

**THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF NATURAL RESOURCES AND
ENVIRONMENTAL CONSERVATION**

**PROJECT
FOR
CAPACITY DEVELOPMENT
IN
BASIC WATER ENVIRONMENT
MANAGEMENT AND EIA SYSTEM
IN
THE REPUBLIC OF THE UNION OF MYANMAR**

**FINAL REPORT
OF
WATER ENVIRONMENT MANAGEMENT
COMPONENT**

VOLUME NO.1

JUNE 2018

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIPPON KOEI CO., LTD.

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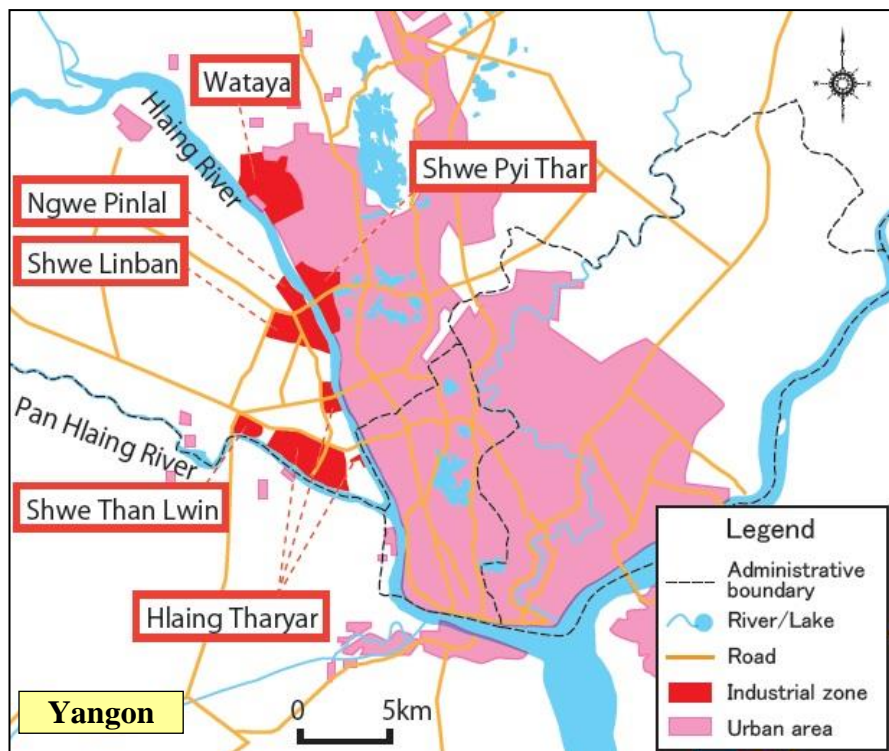
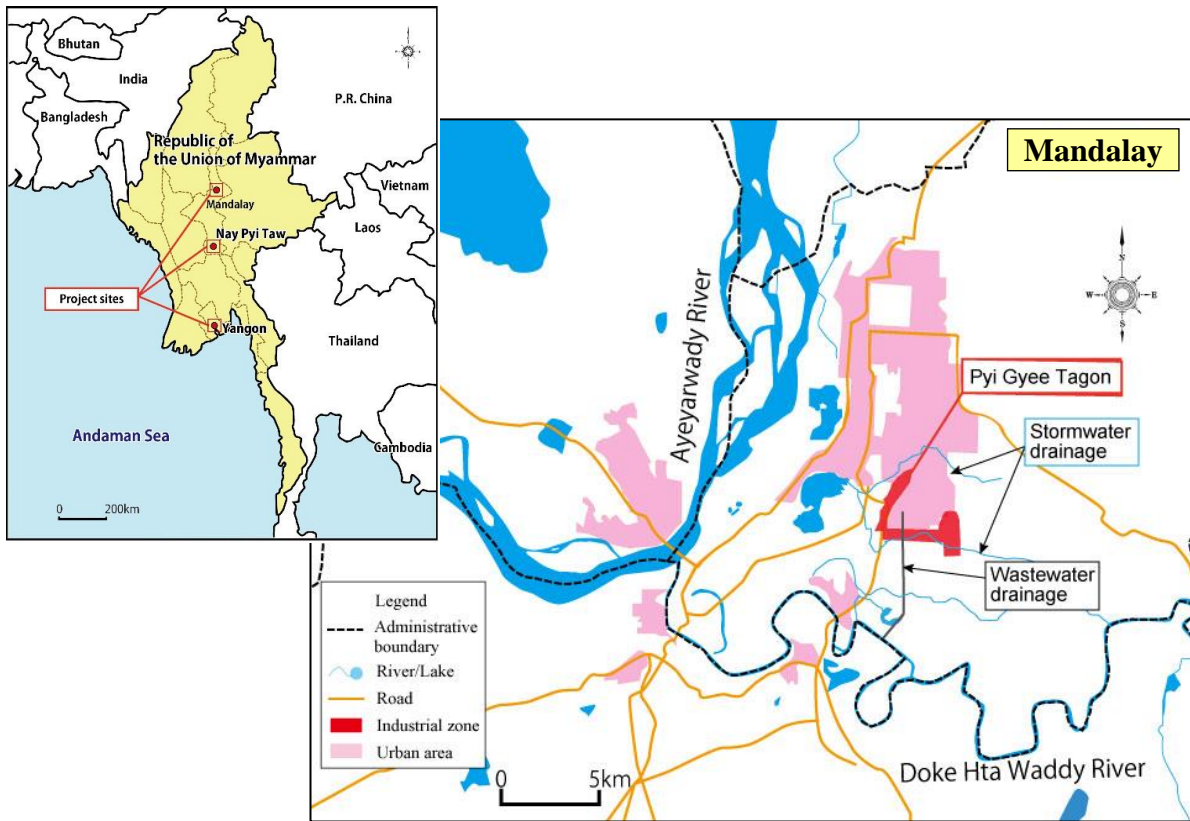
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USD 1.00 = MMK 1,340.0

JPY 100 = MMK 1,220.3



Location Maps of the Project Areas

EXECUTIVE SUMMARY

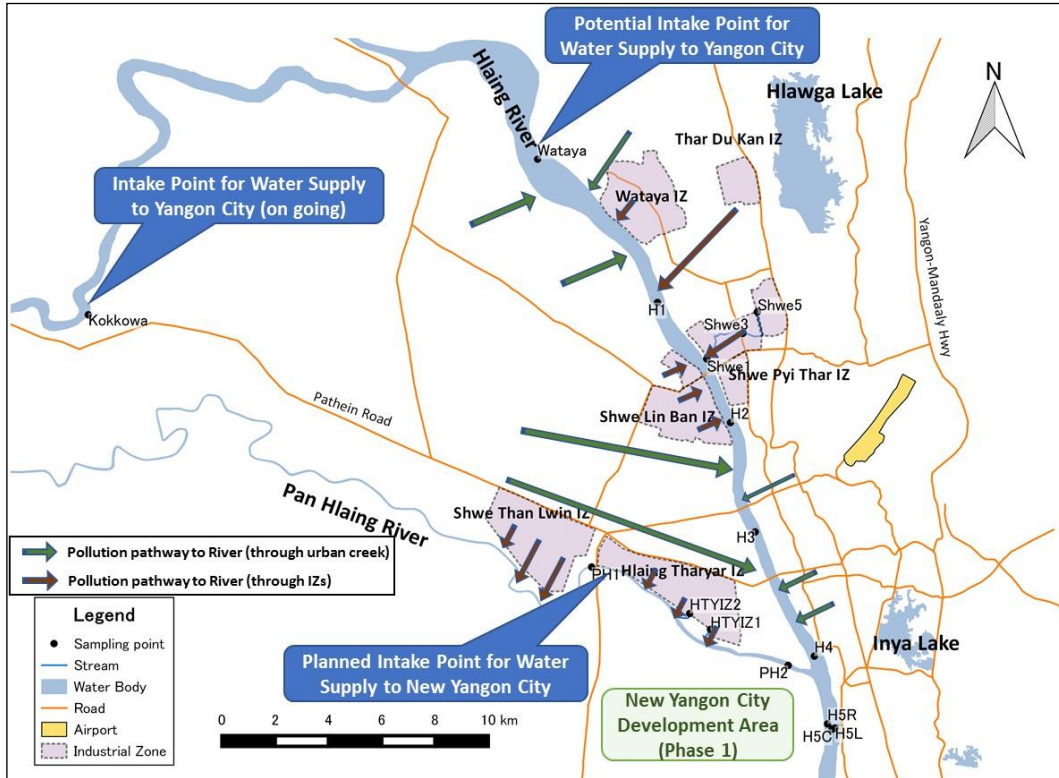
BACKGROUND

- This project was implemented to strengthen capacities of environmental authorities in Myanmar for water environmental management and Environmental Impact Assessment (EIA) review works. The activities were implemented based on the Record of Discussions (R/D) signed between Ministry of Environmental Conservation and Forestry (MOECAF) and Japan International Cooperation Agency (JICA) in December 2014. The project had two components: namely water environment management component and EIA component. This report is the final report of the water environment management component. The overall goal, project purpose and outputs of the project are summarized in the following table and elaborated in the text below it by output.

Table ES-1 Overall Goal, Project Purpose and Outputs of the Project

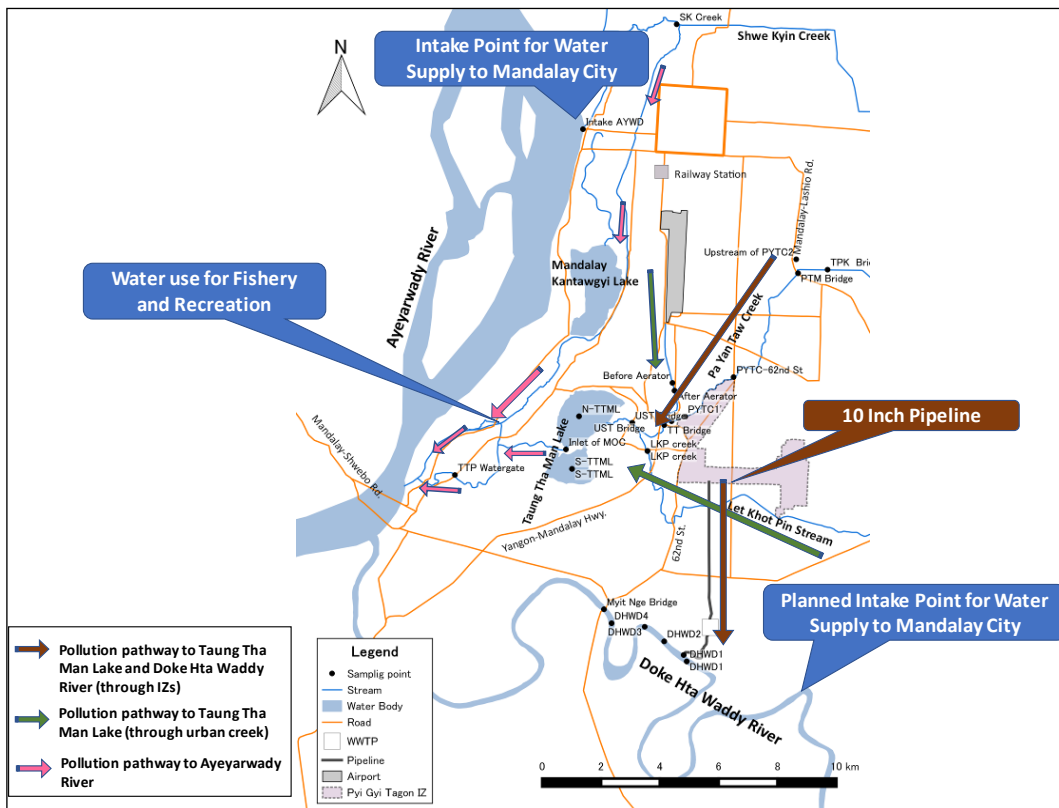
Item	Contents		Component
Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.		
Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.		
Outputs	Output 1	Inspection procedure is standardized.	Water environment management
	Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.	Water environment management
	Output 3	Database of water pollution sources and river water quality is developed.	Water environment management
	Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.	Water environment management
	Output 5	Necessary technical manuals and forms for the EIA review are developed.	EIA
	Output 6	Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.	EIA
Duration	June 2015 – May 2018 (3 years)		

- The water environment management component covers Outputs 1 through 4, and the activities were implemented jointly by Environmental Conservation Department (ECD) of Ministry of Natural Resources and Environmental Conservation (MONREC which succeeded MOECAF in 2016), Yangon City Development Committee (YCDC), Mandalay City Development Committee (MCDC), and JICA Expert Team (JET). Many of the project activities were implemented in the two pilot study areas: namely Hlaing River basin in Yangon and Doke Hta Waddy River basin in Mandalay. They were selected to study impacts of industrial activities on river water qualities.
- The general pollution pathways in the project areas summarized in the maps below for Hlaing River Basin and Doke Hta Waddy River Basin. They are based on Output 4 activities.



Source: JET

Figure ES-1 Pollution Pathways in the Hlaing River Basin



Source: JET

Figure ES-2 Pollution Pathways in the Doke Hta Waddy River Basin

OUTPUT 1 (INSPECTION)

- Output 1 was implemented to standardize the procedure of environmental inspection of factories by ECD, YCDC and MCDC. The activities and the indicators of Output 1 are summarized in the following table.

Table ES-2 Activities and Indicator of Output 1 (Inspection)

Output 1	Inspection procedure is standardized.
Activities	1-1 To collect information on water pollution sources 1-2 To evaluate present inspection procedures 1-3 To develop an inspection manual 1-4 To implement trial inspection based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures
Indicator	Inspections are implemented according to the inspection manual by YCDC, MCDC and ECD.

Source: JET

- In order to standardize the inspection procedure, an inspection manual was developed. It was designed to support officers to understand important steps of the procedure and to minimize mistakes that arise from lack of knowledge and experience. Following the distribution of the draft manual in November 2016, ECD Yangon and ECD Mandalay implemented a total of about 80 inspections until the end of the 2016-2017 fiscal year. Overall, the inspection manual was received positively by regional ECDs, YCDC and MCDC. Currently ECD is translating the manual for official use by all regional ECD offices in the country.
- In addition to standardization of the inspection procedure, the project organized a series of workshops on wastewater treatment to help officers and people of factories learn how to manage wastewater. The workshops covered various technical and practical issues, such as different technologies for wastewater treatment, comparison of individual versus joint/central treatment, etc.
- Development of a centralized wastewater treatment facility is an attractive option to control industrial wastewater in an industrial zone. However, most industrial zones in Yangon still do not have such facilities. Thus, to facilitate discussions among related organizations, the project implemented a small case study in Hlaing Thar Yar Industrial Zone (IZ), and organized a workshop in October 2017. This case study identified a number of practical issues that have to be resolved before a facility is designed, constructed and operated. They include, but are not limited to, demarcation of responsibilities among different organizations including the possibility of establishing a company responsible for overall management of an IZ, financing of the investment cost including possible governmental subsidies, cost recovery including minimum flow guarantee by the government, estimation of quantity and quality of wastewater from each factory, and securing land for the treatment and auxiliary facilities. Yangon Region Government is now spearheading the effort to develop centralized wastewater treatment facilities in industrial zones in Yangon.
- Through these activities, it became evident that environmental laws in Myanmar generally do not clearly define detailed and legally-binding environmental requirements for factories, and this is making environmental enforcement difficult and reactive. Thus, the project made a series of recommendations on how to clarify environmental requirements. This is highly pertinent to environmental administration in Myanmar right now because in January 2018 MONREC ordered factories in nine priority sectors to develop their own Environmental Management Plan (EMP) and obtain the Environmental Compliance Certificates (ECC) within 2018.

OUTPUT 2 (WATER QUALITY SURVEY)

- Output 2 focused on capacity development through implementation of water quality surveys in the Hlaing River basin in Yangon and the Doke Hta Waddy River basin in Mandalay.

Table ES-3 Activities and Indicator of Output 2 (Water Quality Survey)

Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.
Activities	2-1 To select a private or governmental laboratory which can provide reliable services of sampling and chemical analysis 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters, etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report
Indicator	Water quality survey reports are prepared in the pilot area by YCDC and MCDC.

Source: JET

- Water quality surveys were implemented five times (Feb 2016, June 2016, Jan-Feb 2017, Sep 2017, and Feb 2018) during the course of the project. As discussed later, the project encountered various difficulties in obtaining reliable results in the first three surveys, and the water qualities of these rivers were evaluated based on the results of the 4th and 5th surveys.
 - The water qualities in Hlaing River and Pan Hlaing River in the rainy season (September 2017) were acceptable for conservation of aquatic life, irrigation and water transportation, except for total suspended solid (TSS) and total coliform. In the dry season (February 2018), the water quality deteriorated as shown by high COD detected at some points and slight oil and grease detected at all points. The upstream area of Hlaing River (upstream of Shwe Pyi Thar Bridge) maintained adequate water quality for irrigation and water transportation even in the dry season, except for TSS, total coliform and oil and grease. The water quality of the creek in the Shwe Pyi Tar IZ improved in September 2017 following the suspension of distilleries in the area, although it deteriorated again in February 2017 after the operation of the factories resumed.
 - The Doke Hta Waddy River seems to have adequate water quality for domestic water supply after conventional treatment. The level of organic pollution does not appear to be very high. None of the results in this project showed elevated levels of toxic substances. The water quality did not dramatically vary in seasons or from point to point. The water quality in Taung Tha Man Lake was eutrophic, which was manifested by higher phosphorus and nitrogen concentrations, relatively low DO as well as high COD and pH. The water quality in the lake deteriorated significantly during the dry season compared with the rainy season.
- The surveys provided governmental officers with various opportunities to get hands-on experiences in designing monitoring plans, using equipment (portable water quality meters and flow meters), taking samples, making on-site measurement, and cross-examining monitoring results. A series of report writing trainings was organized from November 2017 – February 2018, in which officers practiced writing a water quality survey report under the guidance of JET’s engineers.
- Data reliability was one of the main issues encountered in Output 2. Until the third survey, samples were analyzed in Myanmar and Thailand, but these laboratories used different

analytical methodologies, and some laboratories had quality control issues. Thus, despite the efforts to diagnose and rectify the problems, it was not possible to ensure reliability of data. For this reason, the sample analysis in the 4th and 5th surveys was carried out in Japan for most parameters. Based on these experiences, a series of recommendations were made to ensure reliability of monitoring data in the future.

- It was also noted that there was no ambient water quality standard in Myanmar, and the results of the surveys had to be compared against the standards in other countries. An environmental standard is important as the basis of environmental decision-making, and recently ECD has started developing environmental standards, including ambient water quality standard. It is hoped that the environmental authorities in Myanmar will start environmental monitoring throughout the country, and evaluate water qualities based on their own standard.

OUTPUT 3 (DATABASE)

- Output 3 aimed to develop databases of pollution sources and river water quality. Because the river water quality data were collected in Output 2 activities, this output focused on gathering information on pollution sources.

Table ES-4 Activities and Indicators of Output 3 (Database Development)

Output 3	Database of water pollution sources and river water quality is developed.
Activities	3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database
Indicator	At least 150 factories' information is accessible on the database. Results of water quality survey is accessible on the database

Source: JET

- In the early phase of the project, an attempt was made to develop a pollution source database from readily available information, such as those from DISI. However, detailed information essential to characterize pollution sources, such as production volume, water usage, measures to minimize pollution, wastewater treatment facilities, etc., were not available. Thus, pollution source surveys consisting of a questionnaire survey of 202 factories and wastewater sampling at 100 factories in total were carried out in 2016 and 2017.
- These surveys provided inspection officers with opportunities to closely investigate the situations of environmental management in different factories, and to take more than 100 wastewater samples and compare the results against the National Environmental Quality (Emission) Guideline (NEQEG, 2015) values, although the guidelines were not legally-binding at the time of the surveys. Even though the surveys covered only about 10% of factories in the target areas, the results were quite revealing.
 - According to the results of the questionnaire survey in 2016, only 10% of factories in Yangon and 2% in Mandalay were equipped with water meters to monitor water usage. Apparently, most factories are not monitoring the water usage and the amount of wastewater.
 - Only 53% and 46% of factories investigated in Yangon and Mandalay respectively replied that they had wastewater treatment facilities. Majority of them were rudimentary screens and sedimentation tanks to remove solid waste and settling solids. Only a few percent of factories had secondary treatment facilities to remove organic matter (BOD and COD) in wastewater.

- According to the results of the wastewater analysis in 2017 for BOD and COD, 89 % and 64% of factories were not meeting the NEQEG (2015) vales respectively. This was expected because to meet the requirements of NEQEG for BOD and COD, one usually needs secondary treatment, but most factories investigated did not have secondary treatment facilities. It was also confirmed that effluent concentration depends largely on the efforts of the industrial sector. Most factories in distillery, food and beverage, leather tanning, and paper sectors significantly exceeded the NEQEG (2015) requirements for BOD and COD. As for nutrients T-N and T-P, about 43% and 45% of the factories exceeded the NEQEG (2015) valuesrespectively.
- With respect to toxic substances, elevated levels of Pb, Zn and Hg were detected from battery factories (categorized as semi-conductor). Similarly, elevated levels of phenols, sulphate and Cr were found from wastewaters of tanneries. Also, Zn was found from one of garment/textile factory. Environmental authorities should closely monitor these sectors/factories and control them as needed.
- The questionnaire survey in 2016 also indicated that lack of expertise and lack of land are among the main difficulties factories were facing in installing proper wastewater treatment facilities, especially in Mandalay. The result in Yangon was mixed and not very conclusive.
- Based on the data collected through the pollution source surveys in 2016 and 2017, a pollution source database was developed. The database contained data and information of 202 factories in Yangon and Mandalay, and is linked to a GIS software. The results of the water quality surveys from Output 2 were stored in another database on river water quality. The staff received a series of training programs about the use of databases including the GIS software.
- A number of important lessons for water environmental management were drawn from the activities. First, it became clear that information essential for water environment management, such as water usage and wastewater quality, was not readily available for most factories. Moreover, obtaining reliable data were not easy. Most factories were not monitoring water usage, and many managers and operators of factories were not familiar with environmental management issues. Furthermore, laboratory data was often plagued with quality control issues. Thus, the project made some recommendations on gathering environmental information from factories and improving reliability of data on water usage and wastewater quality.
- The results of the pollution source survey revealed that many factories lack measures to minimize pollution and treat wastewater, and their wastewaters were not meeting the NEQEG (2015). Environmental authorities need to both strengthen enforcement and actively support factories. The factories' side should also consider how to conduct pollution control and maximize production efficiency.

OUTPUT 4 (INFORMATION INTERPRETING CAPACITY)

- Output 4 focused on developing capacities to interpret environmental information in order to develop strategies to control water pollution.

Table ES-5 Activities and Indicator of Output 4 (Information Interpreting Capacity)

Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.
Activities	4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report
Indicator	Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.

Source: JET

- To teach different skills of interpreting environmental information, the following five case

studies were carried out jointly using the data and information gathered through the project activities.

- Case Study 1: Pollution load analysis in the pilot area of Yangon
- Case Study 2: Pollution load analysis in the pilot area of Mandalay
- Case Study 3: Installation of centralized wastewater treatment system in Hlaing Thar Yar Industrial Zones
- Case Study 4: Preliminary estimation of dilution capacity for water quality leading to future water resource management in the Doke Hta Waddy River
- Case Study 5: Industrial water pollution control measures at national level
- The pollution load analyses in Yangon (Case Study 1) and Mandalay (Case Study 2) were implemented to examine contributions of different sources of pollution, including not only industrial sources, but also domestic wastewater (sewage) and non-point sources, on the overall pollution loads to the Hlaing River and the Doke Hta Waddy River. The results showed that contributions of these sources vary significantly from location to location, and it is essential to elucidate pollution mechanisms to control water pollution.
- Case Study 3 was for development of a centralized industrial wastewater treatment plant in Hlaing Thar Yar IZ implemented as part of Output 1 activities. The results are explained in the section of Output 1.
- Case Study 4 on the Doke Hta Waddy River in Mandalay examined how the seasonal fluctuation of water flow, operation of Yeywa Dam in the upstream, water uptake for irrigation and the planned domestic water supply, and operation of the centralized wastewater treatment facility under construction, could influence the water quality of the river. The results demonstrated these factors significantly influence the water quality, and coordination among relevant stakeholders was suggested to maintain the water quality of the river.
- Case Study 5 was a series of brainstorm meetings with the officers of ECD to identify policy issues to be considered at the national levels.

RECOMMENDATIONS

- Based on the experiences gained through the activities of Outputs 1 to 3, and the findings from the five case studies in Output 4 mentioned above, a series of strategies and action plans were developed jointly to improve water environment management in the future.
- The suggestions for improvement of water environment management identified through the activities of Outputs 1 to 3 are summarized in the table below.

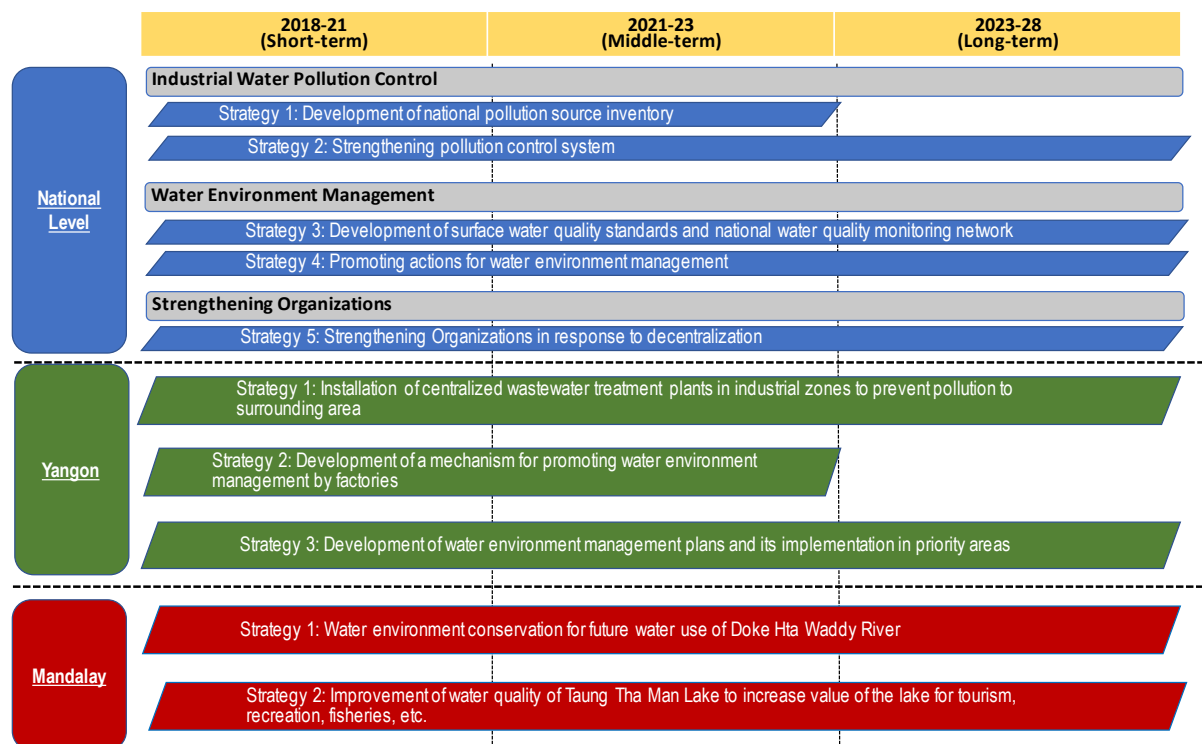
Table ES-6 Suggestions from Activities of Outputs 1 to 3

- Output	Suggestions	Summary
Output 1 (Inspection)	Clarification of Environmental Requirements	Implement sectoral studies, and set requirements considering the best practices in each sector.
	Clarification of Inspection Procedures for Each Environmental Requirement	Once environmental requirements for factories are set, clarify the detailed inspection procedure for each environmental requirement. Revise the manual accordingly.
	Support to Factories on Pollution Control	Organize workshops and consultation events to educate regulated communities focusing on both procedural and technical issues. Workshops for specific sector or area should be considered.
Output 2 (Water Quality)	Improvement of monitoring data quality in	Standardize analytical methodologies and establish QA/QC, including proficiency testing and accreditation system. Also obtain more reliable

Survey)	Myanmar	data as the basis for comparison with monitoring data.
	Development of proper water environmental standard	Develop the surface water quality standard that has proper criteria and is also implementable with the capacity of monitoring organizations.
	Regular Surface Water Monitoring	Plan and implement regular surface water monitoring programs by responsible authorities. Ensure reporting of results from regional ECDs to ECD Headquarters. For important cases, implement special investigations to elucidate detailed, site-specific pollution mechanisms.
Output 3 (Database Development)	Gathering Information from Factories	Collect relevant information from factories through EMP and as part of reporting requirements of ECC. Or implement a questionnaire survey similar to the one implemented in this project.
	Development of Database of Pollution Sources	For managing ECC, expansion of the EIA database may be appropriate. Limit the information to be digitized if digitizing work is overwhelming.
	Improving Reliability of Measurement of Water Usage and Wastewater Qualities	Include installation of water meters and measurement of water usage as part of ECC requirements. Standardize analytical methodologies and introduce a system of QA/QC.
	Improving Environmental Measures by Factories	Enforce realistic environmental regulations and implement support measures. Regulate groundwater abstraction. Request regulated communities to take their own initiatives for pollution control and efficient production, possibly spearheaded by MOI and/or industrial associations.

Source: JET

- Recommended series of strategies for water environment management developed in Output 4 activities are summarized in the Figure below. The suggestions from Outputs 1 to 3 and the results of casestudies in Output 4 were taken into consideration. The strategies were developed for Yangon, Mandalay and at the national level, and the actions were divided into three terms: short-term (within 3 years), middle-term (within 5 years), and long-term (within 10 years). Counterpart organizations are urged to discuss these strategies further, develop official documents, get approval, and implement the actions.



Source: JET

Figure ES-3 Strategies for Water Environment Management

- To support implementation of these strategies and action plans, further recommendations for top decision makers are also provided in the report. They cover (i) clear demarcation of responsibilities among environmental authorities, (ii) development of realistic environmental requirements, (iii) inducing behavior change in regulated communities, (iv) involvement of stakeholders, such as local residents, NGOs and industrial associations, and (v) promotion of regional coordination for activities that are beyond the capacity of environmental authorities.

Table of Contents (Volume No.1)

EXECUTIVE SUMMARY

CHAPTER 1 INTRODUCTION	1-1
1.1 Background	1-1
1.2 Overall Framework of the Project	1-1
1.2.1 Overall Goal, Project Purpose and Outputs	1-1
1.2.2 Organizational Structure.....	1-2
1.3 Amendments of PDM and PO.....	1-3
CHAPTER 2 PROJECT ACTIVITIES	2-1
2.1 Introduction	2-1
2.2 Activities Common to All Outputs.....	2-2
2.2.1 Joint Coordinating Committee Meetings.....	2-2
2.2.2 Project Coordination Meetings.....	2-2
2.2.3 Capacity Assessment.....	2-3
2.3 Output 1 – Inspection	2-3
2.3.1 To Collect Information on Water Pollution Sources (Activity 1-1).....	2-3
2.3.2 Evaluate Present Inspection Procedures (Activity 1-2).....	2-4
2.3.3 Develop an Inspection Manual (Activity 1-3).....	2-9
2.3.4 Implement Trial Inspection based on the Inspection Manual (Activity 1-4).....	2-11
2.3.5 Provide Training on Measures to Control Industrial Effluent (Activity 1-5).....	2-12
2.3.6 Evaluate the Inspection Procedures (Activity 1-6).....	2-14
2.3.7 Issues and Suggestions Identified through Output 1 Activities.....	2-15
2.4 Output 2 – Water Quality Survey.....	2-16
2.4.1 Select a Private or Governmental Laboratory which can Provide Reliable Services of Sampling and Chemical Analysis (Activity 2-1).....	2-16
2.4.2 Collect Information on Hydraulic Observation, Tide, Water Utilization and Water Pollution Sources in the Pilot Study Areas (Activity 2-2).....	2-17
2.4.3 Develop Criteria for Selecting Sampling Points, Sampling Time, Measurement Parameters, etc. (Activity 2-3).....	2-19
2.4.4 Develop a Water Quality Survey Plan (Activity 2-4).....	2-19
2.4.5 Develop a Water Quality Survey Manual (Activity 2-5)	2-20
2.4.6 Implement a Water Quality Survey based on the Water Quality Survey Plan (Activity 2-6).....	2-21
2.4.7 Supervise the Water Sampling Referring to the Water Quality Survey Manual (Activity 2-7).....	2-23
2.4.8 Verify the Results of Water Quality Survey Using the Water Quality Survey Manual (Activity 2-8).....	2-23
2.4.9 Prepare a Water Quality Survey Report (Activity 2-9)	2-24
2.4.10 Issues and Suggestions Identified through Output 2 Activities.....	2-33
2.5 Output 3 – Database Development.....	2-35
2.5.1 Collect and Sort out the Information on Water Pollution Sources which was Collected by the Activity 1-1, Inspection Results and the Water Quality Survey Results (Activity 3-1).....	2-35
2.5.2 Develop a System Concept (Activity 3-2).....	2-39
2.5.3 Design the Database based on the System Concept (Activity 3-3)	2-40
2.5.4 Collect Additional Information Required to Develop the Database (Activity 3-4).....	2-40
2.5.5 Develop the Database (Activity 3-5).....	2-51
2.5.6 Conduct Training on Operation and Utilization of the Database (Activity 3-6)	2-54
2.5.7 Develop an Operation and Maintenance Manual of the Database (Activity 3-7)	2-55
2.5.8 Issues and Suggestions Identified through Output 3 Activities.....	2-56
2.6 Output 4 – Information Interpretation	2-57

2.6.1	Collect the Information Necessary for the Water Quality Status Report (Activity 4-1)	2-57
2.6.2	Interpret the Collected Information (Activity 4-2)	2-59
2.6.3	Prepare a Water Quality Status Report (Activity 4-3)	2-77
2.7	Other Activities	2-78
2.7.1	Study Programs in Japan	2-78
2.7.2	Project Promotion and Publicity Activities	2-84
2.7.3	Collect Information on Activities of Relevant Organizations and Donors	2-87
CHAPTER 3 ISSUES AND LESSONS LEARNED		3-1
3.1	Designing Effective Capacity Development Activities within Constraints	3-1
3.2	Adjusting to the Evolving Environmental Administration in Myanmar	3-2
3.3	Office and Counterpart Costs	3-3
CHAPTER 4 ACHIEVEMENTS OF THE PROJECT		4-1
4.1	Mid-term Review	4-1
4.2	Terminal Evaluation	4-2
4.2.1	Achievements of the Project	4-2
4.2.2	Evaluation Based on DAC Evaluation Criteria	4-2
4.2.3	Progress of Activities and Plan of Operation	4-3
CHAPTER 5 RECOMMENDATIONS		5-1
5.1	Introduction	5-1
5.2	Lessons Learned from Activities of Outputs 1 to 3	5-2
5.3	Strategies for Water Environment Management	5-2
5.4	Additional Recommendations for Decision Makers	5-3
5.4.1	Clear Demarcation of Responsibilities of Environmental Authorities	5-3
5.4.2	Development of Realistic Environmental Requirements	5-4
5.4.3	Inducing Behavioral Change	5-4
5.4.4	Involvement of Stakeholders	5-5
5.4.5	Promoting Regional Coordination	5-5

Appendices (1/2)

Appendix 1	PDM and PO
Appendix 2	Assignments of Experts
Appendix 3	Records of Study Programs in Japan
Appendix 4	List of Equipment Handed Over to the Myanmar Side
Appendix 5	Minutes of Joint Coordinating Committee Meetings

Table of Contents (Volume No.2)

Appendices (2/2)

Appendix 6	Inspection Manual
Appendix 7	Criteria for Selecting Sampling Points, Time and Parameters
Appendix 8	Water Quality Survey Plan
Appendix 9	Water Quality Survey Manual
Appendix 10	Water Quality Survey Reports
Appendix 11	Manual for Operation and Maintenance of Databases
Appendix 12	Water Quality Status Report
Appendix 13	Pollution Source Survey Report
Appendix 14*	Materials from Seminars and Workshops
Appendix 15*	Publicity Documents

* Appendix 14 and Appendix 15 are available only in electronic format in CD-R.

List of Tables

Table 1.3-1	Changes of PDM Related to Water Environment Management Component Adopted at JCC Meeting No.2 in December 2015	1-3
Table 1.3-2	Changes of PDM Related to Water Environment Management Component Adopted at JCC Meeting No.3 in November 2016.....	1-4
Table 2.1-1	Major Project Activities	2-1
Table 2.2-1	Summaries of Joint Coordinating Committee Meetings	2-2
Table 2.2-2	Summaries of Project Coordination Meeting.....	2-2
Table 2.3-1	Activities and Indicator of Output 1 (Inspection)	2-3
Table 2.3-2	Laws and Regulations Related to Pollution Control in Manufacturing Industries	2-4
Table 2.3-3	Licensing/Registration Systems and Inspection.....	2-5
Table 2.3-4	Objectives, Target and Table of Contents of Inspection Manual.....	2-10
Table 2.3-5	Inspections by ECD in April 2016 – March 2017.....	2-11
Table 2.4-1	Activities and Indicators of Output 2 (Water Quality Survey)	2-16
Table 2.4-2	Collected Information on Water Quality Survey for the Hlaing River Basin	2-17
Table 2.4-3	Collected Information on Water Quality Survey for Doke Hta Waddy River Basin..	2-18
Table 2.4-4	Criteria to Select the Sampling Points, Sampling Time and Measurement Parameters	2-19
Table 2.4-5	Summary of Water Quality Survey Plan for the Hlaing River Basin	2-19
Table 2.4-6	Summary of Water Quality Survey Plan for the Doke Hta Waddy River Basin	2-20
Table 2.4-7	Sampling Dates for the Hlaing River Basin.....	2-21
Table 2.4-8	Sampling Dates for the Doke Hta Waddy River Basin.....	2-21
Table 2.4-9	Classification of BOD and COD Levels in the Hlaing River Basin	2-25
Table 2.4-10	Comparison with Draft Drinking Water Quality Standard for Possible Domestic Water Supply (Hlaing River Basin).....	2-28
Table 2.4-11	Classification of BOD and COD Levels in Doke Hta Waddy River Basin	2-29
Table 2.4-12	Comparison with Draft Drinking Water Quality Standard for Existing/Possible Domestic Water Supply (Doke Hta Waddy River Basin)	2-29
Table 2.4-13	Nutrients Level in Taung Tha Man Lake	2-31
Table 2.5-1	Activities and Indicators of Output 3	2-35
Table 2.5-2	Inspection Form of YCDC-PCCD	2-35
Table 2.5-3	Collected Existing Information.....	2-36
Table 2.5-4	Items stored into each Database	2-40
Table 2.5-5	Summary of Pollution Source Survey for Collection of Additional Information	2-41
Table 2.5-6	Increase in Factories with Treatment Facilities during 2016-2017	2-46
Table 2.5-7	Comparison Results of BOD (Period 1 and Period 2)	2-47
Table 2.5-8	Comparison Results of COD (Period 1 and Period 2)	2-47
Table 2.5-9	Comparison Results with NEQEG (Period 2).....	2-47
Table 2.5-10	Number of Target Factories for each Sector (analyzed in Japan)	2-48
Table 2.5-11	Summary of Two Databases Developed in the Project.....	2-51
Table 2.5-12	Contents of Pollution Source Database.....	2-52
Table 2.5-13	Contents of Surface Water Quality Database.....	2-53
Table 2.5-14	Schedule of Training for Database.....	2-55
Table 2.5-15	Development of Database Operation and Maintenance Manual.....	2-55
Table 2.6-1	Activities and Indicators of Output 4.....	2-57
Table 2.6-2	Key Data and Information Collection for Water Quality Status Report	2-58
Table 2.6-3	Outline of Action Plans for Water Pollution Control from Industrial Zones in the Pilot Area of Yangon	2-64
Table 2.6-4	Outline of Action Plans for Water Pollution Control from Industrial Zones and Other Pollution Sources in the Pilot Area of Mandalay	2-71
Table 2.6-5	Outline of Action Plans for Industrial Wastewater Pollution Control and Environment Management at the National Level	2-73
Table 2.6-6	Detailed Action Plans and Implementation Schedule for Industrial Wastewater	

	Pollution Control and Environment Management at the National Level.....	2-74
Table 2.6-7	Table of Contents of the Water Quality Status Report	2-78
Table 2.7-1	Summary of the Study Program in Japan No.1	2-79
Table 2.7-2	Schedule of the Study Program in Japan No.1.....	2-79
Table 2.7-3	Summary of the Study Program in Japan No.2.....	2-80
Table 2.7-4	Schedule of the Study Program in Japan No.2.....	2-81
Table 2.7-5	Summary of the Study Program in Japan No.3.....	2-83
Table 2.7-6	Schedule of the Study Program in Japan No.3.....	2-83
Table 4.2-1	Summary of the Terminal Evaluation	4-2
Table 4.2-2	Achievements of the Project (Water Environment Management Component).....	4-4
Table 4.2-3	Comparison of Progress of the Project Activities and Plan of Operation	4-5
Table 5.1-1	Overall Goal and its Objectively Verifiable Indicators.....	5-1
Table 5.1-2	Overall Goal and Its Objectively Verifiable Indicators	5-1
Table 5.2-1	Suggestions from Activities of Outputs 1 to 3	5-2
Table 5.4-1	Examples of Elements of Behavioral Change.....	5-4

List of Figures

Figure 1.2-1	Organizational Structure of the Project	1-2
Figure 2.3-1	Processes of Granting Operation License in Development Committee.....	2-7
Figure 2.3-2	Photos from the Training for Use of Inspection Manual for YCDC-PCCD.....	2-12
Figure 2.3-3	Photos of Lecture by Expert on Industrial Wastewater Treatment.....	2-13
Figure 2.3-4	Examples of Comparison of Hypothetical Options for Wastewater Treatment	2-13
Figure 2.3-5	Photos from the Workshop on Wastewater Treatment.....	2-14
Figure 2.4-1	Sampling Points of Water Quality Surveys in the Hlaing River Basin	2-21
Figure 2.4-2	Sampling Points of Water Quality Surveys in the Doke Hta Waddy River Basin	2-22
Figure 2.4-3	Photographs from the Water Quality Surveys	2-23
Figure 2.4-4	Water Quality Distribution in the Hlaing River.....	2-26
Figure 2.4-5	Water Quality Changes between Rainy Season and Dry Season (Hlaing River Basin).....	2-26
Figure 2.4-7	Water Quality and Pollution Load Changes between Rainy Season and Dry Season (Doke Hta Waddy River Basin)	2-30
Figure 2.4-8	Water Quality Changes in Northern Taung Tha Man Lake.....	2-32
Figure 2.4-9	Photographs of Seminar on Development of Water Quality Survey Report	2-33
Figure 2.5-1	Number of Factories in Industrial Zones in Hlaing River Basin	2-37
Figure 2.5-2	Number of Employees in Industrial Zones in Hlaing River Basin	2-37
Figure 2.5-3	Number of Factories in Industrial Zones in Doke Hta Waddy River Basin	2-38
Figure 2.5-4	Number of Employees in Industrial Zones in Doke Hta Waddy River Basin	2-38
Figure 2.5-5	Conceptual Databases for YCDC-PCCD	2-39
Figure 2.5-6	Working View of Pollution Source Survey (Sub-contract Work)	2-41
Figure 2.5-7	Measures to Minimize Water Pollution in Factories in the Hlaing River Basin	2-42
Figure 2.5-8	Measures to Minimize Water Pollution in Factories in Doke Hta Waddy River Basin	2-43
Figure 2.5-9	Status of Primary Treatment Installation in the Hlaing River Basin	2-43
Figure 2.5-10	Status of Primary Treatment Installation in the Doke Hta Waddy River Basin	2-44
Figure 2.5-11	Status of Secondary Treatment Installation in the Hlaing River Basin	2-44
Figure 2.5-12	Status of Secondary Treatment Installation in the Doke Hta Waddy River Basin ..	2-45
Figure 2.5-13	Difficulties of WWTP Installation in the Hlaing River Basin.....	2-45
Figure 2.5-14	Difficulties of WWTP Installation in the Doke Hta Waddy River Basin.....	2-46
Figure 2.5-15	Sectoral Wastewater Analysis Result (COD)	2-49
Figure 2.5-16	Sectoral Wastewater Analysis Result (TN and TP).....	2-49
Figure 2.5-17	Results Comparison (COD).....	2-50
Figure 2.5-18	Results Comparison Result (TN).....	2-50
Figure 2.5-19	Results Comparison (TP).....	2-51
Figure 2.5-20	Sample View of Pollution Source Database (Yangon).....	2-52
Figure 2.5-21	Location Map of 100 Target Factories of Questionnaire Survey in Mandalay	2-53
Figure 2.5-22	Sample View of Surface Water Quality Database (Mandalay)	2-54
Figure 2.5-23	Sample of Surface Water Quality Map (COD in Yangon)	2-54
Figure 2.5-24	Photos of 3rd and 4th GIS Training.....	2-55
Figure 2.5-25	Sample View of Operation and Maintenance Manual (Ver. 3)	2-56
Figure 2.6-1	Pollution Pathway to the Rivers with Location of Industrial Zones and Planned Intake Points for Water Supply in the Pilot Area of Yangon	2-60
Figure 2.6-2	Estimated Pollution Load in the Pilot Area of Yangon (Upper Left: Pollution Load Generated at Source and Reaching Rivers by Sector, Lower Left: Industrial Pollution Load by Industries)	2-61
Figure 2.6-3	Pollution Pathways to Rivers with Locations of Industrial Zones and Existing and Planned Intake Points for Water Supply in the Pilot Area of Mandalay.....	2-66
Figure 2.6-4	Estimated Pollution Load in Doke Hta Waddy River Basin (Upper Right: Pollution Load at Source and Reaching to the Rivers by Sector, Lower Right: Industrial Pollution Load by Industries)	2-67

Figure 2.6-5	Estimated Pollution Load in Taung Tha Man Lake Basin (BOD, T-N, and T-P Pollution Load at Source and Reaching to the Lakes by Sector).....	2-68
Figure 2.6-6	Results of Preliminary Dilution Capacity in the Doke Hta Waddy River	2-69
Figure 2.6-7	Outline of the Porposed Project on Strengthening Enforcement and Promotion of Environmental Compliance	2-77
Figure 2.7-1	Photos of the Study Program in Japan No.1	2-80
Figure 2.7-2	Photos of the Study Program in Japan No.2	2-82
Figure 2.7-3	Photos of the Study Program in Japan No.3	2-84
Figure 2.7-4	Poster for World Environment Day on 5th June 2016.....	2-85
Figure 2.7-5	Visit by the President and the Minister.....	2-85
Figure 2.7-6	Website of the Project.....	2-86
Figure 2.7-7	Project Newsletters	2-87
Figure 2.7-8	International Assistance related to Environmental Conservation (As of end of September 2017).....	2-88
Figure 4.1-1	Photos of the Mid-Term Review	4-1
Figure 4.2-1	Photos of the Terminal Evaluation	4-2
Figure 5.3-1	Strategies for Water Environment Management	5-3

List of Abbreviations

ADB	Asian Development Bank
ASEAN	Association of South East Asian Nations
BOD	Biochemical Oxygen Demand
BOO	Build-Operate-Own
BOT	Build-Operate-Transfer
C/P	Counterpart
CD	Cleansing Department
COD	Chemical Oxygen Demand
DICA	Directorate of Investment and Company Administration
DISI	Directorate of Industrial Supervision and Inspection
DO	Dissolved Oxygen
DOA	Department of Agriculture
EC	Electrical Conductivity
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
ECD HQ	Environmental Conservation Department, Head Quarter
EHS	Environmental Health and Safety
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
FY	Fiscal Year
GAD	General Administration Department
GIS	Geographic Information System
GPS	Global Positioning System
HHWL	Highest High Water Level
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ISO	International Standards Organization
IZ	Industrial Zone
IZMC	Industrial Zone Management Committee
JCC	Joint Coordinating Committee
JET	JICA Expert Team
JICA	Japan International Cooperation Agency
MCDC	Mandalay City Development Committee
M/M	Minutes of Meeting
MOALI	Ministry of Agriculture, Livestock and Irrigation
MOE	Ministry of Education
MOE	Ministry of Environment in Japan
MOECAF	Ministry of Environmental Conservation and Forestry
MOEE	Ministry of Electricity and Energy
MOHS	Ministry of Health and Sports
MOI	Ministry of Industry
MONREC	Ministry of Natural Resources and Environmental Conservation
MOPF	Ministry of Planning and Finance
MOTC	Ministry of Transport and Communications
MPA	Myanmar Port Authority
MS	Microsoft
MWL	Mean Water Level
NECCCC	National Environmental Conservation and Climate Change Central Committee
NEQEG	National Environmental Quality (Emission) Guideline

NGO	Non-Governmental Organization
ODA	Official Development Assistance
OECD-DAC	Development Assistance Committee of Organization for Economic Co-operation and Development
ORP	Oxidation-Reduction Potential
OVI	Objectively Verifiable Indicators
Pb	Lead
PCB	Polychlorinated Biphenyls
PCCD	Pollution Control and Cleansing Department
PCD	Pollution Control Department
PCM	Project Coordination Meeting
PDM	Project Design Matrix
pH	Potential of Hydrogen
PO	Plan of Operations
Ppm	Parts per million
PPP	Public Private Partnership
QA/QC	Quality Assurance/Quality Control
Q-GIS	Quantum Geographic System
R/D	Record of Discussions
SEZ	Special Economic Zone
SS	Suspended Solid
TDS	Total Dissolved Solid
TN	Total Nitrogen
TOR	Terms of Reference
TP	Total Phosphorus
TSS	Total Suspended Solid
UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
UNIDO	United Nations Industrial Development Organization
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
WP	Work Plan
WQSR	Water Quality Status Report
WSD	Water and Sanitation Department
WWF	World Wide Fund for Nature
WWTP	Wastewater Treatment Plant
YCDC	Yangon City Development Committee
YRG	Yangon Regional Government

CHAPTER 1 INTRODUCTION

1.1 Background

Myanmar has been facing considerable challenges in management of the environment due to increasing domestic and international investments in the industrial and urban/rural development sectors. In order to control environmental issues, the Government of Myanmar enacted the Environmental Conservation Law in 2012, established the Ministry of Environmental Conservation and Forestry (MOECAF)¹ in the same year, and issued Environmental Conservation Rule in 2014. However, in order to enforce environmental management based on the Environmental Conservation Law (2012) and Environmental Conservation Rule (2014), the capacities of the Environmental Conservation Department (ECD) of MOECAF have to be developed.

At the local level, the Yangon City Development Committee (YCDC) and Mandalay City Development Committee (MCDC) have been inspecting factories and providing technical advices on pollution control within the frameworks of business licensing. Through these experiences, these organizations have gained basic capacities for environmental management. Nevertheless, they were not sufficient to control growing environmental problems. With the establishment of ECD and introduction of the Environmental Impact Assessment (EIA), it was hoped that the capacities of these organizations would be developed further in coordinated manner to meet the demands for better environmental management.

Thus, the Government of Myanmar requested the Japan International Cooperation Agency (JICA) to support enhancement of capacities of ECD and other organizations concerned. In response, JICA sent a mission to Myanmar to discuss project formulation, and on 23 December 2014, the Record of Discussions (R/D) was signed by MOECAF and JICA to implement this project.

1.2 Overall Framework of the Project

1.2.1 Overall Goal, Project Purpose and Outputs

The framework of the project is summarized in Table 1.2-1 in accordance with the R/D. The project had two components: water environment management component and EIA component. The water environment management component covered four outputs, namely Output 1 (inspection), Output 2 (water quality survey), Output 3 (database) and Output 4 (information interpretation). As for the EIA component, which covered Outputs 5 and 6, it was implemented separately from the water environment management component, and is not discussed in this report.

Table 1.2-1 Overall Goal, Project Purpose and Outputs of the Project

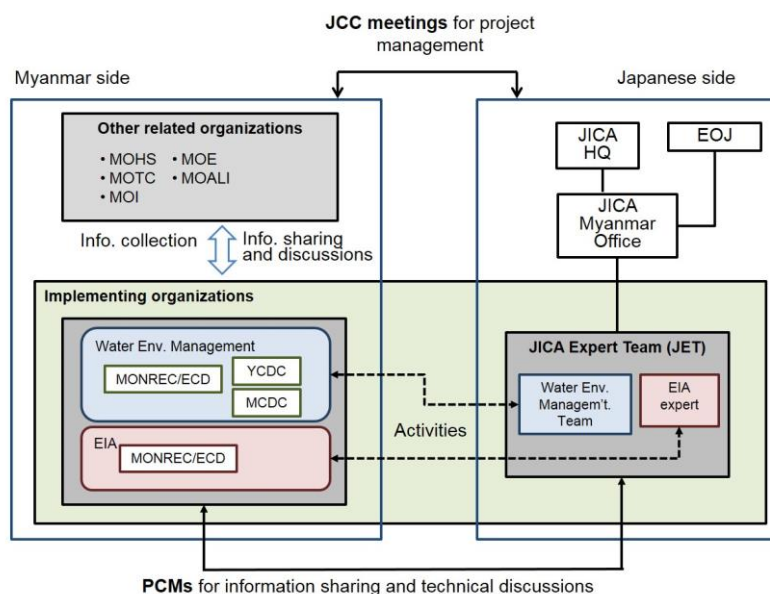
Item	Contents		Component
Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.		
Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.		
Outputs	Output 1	Inspection procedure is standardized.	Water environment management
	Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.	Water environment management
	Output 3	Database of water pollution sources and river water quality is developed.	Water environment management
	Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.	Water environment management
	Output 5	Necessary technical manuals and forms for the EIA review are developed.	EIA
	Output 6	Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.	EIA

Source: JET

¹ MOECAF was restructured as the Ministry of Natural Resources and Environmental Conservation (MONREC) in 2016.

1.2.2 Organizational Structure

Figure 1.2-1 below summarizes the organizational structure of the project. The ECD of the Ministry of Natural Resources and Environmental Conservation (MONREC), which superseded MOECAP in 2016, YCDC and MCDC were the main counterpart (C/P) organizations, and all activities were implemented jointly by the members of the C/P organizations and the JICA Expert Team (JET) in accordance with the R/D. In addition, the Ministry of Health and Sports (MOHS), the Ministry of Transport and Communications (MOTC), the Ministry of Industry (MOI), the Ministry of Education (MOE), and the Ministry of Agriculture, Livestock and Irrigation (MOALI) participated in the project as member organizations.



Organizational structure

Source: JET

Figure 1.2-1 Organizational Structure of the Project

In order to formulate the work plan and to review and the control overall progress of the project, Joint Coordinating Committee (JCC) meetings were held in total of five times during the course of the project. The members of the JCC were officially nominated by member organizations, appointed at the JCC meeting No.1 on 8 July 2015, and replaced as needed. The list of the latest JCC members as of May 2018 is given in Table 1.2-2.

Table 1.2-2 Members of Joint Coordinating Committee as of May 2018

No.	Name	Title	Organization
Members from the Myanmar Side			
1	Mr. Hla Maung Thein	Director General (DG)	ECD, MONREC
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MONREC
3	Mr. Htun Naing Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport and Communications
4	Dr. San Oo	Director	ECD, MONREC
5	Dr. Kyi Lwin Oo	Director	Occupational and Environmental Health Sub-Department, Department of Public Health, Ministry of Health and Sports
6	Dr. Thar Htet Kyaw	Deputy Director (DD)	Research and Innovation Department, Ministry of Education
7	Ms. Mya Mya Thet	Assistant Director (DD)	Department of Industrial Inspection and Supervision, Ministry of Industry

No.	Name	Title	Organization
8	Mr. Bawi Chung	Assistant Department Head	Pollution Control and Cleansing Department, Yangon City Development Committee
9	Mr. Khin Mg Thinn	Assistant Director (Engineering)	Water and Sanitation Department, Mandalay City Development Committee
10	Mr. Tun Tun Aung	Assistant Director	MOALI
11	Mr. Min Maw	Director	ECD, MONREC
12	Dr. Tin Aung Win	Assistant Director	ECD, MONREC
Members from the Japanese Side			
13	Mr. Masayuki Karasawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team
20	Mr. Toshiyuki Nishio	Industrial Effluent Treatment	JICA Expert Team

Source: JET

For details of JCCs, please see Section 2.2.1, and for the minutes of JCC meetings, please see Attachment 5. In addition to JCCs, Project Coordination Meetings (PCM) were held five times during the course of the project to share achievements and to discuss technical issues. Please see Section 2.2.2 for details of the PCMs

1.3 Amendments of PDM and PO

The project framework, including the overall goal, project purpose, outputs, indicators (objectively verifiable indicators (OVI)) for achievements, important assumptions for project implementation, inputs to the project, and the schedule of project implementation, were set out in the Project Design Matrix (PDM) and the Plan of Operation (PO), attached to the R/D. As explained below, the PDM and the PO were revised twice during the course of the project without changing the overall framework of the project. See Attachment-1 for PDM and PO.

(1) Addition of Project Activities at JCC Meeting No.2

The project activities in Myanmar started in June 2015. In December 2015, after seven months into the project, the activities summarized in Table 1.3-1 were added to the project to make the project activities more effective. The changes were endorsed with the minutes of JCC meeting No.2.

Table 1.3-1 Changes of PDM Related to Water Environment Management Component Adopted at JCC Meeting No.2 in December 2015

Output	Activities Added	Reason of Revision
Output 1 (Inspection)	Activity 1-5 To provide training on measures to control industrial effluent	To learn technologies and issues of controlling industrial effluent
Output 2 (Water Quality Survey)	2-8 To verify the results of the water quality survey using the water quality survey manual	To learn how to check the accuracy of the analytical data
Output 3 (Database)	3-4 To collect additional information required to develop the database	To implement a pollution control survey and collect additional information about pollution sources.

Source: JET

(2) Revision of PDM Based on Recommendations of Joint Mid-Term Review Team

During the Mid-term Review in October – November 2016, the Joint Mid-term Review Team reviewed the progress of the project, and suggested a number of changes to the PDM. These changes were officially agreed at the JCC meeting No.3 on 9 November 2016. The key changes related to water environment management component are summarized in Table 1.3-2. This was the last time the PDM was revised during the project period.

