilizers and pesticides</li> </ul>
	<ul style="list-style-type: none"> <li>Farmers are indebted because being forced to grow paddy during the 2008-9, and the water supply was insufficient, not getting water when the fields are in need of water, resulting in failed paddy crops. Even now, when they are permitted to grow other crops, they are still in debt. One farmer has lost all of his cattle to feed his household.</li> </ul>	<ul style="list-style-type: none"> <li>Project intervention: with CSA water management system to provide sufficient water supply when needed. To grow crop that are suitable to the soil and better water management techniques</li> </ul>
	<ul style="list-style-type: none"> <li>Poor technical practice for land preparation, planting method, weed control, pest control with wrong decision of farmers in selecting chemicals without recommendation from</li> </ul>	<ul style="list-style-type: none"> <li>Project intervention: Capacity building for CSA</li> </ul>



	Key Issue	Method to Address
	agricultural extension workers. Normally farmers grow crops based on their experience without proper guidance by technical institution.	
	<ul style="list-style-type: none"> <li>Poor technical transfer between farmers and agricultural extension workers and also from farmers to other farmers because lack training place in village and lack of field demonstration.</li> </ul>	<ul style="list-style-type: none"> <li>Project intervention: Capacity building for CSA</li> </ul>

## VII. GRIEVANCE REDRESS MECHANISM

145. **Proposed Mechanism:** The PMU will establish a Project Public Complaint Unit (PPCU) which will act as a central recording and coordinating unit in compliance with ADB's SPS (2009) requirement to prevent and address community concerns and assist the project to maximize environmental and social benefits. For each subproject, including this one, the PIU will ensure that a Grievance Redress Mechanism (GRM) is publicized locally so that the community is fully aware of the mechanism and the local points of entry to it. The GRM will be set-up to also address land acquisition and resettlement concerns as detailed separately in the land acquisition and resettlement framework. The setting up of the GRM in the PMU and its initial implementation through the Regional and Township PIUs will be supported by the Environmental Specialist (and social safeguards specialist) of the PIC.

146. The GRM will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple points of entry, including face-to-face meetings, written complaints, telephone conversations, or e-mail, will be available. Opportunities for confidentiality and privacy for complainants will be honoured where this is seen as important.

147. When construction starts, a sign will be erected at each construction site providing the public with updated project information and summarizing the GRM process including details of the GRM entry points. The contact persons for different GRM entry points; PMU, PIU, contractors, and operators of project facilities, will be identified prior to construction. The contact details for the entry points (e.g. phone numbers, addresses, e-mail addresses, etc.) will be publicly disseminated on information boards at construction sites and on the website of the local government.

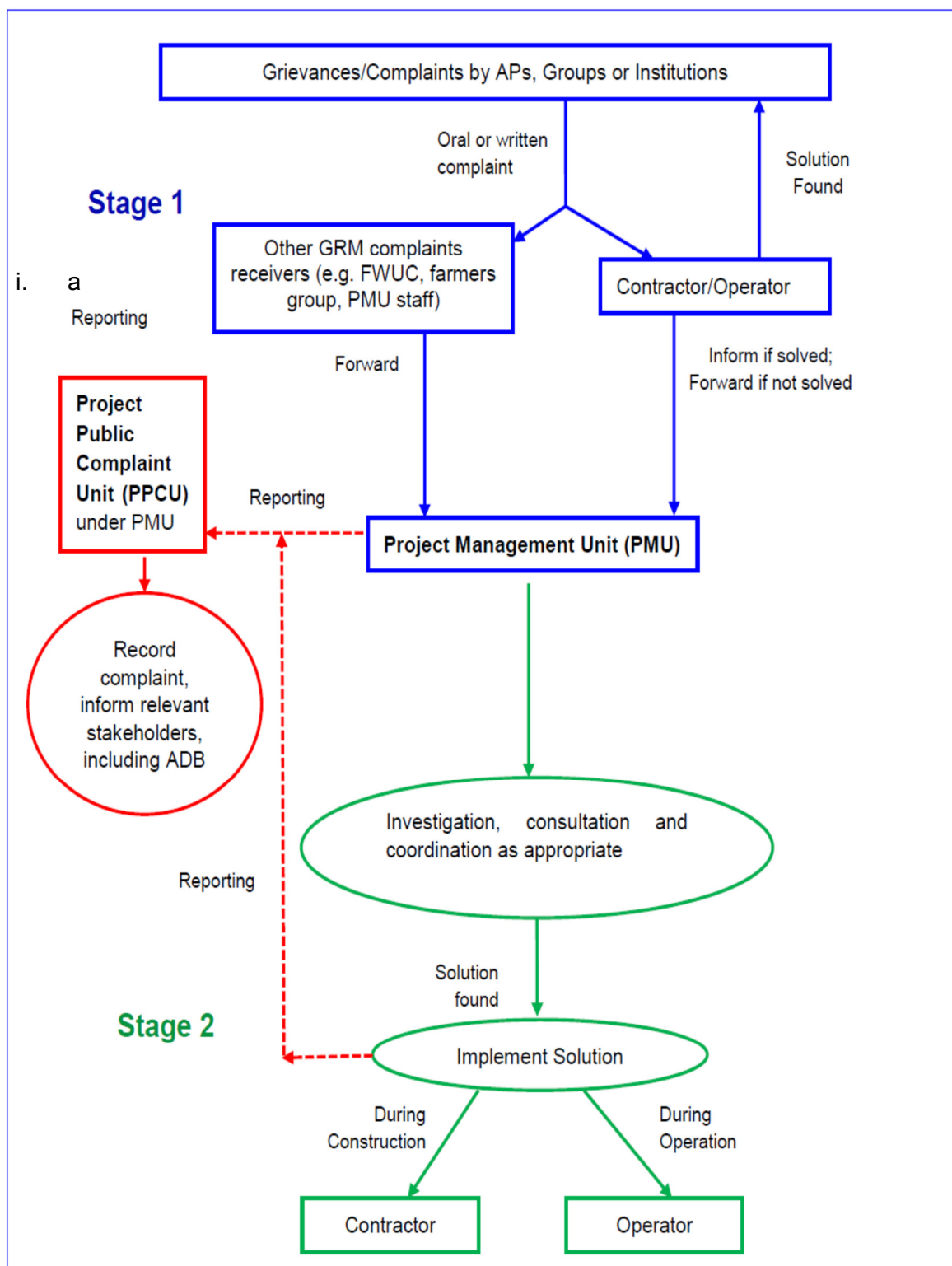
148. The preferred action sequence for complaints handling is that the complaint should be investigated and resolved by the unit receiving the complaint. If this is not possible, the complaint should be referred to the PMU (whose wider membership will enable coordinated action in response).

149. The PPCU will maintain records of complaints and actions taken to correct them. This data will be included in the PMU's reports to the ADB. The PPCU will establish a GRM tracking and documentation system. The system will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) staff to update the database routinely; (iii) systems with the capacity to analyse information so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

#### A. GRM Procedure and Timeframe

150. The procedure and timeframe for the grievance redress mechanism are described as follows (see figure below). The stages are represented by different colours in the flow diagram:

- (i) **Stage 1:** If a concern arises during construction, the affected person will submit a written or oral complaint to the contractor directly. Whenever possible, the contractor will resolve the issue directly with the affected person. The contractor will give a clear reply within one week. If successful, the contractor will inform the PPCU accordingly.
- (ii) **Stage 2:** If no appropriate solution can be found, the contractor should forward the complaint to the PMU within five (5) working days. The complainant may also decide to submit a written or oral complaint to the PMU, either directly or via one of the GRM entry points. The PMU will investigate and identify the solution and provide a clear reply for the complainant within five (5) working days. The environment consultants of the PIC will assist the PMU in replying to the affected person. The PMU will timely convey the complaint/grievance and suggested solution to the contractors or operators of facilities. The contractors during construction and the operators during operation will implement the agreed upon redress solution and report the outcome to the PPCU within seven (7) working days.

**Figure 9 - Grievances Redress Mechanism Procedure**

151. **Reporting.** The PPCU will record all complaints, investigations, and subsequent actions and report monthly. A summary report of the complaint logs will be included in semi-annual environmental monitoring reports to ADB and MONREC.

## **VIII. ENVIRONMENTAL MANAGEMENT PLAN**

### **A. Introduction**

152. The environmental management plan (EMP) covers all phases of core subproject implementation from preparation through commissioning and operation, and it aims to ensure the monitoring of environmental impacts and activation of environmental mitigation measures. Relevant parts of the EMP will be incorporated into the planning and design, construction, operation, and management of each subproject. Environmental protection measures will (i) avoid, and (ii) where avoidance is not possible, mitigate environmental impacts, and (iii) achieve compliance with national environmental regulations and ADB Safeguard Policy Statement (SPS) (2009).