**Table 1.3-2 Changes of PDM Related to Water Environment Management Component
Adopted at JCC Meeting No.3 in November 2016**

Item	Before Revision PDM (18 Dec. 2015)	After Revision PDM (9 Nov. 2016)	Reason of Revision
Overall Goal (OVI 2)	Guidelines for wastewater management in industrial zones are developed by YCDC and MCDC in coordination with MOECAAF.	Written strategies for wastewater management in industrial zones are developed by YCDC and MCDC in coordination with MONREC.	Changes to the level achievable in three years
Output 1 (OVI 1)	More than 80% of the inspection is implemented according to the inspection manual by the end of the project.	Inspections are implemented according to the inspection manual by YCDC, MCDC and ECD.	Difficult to quantify no of inspections thus focused more on using inspection.
Output 3 (OVI 2)	Inspection reports of YCDC and MCDC prepared during the project period are stored in the database.	Results of river water quality survey are accessible in the database.	Adjusted to the outcomes of Output 3.
Output 1 Activity 4	To implement inspection based on the developed inspection manual.	To implement trial inspection based on the inspection manual	Inserted trial as inspection is yet to be defined.
Output 1 Activity 6	To revise the inspection manual	To evaluate the trial inspection procedures	

Source: Joint Mid-term Review Team

CHAPTER 2 PROJECT ACTIVITIES

2.1 Introduction

The major activities implemented during the project are summarized in Table 2.1-1.

Table 2.1-1 Major Project Activities

Year	Date	Activity
2015	11 Jun.	Kickoff meeting
	12-30 Jun.	Meetings with ECD, YCDC and MCDC to draft the Work Plan
	1-6 Jul.	Visiting laboratories
	8 Jul.	JCC Meeting No.1
	Jul – Sep.	Capacity assessment
	Sep.	Distribution of finalized Work Plan
	Oct. – Nov.	Collection and digitization of factory data and river water quality data
	17,18 Nov.	Meetings with MOHS, MOTC, MOI, MOALI
	Nov.	Evaluation of present inspection procedure
	25 Nov. - 1 Dec.	Meeting with Industrial Zone Management Committee in Mandalay and Yangon
	4, 10 Dec.	GIS Workshop in Yangon and Mandalay
	Dec.	Development of Progress Report No.1
	17 Dec.	PCM Meeting No.1
	18 Dec.	Signing of the MM of JCC No.2 on revision of PDM and PO
2016	17 - 24 Feb.	Water quality survey No.1 in Mandalay and Yangon
	2-9 Mar.	Survey of impact of tide in Yangon
	May	Development of Progress Report No.2
	22 May - 28 May	Study program in Japan No.1
	1, 2 Jun.	Workshop on Water Quality Status Report No.1 in Yangon and Mandalay
	6 Jun.	PCM No.2
	20 - 28 Jun.	Second water quality survey in Yangon and Mandalay
	Aug.	Development of Inspection Manual
	Aug. – Nov.	Pollution source survey in Yangon and Mandalay (Questionnaire survey and wastewater sampling)
	27 Sep. -18 Oct.	Study program in Japan No.2
	24 Oct. - 9 Nov.	Mid-term Review
	9 Nov.	Meeting of Joint Coordinating Committee No.3 and Mid-term Review
	Nov.	Development of Progress Report No.3
	8 Dec.	Project Coordination Meeting No.3
2017	Jan.	Industrial Wastewater Treatment Workshops in Yangon and Mandalay
	23 Jan. - 1 Feb.	Third water quality survey in Yangon and Mandalay
	Mar.	Development of technical materials; (i) Criteria for Selecting Sampling Points, Sampling Time and Measurement Parameters, (ii) Water Quality Survey Plan, (iii) Water Quality Survey Manual, (iv) Water Quality Survey Report for Period 1, and (v) Database Manual
	21 Jun.	PCM No.4
	28 Aug. - 14 Sep.	Study program in Japan No.3
	Aug. - Nov.	Pollution source survey in Yangon and Mandalay (Additional wastewater sampling and questionnaire survey)
	18 Sep. -3 Oct.	Fourth water quality survey in Yangon and Mandalay
	30 Oct.	Industrial Wastewater Treatment Workshop in Yangon (C/Ps in Nay Pwi Taw and Mandalay were also joined.)
	Nov. – Feb. 2018	Joint training for water quality survey report writing and database development in Yangon and Mandalay
	24 Nov.	Inspection training in Yangon (for YCDC)
	Nov. - Dec.	Development of Progress Report No.4
2018	8 Dec.	PCM No.5
	2 - 23 Feb.	Terminal Evaluation
	22 Feb.	JCC Meeting No.4
	19 - 27 Feb.	Fifth water quality survey in Yangon and Mandalay
	9 May	Final Seminar in Mandalay
	15 May	Final Seminar in Yangon
17 May	JCC No.5 and Final Seminar in Nay Pwi Taw	

Source: JET

2.2 Activities Common to All Outputs

2.2.1 Joint Coordinating Committee Meetings

The Joint Coordinating Committee (JCC) meetings were held in total of five times to formulate the work plan and to review and control overall progress of the project. Summaries of JCC meetings are given in Table 2.2-1. For the Minutes of Meetings (M/Ms) of these meetings, please see Attachment .

Table 2.2-1 Summaries of Joint Coordinating Committee Meetings

No.	Date	Summary
No.1	8 Jul 2015	This was the first JCC meeting organized after the project activities were started in Myanmar in May 2015. The main agenda of this meeting are (i) to introduce the project to all JCC members, (ii) to present related activities of relevant organizations, and (iii) to confirm proposed work plans of both water environment management and EIA components.
No.2	18 Dec 2015	Considering the changes in the circumstances since the project had been formulated in 2014, the JCC members agreed to add the following activities to the PDM and the PO to make the project even more effective and practical: (i) training on industrial wastewater treatment (Activity 1-5 on Inspection), (ii) verification of results of water quality survey using the Water Quality Survey Manual (Activity 2-8 on Water Quality Survey), (iii) additional collection of data on pollution sources (Output 3-4 on Database). Also, there were some changes to the EIA component (Output 5 and Output 6). Due to the difficulty in organizing a JCC, the JCC members were consulted in writing, and the minutes of the meeting was signed on 18 December 2015.
No.3	9 Nov 2016	This JCC was held as part of the Mid-term Review. The following presentations by ECD (PCD), YCDC, MCDC, ECD (EIA) and JET (EIA) on progresses, findings and challenges of project implementation, the Joint Mid-term Review Team presented the results of the Mid-term Review. Then, participants discussed and agreed on the changes to the PDM suggested by the Joint Mid-term Review Team.
No.4	22 Feb 2018	This JCC was held as part of the Terminal Evaluation of the project. The following presentations by ECD on the water environment management component and the EIA component, the Terminal Evaluation Team explained the results of the evaluation, and the participants discussed the results and the ways forward.
No.5	17 May 2018	This JCC was held to close the project.

Source: JET

2.2.2 Project Coordination Meetings

In addition to JCCs, Project Coordination Meetings (PCMs) were held in total of five times to share the achievements of the project and to discuss technical issues. The summaries of these meetings are given in Table 2.2-2.

Table 2.2-2 Summaries of Project Coordination Meeting

No.	Date	Remarks
No.1	17 Dec 2015	The first Project Coordination Meeting (PCM) was held in December 2015 in Nay Pyi Taw to discuss technical aspects of (i) database development, (ii) development of inspection manual, (iii) drafting of Water Quality Status Report No.1, and (iv) the proposed revision of the PDM and the PO. The draft version of the Progress Report No.1 was distributed in the PCM meeting, which was finalized in April 2016.
No.2	6 Jun 2016	The second Project Coordination Meeting (PCM) was held on 6 June 2016 in Nay Pyi Taw to discuss the progresses of project activities until May 2016 and proposed activities until November 2016. The draft version of Progress Report No.2 was distributed for review.
No.3	8 Dec 2016	The third PCM was organized in December 2016 for the following objectives: (i) to introduce results of water quality survey (Output 2), (ii) to introduce results of pollution source survey (Output 3), (iii) to make comments on inspection manual from Myanmar Side and how to collaborate each organization to implement inspection (Output 1), and (iv) to make comments on Water Quality Status Report and clarify the objective of Water Quality Status Report (Output 4).
No.4	21 Jun 2017	The forth PCM was organized (i) to summarize achievements made in Period 1 (June 2015 – April 2017), and (ii) to explain the Work Plan for Period 2 (June 2017 to June 2018). The members discussed the results of the evaluation with the evaluation team members.
No.5	8 Dec 2018	This PCM was organized (i) to report progress of each output in this period (June to November 2017), (ii) to report training in Japan in August to September 2017, and (iii) to explain the Work Plan for reaming period (Dec 2017 to May 2018).

Source: JET

2.2.3 Capacity Assessment

At the beginning of the project, in August – September 2015, a capacity assessment questionnaire survey was carried out to assess capacities of the main counterpart (C/P) organizations at the levels of individual and organization. First the organizational structure of each C/P organizations was surveyed, and then officers were asked to evaluate, on a scale of 1 to 5, their own capacities related to inspection and licensing activities, such as their capacities to explain regulations and legal responsibilities of factories, typical environmental issues of selected sectors (e.g., food, distillery, paper and textile), basic knowledge about wastewater treatment, sampling of industrial wastewater, etc.

It is important to point out that circumstances surrounding water environment management in Myanmar have changed significantly during the course of the project. Among the most important changes are the expansion of Environmental Conservation Department’s (ECD’s) responsibilities in environmental management with the Environmental Impact Assessment (EIA) as a main tool, and the emergence of the Region Government as the center of regional governance. These changes, which are still in the process of transformation, shifted the main responsibilities for industrial pollution control from the Yangon City Development Committee (YCDC)/ Mandalay City Development Committee (MCDC) to ECD under the coordination by the Region Government, although as of early 2018, ECD’s capacity is still limited, and at the local level, industrial pollution control is controlled jointly by ECD, YCDC/MCDC, the Directorate of Industrial Supervision and Inspection (DISI), General Administration Department (GAD) and other relevant organizations under the overall direction of the Region Government.

2.3 Output 1 – Inspection

Table 2.3-1 summarizes the output, activities and indicator of Output 1 according to the final PDM. Output 1 was implemented to standardize the procedure of inspection of factories related to industrial wastewater. In the JCC No.2 in December 2015, “Activity 1-5: To provide training on measures to control industrial effluent” was added to Output 1. Also, the activities and indicator of Output 1 have been revised during the Mid-term Review in October – November 2016.

Table 2.3-1 Activities and Indicator of Output 1 (Inspection)

Output 1	Inspection procedure is standardized.
Activities	1-1 To collect information on water pollution sources 1-2 To evaluate present inspection procedures 1-3 To develop an inspection manual 1-4 To implement trial inspection based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures
Indicator	Inspections are implemented according to the inspection manual by YCDC, MCDC and ECD.

Source: JET based on amended PDM

2.3.1 To Collect Information on Water Pollution Sources (Activity 1-1)

In 2015 and 2016, readily available information on pollution sources in the Hlaing River basin and the Doka Hta Waddy River basin were collected from relevant organizations. In Myanmar, basic information on factories, such as names of enterprises, sectors, products, number of employees, etc., are generally available because such data are regularly collected by development committees (YCDC and MCDC) and DISI of the Ministry of Industry (MOI) for issuing business licenses and for registering enterprises.

For example, DISI has a registration of private industrial enterprises based on the Private Industrial Enterprise Law (1990), and according to DISI’s inventory for FY2015-2016, there were 6,177 and 7,545 registered industrial enterprises in Yangon Region and Mandalay Region, respectively, and for

these enterprises, names, sector, products, turnover, etc., were available. However, environmental information on these factories were limited.

In 2012-14 Pollution Control and Cleansing Department (PCCD)-YCDC implemented a questionnaire survey to factories within its jurisdiction using an inspection form, and gathered key information, such as name of enterprise, address, raw material, water consumption, and effluent quality for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Suspended Solid (SS), pH and temperature. This data set is useful for analyzing environmental management of different factories, however, this has not been digitized, and is a self-declared data. Reliability of some of these data is a concern.

In order to develop a pollution source database, the project implemented the pollution source surveys in September – November 2016 (first survey) and August – November 2017 (second survey) as part of Output 3 activities. The first survey consisted of (i) a questionnaire survey for a total of 200 factories and (ii) sampling and analysis of wastewaters at 50 factories, both in the pilot study areas in Yangon and Mandalay. Because some of the results from the first survey were not reliable, the second survey was conducted in 2017 in which, wastewater samples were collected from 50 factories and analyzed. For details, please see the section on Output 3 below.

2.3.2 Evaluate Present Inspection Procedures (Activity 1-2)

(1) Legal Mechanisms for Pollution Control

Table 2.3-2 below summarizes laws and regulations related to pollution control in manufacturing industries in Myanmar.

Table 2.3-2 Laws and Regulations Related to Pollution Control in Manufacturing Industries

Level	Law and Regulation	Relevance
National	Law on Environmental Conservation Law (Law No. 9/2012)	<ul style="list-style-type: none"> Chapter VII (Environmental Conservation) stipulates that businesses, which cause pollution, are required to install on-site facility and monitor, control, manage, reduce, or eliminate environmental pollution. Chapter VII also stipulates that a person or organization operating business in the industrial estate to contribute the stipulated cash or in kind for environmental conservation. Other articles pertinent to industrial pollution control include discharge/emission standards in Chapter VI, prior permission for industrial operation in Chapter X, and environmental emergency in Chapter V.
	Environmental Conservation Rules (2014)	<ul style="list-style-type: none"> In relation to the Environmental Conservation Law (2012), the roles and responsibilities of the Environmental Conservation Committee, MONREC, and other governmental organizations are described in the Environmental Conservation Rules (2014).
	National Environmental Quality (Emission) Guidelines (2015)	<ul style="list-style-type: none"> Annex 1 sets out the general and sector-specific effluent guideline values based primarily on International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines. The guidelines are expected to apply to new projects subject to EIA Procedure. As for the existing projects, less stringent levels or measures may be adopted at the discretion of MOECAAF. A new national effluent standard is already in discussion and the guidelines are expected to be succeeded by the standard in the near future.
	Environmental Impact Assessment Procedure (2015)	<ul style="list-style-type: none"> MOECAAF has the right to conduct monitoring and inspection regarding the requirements of Environmental Management Plan (EMP) or other requirements in the Environmental Compliance Certificate (ECC).
	Private Industrial Enterprise Law (Law No. 22/1990)	<ul style="list-style-type: none"> Chapter V describes the duties of powers of supervisory bodies in the states and divisions in recommending a grant of registration of a private industry considering “no cause of being injurious to the health of the public residing in the vicinity” and “no cause of being a nuisance to the environment and not cause of there being any pollution”.
	Standing Order No. 3 of the Ministry of Industry (1), Water and Air Pollution Control Plan	<ul style="list-style-type: none"> This standing order requires factories to adopt uniform preparatory measures beforehand for the prevention of pollution and destruction of the environment. Chapter III of the standing order is devoted to water pollution control, requiring factories to report monitoring result of wastewater, to set a

	(1995)	<p>timeframe for treatment of wastewater, and to complete the installation of the facility.</p> <ul style="list-style-type: none"> Annexure (C) provides a sample specification of allowable waste effluent standard.
Development Committees	Law of Yangon City Development Committee (2013)	<ul style="list-style-type: none"> Article 62 of the Law of Yangon City Development Committee (2013) stipulates that no one is allowed to discharge wastewater from any factory, industry, and enterprise into the drainages and rivers without treating it in accordance with the standard set by the committee.
	By-law of Yangon City Development Committee (2015), activities of PCCD	<ul style="list-style-type: none"> This has not been officially approved and is being used as an internal document.
	Law of Mandalay City Development Committee (2014)	<ul style="list-style-type: none"> Chapter 24 of the Law of Mandalay City Development Committee (2014) stipulates that no one must dispose or discharge wastewater from factory/workshop and business to drains, rivers and agricultural land, without treating it in accordance with the specification set by the committee.
	By-law of Mandalay City Development Committee, activities of CD (2009)	<ul style="list-style-type: none"> Chapter 2 of Environmental Conservation and Cleansing By-law of MCDC (2009) states that MCDC shall take action against anyone/ anything that cause environmental damage/ degradation/ and destruction.

Source: JET

Pollution control in Myanmar has long been implemented within the framework of business licensing and business registration by line ministries and city development committees. Even today, these are the main mechanism of controlling pollution, and environmental inspection is implemented in line with business licensing and registration. However, this is changing rapidly with the introduction of Environmental Conservation Law (2012) and EIA Procedures (2015), under which pollution is to be controlled based on the Environmental Management Plan (EMP) submitted by each factory and Environmental Compliance Certificate (ECC) issued by ECD. Because both business licensing/registration and the newly introduced ECC are important in controlling industrial pollution, both of them are discussed in this section in relation to inspection procedures.

(2) Business Licensing/Registration and Inspection

1) Business Licensing/Registration

In order to operate a business in Myanmar, one has to obtain a business license from the ministry in charge of the economic sector of the business. For most manufacturing industries, such as paper, tanning, chemicals, etc., the Ministry of Industry is responsible, and registration with DISI is necessary in accordance with the Private Industrial Enterprise Law (1990). In the case of alcohol production, such as distillery and brewery, a license from GAD under the Ministry of Home Affairs is also required. Also, if the business is going to operate in the administrative area of YCDC or MCDC, one has to obtain an operating license from YCDC or MCDC in addition to the license/registration from the line ministry(ies). Table 2.3-3 summarizes the numbers of licenses, environmental requirements, and relevant organizations of YCDC, MCDC and DISI licensing/registration.

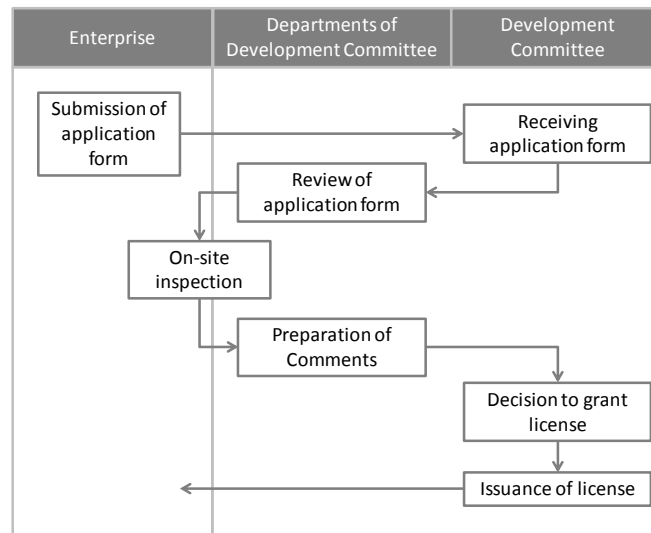
Table 2.3-3 Licensing/Registration Systems and Inspection

System	Relevant Law	Environmental Requirements	Number of Licenses issued in 2014	Organization Involved in Review Process	Organization Responsible for Licensing
YCDC Business License (Annual)	Yangon City Development Committee Law (2013)	<ul style="list-style-type: none"> Article 62 of the Law requires factories to treat wastewater in accordance with the standard set by the committee. There are no officially approved detailed requirements (e.g., by-law) and external guidelines, such as MONREC's new effluent guideline, WHO's drinking water guideline, etc., are referred to. 	3,474 enterprises (This is limited to factories in industrial zones)	PCCD, WSD, other relevant departments of YCDC	YCDC

System	Relevant Law	Environmental Requirements	Number of Licenses issued in 2014	Organization Involved in Review Process	Organization Responsible for Licensing
MCDC Business License (Annual)	Mandalay City Development Committee Law	<ul style="list-style-type: none"> - Chapter 24 of the Law forbids factories to discharge wastewater without treatment according to specification set by the committee. - There is a by-law but detailed licensing conditions are not specified. 	16,997 enterprises (This seems to include small enterprises)	CD, WSD, other relevant departments of MCDC, ECD Mandalay	MCDC (CD)
DISI Business Registration (Annual)	Private Industrial Enterprises Law (1990) including Standing Order No.3 of Ministry of Industry (1), Water and Air Pollution Control Plan (1995)	<ul style="list-style-type: none"> - Standing order requires factories to adopt uniform preparatory measures beforehand for the prevention of pollution and destruction of the environment. - Chapter III of the standing order is devoted to water pollution control, requiring factories to report monitoring result of wastewater, to set time frame for treatment of wastewater, and to complete the installation of the facility. - Similarly, Chapter IV stipulates requirements for air pollution control. - Annexure (C) provides a sample specification of allowable waste effluent standard. 	6,177 enterprises in Yangon District and 7,545 enterprises in Mandalay District	MOI (DISI), regional ECD, MOHS, and other organizations	MOI (DISI)
ECD Environmental License (ECC) (5 years)	Environmental Conservation Law (2012) and EIA Procedure (2015)	<ul style="list-style-type: none"> - EIA Procedure (2015) requires all projects and expansion projects having the potential to cause adverse impacts to undertake IEE or EIA or to develop an EMP and to obtain an ECC in accordance with this Procedure. - According to Chapter II of the procedure, any existing projects are also required to undertake environmental compliance audit, develop IEE, EIA, or EMP, and obtain ECC. MOECAAF has the right to conduct monitoring and inspection regarding the requirements of Environmental Management Plan (EMP) or other requirements in Environmental Compliance Certificate (ECC). - Licensing conditions are to be stipulated in the ECC of each firm. 	Not issued yet	ECD	ECD

Source: JET

Figure 2.3-1 summarizes the processes of granting business license by YCDC or MCDC. The procedure starts with the submission of application document by the enterprise, and is followed by review of document by different departments of the development committee or other organizations, on-site inspection, preparation of comments, decision by committee, and issuing of the license.



Source: JET

Figure 2.3-1 Processes of Granting Operation License in Development Committee

The procedures are similar in DISI's business registration. In order to be registered by DISI, an applying enterprise needs a business license from YCDC/MCDC, occupational health certificate from the Health Department, letter of remarks from ECD on environmental concerns, letter from the Fire Department, and letters from other relevant organizations as needed. The registration has to be renewed annually.

These licenses and registration by authorities require factories to be environmentally-responsible as stipulated in related laws and regulations. However, controlling environmental issues is not the main purpose of these licenses/registration, and they do not impose detailed environmental requirements on factories, such as legally-binding effluent standard and/or technical standard for pollution control facilities. Thus, governmental intervention on pollution is usually triggered by complaints from local residents over pollution-related damages to property, livelihood or health, and not by incompliance with environmental requirement itself. The decision over the dispute is made in a way similar to resolving a dispute over a common tort problem. This is done by a concerted effort of different departments of local authorities, such as the Water and Sanitation Department and Cleansing Department of YCDC/MCDC, Public Health Department, and DISI. With the advent of the new regime and the trend of decentralization, the Regional Government now spearheads such coordination, especially for major cases. Then, following the decision, administrative actions, such as warning to the polluter, ordering of installation of a wastewater treatment facility, imposition of fines, and ultimately suspension or revocation of business license, are given on the bases of violation of the law requiring the business entity to be environmentally-responsible.

This is the main mechanism of resolving pollution problems, but it has a number of weaknesses. First, it is largely reactive and does not promote prevention of pollution. Second, it is highly case-dependent, and is not predictable, which is not ideal for investors and businesses who need to estimate risks in business decisions as well as for environmental authorities who are expected to give consistent guidance to regulated communities. Third, it requires significant inter-organizational coordination even for relatively minor cases.

2) Inspection for Business Licensing/Registration

In line with the mechanism of business licensing and registration, environmental inspection in Myanmar at the moment is implemented in the forms of: (i) compliance inspection related to licensing/registration, and (ii) inspection to resolve complaints.

(a) Compliance Inspection for Business Licensing and Registration

This type of inspection has been implemented, in principle, to confirm compliance of factories with respect to requirements of business licensing by YCDC or MCDC, or business registration by DISI.

With respect to YCDC's business license, the administration department of YCDC is in charge of issuing business license, but PCCD is the main organization that provides technical assessment and recommendations on pollution-related issues. PCCD has developed an inspection form, and has started using the form to gather relevant information from factories, including availability of wastewater treatment facilities and self-monitored concentrations of effluent (see section on Output 3). Based on the replies from the factories and results of on-site inspection, PCCD provides suggestions regarding pollution control.

The situation is similar in MCDC, where Cleansing Department (CD) is responsible for issuing the business license, and Water and Sanitation Department (WSD) is responsible for providing technical recommendations on wastewater issues.

With respect to DISI's business registration, Industrial Inspection Department of DISI has an environmental inspection form, in which factors to be inspected, i.e., waste, wastewater, emission, environmental health, health and site hazard, and fire, are specified. In order to support DISI, ECD Yangon carries out several on-site inspections per month, which are largely for writing remarks on environmental performance of the factory. ECD Mandalay also carries out frequent inspection, several times a week, in relation to the Ministry of Industry (MOI) registration.

As discussed above, various efforts have been made to build pollution control into the existing licensing/registration schemes and inspect environmental performance of each factory. Nevertheless, the situation is quite different from typical compliance inspection in other countries, as these laws merely require factories to be environmentally-responsible and do not impose detailed, legally-binding requirements. Thus, environmental inspection related to business licensing and registration of YCDC, MCDC and DISI are very general, and geared toward checking, after walk-through inspection, if there is a significant environmental issue that is considered gross negligence for being environmentally-responsible.

(b) Inspection to Resolve Environmental Complaints

As the laws related to business licensing/registration do not provide clear legal ground to control industrial pollution, governmental intervention are taken predominantly based on complaints, such as those from local residents. Inspection in response to complaints are carried out by YCDC, MCDC, ECD, DISI and other organizations, depending on to which organizations the complaint was submitted, and who is giving the order. Recently, Regional Governments are becoming the focal point of such decisions, but some instructions are coming from the central ministries, such as MONREC. This type of inspection, which is implemented roughly 10 to 20 times a year in both Yangon and Mandalay, is organized by a single organization or jointly by many organizations (e.g., together with the Health Department) depending on the nature of the complaint. The main goal of inspection is to resolve the problem, and environmental authority sometime actively suggests a measure to contain the problem. If it is necessary, suspension of business licensing and registration is considered. Due to the ad-hoc nature of this type of inspection, there is no standardized procedure.

(3) ECC-based Environmental Licensing and Inspection

1) Schemes of Environmental Licensing

With the introduction of the Environmental Conservation Law (2012) and EIA Procedures (2015), the situation is changing rapidly. Under the framework of EIA, a proponent of a new business is required to evaluate environmental impact of the business based on the framework of EIA/IEE, develop Environmental Management Plan (EMP), and obtain Environmental Compliance Certificate (ECC). Then, the business entity has to implement the environmental measures based on EMP and ECC, and to stay compliant with the requirements of ECC to continue its operating. Existing businesses should also develop EMP, obtain ECC, and stay compliant with the requirements of the ECC.

Most likely, this becomes the main mechanism of industrial pollution control in the near future, and it will make environmental management more prevention-oriented, predictable, and requiring less coordination. On 10 January 2018, MONREC issued an order to businesses in nine prioritized industrial sectors (distilleries/wine/beer, food and beverage processing, pesticide, cement and lime, textile and dyeing, foundry and smelting, tanning and leather finishing, pulp and paper, and sugar) to prepare their own EMP and obtain an ECC within 9 to 12 months.

Under this mechanism, conditions of EMP and ECC become the legally-binding requirements, and the target of compliance inspection. At the moment, ECC is expected to require factories to fulfill the following conditions:

- general conditions
- environmental performance conditions
- environmental management conditions
- monitoring, reporting, and compliance with ECC conditions
- project commitments, and
- dispute resolution conditions.

For example, compliance with the National Environmental Quality (Emission) Guideline (NEQEG, 2015) is likely to become one of the requirements of environmental performance conditions. However, details of these requirements are yet to be set. Setting and satisfying these requirements will be a major challenge for environmental authorities and regulated communities. For example, in order to meet the NEQEG (2015) requirements, most factories will have to newly install sophisticated wastewater treatment facilities, but most factories may not be able to afford or find land to install such facilities, and setting the effluent requirement is not easy. Similarly, ECD is yet to set other requirements. Thus, it is still premature to discuss details of these requirements.

In addition to ECC, Environmental Conservation Law (2012) has another mechanism to control factories, known as “Prior Permission”. However, this mechanism is yet to be introduced.

2) Compliance Inspection for Environmental Licensing

Under the scheme of ECC, the role of inspection is to check compliance with requirements of EMP and ECC, and suggest actions against those who are in violation of the requirements. However, as stated above, ECD is yet to clarify the requirements of ECC, and essentially none of these factories has obtained ECC.

It was noted that some factories already have EMPs, and ECD have started inspecting such factories based on EMPs. Nevertheless, such factories are rare and there is no inspection framework based in EMP, and EMP is technically not legally binding without ECC. As such, inspection based on EMP at the moment is largely general walk-through inspection, similar to the ones for business licensing and registration.

2.3.3 Develop an Inspection Manual (Activity 1-3)

As discussed above, business licensing and registration by YCDC, MCDC and DISI have been the main mechanisms for pollution control in Myanmar, but the situation is changing rapidly with the introduction of ECC based on EIA/IEE and EMP. Thus, the inspection manual in this project was developed in anticipation of a new environmental management system based on ECC. Table 2.3-4 summarizes the objectives, target and table of contents of the inspection manual.

Table 2.3-4 Objectives, Target and Table of Contents of Inspection Manual

Objectives	<ul style="list-style-type: none"> - To standardize inspection procedures so that officers in charge of inspection can minimize undetected serious pollution problems - To provide officers with general information on current laws and regulations pertinent to inspection activities - To provide officers with basic information on pollution control measures in typical industrial sectors in Myanmar - To provide sources of more detailed information on environmental management 	
Target	Junior officers with limited experiences	
Table of Contents	Introduction	Background and introduction to the inspection manual
	Legal systems	Brief summary of current legal systems for pollution control
	Inspection Procedures	Explanation about recommended procedures for pre-inspection preparation, on-site inspection, and post-inspection activities
	Appendix 1: Checklist	A checklist to be used by an officer to standardize inspection procedure

Source: JET

Under the new system, the main task of inspection officers is to inspect each factory's compliance with respect to specific requirements given in ECC. Therefore, although the requirements of ECC have not been clarified, inspection procedures for ECC are expected to be similar to those of compliance inspection in other countries; which usually consist of (i) pre-inspection preparation, (ii) on-site inspection and (iii) post-inspection activities. Hence, the general framework of the manual was developed in accordance with these steps based on manuals used in other countries for environmental compliance inspection, such as IMPEL (1999)¹, Ministry of Environment Japan (2006)², OECD (2004)³ and US EPA (2002)⁴. The manual was developed together with the Asian Development Bank (ADB).

The target of the manual are junior ECD officers who are going to start compliance inspection based on ECC, including those related to businesses in the nine industrial sectors that have to obtain ECCs within 2018. Examples of typical mistakes made by inexperienced officers include: (i) officer does not think about what to achieve in inspection (i.e., objectives) and does not make adequate preparation before inspection, (ii) officer does not know how to act professionally and makes the relations with the factory worse by abusing his/her authority, (iii) officer does not know the relevant laws, regulations, and official protocols; as a result, his/her inspection is later on considered not valid, (iv) officer infringes other laws and regulations or violates rights of factory people, (v) officer does not know what to inspect or how to inspect because he/she does not have enough knowledge and experiences, and (vi) officer does not properly report results and make a follow-up on the inspection. The manual was developed to minimize such mistakes. Most issues were addressed in the manual at least to some extent. However, (v) was difficult to cover because environmental requirements are yet to be defined in EMP and ECC. It is suggested to revise this part of the manual once ECD gain some basic experiences in implementing inspection based on ECC.

In implementing compliance inspection, officers have to be intimately familiar with the law and the regulations. Thus, the manual has a special chapter on legal systems, which includes sections on environmental requirements of the Constitution (2008), Environmental Conservation Law (2012),

¹ IMPEL, IMPEL Reference Book for Environmental Inspection, 1999.

² Ministry of Environment Japan, Guideline for Developing Inspection Manual based on Water Pollution Control Act, 2006.

³ OECD, Assuring Environmental Compliance, A toolkit for building better environmental inspectorates in Eastern Europe, Caucasus and Central Asia, 2004.

⁴ US EPA, Conducting Environmental Compliance Inspection, 2002.

Private Industrial Enterprise Law (1990), YCDC Law (2013) and MCDC Law (2014), and another section on legal responsibilities of factories and environmental authorities.

While the manual was developed mainly for ECC-based compliance inspection, the manual is considered useful for officers of YCDC, MCDC and/or DISI to implement similar inspection in line with business licensing and registration.

2.3.4 Implement Trial Inspection based on the Inspection Manual (Activity 1-4)

(1) Inspection by ECD

Table 2.3-5 summarizes the inspections carried out by ECD in FY 2016 (April 2016 – March 2017).

Table 2.3-5 Inspections by ECD in April 2016 – March 2017

State/ Region	Types of Inspection	Number of Inspections (Apr. 2016 – Mar. 2017)	Number of Inspections (Dec. 2016 – Mar. 2017)
Yangon	1) Regular Inspection of ECD (Yangon)	83	28
	2) Inspection by ECD (Yangon) according to Complaints	7	2
	3) Inspection by ECD (Yangon) according to instruction of Union Minister	2	2
	4) Inspection by ECD (Yangon) according to instruction of Region Government	3	2
	Sub-Total	95	34
Mandalay	1) Regular Inspection of ECD (Mandalay)	46	6
	2) Inspection by ECD (Mandalay) according to Complaints	16	4
	3) Inspection by ECD (Mandalay) according to instruction of Union Minister	18	13
	4) Inspection by ECD (Mandalay) according to instruction of Region Government	108	21
	Sub-Total	188	44
Total of Other Area (except Yangon & Mandalay)	1) Regular Inspection of ECD	593	-
	2) Inspection by ECD according to Complaints	39	-
	3) Inspection by ECD according to instruction of Union Minister	50	-
	4) Inspection by ECD according to instruction of Region Government	91	-
	Sub-Total	773	-
Total		1,056	-

Source: JET based on information provided by ECD

The draft Inspection Manual was officially circulated to C/P organizations in November 2016 half way through FY2016, and after the circulation of the draft manual, in total 34 and 44 inspections were implemented in Yangon and Mandalay, respectively. Overall, the manual received positive reviews among the C/P organizations as it outlines the general inspection procedures, and they adopted the manual one way or another. Nevertheless, this does not necessarily mean that the C/P organizations fully adopted the manual. Please see Section 2.3.6 for details

(2) Training for Use of Inspection Manual for YCDC-PCCD

In order to train officers regarding environmental inspection, the department head of PCCD-YCDC in early November 2017 requested JET to organize a training for use of inspection manual. After some discussions, PCCD and JET developed a training program consisting of i) explanation of inspection manual, ii) Case Study 1: introduction of administrative guidance/ order system in accordance with the Water Pollution Control Law in Japan, iii) Case Study 2: introduction of environmental management system by the Thilawa Special Economic Zone (SEZ) Management Committee, and iv) site visit to a Japanese food factory and a Japanese garment factory in Thilawa SEZ to learn good practices in environment management.

This training was held on 24 November 2017 in Yangon. More than 60 officers from PCCD headquarters and township supervisors of PCCD attended, and 50 offices joined the site visit. In the

site visit, the representatives of factories explained their wastewater treatment systems, sludge management, monitoring of treated wastewater in the monitoring pit, prevention of leakage of chemical and hazardous substances, emission control of a boiler, noise prevention device for generators, separation of hazardous waste, storage of waste, training of employees, and so on. Figure 2.3-2 shows the photos from the training.



Source: JET

Figure 2.3-2 Photos from the Training for Use of Inspection Manual for YCDC-PCCD

2.3.5 Provide Training on Measures to Control Industrial Effluent (Activity 1-5)

(1) Workshops on Wastewater Treatment Technologies

The pollution source survey implemented in 2016 (see section on Output 3) revealed that most factories do not have adequate wastewater treatment facilities. In the near future, these factories have to install proper wastewater treatment facilities according to ECC, while officers of environmental authorities have to inspect such facilities based on ECC. For these tasks, readily available technical information on wastewater treatment was too limited in Myanmar. Thus, a series of workshops on wastewater treatment were organized for officers as well as for the people of factories. The presentation files are available in Appendix 14.

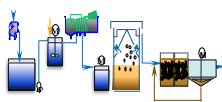
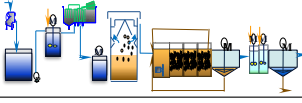
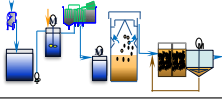
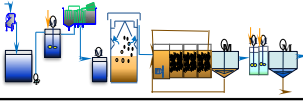
The first set of training was held on 30 November 2016 in Mandalay and 2 December 2016 in Yangon, in which JET gave lectures to officers of YCDC, MCDC, and regional ECDs. It focused on basic steps for designing, constructing and operating industrial waste water treatment plant (WWTP), including how different technologies are combined to treat wastewater, typical technologies and functions of primary, main and tertiary treatment stages, typical treatment in each sector, and development of a centralized wastewater treatment facility for an industrial zone (IZ).



Source: JET

Figure 2.3-3 Photos of Lecture by Expert on Industrial Wastewater Treatment

The second set of training was provided in January 2017 in Yangon, Mandalay and Nay Pyi Taw. This time, the focus was placed on more pragmatic aspects of wastewater treatment, such as how treatment in individual factory, joint treatment among neighboring factories, joint treatment among specific sector, or centralized wastewater treatment, may be approached, and how treatment cost could differ among different approaches. Figure 2.3-4 shows an example of comparison presented in the workshop based on the cost information in Vietnam.

CASE	WWTP for	Capacity of WWTP (m3/day)	Treatment Process	Unit Fee for 10 years (USD/m3ww)	Operation and Management of WWTP
1	Each factory	100	Optimum for specific industry 	0.50	By each factory
2	10 Neighbors	100 x 10 factories = 1,000	Common for various industries 	0.46	By Neighbor factories? By IZ committee?
3	10 factories of same industry	100 x 10 factories = 1,000	Optimum for specific industry 	0.36	By IZ committee?
4	All (50) factories in IZ (Central WWTP)	100 x 50 factories = 5,000	Common for various industries 	0.40	By IZ committee?

Source: JET

Figure 2.3-4 Examples of Comparison of Hypothetical Options for Wastewater Treatment

(2) Workshop on Centralized Wastewater Treatment

Many factories have to start exploring options to treat wastewater soon. This is particularly true for factories in nine prioritized sectors that have to obtain ECCs within 2018. For factories in an industrial zone, centralized wastewater treatment will be an attractive option because (i) the cost for each factory is expected to be lower than the one for an individual treatment because the scale of economy can be expected, (ii) each factory does not have to operate a full wastewater treatment facility, which requires significant technical and financial resources, and (iii) each factory could be spared from full-legal responsibility associated with final treatment/disposal of wastewater, although they still have to satisfy

other requirements of ECC and requirements set by the operator of the centralized wastewater treatment facility.

On the other hand, the development of a centralized wastewater treatment facility is a major endeavor. To support the identification of possible options and issues for development of a centralized wastewater treatment in an IZ in Myanmar, the project implemented a small case study in Hlaing Tar Yar IZ in the summer of 2017. In this case study, options to treat wastewaters from Zone 1 and Zones 1-4 of the IZ were examined, and responsibilities of the government and the specialized company during construction and operation were clarified. The results were presented at the workshop on wastewater treatment organized on 30 October 2017. The workshop also featured presentations on centralized wastewater treatment in Mandalay (under construction), Thilawa SEZ in Yangon and an IZ in Vietnam.



Source: JET

Figure 2.3-5 Photos from the Workshop on Wastewater Treatment

The workshop identified major issues in establishing a centralized wastewater treatment facility, such as:

- Organization of a company responsible for overall management of an IZ
- Scheme for construction and operation of a centralized wastewater treatment facility (public project, BOO, BOT, etc.)
- Financing of investment cost
- How to estimate quantity and quality of wastewater from each factory
- How to secure land to construct the treatment facility and auxiliary facilities
- How to recover cost from factories and guarantee for minimum flow rate

Many IZs in Myanmar are facing similar issues in other utilities/infrastructure, such as water supply, electricity and road. Moreover, many IZs do not have clear organizational structure for management. Thus, establishing the management structure may be the first step before establishing centralized wastewater treatment.

2.3.6 Evaluate the Inspection Procedures (Activity 1-6)

Overall, the inspection manual received positive reviews by C/P organizations, but it seems C/P organizations had some difficulties in fully adopting the manual. This is largely because the manual was developed as procedures for formal compliance inspection based on very clear, legally-binding requirements, but ECD is yet to introduce such requirements. Moreover, the manual implicitly assumes other legal mechanisms, such as formal administrative procedures as well as environmental,

administrative and injunction litigations, which are available in many countries for environmental regulation and dispute resolution. In Myanmar, these mechanisms are not fully in place, presumably because Myanmar has historical mechanisms of governmental regulation and dispute resolution at least for now. Nevertheless, environmental legislation as well as mechanisms of public administration and dispute resolution are changing rapidly, and with the introduction of ECC-based regulation, the manual will become more befitting to the situation of Myanmar in the near future. It was noted that ECD HQ has circulated the manual developed in the project to all ECD regional offices for their comments, and is translating the manual for formal adoption by regional offices. Thus, the effort in this project well-served its purpose.

2.3.7 Issues and Suggestions Identified through Output 1 Activities

This section summarizes the key issues identified in relation to Output 1 and the suggestions of JET on the issues.

(1) Clarification of Environmental Requirements

Issues: One of the main issues in inspection is the lack of specific environmental requirements for factories. Industrial pollution is addressed in Environmental Conservation Law (2012), YCDC Law (2013), MCDC Law (2014), Private Industrial Enterprises Law (1990), etc., but currently none of these laws have detailed, legally-binding requirements. This is making environmental administration arbitrary, and both the people of a factory and inspection officers cannot determine with confidence if the operation of a factory is considered in compliance with relevant laws or not. Thus, it is necessary to set clear and legally binding requirements for factories. It was noted that MONREC has already issued an order in January 2018 to factories in nine industrial sectors to develop EMPs and obtain ECCs within 9-12 months. If this order is enforced, each factory under this order will have legally-binding requirements based on its EMP and ECC. However, development of an EMP is largely left to the hand of each factory. Thus, most likely, ECD will receive EMPs of a wide range of qualities and contents even in a single industrial sector. Some of EMPs could be utterly unrealistic. Others may request special treatment for different reasons. Such situations would make enforcement very difficult.

Suggestions: ECD is suggested to implement a series of sectoral studies, and set requirements sector by sector, considering the best practices in each sector, and develop detailed regulations for each industrial sector. This would take a few years, but once implemented, it will make environmental control, including inspection activities, much easier.

(2) Clarification of Inspection Procedures for Each Environmental Requirement

Issues: Inspection officers should know how to inspect each environmental requirement, such as those to be set in EMPs and ECCs. However, because the legal requirements are yet to be clarified, it is not possible to clarify the details at the moment.

Suggestions: As far as the general inspection procedures are concerned, those described in the inspection manual are considered sufficient for now. In addition, international manuals described above, such as IMPEL (1999), Ministry of Environment Japan (2006), OECD (2004) and US EPA (2002) are useful references. For on-site wastewater sampling, Environment Canada (2005)¹ may be useful. Once detailed requirements are set (e.g., in line with EMPs and ECCs), the environmental authorities should carry out trial inspections to determine how to inspect and make decisions under different situations. After sufficient experiences in inspection are accumulated, revised the section of the inspection manual as needed. There could be numerous technical/procedural issues to be resolved. For example, NEQEG (2015) stipulates that “specified guideline values should be achieved, without dilution, at least 95 percent of the time that a project is operating, to be calculated as a proportion of

¹ Environment Canada, 2005, The inspector’s field sampling manual (2nd issue).

annual operating hours.”. Thus, in principle, inspection officers should know, what to do if wastewater from the production line is mixed with domestic wastewater, how to evaluate concentration in 95 percent of the time based on one or two measurements, how to calculate operating hours, etc.

(3) Support to Factories on Pollution Control

Issues: During the project, efforts were made to educate people of factories about how to control pollution, such as different technologies to treat wastewater, pros and cons of individual and joint/centralized treatment, among others. However, knowledge of factory owners and managers is still too limited to make business decisions about pollution control, and more support to factories is desired.

Suggestions: Environmental authorities are encouraged to organize workshops and consultation events to educate regulated communities. They should cover both procedural issues as well as technical issues. Workshops targeting a specific industrial sector are suggested because they usually share similar difficulties and similar solutions. Also, workshops targeting a specific area (e.g., industrial zone) are desirable in order to promote a joint/centralized wastewater treatment. For technical workshops, perhaps academics and practitioners in the fields of pollution control and pollution prevention should be called in.

2.4 Output 2 – Water Quality Survey

This output focused on capacity development through implementation of water quality surveys in Hlaing River basin in Yangon and Doke Hta Waddy River basin in Mandalay. Table 2.4-1 summarizes the activities and the indicator of Output 2.

Table 2.4-1 Activities and Indicators of Output 2 (Water Quality Survey)

Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.
Activities	2-1 To select a private or governmental laboratory which can provide reliable services of sampling and chemical analysis 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters, etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report
Indicator	Water quality survey reports are prepared in the pilot area by YCDC and MCDC.

Source: JET based on amended PDM

The water quality surveys were carried out for a total five times in the dry season and rainy season from 2016 to 2018. The following descriptions summarize the results of the activities of Output 2.

2.4.1 Select a Private or Governmental Laboratory which can Provide Reliable Services of Sampling and Chemical Analysis (Activity 2-1)

The tasks of sampling and water quality analysis in Output 2 were outsourced to local environmental consulting companies and laboratories. In order to select these companies and laboratories, in February 2016, JET visited several candidate companies and laboratories and checked their capabilities in terms of related work experiences, methods and procedures of sampling and analysis work, quality control system, and availability of human and other resources, etc.

Regarding the sampling, on-site measurement and transportation of samples, JET found that some

local environmental consulting companies have relatively good work experiences in water quality surveys. The subcontractor for such field work was selected from these consulting companies for Period 1 (June 2015 – April 2017) to implement the 1st – 3rd surveys, and for Period 2 (June 2017 to June 2018) to implement the 4th and 5th surveys.

The laboratories providing the water quality analysis services for Period 1 (June 2015 – April 2017) were selected for the first time in early February 2016. The performance of laboratories was evaluated at each survey time, and the laboratories were changed as needed. Although these laboratories were carefully selected with available information, C/Ps and JET found that the analytical precision was not enough based on the examination of their performance in the 1st – 3rd surveys (see the details in Section 2.4.8). The chemical analysis results varied significantly among the local laboratories, and it was not possible to determine which local laboratories were reliable.

Based on the lessons learned in Period 1, JET discussed with C/Ps and decided to outsource the laboratory analysis for most measurement parameters in the 4th and 5th surveys to a certificated laboratory in Japan except BOD and total coliform, which were analyzed in local laboratories in Yangon since the samples for these parameters cannot be preserved for a long time and they require immediate analysis work.

2.4.2 Collect Information on Hydraulic Observation, Tide, Water Utilization and Water Pollution Sources in the Pilot Study Areas (Activity 2-2)

In order to develop the water quality survey plan, information on climate, hydrology, pollution sources and other relevant characteristics of the target river basins was collected from various sources.

(1) Hlaing River Basin

The collected information is summarized in Table 2.4-2. The Hlaing River runs through the western part of Yangon City, joins with the Pan Hlaing River, becomes the Yangon River, and drains to Andaman Sea. Overall, readily available information on the Hlaing River and its basin was quite scarce. The spatial and temporal fluctuations of the flow of Hlaing River, which is significantly affected by the tide, have not been investigated in detail in the past. The main pollution sources along the Hlaing River in the urban area seemed to be domestic wastewater and industrial wastewater. Several industrial zones are located on both sides of the Hlaing River, and the water quality of drainage channels receiving discharges from factories seemed deteriorated. However, the impact of pollution sources on the water quality of Hlaing River had not been studied prior to the project.

Table 2.4-2 Collected Information on Water Quality Survey for the Hlaing River Basin

Category		Summary
Meteorology		- The highest precipitation (approx. 600 mm/month) is observed in July while it hardly rains in the dry season especially from Nov. to Mar. (JICA, Final Report of The Project for the Strategic Urban Development Plan of the Greater Yangon, 2013)
Hydrology	River information	- The water level data of Hlaing River was unavailable.
	Tidal information	- Lately the tide has not been observed by Myanmar Port Authority (MPA). The available historical data at Yangon Port up to 1936 showed that the highest high water level (HHWL) was at +6.74 m and mean water level (MWL) was at +3.121 m in Yangon River at Yangon Port Station. (JICA, Final Report of The Project for the Strategic Urban Development Plan of the Greater Yangon, 2013) - The saltwater intrusion has been observed along the Hlaing River; however the spatial distribution of brackish water and its fluctuation are unknown.
Pollution Source		- Several industrial zones (IZs), including Shwe Pyi Thar IZ, Shwe Linban IZ and Hlaing Tharyar IZ, are located along the river. The effluent from factories such as battery, alcohol, and seafood factories, seems to deteriorate the surface water quality in drainage channels. Domestic sewage is also directly discharged to the Hlaing River. The detailed information on factories was collected in Output 3 (Database). - The upstream and rural area of Hlaing River receive agricultural wastewater.

Past water quality data	<ul style="list-style-type: none"> - In total 10 river water samples and 20 wastewater samples were analyzed in 2013 for 11 analytical parameters. The level of COD was not high, and varied from 9 to 25 mg/L. (University of Public Health and YCDC, Water quality assessment of Hlaing River Near Industrial Zone, Yangon, 2013) - It seems the wastewaters from factories flow into the channels and its adverse effect on water quality is obvious. However, concentrations of many pollutants as well as their main sources are not clear.
Water use	<ul style="list-style-type: none"> - YCDC plans to construct a water intake facility and water treatment plant in Kokkwa upstream of the Hlaing River to distribute drinking water to Yangon City. - YCDC is seeking the possibility of taking water from the Hlaing River to Hlawga Lake, which is one of the important water intake points for urban water supply, in order to restore the water storage in dry season. - The Hlaing River serves for flood control, river transportation and fisheries.

Source: JET

(2) Doke Hta Waddy River Basin

Collected information is summarized in Table 2.4-3 below. The Doke Hta Waddy River flows from east to west in the south of Mandalay City and joins the Ayeyarwaddy River. There is a large industrial zone (three zones) in Pyi Gyi Tagon Township discharging wastewater to the south toward Doke Hta Waddy River and to the west toward Taung Tha Man Lake. As for the south-bound flow from Pyi Gyi Tagon IZ, it is discharged directly to the Doke Hta Waddy River through a 10-inch-diameter pipeline. In the upstream of discharging point, WSD-MCDC plans to abstract water for domestic water supply in the future. The pollution load from the factories and sewage in the area was also affecting Taung Tha Man Lake through the west-bound flow from the industrial zone. The lake is famous as a tourist destination in Amarapura (former capital of Myanmar), and is rich in fishery resources. Because there were major fish kill incidents in the lake in April – May and September – October 2015 presumably due to the pollution load from factories as well as other sources, WSD-MCDC started to check the water quality in the lake and surrounding channels periodically.

Table 2.4-3 Collected Information on Water Quality Survey for Doke Hta Waddy River Basin

Category	Summary
Meteorology	<ul style="list-style-type: none"> - High precipitation (more than 100 mm/month) is observed in the rainy season from May to October while it hardly rains in the dry season especially from Dec. to Mar. (www.weather-and-climate.com)
Hydrology	<ul style="list-style-type: none"> - The river water level in the Ayeyarwady River varied from 3.6 m to 11.5 m in 2014. According to the 13-year monitoring data available from MCDC, the minimum river water level is observed in May, June, or December and the maximum level is in July, August, or September. - The monthly-average water level at Myintge Bridge of the Doke Hta Waddy River is relatively high from July to October and low from December to May (Department of Meteorology and Hydrology, 2005-2016)
Pollution Source	<ul style="list-style-type: none"> - The wastewater from the industrial zone in Pyi Gyi Tagon Township is discharged to Doke Hta Waddy River basin through the 12,000 feet and 10-inch-diameter pipeline. The pipeline has been constructed to reduce the pollution load in Pa Yan Taw Creek and intend to be connected to the wastewater treatment plant under construction. - The surrounding factories are allowed to discharge wastewater only at night time. - The detailed information on factories was collected in Output 3 (Database).
Past Water Quality Data	<ul style="list-style-type: none"> - WSD-MCDC has been monitoring water quality of Doke Hta Waddy River weekly as a potential source of supplied water (e.g., BOD varies from 3.5 to 5.3) (MCDC, from Mar. 2014 to Mar. 2015) - The water temperature, pH, color, DO, BOD and COD in Taung Tha Man Lake and a connected channel have been monitored by WSD-MCDC. Concentrations of COD (48 mg/L - more than 150 mg/L) and BOD (19 – 98 mg/L) are rather high. (MCDC, Oct. 2015) - Many dead fishes were found on the coastline of north Taung Tha Man Lake in April and September 2015, and it was suspected that it was caused by low level of oxygen and pollution load from factories. - Some data of wastewater quality discharged from factories have been collected.

	- Water quality of Ayeyarwaddy River is monitored by the Ministry of Transport and Communications.
Water Use	- MCDC plans to use the Doke Hta Waddy River as an additional source of supplied water in the near future. - The upstream of Doke Hta Waddy River has been used for hydropower plant. - The other key uses are irrigation, flood control and artisanal fisheries.

Source: JET

2.4.3 Develop Criteria for Selecting Sampling Points, Sampling Time, Measurement Parameters, etc. (Activity 2-3)

The main objectives of the pilot studies under Output 2 were to confirm the pollution statuses of the target river basins and to examine the impacts of industrial wastewater on the Hlaing River and Doke Hta Waddy River. The criteria for selecting sampling points, sampling time, measurement parameters, etc., were developed before the 1st survey and optimized further each time considering the results of the past water quality surveys and updated site-related information as shown in the table below.

Table 2.4-4 Criteria to Select the Sampling Points, Sampling Time and Measurement Parameters

Item	Important Points to Consider	Criteria for Selection	
		Hlaing River Basin	Doke Hta Waddy River Basin
Sampling Point	Locations of pollution sources, water usage, change in water quality and flow rate etc.	- Pollution control point: major routes of pollution (e.g., channels from factories) and downstream locations in the river after sufficient mixing of wastewater and river water - Water usage control point: upstream of (future) water intake - Baseline point: upstream and downstream of confluent point, as well as the lowest point in the watershed	
Sampling Time/ Frequency	Seasonal fluctuation (e.g., rainy /dry season), tidal fluctuation, other characteristics	- Precipitation and river discharge: dry and rainy seasons - Tide: basically, at the time of spring tide and ebb tide in tidal area - Stability of water quality: on a day after several days of good weather (dry season)	- Precipitation and river discharge: dry and rainy seasons - Stability of water quality: on a day after several days of good weather (dry season)
Parameters	Parameters to characterize river waters and industrial wastewaters	- Relevant standards: Key parameters to monitor river water quality with reference to Japanese environmental standard, which will be replaced with the Myanmar Environmental Quality Standard after it is specified in the future. - Pollution sources: Discharge standard and main pollutants in the effluent In addition, existing water quality data, analytical capacity of laboratory, and other factors also shall be considered.	

Source: JET

2.4.4 Develop a Water Quality Survey Plan (Activity 2-4)

The water quality survey plan was developed as shown in the tables below. It was originally prepared in late 2015 based on the criteria presented in Section 2.4.3. The plan was slightly modified and optimized each time based on the discussions with C/Ps considering the changes in conditions of sampling sites and past survey results.

Table 2.4-5 Summary of Water Quality Survey Plan for the Hlaing River Basin

Item	Contents
Sampling Point	- Hlaing River: 3 – 5 points, depending on the survey time - Channels in Shwe Pyi Thar IZ: 3 points - Channels in Hlaing Tharyar IZ: 0 – 2 points, depending on the survey time - Pan Hlaing River: 2 points - Kikkowa River: 0 – 1 point, depending on the survey time
Sampling Time	[Season] - 1 st survey: dry season in 2016 - 2 nd survey: rainy season in 2016

Item	Contents
	<ul style="list-style-type: none"> - 3rd survey: dry season in 2017 - 4th survey: rainy season in 2017 - 5th survey: dry season in 2018 [Time] <ul style="list-style-type: none"> - At the time of ebb tide near spring-tide day as much as possible
Measurement Parameters	[All points] <ul style="list-style-type: none"> - pH, EC, DO, TDS, salinity, turbidity, water temperature, ORP [Basic points] <ul style="list-style-type: none"> - Flow rate (if available), TSS, BOD, COD, oil and grease, total coliform [Representative points] <ul style="list-style-type: none"> - Total phosphorus, total nitrogen, cyanide, phenols, zinc, total chromium, hexavalent chromium, arsenic, total mercury, cadmium, and lead - Color, odor, iron and manganese in the 1st survey - Copper, phosphate, ammonia nitrogen, nitrate nitrogen and nitrite nitrogen in the 1st – 3rd surveys [Only one or two points] <ul style="list-style-type: none"> - Pesticides* and PCB

* Total organic chlorine pesticides and total organic phosphorus pesticides for second and third surveys

* Aldrin, atrazine, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan, endosulfan sulfate, endrin, HCH-alpha (benzene hexachloride-alpha), HCH-beta, HCH-delta, HCH-gamma(Lindane), alachlor, diazinon, chlorpyrifos, dimethoate and imidacloprid for fourth and fifth surveys

Source: JET

Table 2.4-6 Summary of Water Quality Survey Plan for the Doke Hta Waddy River Basin

Item	Contents
Sampling Point	<ul style="list-style-type: none"> - Doke Hta Waddy River: 3 – 4 points, depending on the survey time - Wastewater pipeline discharging to Doke Hta Waddy: 1 point - Taung Tha Man Lake: 2 – 3 points - Flow path to Taung Tha Man Lake :4 – 7 points depending on the survey time - Ayeyarwaddy River: 0 – 1 point, depending on the survey time - Shwe Kyin Creek: 0 – 1 point, depending on the survey time
Sampling Time	<ul style="list-style-type: none"> - 1st survey: dry season in 2016 - 2nd survey: rainy season in 2016 - 3rd survey: dry season in 2017 - 4th survey: rainy season in 2017 - 5th survey: dry season in 2018
Measurement Parameters	[All points] <ul style="list-style-type: none"> - pH, EC, DO, TDS, salinity, turbidity, water temperature, ORP [Basic points] <ul style="list-style-type: none"> - Flow rate (if available), TSS, BOD, COD, oil and grease, total coliform [Representative points] <ul style="list-style-type: none"> - Total phosphorus, total nitrogen, cyanide, phenols, zinc, total chromium, hexavalent chromium, arsenic, total mercury, cadmium, and lead - Color, odor, iron and manganese in the 1st survey - Copper phosphate, ammonia nitrogen, nitrate nitrogen and nitrite nitrogen in the 1st – 3rd surveys [Only one or two points] <ul style="list-style-type: none"> - Pesticides* and PCB

* Total organic chlorine pesticides and total organic phosphorus pesticides for second and third surveys.