153. The critical environmental facts concerning the findings from the IEE are that the proposed subproject is focused upon implementation of environmentally benign activities following a “Climate-Smart Water Management” approach.

154. The potential area of impact during construction concerns the dredging out of the existing tertiary canals and the associated spoil handling and disposal: The PPTA irrigation engineer indicates that only a small amount of earthwork is expected to be required for this project as the existing earthen tertiary canals will be lined by concrete. The spoil produced from the earthworks will be spread evenly on the berm and use for filling any pot holes on the embankment and possibly the paddy fields (rat holes and swamps), so that there is minimum issue with waste disposal problem. The amounts are so small that no spoil is expected to leave the subproject site.

155. A number of environmental management measures will be implemented in the pre-construction phase to ensure that appropriate design, plans and documentation to determine environmental performance of construction and operation of subprojects are in place. These include:

- (i) Mitigation measures defined in this EMP will be updated and incorporated into the detailed design to minimize adverse environmental impacts. This will be the responsibility of the PMUs.
- (ii) Final designs of canal, embankments, siting of control structures and type system alignments will be completed after taking into account the provisions of the EMP.
- (iii) Engineering design will be considered on avoiding impacts on environment and social impacts and also considered on long-lived use with sustainability, particularly impacts of climate change.
- (iv) Contract documents which need to be included the environmental section including EMP and monitoring plan in the Terms of Reference for bidders/contractor for construction.

- (v) Establishment of the Grievance Redress Mechanism during the subproject design which is possibly updated during project activities meeting real situation adhering to ADB and GoM guidelines.
- (vi) Capacity building on implementation and supervision of EMP and environmental monitoring plan effectively.

## **H. Responsibilities for Implementation**

156. To ensure that construction contractors are able to implement the mitigation measures effectively, the PMU will put in place the following arrangements: (i) environmental specifications will be included in the bidding documents to contractors; (ii) an appropriate environment section describing standards and responsibilities will be included in the terms of reference for bidders; and (iii) clauses referencing the EMP mitigation provisions and monitoring plans will be written into the construction contracts.

157. As previously discussed, at the awarding of construction contracts, contractors will prepare a CEMP (contained within a Site Environmental Management and Supervision Manual, including an emergency preparedness and response plan for construction emergencies and site environmental health and safety plan) for approval by the PMU.

158. The supervision and monitoring of project-related environmental activities during the preconstruction, construction and operation phases are the functions of the regional and township PIU. An Environmental Safeguards Officer (ESO) in the PMU will be assigned to be responsible for overseeing environmental management and for environmental monitoring guided by the Project Implementation Consultants (PIC). The major environmental responsibilities of the safeguards officer will be to ensure that:

- Mitigation measures and monitoring of these activities are carried out in accordance with the EMP;
- Environmental monitoring program, comprising the of taking samples and analysis are being carried out;
- Reporting is performed in compliance with ADB and GoM requirements.

159. The PIC firm will be recruited to assist PMU to (i) implement the project and to meet the reporting and procedural requirements of ADB; (ii) ensure adequate provision for compliance with social and environmental safeguards, including monitoring and review during the construction and post-construction period. The PIC services include International and National Environmental Safeguards Specialists who will support the EA and implementing agencies (IAs) to prepare environmental safeguards documents, and implement the environmental management and monitoring plans of subprojects. The specialists will be required to provide training on environmental aspects of the project.

160. Contractors will be engaged by the PMU for construction. The construction impact mitigation measures contained in this EMP will be included as necessary activities in the contract documents. The incorporation of EMP provisions into the contract documents will be undertaken by the PMU. The contractor will be responsible for the preparation of a Contractor's Environmental Management Plan (CEMP). CEMP should be submitted to PMU for review and approval. The contractors will have the responsibility for implementing the impact mitigation measures in the construction phase and their performance will be supervised by the PIU (and PMU).

161. The table which follows is labelled as the “EMP - Potential Environmental Impacts and Possible Mitigation Measures”. The table summarizes the potential impacts of the subprojects during construction and operation as identified by the initial environmental examination (IEE), as well as corresponding mitigation measures designated to minimize those impacts.

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**Table 14 – EMP Potential Environmental Impacts and Possible Mitigation Measures**

Potential impacts	Nature of impacts	Significance	Duration	Mitigation Measures	Cost	Responsibilities
<b>1. Recommendation during project location and design phase</b>						
Non-compliance of the technical design to applicable national and international guidelines	- Quality of building ensuring building incorporates where appropriate (i) energy efficient principles and detailing, (ii) is positioned such that it is not vulnerable to flash flooding, (iii) specified to withstand potential impact of increase in high velocity winds and storms.	Medium	Long Term	- Final technical design of the building should take into consideration the following: (i) construction specifications to incorporate energy efficient principles and technical specification to withstand increase in uncharacteristic storm events, (ii) sanitation facilities should not be located near source of drinking water (at least 30 meters from the source of drinking water) and consistent with applicable national and international guidelines (i.e. World Health Organization's Water, Sanitation and Hygiene Standards for Schools in Low-cost Settings) if project will provide; and (iii) follow further applicable rules and regulations on structural integrity of building structure.	Included in the project cost	- PMU/PIU/PIC
Protected areas	- The sub project is located outside all of the protected areas and multiple use area. The surrounding land use is dominated by paddy field. Thus, the potential impact on local ecological features is not envisaged.	Low	Long term	N/A	N/A	- PMU/PIU
Downstream impacts (Water Quantity)	- Increased irrigation could cause a decrease in the available water for downstream farmers but this project is CSA water management irrigation so risk is not likely to be significant.	Low	Short	- The technical assistance will provide training for the farmers on an irrigated agriculture practice to improve their knowledge on soils and appropriate responses, field improvement and preparation for irrigation, field water management, maintenance of water depth, level and timing, and role of drainage and its benefits. As part of the environmental monitoring plan, however, a water availability monitoring will be conducted in the downstream village during the wet and dry seasons to minimize any adverse impacts and take any necessary remedial measures in a timely manner if necessary.	Project cost (Package of capacity building and FWUC)	- PMU/PIU/PIC - FWUC
Fish migration	- Not considered to be significant.	Low	N/A	N/A		- PMU/PIU

Potential impacts	Nature of impacts	Significance	Duration	Mitigation Measures	Cost	Responsibilities
Flooding and erosion	- Some sections of the project alignment will be affected by flooding and erosion especially during the rainy season.	Low	Short Term	- The impacts will be reduced or avoided by proper qualitative design and experienced contractor together with environmental consideration like plantation of tree along alignment where is highly affected by erosion.	Cost of the plantation (in construction contract)	- PMU/PIC - Monitor by: PMU/PIU
Encroachment of precious ecological areas.	- Not significant	Low	Short Term	- As the proposed site is out of protected areas and conservation thus it will not have any significant impact, but environmental consideration is still care about ecological species if there will happen during construction or operation.	Project cost	- Contractor - Monitor by: PMU/PIU
Historical/cultural monuments and values	- No historical or cultural monuments are located in the subproject area	Low	N/A	N/A	N/A	
Funeral areas	- Based on the visit in Nov 2016, there are no cemeteries within the proposed project. Villagers also do not raise this issue	Low	N/A	N/A	N/A	
<b>2. Impacts during Construction</b>						
Excavating and / or dredging; spoil handling and disposal	- Construction will include dredging and clearing of existing canals which will generate spoil	Low	Short Term	- Valuable silt and top soil can be relocated to areas where farmers can use or make good soil profiles. "B" profile soils should be relocated as fill with topsoil over.	Costed into Construction contract (and requirement in contract docs)	- Contractor - Monitor: PIU/PMU
Dust from construction works	- An adverse environmental impact could occur during the construction phase in case of improper construction management but is not likely significant.	Low	Short Term	- Water shall be sprayed during construction if the construction zone will be located close 50 m to urban areas such as village, hospital, school and so on to ensure that dust is minimized throughout the construction zone.	Costed into Construction contract (and requirement in contract docs)	- Contractor - Monitor: PIU/PMU
Dust and material Transportation	- An adverse environmental impact could occur during the construction phase in case of improper construction management but is not likely significant.	Low	Short Term	- Dry material handling and transport generate large amounts of dust thus: <ul style="list-style-type: none"> <li>The Contractor shall prepare a dust control program.</li> <li>Water shall be sprayed where dry materials are handled, crushed and transported.</li> </ul> - Vehicles transporting materials are to be covered to reduce spills and dust.	Costed into Construction contract (and requirement in contract docs)	- Contractor - Monitor: PIU/PMU
Air pollution and noise	- An adverse environmental impact	Low	Short	- Vehicle and equipment emissions cause air	Costed into	- Contractor