* Aldrin, atrazine, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan, endosulfan sulfate, endrin, HCH-alpha (benzene hexachloride-alpha), HCH-beta, HCH-delta, HCH-gamma(Lindane), alachlor, diazinon, chlorpyrifos, dimethoate and imidacloprid for fourth and fifth surveys

Source: JET

2.4.5 Develop a Water Quality Survey Manual (Activity 2-5)

The water quality survey manual was developed to improve quality and reliability of water quality surveys by the C/P organizations. The manual summarized methodologies of developing a sampling plan, sampling and on-site measurement, storage and preservation of samples, review of analytical data, and report writing.

2.4.6 Implement a Water Quality Survey based on the Water Quality Survey Plan (Activity 2-6)

The water quality surveys were conducted for a total of five times by a team from a local consulting company under the supervision of C/Ps and JET as per the following schedule targeting one time in the rainy season and another time in the dry season for each year.

Table 2.4-7 Sampling Dates for the Hlaing River Basin

Survey	Sampling Period	Note
First water quality survey	21-23 Feb 2016	-
Second water quality survey	20 and 21 Jun 2016	-
Third water quality survey	30 Jan–1 Feb 2017	-
Fourth water quality survey	18-20 Sep 2017	It rained heavily in the afternoon of 19 Sep.
Fifth water quality survey	19–21 Feb 2018	-

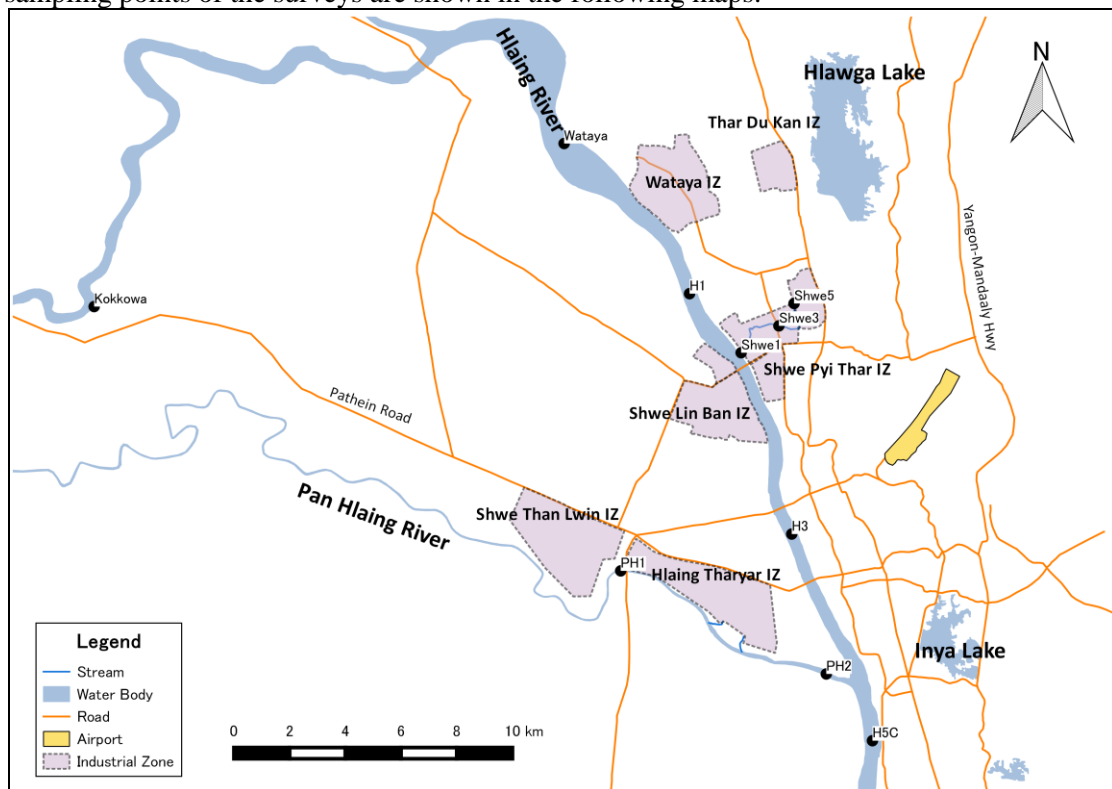
Source: JET

Table 2.4-8 Sampling Dates for the Doke Hta Waddy River Basin

Survey	Sampling Period	Note
First water quality survey	17, 18 and 25(re-sampling) Feb 2016	Since the survey team found the sample volume was not enough for analysis after the survey, they went to the site again to retake the samples on 25 Feb.
Second water quality survey	20 and 21 Jun 2016	The samples of Doke Hta Waddy River were taken at night time.
Third water quality survey	30 Jan–1 Feb 2017	-
Fourth water quality survey	25 and 26 Sep 2017	-
Fifth water quality survey	26–27 Feb 2018	-

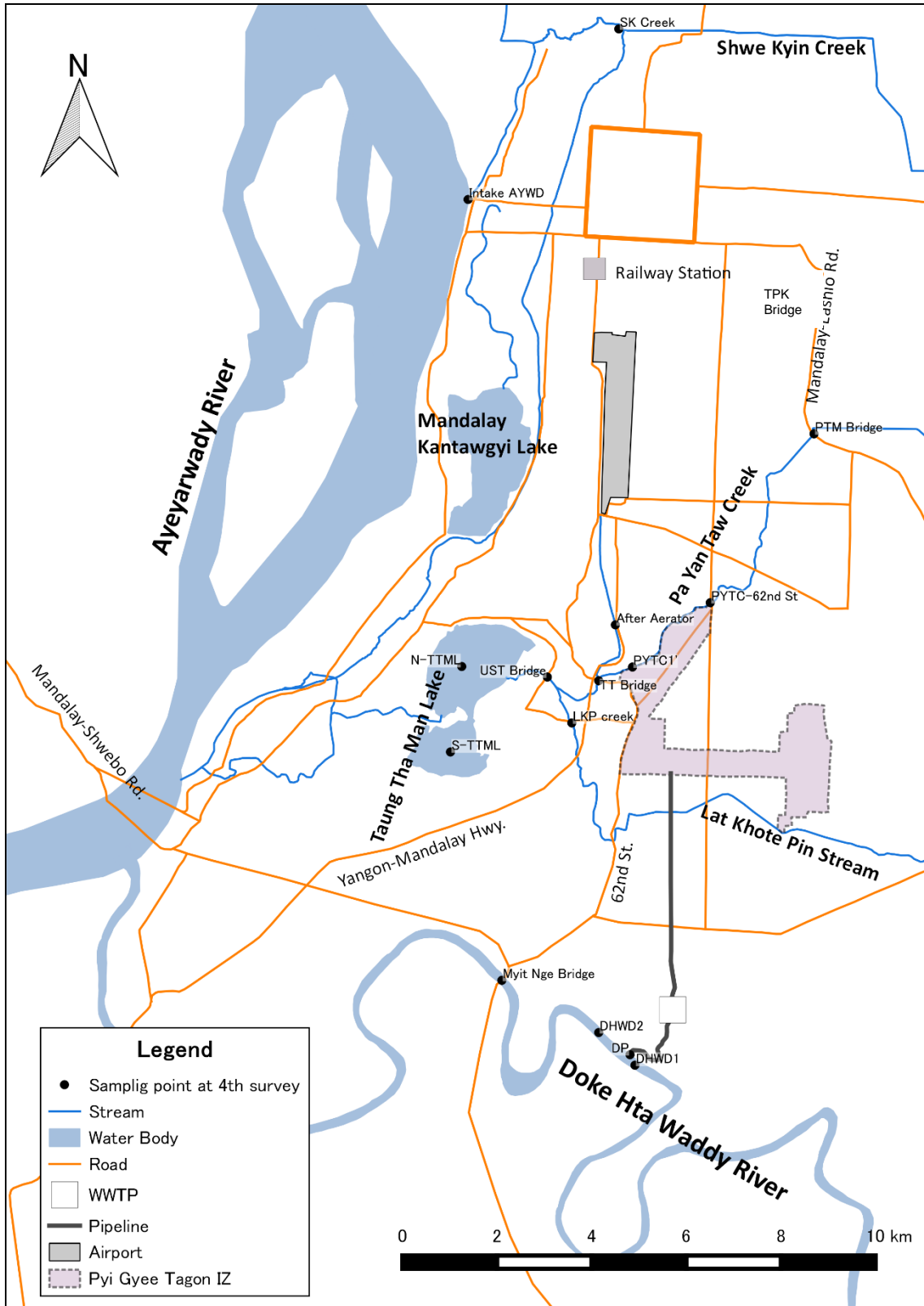
Source: JET

The sampling points of the surveys are shown in the following maps.



Source: JET

Figure 2.4-1 Sampling Points of Water Quality Surveys in the Hlaing River Basin



Source: JET

Figure 2.4-2 Sampling Points of Water Quality Surveys in the Doke Hta Waddy River Basin

2.4.7 Supervise the Water Sampling Referring to the Water Quality Survey Manual (Activity 2-7)

The field work of the surveys was supervised by C/Ps from ECD-Yangon Regional Office, PCCD-YCDC and WSD-YCDC in the surveys in Yangon, and ECD-Mandalay Regional Office and WSD-MCDC and in the surveys in Mandalay (see Figure 2.4-3). The instructions given through the surveys included the basic procedure of water sampling, on-site measurement using the multi-parameter water quality meter and water flow measurement, sample preservation as well as recording of on-site information.

Apart from the samples analyzed by the outsourced laboratories, one set of water samples was delivered to the C/Ps' laboratories (Water Laboratory and Wastewater Laboratory in WSD-YCDC and the laboratory in WSD-MCDC) for chemical analysis.



Source: JET

Figure 2.4-3 Photographs from the Water Quality Surveys

2.4.8 Verify the Results of Water Quality Survey Using the Water Quality Survey Manual (Activity 2-8)

The results of the water quality surveys were validated with the technical staff of each C/P organization in accordance with the Water Quality Survey Manual. The checked items included comparison with standard values, consistency with the results of the past surveys, consistency with the results of related parameters, precision of analysis confirmed with the results of quality control samples, and cross-check of results with other laboratory's results. The validation processes revealed that the analytical precision was not sufficiently high in the 1st – 3rd surveys. For example, the results of duplicate analysis, in which two samples collected and analyzed in the same way simultaneously, showed more than a 20% difference. Also there were possibilities that measured values for some

parameters, such as Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), cadmium and lead, were higher than the true values. While overcoming these technical issues is beyond the scope of this project, the validation processes helped the C/P staff learn some important lessons about the issues of current water quality analysis in Myanmar as well as the needs for improvement:

- 1) One of the reasons why there are significant variations of analysis results among the local laboratories is that each laboratory applies a different analysis method including simplified methods and originally-developed methods. Several advanced laboratories apply internationally-recognized and reliable analytical methods for some analytical parameters, but not for all parameters. It is crucial to develop the national standard method of environmental water quality analysis in Myanmar.
- 2) It seems that some laboratories have difficulties in conforming to each step of the procedure and requirement specified in the original analysis method, apparently due to lack of understanding of the analysis method, insufficient skill and unavailability of reagent and apparatus. It is essential to establish a wide range of QA/QC (Quality Assurance/Quality Control) that will ensure appropriate data management in a laboratory, implementation of proficiency test and cross-check, as well as establishment of accreditation system of laboratories, such as ISO17025.

In Period 1 (June 2015 – April 2017), some data was not satisfactorily validated in the 1st – 3rd surveys though efforts were made to improve the data quality. The data reliability was significantly improved in the 4th and 5th surveys due to the change of policy to select the laboratories as described in Section 2.3.2. Thus, the water qualities in target river basins were evaluated based on the results of 4th and 5th surveys. The results from the 1st to 3rd surveys were used as reference.

In addition, an OJT of chemical analysis targeting the Water Laboratory of WSD-YCDC and WSD laboratory of MCDC were conducted in order to check and improve the methodological and operational skills of water quality analysis. A method for cross-checking nitrogen data was introduced to the Water Laboratory of YCDC. As for WSD-MCDC, the standard method of BOD was upgraded and an advise on COD analysis was given to the staff members.

2.4.9 Prepare a Water Quality Survey Report (Activity 2-9)

(1) Water quality survey results

Since there is no ambient water environmental quality standard in Myanmar yet, C/Ps and JET evaluated the water qualities based on some reference standards and related guidelines in Myanmar, Vietnam and Japan, considering the type and usage of water. They included i) Vietnamese national technical regulations on surface water quality (QCVN 08, 2015), ii) Japanese environmental quality standard for water pollution in lakes (Environment Agency Notification No. 59, last amended in 2016), iii) draft national drinking water quality guideline (MOHS, 2014) and iv) National Environmental Quality (Emission) Guideline (MONREC, 2015) for wastewater. The water quality in each target river basin is summarized below based on the past survey results.

1) Water quality survey result in Hlaing River basin

The overall view on water quality in Hlaing River basin is described below.

- a) Pollution levels in Hlaing River and Pan Hlaing River
 - Except TSS (Total Suspended Solid) and total coliform, the water quality in Hlaing River and Pan Hlaing River in the rainy season (September 2017) was acceptable for conservation of aquatic lives, irrigation and water transportation based on the Vietnamese surface water quality guideline values. During the dry season (February 2018), the water quality deteriorated as shown by high COD detected at some points and slight oil and grease detected at all points. Only the upstream area of Hlaing River (upstream of Shwe Pyi Thar Bridge) still kept the good water quality desirable for irrigation and water transportation except above-mentioned TSS, total coliform and

oil and grease. In the middle-stream of Pan Hlaing River (upstream of Hlaing Bridge), the river water was extremely muddy in February 2018 resulting in very low dissolved oxygen (DO) and high BOD and COD, presumably due to the effect of sediment in the water stirred by a surging tide flow or other reasons. See Table 2.4-9 for the result list of BOD and COD.

- The results in these rivers did not exhibit levels of toxic pollutants harmful for human health. Only slight lead (0.058 mg/L) was detected in downstream area in Pan Hlaing River in February 2018, but it was considered as one originally contained in the natural sediment.

Table 2.4-9 Classification of BOD and COD Levels in the Hlaing River Basin

Unit: mg/L

Target		BOD						COD					
		Rainy Season(Sep 2017)			Dry Season(Feb 2018)			Rainy Season(Sep 2017)			Dry Season(Feb 2018)		
		Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
River	Hlaing River	1.2	2.3	1.6	2.4	3.7	3.0	10	14	12	20	71	44
	Pan Hlaing River	0.7	1.6	1.1	3.8	44.6	24.2	12	14	13	63	3400	1732
	Kokkowa River	3.7			5.7			8.3			5.2		
Creek	Creek in Shwe Pyi Tar IZ	5.4	32	14	134	268	222	19	44	28	230	5700	3610

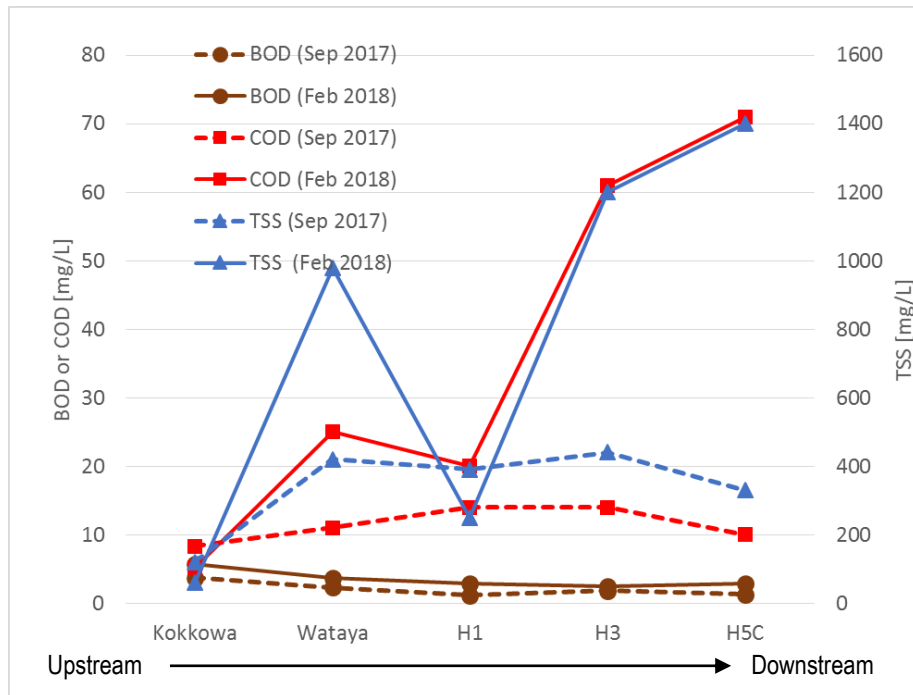
Vietnamese Environmental Standard(QCVN08:2015) for reference

Water Usage		BOD	COD
A1	For domestic water supply	4	10
A2	For domestic water supply with treatment and conservation of aquatic lives	6	15
B1	For irrigation	15	30
B2	For water transportation and other purposes with demand for low-quality water	25	50
Less than B2		>25	>50

Source: JET

b) Spatial distribution of pollution in Hlaing River: difference in water quality from upstream to downstream

- The results in Hlaing River did not show clear deterioration of the surface water quality in the flow direction during the rainy season (see Figure 2.4-4).
- During the dry season, the COD level increased from the up-stream to downstream (Figure 2.4-5). while there was no significant difference in BOD level among the locations. It implies that the high COD in the dry season in the downstream area was largely due to organic matter associated with suspended solid in the water and not soluble organic substance.
- More monitoring data is required to identify the spatial and temporal changes of surface water quality in Hlaing River.

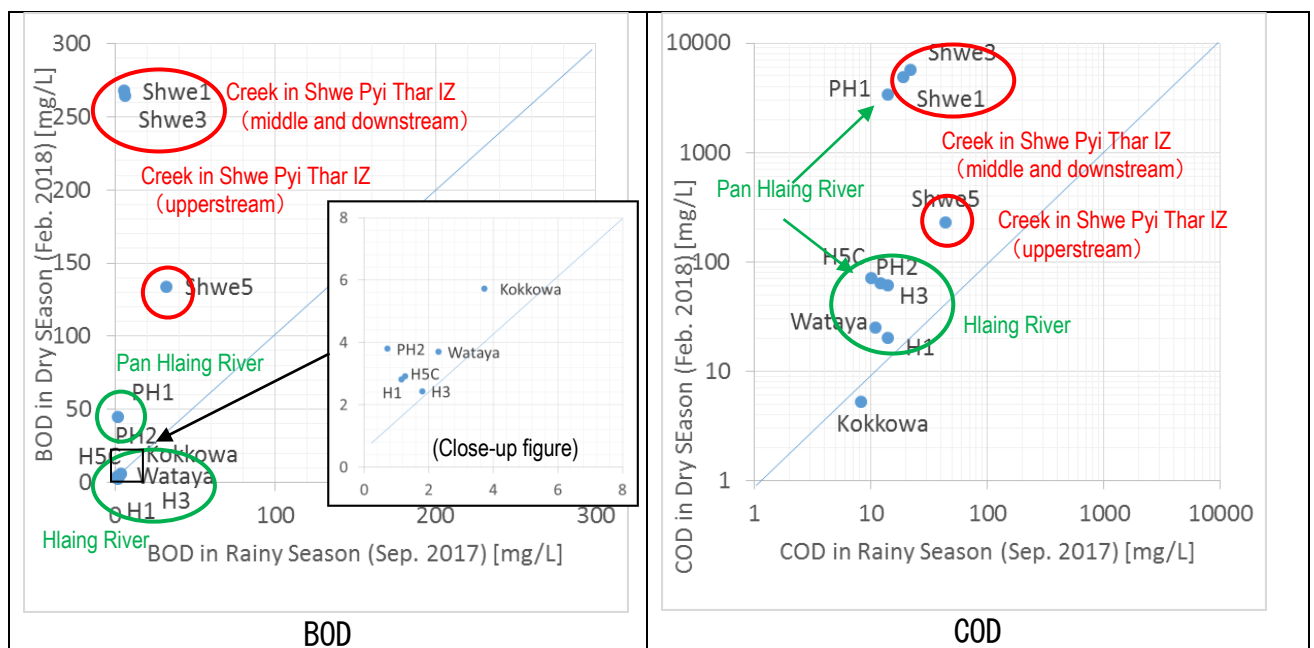


Source: JET

Figure 2.4-4 Water Quality Distribution in the Hlaing River

c) Seasonal changes of water quality

- The concentration of pollutants in the dry season was higher than one in the rainy season for most sampling points and for most parameters as represented by BOD and COD (see Figure 2.4-5). It indicated that in the rainy season the storm water diluted such pollutants and alleviated the pollution impact in the river. The result revealed that the pollution impact of industrial wastewater and domestic wastewater from the basin gets larger during the dry season, making it difficult to fully maintain the desired water quality in the Hlaing River during the dry season.

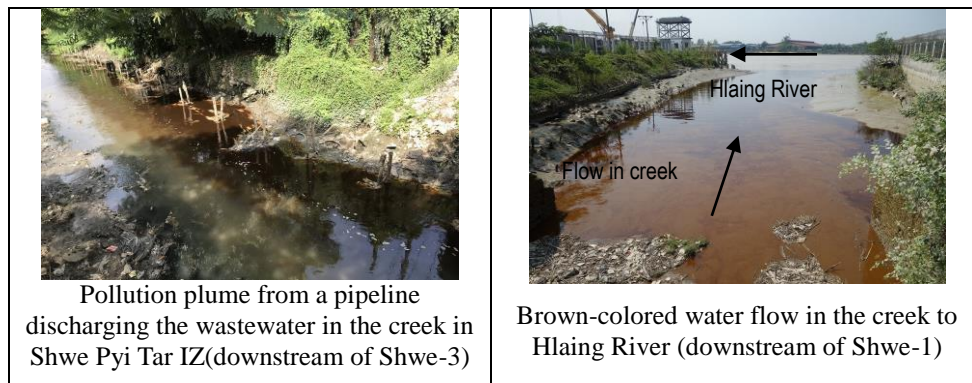


Source: JET

Figure 2.4-5 Water Quality Changes between Rainy Season and Dry Season (Hlaing River Basin)

d) Pollution impact from IZs

- In the creek that flows through the Shwe Pyi Thar Industrial Zone (IZ) to Hlaing River, the water quality in the past surveys until February 2017 was significantly worse due to the inflow of wastewater, which was indicated by low DO as well as high concentrations of COD, BOD, oil and grease, nutrients, phenol and others.
- The water quality of this creek improved in September 2017 probably because the operation of distilleries along the creek was suspended. This order was given by the Yangon Region Government to six distilleries in the IZ in July or August 2017. However, after the new pipeline from distilleries was constructed in the creek, the water quality deteriorated again (see Figure 2.4-6).
- The water quality in the creek hinges on the impact of wastewater from these factories. It is important to continue to monitor the wastewater from these pollution sources, which could improve or deteriorate depending on the factories' operation and performance of wastewater treatment.
- Overall, Hlaing River has a significant capacity to dilute water from the creek, and the pollution impact to Hlaing River does not appear to be so high, though the impact of localized pollution would be a concern.



Source: JET

Figure 2.4-6 Pollution Plume in the Creek of Shwe Pyi Tar IZ

e) Water quality for domestic water supply at Kokkowa River and Wataya



- The sampling points of Kokkowa and Wataya were investigated as possible future intake point(s) of domestic water supply to Yangon City. The water treatment plant is planned to be constructed on the bank of the Kokkowa river, upstream of Hlaing River. WSD-YCDC is also seeking the possibility to withdraw water from Hlaing River to Hlawga Lake to prevent a drawdown of Hlawga lake in the dry season. Judging from the results, the water qualities at Kokkowa and Wataya in rainy season seem good enough for water supply for domestic water supply if the water is treated at a water treatment facility using filters and other ordinary means. It satisfied the draft national drinking water guideline values (MOHS, 2014) with respect to the measured parameters except turbidity at both sampling points in September 2017 and February 2018 as well as total chromium and lead at Wataya point in February 2018 (see Table 2.4-10). It was hypothesized that chromium and lead, whose concentrations were not very high, were contained in the suspended sediment and are of natural origin. Whether they can be removed during water treatment or not should be confirmed.
- The pesticides were not detected in the survey both in September 2017 and February 2018, but needs to be further investigated in other seasons including the farming season.
- There are some potential pollution sources along Hlaing River in the surrounding of Wataya. The water samples in these surveys were taken during the spring tide time and when the water was

flowing downward after high-tide. However, the pollution level might change in a farming season, or when the water flows upward after low-tide.

- It should be noted that these surveys were conducted as part of the environmental monitoring under Output 2, and the results do not guarantee the safety of waters for drinking and other purposes. The measurement parameter in these surveys were limited and did not cover all the guideline values. Thus it is crucial to continue to check the water quality throughout the year for a wider range of parameters and with continuous monitoring in one tide cycle per day and between spring tide and neap tide.

Table 2.4-10 Comparison with Draft Drinking Water Quality Standard for Possible Domestic Water Supply (Hlaing River Basin)

Parameter	Unit	Kokkowa		Wataya		MOH Draft National Drinking Water Quality Std(2014)
		Sep 2017	Feb 2018	Sep 2017	Feb 2018	
pH	-	7.89	8.35	7.61	8.21	6.5 - 8.5
Turbidity	NTU	545	169	618	>1000	5
TDS	mg/L	66	140	81	156	1000
Cyanide(total)	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	0.07
Zinc (Zn)	mg/L	0.029	0.014	0.054	0.13	3
Total chromium (T-Cr)	mg/L	0.019	0.010	0.048	0.11	0.05
Arsenic (As)	mg/L	0.0016	0.0015	0.0026	0.011	0.05
Copper (Cu)	mg/L	0.010	0.0054	0.017	0.045	2
Total Mercury (Hg)	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.001
Cadmium (Cd)	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	0.003
Lead (Pb)	mg/L	< 0.005	< 0.005	0.0097	0.024	0.01
Pesticides (total 17 paramete	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	Specified for some parameters respectively

 : Satisfied with reference standard
 : Not satisfied with reference standard

Source: JET

2) Water quality survey result in Doke Hta Waddy River Basin

The overall view on water quality in Doke Hta Waddy River basin is described below.

a) Pollution impact of the industrial wastewater to Doke Hta Waddy River

- The Doke Hta Waddy River seems to have adequate water quality for domestic water supply with water treatment facility using filters and other ordinary means. The level of organic pollution does not appear to be very high. None of the results in this project showed elevated levels of toxic substances. The water quality did not dramatically vary in seasons or from point to point. See Table 2.4-11 for the results of BOD and COD, and see Table 2.4-12 for the results of water qualities at future intake points compared with drinking water quality guideline value.
- Until the 3rd water quality survey in February 2017, the wastewater discharged from 10-inch pipeline had contained high concentrations of pollutants that included oil and grease, phenols and hexavalent chromium in addition to organic materials and nutrients. The concentrations of these pollutants were higher than the guideline values applied to general wastewater (general application, National Environmental Quality (Emission) Guidelines, 2015). It was noted that the pollution impact of this 10-inch pipe wastewater on water quality of Doke Hta Waddy River was limited because of the large dilution capacity of the river, though localized pollution and adverse impact, such as an awful odor to residents in the vicinity of the discharging point, were undeniable.

- After several distilleries in Pyi Gyi Tagon IZ were shut down their operation temporarily from June – August 2017 by instructions of Mandalay Region Government and MCDC, the pollution load from the 10-pipe line seemed to decrease. However, the discharging wastewater still contained oil and grease, phenols, and other pollutants.
- The concentrations of pollutants in the dry season was higher than those in the rainy season for most sampling points and for most parameters. This is similar to the Hlaing River basin (Figure 2.4-7). On the other hand, the pollution loads of organic substances, i.e., BOD and COD, in Doke Hta Waddy River in October 2017 seemed larger than those in February 2018 (DHWD-1 in Figure 2.4-7). It indicated that the storm water in the rainy season flushed more organic substances with soils from the upper basin to the river, though the concentrations of organic substances is not higher because of the dilution effect.

Table 2.4-11 Classification of BOD and COD Levels in Doke Hta Waddy River Basin

Unit: mg/L

Target		BOD						COD					
		Rainy Season(Sep 2017)			Dry Season(Feb 2018)			Rainy Season(Sep 2017)			Dry Season(Feb 2018)		
		Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
River	Doke Hta Waddy River	1.1	5.4	3.7	4.7	5.7	5.0	4.2	6	5.2	2.8	5.2	3.6
	Ayeyarwaddy River	5.4			4.7			11			4.4		
Lake	Taung Tha Man Lake	5.4	6.0	5.7	23	357	190	28	28	28	130	280	205
Creek	Inflow to Taung Tha Man Lake (LKP Stream, UST Bridge, Pa Yan Taw Creek, Columbo Creek)	2.3	6.6	4.4	9.8	354	206	14	70	32	21	540	209

Vietnamese Environmental Standard(QCVN08:2015) for reference

Water Usage		BOD	COD
A1	For domestic water supply	4	10
A2	For domestic water supply with treatment and conservation of aquatic lives	6	15
B1	For irrigation	15	30
B2	For water transportation and other purposes with demand for low-quality water	25	50
Less than B2		>25	>50

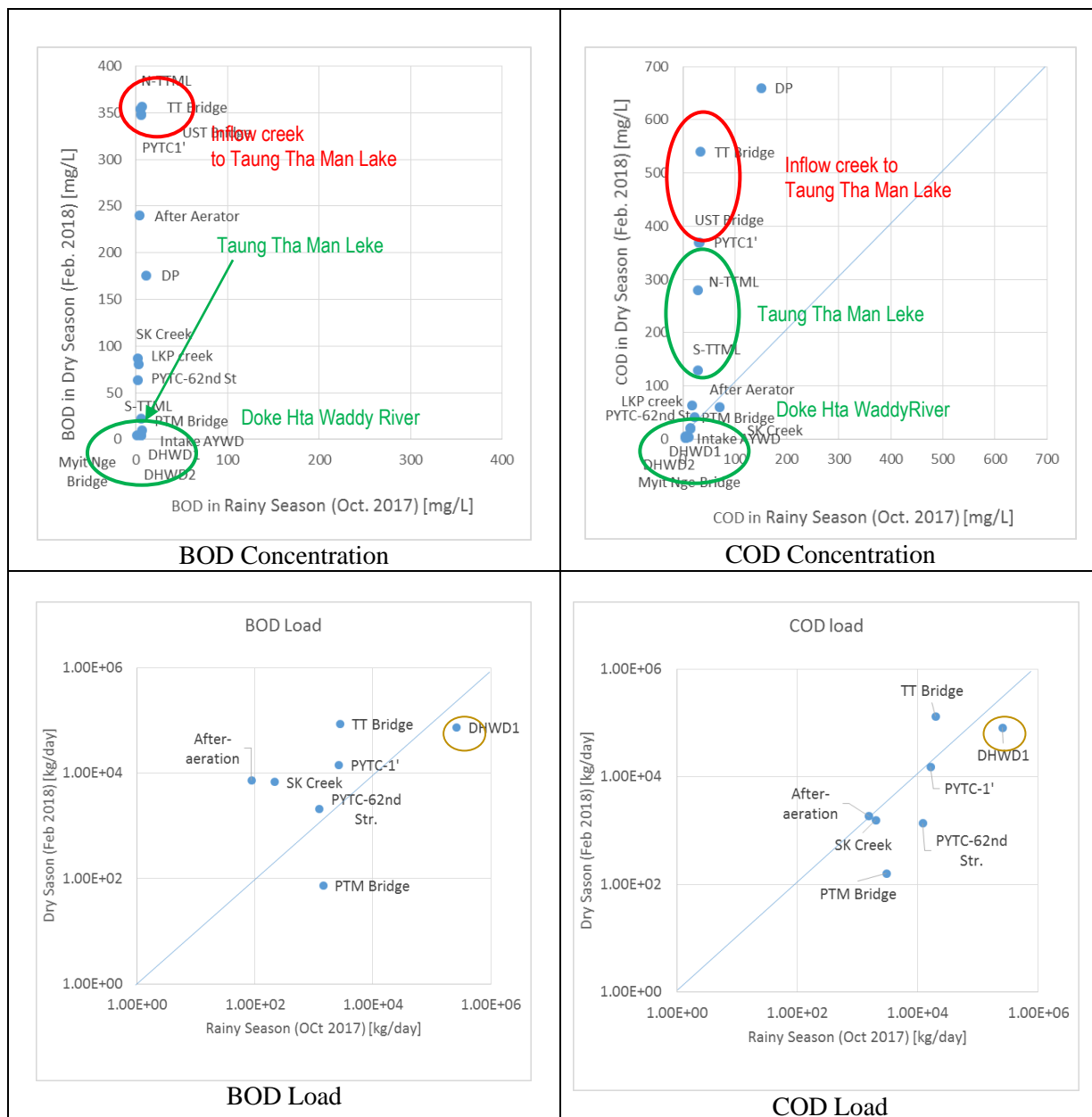
Source: JET

Table 2.4-12 Comparison with Draft Drinking Water Quality Standard for Existing/Possible Domestic Water Supply (Doke Hta Waddy River Basin)

Location Name	Unit	DHWD1		Intake AYWD		MOH Draft National Drinking Water Quality Std(2014)
		Sep 2017	Feb 2018	Sep 2017	Feb 2018	
pH	-	8.40	8.15	7.88	8.06	6.5 - 8.5
Turbidity	NTU	39.5	9.5	74.1	80	5
TDS	mg/L	160	0.245	133	0.101	1000
Cyanide(total)	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	0.07
Zinc (Zn)	mg/L	0.0081	< 0.005	0.0087	0.0078	3
Total chromium (T-Cr)	mg/L	0.0058	< 0.005	0.0056	< 0.005	0.05
Arsenic (As)	mg/L	0.0016	0.0023	0.0017	0.0013	0.05
Copper (Cu)	mg/L	< 0.005	< 0.005	< 0.005	0.014	2
Total Mercury (Hg)	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.001
Cadmium (Cd)	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	0.003
Lead (Pb)	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	0.01
Pesticides	mg/L		-	< 0.0005	< 0.0005	Specified for some parameters respectively

 : Satisfied with reference standard
 : Not satisfied with reference standard

Source: JET



Source: JET

Figure 2.4-7 Water Quality and Pollution Load Changes between Rainy Season and Dry Season (Doke Hta Waddy River Basin)

b) Pollution level of Taung Tha Man Lake

- The water quality in Taung Tha Man Lake was characterized as eutrophic. The lake, manifested traits like higher phosphorus and nitrogen concentrations compared to general indicators for eutrophication: 0.01 mg/L for total phosphorus and 0.15 mg/L for total nitrogen (USEPA, Nutrient Criteria Technical Guidance Manual, 2000), has relatively low DO as well as high COD and pH.
- As a whole the water quality in the lake was significantly deteriorated in the dry season compared with the rainy season (Table 2.4-13 and Figure 2.4-8). Especially in February 2018, the nutrient level was very high (4.3 mg/L for total phosphorus and 25 mg/L of total nitrogen) in the northern lake. At that period, the lake's water level was quite low and the water area was enclosed without enough water exchanges between the lake and other water bodies in the dry season. In such

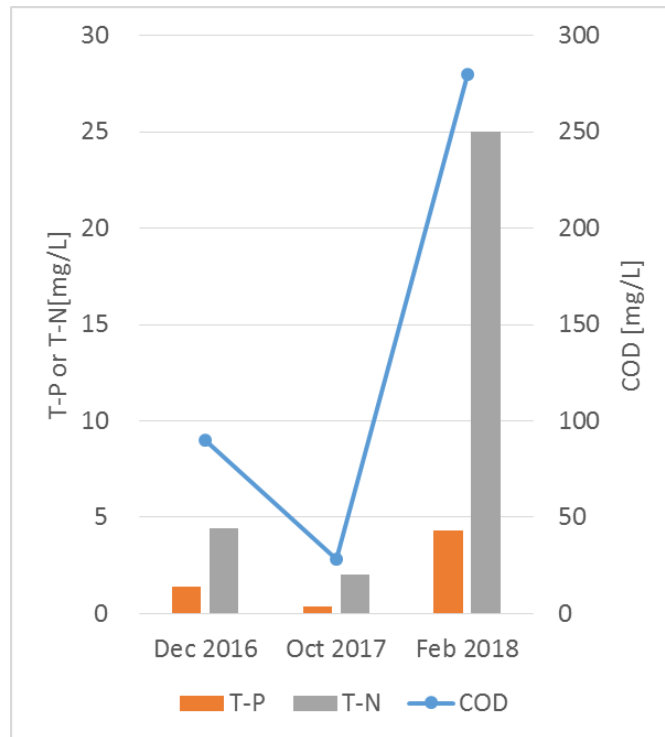
condition, the influent nutrients are further accumulated in the lake. It will increase algae and phytoplankton and result in internal organic production, which accelerates eutrophication. There is no doubt that the lake is eutrophic, even hypereutrophic. However the eutrophication mechanism in the lake is not clear and complicated. Since the water quality in the lake has changed or fluctuated dramatically over time or with seasons, more monitoring data will be necessary to examine the mechanism of water pollution in the lake.

- The creek flowing through U Shwe Taung Bridge, which is a confluence of Pa Yan Taw creek, Let Khot Pin stream and Columbo creek, is one of the major pollution paths to Taung Tha Man Lake. Among these creeks, the pollution loads of organic material and nutrients were the highest in Pa Yan Taw creek except the total nitrogen in the dry season. This implies that the Pa Yan Taw creek basin would have the highest priority for pollution control measures among these three basins in order to reduce the load to Taung Tha Man Lake. Pollution control measures based on pollution load are to be discussed in Output 4.
- In addition to BOD and COD, moderate levels of oil and grease (max. 10 mg/L) and phenols (max. 0.06 mg/L) were detected from these creeks, which are considered to originate from the domestic wastewater and industrial wastewater.
- Harmful levels of toxic substances for human health such as heavy metals were not detected.

Table 2.4-13 Nutrients Level in Taung Tha Man Lake

Location Name		Total Phosphorus		Total Nitrogen	
		Oct 2017	Feb 2018	Oct 2017	Feb 2018
N-TTML		0.38	4.3	2.0	25
S-TTML		0.36	1.7	1.7	9.2
Comparison with Japanese Environmental Standard (lake) for reference					
I	Conservation of natural environment	0.005 mg/L or less		0.1 mg/L or less	
II	Water supply for purify water using filters and other simple means, fishery for salmon/troun, sweetfish, bathing etc.	0.01 mg/L or less		0.2 mg/L or less	
III	Water supply for purify water using pre-treatment and other advanced methods	0.03 mg/L or less		0.4 mg/L or less	
IV	Fishery for smelt etc.	0.05 mg/L or less		0.6 mg/L or less	
V	Fishery for smelt etc., industrial water, agricultural water, and conservation of the environment	0.1 mg/L or less		1 mg/L or less	
Remarks	1 Standard values are based on daily average values. 2 Standard values for total phosphorous are not applicable to water for agricultural use.				

Source: JET



Source: JET

Figure 2.4-8 Water Quality Changes in Northern Taung Tha Man Lake

(2) Develop water quality survey reports

A series of seminars on the development of water quality survey reports were organized for the technical staff of ECD (HQ office, Yangon Regional Office and Mandalay Regional Office), YCDC (PCCD and WSD) and MCDC (WSD and CD) and was conducted from November 2017 to February 2018 in order to provide an opportunity to evaluate the survey results based on their own survey objectives and to develop technical reporting skills in the area of water environmental management. The C/P staff involved in Output 2 activities were divided into five groups (ECD group, PCCD-YCDC group and WSD-YCDC group for Hlaing River basin and ECD group and MCDC group for Doke Hta Waddy River basin), and they developed their own water quality survey reports in line with their duty of water environmental management and interest of each C/P organization. Another water quality report was developed by JET in order to present the comprehensive survey results.



Seminar in Yangon

Seminar in Mandalay

Source: JET

Figure 2.4-9 Photographs of Seminar on Development of Water Quality Survey Report

2.4.10 Issues and Suggestions Identified through Output 2 Activities

This section summarizes the key issues identified in relation to Output 2 and the suggestions of JET on the issues.

(1) Improvement of Monitoring Data Quality in Myanmar

Issues: The quality control of survey data was a big challenge in the first half of the project as described in Section 2.4.8. A series of validation processes of analytical data revealed that the accuracy and precision of the results from local laboratories were not always good enough to evaluate water environmental quality. The suspected errors were likely caused by improper analytical methodologies and/or performance at laboratories. For example, some laboratories apply a simple and quick analysis method, but it was sometimes insufficient considering the monitoring purpose and the nature of the water sample. Even if the laboratory applies a reasonable analysis method, there are other difficulties in conforming to each step of the procedure and requirement specified in the original analysis method due to lack of understanding of the method, as well as insufficient skill and unavailability of a reagent, apparatus and equipment. Furthermore, there is no national accreditation system to judge the performance of laboratories. The capacity improvement of laboratory in Myanmar is one of key challenges to acquire reliable data.

Suggestions: The technical guideline and guidance to environmental analysis laboratories should be provided by ECD. The required measures include the standardization of environmental analytical

methodologies of laboratories and establishment of a wide range of QA/QC (Quality Assurance/Quality Control) system that will ensure appropriate data management in a laboratory. The monitoring method should be specified for each environmental parameter once the national surface water quality standard is stipulated. The QA/QC activities include an implementation of proficiency test and cross-check, as well as establishment of a quality management system required by an accreditation system of laboratories, such as ISO17025. In addition, it is also crucial to obtain more reliable environmental surface water quality data in wider areas in Myanmar so that the obtained data at specific site can be compared with the data of different area or time, which will help validate the monitoring data.

(2) Development of Proper Water Environmental Standard

Issues: Since a surface water quality standard has not been set in Myanmar, it is difficult for relevant parties including environmental authorities to have a common understanding of desirable water quality in the target water body. The environmental standard is important to assess water quality based on the surface water quality standard, and then to implement environmental management measures necessary to achieve the standard.

Suggestions: National Environmental Quality Standards including surface water quality standard is under development by ECD/MONREC according to Article 10 of the Environmental Conservation Law (Law No.9, 2012). The surface water quality standard should have proper criteria to characterize water quality under different water usage, and also financially and technically enforceable with the capacity of monitoring organization. It is recommended to utilize the monitoring data acquired from water quality surveys under Output 2 to establish a proper surface water quality standard in Myanmar.

(3) Regular Surface Water Monitoring

Issues: It is essential that the national and local governments monitor the water qualities of public waters, and obtain spatial and historical data for making administrative decisions. However, there are no laws or rules that stipulate the specific mandate or responsibilities of water quality monitoring in the public water bodies yet. In addition, a nation-wide and region-wide water quality monitoring has not been conducted by the national and the local governments for water environment conservation and management. Regarding technical aspects, it has to be admitted that the spatial and temporal changes of surface water quality in the target water bodies in the project were not clear in detail. The water quality data might have been affected by a specific event, such as soil erosion, wastewater discharged temporarily, sand excavation activities, etc. In addition, the water quality would have not only seasonal variation, but also other variations at monthly or daily frequency. Only two-times-per-year sampling survey cannot reveal the mechanisms and reasons of such variations. More sampling frequency to acquire at least monthly data for representative points and parameters will be required in terms of environmental water quality monitoring

Suggestions: It is suggested that the regular water quality monitoring be planned, conducted and reported by responsible authorities. According to Article 13 of the Environmental Conservation Law (2012), ECD is developing a nation-wide environmental monitoring program. Under such national program and instruction, regional ECDs will be expected to develop a detailed monitoring plan for the region, conduct the survey, and report the results to ECD Headquarters and other relevant parties. Such comprehensive monitoring program should be implemented regularly. Furthermore, investigations of detailed mechanism of water pollution are required in specific areas, such as a tidal reach area of Hlaing River and Taung Tha Man Lake. Variations in water qualities in cross/longitudinal sections in daily and monthly tidal cycles in different season should be investigated to clarify how the water quality changes by tidal current in the Hlaing River. The eutrophication mechanism in Taung Tha Man lake also has not been investigated: how the nutrients inflow to the lake, how the oxygen in the water is consumed, and how the nitrogen and phosphorus are cycled among the sediment, water, phytoplankton and other medium need to be investigated.

2.5 Output 3 – Database Development

This output aims to develop a databases for pollution sources and river water qualities. Table 2.5-1 summarizes the output, activities and indicators of Output 3. According to the original PDM and the PO, six activities were to be implemented to achieve the output. However, existing data and information were too limited to develop the databases, and Activity 3-4 “To collect additional information required to develop the database” was added when the PDM and PO were amended in December 2015. Also, one of the indicators of Output 3 was revised during the Mid-term Review so that the indicators cover the database of Output 3.

Table 2.5-1 Activities and Indicators of Output 3

Output 3	Database of water pollution sources and river water quality is developed.
Activities	3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database
Indicator	At least 150 factories’ information is accessible on the database. Results of water quality survey is accessible on the database

Source: JET based on amended PDM

2.5.1 Collect and Sort out the Information on Water Pollution Sources which was Collected by the Activity 1-1, Inspection Results and the Water Quality Survey Results (Activity 3-1)

In 2015 and 2016, existing information on pollution sources, such as lists of factories that discharge wastewater in Hlaing River basin and Doke Hta Waddy River basin, was collected from YCDC and MCDC. In Yangon, YCDC had collected information from each industry using PCCD’s inspection form shown in Table 2.5-3 as part of YCDC’s effort to manage pollution and improve business licensing. The filled inspection forms were available in hard copy only, and in 2015, in order to develop a trial database, YCDC and JET digitized information for 68 factories that discharge wastewaters and located in Hlaing Tharyar, Shwe Linban, and Shwe Pyi Thar Industrial Zones (IZs) in Hlaing River Basin.

Table 2.5-2 Inspection Form of YCDC-PCCD

Inspection Form of Environmental Pollution Status concerning water pollution caused by industrial waste discharged from Industrial Zones in YCDC boundary area	
	(-----) Industrial Zone
	(-----) Factory
1. Name of Factory	-----
2. Name of Owner/ Address/Contact No	-----
3. Area	-----
4. Raw Material	-----
5. Production Capacity (daily)	-----
6. Water resource/Water use	-----
7. Mixing Chemical Substances	-----
8. Energy Consumption	-----
9. Type of Filtration Tank	-----
10. Size of Filtration Tank	-----
11. Current waste water quality discharged from factory (2012-2014)	
(A) BOD (Biological Oxygen Demand)	-----
(B) COD (Chemical Oxygen Demand)	-----
(C) TS (Total Solid)	-----
(D) SS (Suspended Solid)	-----
(E) pH	-----

(F) Temperature C -----
 (G) Other Contents -----
 12. Whether measuring weight of solid waste at the time of departure from factory or not
 If yes, -----, If no, -----
 List of solid waste amount (monthly or annual) in (ton or m³)
 (1) -----
 (2) -----
 (3) -----
 etc.
 13. Solid waste management

Type of solid waste	Reuse	Recycle	Dispose at factory	Dispose at other place (dumping site/ incinerator)

Other related document of solid waste disposal (e.g., Name of solid waste disposal/treatment factory and authorized organization, weighting of solid waste)
 14. Name of Contact Person from factory/Address/Signature

Source: YCDC

Similar efforts were made to collect relevant information in Mandalay in 2015. By this time MCDC had already been trying to construct a centralized wastewater treatment facility in the south of Pyi Gyi Tagon IZ, and a 10-inch pipeline had been laid out to collect wastewater from major factories. Furthermore, the major fish kill in Taung Tha Man Lake in 2015 prompted MCDC and other organizations to implement inspection of factories in the area. Thus, some data were available from MCDC.

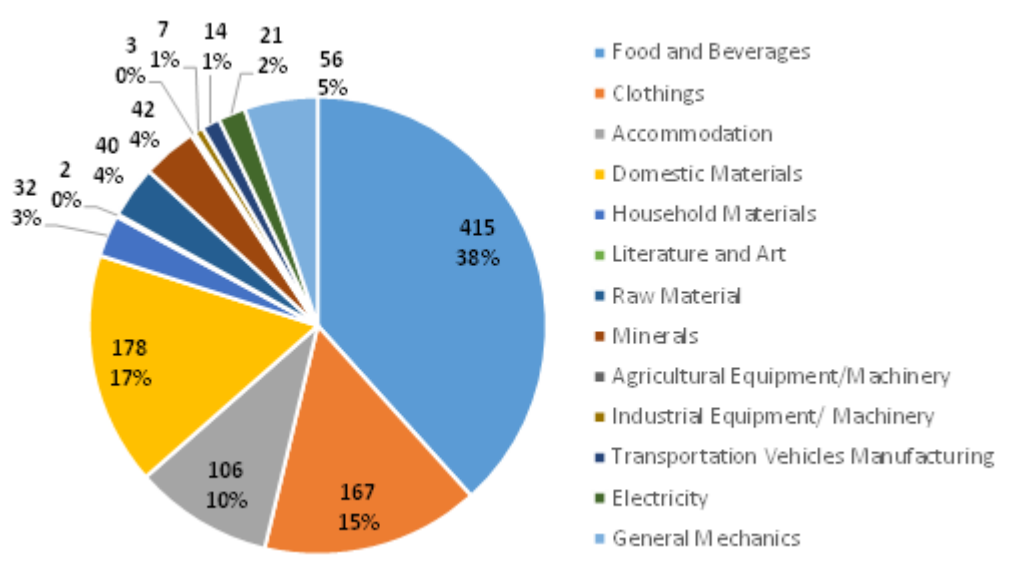
In addition, DISI had a digitized dataset of registered businesses and similar information was generally available from industrial zone management committees (IZMCs). These data sets were obtained by July 2016 from DISI in Yangon and Pyi Gyi Tagon IZ in Mandalay. The information collected by the end of December 2015 and by July 2016 is shown in Table 2.5-3.

Table 2.5-3 Collected Existing Information

	Until December 2015	From January to July 2016
Hlaing River Basin (Yangon)	<ul style="list-style-type: none"> ● Number of Factories: 68 (only the factory which discharge wastewater) ● Source: YCDC ● Description (Answer for Inspection Form which YCDC prepared) <ul style="list-style-type: none"> - Name of Factory/ Type of Business/ Products - Owner name/ type of ownership - Location - Energy Usage (Horse Power, HP) - Results of some parameters of wastewater, etc. 	<ul style="list-style-type: none"> ● Number of Factories: 1,083 (all factories in the target area) ● Source: DISI (January 2015; collected via ECD Yangon Office) ● Description <ul style="list-style-type: none"> - Name of Factory/ Type of Business/ Products - Owner name/ type of ownership - Location - Registration Number/Registration Date - Investment Value, Yearly Production Value - Energy Usage (Horse Power, HP) - Number of Employee/ Labors, etc.
Doke Hta Waddy River Basin (Mandalay)	<ul style="list-style-type: none"> ● Number of Factories: 97 (only the factory which discharge wastewater) ● Source: MCDC ● Description <ul style="list-style-type: none"> - Name of Factory/ Type of Business/ Products - BOD and pH of wastewater - Water Usage, etc. 	<ul style="list-style-type: none"> ● Number of Factories: 1,276 (all factories in the target area; 1,228 according to DISI) ● Source: Pyi Gyi Tagon Industrial Zone Management Committee (data from DISI were collected later) ● Description <ul style="list-style-type: none"> - Name of Factory/ Type of Business - Owner name - Location (Address)

Source: JET

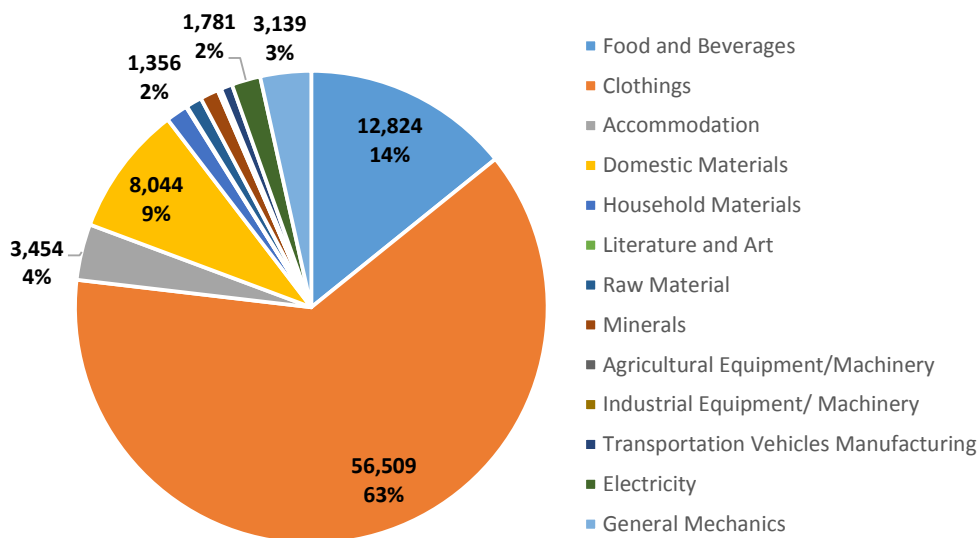
In Yangon, there exist as many as 3,500 factories under control of YCDC, and according to the January 2015 data from DISI, there are 1,083 factories in the six target IZs (see Figure 2.5-1). Food and beverage sector is the most common sector with the share of 38%, followed by clothing with 15%.



Source: JET based on DISI's data

Figure 2.5-1 Number of Factories in Industrial Zones in Hlaing River Basin

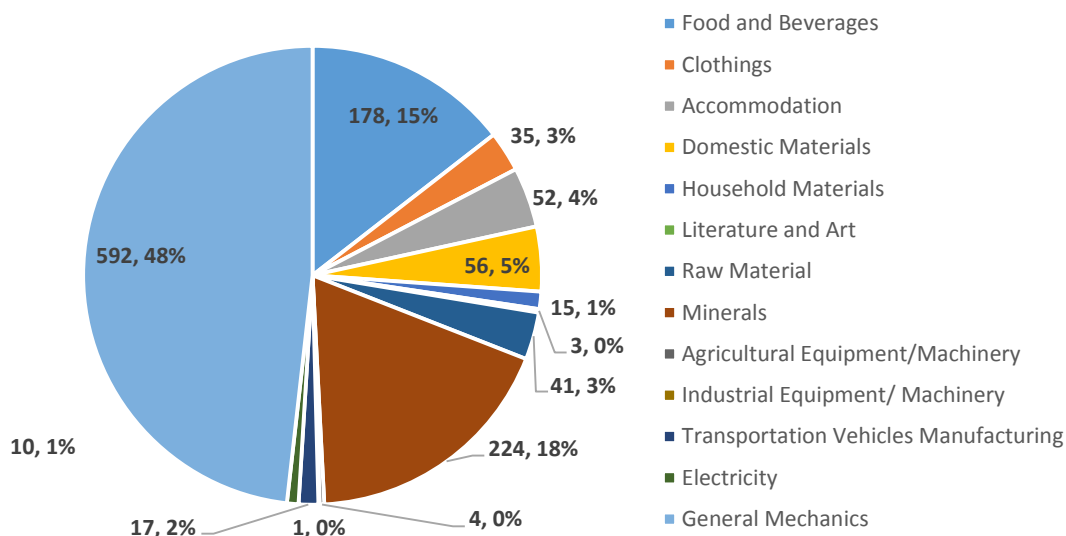
With respect to the number of employees, there were in total 90,211 people working in the 1,083 factories in the IZs, and the clothing sector employs as many as 63% of them.



Source: JET based on DISI's data

Figure 2.5-2 Number of Employees in Industrial Zones in Hlaing River Basin

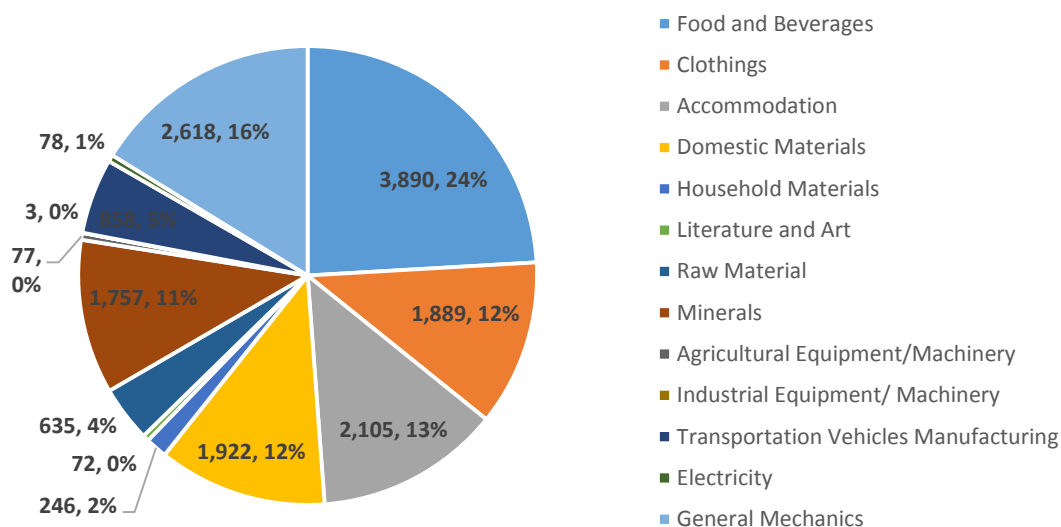
As for Mandalay, there were 1,228 DISI-registered factories in Pyi Gyi Tagon IZ, and the sectoral composition is markedly different from that of Yangon. In the Pyi Gyi Tagon IZ, as many as 48% of the factories are in general mechanics sector, such as small machine shops.