Potential impacts	Nature of impacts	Significance	Duration	Mitigation Measures	Cost	Responsibilities
	could occur during the construction phase in case of improper construction management but is not likely significant.		Term	<p>pollution and noise: Hence, vehicles and equipment are to be maintained to meet Myanmar emission and noise standards.</p> <p>- Construction within 100m of a village or town is to be limited to lunch hours and night time.</p>	Construction contract (and requirement in contract docs)	Monitor: PIU/PMU
Human waste from construction	- An adverse environmental impact could occur during the construction phase from workers feces. This will generate flies and transmitted diseases which will possibly result unsanitary condition in the areas.	Low	Short Term	- Provision of sanitary facilities (toilets, burying, etc.) with proper waste disposal will be provided by contractors.	Costed into Construction contract (and requirement in contract docs)	- Contractor Monitor: PIU/PMU
Solid waste generation from construction camp, work sites and workers	- Solid waste can create nuisance and bad odor, encourage disease vectors (such as flies and rats), block drainage system and hazard to environment. Hence, sufficient garbage containers are to be provided in construction camps and at work site, and be emptied daily, the waste being disposed of in an approved dump site.	Low	Short Term	- Every camp and work site should be clean during stay and before moving to a new sites.	Costed into Construction contract (and requirement in contract docs)	- Contractor Monitor: PIU/PMU
Traffic accident and traffic jam of equipment transportation	- Some heavy equipment (heavy trucks, bulldozers, backhoes, etc.) will be brought to the construction areas for excavation and construction works. They will only be transported in and out during the construction period and in relatively small numbers. Even though the project area not heavily populated, no serious disturbance is envisaged; however it will possibly cause accidents to local communities, traffic jam and dust.	Low	Short Term	<p>- Construction vehicles will comply with national speed limitation.</p> <p>- Construction vehicles will drive at low speeds, especially at market, school, hospital, urban areas...</p> <p>- Keep road space or bypass for travelers to avoid traffic jams.</p> <p>- Vehicle for construction should park at designated safe places.</p>	Costed into Construction contract (and requirement in contract docs)	- Contractor Monitor: PIU/PMU
Soil erosion	- Soil erosion could occur during earthwork and clearing along the line of irrigation canal.	Low	Short	- Hence good construction practices shall help to mitigate soil erosion and siltation.	Costed into Construction contract (and requirement in contract docs)	- Contractor Monitor: PIU/PMU

Potential impacts	Nature of impacts	Significance	Duration	Mitigation Measures	Cost	Responsibilities
Worker safety and health	- Some workers will be recruited for construction activities and workers' camp will be constructed. These will include non-skilled workers, operators and drivers as well as surveyors and construction supervisors. Since the works will be relatively small scale and expected to be completed within one year, large numbers of workers are not expected. However, safety and health impacts will be also expected.	Low	Short Term	<ul style="list-style-type: none"> <li>- Workers should wear protection equipment during works to ensure that they are safe and good health.</li> <li>- A contractor should develop a guideline on working mechanism, health and safety during construction. Manager should educate his workers on health and safety projection.</li> </ul>	Costed into Construction contract (and requirement in contract docs)	<ul style="list-style-type: none"> <li>- Contractor Monitor: PIU/PMU</li> </ul>
Conflict	- Some local workers maybe recruited for construction activities and workers' camp could be constructed. These will include non-skilled workers, operators and drivers as well as surveyors and construction supervisors. Since the works will be relatively small scale and expected to be completed within one year, large numbers of workers are not expected. However, conflict will be also expected.	Low	Short Term	<ul style="list-style-type: none"> <li>- A contractor should develop a guideline on staff management and policy. Manager should educate his workers to avoid any conflict may happen in advance.</li> </ul>	Costed into Construction contract (and requirement in contract docs)	<ul style="list-style-type: none"> <li>- Contractor Monitor: PIU/PMU</li> </ul>
Transmitted diseases	- Some workers could be recruited for construction activities and workers' camp may be constructed. Construction team will include non-skilled workers, operators and drivers as well as surveyors and construction supervisors with different gender. Hence, transmitted diseases, especially HIV, will be also expected.	Low	Short Term	<ul style="list-style-type: none"> <li>- A contractor should develop a guideline on health and safety management during construction.</li> <li>- Manager should educate his workers on health and HIV program.</li> </ul>	Costed into Construction contract (and requirement in contract docs)	<ul style="list-style-type: none"> <li>- Contractor Monitor: PIU/PMU</li> </ul>
Pollution from fuels and black oil	- The impact is temporary, as the risk will be confined to the construction period.	Low	Medium Term	<ul style="list-style-type: none"> <li>- Secure and controlled storage of all toxic and hazardous materials including fuels and black oil. Provide sanitation arrangements at work sites, to avoid no raw sewage released into drains or streams. Maintenance of vehicles and plant in sound operable condition, preventing oil leakages</li> </ul>	Costed into Construction contract (and requirement in contract docs)	<ul style="list-style-type: none"> <li>- Contractor Monitor: PIU/PMU</li> </ul>

Potential impacts	Nature of impacts	Significance	Duration	Mitigation Measures	Cost	Responsibilities
				and excessive exhaust emissions. - Black oil should be stored for sale.		
<b>3. Environmental Impacts during Operation</b>						
Water pollution	- Currently, use of agricultural chemicals is available in the project area. The primary objective of the Project is to provide supplementary wet season irrigation and dry season irrigation but the project scale is very small. Therefore, it is not likely to significantly increase the use of agricultural chemicals. However environmental consideration, especially about the toxic chemical used, must be considered.	Low	Long Term	- Educational program on the fertilizer uses and environmental impacts should be provided. - Environmental monitoring of water quality is conducted by PMU to assess any negative impact on the water bodies and collaborate with DOA to ensure appropriate use of agricultural chemicals.	Training budget; monitoring budget	- DOA - Monitor by: PMO
Inadequate O&M	- Poor and inadequate operation and maintenance (O&M) of the improved irrigation systems could cause unintended adverse environmental impacts. Establishment and operation of WUGs is part of the project design and support. The IWRUMD in cooperation with TA should provide a technical support to set up WUGs and Farmers Water User Groups (FWUGs). A FWUC is the governing board, normally comprising chairman, deputy chairman, secretary and treasurer. A FWUG is charged with undertaking or ensuring the key activities - operation and maintenance and is also involved in collecting irrigation service fee. The FWUCs through a project technical assistance to strengthen overall water management capacity of FWUCs.	Low	Medium Term	- Acceptable and appropriate O & M should be developed for sustainable operation and maintenance. - Sufficient training to FWUGs must be also provided thus they will be able to manage, operate and maintain the irrigation in sustainability.	Project Cost (in design, capacity building and FWUG package)	- IWRUMD - PMU/PIU/PIC
Conflict of water	- This will occur between water users	Medium	Long	- It should be avoidable with support of FWUC and		- IWRUMD

Potential impacts	Nature of impacts	Significance	Duration	Mitigation Measures	Cost	Responsibilities
utilization	of downstream and upstream in case of in-appropriate management and equitable share with understanding.		Term	<ul style="list-style-type: none"> <li>proper O&amp;M manual.</li> <li>Educational program for water saving uses should be also provided. Hence concepts of water equitable share and effective management should be applied.</li> </ul>		<ul style="list-style-type: none"> <li>PMU/PIU/PIC</li> </ul>
Ground Water Resources	<ul style="list-style-type: none"> <li>As the need to irrigate the crop / paddy fields will need, it is likely that the tube well water might be pumped much to satisfy the need for irrigation</li> </ul>	Low	Long Term	<ul style="list-style-type: none"> <li>To limit the time of pumping for allowance of recharging and prevent over extraction of the ground water resources.</li> </ul>		<ul style="list-style-type: none"> <li>IWRUMD</li> <li>PMU/PIU/PIC</li> </ul>
<b>4. Environmental and Social Benefits</b>						
Increasing agricultural activities and farmer's knowledge	<ul style="list-style-type: none"> <li>The improved water control and management as a result of the improved irrigation scheme will enable the communities to manage the flood and drought. Training on irrigated agriculture practice will improve farmers' knowledge on soils and appropriate responses, field improvement and preparation for irrigation, field water management, maintenance of water depth, level and timing, and role of drainage and its benefits, which strengthens the adaptive capacity of farmers to climatic variability.</li> </ul>	Medium	Long Term	<ul style="list-style-type: none"> <li>Strengthen capacity of FWUC and local authority for flood control, management and maintenance of the irrigation.</li> </ul>	Cost in package of FWUC and capacity building	<ul style="list-style-type: none"> <li>IWRUMD</li> <li>PMU/PIU/PIC</li> </ul>
Employment	<ul style="list-style-type: none"> <li>Through the enhancement of agricultural activities and local incomes, in-migrant employment will benefit to local communities who will migrate for job. Additionally some of migrant employment will return home for improving their agriculture and will have a chance to find a job at the locality.</li> </ul>	Medium	Long Term	<ul style="list-style-type: none"> <li>Strengthen capacity of FWUC and local authority for problem solution, management and maintenance of the irrigation.</li> </ul>	Cost in package of FWUC and capacity building	<ul style="list-style-type: none"> <li>IWRUMD</li> <li>PMU/PIU/PIC</li> </ul>



## I. Environmental Monitoring

### 1. Monitoring Program

162. The Project monitoring program will focus on the environment within the Project's area of influence. An environmental monitoring program is summarized in the table below. The program considers the scope of monitoring and frequency. The monitoring results will be assessed against the following standards and corrective management implemented in cases of non-compliance.