Source: JET based on DISI's data

Figure 2.5-3 Number of Factories in Industrial Zones in Doke Hta Waddy River Basin

The number of employees was also quite different in Mandalay, While the number of factories in Pyi Gyi Tagon IZ (1,228 factories) was similar to those of IZs in the Hlaing River basin in Yangon (1,083), only 16,150 people were employed by factories in Pyi Gyi Tagon IZ, compared to 90,211 in Hlaing River basin. Factories in Pyi Gyi Tagon IZ are much small-scaled than those in IZs in Hlaing River basin.



Source: JET based on DISI's data

Figure 2.5-4 Number of Employees in Industrial Zones in Doke Hta Waddy River Basin

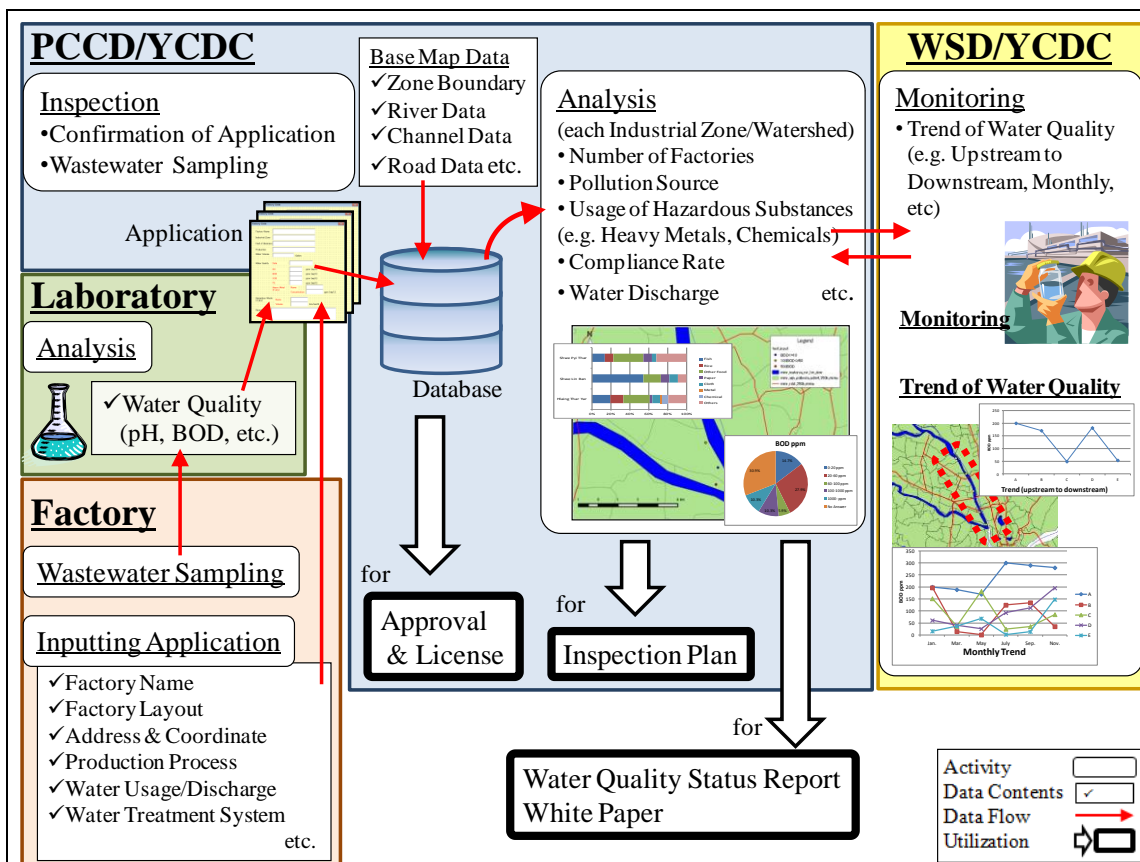
By analyzing the data, it was confirmed that some basic information, such as the name of factory, sector, locations, investment and turnover, etc., was available not only for large factories, but also for small and medium-scale factories. Moreover, ground-level officers of C/P organizations were familiar with the situation of each factory. Nevertheless, it was also found that readily available information did not contain detailed data on environmental management at each factory and accuracy of information was suspicious because it was largely self-declared information. Hence, it was decided to implement a pollution source survey from the summer of 2016.

2.5.2 Develop a System Concept (Activity 3-2)

In 2015 and early 2016, YCDC, MCDC, ECD and JET discussed the development of the system concept for the pollution source database as below.

- Databases consists of 1) pollution source database and 2) surface water quality database.
- Databases are linked with a GIS system to display and analyze geographical information.
- Quantum GIS (Q-GIS), which is a free GIS software with enough basic function for general water environmental management, is adopted.
- Databases are developed in two steps; 1) pilot database based on existing information and 2) database for water environmental management of YCDC and MCDC to be developed using existing data as well as new data and information to be acquired in the project activities.
- Databases are designed in such ways that entering data and updating the database are easy for convenience and sustainability.
- Database will be standardized among local governments as much as possible so that in the future MONREC-ECD can analyze data and compare information from different local governments.

A conceptual design of databases of pollution source, inspection, and analyzed data for PCCD-YCDC has been developed as shown in Figure 2.5-5. It should be noted that when the system concept was discussed, there were systems of business licensing/registration by YCDC, MCDC and DISI, and MONREC issued the EIA procedures in December 2015. However, there was no definite legal requirements for pollution control for which the database could be designed (for details see the section on Output 1). Hence, the pollution control database was designed mainly to analyze the situation of pollution sources and to report the results to the decision makers.



Source: JET

Figure 2.5-5 Conceptual Databases for YCDC-PCCD

2.5.3 Design the Database based on the System Concept (Activity 3-3)

Based on the system concept (see Table 2.5-4), both of pollution source database and surface water quality database were designed and below items can be stored in the format of Microsoft Excel.

Table 2.5-4 Items stored into each Database

Pollution Source Database						
1. Basic Information	-	Factory Name	-	Type of Business	-	Number of Employee etc.
	-	Address/ IZ	-	Product		
	-	Coordinate	-	Area		
2. WWTP	-	Existence				
	-	Type (Primary Treatment)				
	-	Type (Secondary Treatment), etc.				
3. Water Quality of Wastewater		On-site Measurement				
	-	Flow Rate	-	Color	-	Turbidity
	-	Date & Time	-	Turbid	-	EC
	-	Sampling Method	-	Sediment	-	Salinity
	-	Existence of	-	pH	-	DO
	-	Centralized WWTP	-	Water Temperature	-	ORP
	-	Wastewater Type	-	Turbidity		etc.
		Laboratory Analysis				
	-	Chemical Oxygen Demand (COD)				
	-	Total Nitrogen				
	-	Total Phosphorus				
	-	Total Suspended Solids				
	-	Other parameters based on NEQEG (2015)				
Surface Water Quality Database						
1. Basic Information	-	Location Name	-	Date & Time	-	Air Temperature
	-	Coordinate	-	Weather		
2. Surface Water Quality		On-site Measurement				
	-	pH	-	Salinity	-	TDS
	-	Water Temperature	-	Turbidity	-	DO
	-	EC	-	ORP		
		Laboratory Analysis				
	-	Total Suspended Solids	-	Odor	-	Zinc
	-	Total Dissolved Solids	-	Cyanide	-	Chromium
	-	Biochemical Oxygen Demand (BOD)	-	Oil & Grease	-	Hexavalent Chromium
	-	Chemical Oxygen Demand (COD)	-	Total Phosphorus	-	Arsenic
	-	Color (Pt-Co unit)	-	Phosphate	-	Copper
	-		-	Total Nitrogen	-	Mercury
	-		-	Ammonia	-	Cadmium
	-		-	Nitrate Nitrogen	-	Lead
	-		-	Nitrite Nitrogen		etc.
	-		-	Total Coliform		

Source: JICA Expert Team

2.5.4 Collect Additional Information Required to Develop the Database (Activity 3-4)

(1) Outline of Pollution Source Surveys

Because the review of existing information revealed that detailed information on pollution sources, such as water usage, wastewater volume, existing wastewater treatment facilities, measures to minimize wastewater, difficulties factories are facing to manage wastewater, etc. was scarce, it was decided to implement a pollution source survey to gather such information. Table 2.5-5 summarizes the surveys conducted in Period 1 (2016) and Period 2 (2017), and photos from the survey are shown in Figure 2.5-6. Details are available in Pollution Source Survey Report (2018).

Table 2.5-5 Summary of Pollution Source Survey for Collection of Additional Information

Item	Period 1 (2016)	Period 2 (2017)
Purpose /Activity	To collect additional information of pollution source (especially factories in Industrial Zones in the target river basin)	Same as Period 1
Survey Area	- Hlaing River basin in Yangon - Doke Hta Waddy River basin in Mandalay	Same as Period 1
Scope	- Questionnaire Survey: total 200 factories (Yangon and Mandalay each has 100 factories) - Wastewater Sampling and Analysis: total 50 factories (Yangon and Mandalay each has 25 factories) *Wastewater samples were analyzed in Myanmar or Thailand *All target factories of wastewater sampling and analysis are included in the target factories of the questionnaire survey.	- On-site investigation of wastewater management: total 50 factories (Yangon and Mandalay each has 25 factories) - Estimation of wastewater flow rate: total 50 factories (Yangon and Mandalay each has 25 factories, same factories of on-site investigation) - Wastewater Sampling and Analysis: total 50 factories (Yangon and Mandalay each has 25 factories, same factories of on-site investigation) *18 wastewater samples out of 50 were analyzed not only in Myanmar nor Thailand but in Japan. *Some target factories are overlapped with those in Period 1.
Schedule	- June to first half of August 2016: Finalization of Questionnaire and Terms of Reference (TOR) for Sub-Contract Work - 2 nd half of August to first half of Nov 2016: Implementation of Survey (both Questionnaire Survey and Wastewater Sampling)	- Jul 2017: Finalization of Terms of Reference (TOR) for Sub-Contract Work - 2 nd half of August to Sep 2017: Implementation of Survey
Attendance	- Yangon: Staff from PCCD in YCDC and ECD Yangon - Mandalay: Staff from WSD in MCDC, ECD Mandalay	Same as Period 1
Others	Workshops for explanation and prior announcement to target factories were held as follows. In Yangon, PCCD in YCDC, ECD Yangon, each Industrial Zone Management Committee and JET, on the other hand, in Mandalay, WSD in MCDC, ECD Mandalay, Industrial Zone Management Committee and JET. [Yangon] - 24 Aug 2016 for Shwe Pyi Thar and Wataya Industrial Zones - 5 Sept 2016 for Hlaing Tharyar and other Industrial Zones [Mandalay] - 23 Aug 2016 for all target factories in Mandalay	Workshops for explanation and prior announcement to target factories were held as follows. In Yangon, PCCD in YCDC, ECD Yangon, each Industrial Zone Management Committee and JET, on the other hand, in Mandalay, WSD in MCDC, ECD Mandalay, Industrial Zone Management Committee and JET. [Yangon] - 10 Aug 2017 for all target factories in Yangon [Mandalay] - 15 Aug 2017 for all target factories in Mandalay

Source: JICA Expert Team



Source: JET

Figure 2.5-6 Working View of Pollution Source Survey (Sub-contract Work)

(2) Questionnaire Survey

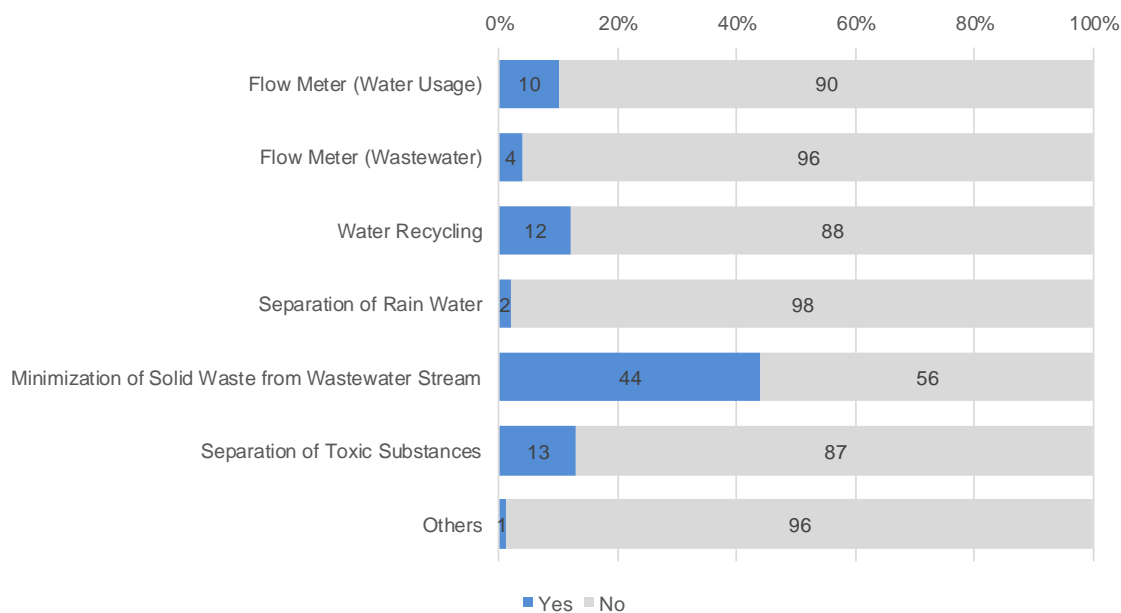
In 2016, a questionnaire survey of 200 factories, 100 factories in the Hlaing River basin and 100 factories in the Doke Hta Waddy River basin, was conducted. The target factories of the questionnaire survey were selected through discussions among YCDC/MCDC, ECD and JET focusing on major factories considering sectors, environmental impacts, and locations of factories. The survey was carried out by using a questionnaire in Myanmar language, prepared jointly by relevant authorities, JET and the Norwegian project for hazardous waste management. In the questionnaire, there were 47 questions in 6 categories to examine operations as well as environmental management of the target factories:

- Basic Information (15 questions)
- Raw Materials and Utility (4 questions)
- Layout of Factory and Manufacturing Process (2 questions)
- Wastewater (9 questions)
- Solid Waste (4 questions)
- Environmental Management (13 questions)

The questionnaire was hand-delivered to each of the 200 target factories, answered by the management of each factory, and collected during the visit to each factory by the joint team of the ECD, YCDC, MCDC, JET and a local consulting firm to which the survey was contracted out.

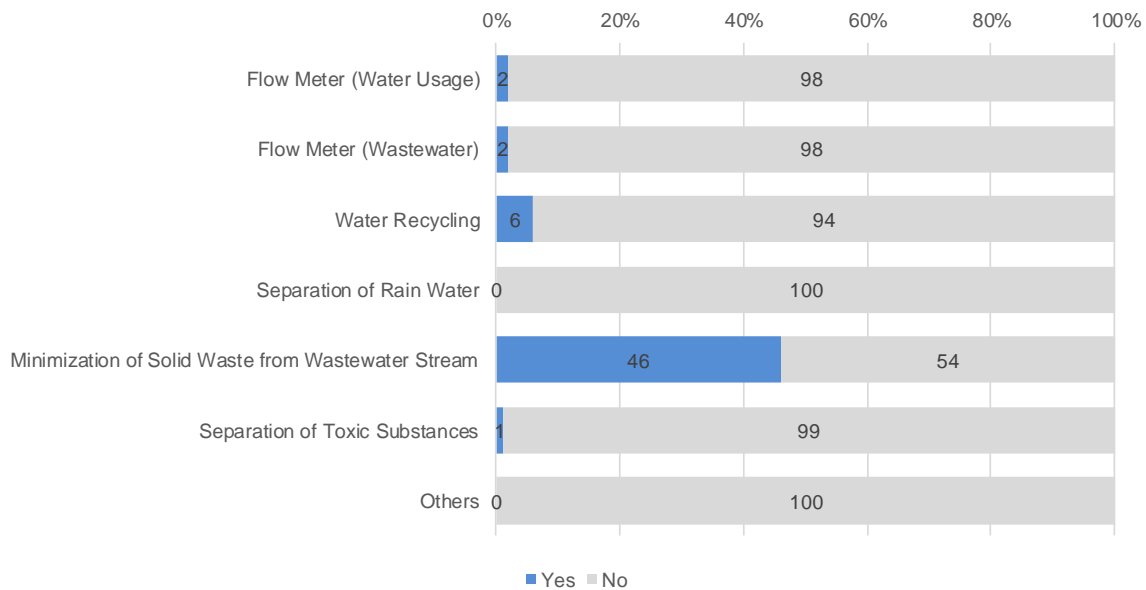
The results of the survey revealed only the conditions of the 200 target factories, and not all the factories in the areas. Nevertheless, the results were quite illustrative about the current environmental management in factories in Yangon and Mandalay. The questionnaire was quite comprehensive and it is not possible to present all the results here. Thus, only selected data are shown below. For details, please see the Pollution Source Survey Report (2018).

With respect to measures to minimize pollution, it was found that only 10% of factories in Yangon and 2% in Mandalay are equipped with water meters to monitor water usage (see Figure 2.5-7 and Figure 2.5-8). Apparently many factories are not aware of how much water they are consuming. On the other hand, about a half of 200 factories replied that they are trying to minimize solid waste from entering wastewater stream.



Source: JET based on Pollution Source Survey in 2016

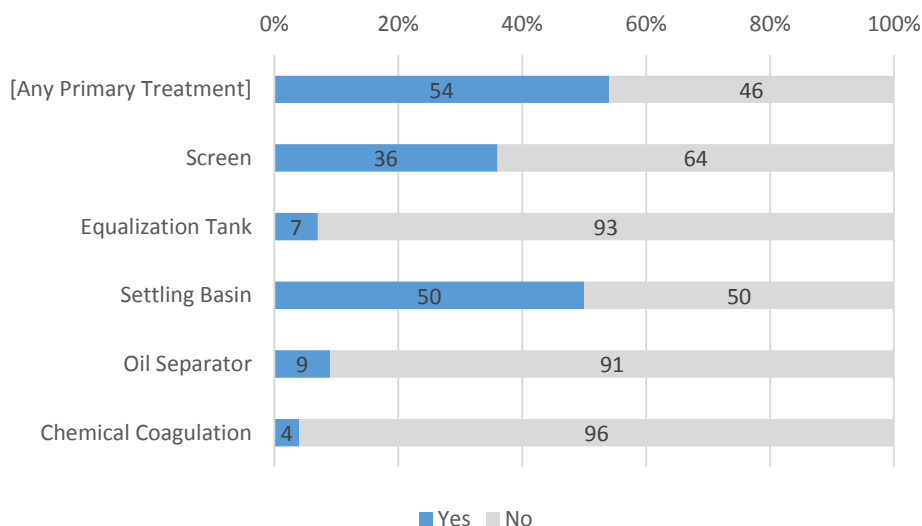
Figure 2.5-7 Measures to Minimize Water Pollution in Factories in the Hlaing River Basin



Source: JET based on Pollution Source Survey in 2016

Figure 2.5-8 Measures to Minimize Water Pollution in Factories in Doke Hta Waddy River Basin

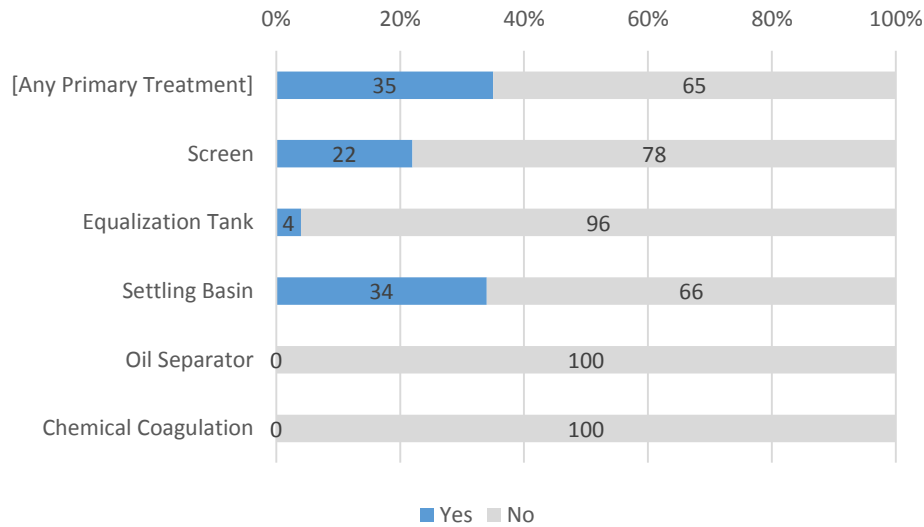
One of the key questions related to wastewater treatment was how many percent of the factories are equipped with primary treatment facilities¹ mainly to remove solids. According to the results of the questionnaire survey in 2016, 54% of 100 factories surveyed in the Hlaing River basin are equipped with some kind of primary treatment facilities, and simple settling basin to remove settleable solids is the most common primary treatment facilities, as shown in Figure 2.5-9. In Pyi Gyi Tagon IZ, only 35% of the factories are equipped with a primary treatment facility (see Figure 2.5-10). Screens to remove large solids and settling basin to remove settleable solids are among the most simple wastewater treatment facilities, and this means roughly half of factories have essentially no treatment facilities at all.



Source: JET based on Pollution Source Survey in 2016

Figure 2.5-9 Status of Primary Treatment Installation in the Hlaing River Basin

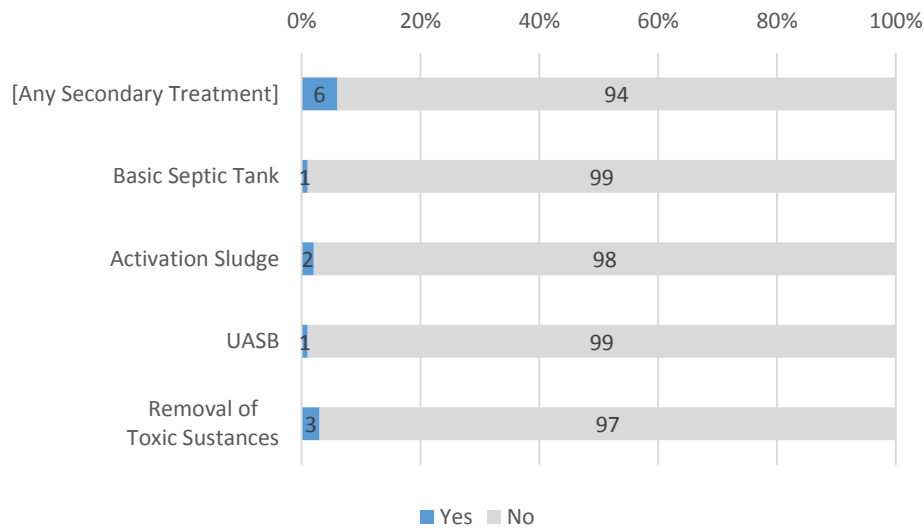
¹ In this survey, facilities, such as equalization tank and chemical coagulation, were included in primary treatment, though primary treatment usually refers to physical removal of solid by screening and settling.



Source: JET based on Pollution Source Survey in 2016

Figure 2.5-10 Status of Primary Treatment Installation in the Doke Hta Waddy River Basin

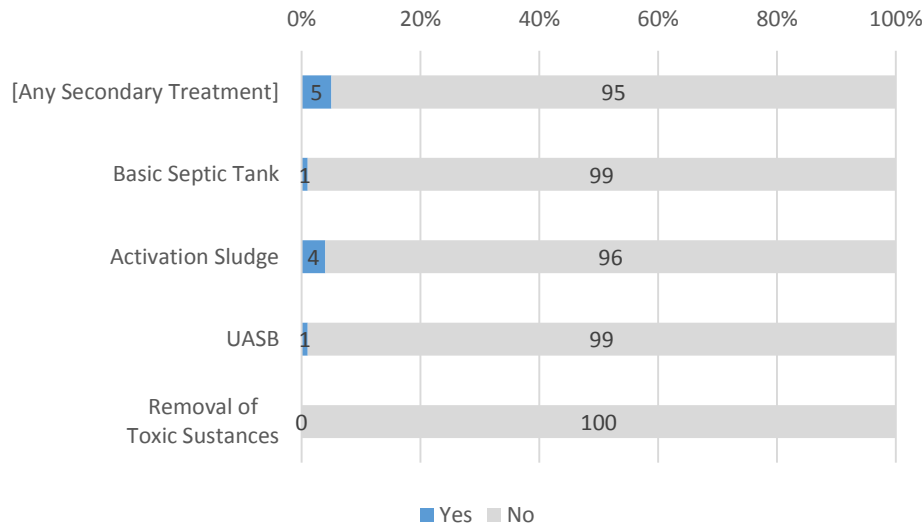
With respect to the secondary treatment¹ to remove organic matter, 6% of the factories in IZs in Hlaing River basin were equipped with facilities in 2016 (see Figure 2.5-11). In Pyi Gyi Tagon IZ in Mandalay, 5 % of factories were equipped with facility (see Figure 2.5-12).



Source: JET based on Pollution Source Survey in 2016 and 2017

Figure 2.5-11 Status of Secondary Treatment Installation in the Hlaing River Basin

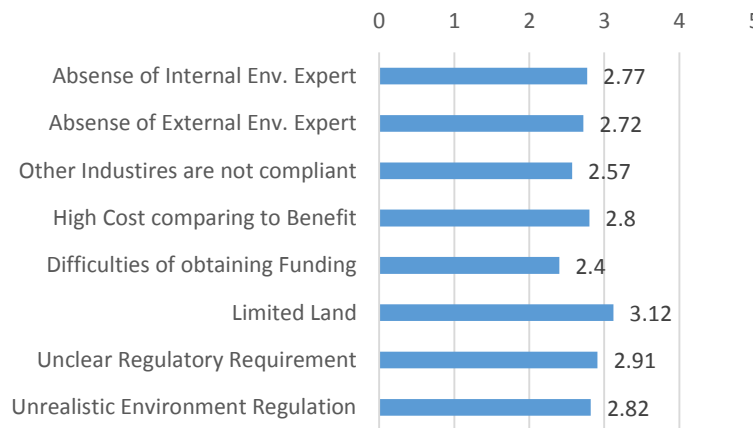
¹ In this survey, basic septic tank was included in secondary treatment. Also, removal of toxic substances was included in this category for simplicity, although the process of removal of toxic substances is often chemical and not biological.



Source: JET based on Pollution Source Survey in 2016 and 2017

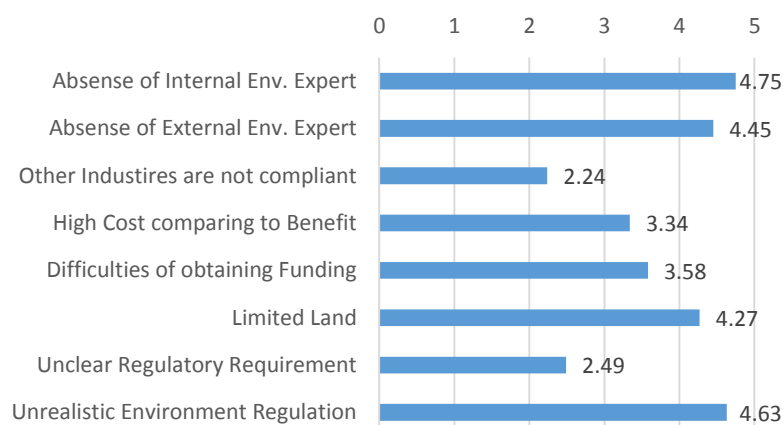
Figure 2.5-12 Status of Secondary Treatment Installation in the Doke Hta Waddy River Basin

Another interesting question is the difficulties these factories are facing to install an adequate wastewater treatment plant (WWTP). There could be many reasons, such as absence of internal or external expert, other factories are not compliant, high cost compared with benefit, limited land, etc. The results of factories in the Hlaing River basin are mixed and none of the reasons stood out as the main reasons common to most factories (see Figure 2.5-13). In Mandalay, lack of expertise, unrealistic regulation and limited land appeared to be the main difficulties factories are facing to install treatment facilities (see Figure 2.5-14).



Source: JET based on Pollution Source Survey in 2016

Figure 2.5-13 Difficulties of WWTP Installation in the Hlaing River Basin



Source: JET based on Pollution Source Survey in 2016

Figure 2.5-14 Difficulties of WWTP Installation in the Doke Hta Waddy River Basin

It is worth pointing out that the number of factories equipped with wastewater treatment facilities are increasing rapidly in recent years. Although data are limited to 48 major factories in Yangon and Mandalay at which wastewater samples were collected in both years. i.e., 2016 and 2017, the number of factories that have primary treatment facilities increased from 35 to 43 and secondary treatment from 6 to 12 (see Table 2.5-6). Nevertheless, many factories are yet to install sophisticated wastewater treatment facilities.

Table 2.5-6 Increase in Factories with Treatment Facilities during 2016-2017

City	Yangon		Mandalay		Total	
	2016	2017	2016	2017	2016	2017
Number of factories investigated both in 2016 and 2017	25		23		48	
Any Primary Treatment	21	22	14	21	35	43
Screen	11	13	5	7	16	20
Equalization Tank	5	6	2	7	7	13
Settling Basin	19	22	14	20	33	42
Oil Separator	4	4	0	0	4	4
Chemical Coagulation	3	5	0	0	3	5
Any Secondary Treatment	3	9	3	3	6	12
Basic Septic Tank	0	3	1	1	1	4
Activated Sludge	1	6	2	2	3	8
UASB	1	1	0	1	1	2
Removal of Toxic Substances	2	5	0	2	2	7

Source: JET

(3) Wastewater Sampling and Analysis

From the target factories of the questionnaire survey, 50 factories that were major dischargers and/or representative of the industrial sectors were selected, and wastewater samples were collected and analyzed in the summer of 2016. The analytical parameters were selected based on NEQEG (2015) of corresponding sectors so that % of factories meeting the guideline could be evaluated. The results in 2016 provided valuable insight into the status of environmental control at factories in the target areas. However, some of the results, such as the analytical results of total nitrogen, were deemed suspicious. Thus, a follow-up survey was implemented from August to September 2017 targeting 50 factories. Basically the same factories from which the wastewater samples were collected in 2016 were chosen, but some adjustments were made as explained below. This time some effluent samples were analyzed not only in Myanmar and Thailand but also in Japan to confirm data reliability. The results are

summarized below. Details of both surveys in 2016 and 2017 are available in the “Pollution Source Survey Report” .

1) Comparison of Results with NEQEG

Table 2.5-7 and Table 2.5-8 show effluent concentrations of BOD and COD. The values of NEQEG for BOD and COD are 50 mg/L for BOD and 250 mg/L, respectively for most industrial sectors. It should be noted that NEQEG (2015) was not legally-binding even at the time of the follow-up survey in 2017, and thus these factories had no obligation to satisfy the guideline. Nevertheless, it was of interest to know whether these factories need new investment, such as construction of wastewater treatment facilities and/or introduction of cleaner manufacturing processes to meet the guideline in the future. Although, some target factories in Period 2 are different from those in Period 1, there was no difference in the trend that most of the wastewaters do not meet the guideline values for BOD and COD. Table 2.5-9 summarizes the results of comparison with the guideline values for BOD, COD, total nitrogen (TN) and total phosphorus (TP) which are different by sector. In 2017, 89% (39 out of 44), 64% (28 out of 44), 43% (17 out of 40) and 45% (20 out of 44) of factories investigated exceeded the NEQEG (2015) values for BOD, COD, TN and TP, respectively.

Table 2.5-7 Comparison Results of BOD (Period 1 and Period 2)

BOD	1st Period			2nd Period		
	Yangon	Mandalay	Total	Yangon	Mandalay	Total
0 – 20 mg/L	6	2	8	1	0	1
20 – 50 mg/L	1	1	2	4	0	4
50 – 100 mg/L	1	2	3	8	0	8
100 – 1,000 mg/L	10	6	16	12	16	28
1,000 – mg/L	5	8	13	0	9	9
No Data	2	6	8	0	0	0
Total	25	25	50	25	25	50

Source: JET

Table 2.5-8 Comparison Results of COD (Period 1 and Period 2)

COD	1st Period			2nd Period		
	Yangon	Mandalay	Total	Yangon	Mandalay	Total
0 – 100 mg/L	9	1	10	0	0	0
100 – 250 mg/L	2	2	4	1	1	2
250 – 1,000 mg/L	7	4	11	6	2	8
1,000 – 2,000 mg/L	1	1	2	15	9	24
2,000 – mg/L	4	11	15	3	13	16
No Data	2	6	8	0	0	0
Total	25	25	50	25	25	50

Source: JET

Table 2.5-9 Comparison Results with NEQEG (Period 2)

Category	BOD	COD	TN	TP
Equal to or under NEQEG Value	5	16	23	24
Over NEQEG Value	39	28	17	20
No Evaluation	6	6	10	6
Total	50	50	50	50

1) "Pulp and / or Paper Mills" have NEQEG value with different unit as "kg/Air dried metric ton" and some sectors do not have NEQEG value for these parameter.

Source: JET

2) Difference of Wastewater Quality by Sector

In the 2016 survey, differences in wastewater quality were investigated by sector, but some of the data were not deemed reliable. Thus, in the follow-up survey in 2017, wastewaters from in total 18 factories representing different sectors, such as distillery, textile manufacturing, tanning and leather finishing, etc., were analyzed at a certified laboratory in Japan. They were selected considering their potential impacts on water environment (e.g. volume of wastewater, concentration of main parameters such as BOD or COD, existence of heavy metal pollutants, etc.). Although the number of investigated factories in each sector was very limited (see Table 2.5-10), the results confirmed the general characteristics of different sectors as follows:

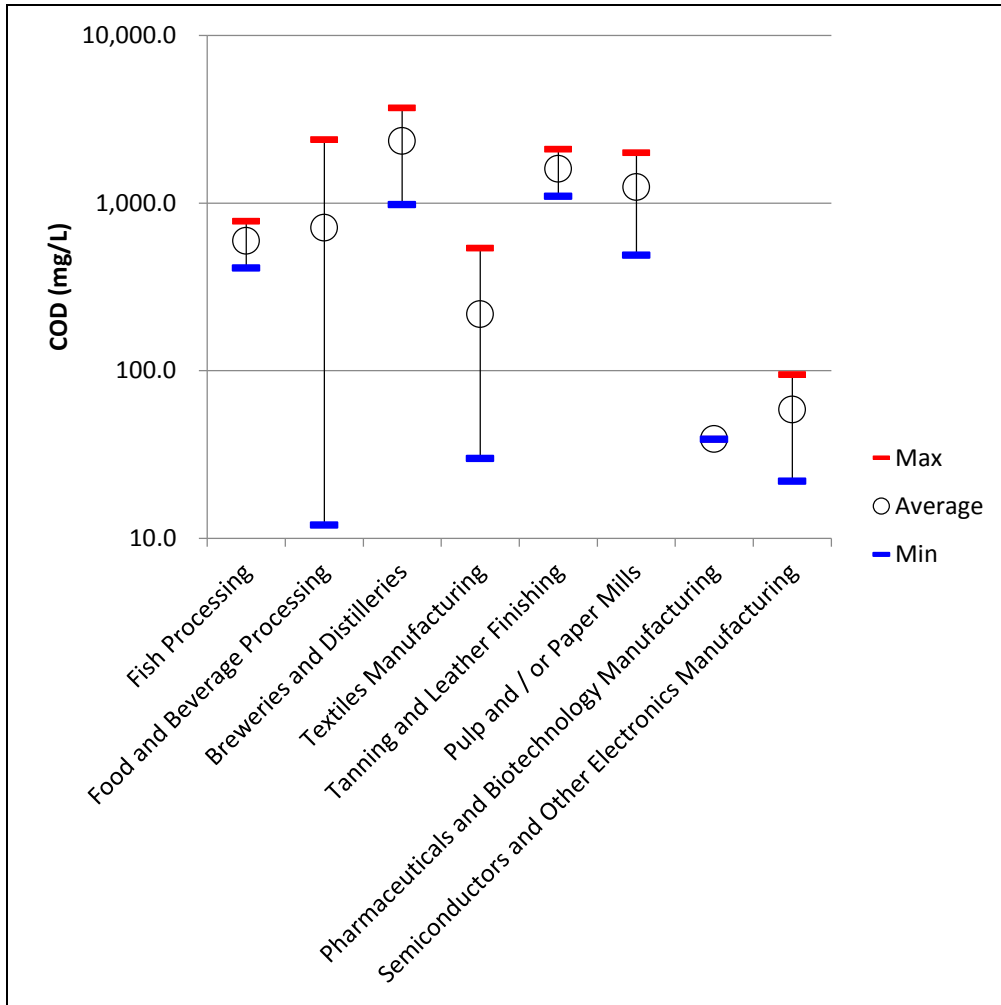
- There is a trend that “Breweries and Distilleries”, “Tanning and Leather Finishing” and “Pulp and / or Paper Mills “ sectors have higher COD concentration than other sectors.
- “Tanning and Leather Finishing” and “Fish Processing” sectors have higher TN than other sectors. In addition, both two factories of these sectors have similar value.
- “Fish Processing” sector also has higher TP concentration. “Breweries and Distilleries”, “Food and Beverage Processing” and “Tanning and Leather Finishing” also have higher TP concentration, however, results in each sector varied in wide range.
- Phenols (4.6 mg/L and 9.6 mg/L) and sulfate (410 mg/L and 550 mg/L) were detected from both factories of “Tanning and Leather Finishing” sector investigated.
- Total Chromium (4.5 mg/L) was detected from the wastewater of one of the “Tanning and Leather Finishing” factories. It was noted that many tanneries in Myanmar employ vegetable tanning method.
- Two battery factories were selected as the “Semiconductors and Other Electronics Manufacturing” sector. Lead was detected from the wastewater of one battery factory (6.8 mg/L). On the other hand, Zinc (170 mg/L) and Mercury (0.057 mg/L) were detected from the wastewater of the other one.
- Zinc (0.34 mg/L and 2.7 mg/L) was also detected from the “Textiles Manufacturing” factories, however, the value is lower than that of above battery factory.

*Note that these are logarithmic graphs.

Table 2.5-10 Number of Target Factories for each Sector (analyzed in Japan)

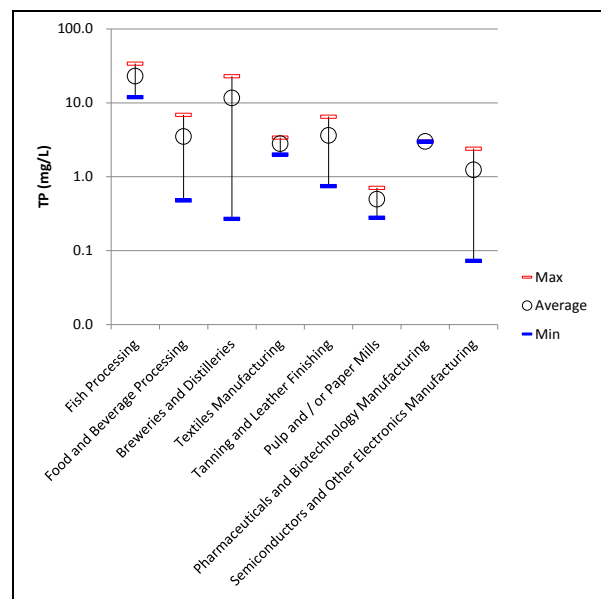
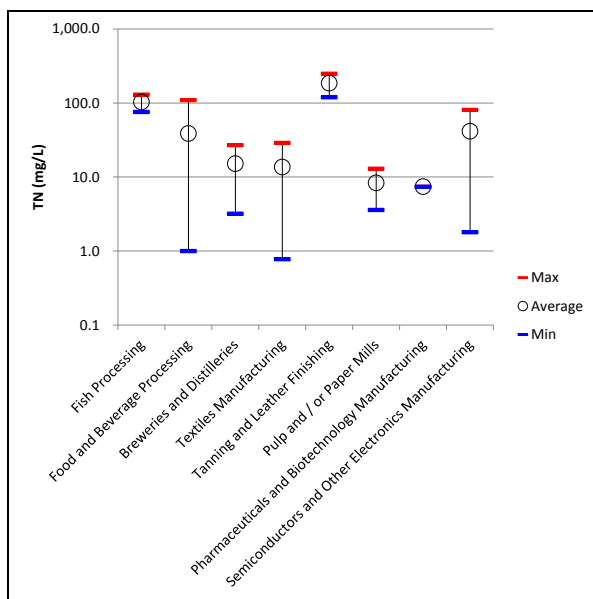
No.	Serial Number (NEQEG)	Sector	Number of Factories
1	2.3.1.3	Fish Processing	2
2	2.3.1.4	Food and Beverage Processing	4
3	2.3.1.8	Breweries and Distilleries	2
4	2.3.2.1	Textiles Manufacturing	3
5	2.3.2.2	Tanning and Leather Finishing	2
6	2.3.3.3	Pulp and / or Paper Mills	2
7	2.3.4.8	Pharmaceuticals and Biotechnology Manufacturing	1
8	2.3.7.5	Semiconductors and Other Electronics Manufacturing * Battery factories were selected.	2
Total			18

Source: JET



Source: JET

Figure 2.5-15 Sectoral Wastewater Analysis Result (COD)



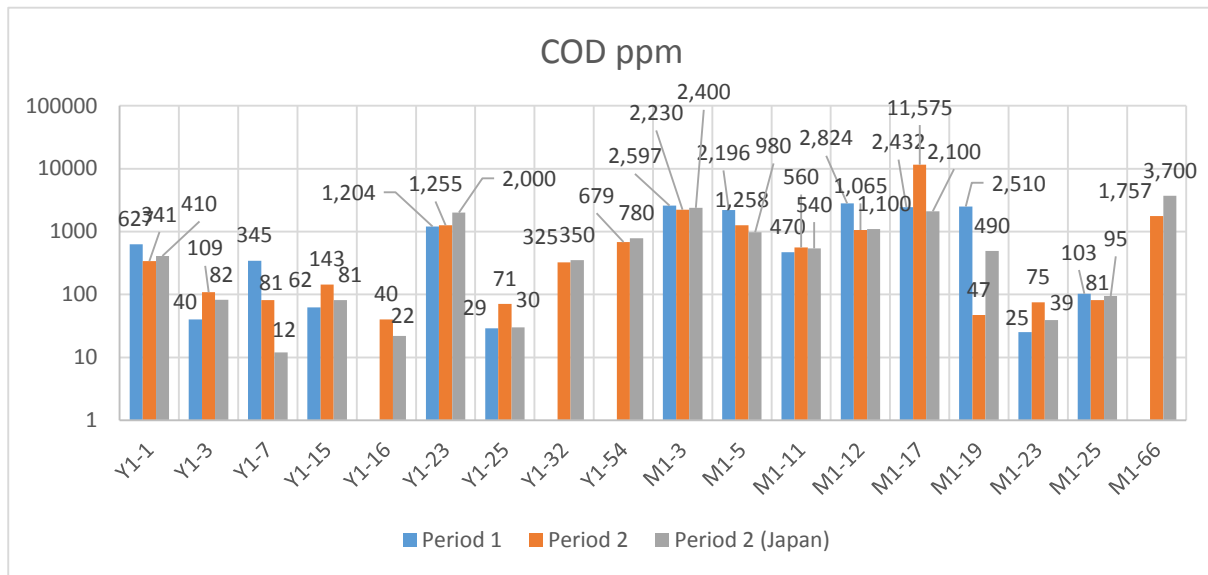
Source: JET

Figure 2.5-16 Sectoral Wastewater Analysis Result (TN and TP)

(4) Comparison Results in 2016 and 2017 (COD, TN and TP)

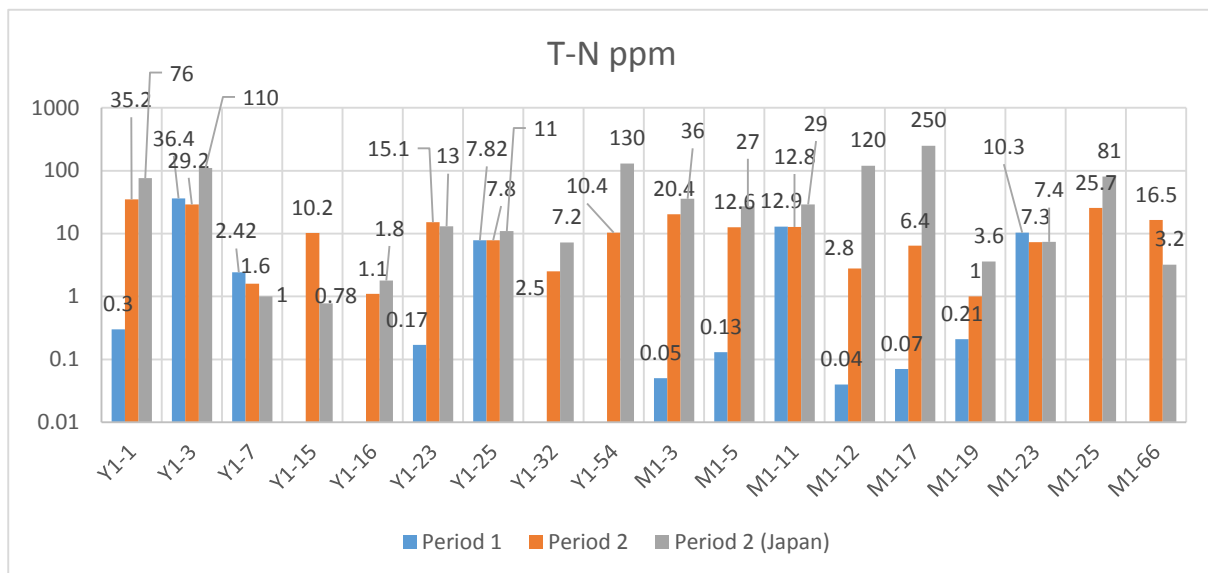
Reliability of analytical data was one of the main concerns in the survey in 2016. Thus, the follow-up survey was designed in such a way that some target factories of wastewater sampling and analysis in 2016 and 2017 overlap so that the analytical results in 2016 in Myanmar/Thailand, those in 2017 in Myanmar/Thailand, and those in 2017 in Japan could be compared. Figure 2.5-17 to Figure 2.5-19 present the results of COD, Total Nitrogen (TN) and Total Phosphorus (TP). Please note that concentrations are shown on logarithmic scale as the data span orders of magnitude.

While COD and TP data are more consistent than TN data, closer examination reveals that variability is significant even for COD and TP. Differences in analytical methodologies and practices of analytical quality control appeared to be the most important reasons for the variability. In order to regulate industrial wastewater using effluent standard, these issues should be resolved first.



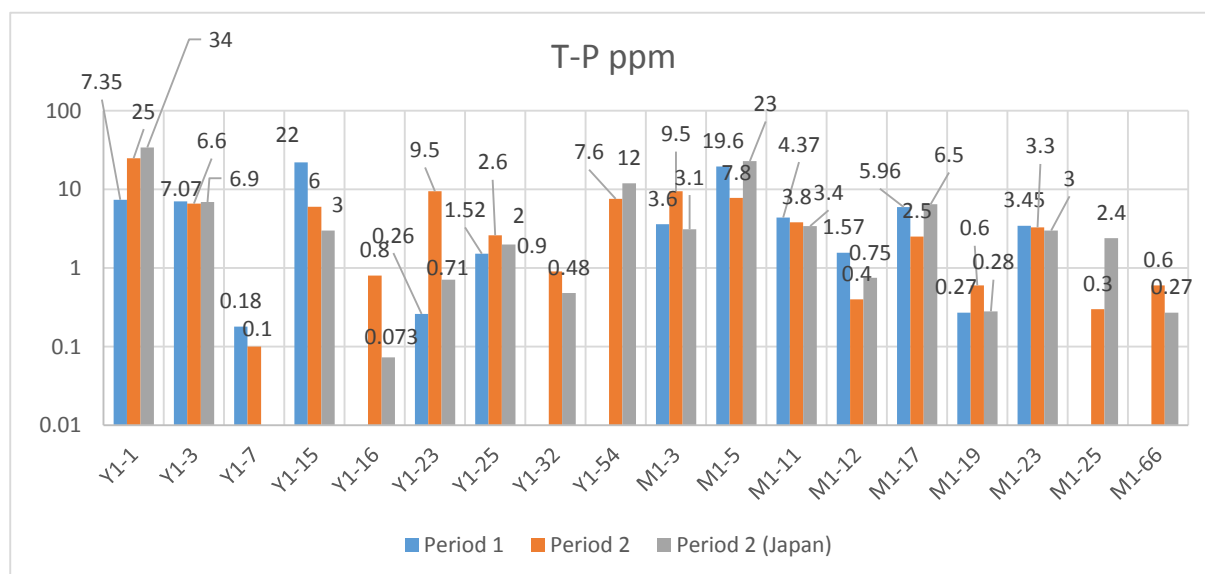
Source: JET

Figure 2.5-17 Results Comparison (COD)



Source: JET

Figure 2.5-18 Results Comparison Result (TN)



Source: JET

Figure 2.5-19 Results Comparison (TP)

2.5.5 Develop the Database (Activity 3-5)

This section summarizes the two kinds of database, “Pollution Source Database” and “Surface Water Quality Database”, developed based on the results of the activities of this project. Table 2.5-11 summarizes these databases.

Table 2.5-11 Summary of Two Databases Developed in the Project

Pollution Source Database (collected through the pollution source survey in Period 1 and 2)						
(Activity 3-4) To collect additional information required to develop the database						
Data Type	Number of Data (Factory)					Remarks
	Total	Yangon		Mandalay		
		Period 1	Period 2	Period 1	Period 2	
(i) Basic Information collected by Questionnaire Survey1)	202	100	0	100	2	Two additional factories were selected as target in Mandalay in Period 2.
(ii)-1 Wastewater Analysis Result by Wastewater Sampling and Analysis (Myanmar/Thailand)	100	25	25	25	25	33 factories (17 factories in Yangon and 16 factories in Mandalay) are overlapped..
(ii)-2 Wastewater Analysis Result by Wastewater Sampling and Analysis (Japan)	18	0	9	0	9	18 factories out of 50 were selected in Period 2.
Surface Water Quality Database (collected through the water quality survey in Period 1 and 2)						
(Activity 2-6) To implement a water quality survey based on the water quality survey plan						
Data Type	Number of Data (Samples)					Remarks
	Total	Yangon		Mandalay		
		Period 1	Period 2	Period 1	Period 2	
(i) Results of On-site Measurement	117	29	20	38	30	1st, 2nd and 3rd surveys were implemented in Period 1, and 4th and 5th surveys were implemented in Period 2.
(ii) Results of Laboratory Analysis	50	0	20	0	30	Samples of the 4th and 5th surveys were analyzed in Myanmar/Japan.

Note 1): Basic Information: e.g. factory name, business type, number of employee, etc.

Source: JET

(1) Pollution Source Database

Based on the results from Activity 3-4, the pollution source database was developed in MS Excel and shapefile format for GIS. Information of 202 factories in total including the analysis results of 100 wastewater samples (50 samples each in 2016 and 2017) are stored in the pollution source database. Table 2.5-12 and Figure 2.5-20 - Figure 2.5-21 show the contents and GIS snapshot of the database.

Table 2.5-12 Contents of Pollution Source Database

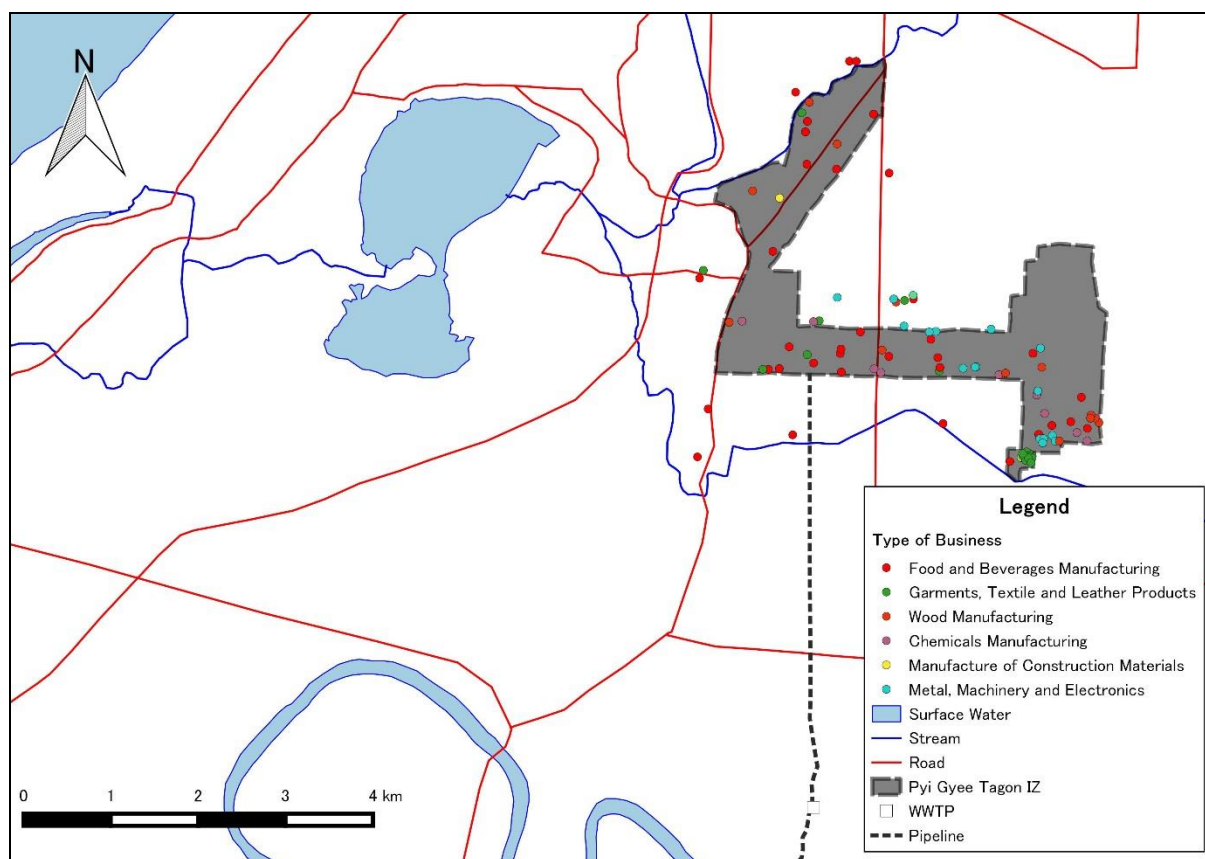
Data Type	Description	Number of Data	Remarks
(i) Basic Information	<ul style="list-style-type: none"> Name of factory and coordinates of the location Type of business (based on NEQEG) Number of employees Self evaluation on environment management Type of WWTP 	Total: 202 - Yangon: 100 - Mandalay: 102 (100 in Period 1 and 2 in Period 2)	<ul style="list-style-type: none"> Mainly collected by questionnaire survey in Period 1 Confirmed by site visit in Period 2 (only for 50 target factories in Period 2)
(ii) Results of Wastewater Analysis Result	<ul style="list-style-type: none"> Date of wastewater sampling Sampling method Existence of pipeline to central WWTP Type of wastewater Analysis result for each parameter (e.g., BOD, COD, TN, TP, heavy metals, etc.) according to NEQEG 	Total: 100 - Yangon: 50 (25 each in Period 1 and Period 2) - Mandalay: 50 (25 each in Period 1 and Period 2)	<ul style="list-style-type: none"> Analyzed by wastewater sampling and analysis in Period 1 and Period 2 18 samples were analyzed in Japan in Period 2

Source: JET

Area	No.	Factory Name	Period	Questionnaire Survey	Wastewater Sampling	Analysis in Japan	Sampling Method	Combined to Central WWTP	Type of Wastewater	Flow rate (Gal/day)	pH	DO (mg/l)	BOD (mg/l)	CO (mg)
Yangon	Y1-1		2016	Yes	Yes		10:20 Composite			2,002	7.6	7.6	224	
Yangon	Y1-1		2017		Yes		11:20 Composite	No	Industrial Only	8,500	7.3	7.3	229	
Yangon	Y1-1		2017			Yes								
Yangon	Y1-2		2016	Yes	Yes		~12:15 Composite			1,540	7.7	7.7	1950	
Yangon	Y1-2		2017		Yes		10:50 Grab	No	Industrial Only	8,500	4.5	4.5	123	
Yangon	Y1-3		2016	Yes	Yes		~13:00 Composite			65,991	8.6	8.6	ND	
Yangon	Y1-3		2017		Yes		11:10 Grab	No	Industrial Only	228,096	6.5	6.5	69	
Yangon	Y1-3		2017			Yes								
Yangon	Y1-4		2016	Yes	Yes		11:20 Composite			6,599	7.2	7.2	3.1	
Yangon	Y1-4		2017		Yes		9:50 Grab	No	Mixed	7,656	6.8	6.8	78	
Yangon	Y1-5		2016	Yes	Yes		~15:45 Composite			33,435	10.1	10.1	104	
Yangon	Y1-5		2017		Yes		11:05 Grab	No	Mixed	13,200	9.3	9.3	25	
Yangon	Y1-6		2016	Yes	Yes		~11:10 Composite			65	3.9	3.9	2940	
Yangon	Y1-7		2016	Yes	Yes		~11:30 Composite			440	8.6	8.6	225	
Yangon	Y1-7		2017		Yes		11:00 Grab	No	Industrial Only	4,224	7.9	7.9	50	
Yangon	Y1-7		2017											
Yangon	Y1-8		2016	Yes	Yes	Yes	~12:00 Composite			6.8-9.5	6.8	6.8	293	
Yangon	Y1-8		2017		Yes		13:05 Grab	No	Industrial Only	8,716	7.3	7.3	83	
Yangon	Y1-9		2016	Yes	Yes		11:30 Composite			1.9-10.0	8.8	8.8	6.2	
Yangon	Y1-10		2016	Yes	Yes		~16:00 Composite				5.8	5.8	377	
Yangon	Y1-10		2017		Yes		14:00 Grab	No	Industrial Only	31,314	4.5	4.5	800	
Yangon	Y1-11		2016	Yes	Yes		~15:30 Composite			288	12.3	12.3	6150	
Yangon	Y1-12		2016	Yes	Yes		15:20 Grab			2.0-2.6	4.5	4.5	3060	
Yangon	Y1-13		2016	Yes	Yes		~17:15 Composite			52	3.4	3.4	2250	
Yangon	Y1-14		2016	Yes	Yes		Grab			8	7	7	6	
Yangon	Y1-15		2016	Yes	Yes		Grab			390	6.8	6.8	228	

Source: JET

Figure 2.5-20 Sample View of Pollution Source Database (Yangon)



Source: JET

Figure 2.5-21 Location Map of 100 Target Factories of Questionnaire Survey in Mandalay

(2) Surface Water Quality Database

Based on the results of the 1st to 5th water quality surveys from Activity 2-6, a surface water quality database was developed in MS Excel and shapefile format for GIS. The results of surface water quality surveys, which consisted of 117 on-site measurement from the 1st to 5th surveys and 50 laboratory analysis only from the 4th survey, have been stored in the surface water quality database. The laboratory analysis results from the 1st to 3rd surveys have not been incorporated into the database due to the issue of accuracy.