- (i) The sub-decree No 27 ANRK.BK on Water Pollution Control is dated on April 6<sup>th</sup>, 1999. (Table for Lake and Reservoir)
- (ii) The sub-decree No 36 ANRK.BK on Solid Waste Management is dated on April 27<sup>th</sup>, 1999.
- (iii) Ministry of Health, National Drinking Water Quality Standards, MYA, 2014

163. For the re-use and disposal of silt from canal cleaning or dredging, there is no national standard, and standards applying to paddy field environments from China and Japan will be referenced. The relevant references for the Chinese and Japanese standards are cited below.<sup>24</sup>

164. The table below is labelled as a typical Environmental Monitoring Plan for works associated with irrigation and manipulation of water resources. The level of detail itemized in this Environmental Monitoring Plan is not envisaged to necessary for the Drip Irrigation subproject, but it is included if it were to be necessary.

**Table 15 - Typical Environmental Monitoring Plan**

Parameters	Location	Frequency	Costs	Responsibilities
<b>Pre-Construction</b>				
Surface water quality: pH, SS, EC, NH <sub>4</sub> <sup>+</sup> , NO <sub>3</sub> <sup>-</sup> , Oil & Grease.	- At main canal headworks to establish baseline water quality for surface water entering the project intervention site	Once at the beginning of construction period	Monitoring budget (\$420 per suite of tests)	PMU to contract an organization to do sampling and testing
<b>During Construction</b>				
Dust and noise	- Site inspection of subproject sites	Quarterly	Contractor responsibility & part of costs.	PIU to monitor
Surface water quality: pH, SS, EC, NH <sub>4</sub> <sup>+</sup> , NO <sub>3</sub> <sup>-</sup> , Oil & Grease	- Canal water 100m downstream of major construction sites.	Quarterly	Monitoring budget (\$420 per suite of tests)	PMU to contract an organization to do sampling and testing
Silt and dredge spoil: Organic matter, Zn, Cu, Pb, Hg, As, Cd, moisture content, phenols, mineral oil. <sup>25</sup>	- Canal silt cleared from waterway. Three sampling locations; - at start, midpoint, and end of main canal.	Once at each location to check disposal / reuse safety.	Monitoring budget (\$420 per suite of tests)	PMU to contract an organization to do sampling and testing
<b>Operation Phase</b>				
Surface water quality:	- Canal waters at start,	Semi-annual	Monitoring budget	PMU to contract

<sup>24</sup> People's Republic of China (PRC): GB4284-84 Control standards for pollutants in sludge for agricultural use; PRC: GB/T23486-2009 Sludge quality for afforestation in gardens or forests; and Japan: Environmental Quality Standards (EQS) for soil pollution, August 1991.

<sup>25</sup> For the re-use and disposal of silt from canal cleaning or dredging, there is no national standard and standards applying to paddy field environments from China and Japan will be referenced.

Parameters	Location	Frequency	Costs	Responsibilities
pH, SS, EC, NH <sub>4</sub> <sup>+</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , DO, BOD <sub>5</sub> , COD, Oil & Grease, Coliforms.	midpoint and end of main canal.			an organization to do sampling and testing

165. During construction, the PIU will make appropriate arrangements for monitoring according to the progress of implementation. When complaints are received from the public (either directly or via the formal grievance redress mechanism), monitoring staff will conduct additional inspections immediately.

166. Environmental monitoring during operation of the project in the longer term is the responsibility of the township authorities.

167. **Reporting:** The PMU (ESO) with assistance from the PIC will submit semi-annual environmental monitoring reports to ADB in January for the July-December reporting period, and in July for the January-June reporting period. All the environmental monitoring reports will be disclosed on ADB and the project websites, and made available to MONREC as required.

**Table 16 - Monitoring Reporting Plan**

Reports		From	To	Frequency
<b>Construction Phase</b>				
Internal progress reports by contractors	Internal project progress report by construction contractors, including monitoring results. Weekly reports on construction activities. Monthly reports to also include environmental and other compliance.	Contractors	PIU	Weekly and monthly reports
Progress reporting for project management	Monthly reports on project progress (to include safeguard compliance)	PIU	PMU	Quarterly
Environmental monitoring and compliance monitoring reports	Environment monitoring reports	PMU (consolidated from PIU reports)	ADB	Semi-annual
Project Completion Report (PCR)	Environmental monitoring and audit details included in PCR	PMU	ADB	Once; within 6 months of completion of physical works
<b>Operational Phase</b>				
Environmental monitoring	Environmental monitoring reports (until a PCR is issued)	PMU (consolidated from PIU reports)	ADB	Semi-annual
Note: <b>ADB</b> = Asian Development Bank; <b>ESO</b> = PMU Safeguards Officer; <b>PCR</b> = Project Completion Report; <b>PIU</b> = Project Implementation Unit; <b>PMU</b> = Project Management Office				

168. Since the subproject involves the refurbishment of existing irrigation schemes, it does not require an EIA under Sub-decree No 30 of Annex A, EIA Procedure Notification of GoM, 2015 as screened and classified by ECD. Where the command area is substantially expanded by the refurbishment of a scheme to provide more than 3,000 ha of newly irrigated land or land previously without reliable irrigation, the provisions of the sub-decree will apply. This IEE will therefore be forwarded to MONREC by ECD for approval under the government's requirements.

169. **Environmental Due Diligence:** Although there is no need for an EIA, environmental due diligence and review needs to be carried out and pre-screened by the ECD, and the subproject will

undergo the IEE procedure (this document), which consists of environmental investigations and reporting after which the review and approval process from the ECD, MONREC would follow before project implementation is given approval.

170. **Management and Monitoring Costs:** The costs of implementing the environmental management and impact mitigation measures listed in the EMP matrix are included in the design costs, construction contracts and operational budgets. Detailed budget allocations against each of the items in the EMP will be developed by the PMU with the assistance of the PIC.



## **IX. CONCLUSION & RECOMMENDATION**

### **A. Positive Impact and Environmental Benefits**

138. The result of the subproject irrigation facilities will be an increase in certainty and control of canal irrigation. The subproject will increase crop productivity and potential for diversification. The beneficiaries of these changes will be local farmers, with flow-on effects to local commercial enterprises. Since rural populations are the poorest sectors of the Myanmar population, poverty alleviation effects will be direct and sustainable.

### **B. Negative Impacts**

139. **During construction**, the main issues will be air and water pollution and soil erosion, all of which can be managed by strict control of construction contractors. Additional localised traffic hazards are anticipated and this must be minimised by site access and road safety planning. Health and safety of construction workers is also, as always, a primary concern. Mitigation of construction-phase impacts relies heavily on responsibility of works contractors to follow specification clauses specifically designed to minimise pollution of air and water and soil erosion. This mitigation will in turn rely on enforcement by the Environmental Management Officer and also by construction supervision consultants.

140. Post-construction, there is also a concern that the climate smart irrigation schemes/connection must be sustainable and responsibly managed, to ensure that agreed water flows are maintained and other water users are not disadvantaged.

141. Additional operational concern includes anticipated local increases in the levels of agricultural fertilizer and pesticide residues and their effects on water quality, domestic animal and people. Post-construction mitigation will benefit from capacity building and training under the project to use fertilizers and pesticides efficiently and responsibly.