Table 2.5-13 and Figure 2.5-22 - Figure 2.5-23 show the contents and a GIS snapshot of the database. The details are described in Activity 2-6.

Table 2.5-13 Contents of Surface Water Quality Database

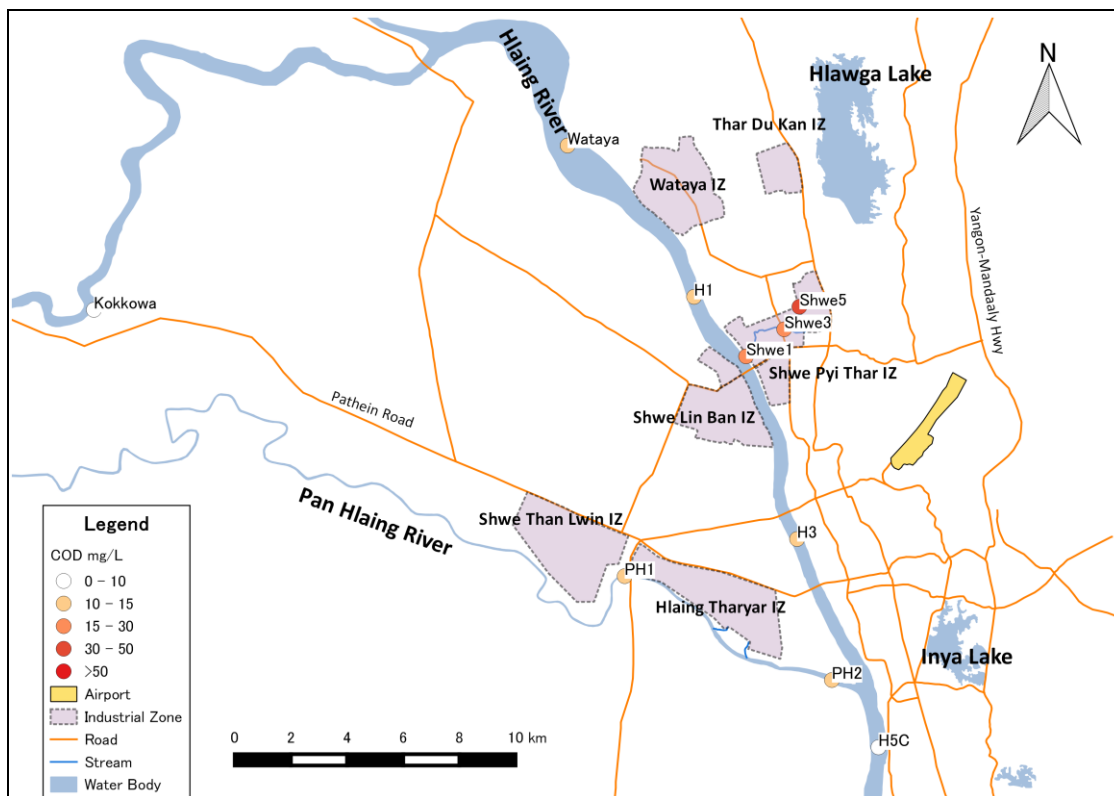
Data Type	Description	Number of Data	Remarks
(i) Results of On-site Measurement	<ul style="list-style-type: none"> - Sampling Site/Name - Period of the Survey - Coordinate of the Sampling Point - Sampling Date/ Time - Analysis Results of Basic Parameter (e.g. Temperature (Air/Water), pH, EC, Salinity, TDS, DO, etc.) 	Total 117 - Yangon: 49 (29 in Period 1 and 20 in Period 2) - Mandalay: 68 (38 in Period 1 and 30 in Period 2)	<ul style="list-style-type: none"> - 1st, 2nd and 3rd survey were implemented in Period 1. - 4th and 5th surveys were implemented in Period 2.
(ii) Results of Laboratory Analysis	<ul style="list-style-type: none"> - Analysis Results of Important Parameter for Surface Water (e.g. BOD, COD, TN, TP, TSS, Total coliform, heavy metals, phenol, pesticides, etc.) 	Total 50 - Yangon: 20 (Period 2) - Mandalay: 30 (Period 2)	<ul style="list-style-type: none"> - Only the Results of 4th and 5th surveys in Period 2 were stored.

Source: JET

Basic Information										On-site Measurement				
No	Sampling Site	Name	Period	Latitude	Longitude	Sampling date	Sampling time	Weather	Air Temp	pH	Water Temp	EC ms/cm	Salinity	
54	DHWD1	Doke Hta Wadd	5th	21.8260	96.0945	2018/2/27	14:11	Sunny	33.89	8.15	25.65	0.377	0.2	
55	DHWD2	Doke Hta Wadd	5th	21.8322	96.0871	2018/2/27	15:59	Sunny	32.20	7.02	25.62	0.378	0.2	
56	Myit Nge Bridge	Myit Nge Bridge	5th	21.8421	96.0673	2018/2/27	11:30	Sunny	34.10	8.07	24.94	0.379	0.2	
57	DP	Discharge Point	5th	21.8290	96.0935	2018/2/27	15:30	Sunny	32.00	6.89	27.06	0.844	0.4	
58	LKP creek	Lat Khoke Pin	5th	21.8909	96.0816	2018/2/26	17:08	Sunny	31.89	8.03	25.92	1.520	0.8	
59	UST Bridge	U shwe Taung	5th	21.8996	96.0766	2018/2/26	16:28	Sunny	32.67	6.80	27.18	1.030	0.5	
60	TT Bridge	Tagon Taing B	5th	21.8989	96.0871	2018/2/26	13:04	Sunny	34.94	6.71	29.32	1.200	0.6	
61	PYTC-62nd St	PYTC-62nd St	5th	21.9137	96.1089	2018/2/26	12:11	Sunny	29.61	7.65	25.78	0.189	0.1	
62	PYTC1	Pa Yan Taw C	5th	21.9015	96.0940	2018/2/26	14:54	Sunny	37.72	7.13	29.17	0.766	0.4	
63	After Aerator	After Aerator	5th	21.9095	96.0905	2018/2/26	14:40	Sunny	33.72	7.55	27.85	1.210	0.6	
64	N-TTML	North of Taun	5th	21.9016	96.0591	2018/2/27	8:39	Sunny	28.72	7.47	24.83	1.430	0.7	
65	S-TTML	South of Taun	5th	21.8854	96.0568	2018/2/27	10:18	Sunny	27.33	8.74	25.96	0.557	0.3	
66	PTM Bridge	Paw Taw Muu	5th	21.9457	96.1311	2018/2/26	11:27	Sunny	31.33	7.70	25.19	0.361	0.2	
67	SK Creek	Shwe Kyin Cre	5th	22.0224	96.0912	2018/2/26	10:20	Sunny	31.50	7.57	23.89	0.352	0.2	
68	Intake AYWD	Intake point of	5th	21.9901	96.0604	2018/2/26	8:45	Sunny	26.28	8.06	24.28	0.155	0.1	

Source: JET

Figure 2.5-22 Sample View of Surface Water Quality Database (Mandalay)



Source: JET (based on the results of Output 2)

Figure 2.5-23 Sample of Surface Water Quality Map (COD in Yangon)

2.5.6 Conduct Training on Operation and Utilization of the Database (Activity 3-6)

The first trainings on the operation and utilization of the databases, i.e., “GPS Data Collection Training” and “Initial GIS Database Development Training”, were held in Yangon and Mandalay in November and early December 2015, respectively. In addition, the second training on trial database utilization was held in January 2017. Participants learned how to use QGIS to create sample outputs based on the collected information and developed manual through the activities in Period 1.

Through the first and second training activities, it became clear that most participants were not familiar with the operation of MS Excel and/or GIS. Therefore, the next set of training was organized in August 2017 as an opportunity to learn the basic operation of these software products. In addition,

the fourth training was held in November 2017 to learn how to prepare maps using the database developed through this project.

Table 2.5-14 Schedule of Training for Database

Period	Contents	Date of Training		
		Yangon	Mandalay	Nay Pyi Taw
1st Training	GPD Data Collection	30 Nov – 1 Dec 2015	25, 26 Nov and 8 Dec 2015	-
	Initial GIS Database Development	4 Dec 2015	10 Dec 2015	-
2nd Training	Trial Database Utilization	13 Jan 2017	12 Jan 2017	-
3rd Training	Basic Practice on Excel/GIS	21 – 22 Aug 2017	14 – 18 Aug 2017)	24 -25 Aug 2017
4th Training	Map Preparation	20 Nov 2017	23 Nov 2017	-2)

Note

- 1): 2 day-training were planned as 2nd training, however, 5 day-training was implemented because of the strong demand from MCDC.
- 2) One staff joined the training in Yangon and another one joined that in Mandalay.

Source: JET



Source: JET

Figure 2.5-24 Photos of 3rd and 4th GIS Training

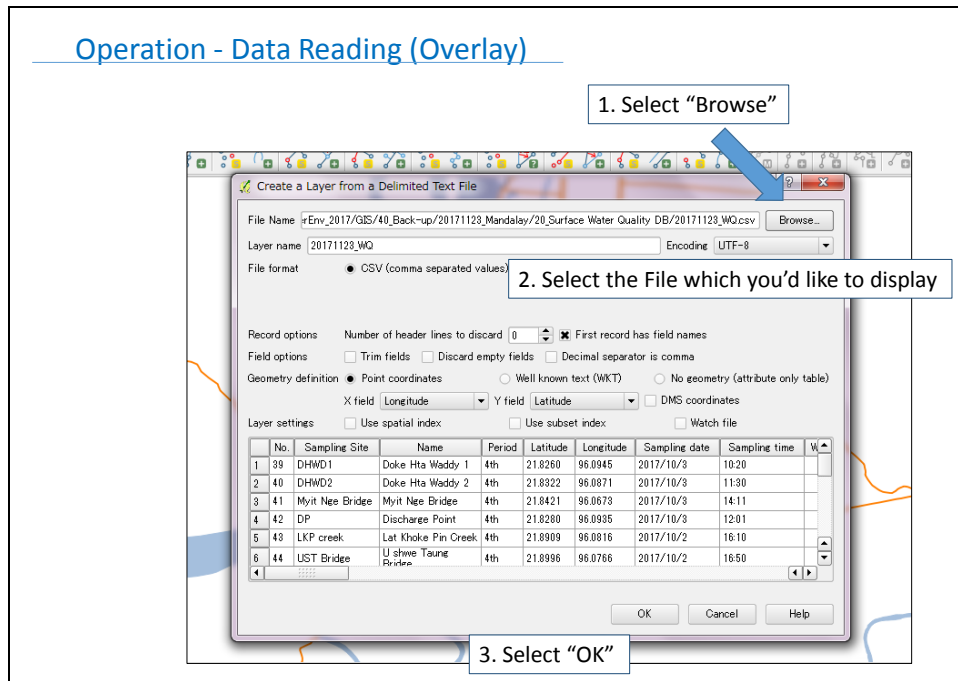
2.5.7 Develop an Operation and Maintenance Manual of the Database (Activity 3-7)

The first draft was developed in January 2017 and distributed to the participants in the training related to Activity 3-6 and their supervisors. Considering the comments and situation of the participants, it was updated in March 2017 and November 2017.

Table 2.5-15 Development of Database Operation and Maintenance Manual

Version	Preparation Schedule	Remarks
Ver. 1 (First Draft)	Jan 2017	Draft version for the pollution source database was developed based on the results of pollution source survey in Period 1.
Ver. 2	Mar 2017	Comments on Ver.1 was reflected to Ver.2.
Ver. 3	Nov 2017	Results of pollution source survey in Period 2 and 4th water quality survey were considered.
Ver. 4 (Final)	Dec 2017	Comments on Ver. 3 will be reflected to Ver.4.

Source: JET



Source: JET

Figure 2.5-25 Sample View of Operation and Maintenance Manual (Ver. 3)

2.5.8 Issues and Suggestions Identified through Output 3 Activities

(1) Gathering Information from Factories

Issues: Right now environmental authorities generally do not have detailed information about factories required for environmental management, such as production volume, water usage, pollution prevention and control measures taken, use of toxic substances, monitoring results, environmental issues encountered, emergency plan, etc. Such information is not contained in the data set of DISI and/or IZMCs. Without such information, it is difficult to know which factories are subject to different requirements or which factories should be considered environmental priorities.

Suggestions: Environmental authorities should collect such information from factories in relation to ECC and/or business licensing/registration. As MONREC has already issued an order to factories in nine priority sectors to submit EMPs, an EMP is a good place to start. However, basic information should be collected every year, as the situation of factories could change. Thus, submission of such information should be incorporated into the reporting requirements of ECC and/or business licensing/registration. If gathering information through EMPs takes too much time, it is suggested to implement a questionnaire survey, similar to the one implemented in this project.

(2) Development of Database of Pollution Sources

Issues: As demonstrated in this project, an electronic database is very useful for managing environmental information. However, the pollution source database developed in this project was designed largely to analyze the current situation of pollution sources, and was not designed specifically for ECC and business licensing/registration. Thus, once the frameworks of environmental requirements related to ECC and business licensing/registration are set, a new database should be designed.

Suggestions: In principle, they should be designed considering the licensing scheme, and end use of the database, e.g., tracking official and unofficial correspondence, managing inspection activities, managing information submitted by factories, and analyzing information to prepare reports to top management. For ECC, perhaps it is more appropriate to expand the EIA database, rather than developing a new database. It is important to note that digitizing of non-digitized information is very

labor intensive. Thus, for the time being, it is probably wise to limit the information to be managed by a database, and manage other information in hard copies. In the future, perhaps the regulated communities can submit information in electronic format.

(3) Improving Reliability of Measurement of Water Usage and Wastewater Qualities

Issues: Volume of wastewater and concentrations of pollutants in wastewater are among the most important parameters in managing water pollution, but the project encountered serious difficulties in measuring these parameters. Water usage in a factory is known to fluctuate significantly during production, and one or two-time on-site measurement does not give accurate estimate of water usage (and wastewater volume). Less than 10% of factories are equipped with flow meters to measure water usage, and very often water usage had to be estimated based on the size of water tanks and other means. As for water quality, laboratory data were not always reliable, and this problem necessitated the project to analyze wastewater samples in Japan. This issue should also be considered serious because environmental authorities are going to regulate pollution based on water quality data.

Suggestions: With respect to water usage, installation of water meters and measurement of water usage should be incorporated into the requirements of ECC and/or business licensing/registration, at least for major dischargers. As for reliability of laboratory data, environmental authorities should standardize the analytical methodologies, introduce a system of certification of environmental laboratories, and also make certified laboratories to regularly practice quality assurance/quality control measures. See section on Output 2.

(4) Improving Environmental Measures by Factories

Issues: The pollution source surveys revealed a glimpse of primitive environmental management by many pollution sources in Myanmar. Most factories lack secondary treatment. Moreover, the whole management of resources, including water and other raw materials, seems rudimentary.

Suggestions: To control pollution, the environmental authorities should impose realistic regulations and support measures, perhaps based on sector studies. These are discussed elsewhere, and are not repeated here. In addition, regulation of water usage, especially groundwater usage seems necessary. In Yangon region, saltwater intrusion is a concern, and uncontrolled withdrawal of groundwater should be controlled. Aside from these government-side regulations, the industry side should also implement some studies about their management of resources and environment in order not only to control pollution, but also to improve efficiency of production and to make the workplace safe. Such studies may be spearheaded by MOI and/or industrial associations.

2.6 Output 4 – Information Interpretation

Table 2.6-1 summarizes the output, activities and indicator of Output 4. The indicator of Output 4 has been revised during the Mid-term Review in November 2016.

Table 2.6-1 Activities and Indicators of Output 4

Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.
Activities	4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report
Indicator	Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.

Source: JET based on amended PDM

2.6.1 Collect the Information Necessary for the Water Quality Status Report (Activity 4-1)

The collection of information for the water quality status report was divided into two stages, namely, collection of data and information for “Water Quality Status Report No.1 (WQSR1)” in Period 1 and the final version of the “Water Quality Status Report” (WQSR) in Period 2. WQSR1 summarized the

data and information related to water environment management collected from C/Ps, relevant ministries, local government offices, and Myanmar Statistical Yearbook, and summarized the results of Outputs 1, 2, 3, and 4 of the project in Period 1. The final version of the WQSR summarized results of case studies which aimed to interpret the relationship between pollution sources and surface water qualities in the pilot areas, in addition to the updating of contents of WQSR1. Table 2.6-2 shows the key data and information collected for WQSRs together with the sources of information.

Table 2.6-2 Key Data and Information Collection for Water Quality Status Report

Category	Key Information	Information Source
Common	Natural condition (meteorology, hydrology, geography, etc.)	Myanmar statistic year book, digital elevation map, township statistic report, universities, etc.
	Social conditions (administrative boundary, population)	Myanmar statistic year book, township statistic report, etc.
	Organizations (organization chart and its activities related to water environment management)	Union level ECD, regional ECD, YCDC, MCDC, and Industrial Management Committees
Inspection	Inspection activities	Output 1/ ECD
Water quality	Results of water quality survey	Output 2
Industrial pollution source	Pollution source survey	Output 3
Water use	Water use, channel network	Ministry of Energy and Electricity/ Irrigation Department of MOALI/ YCDC/ MCDC
[Information Interpretation-1] Pollution load analysis in townships in Yangon in Taung Tha Man Lake (Case Studies 1 and 3)	List of the industries including sector, address, no. of employees, investment cost	DISI, MOI
	Population of each ward	Township GAD
	List of facilities related to commercial activities, slaughter houses, and disposal site	YCDC/ MCDC
	Common water treatment system for household, residential area, commercial, hotels, slaughter houses, etc.	YCDC/ MCDC
	List of hotels and number of beds	Ministry of Hotel and Tourism/ regional ECD
	List of hotels and clinic and number of bed	MOHS/ regional ECD
	Number of livestock	Livestock Breeding and Veterinary Department, MOALI
	Aquaculture activities (only for Mandalay)	Department of Fishery, MOALI
	Land use information	YCDC/ MCDC
	Area of agriculture land, type of crop and its calendars, and amount of application of fertilizer and pesticide	Department of Agriculture/ Plant Protection Department, MOALI
[Information Interpretation-2] Installation of centralized wastewater treatment system in zones (Case Study 2, under activity of Output 1)	Results of case study for installation of centralized wastewater treatment system in Hlaing Thar Yar Industrial Zones (Zone 1 to Zone 4)	Output 1
[Information Interpretation-3] Examination of estimation of cumulative water quality capacity of the Doke Hta Waddy River (Case Study 4)	Water discharge data from hydrological dam	Ministry of Energy and Electricity
	Seasonal trend of wastewater use for irrigation and water discharge data from irrigation dam/ gate	Irrigation Department of MOALI
	Future plans of water use of the Doke Hta Waddy River	MCDC/ EPGE/ MOALI
[Preparation of Road Map for Water Environment Management] Industrial water pollution control measures at the national level (Case Study 5)	Existing and future pollution control measures/ Policies of water environmental management at the national level	ECD

Source: JET

2.6.2 Interpret the Collected Information (Activity 4-2)

The overall water quality statuses of the pilot areas in Yangon and Mandalay were evaluated based on the collected information described in Section 2.6.1. Five case studies were implemented as explained in Section 2.6.2.1 in order to explain to decision makers current water quality statuses, expected relationship between the water quality and the pollution sources, and possible countermeasures. The results of the case studies are summarized in Section 2.6.2.2 for Yangon and Section 2.6.2.3 for Mandalay, respectively. These water quality status information and the results of the case studies were incorporated into the final version of the “Water Quality Status Report”.

2.6.2.1 Case Studies to Interpret Key Water Quality Status

Five case studies were selected through meetings among C/Ps in Yangon, Mandalay, and Nay Pyi Taw. They were categorized into two types, namely : i) pollution load analysis in order to prioritize sectors to control wastewater, and ii) examination of possible countermeasures for water environment management, such as control of industrial wastewater, estimation of dilution capacity leading to future water resource management, and industrial water pollution control measures at national level. These case studies are as follows:

[Pollution load analysis in order to prioritize sectors to control wastewater]

- Case Study 1: Pollution load analysis in the pilot area of Yangon (See Section 2.6.2.2)
- Case Study 2: Pollution load analysis in the pilot area of Mandalay (See Section 2.6.2.3)

[Examination of possible countermeasures for water environment management]

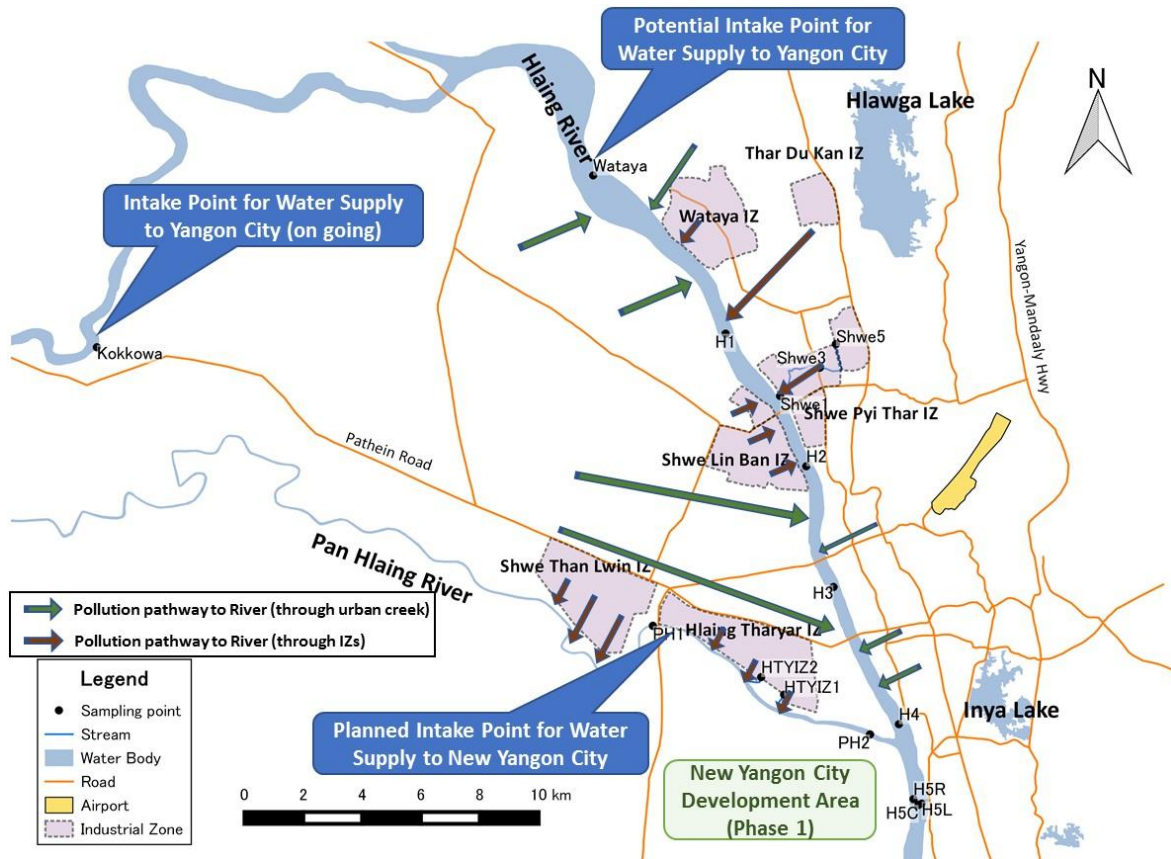
- Case Study 3: Installation of centralized wastewater treatment system in Hlaing Thar Yar Industrial Zones (under activity of Output 1, See Section 2.3.5)
- Case Study 4: Preliminary estimation of dilution capacity for water quality leading to future water resource management in the Doke Hta Waddy River (See Section 2.6.2.3)
- Case Study 5: Industrial water pollution control measures at the national level (See Section 2.6.2.4)

The results are briefly summarized in the following sections. For the details of these case studies, please refer to the WQSR.

2.6.2.2 Water Quality Status in the Pilot Area of Yangon (Hlaing River Basin)

(1) Overall Pollution Pathways to Rivers

Figure 2.6-1 shows the pollution pathways to the Hlaing River and Pan Hlaing River with locations of industrial zones and intake points for water supply in the pilot area in Yangon. The pollution pathways are divided into three areas i.e.: left bank (east side) of the Hlaing River, right bank (west side) of the Hlaing River, and left bank (north side) of the Pan Hlaing River. Pollution generated in each area reaches the rivers through creeks and drainage channels and some creeks and drainage channels flow through industrial zones. As for intake points from the rivers, there are three planned intake points, i.e.; i) intake point at Kokkowa in the Kokkowa River for water supply project by YCDC, ii) potential intake point at Wataya in Hlaing River for future water supply project by YCDC, and iii) potential intake point at a point between Hlaing Thayar Industrial Zone and Shwe Than Lwin Industrial Zone in the Pan Hlaing River for planned water supply to New Yangon City Development Area.

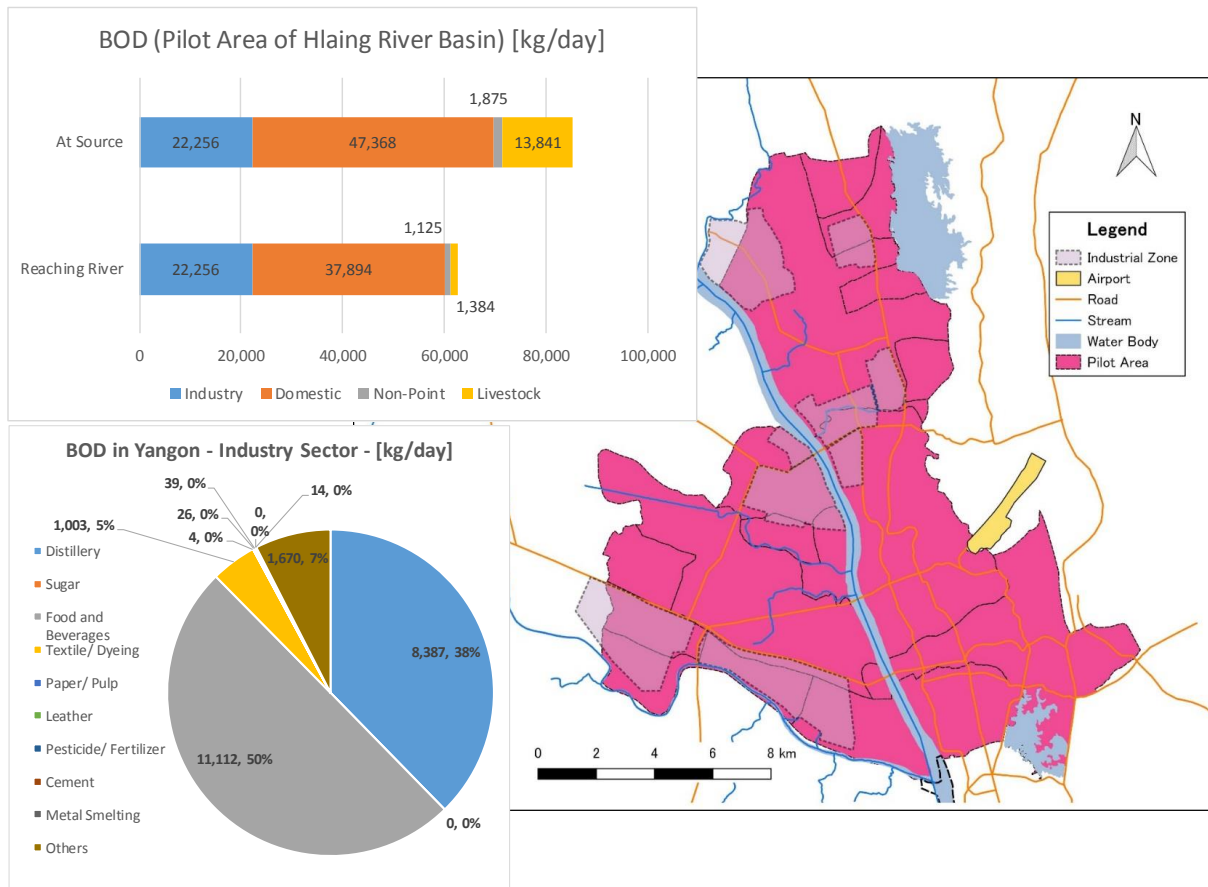


Source: JET based on dataset prepared by MIMU

Figure 2.6-1 Pollution Pathway to the Rivers with Location of Industrial Zones and Planned Intake Points for Water Supply in the Pilot Area of Yangon

(2) Results of Pollution Load Estimation

The results of the pollution load analysis in the pilot area of Yangon is summarized in Figure 2.6-2. In this analysis, pollution loads from industrial sources, domestic sources and non-point sources, such as agricultural fields, were estimated using the results of the pollution source survey as well as unit pollution load for different pollution sources established in different countries. According to the results, 85,000 kg/day of BOD pollution load is generated in the townships of Yangon City (Hlaingtharya, Mayangone, Insein, Hlaing, and Shwepyithar townships) in the Hlaing River basin, and 63,000 kg/day of generated BOD reaches the Hlaing River and Pan Hlaing River. Among the 63,000 kg/day of pollution load reaching the rivers, 60% is from domestic wastewater, 36% is from industries, and 4% is from livestock and non-point sources. Evidently sewage from domestic sources is the main source of BOD load, but the contribution of industrial sources is also significant. The major types of industries which generate large pollution load are distillery, food and beverage, and textile, and these three industries generate 93% of BOD pollution load from industrial sources.



Source: JET based on dataset prepared by MIMU

Figure 2.6-2 Estimated Pollution Load in the Pilot Area of Yangon (Upper Left: Pollution Load Generated at Source and Reaching Rivers by Sector, Lower Left: Industrial Pollution Load by Industries)

In this section, only the results for BOD were presented, but the sources of pollution vary significantly depending on the pollutants. Please refer to WQSR for details.

(3) Impact of Pollution on River Water Quality

1) Upstream Area of the Hlaing River

In the upstream area of Hlaing River at Kokkowa, the water quality met the Vietnamese standard for domestic water supply (Class A1 or A2) except for TSS and total coliform both in the latest rainy season (September 2017) and dry season (February 2018) because there are no large scaled towns, industrial zones, and intensive agriculture/livestock activities in the upstream area. There are no new town development and industrial zone development plans in the upstream for now, thus most likely the water quality at Kokkowa can be maintained at the current level (possible for domestic water supply in accordance with Vietnamese surface water quality standard for another 5-10 years), although more detailed assessment is needed.

2) Downstream Area of the Hlaing River

In the downstream area of the Hlaing River (at Wataya, Hlaing-1, -3, and -5), the water quality in the latest rainy season met the surface water quality standard for domestic water supply in Vietnam (Class A1 or A2) except for TSS and total coliform. In the latest dry season, the levels of CODCr, which is one of the key parameters for water use, at Wataya and Hlaing-1 in the upstream of Shwe Pyi Thar IZ were less than 30 mg/L (the Vietnamese standard for irrigation water supply; Class B1), but at Hlaing-3 and Hlaing-5 in the downstream of the industrial zone, the levels were more than 50 mg/L

(the Vietnamese standard for navigation; Class B2). As shown in Section 2.4.9, it was hypothesized that the high value of CODCr in this area is due to organic matter associated with suspended solid in the water and not soluble organic substance because there was no significant difference in BOD level among the locations, although this is not conclusive at the moment. This elevated CODCr could also be the direct or indirect results of a number of factors related to pollution, i.e.: i) insufficient capacity to absorb the impact of wastewater from industry, domestic, and other activities¹, ii) pollution from Myaung Dagar IZ and domestic wastewater from Hmawbi Township located at 25km upstream of Wataya, iii) pollution from Shwe Pyi Thar IZ and domestic wastewater from Shwe Pyi Thar Township in case of back-flow by tidal effect, and iv) limited mixing and slowdown of river flow in the downstream area due to sea water intrusion. Further investigation is needed to clarify whether the water quality at Wataya intake point can be used for domestic water supply or not, and for this, pollution mechanism should be elucidated based on long-term water monitoring data, hydrological data, and water use information. As for the impact of industrial pollution on water quality, Ta Gu Chan Creek, which is a tributary draining to the Haing River through the Shwe Pyi Htar Industrial Zone, is a good example of how industrial wastewater could affect water quality. This creek was polluted by industrial wastewater and domestic wastewater in the dry season at the downstream point (Shwe1) of the creek, and the concentrations of organic matter and nutrients were high (BOD: 267 mg/L, CODCr: 4,900 mg/L, T-N: 130 mg/L, T-P: 10 mg/L). Lead concentration was also somewhat elevated (Pb: 0.066 mg/L). Thus, one of the reasons for water deterioration in the Hlaing River in the dry season is the impact of industries, though the impact of reduced river flow and domestic wastewater are also significant.

3) Pan Hlaing River

In the latest rainy season, water quality in the Pan Hlaing River ranged between Class A2 (for domestic water with treatment and conservation of aquatic life) and Class B1 (for irrigation) except for total coliform and TSS. The water quality is slightly worse than the water quality in the Hlaing River because Pan Hlaing River has smaller capacity of receiving wastewater from domestic and industrial sources.

In the latest dry season, the water quality at “PH1” located between Hlaing Tharyar IZ and Shwe Than Lwin IZ, where the planned water intake point for the New Yangon Development is located, was worse than the rainy season presumably because the flow was limited and the bottom sediment was suspended in water. The levels of organic matter and nitrogen compounds were high (BOD: 47 mg/L, COD: 3,400 mg/L, T-N: 92 mg/L). The water quality at PH2 located before the confluence of Hlaing River was the same as that at Hlaing-5 because water was mixed by tidal flow. One heavy metal parameter exceeded the Vietnamese standard (Pb: 0.058 mg/L) presumably because the stirred sediment containing naturally-occurring lead affected the result. In addition to the impact by reduced river discharge in the dry season, there are three possible impacts by pollution, i.e.: i) pollution from Shwe Than Lwin IZ and domestic wastewater around the industrial zone located at 500m upstream of the planned intake point of Yangon New Development water supply, ii) pollution from Hlaing Tharyar IZ and domestic wastewater around the industrial zone located 100m to 5km downstream of the intake point in case of back-flow by tidal effect, and iii) limited mixing and slowdown of river flow over the stretch of the river from the potential intake point at PH1 to the downstream due to sea water intrusion, which also caused stirring of polluted bottom sediment. However, more investigation on the pollution mechanism is needed based on long-term water monitoring data, hydrological data, and water use information.

(4) Strategy for Water Pollution Control from Industrial Zones and other Pollution Sources

As the first step to formulate strategies for water pollution control for industrial zones and other pollution sources, a draft framework of key strategies was formulated as below through

¹ Water discharge of Yangon River before the confluence of Bago River is estimated as around 200 m³/s in the lowest month (April), 7,000 m³/s in the highest month (August) by Delft3D-FLOW Model of the Yangon Port, Dec 2015 (R.J. DE KOING & M.P.J. Janssen).

brainstorming discussions with C/Ps based on related project activities on inspection, water quality surveys, pollution source survey, development of databases, and information interpretation:

- Key Strategy 1: Installation of centralized wastewater treatment plants in industrial zones to prevent pollution in the surrounding area
- Key Strategy 2: Development of a mechanism for promoting water environment management by factories
- Key Strategy 3: Development of water environment management plans and their implementation in priority areas

The written strategies will be drafted by C/P organizations within a few years after completion of the project to achieve the overall goal indicators.

1) Key Strategy 1: Installation of Centralized Wastewater Treatment Plants In Industrial Zones

As for pollution control in industrial zones, the committee has been discussing upgrading of infrastructure of existing industrial zones in order to improve provision of utilities, such as electricity, water, wastewater treatment and solid waste treatment services, by utilizing the Public Private Partnership (PPP) scheme as much as possible. YRG is the organization who can promote installation of centralized wastewater treatment plants in the existing industrial zones in Yangon Region including Yangon City. Currently, YRG, Urban and Housing Development Department of the Ministry of Construction, which has an experience in constructing the centralized wastewater treatment in Mingaladon Industrial Park with a Japanese developer in the 1990s, and other relevant stakeholders together with UNIDO are starting a project to install a pilot centralized wastewater treatment plant in an existing industrial zone. The experiences of constructing and operating a centralized wastewater treatment plant through this project will provide good lessons learnt to be applied in other industrial zones.

Installation of a centralized wastewater treatment plant is one of the critical actions for water pollution control in industrial zones. The most important issue in installing the treatment plant is financing, and some financial measures are key factors to realize the installation of a treatment plant, such as securing a government subsidy (and or ODA loan) and finding partners (investors) of a government organization that can supply utility services (electricity, water, wastewater treatment, solid waste treatment) to reduce the financial burden of the installation of the treatment plant. Moreover, in case of application of PPP for installation of the treatment plant, there are several issues such as securing land, guarantee of minimum volume of wastewater to be treated, demarcation of government responsibilities and private side responsibilities. Thus, the prompt initiative led by YRG to install centralized wastewater treatment plants is a key strategy for wastewater management in industrial zones.

2) Key Strategy 2: Development of Mechanism for Promoting Water Environment Management by Factories

Currently, most of the actions implemented by the C/Ps are oriented toward strengthening governmental control over factories. However, most factories in the industrial zones in the pilot areas are small and medium-scaled enterprises, and they have many constraints to improve water pollution control because of insufficient budget, human resources, land, and so on. Thus, it is necessary to not only strengthen supervision of factories by the government side, but also develop support tools for factories to promote the implementation of water pollution control measures through own initiatives. In the future, the following tools can be prepared by the government side at the regional level.

- Organizing seminars for introduction of good practice on pollution control in Myanmar

- Setting consultation desks in district/township ECD offices to provide advice/information to factories on pollution control
- Establishment of award system for factories and provision of some incentives (reducing monitoring frequency and reducing tax rate)
- Establishment of a low interest loan for factories to install a wastewater treatment plant and other pollution control facilities

3) Key Strategy 3: Development of Water Environment Management Plans and its Implementation in Priority Areas

In the pilot area in Yangon, one of the important issues on water environment management is to conserve water quality at the planned intake points for water supply to the New Yangon City Development areas in the Pan Hlaing River, and to Yangon City in the Hlaing River (at Kokkowa and Wataya). Thus, these planned intake points for water supply shall be selected as the prioritized areas, and water environment management plans in the priority areas shall be developed.

- Setting the target water quality level to meet the objective of water use
- Setting socio-economic development scenarios in the future
- Examination of dilution capacity at the planned intake points in the future
- Development of water pollution reduction plans for each sector in the main pollution sources
- Formulation of support programs for factories and facilities on pollution control
- Development of water quality monitoring plan
- Development of budget plan for implementation of water environment management; and
- Summarizing water environment management plan for each sector in the priority areas on the basis of the above examinations

(5) Actions Plans for Water Pollution Control for Industrial Zones and Other Pollution Sources

On the basis of the above strategies, actions for control of water pollution from industrial zones and other pollution sources were identified through the results of a series of discussions and workshops among YCDC, ECD Yangon Region Office, and JET. Table 2.6-3 summarizes the outline of the action plans for controlling water pollution from industrial zones in the pilot area of Yangon. The actions are divided into three terms, i.e.: short-term (within 3 years), middle-term (within 5 years), and long-term (within 10 years).

Table 2.6-3 Outline of Action Plans for Water Pollution Control from Industrial Zones in the Pilot Area of Yangon

Goal	To contribute to a part of water environment management in upgrading existing industrial zones to “Eco-industrial Zones”
Target Year	Short term: FY2020-21 (from October 2018 to September 2021) Middle term: FY2022-23 (from October 2021 to September 2023) Long term: FY2027-28 (from October 2023 to September 2028)
Key Strategies	Key Strategy 1: Installation of centralized wastewater treatment plants in industrial zones to prevent pollution in the surrounding area Key Strategy 2: Development of a mechanism for promoting water environment management by factories Key Strategy 3: Development of water environment management plans and their implementation in priority areas
Actions and Schedule	<u>Key Strategy 1: Installation of centralized wastewater treatment plants in industrial zones to prevent pollution in the surrounding area</u> [Yangon Region Government] AY1-1: Setting policy for installation of centralized wastewater treatment plants in industrial zones (short term)

	<p>AY1-2: Construction and operation of a pilot centralized wastewater treatment plant in an industrial zone (<u>short term to middle term</u>)</p> <p>AY1-3: Formulation of PPP scheme on construction and operation of centralized wastewater treatment plants in priority industrial zones (<u>short term</u>)</p> <p>AY1-4: Construction and operation of centralized wastewater treatment plants in priority industrial zones (<u>middle term to long term</u>)</p>
	<p><u>Key Strategy 2: Development of a mechanism for promoting water environment management by factories</u></p> <p>[YCDC]</p> <p>AY2-1: Improvement of inspection activities for issuing/renewing licenses by YCDC Administration Department in accordance with the revised YCDC law to be enacted (<u>short-term</u>)</p> <p>AY2-2: Strengthening on-site monitoring such as wastewater monitoring, noise monitoring, air emission monitoring (<u>short-term</u>)</p> <p>AY2-3: Examining the possibility to introduce wastewater discharge fee system in Yangon City, such as research for similar systems in ASEAN countries (<u>middle-term</u>)</p> <p>[ECD Yangon Region]</p> <p>AY2-1: Collection of information on existing factories which have been requested to prepare EMPs in accordance with the Notification No. 03/2018, and identification of important factories associated with large pollution load through guidance seminars to each industrial zone for collection of target factories and awareness raising to factories by ECD Yangon Region, collection of information from DISI/MOI, collection through inspection activity by ECD Yangon Region, DICA/MOPF and collection from PCCD/YCDC (<u>short-term</u>)</p> <p>AY2-2: Establishment of monitoring/supervising system to check status of preparation of EMPs by the prioritized factories, such as monitoring/supervising through inspection activities (<u>short-term</u>)</p> <p>AY2-3: Organizing seminars for introduction of good practice on pollution control in Myanmar (<u>short-term</u>)</p> <p>AY2-4: Setting consultation desks in district/township ECD offices to provide advices/information to factories on pollution control (<u>middle-term</u>)</p> <p>AY2-5: Examining the possibility to promote water environment management (e.g. award system with some incentives, establishment of low interest fund, consultation on cleaner production) in Yangon Region, through research for similar systems in ASEAN countries (<u>middle-term</u>)</p>
	<p><u>Key Strategy 3: Development of water environment management plans and its implementation in priority areas</u></p> <p>[YCDC]</p> <p>AY3-1: Improvement of domestic and commercial wastewater of existing factories (short-term to middle-term)</p> <p>AY3-2: Expansion of sewerage areas (middle-term to long-term)</p> <p>AY3-3: Development of water environment management plans in the priority areas (<u>short-term to middle term</u>)</p> <p>[ECD Yangon Region]</p> <p>AY3-4: Establishment of water quality testing laboratory (middle-term)</p> <p>AY3-5: Starting-up and implementation of surface water quality monitoring in rivers in the region (middle-term to long-term)</p> <p>AY3-6: Implementation of water environment management plans in the priority areas (<u>middle term to long term</u>)</p>

Source: YCDC, ECD Yangon Region, and JET

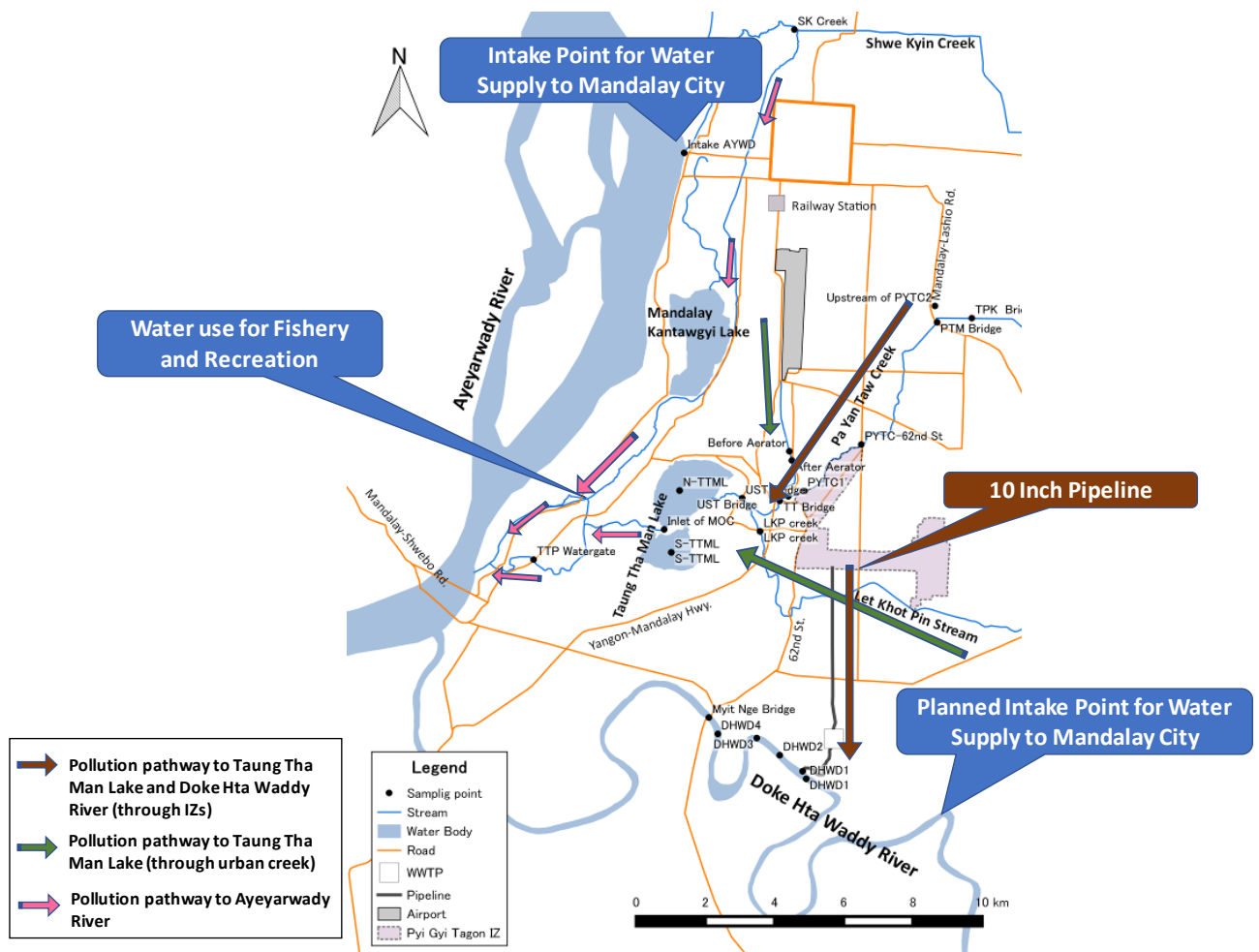
2.6.2.3 Water Quality Status in the Pilot Area of Mandalay (Doke Hta Waddy River Basin and Taung Tha Man Lake Basin)

(1) Overall pollution pathways to rivers and lakes

Figure 2.6-1 shows the pollution pathways with locations of industrial zones and intake points for water supply in Mandalay City and its surrounding area. The pollution pathways in Mandalay City are divided into two areas, namely, i) Taung Tha Man Lake basin in the central and east part of Mandalay City, and ii) Shwe Kyin Creek, Mandalay Kantawgyi Lake, and some small creeks in the west part of Mandalay City. In central and east part of Mandalay City, pollution from Pa Yan Taw Creek, Let Khot Pin Stream, other small creeks and drainages reaches Thaugung Tha Man Lake then discharges to the Ayeyarwaddy River. Among the creeks and stream, Pa Yan Taw Creek flows through Pyi Gyi Tagon industrial zone into the lake. In the west part of the city, pollution from Shwe Kyin Creek, Mandalay Kantawgyi Lake, and some small creeks reach Ayeyarwaddy River directly, so this area was excluded from the pilot area because the wastewater in west part of Mandalay City is not linked with Doke Hta Waddy River.

The Doke Hta Waddy River is located in the southern part of Mandalay City and the wastewater from Pyi Gyi Tagon IZ is collected through 10-inch-pipeline constructed by MCDC and discharged to the river. MCDC has entrusted a private company to construct a centralized wastewater treatment plant through Built-Operation-Transfer (BOT) scheme in the outskirts of the industrial zone before the outlet of the pipeline to the river.

As for intake points for domestic water supply from the rivers, there are one current and one planned intake points by MCDC, i.e.: i) intake point from Ayeyarwaddy River for water supply to Mandalay City, and ii) planned intake point at 10km upstream from the discharge point of the 10-inch-pipeline in the Doke Hta Waddy River. As for other water use, Taung Tha Man Lake is used for fisheries, recreation, and flood control. The Doke Hta Waddy River is used for irrigation, ship navigation, recreation, and domestic use for residences along the river.



Source: JET based on dataset prepared by MIMU

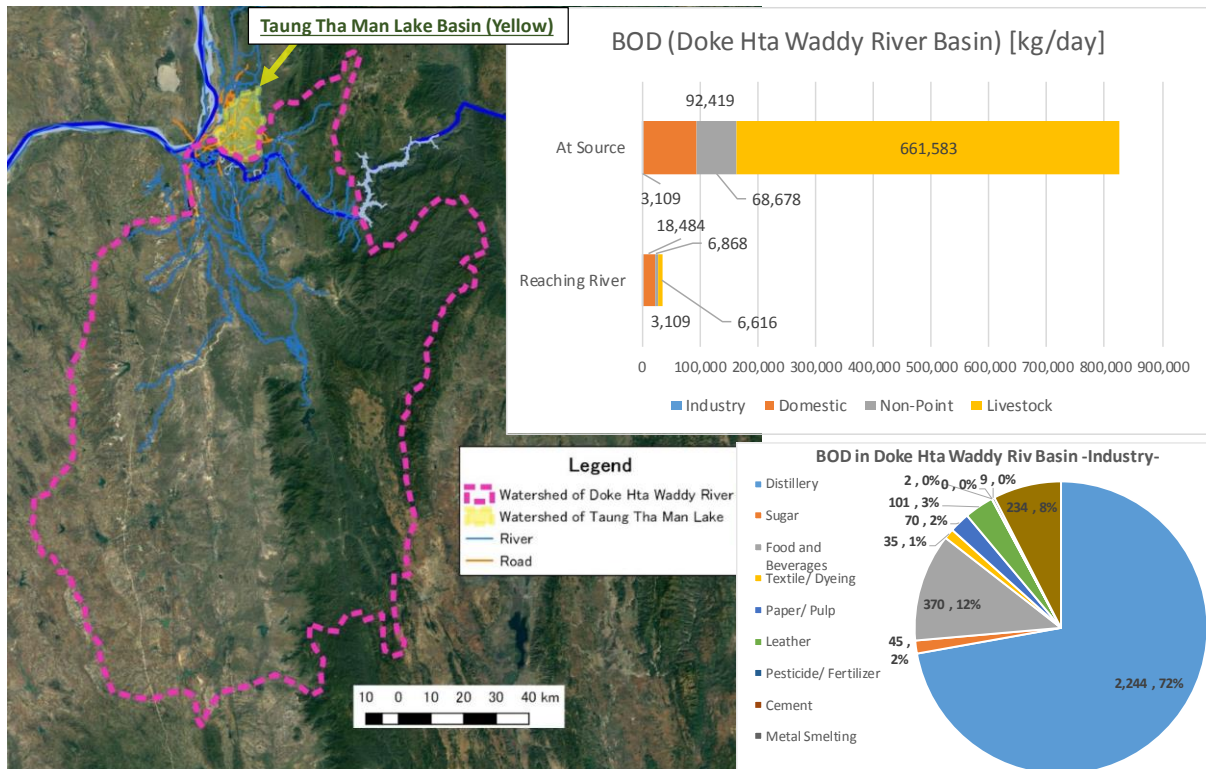
Figure 2.6-3 Pollution Pathways to Rivers with Locations of Industrial Zones and Existing and Planned Intake Points for Water Supply in the Pilot Area of Mandalay

(2) Results of pollution load estimation

1) Doke Hta Waddy River basin

The results of pollution load analysis in Doke Hta Waddy River basin (the basin from the outlet of Yeywa Dam up to the confluence of Ayeyawaddy River with an area of 17,000km²) are summarized in Figure 2.6-4. 825,000 kg/day of BOD pollution load is generated in the basin and 35,000 kg/day of BOD reaches the Doke Hta Waddy River. Among 35,000 kg/day of pollution load reaching the river,

53% is from domestic wastewater, 9%¹ is from industries, 19% is from livestock, and 19% is from non-point sources. The ratio of pollution load reaching the river is on average less than 10% due to natural attenuation in the basin, especially in the rural areas. The major types of industries which generate large pollution load are distillery and food and beverage, and these two industrial sectors are responsible for 84% of the BOD pollution load.



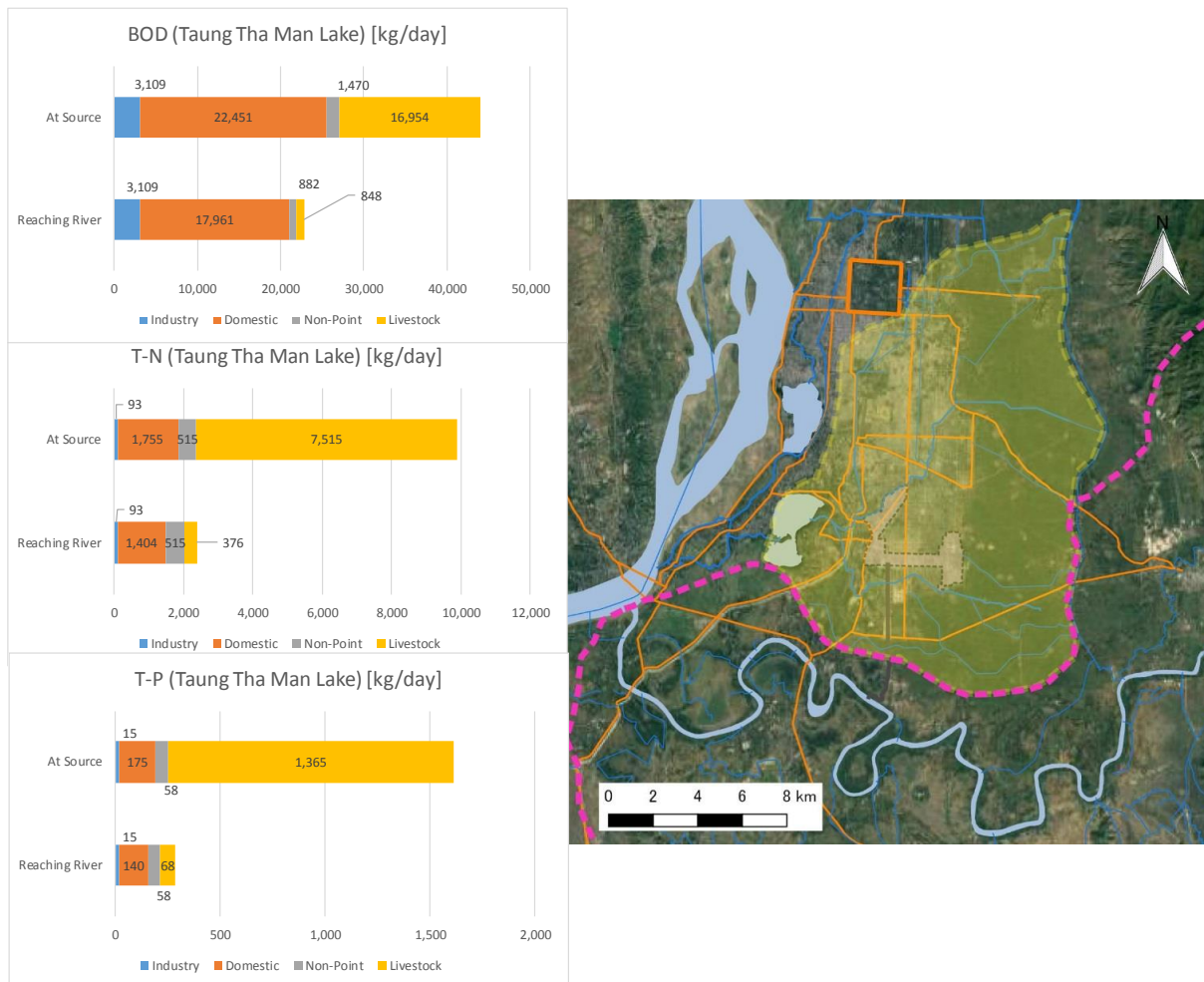
Source: JET based on dataset prepared by MIMU

Figure 2.6-4 Estimated Pollution Load in Doke Hta Waddy River Basin (Upper Right: Pollution Load at Source and Reaching to the Rivers by Sector, Lower Right: Industrial Pollution Load by Industries)

2) Taung Tha Man Lake Basin

The results of BOD, T-N, and T-P pollution load analysis in Taung Tha Man Lake basin are summarized in Figure 2.6-5. BOD pollution loads generated at source and reaching the lake are 44,000 kg/day (at source) and 23,000 kg/day (to the lake), respectively. Among the 23,000 kg/day of pollution load reaching the lake, 79% is from domestic wastewater, 13% is from industries, 4% is from livestock, and 4% is from non-point sources. As for T-N and T-P pollution loads related to eutrophication, 10,000 kg/day of T-N is generated at source, and 2,400 kg/day is reaching the lake. As for T-P, 1,600 kg/day is generated at source, and 300 kg/day is reaching the lake. Among the T-N and T-P pollution loads reaching the lake, 59% of T-N pollution load (50% of T-P pollution load) is from domestic wastewater, 4% of T-N (5% of T-P) is from industries, 16% of T-N (24% of T-P) is from livestock, and 16% of T-N (21% of T-P) is from non-point sources. The major pollution source of T-N and T-P is from domestic wastewater similar to BOD pollution load, and the second and third largest pollution load are from livestock and non-point sources and these ratios are relatively high compared with the BOD pollution load.