### **C. Conclusion**

142. With regards to the result of IEE study and the screening of possible environmental impacts for the proposed subproject, any serious negative environmental impacts are unlikely to result from the proposed development. This is due to the incorporation of environmental precautions at the early stage of subproject selection. The selected subproject site is not located in an environmentally sensitive area. Other reasons to support the insignificant environmental impact are, as,

- (i). Subproject is located in agricultural areas and is primarily the rehabilitation existing irrigation facilities;
- (ii). Subproject is only small scale. Therefore, the overall impact of the individual subproject will be small and cumulative effects are unlikely.

143. The subproject actually will result positively. It will contribute to the improved agricultural production. An improved performance of a cooperative management system will increase the agricultural production and improve the socioeconomic conditions for the farmers. Construction of the CSA Water Management Activities will provide benefit to local communities including farmers and cooperative committee. Local employment for construction and operation activities will create job opportunities.

144. The IEE found that there will be no significant adverse environmental impacts associated the proposed works. The mitigation measures described in the IEE will be used as tool for environmental management and monitoring that can minimize site-specific negative environmental impacts. However, the IEE will be updated, if necessary, upon completion of the detailed engineering design.

## X. REFERENCES

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## APPENDIX I: RAPID ENVIRONMENT ASSESSMENT CHECKLIST

### Rapid Environmental Assessment (REA) Checklist

**Instructions:**

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

**Country/Project Title:** Myanmar: Climate-Friendly Agribusiness Value Chain Sector Project

**Sector Division:** Agriculture and Natural Resources

Screening Questions	Yes	No	Remarks
<b>A. PROJECT SITING</b> Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ PROTECTED AREA		✓	
▪ WETLAND		✓	
▪ MANGROVE		✓	
▪ ESTUARINE		✓	
▪ BUFFER ZONE OF PROTECTED AREA		✓	
▪ SPECIAL AREA FOR PROTECTING BIODIVERSITY		✓	
<b>B. POTENTIAL ENVIRONMENTAL IMPACTS</b> WILL THE PROJECT CAUSE...		✓	
▪ loss of precious ecological values (e.g. result of encroachment into forests/swamplands or historical/cultural buildings/areas, disruption of hydrology of natural waterways, regional flooding, and drainage hazards)?		✓	
▪ conflicts in water supply rights and related social conflicts?		✓	

Screening Questions	Yes	No	Remarks
▪ impediments to movements of people and animals?		✓	
▪ potential ecological problems due to increased soil erosion and siltation, leading to decreased stream capacity?		✓	
▪ Insufficient drainage leading to salinity intrusion?		✓	
▪ over pumping of groundwater, leading to salinization and ground subsidence?		✓	
▪ impairment of downstream water quality and therefore, impairment of downstream beneficial uses of water?		✓	
▪ dislocation or involuntary resettlement of people?		✓	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	
▪ potential social conflicts arising from land tenure and land use issues?		✓	
▪ soil erosion before compaction and lining of canals?		✓	
▪ noise from construction equipment?		✓	
▪ dust during construction?		✓	
▪ waterlogging and soil salinization due to inadequate drainage and farm management?		✓	
▪ leaching of soil nutrients and changes in soil characteristics due to excessive application of irrigation water?		✓	
▪ reduction of downstream water supply during peak seasons?		✓	
▪ soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides?		✓	
▪ soil erosion (furrow, surface)?		✓	
▪ scouring of canals?		✓	
▪ clogging of canals by sediments?		✓	
▪ clogging of canals by weeds?		✓	
▪ seawater intrusion into downstream freshwater systems?		✓	
▪ introduction of increase in incidence of waterborne or water related diseases?		✓	
▪ dangers to a safe and healthy working environment due to physical, chemical and biological hazards during project construction and operation?		✓	

Screening Questions	Yes	No	Remarks
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	
▪ social conflicts if workers from other regions or countries are hired?		✓	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		✓	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., irrigation dams) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		✓	

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
• Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)	✓		The AWARE climate risk screening and classification for this project is Medium, which includes expected temperature and precipitation increase, incidence of flooding, landslides, and precipitation decrease. Incidence of wind speed is also expected to increase, and in coastal areas a sea level rise.
▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., increased glacial melt affect delivery volumes of irrigated water; sea level rise increases salinity gradient such that source water cannot be used for some or all of the year).		✓	
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		✓	
▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by diverting water in rivers that further increases salinity upstream, or encouraging settlement in earthquake zones)?		✓	

Note: Hazards are potentially damaging physical events.

### A Checklist for Preliminary Climate Risk Screening

Country/Project Title: MYA (PPTA 8897): The Climate Friendly Agribusiness Value Chain Sector Project, SPFS4: Climate-smart small-scale irrigation and water management for farmer groups in Pakokku

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?		Affected sections of the canals will be strengthened to withstand anticipated floods and landslides. For droughts irrigation scheduling will be done based crop water requirements
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc.)?	0	Hydrological analysis will be done to forecast the river flows, water availability and extreme floods/droughts
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project output(s)?	0	
Performance of project outputs	Would weather/climate conditions and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Low \_\_\_\_\_

Below. - **Matrix of Potential Environmental Impacts and Possible Mitigation Measures,**  
Other \_\_\_\_\_

Prepared by: Dr. A. G. Tony McDonald

## APPENDIX II: TABLE OF PROTECTED AREAS IN MYANMAR

Protected area	Surface area ha	Location
<b>National Parks</b>		
Alaungdaw Kathapa	160,500	Sagaing Region, Upper Myanmar
Hlawga		North Yangon Region
Khakaborazi	381200	Kachin State, North Myanmar
Lenya	176,638	Tanintharyi Region, South Myanmar
Lampi Island Marine National Park	20,500	Mergui Archipelago, South Myanmar
Loimwe National Park	4,300	Eastern Shan State, East Myanmar
Mount Victoria National Park		Chin State
Popa Mountain National Park		Mandalay Region
<b>Wildlife Sanctuary and Reserves (IUCN management categories IV)</b>		
Chatthin Wildlife Sanctuary	26600	Sagaing Region
Hukawng Valley Tiger Reserve		Sagaing Region
Indawgyi Lake Wildlife Sanctuary		Kachin State
Inlay Lake Wetland Sanctuary	64200	Shan State
Kahilu Wildlife Sanctuary	10700	
Kelatha Wildlife Sanctuary	2400	Mon State
Kyaikhtiyo Wildlife Sanctuary	18100	Kyaikhiyo Pagoda, Mon State
Lampi Kyun Wildlife Reserve	20500	Southern Tanintharyi Region
Mein-ma-hla Kyun Wildlife Sanctuary	13700	
Minwuntaung Wildlife Sanctuary	20600	Sagaing Region
Minsontaung Wildlife Sanctuary	20200	Sagaing Region
Moneyingyi Wetland Sanctuary	10400	Bago Region
Moscov Islands Wildlife Sanctuary	4,918	Moscov Islands
Mulayit Wildlife Sanctuary	13900	Dawna Range
Myaing Hay Wun Elephant Park	4	Taikky Township, Yangon Region
Pasa Wildlife Reserve	7800	Loi La Range, Tachileik, Eastern Shan State
Pitaung Wildlife Reserve	69800	Kachin State
Rakhine Yoma Elephant Reserve	129,500	Rakhine State
Sein Ye Forest Park		Oaktwin Township, Bago Region
Shwesettaw Wildlife Reserve	55,271	Magwe Region
Tamanthi Wildlife Reserve	215100	Sagaing Region
Tanintharyi Nature Reserve		Tenasserim Hills
Taunggyi Bird Sanctuary	1600	Shan Hills
Wethigan Wildlife Sanctuary	453	Minbu District, Magwe Region



Protected area	Surface area ha	Location
Wunbaik Mangrove Forest Reserve	22,919	Rakhine State
<b>Protected Landscape, Botanical Garden</b>		
Kandawgyi National Botanical Gardens (Pyin-O-Lwin)	12700	Mandalay Region, Upper Myanmar
<b>Wildlife Park (IUCN management Category II)</b>		
Hlawga	600	North Yangon Region
<b>Mountain Park (IUCN management Category V)</b>		
Popa	12900	Bago Region

Source: JE Clark, PhD, "Biodiversity and Protected Areas Myanmar",  
[https://en.wikipedia.org/wiki/List\\_of\\_protected\\_areas\\_of\\_Myanmar#cite\\_note-8](https://en.wikipedia.org/wiki/List_of_protected_areas_of_Myanmar#cite_note-8)

### APPENDIX III: FOCUS GROUP MEETINGS (AUG 2016)

#### KYI VILLAGE Focus Group Discussion Meeting Minutes at local level, Pakokku Township villages (Aug 2016)

The summary notes from these discussions with different key stakeholders are as follows:

<b>TA8897: Climate-Friendly Agribusiness Value Chains Sector Project: PPTA Meeting Record</b>	
1. Meeting with Farmer Group at Shwe Tan Dit Village (Kyi Ywa Pumping)	
Date (time: D/M/Yr)	30/08/2016
Meeting Location	Shwe Tan Tik Village, Pokkoku Township
Venue	Pumping Station and canal distribution system, ShweTanTik Village
Contact Name	Ko Ye Aung, Village Pump Water Supply incharge
Contact Phone	Cell No. 09265711556
Purpose	Feasibility Study: Potential typical subproject
Outcome (Summary Notes of FGD)	Baseline study for environmental assessment: Impact scope: <ul style="list-style-type: none"> <li>water wastage because of earthen canal and soil pervious,</li> <li>high electrical energy consumption,</li> <li>low rate of return for cost invested</li> <li>some farmers don't pay tariff</li> </ul>
Consultants	<ul style="list-style-type: none"> <li>Daw Aye Aye Khaing, DTL, PPTA 8897</li> <li>U Ko Ko Naing, Project Assistant, PPTA 8897</li> <li>Dr. Nyi Nyi, PMO, DOA</li> <li>U San Lwin, Pakkoku Township Officer, DOA</li> <li>Daw Phyu Phyu Aye, National Environment Specialist</li> </ul>
Participants	<ul style="list-style-type: none"> <li>Ko Ye Aung, Village Pump water supply in-charge and</li> <li>7 beneficiary farmer group (U Hla Htay, U Hla Chit, U Kyaw Zin Tun, U Khin Maung Shwe, U Mo Kyaw Thu, U Pyay Aye, U Myint Aung)</li> </ul>
2. Meeting with Farmer Group at Kyi Ywa Village	
Date (time: D/M/Yr)	13/11/2016
Meeting Location	Kyi Ywa Village, Pakkoku Township
Venue	Kyi Ywa Village Administrator's Residence
Contact Name	U Nann Htwe, Kyi Ywa Village Administrator
Contact Phone	Cell No. 09442355804
Purpose	Environmental Assessment for Output 1.4: CSA Irrigation Infrastructure: Typical subproject: Renovation of existing earthen canal with three sides concrete lining
Outcome (Summary Notes of FGD)	<ul style="list-style-type: none"> <li><b>CSA subproject activity:</b> minor canal renovation 200 ft long. Present canal is not in good shape: soil of Kyi Village is sandy soil, pervious, cannot retain water sent to farmers. Presently, takes a long time to reach their fields (4 hrs) compared with Paung Laung Kan village (1hr). Kyi Ywa is 3.5 miles away from Ayeyarwaddy R. Beneficiaries: 13 farmers</li> <li><b>Water supply system</b> at Kyi Ywa is Pump Irrigation from the Ayeyarwaddy River. Crops cultivated: Groundnut, green gram, pigeon pea and black sesame.</li> <li><b>Climate change effect:</b> Weather is getting hotter year by year. Now, during Monsoon 32°C, Summer 45°C, during Cold season 30°C. Untimely rain causes damage of crops.</li> <li><b>Cropping pattern:</b> Double crop = black sesame with beans and pulses (sesame harvest by end November). Groundnut and green gram, etc.</li> <li><b>Organic fertilizer</b> preferred (cow dung), but also use Inorganic fertilizers "Armo" (NPK fertilizers). China fertilizer "Pale" mix with "Armo" and use in the field.</li> </ul>

	<ul style="list-style-type: none"> <li>▪ <b>Soil Testing:</b> No facility to test the soil status. Herbicide, Pesticides, Insecticides used. 30% of Kyi Ywa growers use Pesticides. Farm produce sold to collector. Collector sell to traders, who distribute to other parts of the country and abroad. Price difference from Kyi Ywa farm to Mandalay = 3000 MMK / basket of pulses.</li> <li>▪ <b>Value Chain:</b> Kyi Ywa village produce pure products of rice, pulses and beans. However, the price is less than expected. Collector mix pure and impure products and sell to end user to get high profit. Value chain is not good at present.</li> <li>▪ <b>Fuel for Cooking:</b> 70% of Kyi Ywa Villagers use fire wood, from pigeon pea stem and "Gandaya" trees, which are plentiful the CDZ. No problem of acquiring fire wood.</li> <li>▪ <b>Population</b> increases in Kyi Ywa. Not much people go outside to work, only some become traders and work outside.</li> <li>▪ <b>Water quality</b> of canal is soft water. But not sufficient for some household needs in Kyi Ywa Village because of the nature of soil being sandy soil and canals not lined as yet.</li> <li>▪ <b>Protected areas</b> near Kyi Ywa: no wet lands, no forest here and nearby. No floods in Kyi Ywa.</li> <li>▪ <b>Aquatic ecosystem:</b> Kyi Ywa = no fisherman. Rain heavy but no erosion.</li> <li>▪ <b>Historical monument</b> = pagoda and cemetery.</li> <li>▪ <b>Livelihood Status:</b> Don't trust DOA in Kyi Village because of forcing them to grow paddy during 2008-9, in compulsory. When the paddy needs the most amount of water, the pumping scheme could not supply water because of no electricity. One farmer lost all his cattle to feed his household because of failed paddy crop.</li> <li>▪ <b>Perception:</b> Kyi Ywa respondents are agreeable to the project.</li> <li>▪ <b>Potential Environmental Impact</b> = not significant for bio physical, chemical, socio-economic and cultural. For socio economy, there is positive impact from the proposed project.</li> </ul>
Consultants	<ul style="list-style-type: none"> <li>▪ Dr. Tony McDonald, International Environment Specialist</li> <li>▪ U Ngwe Htay, National Social Safeguard Specialist</li> <li>▪ Daw Phyu Phyu Aye, National Environment Specialist</li> </ul>
Participants	<ul style="list-style-type: none"> <li>▪ U Nyan Htwe and</li> <li>▪ 22 Farmer Group (U Tin Tun, U Soe Myint, U Kyi Tun, U Tun Wai, U Tun Myint Aye, U Kyaw Soe, U Soe Tint, U Khin Maung Aye, U Zaw Moe Aung, Daw Pyone Ma, Daw Than Win, Daw Khin Ohn Myot, U Win Min Soe, U Kei Wah, U Tint Swe, U Zaw Moe, Naing, U Maung Swe, U Nan Myint Aung, U Aung Than Oo, U Mying Thanung Hlaing, Daw Mya Kyaing, Daw Amar).</li> </ul>

**APPENDIX IV: AYEYARWADDY RIVER WATER QUALITY AT PAKOKKU**

Sr, No	Parameter	Symbol	Unit	Pakokku			
				15.6.2010	15.9.2010	15.1.2011	15.3.2011
1	Calcium	ca++	me/l	0.10	0.12	0.10	0.15
2	Magnesium	Mg++	me/l	2.00	2.15	2.00	2.73
3	Sodium	Na+	me/l	0.51	0.42	0.45	0.60
4	Potassium	K+	me/l	0.03	0.03	0.04	0.03
5	Carbonate	co3=	me/l	0.20	N.D	N.D	0.20
6	Bicarbonate	HC03-	me/l	1.20	1.20	1.20	1.20
7	Sulphate	so4=	me/l	0.65	0.57	0.85	0.97
" 8	Chloride	cr	me/l	0.56	0.59	0.51	0.57
9	Total Hardness	TH	ppm	105.00	114.00	105.00	144.00
10	Total Dissolved Solids	TDS	ppm	112.00	96.00	85.76	102.00
11	Dissolved Oxygen	DO	ppm	4.35	4.44	4.21	4.30
12	Soluble Sodium Percentage	SSP	%	19.32	15.44	17.37	17.09
13	Sodium Adsorption Ratio	SAR	-	0.50	0.39	0.44	0.50
14	Residual Sodium Carbonate	RSC	me/l	0.00	0.00	0.00	0.00
15	pH	pH	pH units	7.35	7.21	7.11	7.25
16	Electrical Conductivity	EC	1-Jmhos/cm	175	150	134	160
17	Temperature	Temp	°C	29.1	27.9	27.9	28.5
18	Salinity	Sal	%	0.00	0.00	0.00	0.00
19	Turbidity	Turb	NTU	7	3	10	2
20	Iron	Fe	mg/l	N.D	N.D	0.01	0.01
21	Classification	-	-	CtSt	CtSt	CtSt	CtSt

Source: Laboratory Test Results, Irrigation Department, MOALI, 2011

N.D - Not Detected

## Irrigation Water Quality

The water samples of Ayeyarwaddy River at Pakokku were taken from different seasons of 15.6.2010, 15.9.2010, 15.1.2011 and 15.3.2011 respectively. These samples were analyzed at a laboratory of the Irrigation Department.