¹ Industrial wastewater from Pyi Gyi Tagon Industrial Zone is discharges in two directions: discharge to Doke Hta Waddy River through 10-inch pipeline and discharge to Taung Tha Man Lake through creeks. The amount of each wastewater discharge is 50 % each.



Source: JET based on dataset prepared by MIMU

Figure 2.6-5 Estimated Pollution Load in Taung Tha Man Lake Basin (BOD, T-N, and T-P Pollution Load at Source and Reaching to the Lakes by Sector)

(3) Impact of Pollution on River/ Lake Water Quality

1) Doke Hta Waddy River

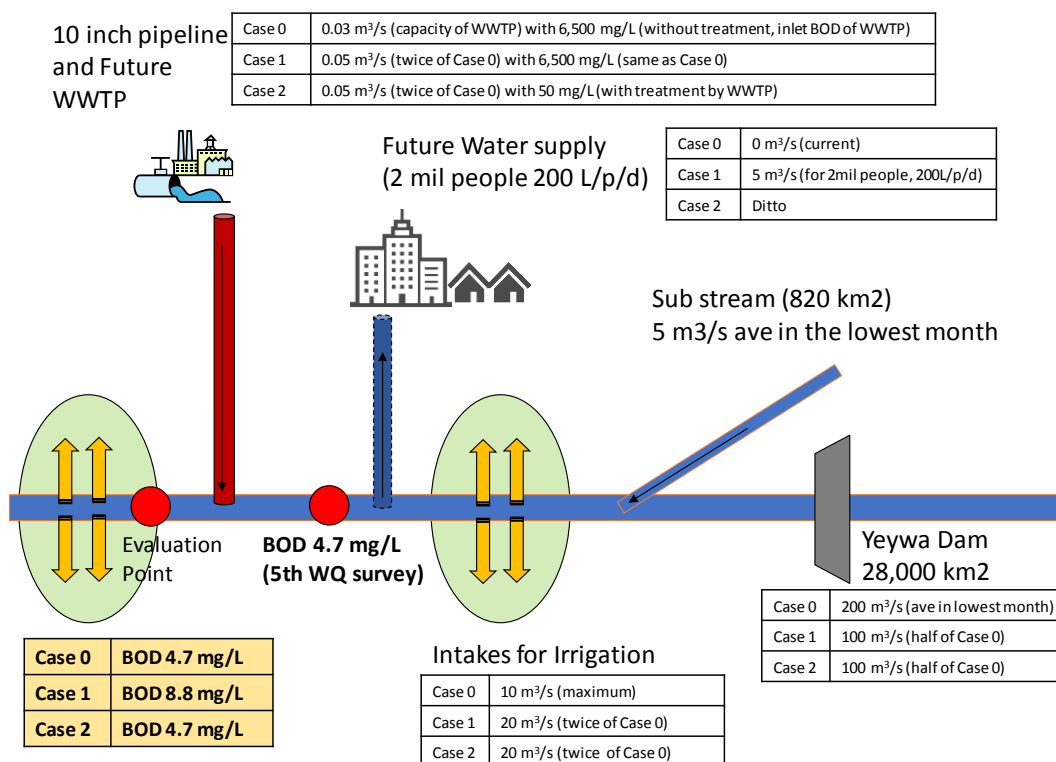
The water quality of Doke Hta Waddy River near Mandalay City (DHWD1, DHWD2, Myint Nge Bridge) met the Vietnamese standard for domestic water supply (Class A1 or A2) both in the latest rainy season (September 2017) and dry season (February 2018) except for total coliform in the rainy season. This is due to the following factors:

- There are no large towns, industrial zones, and intensive agriculture/ livestock activities in the upstream area
- The river has enough capacity to receive untreated wastewater from Pyi Gyi Tagon IZ transmitted through the 10-inch-pipeline¹
- The volume of wastewater from the 10-inch-pipeline was limited at the times of the water quality surveys.

In the future, MCDC has a plan to take water for domestic supply from the Doke Hta Waddy River

¹ Monthly average of water discharge from Yeywa dam is around 200 m³/s in the lowest month (July), 1,100 m³/s in the highest month (August) according to the daily data in 2016 provided by the Electric Power Generation Enterprise under the Ministry of Electric Power and Energy.

from a point upstream of the outlet of the 10-inch-pipeline. Meanwhile, new hydropower development projects, such as Upper Yeywa Dam Project and Deedoke Hydropower Project, are planned in addition to the Yeywa Dam development. If these hydropower projects and other developments of industrial and new urban areas would take place in the future, the water quality of Doke Hta Waddy River may deteriorate due to reduced water volume from the dams and increased pollution from industries and city development. In order to examine such impact, a preliminary study of dilution capacity of the Doke Hta Waddy River was implemented as a case study of Output 4. Figure 2.6-6 summarizes the result of the this study. Compared with the current situation (Case 0), BOD concentration in the downstream of the 10-inch-pipeline could double if the river flow rate decreases due to the operation of the dam(s) as well as the increased water use for irrigation and domestic water supply, and if the industrial wastewater discharge from the 10-inch-pipeline increases without the centralized wastewater treatment (Case 1). If the operation of the centralized wastewater treatment plant will start, the water quality in the downstream area would remain at the current level, even if the river flow decreased (Case 2).



Source: JET

Figure 2.6-6 Results of Preliminary Dilution Capacity in the Doke Hta Waddy River

2) Taung Tha Man Lake

As explained in the section on the results of the water quality surveys, the water quality in Taung Tha Man Lake is characterized as eutrophic due to high phosphorus and nitrogen concentrations as well as relatively low DO and high COD in both the latest rainy season (September 2017) and the dry season (February 2018). The main stream/creeks feeding Taung Tha Man Lake are Let Khot Pin Stream, Pa Yan Taw Creek, and Colombo Creek, and these stream/creeks are receiving pollution loads from the domestic sources in the city, some industries in the Pyi Gyi Tagon IZ not connected to the 10-inch-pipeline, livestock and non-point sources. The lake water quality has worsened in the dry season due to the reduced lake water level. The water quality of the lake changes dramatically or fluctuated over time/seasons, and more monitoring data are necessary to examine the mechanism of water pollution in the lake. As for the impact of industrial pollution on the lake, it seems that the impact has become smaller year by year because MCDC had constructed the 10-inch-pipeline to divert

the industrial wastewater to Doke Hta Waddy River, and most of the large factories have connected to the pipeline under the instruction of MCDC.

(4) Strategy for Water Pollution Control from Industrial Zones and Other Pollution Sources

As the first step to formulate strategies for control of water pollution from industrial zones, a draft framework of key strategies was formulated as shown below thorough brainstorming discussion with C/Ps based on related project activities on inspection, water quality surveys, pollution source survey, development of databases, and information interpretation:

- Key Strategy 1: Water environment conservation for future water use of the Doke Hta Waddy River
- Key Strategy 2: Improvement of water quality of Taung Tha Man Lake to increase value of the lake for tourism, recreation, fisheries, etc.

The written strategies will be drafted by the CP organizations within a few years after completion of the project to achieve the overall goal indicators.

1) Key Strategy1: Water Environment Conservation for Future Water Use of the Doke Hta Waddy River

In Doke Hta Waddy River basin, water quality is very good at the moment and sufficient volume of river water is available even in the dry season due to controlled operation of Yeywa Hydropower Dam. In addition, there are few pollution sources except for the 10-inch-pipeline discharging industrial wastewater from Pyi Gyi Tagon IZ. Two key actions, namely organizing a coordination committee for water use right and setting maintenance flow have been planned, and the centralized wastewater treatment plant is under constriction lead by MCDC to control pollution in the Doke Hta Waddy River basin. In addition, the following actions are necessary and should be added to the written strategy from the view point of prevention of pollution and water conservation.

- Increasing the capacity to treat industrial wastewater from Pyi Gyi Tagon IZ in case more factories start operating using the vacant areas in the IZ, and
- Setting regulations or rules for investment in large-volume water intake and/or discharging of wastewater from/to the Doke Hta Waddy River in the future especially in the upstream of the river

2) Key Strategy2: Improvement of Water Quality of Taung Tha Man Lake to Increase Value of the Lake for Tourism, Recreation, Fisheries, etc.

MCDC and ECD Mandalay Region have already prepared some actions, such as issuing a notification of installation of wastewater treatment systems to new large-scaled facilities, participation in awareness raising activities for farmers regarding proper application of fertilizer organized by DOA Mandalay Region, and following-up on the notification on preparation of EMPs by existing factories in nine sectors. Based on the results of the pollution load analysis, control of domestic wastewater is considered critical in reducing the pollution load to the lake, and MCDC has a plan to expand the sewerage coverage area in the future.

It should be noted that, as the water quality and hydrology of the lake change dramatically or fluctuated over time/seasons, more monitoring data are necessary to examine the mechanism of water pollution in the lake. In addition, it may take time to improve water quality of the lake based on experiences in improving lake water quality in developed countries including Japan. Thus, the development of water pollution reduction plan in Taung Tha Man Lake basin should be added to the written strategy based on the results of detailed examination of the mechanism of water pollution in the lake.

(5) Action Plans for Water Pollution Control from Industrial Zones and Other Pollution Sources

On the basis of the above strategies, actions for water pollution control from industrial zones in Mandalay were identified through a series of discussions and workshops among MCDC, ECD Mandalay Region Office, and JET. Table 2.6-4 summarizes the outline of the action plans for water pollution from industrial zones and other pollution sources in the pilot area of Mandalay. The actions are divided into three terms: short-term (within three years), middle-term (within five years), and long-term (within ten years). Some key actions for industrial wastewater control, such as construction of the 10-inch-pipeline to divert industrial wastewater, construction of a centralized wastewater treatment plant, and installation of individual wastewater treatment plants in large factories, have already been started and/or already completed by MCDC and other stakeholders.

Table 2.6-4 Outline of Action Plans for Water Pollution Control from Industrial Zones and Other Pollution Sources in the Pilot Area of Mandalay

Target year	Short term: FY2020-21 (from October 2018 to September 2021) Middle term: FY2022-23 (from October 2021 to September 2023) Long term: FY2027-28 (from October 2023 to September 2028)
Key Strategies	Key Strategy 1: Water environment conservation for future water use of the Doke Hta Waddy River. Key Strategy 2: Improvement of water quality of Taung Tha Man Lake to increase the value of lake resources for tourism, recreation, fisheries, etc.
Actions and Schedule	<p><u>Key Strategy 1: Water environment conservation for future water use of the Doke Hta Waddy River</u> [MCDC] AM1-1: Setting a coordination committee among DWIR/MOTC, MOALI, MOEE, ECD Mandalay Region, MCDC for water use right and setting the maintenance flow of the Doke Hta Waddy River (short term) AM1-2: Completion of the construction and starting operation of the centralized wastewater treatment plant (ongoing, short term to middle term) AM1-3: Installation of the water supply system from the Doke Hta Waddy River (middle term)</p> <p>[ECD Mandalay Region] AM1-4: Collection of information on existing factories, which are requested to prepare EMPs in accordance with Notification No. 03/2018, and identification of important factories associated with large pollution load through guidance seminars to each industrial zone, collection from DISI/MOI, collection through inspection activity by ECD Mandalay Region, and collection from CD/MCDC out of Mandalay City (short term) AM1-5 Establishment of a monitoring/supervising system to check the status of preparation of EMPs by the prioritized factories, such as monitoring/supervising through inspection activities out of Mandalay City (short term) AM1-6: Starting-up and implementation of surface water quality monitoring in rivers in the region out of Mandalay City (middle term to long term)</p> <p><u>Key Strategy 2: Improvement of water quality of Taung Tha Man Lake to increase value of the lake for tourism, recreation, fisheries, etc.</u> [MCDC] AM2-1: Monitoring of connection status of the 10-inch-pipeline (<u>started, short-term</u>) AM2-2: Issuing a notification of installation of wastewater treatment system to new large scaled facilities, such as housing, commercial, hotel, hospital, and school development (<u>drafting, short-term</u>) AM2-3: Participation in awareness raising activities for farmers by the Department of Agriculture (DOA) in Mandalay Region regarding proper application of fertilizer to reduce the impact of nitrogen and phosphorus to Taung Tha Man Lake and collaboration of the activities with DOA (<u>already implemented by DOA, short term</u>) AM2-4: Establishment of a plan for monitoring of eutrophication status in Taung Tha Man Lake including water quality, flow rate, and water level (<u>short term</u>) AM2-5: Expansion of the sewerage area in Mandalay City (<u>middle term to long term</u>)</p> <p>[ECD Mandalay Region] AM2-6: Collection of information on existing factories, which are requested to prepare EMPs in accordance with the Notification No. 03/2018, and identification of important factories associated with large pollution load (<u>short-term</u>) AM2-7: Establishment of monitoring/supervising system to check the status of preparation of EMPs by the prioritized factories, such as monitoring/supervising through inspection activities (<u>short-term</u>)</p>

Other actions to support the implementation of key strategies [ECD Mandalay Region] AM3-1: Organizing seminars for the introduction of good practice on pollution control in Myanmar (<u>short term</u>) AM3-2: Setting consultation desks in district/township ECD offices to provide advices/information to factories on pollution control (<u>middle term</u>) AM3-3: Examining the possibility to promote water environment management (e.g. awarding system with some incentives, establishment of low interest fund, consultation on cleaner production) in Yangon Region, through research on similar systems in ASEAN countries (<u>middle-term</u>) AM3-4: Arrangement of ad hoc coordination meetings to exchange information on pollution sources and results of inspections among DISI, MCDC, and ECD Mandalay Region (<u>short term</u>)
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Source: MCDC, ECD Mandalay Region, and JET

2.6.2.4 Strategy for Water Pollution Control from Industries and Water Environment Management at the National Level

The PCD of ECD Headquarters in MONREC has been making various efforts to control industrial water pollution, such as expansion of inspection activities to all Region/State-level ECDs, development of the National Environmental Quality (Emission) Guidelines, implementation of water quality monitoring by on-site equipment, and PCD is developing a master plan for hazardous waste management, and drafting surface water quality standards with technical assistance by international cooperation organizations. However, PCD does not have a comprehensive plan for water pollution control with time frame yet. Thus, PCD formulated a draft framework of key strategies for water environment management focusing on water pollution control from industrial sectors, as a case study for Output4 activities through discussions with JET. The written strategy will be drafted by PCD within a few years after the completion of the project to achieve the indicators of the overall goal of the project.

As first step to develop a draft framework of strategies for the water environmental management, the following three principles are set:

- To utilize the function of regional ECDs as much as possible in line with the strategy of localization by ECD Headquarters, such as expanding ECD office at the district and township levels;
- To develop actions for “pollution control” and “environment management other than pollution control” separately because PCD has been divided into “pollution control division” and “environmental quality standard division” since April 2018; and
- To utilize current regulation tools and activities on pollution control, such as EIA procedures, National Environment Quality (Emission) Guidelines, notification on preparation of EMPs by existing factories in the nine sectors, and inspection.

Based on the above three principles, the strategies for Water Environment Management (Water Pollution Control from Industries) at the National Level and their action plans were developed. The issues and recommendations identified in Output 1 (Section 2.3.7), Output 2 (Section 2.4.10) and Output 3 (Section 2.5.8) were all taken into consideration.

The actions under the strategies are divided into three terms; short term plan (within three years), mid-term plan (within five years), and long-term plan (within ten years). Table 2.6-5 shows outline of the action plans for industrial wastewater pollution control and environment management at the national level and Table 2.6-6 shows detailed action plans and implementation schedule.

[Industrial Pollution Control]

- Strategy 1: Development of National Pollution Source Inventory
- Strategy 2: Strengthening Pollution Control System

[Water Environmental Management]

- Strategy 3: Development of Surface Water Quality Standards and National Water Quality Monitoring Network
- Strategy 4: Promoting Actions for Water Environment Management

[Strengthening Organizations]

- Strategy 5: Strengthening Organizations in Response to Decentralization

Table 2.6-5 Outline of Action Plans for Industrial Wastewater Pollution Control and Environment Management at the National Level

Goal	<p>Short term goal: Important industrial pollution sources associated with large pollution emission in the country are identified and surface water quality in key rivers at national level are started to be monitored by FY 2020-21</p> <p>Middle term goal: All of the industrial pollution sources in the country are identified and some pollution control tools are introduced by FY 2022-23</p> <p>Long term goal: Industrial pollution control and environmental management system by government organizations are in the level of ASEAN top five by FY2027-28</p>
Target year	<p>Short term: FY2020-21 (from October 2018 to September 2021)</p> <p>Middle term: FY2022-23 (from October 2021 to September 2023)</p> <p>Long term: FY2027-28 (from October 2023 to September 2028)</p>
Key Strategies	<p>[Industrial Pollution Control]</p> <p>Key Strategy 1: Development of National Pollution Source Inventory</p> <p>Key Strategy 2: Strengthening Pollution Control System</p> <p>[Water Environmental Management]</p> <p>Key Strategy 3: Development of Surface Water Quality Standards and National Water Quality Monitoring Network</p> <p>Key Strategy 4: Promoting Actions for Water Environment Management</p> <p>[Strengthening Organizations]</p> <p>Key Strategy 5: Strengthening Organizations in Response to Decentralization</p>
Key Actions and Schedule	<p>[Industrial Pollution Control]</p> <p>Key Strategy 1: Development of National Pollution Source Inventory</p> <p>NA 1-1: Follow-up the notification on preparation of EMP by existing factories in nine sectors (<u>short to middle Term</u>)</p> <p>NA1-2: Strengthening monitoring system after issuing ECCs (or completion of EIA/ IEE/ EMP Study) (<u>short to middle Term</u>)</p> <p>NA1-3: Development of pollution source inventory system (upgrading pollution source database) (<u>short to middle Term</u>)</p> <p>NA1-4: Development of National Pollution Source Inventory (<u>middle term</u>)</p> <p>Key Strategy 2: Strengthening Pollution Control System</p> <p>NA2-1: Strengthening Enforcement and Promotion of Environmental Compliance (<u>Short Term</u>)</p> <p>NA2-2: Formulating National Environmental Quality (Emission) Standards (<u>short term</u>)</p> <p>NA2-3: Promotion of centralized wastewater treatment plants (<u>short to long term</u>)</p> <p>NA2-4: Strengthening inspection activities (<u>short to middle term</u>)</p> <p>NA2-5: Development of pollution control tools (<u>short to long term</u>)</p> <p>[Water Environmental Management]</p> <p>Key Strategy 3: Development of Surface Water Quality Standards and National Water Quality Monitoring Network</p> <p>NA3-1: Formulating Surface Water Quality Standards (<u>short term</u>)</p> <p>NA3-2: Development of national surface water quality monitoring network (<u>short to long term</u>)</p> <p>NA3-3: Establishment of Water Quality Testing Laboratory and Standardization of Environmental Analytical Method (<u>short to long term</u>)</p> <p>Key Strategy 4: Promoting Actions for Water Environment Management</p> <p>NA4-1: Preparation of environmental statistics (<u>short term</u>)</p> <p>NA4-2: Promoting environmental awareness (<u>short to long term</u>)</p> <p>NA4-3: Preparation of the state of pollution report (<u>middle term to long term</u>)</p> <p>[Strengthening Organizations]</p> <p>Key Strategy 5: Strengthening Organizations in Response to Decentralization</p> <p>NA5-1: Training for industrial pollution control (<u>short to middle term</u>)</p> <p>NA5-2: Training for Water environment management (<u>middle to long term</u>)</p>

Source: ECD and JET

Table 2.6-6 Detailed Action Plans and Implementation Schedule for Industrial Wastewater Pollution Control and Environment Management at the National Level

Strategy/ Key Activity	Implementers	Short Term						Middle Term			Long Term			
		FY2018-19		FY2019-20		FY2020-21		FY21-22	FY22-23	FY23-24	FY24-25	FY25-26	FY26-27	FY27-28
		Q1	Q2	Q3	Q4	Q1	Q2							
1- Industrial Pollution Control														
Key Strategy 1: Development of National Pollution Source Inventory														
Action 1-1: Follow-up/Notification on Preparation of EMP by Existing Factories in 9														
1-1-1) Preparation of list of factories each sector, industrial zone, and State/ Region through past inspections in ECD	PCD/ Regional ECD													
1-1-2) Preparation of format of EMP for existing 9 sectors	EIA/ Div. ECD													
1-1-3) Collection of information from DISI/ MOI, YCDC, MCDC, NCDC guidance through inspection activities	PCD/ Regional ECD													
1-1-4) Preparation of report on status of preparation of EMP of 9 Sectors and guidance through inspection activities	PCD													
1-1-5) Listing 1st priority factories of 9 sectors to prepare EMP (200 factories)	PCD/ Regional ECD													
1-1-6) Checking status of preparation of EMP to 1st priority factories (200 factories) of 9 Sectors and guidance through inspection activities	PCD/ Regional ECD													
1-1-7) Preparation of report on status of preparation of EMP to 1st priority factories (200 factories) of 9 sectors and guidance through inspection activities	PCD/ Regional ECD													
1-1-8) Listing 2nd priority factories of 9 sectors to prepare EMP (300 factories)	PCD/ Regional ECD													
1-1-9) Checking status of preparation of EMP to 2nd priority factories (300 factories) of 9 sectors and guidance through inspection activities	PCD/ Regional ECD													
1-1-10) Preparation of report on status of preparation of EMP to 2nd priority factories (300 factories) of 9 sectors and guidance through inspection activities	PCD/ Regional ECD													
1-1-11) Listing 3rd priority factories of 9 sectors to prepare EMP (500 factories)	PCD/ Regional ECD													
1-1-12) Checking status of preparation of EMP to 3rd priority factories (500 factories) of 9 sectors and guidance through inspection activities	PCD/ Regional ECD													
1-1-13) Preparation of report on status of preparation of EMP to 3rd priority factories (500 factories) of 9 sectors and guidance through inspection activities	PCD/ Regional ECD													
1-1-14) Continues to implement the above actions	PCD/ Regional ECD													
Action 1-2: Strengthening monitoring system after Issuing ECC for new factories (completion of EIA/ IEE/ EMP Studies)														
1-2-1) Preparation of list of status of factories which have been required to carry out EIA/ IEE/ EMP (before construction, construction, operation)	EIA/ PCD													
1-2-2) Checking monitoring report from factories which start to operate in accordance with EIA/ IEE/ EMP	PCD													
1-2-3) Inspections to factories which start to operate in accordance with ECC (or EIA/ IEE/ EMP)	PCD/ Regional ECD													
1-2-4) Preparation of report on status of factories which are required to carry out EIA/ IEE/ EMP, status of monitoring, and results of inspection	PCD/ Regional ECD													
1-2-5) Continues to implement the above actions	PCD/ Regional ECD													
Action 1-3: Development of Pollution Source Inventory (Upgrading Pollution Source Database)														
1-3-1) Conceptual designing of web-based pollution source inventory system	PCD													
1-3-2) Identification of necessary devices and budget claim	PCD													
1-3-3) Development of PSIS for trial	PCD													
1-3-4) Trial operation of PSIS	PCD													
1-3-5) Training to operate PSIS	PCD/ Regional ECD													
1-3-6) Operation of PSIS and its updating	PCD/ Regional ECD													
Action 1-4: Development of National Pollution Source Inventory														
1-4-1) Development of PSI for existing factories of 9 sectors	PCD													
1-4-2) Development of PSI for existing factories other than 9 sectors	PCD													
1-4-3) Development of PSI for new factories which is required to carry out EIA/ IEE/ EMP	PCD/ EIA													

Continuous activities
Intermediate activities

Source: ECD and JET

Strategy/ Key Activity	Implementers	Short Term				Middle Term			Long Term										
		FY 2018-19		FY 2019-20		FY 2020-21		FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28					
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4						
Key Strategy 2: Strengthening Pollution Control																			
Action 2-1: Strengthening Enforcement and Promotion of Environmental Compliance																			
2-1-1) Selection of priority target sectors to be investigated	PCD																		
2-1-2) Analyzing operation and environmental performance of key target industrial	PCD																		
2-1-3) Strengthening enforcement of environmental law and regulations	PCD																		
2-1-4) Strengthening promotion and facilitation of environmental compliance	PCD																		
2-1-5) Development of a roadmap to control industrial pollution	PCD																		
Action 2-2: Formulating Wastewater Quality Standards																			
2-2-1) Development of draft Wastewater Quality Standards	PCD																		
2-2-2) Public consultations	PCD																		
2-2-3) Issuing Wastewater Quality Standards and its updating	PCD																		
Action 2-3: Promotion of Centralized Wastewater Treatment Plant																			
2-3-1) Issuing notification of instruction of measurement water usage and wastewater qualities	ECD																		
2-3-2) Checking status of installation of water flow meter and monitoring wastewater quality by priority factories	PCD/ Regional																		
2-3-3) Checking status of installation of Centralized Wastewater Treatment Plant (WWTP) in existing/ new industrial zones and preparation of the report	PCD/ Regional																		
2-3-4) Discussions how to promote installation of Centralized WWTP in NECC/CC	ECD HQ																		
2-3-5) Issuing instruction from Presidential Office to Regional Governments to promote installation of Centralized WWTP in industrial zones	ECD HQ/ NECC/CC																		
Action 2-4: Strengthening Inspection Activities																			
2-4-1) Inspection by Regional/ State ECDs and its reporting to ECD HQ	PCD/ Regional																		
2-4-2) Inspection by District ECDs and its reporting to Regional ECD and ECD HQ	PCD/ Regional																		
2-4-2) Inspection by Township ECDs and its reporting to District/ Regional ECD and ECD HQ	PCD/ Regional																		
2-4-4) Inspection by ECD HQ and summarize inspection report at national level	PCD																		
2-4-5) Updating Inspection Manual	PCD																		
Action 2-5: Development of Pollution Control Tools																			
2-5-1) Investigation of Pollution Control Tools in ASEAN countries	PCD																		
2-5-2) Formulation of National Water Pollution Control Strategies	PCD																		
2-5-3) Formulation of Wastewater Discharge Fee System	PCD																		
2-5-4) Development of Performance Rating and Awarding System	PCD																		
2-5-5) Development of Pollution Control Manager System	PCD																		
2-5-6) Establishment of Cleaner Production Technology Center	PCD																		
2-5-7) Establishment of Pollution Control Agreement Scheme	PCD																		
2-5-8) Formulation of Pollution Control Act	PCD																		
2. Water Environment Management																			
Key Strategy 3: Development of Surface Water Quality Standards and National Water Quality Monitoring Network																			
Action 3-1: Development of Surface Water Quality Standards																			
3-1-1) Development of draft Surface Water Quality Standards	EQSD																		
3-1-2) Public Consultations	EQSD																		
3-1-3) Issuing Surface Water Quality Standards and its updating	EQSD																		
Action 3-2: Development of National Surface Water Quality Monitoring Network																			
3-2-1) Setting demarcation of Surface Water Quality Monitoring between Central ECDs and Regional ECDs	PCD/ Regional																		
3-2-2) Identification of important water bodies to be conserved at rivers and lakes at National Level	ECD																		
3-2-3) Phasing to develop National Surface Water Quality Monitoring Network (3 Phases)	Regional ECD																		
3-2-4) Trial Surface Water Quality Monitoring (1st Phase) and Report Preparation	EQSD/ Regional ECD																		
3-2-5) Starting National Surface Water Quality Monitoring (1st Phase)	EQSD/ Regional ECD																		
3-2-6) Development of National Surface Water Quality Monitoring Network (2nd Phase)	EQSD																		
3-2-7) Starting National Surface Water Quality Monitoring (2nd Phase)	EQSD																		
3-2-8) Development of National Surface Water Quality Monitoring Network (3rd Phase)	EQSD																		
3-2-9) Starting National Surface Water Quality Monitoring (3rd Phase)	EQSD																		

Source: ECD and JET

Continuous activities
Intermediate activities

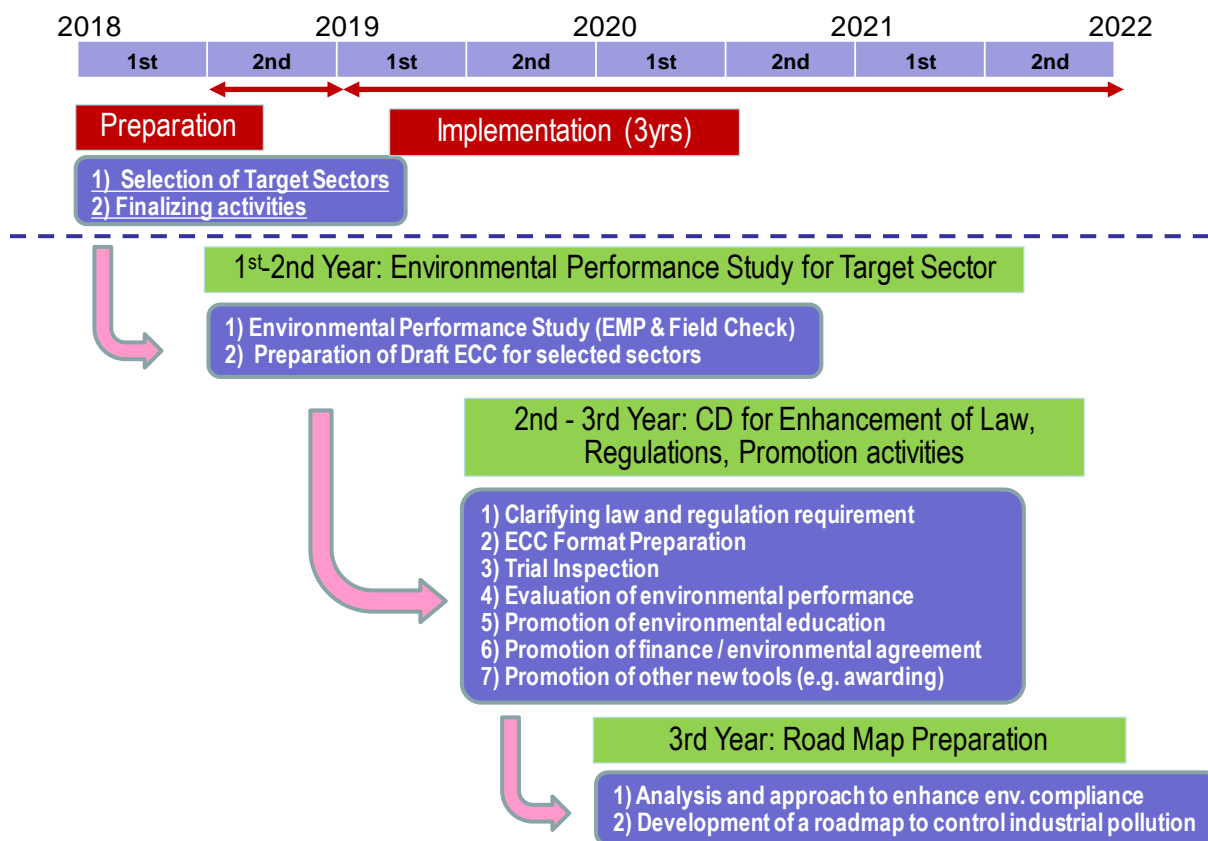
Strategy/ Key Activity	Implementers	Short Term												Middle Term			Long Term				
		FY2018-19				FY2019-20				FY2020-21				FY21-22	FY22-23	FY23-24	FY24-25	FY25-26	FY26-27	FY27-28	
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4								
Action 3-3: Establishment of Water Quality Testing Laboratory and Standardization of Environmental Analytical Method	EQSD																				
3-3-1) Procurement of equipment & construction of building	EQSD																				
3-3-2) Preparation of laboratory analysis and SOPs (Technical guideline for laboratory analysis)	EQSD																				
3-3-3) Starting laboratory analysis & stepwise upgrading the laboratory	EQSD																				
3-3-4) Setting standards of environmental analytical method (wastewater)	EQSD/MOE																				
3-3-5) Setting standards of environmental analytical method (surface water)	EQSD/MOE																				
3-3-6) Establishment of accreditation system of laboratories	EQSD																				
Key Strategy 4: Promoting Actions for Water Environment Management																					
Action 4-1: Preparation of Environmental Statistics (Water)																					
4-1-1) Identification of items to be described in Environmental Statistic	EQSD/ GIS Div.																				
4-1-2) Data and information collection	EQSD/ GIS Div.																				
4-1-3) Preparation of Environmental Statistic	EQSD/ GIS Div.																				
4-1-4) Continues to implement the above actions	EQSD/ GIS Div.																				
Action 4-2: Promoting Environmental Awareness																					
4-2-1) Preparation of awareness raising plan for water environment management	EQSD																				
4-2-2) Preparation of materials and equipment for water environment management	EQSD																				
4-2-3) Awareness raising activities for industries (on going and upgrading)	PCD/ Regional ECD																				
4-2-4) Awareness raising activities for publics (on going and upgrading)	EQSD/ Regional ECD																				
4-2-5) Awareness raising activities for students (on going and upgrading)	EQSD/ Regional ECD																				
4-2-6) Organizing clean up campaign	PCD/ Regional ECD																				
4-2-7) Organizing water quality monitoring by simple test kits for awareness raising	EQSD/ Regional ECD																				
4-2-8) Continues to implement the above actions	EQSD/ Regional ECD																				
Action 4-3: Preparation of State of Pollution every 5 years																					
4-3-1) Identification of items to be described in State of Pollution	PCD/ EQSD																				
4-3-2) Data and Information Collection (2016-2020)	PCD/ EQSD																				
4-3-3) Preparation of State of Pollution (2016-2020)	PCD/ EQSD																				
4-3-4) Data and Information Collection (2021-2025)	PCD/ EQSD																				
4-3-5) Preparation of State of Pollution (2021-2025)	PCD/ EQSD																				
4-3-6) Continue to implement the above actions	PCD/ EQSD																				
3. Strengthening Organizations																					
Key Strategy 5: Strengthening Organizations in accordance with decentralization																					
Action 5-1: Key Trainings for Industrial Pollution Control																					
5-1-1) Identification of role and responsibilities on industrial pollution control at Region, District, and Township (in future) ECD	PCD																				
5-1-2) Development of handbook for pollution control by local ECD officers (fundamental environmental items, inspection, on-site measurement, instruction to	PCD																				
5-1-3) Implementation of initial training for local ECD officers	PCD																				
5-1-4) Continue to implement the above actions	PCD																				
Action 5-2: Key Trainings for Water Environment Management																					
5-2-1) Identification of role and responsibilities on water environment management at Region, District, and Township (in future) ECD	EQSD																				
5-2-2) Development of handbook for water environment management by local ECD officers (fundamental environmental items, water quality monitoring, environmental awareness, reporting)	EQSD																				
5-2-3) Implementation of initial training for local ECD officers	EQSD																				
5-2-4) Continue to implement the above actions	EQSD																				
Continuous activities																					
Intermediate activities																					

Source: ECD and JET

Among the action plans for industrial pollution control and environmental management plan at the national level, “Strengthening Enforcement and Promotion of Environmental Compliance (NA2-1)” is one of the urgent action plans. Environmental Compliance Certificate (ECC) is a certificate of environmental compliance for factories stipulated in Environmental Impact Assessment Procedures (EIAP, 2015), but most factories are yet to obtain ECC. Moreover, MONREC has already issued the Notification of No. 03/2018 to notify existing large-scaled factories in 9 important sectors (1. alcohol, wine and beer production factories, 2. food and beverage processing facilities, 3. pesticide

manufacturing, formulation, and packaging plants, 4. cement and lime manufacturing plants, 5. textile and dyeing facilities, 6. foundry industry, 7. tanning and leather finishing, 8. pulp and/or paper mills, 9. sugar manufacturing plants) to prepare Environmental Management Plan in accordance with EIAP (2015) and to obtain ECC by October 2018 or January 2019. In order to strengthen enforcement and promotion of environmental compliance in line with requirements of ECC and Environmental Conservation Law (2012), a special project including the following activities should be implemented in short term. Figure 2.6-7 shows outline of the special project on strengthening enforcement and promotion of environmental compliance.

- 1) Selection of priority target sectors to be investigated
- 2) Analyzing operation and environmental performance of key target industrial sectors
- 3) Strengthening enforcement of environmental law and regulations
- 4) Strengthening promotion and facilitation of environmental compliance
- 5) Development of a roadmap to control industrial pollution



Source: ECD and JET

Figure 2.6-7 Outline of the Proposed Project on Strengthening Enforcement and Promotion of Environmental Compliance

2.6.3 Prepare a Water Quality Status Report (Activity 4-3)

On the basis of the above activities, the Water Quality Status Report (WQSR) was prepared. The table of contents of the report is shown in Table 2.6-7. WQSR is to be presented to decision makers from each counterpart organization as follows:

- Sub-working group of pollution control in the National Environmental Conservation and Climate Change Central Committee (NECCCCC) presented by MONREC/ECD

- Chief Minister of Yangon Region Government/ Mayor (and/or Secretary, Committee Member) of YCDC from YCDC/PCCD
- Chief Minister of Mandalay Region Government/ Mayor (and/or Committee Member) of MCDC from NCDC/WSD

Table 2.6-7 Table of Contents of the Water Quality Status Report

1	Introduction
1.1	Background
1.2	Objectives
1.3	Procedures of Preparation of Water Quality Status Report
1.4	Case studied for Information Interpretation for Water Quality Status
2	Water Quality Status in the Pilot Area of Yangon (Hlaing River Basin)
2.1	Natural Conditions
2.2	Social Conditions
2.3	Government Organizations Related to Water Environment Management
2.4	Water Quality
2.5	Industrial Water Pollution Source
2.6	Overall Pollution Pathways to Rivers
2.7	Results of Pollution Load Estimation
2.8	Impact of Pollution on River Water Quality
3	Water Quality Status in the Pilot Area of Mandalay (Doke Hta Waddy River Basin and Taung Tha Man Lake basin)
3.1	Natural Conditions
3.2	Social Conditions
3.3	Government Organizations Related to Water Environment Management
3.4	Water Quality
3.4	Industrial Water Pollution Source
3.6	Other Water Pollution Source
3.6	Overall Pollution Pathways to Rivers and Lake
3.7	Impact of Pollution on River Water Quality
4	Strategy for Water Pollution Control from Industries and Water Environment Management
4.1	Approaches for Development of Framework of Strategy For Water Pollution Control from Industries and Water Environment Management
4.2	Strategy for Strategy for Water Pollution Control from Industries and Water Environment Management at National Level
4.3	Strategy for Water Pollution Control from Industries and Water Environment Management in the Pilot Area of Yangon
4.4	Strategy for Water Pollution Control From Industries and Water Environment Management in the Pilot Area of Mandalay
5	Conclusion and Recommendations
Appendices	
	Case Study 1: Pollution load analysis in the pilot area of Yangon
	Case Study 2: Pollution load analysis in the pilot area of Mandalay
	Case Study 3: Installation of centralized wastewater treatment system in Hlaing Thar Yar Industrial Zones in Yangon
	Case Study 4: Preliminary estimation of dilution capacity for water quality leading to future water resource management in the Doke Hta Waddy River

Source: JET

2.7 Other Activities

2.7.1 Study Programs in Japan

(1) First Program

During the course of the project, there were a total of three opportunities for project-funded training in Japan. The first program was implemented during 22 to 28 May 2016. Table 2.7-5 and Table 2.7-2 show the summary and schedule of the first program, respectively. Some photographs from the first

program are shown in Figure 2.7-3. In total six delegates (three from ECD, one from YCDC and two from MCDC) participated in the program.

Table 2.7-1 Summary of the Study Program in Japan No.1

Item	Contents
Title	1st study program in Japan for the Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar
Period	22 May (Sun) – 28 May (Sat) 2016 (for a total of seven days)
Number of Trainees	Six participants (three participants from MOECAAF, one participant from YCDC, and two participants from MCDC)
Main Places for Training	Tokyo
Program	See Table 2.7-2
Language	Myanmar – Japanese

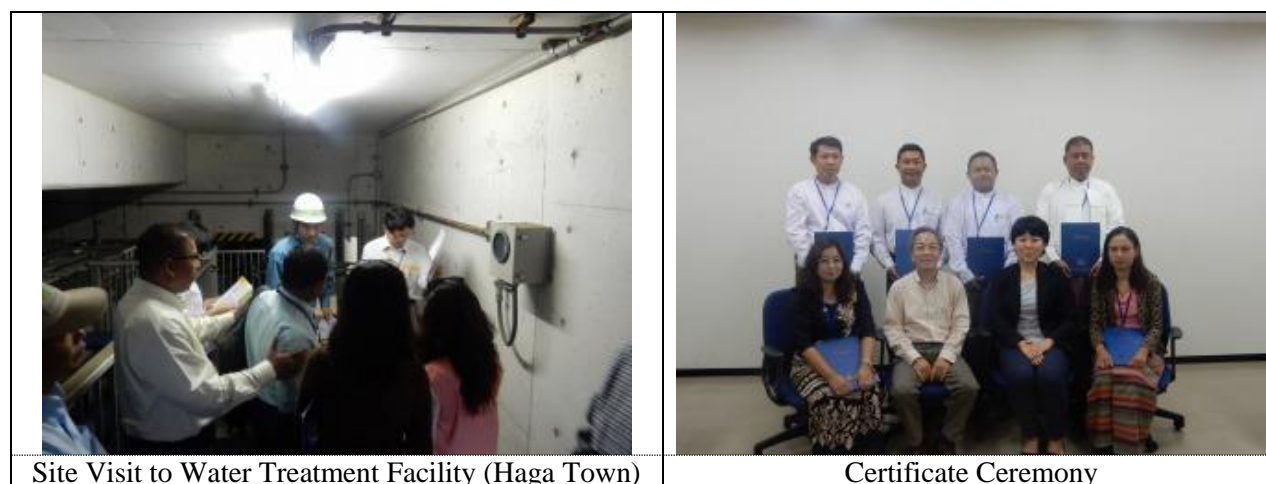
Source: JET

Table 2.7-2 Schedule of the Study Program in Japan No.1

Day	Time	Activities	Lecturer /Venue	Relevant Outputs
-	21 May (Sat)	21:45 - Departure from Yangon for Narita	-	-
1	22 May (Sun)	06:50 - Arrival at Narita Airport - 09:30 - Move to TIC	-	-
2	23 May (Mon)	09:15 – 10:30 - Briefing of the training in Japan - Orientation of the training course	TIC JET	-
		11:30 – 12:00 - Courtesy visit to JICA	-	-
		13:30 – 15:00 - Lecture on necessary policies and effective measures for water pollution / case studies of water quality improvement in Japan	Tokyo Metropolitan Research Institute for Environmental Protection	Output 1, Output 2
		16:30 – 17:10 - Site visit: Sumida River	Sumida River	Output 1, Output 2
		19:00 – 20:30 - Meeting for exchange of opinions	JET	Outputs 1, 2, 3 and 4
		10:00 – 12:00 - Lecture on policies and system for water environment management (watershed) and administrative measures for water pollution in Japan - Courtesy visit to the Ministry of Environment (MOE)	Ministry of Environment (Japan)	Outputs 1 and 2
3	24 May (Tue)	14:20 – 14:45 - Site visit: Giant Ushiku Amida Buddha (Cultural understanding)	-	-
		15:30 – 17:30 - Site visit: Water environment of Lake Kasumigaura	Ibaraki Kasumigaura Environmental Science Center	Outputs 1 and 2
		09:00 – 11:30 - Lecture on measures for water pollution in Kawasaki City (local government)	Kawasaki City	Outputs 1 and 2
4	25 May (Wed)	13:00 – 16:00 - Assignments of the Kawasaki Environment Research Institute (KERI) - Lecture on research and study on water pollution - Laboratory tour (KERI)	Kawasaki Environment Research Institute	Outputs 1, 2 and 3
		17– 17:30 - Site visit for viewing Keihin Industrial Area	JET	-
		10:00 – 11:00 - Site visit for water treatment and management of wastewater	Haga Town, Tochigi Pref.	Outputs 1, 2 and 3
5	26 May (Thu)	14:00 – - Lecture and discussion on issues of water	Dr. Senro Imai	Outputs 1, 2,

Day	Time	Activities	Lecturer /Venue	Relevant Outputs	
	16:30	environmental management and measures toward resolution		3 and 4	
6	27 May (Fri)	10 – 12	- Presentation and discussion	JET	-
		13:00 – 15:00	- Evaluation of the training course - Certificate Ceremony	TIC	-
7	28 May (Sat)	11:00	- Departure from Narita to Yangon (Departure from TIC at 7:00)	-	-

Source: JET



Site Visit to Water Treatment Facility (Haga Town)

Certificate Ceremony

Source: JET

Figure 2.7-1 Photos of the Study Program in Japan No.1

(2) Second Program

The second program was divided into a 1-week course and a 3-week course in order to accommodate the needs of both managerial and technical-level officers. They were implemented from 27 September to 4 October 2016 for the 1-week course, and from 27 September to 18 October 2016 for the 3-week course. Table 2.7-5 and Table 2.7-6 show the summaries and the programs of both courses.

Table 2.7-3 Summary of the Study Program in Japan No.2

Course	Item	Contents
1-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (1-week)
	Period	27 September (Sun) – 4 October (Sat) 2016 (for a total of 7 days)
	Number of Trainees	Three delegates (one participant from MOECAAF, one participant from YCDC, and one participant from MCDC)
	Main Places for Training	Tokyo
	Program	See Table 2.7-4
	Language	Myanmar – Japanese
3-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (3-weeks)
	Period	27 September (Tue) – 18 October (Sun) 2016 (in total 22 days)
	Number of Trainees	Seven participants (three participants from MOECAAF, one participant from YCDC and two participants from MCDC)
	Main Places for Training	Tokyo, Yokohama and Kansai
	Program	See Table 2.7-4
	Language	Myanmar – Japanese

Source: JET

Table 2.7-4 Schedule of the Study Program in Japan No.2

1-week	3-week	Date		Time	Activities	Lecturer /Venue	
1	1	27 (Tue)	Sep	-	PM: Departure from Yangon to Tokyo	-	
2	2	28 (Wed)		AM	Arrival at Tokyo, Move to hotel	-	
				15:20-15:50	Briefing by the JICA Expert Team	Nippon Koei Co., Ltd.	
				15:50-16:20	JCM project formulation for energy conservation and environmental improvement	Nippon Koei Co., Ltd.	
				16:30-18:15	Development of approaches for environmental protection and challenges for SDGs in Japan	Mr. Senro Imai, JICA advisor	
				18:30-20:30	Welcome party	-	
3	3	29 (Thu)		10:00-12:30	Briefing and orientation	TIC	
				14:30-15:00	Courtesy call to JICA	JICA HQ	
				15:00-16:30	Environmental administration in Myanmar and Japan	Dr. Itaru Okuda, Team Leader of the JICA Expert Team	
4	4	30 (Fri)		9:00-12:00	Lecture on measures for water pollution in Kawasaki City	Kawasaki City	
				13:00-14:30	Introduction of the Kawasaki Environment Research Institute/ Laboratory tour	Kawasaki Environment Research Institute, Kawasaki City	
				15:00 - 17:00	Site visit for wastewater treatment facility and management (food industry)	Ajinomoto Co., Inc. Kawasaki Plant	
5	5	1 (Sat)		Oct	10:00 - 12:00	Environmental policy framework and administration in Japan	Prof. Hitoshi Ushijima, Chuo University
					PM	Free time	-
6	6	2 (Sun)			9:00 - 17:00	Holiday (private sightseeing tour in Kamakura)	-
7	7	3 (Mon)	9:00 - 11:30		Site visit for river water treatment facilities	Katsunan Public Works Office, Chiba Prefecture	
			12:50 - 13:50		Lunch meeting with JICA HQ	-	
			14:00 - 15:30		Water environment administration of Japan	Water Environment Division, Environment Management Bureau, Ministry of the Environment	
			16:00 - 17:30		Wrap-up presentation and certificate ceremony for the 1-week program	JICA HQ	
			AM		[Attendees of the 1-week program] Leave Japan for Myanmar	-	
-	9-15	5 (Wed)	9:00 - 17:00		[Attendees of the 3-week program] Training on water quality monitoring	Private lab, Osumi Co., Ltd	
			9:00 - 16:30		Training on water quality analysis	Private lab, Osumi Co., Ltd	
			9:00 - 17:00		Training on water quality analysis	Private lab, Osumi Co., Ltd	
			9:30-12:00		How to develop a water quality monitoring plan and report/ Good practice of inspection activities in other countries	Nippon Koei Co., Ltd.	
			13:30 - 15:30		Preparation of wrap-up presentation	-	
			9:00 - 14:00		Holiday (private sightseeing tour in Asakusa/ Tokyo)	-	
			-		Move from Tokyo to Otsu	-	
			10:00 - 12:00	Lake Biwa cruise	-		
			14:00 - 16:00	Lake Biwa Museum	-		
			10:00 - 12:00	Lecture on lake environmental management/ Laboratory tour	Lake Biwa Environmental Research Institute		
			14:00 - 16:00	Site visit for wastewater treatment facility	Kirin Co., Ltd. Shiga		

1-week	3-week	Date	Time	Activities	Lecturer /Venue
				and management (alcohol and beverage industry)	Factory
	16	12 (Wed)	9:30 – 12:00	Site visit for wastewater treatment facility and management (manufacturing industry)	Shimadzu Corporation, Sanjo Works
			14:00 15:00	Environmental education and environmental activities in Kyoto City	Miyako Ecology Center
			16:15 – 17:00	Sightseeing at Kinkakuji (Golden Pavilion)	Kinkakuji
	17	13 (Thu)	9:00 – 12:00	Lecture on practice and challenges in industrial wastewater treatment	Mr. Chuzo Nishizaki
			14:00 – 16:30	Site visit for wastewater treatment facility and management (paper mill)	Rengo Co., Ltd., Amagasaki Mill
	18	14 (Fri)	9:00 – 12:00	Sewage system in Kobe City / site visit to a sewage treatment plant	Kobe City
			14:00 -16:00	Site visit for wastewater treatment facility and management (power plant)	Kobelco Eco-Solutions Co., Ltd.
	19	15 (Sat)	-	Holiday (sightseeing tour in Kyoto)	-
	20	16 (Sun)	-	Move from Kobe to Tokyo	-
	21	17 (Mon)	9:30 – 11:30	Central wastewater treatment plant in industrial zone	Yokohama City
			13:30 – 17:00	Wrap-up presentation and certificate ceremony for the 3-week program	JICA HQ
	22	18 (Tue)	-	Departure from Tokyo to Yangon	-

Source: JET



Lecture by the Ministry of Environment Japan

Wrap-up Presentation by Delegates

Source: JET

Figure 2.7-2 Photos of the Study Program in Japan No.2

(3) Third Program

The third program was implemented from 28 August to 14 September 2017. This time, some delegates from related ministries participated in the program in addition to those from the main C/P organizations, i.e., ECD, YCDC, and MCDC. The program had two courses, namely, Course 1 and Course 2 for management-level officer and technical officers, respectively, although many contents were common to both courses.

Because of the delay in the internal procedure of the Myanmar government, eight participants for Course 1 (management level), excluding one participant from MOE, joined the program from the afternoon of 1 September 2017 missing the first part of the program. One participant from MONREC

for Course 1 was not allowed to join the program because of the change in the internal regulation of the Myanmar government in August 2017.

Table 2.7-5 and Table 2.7-6 show the summary and schedule.

Table 2.7-5 Summary of the Study Program in Japan No.3

Item	Contents
Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (2)
Period	28 Aug (Mon) – 14 Sep (Thu) 2017 (for a total of 17 days)
Number of Trainees	A total of 14 delegates - 10 delegates for Course 1 (management level): 3 participants from MONREC, 1 participant from YCDC, MCDC, MOTC, MOHS, MOE, MOI and MOALI. - 4 delegates for Course 2 (technical-level): each has 2 participants from YCDC and MCDC
Main Places for Training	Tokyo, Shiga and Kansai
Language	Myanmar – Japanese

Source: JET

Table 2.7-6 Schedule of the Study Program in Japan No.3

Date		Activities		Lecturer /Venue		
28	Aug	Mon	PM: Departure from Yangon to Tokyo		-	
29	Aug	Tue	AM: Arrival at Tokyo PM: Free time		TIC	
30		Wed	AM: Briefing and orientation PM: Courtesy call to JICA/Lecture on the Development of Approaches for Environmental Protection and Challenges for SDGs in Japan		AM: TIC PM: JICA, Dr. Imai	
31		Thu	Lecture on measures for water pollution in local government		Kawasaki Municipality	
1		Sep	Fri	AM: Site visit for centralized wastewater treatment facility for industrial zone PM: Courtesy call to the Ministry of Environment (MOE) and lecture on necessary policies and effective measures for water pollution		AM: Haga Town PM: MOE
2	Sep	Sat	AM: Japan's Environmental Law and its implementation		AM: Professor from Chuo University	
3		Sun	Holiday		-	
4		Mon	Lecture on water quality monitoring		Laboratory (Nippon Koei)	
5		Tue	Course 1: Lecture on water environment management in Southeast Asia	Course 2: Training on water quality monitoring and analysis	Course 1: IGES	Course 2: Laboratory (Nippon Koei)
6		Wed	Course 1: AM: Lecture on financial support mechanism related to environmental measures for factories PM: Lecture on coordination for environmental management for factories	Course 2: Training on water quality monitoring and analysis	Course 1: AM: Development Bank of Japan PM: Japan Environmental Management Association for Industry	Course 2: Laboratory (Nippon Koei)
7		Thu	AM: Move to Kansai PM: Lecture on environment of Shiga Prefecture		PM: International Lake	

Date		Activities	Lecturer /Venue
			Environment Committee
8	Fri	AM: Site visit for agricultural wastewater treatment PM: Lecture on eco-friendly farming Site visit to Biwa Lake (boat tour) Move to Kyoto	AM: Kusatsu City PM: Shiga Prefecture
9	Sat	AM: Site visit to Lake Biwa Museum	AM: Biwa Lake
10	Sun	Holiday	-
11	Mon	AM: - Regulation on industrial wastewater for sewerage - Lecture on pollution control measures by industries / experience of developing wastewater treatment system in Vietnam PM: Site visit to wastewater treatment facilities or sewage treatment plant	AM: Kobe City KOBELCO PM: Suntory Takasago Factory
12	Tue	AM: Environmental education and activities in Kobe City PM: Move to Tokyo	AM: Kobe environment and future museum
13	Wed	AM: Presentation preparation PM: Wrap-up presentation and certificate ceremony	AM:TIC PM: JICA
14	Thu	Move from Japan to Myanmar	-

Source: JET



Laboratory of Nippon Koei

Wrap-up and Certificate Ceremony

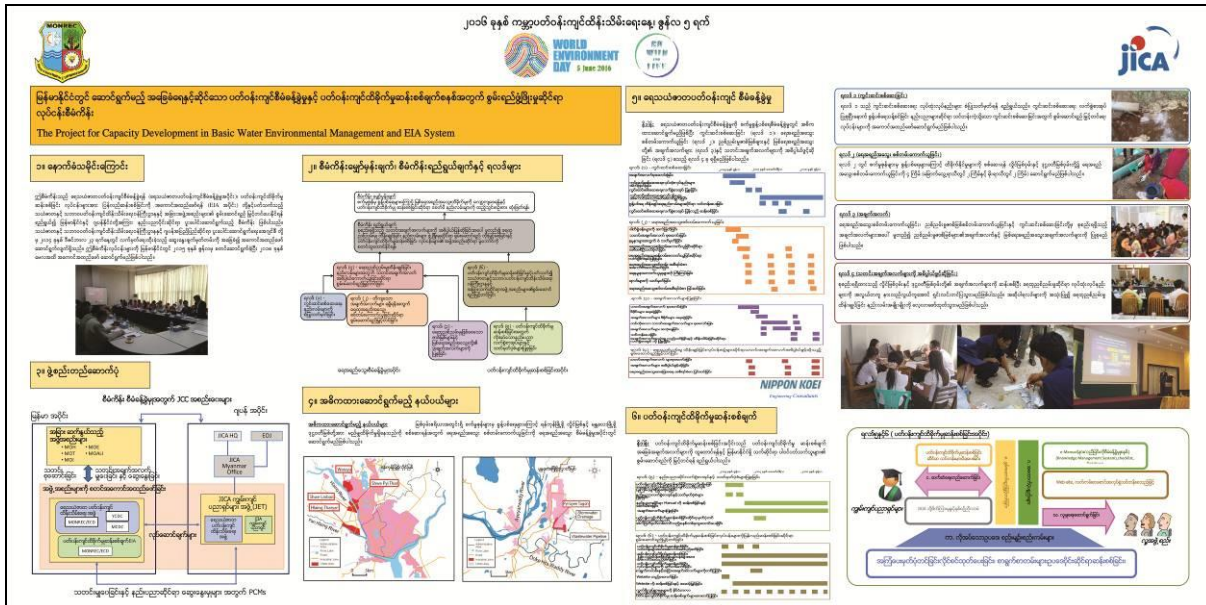
Source: JET

Figure 2.7-3 Photos of the Study Program in Japan No.3

2.7.2 Project Promotion and Publicity Activities

(1) Environment Day Poster

For the Environment Day in May 2016 in Nay Pyi Taw, the project prepared a poster, and explained the project activities to the participants. Among the guests who stopped by the project's booth were then President of the Union of Myanmar, Mr. Htin Kyaw, and the Union Minister of MONREC, Mr. Ohn Win.



Source: JET

Figure 2.7-4 Poster for World Environment Day on 5th June 2016



Figure 2.7-5 Visit by the President and the Minister

(2) Project Website

The project website was developed in Myanmar, English and Japanese. The website included “About Project” pages explaining the framework of the project, “About Us” pages explaining the organizational structures of the project, and about 30 posts explaining the project activities and results. The URL of the website is “<http://myanmar-waterenvironment.com>”.