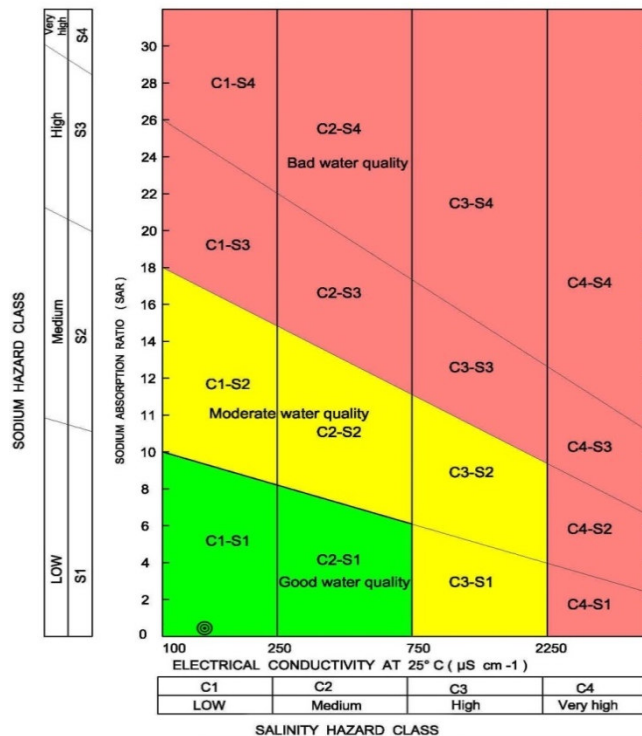
According to United States Department of Agriculture diagram for classification of irrigation water, these analyzed results show that this water sample (Ayeyarwaddy river water at Pakokku) was considered to be **C1-S1**, low salinity hazard class and low sodium hazard class which is good water quality for irrigation.

**C1** – Low salinity water can be used for irrigation with most crops on most soils, with little likelihood that a salinity problem will develop. Some leaching is required, but this occurs under normal irrigation practices, except in soils of extremely low permeability.

**S1** – Low sodium water can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops may accumulate injurious concentrations of sodium.

The general conclusion can be drawn that Ayeyarwaddy River water at Pakokku is of good quality for irrigation.

(Figure) USDA diagram for classification of irrigation water



© Water Sampling at Ayeyarwaddy River at Pakokku  
Sampling Date - 15.6.2010, 15.9.2010, 15.1.2011, 15.3.2011

## APPENDIX V: PAKOKKU COMMUNITY CONSULTATION FOR IEE (AUG 2017)

Workshop Title: Magwe Regional Stakeholders Meeting of CFAVC Subprojects, Magwe.  
 Venue : Shwe Tan Thit Monastery Hall, Pakokku  
 Date : 2 August 2017  
 Time : 17:00 – 19:00 hrs.

Number of Participants: 54 participants (CSO Future Light Rep: 2, Kyi Ywa Local Administrator: 1, Local Administration Officer 2, Land Use Department Rep: 1, Farmer Group Kyi, Kunn, Shwe Tan Thit Rep: 36, Irrigation Department Rep: 1, Water Management Department Rep: 1, DOA Rep: 5, ADB Rep: 1, PPTA 4)

Organized by : DOA (Department of Agriculture), Pakokku Township

Note the consultation covered the subprojects for both DML2 canal rehabilitation and potential tubewells.

### Summary Notes on Recommendations from Participants:

Item	Name of Participant at Stakeholders Meeting	Designation / Organization	Discussion Notes
1	Dr. Ken Neils and Daw Aye Aye Khaing	Team Leader, and Deputy Team Leader, CFAVC PPTA 8897 MYA	<p><b>Introduction to the project:</b></p> <ul style="list-style-type: none"> <li>This project (CFAVC PPTA) aims to contribute to upgrade each step of the value chain by value adding for good variety of pulses, beans and sesame, water management activities according to CSA (Climate Smart Agriculture), post-harvest processing infrastructure, laboratory equipment and testing of product to meet international standard for export quality.</li> <li>Currently, the seed farmers are facing difficulty to acquire good quality seeds, assess to sufficient water at the right time, post-harvest activities to dry, clean and store their products, and getting reasonable price for their efforts and end-products.</li> <li>For the market to be stable, this project will look into the gaps in the value chain and upgrade the needed aspects. The GOM will acquire loan from the ADB to implement this project. In connection to this, seed farmers can also get loans from the GOM for these initiatives upgrade and increase their productivity, contributing to stable marketing of these products.</li> <li>Feasibility studies and environmental safeguard assessments have been carried out for typical subproject activities for the CSA Irrigation at KyiYwa, Kun Ywa and Shwetan Thit villages. This CSA Irrigation subproject can be replicated as examples to other areas of the project in all three regions in the CDZ: Magwe, Sagaing and Mandalay Regions.</li> </ul>

			<ul style="list-style-type: none"> <li>ADB's environmental safeguard policy states that all development projects under their support should conserve the environment. Therefore PPTA aims to renovate existing minor canals, introduce solar powered tube wells and upgrade small reservoirs and dams that will not have detrimental adverse impacts to the environment. In this stakeholders meeting, we're going to discuss the CSA Irrigation subproject's potential impacts and recommended mitigation measures and please may we invite all participants to contribute to the vibrant discussions to express their concerns regarding the environmental issues and recommendations according to their local experiences. Thank you.</li> </ul>
2	Daw Khine Thwe Wynn	Safeguards Officer, Myanmar Resident Mission, ADB	<p><b>Introduction to ADB's Environmental Safeguard Policy:</b></p> <ul style="list-style-type: none"> <li>The ADB (Asian Development Bank) assists in development projects with loans, grants and technical assistance. All development projects administered by the ADB have to adhere to the safeguard guidelines and policies to protect the environment and conserve it.</li> <li>Now this project has carried out the initial environmental examination (IEE) of its subprojects, mainly the infrastructure of the pulses, beans and sesame processing subproject and improvement of irrigation infrastructures.</li> <li>According to ADB Safeguard Policy, projects are classified as Category A (which has significant negative impacts and needs EIA), Category B (of which potential impacts can be mitigated or overcome and would need IEE), or Category C (which has no significant negative impact and needs no EIA; nor an IEE. Sometimes EMP would be required according to the National EIA Procedure guidelines, 2015). CFAVC project is classified as Category B according to ADB Safeguard Policy. Preparations are being made to submit to the ECD (Environmental Conservation Department) for its verification as environmental Category B.</li> <li>I would like to request all participants to contribute vibrantly in this stakeholders meeting discussions to point out their concerns and give suggestions to be incorporated to our environmental safeguards reports of this project. Thank you.</li> </ul>
3	Daw Phyu Phyu Aye	National Environment Specialist, CFAVC PPTA 8897	<p><b>Potential Environmental Impacts and Possible Mitigation Measures for CSA (Climate Smart Agriculture) Irrigation subprojects:</b></p> <ul style="list-style-type: none"> <li>The project has carried out the IEE (Initial Environmental Examination) on these two subprojects in KunYwa, KyiYwa and ShweTanThit</li> </ul>

		MYA	<p>villages at Pakokku Township. The following potential impacts and its mitigation measures of these typical subprojects will be used to prepare the EMP (Environmental Management Plan and Monitoring Plan), of this subproject. All participants are urged to participate vibrantly after this presentation, of which discussion made will be recorded to contribute to prepare the EIA comprehensively. <sup>26</sup></p> <ul style="list-style-type: none"> <li>▪ <b>Recommendation for mitigation of potential impacts in Pre-Construction Phase:</b> a) Ground water use: a) Water extraction and utilization Plan with WUGs (Water User Groups) for sustainable water use and recharge; b) Adherence to Technical Design of infrastructures for stability and durability of structures that can withstand adverse climate change conditions: flash floods, and high winds.</li> <li>▪ <b>Construction Phase:</b> a) <b>Downstream affect</b> by upstream water users: Capacity building for relevant stakeholders, water user farmer groups with CSA (Climate Smart Agriculture), drip irrigation, water and soil conservation techniques for equitable water use for all farmers upstream and downstream of the water course; b) <b>ground water recharge:</b> Hydro-geophysical survey at proposed project site for drilling tube wells for sustainable water bearing aquifer and utilization of ground water only for supplementary purpose during the dry season on site; c) <b>Excavation / dredging of spoil and disposal:</b> Reuse of valuable silt and spoil at farmers B profile soil preparation of good soil; d) <b>Air and noise pollution:</b> Transportation vehicles to comply to NSL (National standard level): Emission guidelines, 2015 and to cover the conveyance material that produce dust during transportation; e) <b>Human waste from construction:</b> The construction team to be provided with proper sanitation facilities and given instructions to keep the construction site clean and leave the site clean after construction; f) <b>Traffic Accident:</b> Construction vehicles to conform to relevant NSLs and ensure skilled and careful drivers; g) <b>Soil Erosion:</b> Ensure good engineering and construction practice with good drainage system and waste disposal plan; h) <b>Workman Safety and Health:</b> Ensure skilled labor and use of relevant PPE (Personal Protective Equipment) during construction; i) <b>Transmitted Disease:</b> Capacity building of workers for occupational health and</li> </ul>
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<sup>26</sup> Presentation in Myanmar Language ppt in Annex 7