Source: JET

Figure 2.7-6 Website of the Project

(3) Newsletter

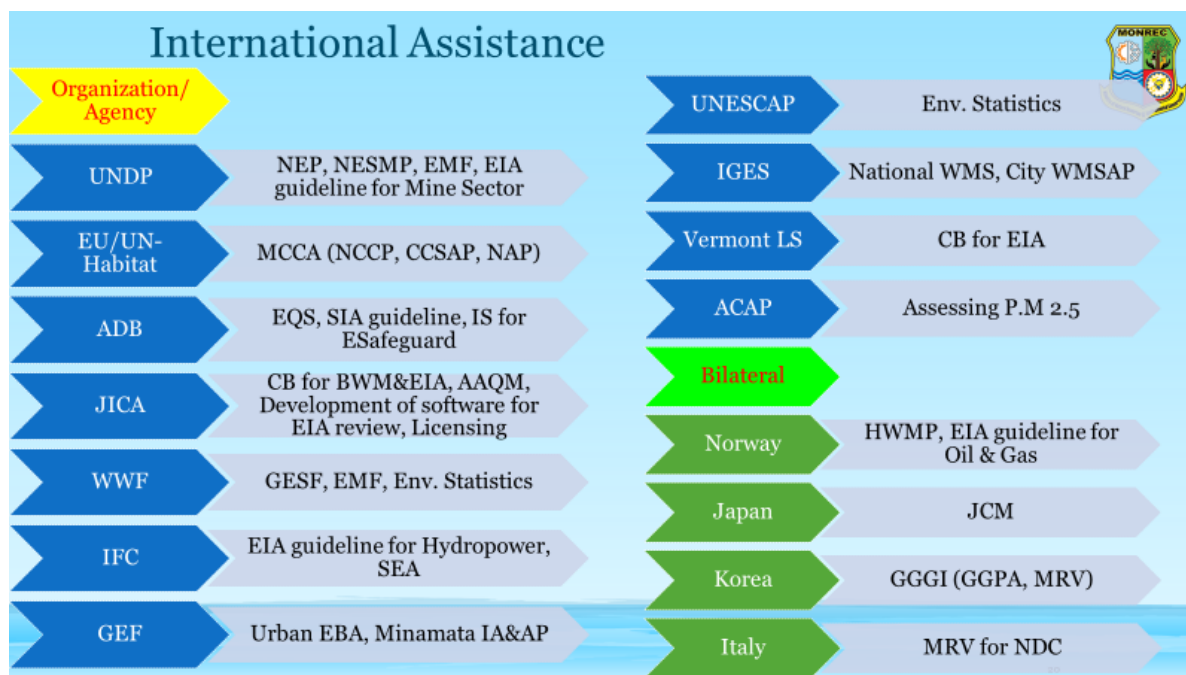
During the course of the project, the project's newsletter was published in order to widely disseminate project information to stakeholders.



Figure 2.7-7 Project Newsletters

2.7.3 Collect Information on Activities of Relevant Organizations and Donors

Figure 2.7-8 summarizes the on-going international projects and activities in the field of environmental conservation as of late 2017. During the project, various donors and local organizations implemented related projects and activities. Thus, the project regularly and actively exchanged information with such donors (e.g., and local organizations (e.g., ADB, Norwegian projects, WWF, UMFCCI). Some of the activities were implemented in coordination with other donors (e.g., pollution source survey with the Norwegian team and development of the Inspection Manual with ADB project).



Source: MONREC-ECD

Figure 2.7-8 International Assistance related to Environmental Conservation (As of end of September 2017)

CHAPTER 3 ISSUES AND LESSONS LEARNED

As presented in Chapter 4, overall this project was executed well thanks to the devotion of counterpart (C/P) organizations to develop their capacities through the project and good relationship among the C/P organizations and JICA Expert Team (JET). Overall, there were no major difficulties in implementing the project. Nevertheless, it is still worth pointing out some of project management issues encountered during the course of the project, how such issues were resolved, and what lessons were learned from the experiences, for implementation of future projects.

3.1 Designing Effective Capacity Development Activities within Constraints

(1) Issues Encountered

Myanmar has just started introducing pollution control regulations based on the Environmental Conservation Law (2012) in recent years, and the demands for capacity development have been substantial in all areas of environmental management, from development of effective policies at the national level down to the on-the-ground enforcement by the frontline officers. Because what this project could do to fulfill these demands were limited, implementing activities with maximum effectiveness within the project constraints have always been the main focus of the project implementation. The following issues were considered particularly important:

- The project activities were implemented in three cities (Yangon, Mandalay and Nay Pyi Taw) with seven organizations (ECD YGN, PCCD-YCDC, WSD-YGN, ECD-MDL, WSD-MCDC, CD-MCDC and ECD-HQ). Thus available time and resources for project implementation had to be spread thinly across different cities and organizations.
- The project aimed to support C/P organizations to adopt new approaches to industrial pollution control, and most of the project activities (e.g., compliance inspection, pollution source surveys, monitoring of environmental conditions of rivers, discussion on centralized wastewater treatment, etc.) were beyond the daily activities of the C/P organizations. The C/P members were often very busy with their daily activities, and balancing their daily activities with project activities was a challenge.
- To learn industrial water pollution control and environmental monitoring, one generally needs a few years of college-level training in environmental chemistry, analytical chemistry, chemical engineering, hydrology, etc. Many officers did not have such backgrounds, and for such officers, the learning curve was very steep.

(2) Measures Taken and Lesson Learned

The following efforts were made to implement project activities in most effective ways considering the constraints:

- A resident JET member based in Yangon and a team of local experts were readily available to prepare for project activities, discuss issues with the C/P members, and follow up on activities even when the JET member in charge was not in Myanmar, as were the cases of pollution source survey, GIS training, and report writing training. The local experiences, resources and connections of the resident JET member, such as his experiences in managing environmental issues in Thilawa Special Economic Zone (SEZ), added significant advantage to the project.
- In order to facilitate quick learning within a limited time, the project emphasized hands-on experiences and learning-by-doing because in this way officers can absorb important points of water environment management through personal experiences even without extensive formal training in the past. For this, the following activities were added during the course of the project: (i) cross-checking of river water quality data by the laboratories of C/P organizations, (ii) report writing training, (iii) questionnaire survey of 202 factories and wastewater sampling at 100

factories, (iv) additional GIS training, and (v) visit to Thilawa SEZ during inspection training for YCDC.

- Some of the subjects (e.g., wastewater treatment technologies and monitoring design) required lectures for structured learning. However, many officers were too busy to participate in long lectures. Thus, lecture-type activities were usually kept short, often a half-day or one-day, and repeated depending on the need. Among the examples were (i) training on industrial wastewater treatment technologies, and (ii) report writing training. In the case of the GIS training, a one-week GIS training was mixed with several one-day hands-on training on usage of database. As for the lectures on wastewater treatment technologies, in addition to the Japanese expert, Vietnamese experts were brought in to give lectures on how Vietnam, another Association of Southeast Asian Nation (ASEAN) country, is addressing similar issues.

Both the C/P organizations and JET found that intensities and depths of capacity development activities were appropriate. Nevertheless, the demands for capacity development were so large, and the project was able to meet only a small fraction of capacity development needs. This is particularly true for ECD, which recruited many new officers toward the end of the project. Should the project have more resources and time, probably it was possible to implement more capacity development activities. On the other hand, one could also argue that a small addition of activities might not improve the capacity significantly. Perhaps it was a good timing to end the project, and re-design capacity development activities considering the experiences gained and the roadmap developed in Output 4.

3.2 Adjusting to the Evolving Environmental Administration in Myanmar

(1) Issues Encountered

Environmental administration in Myanmar has been evolving rapidly in recent years, and the project had to constantly adjust to the new situation. Some of the relevant changes related to the project can be summarized as follows:

- When the project started in 2015, ECD was still a small organization, and pollution control of manufacturing industries were achieved largely by other organizations, such as YCDC and MCDC within the framework of business licensing. However, the role of ECD became significantly larger during the project, and by the end of 2017, ECD became the main organization responsible for pollution control. Also, the role of the region/state governments has been increasing since the regime change in 2016. These changes also affected the roles of YCDC and MCDC in pollution control of manufacturing industries.
- From the point of view of legal mechanisms for pollution control, YCDC law and MCDC law were among the most important legal mechanisms when the project started in 2015. However, in December 2015, then MOECA issued the ECD Procedures (2015) and NEQEG (2015) based on the Environmental Conservation Law (2012), and these regulations are becoming important. More recently, in January 2018, MONREC issued an order to nine industrial sectors to develop EMPs and obtain ECC. Despite such development, details, such as conditions of ECC, are yet to be clarified.

(2) Measures Taken and Lessons Learned

These changes affected the way the project was managed as well as how activities were designed and implemented. Some of the adjustment made include the followings:

- The project was implemented in a flexible manner within the general framework of the PDM. After the capacity assessment and a series of discussions with the C/P members and JICA, the PDM was amended in December 2015 and a number of activities, such as training on wastewater treatment technologies, and the pollution source survey, were added to adjust the project to the situation of Myanmar. Similar adjustments were made throughout the project period to maximize the effectiveness of the activities.

- The project took the bottom-up approach, i.e., examining conditions of pollution sources and target rivers in the field-level first, and then working its way up toward policies using the ground-level knowledge and experiences as building blocks. While the field activities took a lot of time and efforts, it turned out that this approach was very useful because at that time nobody had reliable information about pollution sources, and the experiences gained through the project facilitated discussions for development of new pollution control systems.
- It is also important to point out that the project did not merely react to the changes, but rather anticipated them, and actively tried to set stages for smooth transition to the new water environment management. A good example is the case study of a centralized wastewater treatment in Yangon and the subsequent workshop in October 2017. This case study was implemented to identify practical issues in developing centralized wastewater treatment facilities in industrial zones in Yangon under the leadership of the Region Government, in anticipation of difficulties ECD would face in the near future to enforce the requirements of ECC. Similarly, the inspection manual was developed in order to prepare ECD and other organization for more strict compliance inspection. The project also established dialogue with UMFCCI because coordination with regulated communities become important in the future.

Through the project activities, it is hoped that the C/P organizations are now well positioned to adopt a new approach to manage the water environment, even though there are many challenges ahead as discussed in Chapter 5.

3.3 Office and Counterpart Costs

(1) Issues Encountered

- In accordance with the R/D, ECD HQ did provide JET with a good office in ECD in Nay Pyi Taw. However, JET needed an office in Yangon because most local experts, including JET's staff, were based in Yangon and because most activities were to be implemented either in Yangon or Mandalay.
- Another issue encountered during project implementation was the problem of C/P costs, such as per diem, transportation, accommodation fees for C/Ps engaged in project activities, such as on site sampling activities, though the C/P members actively participated in the project. This issue was anticipated from the time of project formulation, and became an obstacle from the early phase of the project implementation.

(2) Measures Taken and Lessons Learned

- With respect to JET's office, ECD and YCDC discussed the problem in 2015, but it was difficult to resolve. Thus, eventually JICA decided to cover the cost.
- With respect to the C/P costs, again many meetings were held among ECD, YCDC, MCDC and JET. However, it was the third JCC meeting in November 2016 during the Mid-term Review of the project that JICA agreed to provide some part of such cost, and the policy paper drafted by JET was agreed. From there on, JET covered some part of the C/P costs.

It should be noted that these measures were exceptional measures only applicable to this project.

CHAPTER 4 ACHIEVEMENTS OF THE PROJECT

This chapter summarizes the achievements of the project based on the results of the mid-term evaluation in October – November 2016 and the terminal evaluation in February 2018. While these project evaluation reviewed the achievements of the entire project, including the EIA component, this chapter explains the achievements related to the water environment management component only. For details, please see the reports of mid-term review and the terminal evaluation, attached to the minutes of JCC meetings No.3 and No.4 (Attachment 5).

4.1 Mid-term Review

The Joint Mid-term Review Team consisted of members from both the Myanmar side and the Japanese side implemented the project review from 23 October to 10 November 2016 in Myanmar, halfway through the project. The review had the following five objectives:

- To conduct a joint review by the Midterm Review Team (hereinafter referred to as, the Team);
 - To confirm actual inputs, activities and the degree of achievements of the outputs, and the prospect of achieving the project purpose;
 - To assess the project based on OECD-DAC's five evaluation criteria - relevance, effectiveness, efficiency, impact and sustainability;
 - To make recommendations on the measures to be taken during the remaining cooperation period and beyond in consultation with agencies concerned; and
 - To confirm the results of the review, and to agree by signing of the review report.
- As for the results of the mid-term review, the Mid-term Review Team concluded that the project activities had been implemented as planned without any major delays. The review team found that the achievements of the project outputs were on the right track although some adjustments to the Project Design Matrix (PDM) were required. The team also addressed other notable issues in project implementation, such as donor coordination, budgetary issues regarding participation in field activities, and definition of inspections, and made a number of recommendations.

The evaluation report of the mid-term reviewed was presented in the 3rd JCC on 9 November 2016 (see Attachment 5). The team presented the conclusions, recommendations and the proposed revision of PDM, and all of the contents and proposal were agreed among all participants.



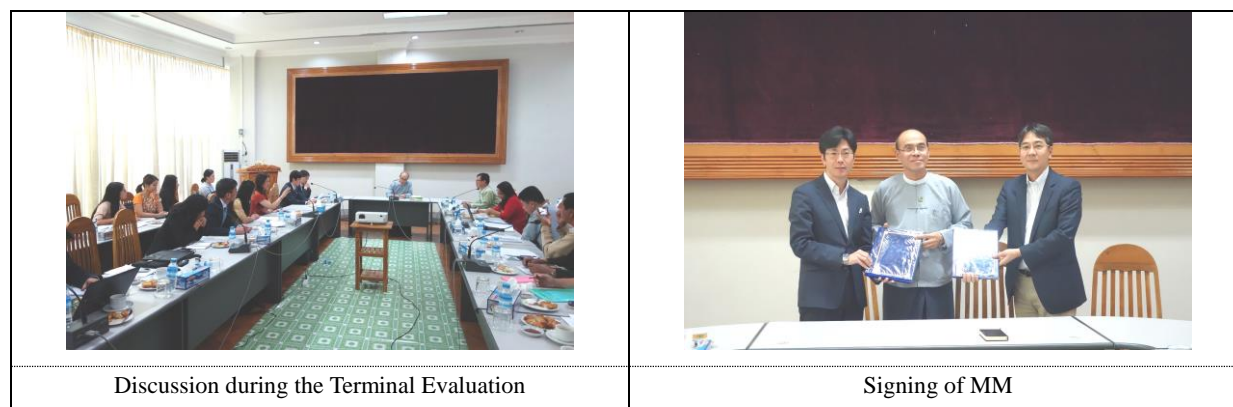
Source: JET

Figure 4.1-1 Photos of the Mid-Term Review

4.2 Terminal Evaluation

The terminal evaluation of the project was implemented from 2 to 23 February 2018, three months to the end of the project. The main objectives of evaluating JICA-supported projects are:

- To ensure accountability to project stakeholders in Myanmar and Japan, by making the project's outcomes public, and
- To improve the project cycle management, by feeding evaluation results to the remaining project activities as well as for the future activities by the government.



Source: JET

Figure 4.2-1 Photos of the Terminal Evaluation

4.2.1 Achievements of the Project

Table 4.2-2 summarizes the results of the evaluation of achievements with respect to the indicators of each output, project purpose and overall goal. Outputs 1 to 3 were considered “achieved” by the time of the terminal evaluation and Output 4 and project purpose were considered “likely to be achieved”. Following the terminal evaluation, remaining activities were duly implemented; thus, Output 4 and the project purpose are also considered achieved.

4.2.2 Evaluation Based on DAC Evaluation Criteria

The project was also evaluated with respect to the five evaluation criteria (relevance, effectiveness, efficiency, impact and sustainability) set by the Development Assistance Committee (DAC) of Organisation of Economic Co-operation and Development (OECD). The results are summarized in Table 4.2-1

Table 4.2-1 Summary of the Terminal Evaluation

Criteria	Concept	Result	Reasons
Relevancy	Whether project design and approach are appropriate to key policies and beneficiaries' needs	High	The project was consistent with the policies and needs and the project design was appropriate.
Effectiveness	Whether six outputs all together have achieved the project's primary objective	High	Given the context and achievements, the project was successful.
Efficiency	Whether inputs and activities are managed efficiently	Relatively High	Although the project lacked some inputs and coordination in the first year, the members were highly committed, and the project was managed well.
Impact	Impact over time and across sectors	Relatively High	Because the overall goals are likely to be achieved, and knowledge-sharing has been observed.
Sustainability	Whether activities and outcomes of this project will last	Moderate	For some CPs, the mandate and the staff assignment still need to be clarified, and capacity development should continue.

Source: Terminal Evaluation Team

Relevancy, effectiveness and efficiency were evaluated as “high”, “high” and “relatively high”, respectively. These mean the project was designed and implemented successfully without major management problems. Impact was rated “relatively high”, indicating the project will be likely to have some lasting impact to the activities of the C/P organizations. sustainability was considered “moderate” largely because there are still significant challenges in the future, such as, clarifying responsibilities of different organizations; making individual-level experiences and knowledge gained through the project into those at the level of organization; making sure tools developed in the project are used and improved; and convincing the decision makers about the need to continue the activities and ensure allocation of budget and other resources for the activities.

4.2.3 Progress of Activities and Plan of Operation

The progress of the activities are compared with the Plan of Operation in Table 4.2-3. Overall, most project activities were implemented as planned, and at the end, all the activities were completed successfully, although there were some delays in the activities during the course of the project.

Table 4.2-2 Achievements of the Project (Water Environment Management Component)

Narrative Summary	Objectively Verifiable Indicators (amended in Nov 2016)	Means of Verification (amended in Nov 2016)	Important Assumptions	Achievements based on Terminal Evaluation in Feb 2018	Remarks
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<p>The number of factories having wastewater treatment plants increases compared with the number at the beginning of the project.</p>	<p>Regulations, number of plants by a simple questionnaire</p>	-	<p>Likely to be achieved</p>	<ul style="list-style-type: none"> According to the results of the pollution source survey, only half of the factories in Yangon and Mandalay are equipped with primary treatment facilities. The number of factories with secondary treatment is in the order of a few to several %. Many distilleries have recently installed or are installing wastewater treatment facilities in 2017-18. In January 2018, MONREC issued an order to businesses in nine prioritized sectors to develop EMPs and obtain ECCs within 9-12 months. This is a significant step toward improving the situation of wastewater management at the factory level.
	<p>Written strategies for wastewater management in industrial zones are developed by YCDC and MCDC in coordination with MONREC.</p>	<p>Written strategy</p>	-	<p>Depends on the C/P</p>	<ul style="list-style-type: none"> Based on the recommendation of the terminal evaluation, brainstorm meetings were organized to discuss the strategies needed to manage wastewater in IZs. In Mandalay, construction of a centralized wastewater treatment facility is already on-going. Also, regional government is coordinating the efforts to promote environmental management of nine sectors based on the order from MONREC. Similarly, the Yangon Region Government started the discussions to improve management of industrial zones, but there are many issues to overcome before proper environmental management is established in IZs.
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<p>Consideration for the water status in the pilot study area is made.</p>	<p>Survey report</p>	<p>National effluent standard is developed.</p>	<p>Likely to be Achieved</p>	<ul style="list-style-type: none"> In Mar-Apr 2018, the C/P members discussed the current status of pollution in the pilot study areas, and the roadmap to progress water environment management in the future. The National Environmental Quality (Emission) Guideline has been issued in December 2015, but the legally-binding national effluent standard was not released within the project period.
<p>Output 1 Inspection procedure is standardized.</p>	<p>Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.</p>	<p>Records of Inspection</p>	<p>Responsibilities of MONREC, YCDC, and MCDC for water pollution control do not change.</p>	<p>Achieved</p>	<ul style="list-style-type: none"> Although the Inspection Manual has been developed, regulatory requirements for pollution control in factories are not clearly defined in the laws and regulations. Roles of MONREC, YCDC and MCDC have changed over the course of the project. Now ECD assumes the main responsibility for pollution control.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<p>Water quality survey reports are prepared in the pilot area by YCDC and MCDC.</p>	<p>Survey report</p>	<p>YCDC and MCDC do not stop inspection system as a water pollution control measure.</p>	<p>Achieved</p>	<ul style="list-style-type: none"> The number of monitoring was increased from four-times to five-times.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<p>At least 150 factories' information are accessible on the database.</p>	<p>Database</p>	<p>Responsibility of MONREC for EIA review does not change.</p>	<p>Achieved</p>	<ul style="list-style-type: none"> Information of 202 factories in Yangon and Mandalay has been stored in the database.
	<p>Results of river water quality survey are accessible on the database.</p>	<p>Database</p>	<p>Relevant legislation of EIA does not significantly change.</p>	<p>Achieved</p>	<ul style="list-style-type: none"> The results of all monitoring activities have been stored in the database.
<p>Output 4 Capacity of interpreting the information for water pollution control measures is enhanced.</p>	<p>Results of water quality status report in the pilot areas are presented to the decision makers by MONREC, YCDC, and MCDC.</p>	<p>Presentation Materials</p>	<p>The draft final of the general technical guidelines prepared by the ADB team is submitted to MONREC.</p>	<p>Likely to be Achieved</p>	<ul style="list-style-type: none"> The Water Quality Status Report, which had not been prepared at the time of the Terminal Evaluation, was successfully produced based on discussions with C/P organizations.

Note: Contents related to the EIA component have been removed from this table.
Source: JET

Table 4.2-3 Comparison of Progress of the Project Activities and Plan of Operation

PO as of 2018/05/17

Year	Plan of Operation (PO)																																			
	1st Year												2nd Year												3rd Year											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Month																																				
Year																																				
Project Period																																				
Output 1																																				
Inspection procedure is standardized.																																				
1-1 To collect information on water pollution sources (Name of a company, Address, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc).																																				
1-2 To evaluate present inspection procedure.																																				
1-3 To develop a inspection manual.																																				
1-4 To implement trial inspection based on the inspection manual.																																				
1-5 To provide training on measures to control industrial effluent																																				
1-6 To evaluate the trial inspection procedures.																																				
Output 2																																				
Capacity for implementing water quality survey to obtain reliable information is enhanced.																																				
2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances).																																				
2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas.																																				
2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc.																																				
2-4 To develop a water quality survey plan.																																				
2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage.																																				
2-6 To implement a water quality survey based on the water quality survey plan.																																				
2-7 To supervise the water sampling with the water quality survey manual.																																				
2-8 To verify the results of the water quality survey using the water quality survey manual																																				
2-9 To prepare a water quality survey reports.																																				
Output 3																																				
Database of water pollution sources and river water quality is developed with GIS software.																																				
3-1 To collect and sort out the information on water pollution sources (Products, Production process, Volume of waste water, pollutants, Waste water treatment method and results of inspection etc.)																																				
3-2 To develop a system concept																																				
3-3 To design the database based on the system concept.																																				
3-4 To collect additional information required to develop the database																																				
3-5 To develop the database.																																				
3-6 To conduct training on operation and utilization of the database.																																				
3-7 To develop an operation and maintenance manual of the database.																																				
Output 4																																				
Capacity of interpreting the information for water pollution control measures is enhanced.																																				
4-1 To collect the information necessary for the water quality status report.																																				
4-2 To interpret the collected information.																																				
4-3 To prepare a water quality status report.																																				

Note: — Black line indicates schedule based on PO
 — Blue line indicates actual progress of activity

Source: JET

CHAPTER 5 RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the recommendations toward the achievement of the overall goal, which is the ultimate goal of the project to be achieved within several years based on the outcomes of the project. As summarized in Table 5.1-1, the overall goal of this project aims to alleviate the impact of industrial effluent from industrial zones on river water quality, and with respect to the Water Environment Management component, there are two indicators, i.e., the increase in number of factories with wastewater treatment plants, and development of written strategies for wastewater management in industrial zones.

Table 5.1-1 Overall Goal and its Objectively Verifiable Indicators

Overall Goal	Objectively Verifiable Indicators	Evaluation in Terminal Evaluation in February 2018
Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.	Likely to be achieved
	Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC.	Depending on C/Ps

Source: JET

The Terminal Evaluation Team made a series of recommendations on actions for the future as shown in Table 5.1-2 Overall Goal and Its Objectively Verifiable Indicators Table 5.1-2 (only the ones related to water environment management are presented here), and these recommendation should be taken into consideration.

Table 5.1-2 Overall Goal and Its Objectively Verifiable Indicators

Recommended Actions	CPs in charge of the Actions				
	ECD-PCD	ECD-EIA	ECD regional	YCDC	MCDC
(1) Utilize the data and information obtained from the Project for the preparation of future policies, guidelines and standards, including the Environmental Quality Standard, or the environmental statistics.	X	-	-	-	-
(2) Start the preparation of the written strategies for waste water management mentioned in (4) of “Actions for before the end of the Project”, in cooperation with MONREC and with other relevant ministries such as Ministry of Construction and Ministry of Industry.	-	-	-	X	X
(3) Ensure that the outputs and tools developed through the Project are utilized in the future, including the manuals, databases, the EIA Tracking System, and the E-manual.	X	X	X	X	X
(4) Integrate the monitoring of the key parameters for water quality -- such as the ones selected for the Project’s water quality surveys—into the routine tasks of each organization.	-	-	X	X	X

Source: Terminal Evaluation Team

Generally speaking, there is ample momentum toward achievement of the overall goal. The number of factories equipped with wastewater treatment plants are increasing as discussed in Section 2.5.4 on the results of the pollution source survey. Also, in January 2018, MONREC issued an order to businesses in nine pollution intensive sectors to submit EMPs and obtain ECCs within 9 to 12 months. Establishment of wastewater treatment plants is expected to be within the scope of ECC. In Mandalay, construction of a centralized wastewater treatment facility is on-going, and in Yangon, there are a number of initiatives to construct centralized wastewater treatment facilities in different industrial zones. Nevertheless, there are numerous challenges ahead.

5.2 Lessons Learned from Activities of Outputs 1 to 3

Outputs 1 to 3 were largely technical activities designed to improve capacities for water environment management, and various lessons were drawn from the experiences in implementing these activities. The suggestions from these activities are summarized in Table 5.2-1. For details, please see Section 2.3.7 on Output 1, Section 2.4.10 on Output 2 and Section 2.5.8 on Output 3.

Table 5.2-1 Suggestions from Activities of Outputs 1 to 3

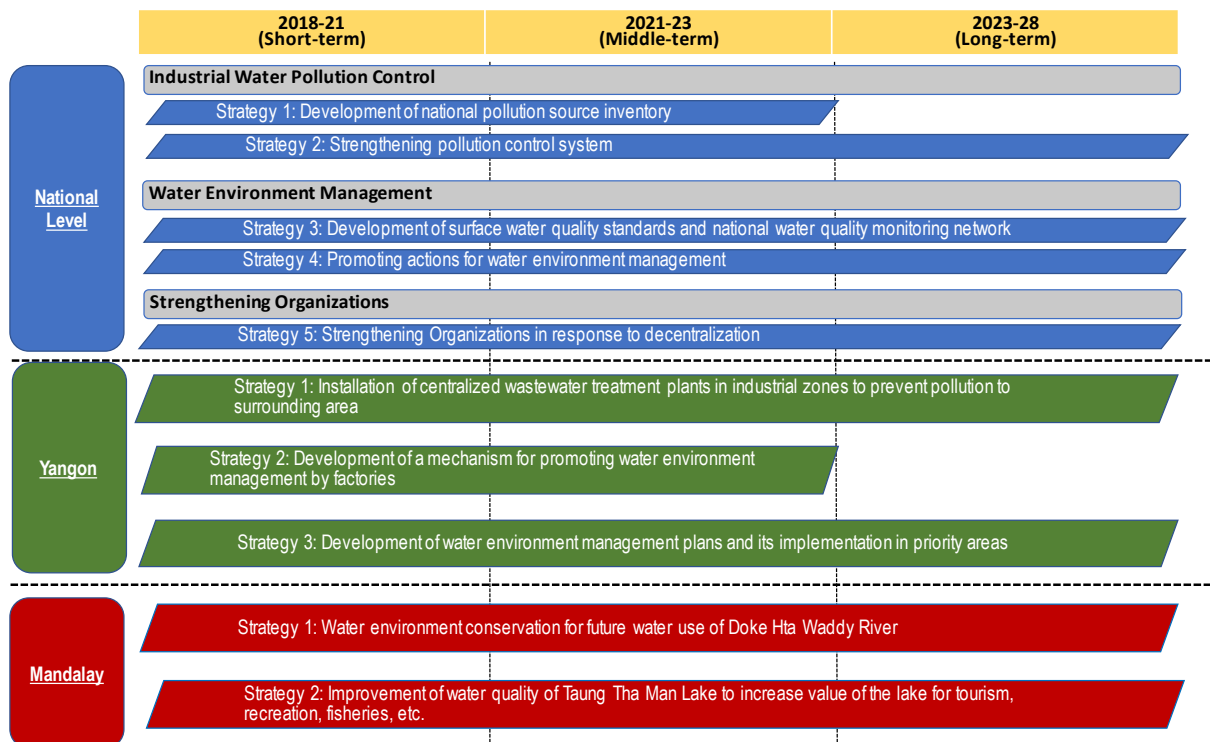
Output	Suggestions	Summary
Output 1 (Inspection)	Clarification of Environmental Requirements	Implement sectoral studies, and set requirements considering the best practices in each sector.
	Clarification of Inspection Procedures for Each Environmental Requirement	Once environmental requirements for factories are set, clarify the detailed inspection procedure for each environmental requirement. Revise the manual accordingly.
	Support to Factories on Pollution Control	Organize workshops and consultation events to educate regulated communities focusing on both procedural and technical issues. Workshops for specific sector or area should be considered.
Output 2 (Water Quality Survey)	Improvement of monitoring data quality in Myanmar	Standardize analytical methodologies and establish QA/QC, including proficiency testing and accreditation system. Also obtain more reliable data as the basis for comparison with monitoring data.
	Development of proper water environmental standard	Develop the surface water quality standard that has proper criteria and is also implementable with the capacity of monitoring organizations.
	Regular Surface Water Monitoring	Plan and implement regular surface water monitoring programs by responsible authorities. Ensure reporting of results from regional ECDs to ECD Headquarters. For important cases, implement special investigations to elucidate detailed, site-specific pollution mechanisms.
Output 3 (Database Development)	Gathering Information from Factories	Collect relevant information from factories through EMP and as part of reporting requirements of ECC. Or implement a questionnaire survey similar to the one implemented in this project.
	Development of Database of Pollution Sources	For managing ECC, expansion of the EIA database may be appropriate. Limit the information to be digitized if digitizing work is overwhelming.
	Improving Reliability of Measurement of Water Usage and Wastewater Qualities	Include installation of water meters and measurement of water usage as part of ECC requirements. Standardize analytical methodologies and introduce a system of QA/QC.
	Improving Environmental Measures by Factories	Enforce realistic environmental regulations and implement support measures. Regulate groundwater abstraction. Request regulated communities to take their own initiatives for pollution control and efficient production, possibly spearheaded by MOI and/or industrial associations.

Source: JET

5.3 Strategies for Water Environment Management

To clarify ways forward, C/P organizations and JET made a series of brainstorming discussions in the last phase to identify strategies and actions in Yangon, Mandalay and at the national-level. The suggestions from Outputs 1 to 3 were taken into consideration. The actions are divided into three terms: short-term (within 3 years), middle-term (within 5 years), and long-term (within 10 years). The

C/P organizations are urged to discuss these strategies further, develop official documents, get approval, and implement the actions. Details are explained in the section on Output 4.



Source: JET

Figure 5.3-1 Strategies for Water Environment Management

Implementing the actions based on these strategies and recommendations proposed by the Terminal Evaluation Team is the most important recommendation from the project.

5.4 Additional Recommendations for Decision Makers

In addition, a number of general recommendations are given below specially for top decision makers as important points to remember in implementing the strategies.

5.4.1 Clear Demarcation of Responsibilities of Environmental Authorities

In Myanmar, many organizations, such as Region Government, ECD, DISI, YCDC/MCDC and GAD, are involved in environmental management. This is partly because decision making has long been done in coordinated manner, and partly because environmental issues are new, and there is no well-established mechanism to resolve environmental issues effectively. The current mechanism based on coordination is an essential element of environmental management in Myanmar. Nevertheless, coordinated decision making requires a lot of time even for resolving small issues, and it could create confusions among regulated communities because opinions could differ from organization to organization. To minimize overlapping tasks and conflicting decision making, and to maximize efficiency of environmental administration and decision making, it is important to clearly demarcate responsibilities among relevant organizations.

For example, ECC by ECD, business licensing by YCDC/MCDC and business registration by DISI all have environmental components at the moment. They should be streamlined so that it is clear how

these certification/licensing/registration work and what roles each organization would take. As part of this process, it is important to set the clear legally-binding requirements in each of these systems so that factories, organization(s) in charge of different pollution control tasks, and organizations that issue business license/registration are all clear about under what conditions environmental performance of a factory is considered acceptable.

This streamlining process will enable these organizations to reduce overlapping activities, confusing decisions and needs for frequent coordination. Then, each organization could spend the time and resources to achieve other tasks or to resolve more serious issues.

5.4.2 Development of Realistic Environmental Requirements

There are different approaches in setting environmental requirements. One approach is to set stringent, highly demanding requirements, perhaps based on environmental requirements in developed countries. This approach might be good in sending a clear message to the regulated communities about the need to improve environmental performance. Some of the large factories with sufficient capacity, such as large foreign-backed firms, might be able to meet the requirements. However, factories with less capacity will not be able to meet the requirements, and probably try to wait and see how other factories would respond to the requirements. Environmental authorities will face serious difficulties in enforcing the requirements and resolving incompliance cases. Meanwhile those who have satisfied the requirements would feel that the environmental authorities are not fair and have double standard. The public might feel that the environmental authorities are not competent enough.

Thus, it is suggested to take a more realistic approach focusing on enforcement, and not merely sending a message. If compliance rate is low, say below 30%, the regulated community would ignore the requirements. Thus, it is suggested to set the goal of the compliance rate higher, and design the requirements such that the goal is achieved in several years. With respect to industrial wastewater in IZs, many factories would probably satisfy significant part of the requirements if factories are connected to a well-maintained centralized wastewater treatment facility. Thus, promoting development of centralized wastewater treatment is desirable. For broader environmental management, it is suggested to implement sectoral studies and set achievable targets based on good/best practices in each industrial sector. Moreover, it is important to limit the scope of regulations manageable based on priority and to set realistic timeframe for compliance, because available resources for compliance and enforcement are limited for both the regulated communities and the environmental authority.

5.4.3 Inducing Behavioral Change

Command-and-control by environmental authorities is one of the main mechanisms to induce environmental compliance by the regulated communities. However, there is a limit to what environmental authority can do. Despite the recent expansion of ECD with respect to the number of officers, other resources, such as transportation and laboratory capability, are still very limited. Moreover, even frequent inspection, administrative guidance/orders, and penalties may not able to make factories to improve environmental performance significantly.

Thus, it is important to think about what would make the reluctant regulated communities to change their mind and improve their environmental performance. Table 5.4-1 summarizes examples of different elements of behavioral change that could influence the way regulated communities respond to an environmental regulation.

Table 5.4-1 Examples of Elements of Behavioral Change

Element	How the Element Influences Behavior
Fear	Whether not complying with the regulation would result in punishment, revocation of license, loss of reputation, and other negative consequences?
Benefit	Whether complying with the regulation brings significant benefit, such as good reputation.

Subjective norm	Whether other factories are complying with the regulation?
Response-efficacy	Whether complying with the regulation would prevent negative impact (fear) from happening.
Self-efficacy	Whether the firm has enough confidence in making the decision (e.g., availability of reliable technical and business advises)
Barrier	Whether there is a barrier to meet the regulation, such as budget and land to install a wastewater treatment facility.
External	Whether there are external factors, such as an order from the parent company or a plan to change orientation of the business.

Source: Terminal Evaluation Team

Depending on what would induce the change, different strategies could be employed. Some factories might hesitate to make commitment to improve environmental performance simply because they do not have any people to advise what to do. For such factories, providing technical and procedural information about how to improve environmental performance or comply with the regulation would be a good tactics. If funding is the main constraint (barrier), establishment of environmental fund and tax exemption would help. During the early days of pollution control in Japan, the organization managing the environmental fund often provided not only financial support, but also technical and business advices so that factories borrowing money would feel confident about their decisions. Dissemination of information about good performers and/or bad performers is also an effective tactics if reputation is the main drive for change.

5.4.4 Involvement of Stakeholders

In environmental enforcement, the relation between the regulated communities and the environmental authority is tense because their interests are often conflicting. This is inevitable. However, this could change with the involvement of a third party. For example, if the regulation is developed based on best-practice in the same sector, the environmental authority becomes an umpire for fair competition within the sector. This could be better for both the environmental authority and the regulated communities, and is the reason why a sectoral study was suggested in this project. Environmental authority will probably face less antagonistic relation. The factories could benefit from such set up because they usually want to improve production efficiency to stay competitive, and environmentally-sound factories are often efficient producers. Moreover, they probably feel the regulation to be realistic and the playing field more level. In many countries, industrial associations often set internal rules for environmental performance among the member companies, to collectively reflect their specific needs for environmental management, and to minimize the bad reputation of one company in the same sector to affect other companies. Promoting such initiatives by industrial associations is recommended.

Similarly, local residents and environmental non-governmental organizations (NGOs) could play important roles in environmental management. In order to stay in business, factories need to keep good relation with local residents, and it is a good driving force to stay environmentally-responsible. The voices of people are also important to make law makers/politicians prioritize important environmental issues. Educating the public about environmental issues could boost these drives. It was noted that in getting a business license in Myanmar, factories often need recommendation letters from local residents.

5.4.5 Promoting Regional Coordination

As discussed in Section 5.4.1 above, clarification of demarcation is highly recommended. Meanwhile, it is also important to realize that certain activities are beyond the capacity and responsibilities of environmental authorities. In particular, development of a centralized wastewater treatment facility requires significant coordination among different stakeholders. The Region Government is expected to

spearhead such effort as other organizations do not have the authority to coordinate such measures. This is why development of written strategies is important, and selected as the indicator of the overall goal, because by developing strategies, roles and responsibilities of each organizations can be made clear.

Appendices

Appendix 1:

PDM and PO

Annex I

Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from October 2014 to October 2017

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doko Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<ol style="list-style-type: none"> The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA. 	<ul style="list-style-type: none"> Regulations Guidelines Annual report 	
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<ol style="list-style-type: none"> Consideration for the water status in the pilot study area is made. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on. 	<ul style="list-style-type: none"> Survey report EIA documents 	<ol style="list-style-type: none"> National effluent standard is developed.
<p>Output 1 Inspection procedure is standardized.</p>	<ol style="list-style-type: none"> More than 80% of the inspection is implemented according to the inspection manual by the end of the Project. 	<ul style="list-style-type: none"> Inspection report 	<ol style="list-style-type: none"> Responsibility of MOECAF, YCDC and MCDC for water pollution control does not change.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<ol style="list-style-type: none"> Water quality survey reports are prepared in the pilot area by YCDC and MCDC. 	<ul style="list-style-type: none"> Survey report 	<ol style="list-style-type: none"> YCDC and MCDC do not change inspection system as a water pollution control measures.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<ol style="list-style-type: none"> At least 150 factories' information is accessible on the database. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database. 	<ul style="list-style-type: none"> Database Database 	<ol style="list-style-type: none"> Responsibility of MOECAF for EIA review does not change. Relevant legislation of EIA does not significantly change.
<p>Output 4 Capacity of interpreting the information for water pollution control measures is enhanced</p>	<ol style="list-style-type: none"> A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC. 	<ul style="list-style-type: none"> Status report 	<ol style="list-style-type: none"> The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 5 Necessary technical manuals and forms for the EIA review are developed.</p>	<p>1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.</p>	<ul style="list-style-type: none"> • Technical manual and forms 	
<p>Output 6 Capacity of MOECAP and the EIA Report Review Body on the EIA review is enhanced.</p>	<p>1. EIA review works by MOECAP are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAP are presented to an international conference.</p>	<ul style="list-style-type: none"> • Evaluation report of EIA • Proceedings 	
<p><Activities> Output 1: Inspection procedure is standardized. 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement inspection based on the developed inspection manual 1-5 To revise the inspection manual</p>	<p><Inputs> Japanese side • Experts. • Training in Japan and other country. • Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side • Counterpart personnel. • Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)</p>		
<p>Output 2: Capacity for water quality survey is enhanced. 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To prepare a water quality survey report</p>			

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 3: Database of water pollution sources and river water quality is developed with GIS software.</p> <p>3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results</p> <p>3-2 To develop a system concept</p> <p>3-3 To design the database based on the system concept</p> <p>3-4 To develop the database</p> <p>3-5 To conduct training on operation and utilization of the database</p> <p>3-6 To develop an operation and maintenance manual of the database</p> <p>Output 4: Capacity of interpreting the information for water pollution control measures is enhance.</p> <p>4-1 To collect the information necessary for the water quality status report</p> <p>4-2 To interpret the collected information</p> <p>4-3 To prepare a water quality status report</p> <p>Output 5: Necessary technical manuals and forms for the EIA review are developed.</p> <p>5-1 To draft necessary Official Forms for the EIA</p> <p>5-2 To develop a technical Manual of the EIA process for review</p> <p>5-3 To evaluate and update the Manual to meet the practical EIA review works</p> <p>5-4 To develop a database for recording the EIA review operation</p> <p>5-5 To establish an evaluation system for issuing license to EIA consultants</p> <p>Output 6: Capacity of MOECAP and the EIA Report Review Body on the EIA review is enhanced.</p> <p>6-1 To implement EIA Training incl. Screening, Scoping, EIA review, EMP, EMoP and so on</p> <p>6-2 To implement EIA review works based on the EIA procedure</p> <p>6-3 To record the EIA review operation</p> <p>6-4 To present leaflets and other materials for dissemination of EIA system</p> <p>6-5 To prepare a periodical report on the EIA review works</p> <p>6-6 To develop a WEB site to disclose EIA works based on the new EIA system</p> <p>6-7 To review and update the WEB site</p> <p>6-8 To presented activities on EIA review to an international conference</p>			
			<p><Preconditions></p> <ol style="list-style-type: none"> 1. Japanese experts are assigned 2. C/Ps are assigned.

Tentative Plan of Operation (PO)

Year	1st Year												2nd Year												3rd Year											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Month																																				
Project Period																																				
Output 1																																				
Inspection procedure is standardized.																																				
1-1 To collect information on water pollution sources (Name of a company, Address, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.).																																				
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1-3 To develop a inspection manual.																																				
1-4 To implement inspection based on the developed inspection manual.																																				
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Output 2																																				
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Output 3																																				
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5-5 To establish an evaluation system for issuing license to EIA consultants.																																				

DATE

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<ol style="list-style-type: none"> The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA. 	<ul style="list-style-type: none"> Regulations Guidelines Annual report 	
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<ol style="list-style-type: none"> Consideration for the water status in the pilot study area is made. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on. 	<ul style="list-style-type: none"> Survey report EIA documents 	<ol style="list-style-type: none"> National effluent standard is developed.
<p>Output 1 Inspection procedure is standardized.</p>	<ol style="list-style-type: none"> More than 80% of the inspection is implemented according to the inspection manual by the end of the Project. 	<ul style="list-style-type: none"> Inspection report 	<ol style="list-style-type: none"> Responsibility of MOECAF, YCDC and MCDC for water pollution control does not change.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<ol style="list-style-type: none"> Water quality survey reports are prepared in the pilot area by YCDC and MCDC. 	<ul style="list-style-type: none"> Survey report 	<ol style="list-style-type: none"> YCDC and MCDC do not change inspection system as a water pollution control measures.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<ol style="list-style-type: none"> At least 150 factories' information is accessible on the database. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database. 	<ul style="list-style-type: none"> Database Database 	<ol style="list-style-type: none"> Responsibility of MOECAF for EIA review does not change. Relevant legislation of EIA does not significantly change.
<p>Output 4 Capacity of interpreting the information for water pollution control measures is enhanced</p>	<ol style="list-style-type: none"> A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC. 	<ul style="list-style-type: none"> Status report 	<ol style="list-style-type: none"> The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.

Note: The changes agreed by JCC members are shown in red.

S: CEO

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

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Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

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Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 5 Necessary technical manuals and forms for the EIA review are developed.</p>	<p>1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.</p>	<ul style="list-style-type: none"> Technical manual and forms 	
<p>Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.</p>	<p>1. EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAF are presented to an international conference.</p>	<ul style="list-style-type: none"> Evaluation report of EIA Proceedings 	
<p><Activities> Output 1: Inspection procedure is standardized. 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement inspection based on the developed inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To revise the inspection manual</p>	<p><Inputs> Japanese side <ul style="list-style-type: none"> Experts. Training in Japan and other country. Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side <ul style="list-style-type: none"> Counterpart personnel. </p>		
<p>Output 2: Capacity for water quality survey is enhanced. 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report</p>	<p>Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)</p>		

Note: The changes agreed by JCC members are shown in red.

Handwritten signature or initials.

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

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Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 3: Database of water pollution sources and river water quality is developed with GIS software.</p> <p>3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey</p> <p>3-2 To develop a system concept</p> <p>3-3 To design the database based on the system concept</p> <p>3-4 To collect additional information required to develop the database</p> <p>3-5 To develop the database</p> <p>3-6 To conduct training on operation and utilization of the database</p> <p>3-7 To develop an operation and maintenance manual of the database</p>			
<p>Output 4: Capacity of interpreting the information for water pollution control measures is enhanced.</p> <p>4-1 To collect the information necessary for the water quality status report</p> <p>4-2 To interpret the collected information</p> <p>4-3 To prepare a water quality status report</p>			
<p>Output 5: Necessary technical manuals and forms-legislation for the EIA review operation are developed.</p> <p>5-1 To draft necessary legislation including Official Forms for the EIA.</p> <p>5-2 To develop a technical Manual of the EIA process for review</p> <p>5-3 To evaluate and update the Manual to meet the practical EIA review works</p> <p>5-4 To develop a database for recording the EIA review operation</p> <p>5-5 To establish an evaluation system for issuing license to EIA consultants</p>			
<p>Output 6: Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.</p> <p>6-1 To implement basic and advanced EIA Training=incl. Screening, Scoping, EIA review, EMP, EMaP and so on</p> <p>6-2 To implement EIA review works based on the EIA procedure</p> <p>6-3 To record the EIA review operation</p> <p>6-4 To present leaflets and other materials for dissemination of EIA system</p> <p>6-5 To prepare a periodical report on the EIA review works</p> <p>6-6 To develop a WEB site to disclose EIA works based on the new EIA system</p> <p>6-6 To review and update the WEB site</p> <p>6-7 To presented activities on EIA review to an international conference</p>			<p><Preconditions></p> <ol style="list-style-type: none"> 1. Japanese experts are assigned 2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

Handwritten marks: 5 and 4.0

as of 2015/12/18

Amendment of Plan of Operation (PO)

Year	2015												2016												2017												2018												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
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Capacity for implementing water quality survey to obtain reliable information is enhanced.																																																	
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2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc.																																																	
2-4 To develop a water quality survey plan.																																																	
2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage.																																																	
2-6 To implement a water quality survey based on the water quality survey plan.																																																	
2-7 To supervise the water sampling with the water quality survey manual.																																																	
2-8 To verify the results of the water quality survey using the water quality survey manual																																																	
2-9 To prepare a water quality survey reports.																																																	
Output 3																																																	
Database of water pollution sources and river water quality is developed with GIS software.																																																	
3-1 To collect and sort out the information on water pollution sources (Products, Production process, Volume of waste water, pollutants, Waste water treatment method and results of inspection etc.)																																																	
3-2 To develop a system concept																																																	
3-3 To design the database based on the system concept.																																																	
3-4 To collect additional information required to develop the database																																																	
3-5 To develop the database.																																																	
3-6 To conduct training on operation and utilization of the database.																																																	
3-7 To develop an operation and maintenance manual of the database.																																																	

Note: Black lines show the original schedule, and the red lines show the amended schedule.

5.00

as of 2015/12/18

Amendment of Plan of Operation (PO)

Year Month	1st Year												2nd Year												3rd Year																																		
	2015			2016			2017			2018			2019			2020			2021			2022			2023			2024			2025																												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Project Period																																																											
Output 4																																																											
Capacity of interpreting the information for water pollution control measures is enhanced.																																																											
4-1 To collect the information necessary for the water quality status report.																																																											
4-2 To interpret the collected information.																																																											
4-3 To prepare a water quality status report.																																																											
Output 5																																																											
Necessary technical manuals and forms legislation for the EIA review operation are developed																																																											
5-1 To draft necessary legislation including Official Forms for the EIA.																																																											
5-2 To develop a technical Manual for the EIA review works.																																																											
5-3 To evaluate and update the Manual to meet the practical EIA review works.																																																											
5-4 To develop a database for recording the EIA review operation.																																																											
5-5 To establish an evaluation system for issuing license to EIA consultants.																																																											
Output 6																																																											
Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.																																																											
6-1 To implement basic and advanced EIA Training and Scoping-EIA review; EMP; EMap and so on																																																											
6-2 To implement the EIA review works based on the new EIA procedure																																																											
6-3 To record the EIA review operation																																																											
6-4 To present leaflets and other materials for dissemination of EIA system																																																											
6-5 To prepare a periodical report on the EIA review works																																																											
6-6 To develop a WEB site to disclose EIA works based on the new EIA procedure																																																											
6-7 To review and update the WEB site																																																											
6-8 To present activities on EIA review to an international conference.																																																											

Note: Black lines show the original schedule, and the red lines show the amended schedule.

W. Q. O

as of 2016/11/04

Annex 10 Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doko Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<ol style="list-style-type: none"> The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC. Improvement of EIA procedure is identified by FCD through EIA reviews. 	<ul style="list-style-type: none"> Database (baseline) Questionnaire strategy Proposal for EIA procedure revision 	
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<ol style="list-style-type: none"> Consideration for the water status in the pilot study area is made. More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project. 	<ul style="list-style-type: none"> Survey report EIA documents 	<ol style="list-style-type: none"> National effluent standard is developed.
<p>Output 1 Inspection procedure is standardized.</p>	<ol style="list-style-type: none"> Inspections are implemented according to the inspection manual by YCDC, MCDC, and FCD. 	<ul style="list-style-type: none"> Records of Inspection 	<ol style="list-style-type: none"> Responsibility of MONREC, YCDC and MCDC for water pollution control does not change.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<ol style="list-style-type: none"> Water quality survey reports are prepared in the pilot areas by YCDC and MCDC. 	<ul style="list-style-type: none"> Survey report 	<ol style="list-style-type: none"> YCDC and MCDC do not stop inspection system as a water pollution control measures.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<ol style="list-style-type: none"> At least 150 factories' information is accessible on the database. Results of river water quality survey is accessible on the database. 	<ul style="list-style-type: none"> Database Database 	<ol style="list-style-type: none"> Responsibility of MONREC for EIA review does not change. Relevant legislation of EIA does not significantly change.
<p>Output 4 Capacity of interpreting the information for water pollution control measures is enhanced</p>	<ol style="list-style-type: none"> Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC. 	<ul style="list-style-type: none"> Presentation materials 	<ol style="list-style-type: none"> The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAAF.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 5 Necessary technical manuals and forms for the EIA review are developed.</p>	<p>1. The technical manual covers every sector (L) of development projects and every major stage indicated in the <u>EIA procedure</u>.</p>	<ul style="list-style-type: none"> • Technical manual and forms 	
<p>Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.</p>	<p>2. The draft official forms are internally approved.</p> <p>1. <u>More than 80% of ECD officers in charge of EIA reviews received completion certificates from the Advanced EIA trainings.</u></p> <p>2. <u>Statistics of EIA reviews are presented.</u></p> <p>3. <u>EIA works by MONREC are presented at an international conference.</u></p>	<ul style="list-style-type: none"> • Evaluation report of EIA • Proceedings 	
<p><Activities> Output 1: Inspection procedure is standardized. I-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)</p>	<p><Inputs> Japanese side</p> <ul style="list-style-type: none"> • Experts. • Training in Japan and other country. • Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. 		
<p>I-2 To evaluate present inspection procedure</p>	<p>Myanmar side</p>		
<p>I-3 To develop an inspection manual</p>	<ul style="list-style-type: none"> • Counterpart personnel. 		
<p>I-4 To implement trial inspections based on the <u>inspection manual</u></p>			
<p>I-5 To provide training on measures to control industrial effluent</p>			
<p>I-6 To evaluate the <u>trial inspection procedures</u></p>	<ul style="list-style-type: none"> • Office space accessible internet under the secure conditions with desks, chairs, meeting table(s) 		
<p>Output 2: Capacity for water quality survey is enhanced.</p>			
<p>2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances)</p>			
<p>2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas</p>			
<p>2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc.</p>			
<p>2-4 To develop a water quality survey plan</p>			
<p>2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage</p>			
<p>2-6 To implement a water quality survey based on the water quality survey plan</p>			
<p>2-7 To supervise the water sampling referring to the water quality survey manual</p>			
<p>2-8 To verify the results of the water quality survey using the water quality survey</p>			

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>2-9 To prepare a water quality survey report manual</p> <p>Output 3: Database of water pollution sources and river water quality is developed with GIS software.</p> <p>3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey</p> <p>3-2 To develop a system concept</p> <p>3-3 To design the database based on the system concept</p> <p>3-4 To collect additional information required to develop the database</p> <p>3-5 To develop the database</p> <p>3-6 To conduct training on operation and utilization of the database</p> <p>3-7 To develop an operation and maintenance manual of the database</p> <p>Output 4: Capacity of interpreting the information for water pollution control measures is enhance.</p> <p>4-1 To collect the information necessary for the water quality status report</p> <p>4-2 To interpret the collected information</p> <p>4-3 To prepare a water quality status report</p> <p>Output 5: Necessary technical manuals and-legislation for the EIA operation are developed.</p> <p>5-1 To draft legislation on demand including Official Submission Forms for the EIA</p> <p>5-2 To develop a technical Manual of the EIA <u>review process</u></p> <p>5-3 To evaluate and update the <u>Technical Manual</u> to meet the <u>ongoing EIA review processes</u></p> <p>5-4 To develop a database for recording the EIA <u>review</u></p> <p>5-5 To draft <u>legislations</u> for issuing licenses to EIA consultants</p> <p>Output 6: Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.</p> <p>6-1 To implement basic and advanced EIA <u>trainings</u></p> <p>6-2 To implement EIA review works based on the EIA procedure</p> <p>6-3 To record the EIA <u>reviews</u></p> <p>6-4 To present leaflets and other materials for dissemination of EIA system</p> <p>6-5 To develop a WEB site to disclose <u>EIAs</u> based on the new EIA system</p> <p>6-6 To review and update the WEB site</p> <p>6-7 To <u>present</u> activities on EIA review to an international conference</p>			
			<p><Preconditions></p> <ol style="list-style-type: none"> 1. Japanese experts are assigned 2. C/Ps are assigned.

(1) sectors are indicated in Annex A of EIA procedure.

Note: The changes agreed by JCC members are shown in red.