			<p>safety and hygienic living standards and provide health care whenever needed;</p> <ul style="list-style-type: none"> <li>▪ <b>Operational Phase:</b> a) <b>Water pollution:</b> Capacity building for GAP (Good Agricultural Practice) and fertilizer usage, Monitoring of water quality for good agriculture water supply and plans for necessary remedial action whenever necessary; b) <b>Conflict in water utilization:</b> Capacity building of FWUG (Farmer Water User Group) for equitable water utilization and GAP, CSA, Drip, sprinkler irrigation, etc. c) <b>O &amp; M:</b> FWUGs to be instructed with operation and maintenance of project infrastructures for good running conditions and durability;</li> <li>▪ <b>Potential Socio-economic beneficial impacts:</b> a) <b>Increased agricultural and farmers' knowledge:</b> 1) Human Resources development regarding FWUGs with project's capacity building initiatives on all aspects of the subprojects in GAP, CSA, Laboratory equipment, processing machinery and equipment, infrastructures operation and maintenance, etc. 2) Employment Opportunities: For local inhabitants due to the project and capacity building for FWUGs and various skills in O &amp; M, etc.</li> </ul>
Participants' suggestions, concerns and questions regarding the environmental safeguards for this presentation (Participants were not forced to offer their names during discussions to enhance their transparency and willingness to speak up without reservation).			
4	<b>Queries / Recommendations from participants (CSA Irrigation subproject Stakeholders Meeting, 2 Aug 17)</b>		
	<p>1) <b>Recommendation from Farmer Shwe Tan Thit U Myint Aung:</b></p> <ul style="list-style-type: none"> <li>▪ Before, our village "Shwe Tan Thit" could not get underground water. Now after some years of implementing the pumping irrigation scheme by the GOM, we can drill tube wells in our area at 50'-80' (15-20m), and can get clear, fresh water. However, in some areas, there is seeping up of irrigated pumped-water to the surface level and this water drains away like drains in some areas. Therefore we have to cover the flooded area with earth.</li> <li>▪ The soil composition here is sandy soil, and during 1995, we were asked to grow rice, and that causes losses for us. So now we grow sesame as priority crops. We get better price for our products.</li> </ul>		
	<p>2) <b>Recommendation from WUMD U Myint Oo:</b></p> <ul style="list-style-type: none"> <li>▪ In low lying flooded areas, the farmers cannot grow crops. So we construct ponds to retain this excess water</li> </ul>		
	<p>3) <b>Recommendation from Farmer Kyi Ywa:</b></p> <ul style="list-style-type: none"> <li>▪ In Kyi Ywa's low Lying areas (about 2 acres) can be flooded for 2-3 days. We need drainage canals to divert the excess water.</li> </ul>		
	<p>4) <b>Concern from Farmer Kun Ywa:</b></p> <ul style="list-style-type: none"> <li>▪ It will be good to have weather warning systems to alert us in time for urgent preparations to store our produce from the rains.</li> <li>▪ Surveyors have visited our place one time in Nov 2016, one time in Feb 2017, and had talked about drilling solar tube wells but until now nothing has been done.</li> </ul>		

	<ul style="list-style-type: none"> <li>Some farmers had been visited 5-6 times already by the ADB , but no visible work done as yet.</li> </ul> <p><b>Answer from ADB:</b></p> <ul style="list-style-type: none"> <li>Like all development projects supported by ADB, WB or JICA, there are various processes before the actual implementation. Now, we are only at its initial stage, which is the feasibility study stage of this subproject.</li> <li>We have to consider various aspects regarding environmental safeguards, socio-economic and financial aspect, for sustainability of the subproject. That's why we have many asked questions to collect the required local data before designing the projects. Please bear with us during our visitations and queries.</li> <li>ADB ensures that its projects are sustainable and provides loans / grants for development projects. All of ADB Projects implemented to date have been successfully implemented in Myanmar.</li> <li>ADB has implemented the YGN-PYAY Highway successfully and is commencing the Mandalay Urban Services Improvement Project for its sustainable development.</li> </ul> <p><b>Answer from PPTA:</b></p> <ul style="list-style-type: none"> <li>In project design, ADB and GOM both consider the beneficial aspect of the proposed project. MOALI (Ministry of Agriculture, Livestock and Irrigation) alone cannot decide with its perspective. We have to consider the environment, gender equality, the infrastructures regarding subprojects, the upgrading of seed farms, capacity building; all steps of the proposed activities and calculate the rate of return for each subproject in all project areas of all three regions in the CDZ (Magwe, Monywa, and Mandalay).</li> <li>Only when the design stage is completed with both parties agreed, then probably in 2018, the loans from ADB can be endorsed from the National Parliament and MOU signed accordingly for project implementation. Therefore, may we encourage you all to help in this stakeholders meeting with your active participation and suggestions? Thank you.</li> </ul>
	<p>5) <b>Concern from Farmers:</b></p> <ul style="list-style-type: none"> <li>The pumping scheme pumps the Ayeyarwaddy river water from low lying area to higher ground in four steps. Therefore, in some parts of the low lying areas at Shwe Tan Tit village get flooded with the excess seepage water from the pumped irrigated water. I would like to express my concern regarding prevention of dengue fever in the flooded areas.</li> <li>The geographical feature of our area is not level. Therefore only 500 acres can be cultivated because of two areas being flooded or some higher areas too high for pumped irrigation water to reach.</li> <li>It would be good if the project considers for construction of contour roads for the seed farms. That will help retain the water in the seed farms during the winter crop season.</li> <li>The market is not stable for our products. The farmers grow different kinds of varieties of rice crop: some grow "Manaw Thuka", some grow "Sin Thuka". The merchant wants the same kind of variety of crop. Therefore, it is important that all farmers grow the same kind of crop for market to be stable.</li> </ul>
	<p>6) <b>Recommendation from WUMD:</b></p> <ul style="list-style-type: none"> <li>It is advisable that the WUG should dredge the renovated canals themselves and take care of the maintenance of canals after project implementation and take ownership for their respective canal parts of the proposed project.</li> <li>The farmer can do this. They should be united to clean up, maintain their canals and conserve their own water and use effectively to grow crops.</li> <li>PPTA Consultant Dinesh Mulla has identified the prospective areas for drilling solar tube wells and leveling work has been done by PPTA for prospective laser leveling work for drip irrigation.</li> </ul>
	<p>7) <b>Concern from Farmer U Chit Hlaing:</b></p>

	<ul style="list-style-type: none"> <li>▪ The local monk closed the discharge drain of our village so that the tertiary canal, which supplies water to 10 acres, is in bad shape.</li> <li>▪ It would solve the problem if an eight inches (20 cm diameter) underground pipe be installed to discharge the water effectively. Then the farmers can grow two crops per year.</li> </ul>
	<p>8) <b>Recommendation from Local CSO “Future Light Youth Association” and farmer:</b></p> <ul style="list-style-type: none"> <li>▪ Here there is no land issue because the existing canals are going to be renovated. However, other regions might have land acquisition issues. It is important to consider the land issue in preparing the frame work of this project.</li> <li>▪ In drilling solar tube wells in 200 acres, and with laser leveling for drip irrigation, there is likelihood of 100% success. It is good to construct farm roads at the same time that the wells are being drilled. For roads crossing the drains, culverts should be provided.</li> <li>▪ Would like to request the PPTA for quick implementation of this project. Thank you.</li> </ul> <p><b>Wrap up from PPTA:</b></p> <ul style="list-style-type: none"> <li>▪ Hopefully, by 2018, ADB and GOM would have signed the MOU if all goes well.</li> </ul>



Photo-1 : A farmer discussing and recommending



Photo-2 : Lady farmer expressing concern



Photo-3 : PPTA Daw Aye Aye Khaing explaining



Photo-4 : Team Leader Dr. Ken Neils introducing the proposed project



**Photo-5: Answering queries from participants**



**Photo-6: CSA Irrigation subproject Stakeholders Meeting participants listening**