Appendix 2:

Assignments of Experts

Appendix 3:

Records of Study Programs in Japan

APPENDIX 3 Records of Study Programs in Japan

(1) First Program

Summary of Study Program in Japan No.1

Item	Contents
Title	1st study program in Japan for the Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar
Period	22nd May (Sun) – 28th May (Sat) 2016 (in total 7 days)
Number of Trainees	Six participants (three participants from MOECA, one participant from YCDC, and two participants from MCDC)
Main Places for Training	Tokyo
Language	Myanmar – Japanese

Source: JET

Schedule of Study Program in Japan No.1

Day	Time	Activities	Lecturer /Venue	Relevant Outputs	
-	21 May (Sat)	21:45	- Departure from Yangon for Narita	-	
1	22 May (Sun)	06:50	- Arrival at Narita Airport	-	
		– 09:30	- Move to TIC	-	
2	23 May (Mon)	09:15 – 10:30	- Briefing of the training in Japan - Orientation of the training course	TIC JET	-
		11:30 – 12:00	- Courtesy visit to JICA	-	-
		13:30 – 15:00	- Lecture on necessary policies and effective measures for water pollution / case studies of water quality improvement in Japan	Tokyo Metropolitan Research Institute for Environmental Protection	Output 1, Output 2
		16:30 – 17:10	- Site visit: Sumida River	Sumida River	Output 1, Output 2
		19:00 – 20:30	- Meeting for exchange of opinions	JET	Outputs 1, 2, 3 and 4
3	24 May (Tue)	10:00 – 12:00	- Lecture on policies and system for water environment management (watershed) and administrative measures for water pollution in Japan - Courtesy visit to the Ministry of Environment (MOE)	Ministry of Environment (Japan)	Outputs 1 and 2
		14:20 – 14:45	- Site visit: Giant Ushiku Amida Buddha (Cultural understanding)	-	-
		15:30 – 17:30	- Site visit: Water environment of Lake Kasumigaura	Ibaraki Kasumigaura Environmental Science Center	Outputs 1 and 2
4	25 May (Wed)	09:00 – 11:30	- Lecture on measures for water pollution in Kawasaki City (local government)	Kawasaki City	Outputs 1 and 2
		13:00 – 16:00	- Assignments of the Kawasaki Environment Research Institute (KERI) - Lecture on research and study on water pollution - Laboratory tour (KERI)	Kawasaki Environment Research Institute	Outputs 1, 2 and 3
		17– 17:30	- Site visit for viewing Keihin Industrial Area	JET	-
5	26 May (Thu)	10:00 – 11:00	- Site visit for water treatment and management of wastewater	Haga Town, Tochigi Pref.	Outputs 1, 2 and 3
		14:00 – 16:30	- Lecture and discussion on issues of water environmental management and measures toward	Dr. Senro Imai	Outputs 1, 2, 3 and 4

Day	Time	Activities	Lecturer /Venue	Relevant Outputs	
		resolution			
6	27 May (Fri)	10 – 12	- Presentation and discussion	JET	-
		13:00 – 15:00	- Evaluation of the training course - Certificate Ceremony	TIC	-
7	28 May (Sat)	11:00	- Departure from Narita to Yangon (Departure from TIC at 7:00)	-	-

Source: JET

List of Participants of Study Program in Japan No.1

No.	Name	Position/Organization
1	Mr. Zaw Moe	Environmental Conservation Department (Yangon), MONREC1 Deputy Director
2	Ms. Thin Thin Nu	Environmental Conservation Department (Ayeyarwaddy), MONREC 1 Assistant Director
3	Mr. Zaw Tun Aung	Environmental Conservation Department (Mandalay), MONREC 1 Staff Officer
4	Mr. Myint Sein	Engineering Department (Water & Sanitation), YCDC Assistant Head of Department
5	Mr. Zaw Zaw Tun	Agriculture and Livestock Breeding Department (), MCDC3 Staff Office
6	Ms. Thwe Hnin Aung	Water and Sanitation Department, MCDC3 Assistant Engineer

Source: JET

(2) Second Program

Summary of Study Program in Japan No.2

Course	Item	Contents
1-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (1-week)
	Period	27 September (Sun) – h October (Sat) 2016 (in total 7 days)
	Number of Trainees	3 delegates (1 participant from MOECAAF, 1 participant from YCDC and 1 participant from MCDC)
	Main Places for Training	Tokyo
	Language	Myanmar – Japanese
3-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (3-week)
	Period	27 th September (Tue) – 18th October (Sun) 2016 (in total 22 days)
	Number of Trainees	7 participants (3 participants from MOECAAF, 1 participant from YCDC and 2 participants from MCDC)
	Main Places for Training	Tokyo, Yokohama and Kansai
	Language	Myanmar – Japanese

Source: JET

Schedule of Study Program in Japan No.2

1-week	3-week	Date	Time	Activities	Lecturer /Venue
1	1	27 (Tue)	Sep -	PM: Departure from Yangon to Tokyo	-
2	2	28 (Wed)	AM	Arrival at Tokyo, Move to hotel	-
			15:20-15:50	Briefing by the JICA Expert Team	Nippon Koei Co., Ltd.
			15:50-16:20	JCM project formulation for energy conservation and environmental improvement	Nippon Koei Co., Ltd.
			16:30-18:15	Development of approaches for	Mr. Senro Imai, JICA

1-week	3-week	Date	Time	Activities	Lecturer /Venue
				environmental protection and challenges for SDGs in Japan	advisor
			18:30-20:30	Welcome party	-
3	3	29 (Thu)	10:00-12:30	Briefing and orientation	TIC
			14:30-15:00	Courtesy call to JICA	JICA HQ
			15:00-16:30	Environmental administration in Myanmar and Japan	Dr. Itaru Okuda, Team Leader of the JICA Expert Team
4	4	30 (Fri)	9:00-12:00	Lecture on measures for water pollution in Kawasaki City	Kawasaki City
			13:00-14:30	Introduction of the Kawasaki Environment Research Institute/ Laboratory tour	Kawasaki Environment Research Institute, Kawasaki City
			15:00 – 17:00	Site visit for wastewater treatment facility and management (food industry)	Ajinomoto Co., Inc. Kawasaki Plant
5	5	1 (Sat)	10:00 – 12:00	Environmental policy framework and administration in Japan	Prof. Hitoshi Ushijima, Chuo University
			PM	Free time	
6	6	2 (Sun)	9:00 – 17:00	Holiday (private sightseeing tour in Kamakura)	-
7	7	3 (Mon)	9:00 – 11:30	Site visit for river water treatment facilities	Katsunan Public Works Office, Chiba Prefecture
			12:50 – 13:50	Lunch meeting with JICA HQ	-
			14:00 - 15:30	Water environment administration of Japan	Water Environment Division, Environment Management Bureau, Ministry of the Environment
			16:00 – 17:30	Wrap-up presentation and certificate ceremony for the 1-week program	JICA HQ
8	8	4 (Tue)	AM	[Attendees of the 1-week program] Leave Japan for Myanmar	-
-			9:00 – 17:00	[Attendees of the 3-week program] Training on water quality monitoring	Private lab, Osumi Co., Ltd
	9	5 (Wed)	9:00 – 16:30	Training on water quality analysis	Private lab, Osumi Co., Ltd
	10	6 (Thu)	9:00 – 17:00	Training on water quality analysis	Private lab, Osumi Co., Ltd
	11	7 (Fri)	9:30-12:00	How to develop a water quality monitoring plan and report/ Good practice of inspection activities in other countries	Nippon Koei Co., Ltd.
			13:30 – 15:30	Preparation of wrap-up presentation	-
	12	8 (Sat)	9:00 – 14:00	Holiday (private sightseeing tour in Asakusa/ Tokyo)	-
	13	9 (Sun)	-	Move from Tokyo to Otsu	-
	14	10 (Mon)	10:00 – 12:00	Lake Biwa cruise	-
			14:00 – 16:00	Lake Biwa Museum	
	15	11 (Tue)	10:00 – 12:00	Lecture on lake environmental management/ Laboratory tour	Lake Biwa Environmental Research Institute
			14:00 – 16:00	Site visit for wastewater treatment facility and management (alcohol and beverage industry)	Kirin Co., Ltd. Shiga Factory
	16	12 (Wed)	9:30 – 12:00	Site visit for wastewater treatment facility and management (manufacturing industry)	Shimadzu Corporation, Sanjo Works
			14:00 15:00	Environmental education and environmental activities in Kyoto City	Miyako Ecology Center
			16:15 – 17:00	Sightseeing at Kinkakuji (Golden Pavilion)	Kinkakuji
	17	13 (Thu)	9:00 – 12:00	Lecture on practice and challenges in industrial wastewater treatment	Mr. Chuzo Nishizaki
			14:00 – 16:30	Site visit for wastewater treatment facility	Rengo Co., Ltd.,

1-week	3-week	Date	Time	Activities	Lecturer /Venue
				and management (paper mill)	Amagasaki Mill
	18	14 (Fri)	9:00 – 12:00	Sewage system in Kobe City / site visit to a sewage treatment plant	Kobe City
			14:00 -16:00	Site visit for wastewater treatment facility and management (power plant)	Kobelco Eco-Solutions Co., Ltd.
	19	15 (Sat)	-	Holiday (sightseeing tour in Kyoto)	-
	20	16 (Sun)	-	Move from Kobe to Tokyo	-
	21	17 (Mon)	9:30 – 11:30	Central wastewater treatment plant in industrial zone	Yokohama City
			13:30 – 17:00	Wrap-up presentation and certificate ceremony for the 3-week program	JICA HQ
	22	18 (Tue)	-	Departure from Tokyo to Yangon	-

Source: JET

List of Participants of Study Program in Japan No.2

No.	Name	Position/Organization
1-week course		
1	Mr.Min Maw	Director, Pollution Control Department, Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation
2	Mr.Myo Thein	Deputy Head of Department, Engineering Department (Water & Sanitation), Yangon City Development Committee
3	Mr.Khin Maung Thin	Deputy Head, Assistant Director, Water and Sanitation Department, Mandalay City Development Committee
3-week course		
4	Mr.Bawi Kyone	Assistant Head of Department, Pollution Control and Cleansing Department, Yangon City Development Committee
5	Ms.Thwe Naing Oo	Assistant Chief Engineer, Engineering Department (Water & Sanitation), Yangon City Development Committee
6	Mr.Win Swe	Assistant Supervisor, Cleansing Department, Mandalay City Development Committee
7	Mr.Aung Zaw Moe	Junior Engineer, Water and Sanitation Department, Mandalay City Development Committee
8	Ms.Khin Myo Sat Aye	Deputy Staff Officer, Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation
9	Mr.Pyae Phyo Kyaw	Deputy Staff Officer, Environmental Conservation Department/ Mandalay Region, Ministry of Natural Resources and Environmental Conservation
10	Ms.Thet Wai Hnin	Deputy Staff Officer, Environmental Conservation Department/ Yangon Region, Ministry of Natural Resources and Environmental Conservation

Source: JET

(3) Third Program

Summary of Study Program in Japan No.3

Item	Contents
Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (2)
Period	28 Aug (Mon) – 14 Sep (Thu) 2017 (in total 17 days)
Number of Trainees	Total 14 delegates - 10 Delegates for Course 1 (management level): 3 participants from MONREC, 1 participant from YCDC, MCDC, MOT, MOHS, MOE, MOI and MOALI.

Item	Contents
	- 4 Delegates for Course 2 (technical-level): each 2 participants from YCDC and MCDC
Main Places for Training	Tokyo, Shiga and Kansai
Language	Myanmar – Japanese

Source: JET

Schedule of Study Program in Japan No.3

Date		Activities		Lecturer /Venue		
28	Aug	Mon	PM: Departure from Yangon to Tokyo		-	
29		Tue	AM: Arrival at Tokyo PM: Free time		TIC	
30		Wed	AM: Briefing and orientation PM: Courtesy call to JICA/Lecture on the Development of Approaches for Environmental Protection and Challenges for SDGs in Japan		AM: TIC PM: JICA, Dr. Imai	
31		Thu	Lecture on measures for water pollution in local government		Kawasaki Municipality	
1	Sep	Fri	AM: Site visit for centralized wastewater treatment facility for industrial zone PM: Courtesy call to the Ministry of Environment (MOE) and lecture on necessary policies and effective measures for water pollution		AM: Haga Town PM: MOE	
2		Sat	AM: Japan's Environmental Law and its implementation		AM: Professor from Chuo University	
3		Sun	Holiday		-	
4		Mon	Lecture on water quality monitoring		Laboratory (Nippon Koei)	
5		Tue	Course 1: Lecture on water environment management in Southeast Asia	Course 2: Training on water quality monitoring and analysis	Course 1: IGES	Course 2: Laboratory (Nippon Koei)
6		Wed	Course 1: AM: Lecture on financial support mechanism related to environmental measures for factories PM: Lecture on coordination for environmental management for factories	Course 2: Training on water quality monitoring and analysis	Course 1: AM: Development Bank of Japan PM: Japan Environmental Management Association for Industry	Course 2: Laboratory (Nippon Koei)
7		Thu	AM: Move to Kansai PM: Lecture on environment of Shiga Prefecture		PM: International Lake Environment Committee	
8		Fri	AM: Site visit for agricultural wastewater treatment PM: Lecture on eco-friendly farming Site visit to Biwa Lake (boat tour) Move to Kyoto		AM: Kusatsu City PM: Shiga Prefecture	
9		Sat	AM: Site visit to Lake Biwa Museum		AM: Biwa Lake	
10		Sun	Holiday		-	
11		Mon	AM: - Regulation on industrial wastewater for sewerage - Lecture on pollution control measures by industries / experience of developing wastewater treatment system in Vietnam		AM: Kobe City KOBELCO	

Date		Activities	Lecturer /Venue
		PM: Site visit to wastewater treatment facilities or sewage treatment plant	PM: Suntory Takasago Factory
12	Tue	AM: Environmental education and activities in Kobe City PM: Move to Tokyo	AM: Kobe environment and future museum
13	Wed	AM: Presentation preparation PM: Wrap-up presentation and certificate ceremony	AM:TIC PM: JICA
14	Thu	Move from Japan to Myanmar	-

Source: JET

List of Participants of Study Program in Japan No.3

No.	Name	Position/Organization
Course 1		
1	Ms. Khin Thida Tin	Director, Environmental Conservation Department/ Yangon Region, Ministry of Natural Resources and Environmental Conservation
2	Mr. Bawi Kyone	Assistant Head of Department, Pollution Control and Cleansing Department, Yangon City Development Committee
3	Mr. Tun Tun Aung	Assistant Director, Irrigation and Water Resource Management Department, Ministry of Agriculture, Livestock and Irrigation
4	Mr. Thant Zin Tun	Assistant Director, Environmental Conservation Department/ Mandalay Region, Ministry of Natural Resources and Environmental Conservation
5	Ms. Khaing Khaing Soe	Assistant Director, Public Health Department, Ministry of Health and Sports
6	Ms. Saw Sanda Win	Assistant Director, Directorate of Water Resources and Improvement of River System, Ministry of Transportation
7	Ms. Swai Thi Htut	Assistant Director, Department of Industrial Supervision and Inspection, Ministry of Industry
8	Mr. Kyaw Zin Tun	Assistant Director, Research and Innovation Department, Ministry of Education
9	Mr. Zaw Min Oo	Deputy Staff Officer, Cleansing Department, Mandalay City Development Committee
Course 2		
10	Ms. Kyawt Kay Khaing	Junior Engineer, Assistant Director, Water and Sanitation Department, Mandalay City Development Committee
11	Mr. Aung Khin Myint	Junior Engineer, Assistant Director, Water and Sanitation Department, Mandalay City Development Committee
12	Mr. Soe Zaw	Deputy Supervisor, Pollution Control and Cleansing Department, Yangon City Development Committee
13	Ms. Yadanar Wuttyi Soe	Deputy Supervisor, Pollution Control and Cleansing Department, Yangon City Development Committee

Source: JET

Appendix 4:

List of Equipment Handed Over to the Myanmar Side

LIST OF EQUIPMENT HANDED OVER TO THE MYANMAR SIDE

No.	Article Name	Standard and Product Number	Present Location	Date of Handover
1.	Desktop computer	HP 20-C0381 (i3)	ECD HQ	17 May 2018
2.	UPS	Powertree S650BX	ECD HQ	17 May 2018
3.	Laptop computer	Lenovo G4070	ECD HQ	17 May 2018
4.	Laptop computer	Lenovo G4070	ECD HQ	17 May 2018
5.	Projector	Epson E03	ECD HQ	17 May 2018
6.	Color Printer	Fuji Xerox, DocuCentre-V C2265	ECD HQ	17 May 2018
7.	Black-White Printer	Canon Copier IR-2520	ECD HQ	17 May 2018
8.	Multi-Parameter Water Quality Meter	Horiba, U52G	ECD HQ	17 May 2018
9.	Current meter	Global Water, FP111	ECD HQ	17 May 2018
10.	GPS	GARMIN, GPSMAP 64s	ECD HQ	17 May 2018
11.	Scanner	Canon, CanoScan LiDE220	ECD HQ	17 May 2018
12.	Camera	Cannon, Cannon Digital Camera Power Shot D30	ECD HQ	17 May 2018
13.	Desktop computer	HP 20-C0381 (i3)	ECD Yangon Region	15 May 2018
14.	UPS	Powertree S650BX	ECD Yangon Region	15 May 2018
15.	Multi-Parameter Water Quality Meter	Horiba, U52G	ECD Yangon Region	15 May 2018
16.	Current meter	Global Water, FP111	ECD Yangon Region	15 May 2018
17.	Desktop computer	HP 20-C0381 (i3)	ECD Mandalay Region	15 May 2018
18.	UPS	Powertree S650BX	ECD Mandalay Region	15 May 2018
19.	Multi-Parameter Water Quality Meter	Horiba, U52G	ECD Mandalay Region	15 May 2018
20.	Current meter	Global Water, FP111	ECD Mandalay Region	15 May 2018
21.	Desktop computer	HP 20-C0381 (i3)	YCDC-PCCD	15 May 2018
22.	UPS	Powertree S650BX	YCDC-PCCD	15 May 2018

No.	Article Name	Standard and Product Number	Present Location	Date of Handover
23.	Multi-Parameter Water Quality Meter	Horiba, U52G	YCDC-PCCD	15 May 2018
24.	Flow meter	Global Water, FP111	YCDC-PCCD	15 May 2018
25.	GPS	GARMIN, eTrex 20	YCDC-PCCD	15 May 2018
26.	COD analysis set	HACH DR3900 spectrometer, HACH DRB200	YCDC-PCCD	15 May 2018
27.	Digital Reactor for digestion of total nitrogen	HACH, DRB 200	YCDC-WSD	15 May 2018
28.	Desktop computer	HP 20-C0381 (i3)	YCDC-WSD	15 May 2018
29.	UPS	Powertree S650BX	YCDC-WSD	15 May 2018
30.	Desktop computer	HP 20-C0381 (i3)	MCDC-WSD	9 May 2018
31.	UPS	Powertree S650BX	MCDC-WSD	9 May 2018
32.	Desktop computer	HP 20-C0381 (i3)	MCDC-WSD	9 May 2018
33.	UPS	Powertree S650BX	MCDC-WSD	9 May 2018
34.	Multi-Parameter Water Quality Meter	Horiba, U52G	MCDC-WSD	9 May 2018
35.	Current meter	JFE Advantech, AME1-DA	MCDC-WSD	9 May 2018
36.	Flow meter	Global Water, FP111	MCDC-WSD	9 May 2018
37.	GPS	GARMIN, eTrex 20	MCDC-WSD	9 May 2018

Appendix 5:

Minutes of Joint Coordinating Committee Meetings

MINUTES OF MEETING OF JOINT COORDINATING COMMITTEE
MEETING NO.1

PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER
ENVIRONMENT MANAGEMENT AND EIA SYSTEM
IN
THE REPUBLIC OF THE UNION OF MYANMAR

Nay Pyi Taw, 8th July, 2015



Dr. Itaru Okuda
Leader, JICA Exert Team



Mr. Sein Htoon Linn
Deputy Director General,
on behalf of Mr. Nay Aye
Director General
Environmental Conservation Department
Ministry of Environmental Conservation
and Forestry



Mr. Keiichiro Nakazawa
Chief Representative
JICA Myanmar Office

These are the minutes of the Joint Coordinating Committee (hereinafter referred to as “JCC”) meeting No.1 of the project entitled “Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar”, which is being implemented in accordance with the Record of Discussions (hereinafter referred to as “R/D”) agreed on 23rd December 2014 between Ministry of Environmental Conservation and Forestry (hereinafter referred to as “MOECAF”) and Japan International Cooperation Agency (hereinafter referred to as “JICA”).

The meeting was held on 8th July 2015 at the conference room of Environmental Conservation Department (hereinafter referred to as “ECD”) of MOECAF in Nay Pyi Taw. The agenda of the meeting and the list of participants are given in Attachments 1 and 2.

Following the opening remarks by the Director General of ECD, Mr. Nay Aye, and the representative of JICA Myanmar Office, four presentations were made by the representatives of ECD, Yangon City Development Committee (hereinafter referred to as “YCDC”) and Mandalay City Development Committee (hereinafter referred to as “MCDC”) on their activities on water environment management and review works of environmental impact assessment (hereinafter referred to as “EIA”). Also, two presentations were made by the JICA Expert Team (hereinafter referred to as “JET”) on the work plans of the water environment management component and the EIA component of the project.

After the presentations, the JCC members agreed on the following matters based on the discussion.

(1) Members of Joint Coordinating Committee

The committee members nominated by relevant organizations were appointed as the members of the Joint Coordinating Committee of the project. The list of members and member organizations is given in Attachment 3.

(2) Work Plans of Water Environment Component and EIA Component

With respect to the work plan of the water environment component, the JCC members agreed that:

- (i) the work plan of the water environment management component is in consistent with the R/D, and overall the contents are acceptable, and
- (ii) comments on the work plan should be submitted to ECD and JET by the end of July 2015. ECD and JET are responsible for finalizing the work plan by the end of August 2015 in consultation with relevant organizations. The finalized work plan shall be distributed to

the JCC members in electronic format.

With respect to the work plan of the EIA component, the members agreed that at this point no further revision of the work plan is necessary. Should the need to revise the work plan arise, ECD and JET are responsible for revising the plan.

(3) Information Sharing

The JCC members agreed that information essential for implementation of the project, such as relevant data, schedules, other donors' activities, urgent issues and change in personnel, shall be shared with JET.

End

Attachments:

Attachment 1: Agenda of the Joint Coordination Committee meeting No.1

Attachment 2: List of participants

Attachment 3: List of members of Joint Coordinating Committee member

The Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar

Agenda of Joint Coordinating Committee Meeting No.1

- Objectives: - To introduce the project to all JCC members
 - To present related activities of relevant organizations
 - To confirm proposed work plans of water environment management and EIA components
- Date and Time: July 8th (Wednesday), 2015, 10:00-12:30
- Place: Meeting Room of ECD, MOECAF
- Participants: ECD/MOECAF, YCDC, MCDC, MOH, MOT, MOI, MOST, MOAI, JICA, Embassy of Japan
- Language: English (consecutive translation available for discussions)

Time	Contents	Speaker
10:00-10:05	Opening remarks	Representative of MOECAF
10:05-10:10	Opening remarks	Representative of JICA
10:10-10:20	Introduction to the Project	JET (Dr. Okuda)
10:20-10:35	PCD/ECD's activities on water environment management	PCD/ECD/MOECAF
10:35-10:50	YCDC's activities on water environment management	YCDC
10:50-11:05	MCDC's activities on water environment management	MCDC
11:05-11:25	Work plan of water environment management component of the Project	JET (Water Environment Management Team)
11:25-11:40	EIA/ECD's activities on EIA review	NRC&EIA/ECD/MOECAF
11:40-12:00	Work plan of EIA component of the Project	JET (Dr. Usui)
12:00-12:25	Discussions (consecutive interpretation in English/Myanmar)	-
12:25-12:30	Closing remarks	Representative of MOECAF
12:30-	Lunch	-

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List of participants of Joint Coordinating Committee Meeting No.1

No.	Name	Title	Name of Organization
Members of Myanmar Side			
1	Mr. Hla Maung Thein	Deputy Director General (DDG)	ECD, MOECAAF
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MOECAAF
3	Mr. Than Aye	Director	ECD, MOECAAF
4	Dr. San Oo	Director	ECD, MOECAAF
5	Mr. Min Maw	Deputy Director (DD)	ECD, MOECAAF
6	Mr. Zayar Oo	Staff Officer (SO)	MOAI
7	Mr. Aung Zaw Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
8	Ms. May Kyi Khing	Deputy Director (DD)	MOI
9	Mr. Htay Win	Deputy Director (DD)	MOH
10	Dr. Thar Htat Kyaw	Deputy Director (DD)	MOST
11	Mr. Bawi Kyone	Assistant Head of Department	YCDC
12	Mr. Khin Maung Thin	AE, Head of Section	MCDC
Members of Japanese Side			
13	Ms. Noriko Sakurai (for Mr. Keiichiro Nakazawa)	Project Formulation Advisor	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team



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Observers

No.	Name	Title	Name of Organization
Myanmar Side			
1	Dr. Tin Tun	Deputy Director (DD)	MOH
2	Dr. Khin Saw Hla	Deputy Director (DD)	Food & Drug Administration Department, MOH
3	Mr. Zaw Nyut	Assistant Director (AD)	Traditional Medicine Department, MOH
4	Dr. Chaw Nande		Medical Service Department, MOH
5	Dr. Khang Khaing Soe	Assistant Director (AD)	Occupational & Public Health Division, PHD, MOH
6	Mr. Zaw Min	Executive Engineer (EE)	WSD, YCDC
7	Mr. Zaw Win	Assistant Director (AD)	ECD, MOECAAF
8	Mr. Hein Latt	Staff Officer (SO)	ECD, MOECAAF
9	Ms. Saint	Deputy Staff Officer (SO)	ECD, MOECAAF
10	Mr. Banyar Aung	Deputy Staff Officer (SO)	ECD, MOECAAF
11	Mr. Sa Aung Thu	Assistant Director (AD)	ECD, MOECAAF
12	Ms. Thin Thin	Staff Officer (SO)	ECD, MOECAAF
13	Ms. Yin Yin Mar	Deputy Staff Officer (DSO)	ECD, MOECAAF
Japanese Side			
14	Ms. Thet Thet Zaw	Secretary	JICA Myanmar Office
15	Mr. Htein Lin	Project Coordinator	JICA Expert Team
16	Ms. Betty Ni Ni Chan	Project Coordinator	JICA Expert Team

List of members of Joint Coordinating Committee

No.	Name	Title	Name of Organization
Members of Myanmar Side			
1	Mr. Nay Aye	Director General (DG)	ECD, MOECAAF
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MOECAAF
3	Mr. Than Aye	Director	ECD, MOECAAF
4	Dr. San Oo	Director	ECD, MOECAAF
5	Mr. Min Maw	Deputy Director (DD)	ECD, MOECAAF
6	Mr. Zayar Oo	Staff Officer (SO)	MOAI
7	Mr. Aung Zaw Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
8	Ms. May Kyi Khine	Deputy Director (DD)	MOI
9	Mr. Htay Win	Deputy Director (DD)	MOH
10	Dr. Thar Htet Kyaw	Deputy Director (DD)	MOST
11	Mr. Bawi Kyone	Assistant Head of Department	YCDC
12	Mr. Khin Maung Thin	AE, Head of Section	MCDC
Members of Japanese Side			
13	Mr. Keiichiro Nakazawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team

MINUTES OF JOINT COORDINATING COMMITTEE MEETING NO.2

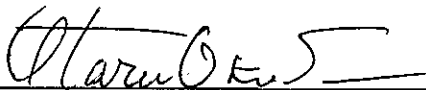
PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER

ENVIRONMENT MANAGEMENT AND EIA SYSTEM


IN

THE REPUBLIC OF THE UNION OF MYANMAR

Nay Pyi Taw, 18th December, 2015



Dr. Itaru Okuda
Leader, JICA Exert Team



Mr. Sein Htoon Linn, Deputy Director
General, Environmental Conservation
Department,
on behalf of
Mr. Nay Aye, Director General
Environmental Conservation Department
Ministry of Environmental Conservation
and Forestry



Mr. Keiichiro Nakazawa
Chief Representative
JICA Myanmar Office

These are the minutes of the Joint Coordinating Committee (hereinafter referred to as "JCC") meeting No.2 of the project entitled "Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar", which is being implemented in accordance with the Record of Discussions (hereinafter referred to as "R/D") agreed on 23rd December 2014 between Ministry of Environmental Conservation and Forestry (hereinafter referred to as "MOECAF") and Japan International Cooperation Agency (hereinafter referred to as "JICA").

The members of the JCC were officially consulted in writing on the issues of amending the Project Design Matrix (PDM) and the Plan of Operation (PO) of the project, and agreed on the following points:

- Minor changes and adjustments are made to the PDM and the PO as shown in Attachment 1 and Attachment 2.
- JICA dispatches an expert on Industrial Effluent Treatment to the project in addition to the members in the five areas already agreed in the R/D.

End

Attachments:

Attachment 1: Amendment of Project Design Matrix

Attachment 2: Amendment of Plan of Operation

Attachment 3: List of members of Joint Coordinating Committee

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<ol style="list-style-type: none"> The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAP. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA. 	<ul style="list-style-type: none"> Regulations Guidelines Annual report 	
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<ol style="list-style-type: none"> Consideration for the water status in the pilot study area is made. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on. 	<ul style="list-style-type: none"> Survey report EIA documents 	<ol style="list-style-type: none"> National effluent standard is developed.
<p>Output 1 Inspection procedure is standardized.</p>	<ol style="list-style-type: none"> More than 80% of the inspection is implemented according to the inspection manual by the end of the Project. 	<ul style="list-style-type: none"> Inspection report 	<ol style="list-style-type: none"> Responsibility of MOECAP, YCDC and MCDC for water pollution control does not change.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<ol style="list-style-type: none"> Water quality survey reports are prepared in the pilot area by YCDC and MCDC. 	<ul style="list-style-type: none"> Survey report 	<ol style="list-style-type: none"> YCDC and MCDC do not change inspection system as a water pollution control measures.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<ol style="list-style-type: none"> At least 150 factories' information is accessible on the database. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database. 	<ul style="list-style-type: none"> Database Database 	<ol style="list-style-type: none"> Responsibility of MOECAP for EIA review does not change. Relevant legislation of EIA does not significantly change.
<p>Output 4 Capacity of interpreting the information for water pollution control measures is enhanced</p>	<ol style="list-style-type: none"> A water quality status report in the pilot areas is prepared by MOECAP, YCDC and MCDC. 	<ul style="list-style-type: none"> Status report 	<ol style="list-style-type: none"> The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAP.

Note: The changes agreed by JCC members are shown in red.

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as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 5 Necessary technical manuals and forms for the EIA review are developed.</p>	<p>1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.</p>	<ul style="list-style-type: none"> Technical manual and forms 	
<p>Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.</p>	<p>1. EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAF are presented to an international conference.</p>	<ul style="list-style-type: none"> Evaluation report of EIA Proceedings 	
<p><Activities> Output 1: Inspection procedure is standardized. 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement inspection based on the developed inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To revise the inspection manual</p>	<p><Inputs> Japanese side <ul style="list-style-type: none"> Experts. Training in Japan and other country. Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side <ul style="list-style-type: none"> Counterpart personnel. </p>		
<p>Output 2: Capacity for water quality survey is enhanced. 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report</p>	<p>Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)</p>		

Note: The changes agreed by JCC members are shown in red.

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as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doko Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 3: Database of water pollution sources and river water quality is developed with GIS software.</p> <p>3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey</p> <p>3-2 To develop a system concept</p> <p>3-3 To design the database based on the system concept</p> <p>3-4 To collect additional information required to develop the database</p> <p>3-5 To develop the database</p> <p>3-6 To conduct training on operation and utilization of the database</p> <p>3-7 To develop an operation and maintenance manual of the database</p>			
<p>Output 4: Capacity of interpreting the information for water pollution control measures is enhanced.</p> <p>4-1 To collect the information necessary for the water quality status report</p> <p>4-2 To interpret the collected information</p> <p>4-3 To prepare a water quality status report</p>			
<p>Output 5: Necessary technical manuals and forms-legislation for the EIA review operation are developed.</p> <p>5-1 To draft necessary legislation including Official Forms for the EIA.</p> <p>5-2 To develop a technical Manual of the EIA process for review</p> <p>5-3 To evaluate and update the Manual to meet the practical EIA review works</p> <p>5-4 To develop a database for recording the EIA review operation</p> <p>5-5 To establish an evaluation system for issuing license to EIA consultants</p>			
<p>Output 6: Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.</p> <p>6-1 To implement basic and advanced EIA Training=net-Screening-Scoping-EIA review-EMF-EMaP-and-so-on</p> <p>6-2 To implement EIA review works based on the EIA procedure</p> <p>6-3 To record the EIA review operation</p> <p>6-4 To present leaflets and other materials for dissemination of EIA system</p> <p>6-5 To prepare a periodical report on the EIA-review-works</p> <p>6-6 To develop a WEB site to disclose EIA works based on the new EIA system</p> <p>6-6 To review and update the WEB site</p> <p>6-7 To presented activities on EIA review to an international conference</p>			<p><Preconditions></p> <ol style="list-style-type: none"> 1. Japanese experts are assigned 2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

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as of 2015/12/18

Amendment of Plan of Operation (PO)

Year	2015												2016												2017												2018												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Month																																																	
Year																																																	
Month																																																	
Project Period																																																	
Output 1																																																	
Inspection procedure is standardized.																																																	
1-1 To collect information on water pollution sources (Name of a company, Address, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)																																																	
1-2 To evaluate present inspection procedure.																																																	
1-3 To develop a inspection manual.																																																	
1-4 To implement inspection based on the developed inspection manual.																																																	
1-5 To provide training on measures to control industrial effluent																																																	
1-6 To revise the inspection manual.																																																	
Output 2																																																	
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2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances).																																																	
2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas.																																																	
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2-6 To implement a water quality survey based on the water quality survey plan.																																																	
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2-8 To verify the results of the water quality survey using the water quality survey manual																																																	
2-9 To prepare a water quality survey reports.																																																	
Output 3																																																	
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Note: Black lines show the original schedule, and the red lines show the amended schedule.

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as of 2015/12/18

Amendment of Plan of Operation (PO)

Year Month	1st Year												2nd Year												3rd Year																																		
	2015			2016			2017			2018			2019			2020			2021			2022			2023			2024			2025																												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Project Period																																																											
Output 4																																																											
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Output 6																																																											
Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.																																																											
6-1 To implement basic and advanced EIA Training and Seminar-Scoping-EIA review; EMP; EMap and so on																																																											
6-2 To implement the EIA review works based on the new EIA procedure																																																											
6-3 To record the EIA review operation																																																											
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Note: Black lines show the original schedule, and the red lines show the amended schedule.

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List of members of Joint Coordinating Committee

No.	Name	Title	Name of Organization
Members of Myanmar Side			
1	Mr. Nay Aye	Director General (DG)	ECD, MOECAF
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MOECAF
3	Dr. San Oo	Director	ECD, MOECAF
4	Dr. Kyi Lwin Oo	Director	MOH
5	Mr. Min Maw	Deputy Director (DD)	ECD, MOECAF
6	Mr. Aung Zaw Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
7	Ms. May Kyi Khine	Deputy Director (DD)	MOI
8	Dr. Thar Htet Kyaw	Deputy Director (DD)	MOST
9	Mr. Bawi Kyone	Assistant Head of Department	YCDC
10	Mr. Khin Maung Thin	AE, Head of Section	MCDC
11	Dr. Tin Aung Win	Assistant Director (AD)	ECD, MOECAF
12	Mr. Zayar Oo	Staff Officer (SO)	MOAI
Members of Japanese Side			
13	Mr. Keiichiro Nakazawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team

**MINUTES OF MEETINGS
OF
JOINT COORDINATING COMMITTEE No. 3
AND
THE MID-TERM REVIEW ON
THE JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR CAPACITY DEVELOPMENT IN BASIC
WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM
IN
THE REPUBLIC OF THE UNION OF MYANMAR**


To review the Project for Capacity Development in Basic Water Environment Management and EIA System (hereinafter referred to as “the Project”), the Japan International Cooperation Agency (hereinafter referred to as “JICA”) sent the mid-term review team (hereinafter referred to as “the Team”) headed by Dr. Mimpei ITO from October 23 to November 11, 2016.

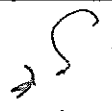
During its stay, both the Team and authorities concerned of Government of the Republic of the Union of Myanmar (hereinafter referred to as “GOM”) had a series of discussions and exchanged views on the Project based on the field observations.

As a result of the discussions, the both sides agreed to the matters referred to in the attached document.

Nay Pyi Taw, 9 November, 2016

西形 康太郎

 Mr. Keiichiro NAKAZAWA
Chief Representative
Myanmar Office
Japan International Cooperation Agency



Mr. Sein Htoon Linn
Deputy Director General,
On Behalf of
Mr. Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resource and
Environmental Conservation
Myanmar

THE ATTACHED DOCUMENT

1. Amended Project Design Matrix

Based on the series of discussions with the Myanmar side and with JICA expert team about the current situation and progress of the project, the revised version of Project Design Matrix (hereinafter referred to as “PDM”) was proposed from the Team. Both Myanmar side and JICA agreed with the contents of amended PDM.

2. Financial support for outdoor water sampling activities

The Myanmar side requested JICA to support the water sampling activities in outdoor. In principle, JICA does not support such activities done by the counterparts, though, considering the situation in Myanmar, the Team recognized that it is important to provide the financial support for the smooth implementation of the project and decided to support the outdoor water sampling activities financially.

The team explained to the Myanmar side that this measure is an exception and it is necessary that GOM provide such kind of support to local authorities after the accomplishment of this project.

Detailed policy of the support will be informed later to the counterparts directly from the JICA expert team.

3. Information sharing

The Myanmar side agreed to share the relevant materials to EIA review operation prepared by other development partners with JICA e.g. report, guidelines, manuals, and any other output from the partners, even if those outputs are draft, for the smooth implementation of the Project.

4. Donor coordination

The Team recommended to the Myanmar side to appoint a donor Coordination Officer in charge of coordination and management of donor –related activities in the field of EIA so as to avoid the duplication or overlapping of activities supported by the donors. The Myanmar side agreed to do so.

Appendix I THE JOINT MIDTERM REVIEW REPORT ON THE PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN MYANMAR

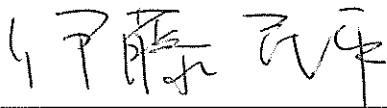
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THE JOINT MIDTERM REVIEW REPORT
ON
THE PROJECT FOR
CAPACITY DEVELOPMENT IN BASIC WATER
ENVIRONMENT MANAGEMENT AND EIA SYSTEM
IN MYANMAR

November 9th, 2016

JOINT MIDTERM REVIEW TEAM



Dr. Mimpei ITO
Leader
Midterm Review Team
Japan International Cooperation Agency



Mr. Sein Htoon Linn
Deputy Director General,
On Behalf of
Mr. Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resource and
Environmental Conservation
Myanmar

Table of Contents

1. Outline of the Midterm Review	6
1-1 Background of the Project	6
1-2 Objective of Midterm Review	6
1-3 Members of Joint Review Team	6
1-4 Schedule of Midterm Review	7
1-5 Outline of the Project	7
2. Midterm Review Methodology	8
2-1 Review Procedure	8
2-2 Component of Review Report	8
2-2-1 Verification of Achievement	8
2-2-2 Implementation Process	8
2-2-3 Review Based on Five Evaluation Criteria	9
2-3 Data Collection and Analysis	9
3. Verification of Achievement	10
3-1 Project Inputs	10
3-2 Achievement of Outputs	11
3-2-1 Output 1	11
3-2-2 Output 2	14
3-2-3 Output 3	17
3-2-4 Output 4	19
3-2-5 Output 5	21
3-2-6 Output 6	22
3-3 Likelihood for Achieving Project Purpose	24
3-4 Prospects for Achieving the Overall Goal	25
4. Implementation Process	26
5. Result of the Midterm Review	28
5-1 Relevance	28
5-2 Effectiveness	28
5-3 Efficiency	29
5-4 Impact	29
5-5 Sustainability	29
6. Conclusion	31
7. Recommendations	32
7-1 Recommendations for the Project	32
7-2 Recommendation for ECD	32
7-3 Recommendation for YCDC, MCDC and ECD	32

List of Tables

Table 1. Project Outline	7
Table 2 Terms and Definitions Used in PDM	8
Table 3 Five Evaluation Criteria	9
Table 4 Summary of Inputs by JICA	10
Table 5 Summary of Inputs by Myanmar	10
Table 6 Summary of Output 1	11
Table 7 Data Sources of Yangon	11
Table 8 Data Sources of Mandalay	12
Table 9 Summary of Inspection activities	12
Table 10 Suggested Content of Inspection Manual	13
Table 11 Summary of Output 2	14
Table 12 Hlang River Basin Survey Plan	15
Table 13 Doka Hta Waddy River Basin Sampling Plan	16

S. 04

Table 14	Summary of Hlang River Basin Survey	16
Table 15	Summary of Doke Hta Waddy River Basin Survey	16
Table 16	Summary of Output 3.....	17
Table 17	Summary of Database/GIS trainings.....	19
Table 18	Summary of Output 4.....	20
Table 19	Proposed content for water status report	20
Table 20	Summary of Interpretation Workshop.....	20
Table 21	Summary of Output 5.....	21
Table 22	Summary of Output 6.....	23
Table 23	List of EIA Trainings Provided.....	23
Table 24	Summary of Project Purpose	24
Table 25	Summary of Overall Goal	25

List of Figure

Figure 1	Implementation of Project Outputs	27
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List of Annexes

Annex 1.	Schedule of Midterm Review
Annex 2.	PDM (as18 Dec. 2015)
Annex 3.	PO (as18 Dec. 2015)
Annex 4.	Evaluation Grid
Annex 5.	List of Experts
Annex 6.	List of Counterparts participated in the trainings in Japan
Annex 7.	List of Equipment
Annex 8.	List of Counterparts
Annex 9.	Suggested Changes of PDM
Annex 10.	Proposed PDM

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Abbreviations

ADB	Asian Development Bank
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CP	Counterpart
DISI	Directorate of Industrial Supervision and Inspection
DO	Dissolved Oxygen
ECC	Environmental Conservation Certificate
ECD	Environmental Conservation Department
ECL	Environmental Conservation Law
ECR	Environmental Conservation Rule
EIA	Environmental Impact Assessment
GIS	Geographic Information System
GoM	Government of Myanmar
GPS	Global Positioning System
HIA	Health Impact Assessment
IAIA	International Association for Impact Assessment
IFC	International Finance Cooperation
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
MCDC	Mandalay City Development Committee
MLSS	Mixed Liquor Suspended Solids
M/M	Minutes of Meeting
MOECAF	Ministry of Environmental Conservation and Forestry
MONREC	Ministry of Natural Resources and Environmental Conservation
MoU	Memorandum of Understanding
NPT	Nay Pyi Taw
NGO	Non-Governmental Organization
OECD-DAC	Organization for Economic Co-operation and Development – Development Assistance Committee
OVI	Objectively Verifiable Indicators
PCCD	Pollution Control and Cleansing Department
PCM	Project Coordination Meeting
PDM	Project Design Matrix
pH	potential of Hydrogen
PO	Plan of Operation
R/D	Record of Discussion
SEA	Strategic Environmental Assessment
SLA	Social Impact Assessment
SS	Suspended Solid
SVI	Sludge Volume Index
TS	Total Solid
YCDC	Yangon City Development Committee

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WSD	Water and Sanitation Department
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1. Outline of the Midterm Review

1-1 Background of the Project

Myanmar has been facing considerable challenges in the management of the environment due to rapidly increasing domestic and foreign investments in the industrial, urban and rural development sectors. In this regard, Environmental Conservation Law (ECL) with the objective of enabling to implement the Myanmar National Environmental Policy, was enacted in 2012 and Environmental Conservation Rules (ECR) has been developed for the implementation of the Law. According to the prescription of environmental conservation law and rules, it is urgently needed to develop technical tools for Environmental Impact Assessment (EIA) and Environmental Quality Standards, effluent and emissions standards. In this context, there are many obstacles such as the lack of baseline information on environmental quality standards, and limited technical capacity for environmental monitoring systems in Myanmar.

To overcome these obstacles, at national level, it is immediately needed to strengthen capacity of Environmental Conservation Department (hereinafter, ECD). ECD has been newly established in the Ministry of Environmental Conservation and Forestry (hereafter, MOECAF)¹ as the focal institution for environmental management, EIA review, and other environmental conservation issues.

At municipality level, although, Yangon City Development Committee (hereinafter, YCDC) and Mandalay City Development Committee (hereinafter, MCDC) have been carrying out the regular inspections on pollution sources, further improvements of inspection are required.

Based on the present status on environmental management in Myanmar described above, Government of Myanmar (hereinafter, GoM) requested Japan International Cooperation Agency (hereinafter, JICA) to support and enhance the capacity of MOECAF and overall environmental management in Myanmar. Record of Discussion (R/D) was signed for “The Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar” (hereinafter, the Project) on December 2014.

The Project launched in May 2015 and will be completed in May 2018. This Midterm Review (hereinafter, “the Review”) was organized at the turning point of the implementation period with the objective to confirm Project’s inputs, activities and achievements of Outputs and Project Purpose. The Project will be reviewed based on the five evaluation criteria and recommendations for the implementation of remaining project period will be proposed.

1-2 Objective of Midterm Review

The objectives of the Review are:

- 1) To conduct a joint review by the Midterm Review Team (hereinafter, the Team);
- 2) To confirm actual inputs, activities and the degree of achievements of the outputs, and the prospect of achieving the project purpose;
- 3) To assess the Project based on OECD-DAC’s five evaluation criteria - Relevance, Effectiveness, Efficiency, Impact and Sustainability;
- 4) To make recommendations on the measures to be taken during the remaining cooperation period and beyond in consultation with agencies concerned; and
- 5) To confirm the results of the Review, and to agree by signing of the Review report.

1-3 Members of Joint Review Team

MANMAR member

¹ In April 2016, MOECAF was merged with Ministry of Mining and became Ministry of Natural Resources and Environmental Conservation (MONREC).

1. Hla Maung Thein	Leader	Director General Environmental Conservation Department Ministry of Natural Resources and Environmental Conservation Myanmar
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JAPANESE members

1. Mimpei Ito	Leader	Director Environmental Management Team 1 Environmental Management Group Global Environmental Department Japan International Cooperation Agency
2. Mizuki Hosokai	Evaluation Planning	Program Officer Environmental Management Team 1 Environmental Management Group Global Environmental Department Japan International Cooperation Agency
3. Hiroko Sugimoto	Evaluation and Analysis	Evaluation Analysis Japan Development Service Co., Ltd.

1-4 Schedule of Midterm Review

The Review was carried out from 23rd October to 10th November 2016. The detail of the Midterm Review schedule is shown in Annex 1.

1-5 Outline of the Project

The Project outline is shown in Table 1. The detail of the Project is described in Project Design Matrix (PDM) approved on 18th Dec. 2015 and Plan of Operation (PO) in Annex 2 and 3.

Table 1. Project Outline

(Based on PDM approved on 18 Dec. 2015)

Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.
Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.
Outputs	1. Inspection procedure is standardized.
	2. Capacity for implementing water quality survey to obtain reliable information is enhanced.
	3. Database of water pollution sources and river water quality is developed.
	4. Capacity of interpreting the information for water pollution control measures is enhanced.
	5. Necessary technical manuals and forms for the EIA review are developed.
	6. Capacity of MOECAAF and the EIA Report Review Body on the EIA review is enhanced.

(Source: Project)

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2. Midterm Review Methodology

2-1 Review Procedure

The aims of the Review are: to examine project achievements based on R/D, PO, and PDM; to evaluate Project Outputs, Project Purpose and Overall Goal by using five evaluation criteria shown in Table 2; to propose recommendations for the Project.

During the Review, the Team collected and analyzed data and information, and examined project achievements based on PDM. Then, the Team evaluated the project achievements so far, and proposed recommendations for the remaining project period. The result of the Review was compiled as a Review report and presented to the Joint Coordinating Committee (JCC) for the approval. The approved Review report is signed by the representatives from Japan and Myanmar.

2-2 Component of Review Report

The Review report is composed of three components. 1. Verification of Achievement; 2. Implementation Process; 3. Review based on Five Evaluation Criteria. The detail of each component is described below.

2-2-1 Verification of Achievement

Verification of achievement was measured in terms of Project Outputs, Project Purpose and Overall Goal by using Objectively Verifiable Indicators (OVIs) described in current PDM (as of 18. Dec. 2015). Table 2 summarizes the terms and definitions used in PDM.

Table 2 Terms and Definitions Used in PDM

Items in PDM	Definitions
Overall Goal	Development effect expected as a result of the achievement of project purpose in about 3-5 years after the completion of project.
Project Purpose	Objective that is expected to be achieved by the end of project. It should be described as a specific benefit or impact given to target group.
Outputs	Outputs are objectives to be realized by project in order to achieve Project Purpose through implementing a series of project activities.
Activities	Activities are specific actions intended to produce project outputs by effective use of project inputs.
Important Assumption	Important assumptions are conditions required for a success of project but exist outside the control of project.
Preconditions	Preconditions are requirements prior to the launch of project. Project cannot be expected to be successful if it is started before pre-conditions are met.
Objectively Verifiable Indicators	Indicators to verify achievements of Project Outputs, Purpose and Overall Goal. Indicators should be objectively verifiable and measurable.
Means of Verification	The data sources required to verify OVIs.
Inputs	Inputs are human, financial, and material resources required for each project activity.

(Source: JICA Project Evaluation Guideline 2010)

2-2-2 Implementation Process

For the implementation process, the Team reviewed functionality of project implementation such as decision making process, implementation management, communication, budget, and progress monitoring. Obstacles and/or facilitating factors affecting the implementation of the Project were identified.

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2-2-3 Review Based on Five Evaluation Criteria

The Team evaluated project achievements so far by using OECD-DAC's Five Evaluation Criteria shown in Table 3.

Table 3 Five Evaluation Criteria

1. Relevance	Whether the project is consistent with the priority of both counterpart and Japanese governments; whether the project responds to the needs of target group and society; whether the methodology taken in the project is appropriate to address and needs and/or developmental strategy of the country or target group.
2. Effectiveness	Likelihood of Project Purpose to be achieved at the end of project. Relevance of Output for achieving Project Purpose; Effects by important assumptions as well as contributing/hampering factors for achieving Project Purpose.
3. Efficiency	Appropriateness of activities to produce Output: appropriateness of quality, quantity, and timing of project inputs for activities; Efficiency of input against output produced.
4. Impact	Likelihood of achieving Overall Goal; Impact for developmental goal of the country; Positive and negative impacts that are not intended originally.
5. Sustainability	Sustainability of achieved Project Purpose after the completion of cooperation of JICA assessed in policy, institutional, financial, and technological aspects.

(Source: JICA Project Evaluation Guideline, 2010)

2-3 Data Collection and Analysis

The Team used following methods to collect information and data.

- Document review: Collecting data and information from existing materials such as experts' work completion reports, policy documents, JCC meeting minutes, and Japan's assistance strategy for Myanmar, materials produced by the Project, and other documents relating with the Project. The results of review were compiled in the Evaluation Grid (Annex 4).
- Questionnaires: The Team sent questionnaires to Japanese Experts and Myanmar Counterparts (CPs), responses were collected and analyzed.
- Interviews: The Team conducted key informant interviews with Experts, CPs and other relevant stakeholders of the Project.
- Site visits: The Team visited pilot water survey points and observed water sampling activities.

3. Verification of Achievement

The results of project achievements (Inputs, Outputs and Project Purpose) are presented in this section.

3-1 Project Inputs

The Project inputs from JICA and Myanmar, in terms of personnel, equipment and facility, trainings in Japan, and operational costs are shown below.

Table 4 summarizes inputs from JICA. By the time of Review, five (5) Japanese Experts has been dispatched. The list of Experts, organization, and area of expertise is shown in Annex 5. By the time of Review, 16 CPs have been trained in Japan (Annex 6). Equipment such as computers, projector, printers, GPSs were provided by JICA (Annex 7).

Table 4 Summary of Inputs by JICA

1) Japanese Experts	5 Experts were dispatched (804 man/month, at the time of Review)
2) Equipment	Computers, printers, photocopier, projector, and GPSs have been provided.
3) CP trainings in Japan	16 CPs have been trained in Japan
4) Operational Costs	At the time of Review, approximately 32.5 million yen ² has been spent on the Project.

(Source: Project)

By the time of Review, 30 CPs have been involved in the Project. (Annex 8) Working space was provided in ECD headquarters in Nay Pwi Taw and the expenses of utilities were covered by Myanmar side. Table 5 summarizes the inputs from Myanmar side.

Table 5 Summary of Inputs by Myanmar

1) Counterparts	30 CPs have been engaged in the Project.
2) Office and facilities	Office space for Experts in Nay Pwi Taw and its utilities
3) Operational costs	Travel cost of CPs and other costs.

(Source: Project)

Some of the notable issues regarding Project inputs are as follows.

1. Office space in YCDC and MCDC

ECD provided office spaces for the Experts in Nay Pwi Taw. However, in Yangon and Mandalay where activities of Output 1 to 4 are taking places, no office spaces were provided by the Myanmar side. Experts involved in Output 1 to 4 had to prepare its own office since there was no agreements made for providing office spaces in Yangon and Mandalay.

2. Cost incurred for CP's participation to the field activities

R/D signed on December 2014 between JICA and MOECAAF stipulates that the operation costs required for the participation of the Project activities by CPs are responsible of the Myanmar side. However, YCDC, MCDC and ECD regional offices cannot allocate the costs of CPs to participate in the field work. Therefore, the matter

² Due to separate accounting systems, total amount presented is the combined budgeted amount for Output 1-4 and actual expenses for Output 5&6.

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will be discussed and agreed at JCC.

3-2 Achievement of Outputs

3-2-1 Output 1

The focus of Output 1 is to standardize inspection procedure. The majority of activities in Output1 were implemented without delay. Inspection manual indicated in OVI 1 has been drafted and it is under the review. Table 6 indicates the summary of Output1.

Table 6 Summary of Output 1

Output 1	Inspection procedure is standardized.
OVI	More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.
Activity	<p>1.1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)</p> <p>1.2 To evaluate present inspection procedure.</p> <p>1.3 To develop an inspection manual.</p> <p>1.4 To implement inspection based on the developed inspection manual.</p> <p>1.5 To provide training on measures to control industrial effluent.</p> <p>1.6 To revise the inspection manual.</p>

The Review Team confirmed the following status of implementation of activities.

Activity 1.1	To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)
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General information about company such as location, sector, products and production processes have been collected from existing data sources shown below.

a. Yangon

Table 7 Data Sources of Yangon

Data source	No of companies	Data contents
YCDC (PCCD)*	3,474 (24 industrial zones) ***	name; location; materials; water usage amount: discharge (BOD, COD, TS, SS, pH and temperature)
DISI**	1083	name; type of business; products; owner name; location; energy usage; investment value; no of employees

*PCCD: Pollution Control and Ceasing Department of YCDC. Project)

** Directorate of Industrial Supervision and Inspection, Ministry of Industry

***Information of YCDC is based on responses of 2012-14 PCCD Inspection questionnaire

(Source:

From the data sources above, information of 69 factories that were discharging waste water was digitalized for the database and analyzed.

b. Mandalay

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Table 8 Data Sources of Mandalay

Data source	No of companies	Data contents
MCDC(WSD)*/ ECD Mandalay	1292	name; type of business; products; waste water (BOD, pH: for some factories) ; water usage

*Water and Sewage Department Project)

(Source:

From the data source above, information of 97 factories that were discharging waste water was digitalized for the database and analyzed.

Further, the Project employed sub-contractor to collect additional more detailed information such as waste water treatment plants, and contents of discharged water. The questionnaire survey have been conducted for 200 factories (100 in Yangon and 100 in Mandalay). In addition, 50 waste water samples (25 in Yangon, 25 in Mandalay) will be collected from the selected factories. The survey is expected to complete by early December 2016.

Activity 1.2	To evaluate present inspection procedure.
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To understand the current inspection procedures, the Experts conducted reviews of current inspection activities of YCDC, MCDC, and ECD, environmental compliances and/or inspections of other countries, Myanmar’s laws and regulations about industrial waste management. From the reviews, the Experts identified two types of inspections were carried out by CP organizations: 1. Inspection for licensing and registration; 2. Inspection based on complains to resolve environmental complains.

1. Inspection for licensing and registration

Meeting laws and sub-laws is the prerequisite for the industry/business to receive licensing/registrations administered by YCDC, MCDC, DISI, and ECD. Inspections are carried out by these organizations to check whether industries/businesses are in compliance with the requirements. Table 9 below summarizes the inspection activities of YCDC, MCDC and ECD.

Table 9 Summary of Inspection activities

Organization	Inspection methodology	Contents of inspection
YCDC/PCCD	Inspection through questionnaires to the factories (2012-2014)	Factory is to provide: name, address, materials, water usage, waste water contents (BOD, COD, TS, SS, pH and temperature)
MCDC/ Cleansing department	Inspection through questionnaires at the renewal of license/ registration	Factory is to provide: name, address, water source, existence of waste water treatment plant
ECD	Document review and on-site inspection to check conditions of businesses submitting EIA	Factory to provide: EIA documents explaining proposed project, mitigating measures, monitoring plan

(Source: Project)

However the lack of clear and legally binding regulatory requirements such as effluent quality standard makes it ambitious for the licensors (YCDC and MCDC) to enforce relevant laws and sub-laws. MONREC issued National Environmental Quality (Emission) Guideline supported by Asian Development Bank (ADB) in December 2015. However this guideline is not legally-binding and designed for newly established businesses under the framework of EIA. To make the requirements binding, the requirements have to be incorporated into the permitting conditions of the Environmental Conservation Certificate (ECC). Most existing factories are yet to apply for ECC. As for YCDC and MCDC, annual business licensing is already in place, though legal requirements are not clearly stipulated in relevant documents.

During interviews, ECD officials emphasized the importance of follow-up monitoring and inspection of EIA.

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A company whose EIA has been approved is required to follow what is proposed in EIA. It is ECD's mandate to follow up and monitor the compliance by ECD regional offices. Similarly, YCDC and MCDC are aware of the need to monitor the compliance.

However, for the reasons mentioned above, there is no organization (YCDC, MCDC, ECD Yangon and Mandalay) conducting regular compliance monitoring and inspection for industrial water discharge.

2. Inspection based on complains to resolve environmental complains

YCDC, MCDC and ECD regional offices conduct on-site inspection when they receive complains about pollution from the public and/or other stakeholders. Complains are often submitted to the regional governments or city mayors then the relevant departments and/or offices must react on complains. It is an ad-hoc inspection and there seems be no standard way to conduct inspection nationwide. A complain is usually dealt with case-by case. One example is the pollution case of Taung Thaman Lake in Mandalay where the death of fish caused public outcry. Since the issue was raised, MCDC has been regularly monitoring the water quality of the lake.

Activity 1.3	To develop an inspection manual
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Initial reviews of inspection procedures found that ECD, YCDC, and MCDC do not have inspection manuals. To assess the needs for the inspection manual, the Project conducted capacity assessments by requesting officers involved with licensing to self-assess their capacity. Based on the results and review of inspection manuals in Activity 1.2, the objective and contents of the inspection manual were identified as below.

Table 10 Suggested Content of Inspection Manual

Objective	<ul style="list-style-type: none"> - To standardize inspection procedures in order to minimize undetected serious pollution problems - To provide officers with general information on current laws and regulations - To provide officers with basic information on pollution control measures in typical industrial sectors - To provide sources of more detailed information
Target	Novice officers with limited experiences on inspection
Contents	Background and introduction to the inspection manual Brief summary of current legal systems for pollution control Inspection Procedures. Explanation about recommended inspection procedures to develop an inspection plan, implement an on-site inspection, report results, etc. Appendix 1: Checklist: to be used by an officer to standardize inspection procedure Appendix 2: Good practices for pollution control: to provide brief technical information on different industrial sectors, waste water treatment technologies, environmental issues, etc.

(Source: Project)

A check list for inspection has been developed in March 2016 to standardize the regular inspection procedure of ECD, YCDC and MCDC. Then, the inspection manual was drafted in August 2016. At the time of the Review, checklist and manual are under the review by ECD.

Activity 1.4	To implement inspection based on the developed inspection manual.
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Since the draft inspection manual is still under the review, the activity 1.4 has not been implemented at the time of Review.

Activity 1.5	To provide training on measures to control industrial effluent.
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An Expert on waste water treatment technology will be assigned in late Nov. 2016. After initial assessment, he will conduct trainings on waste water treatments. MCDC and YCDC requested to organize a seminar on waste water treatment and invite factory owners and other relevant groups to raise awareness of waste water

treatment.

Activity 1.6	To revise the inspection manual
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As the draft inspection manual is still under the review, the activity 1-6 has not been implemented at the time of Review.

OVI 1.1	More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.
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The inspection manual has already been drafted and is currently reviewed by ECD. The findings from the evaluation of existing inspection indicate that currently YCDC, MCDC or ECD do not conduct regular compliance inspections to the factories. Onsite inspections are conducted to respond to complains. In addition, the lack of rules and regulations about inspection makes difficult to determine what and how to inspect by officials. Through discussions with CPs, it was agreed that current draft inspection manual to be shared with CPs and additional discussion will be held to determine how to conduct inspection by using the manual. Based on the discussion, the Review Team suggests that the revision of OVI to adjust current condition. The suggested revision is referred in Annex 9.

3-2-2 Output 2

The focus of Output 2 is to enhance the capacity to obtain reliable information through the water quality survey. The activities are implemented as planned without major delay. Water quality survey report indicated in OVI will be complied once additional survey is completed. Table 11 indicates the summary of Output 2.

Table 11 Summary of Output 2

Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.
OVI	Water quality survey reports are prepared in the pilot areas by YCDC and MCDC.
Activity	2.1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2.2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas. 2.3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2.4 To develop a water quality survey plan. 2.5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2.6 To implement a water quality survey based on the water quality survey plan. 2.7 To supervise the water sampling referring to the water quality survey manual. 2.8 To verify the results of the water quality survey using the water quality survey manual. 2.9 To prepare a water quality survey report

The Review Team confirmed the following status of implementation of activities.

Activity 2.1	To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances)
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The Project identified government and private laboratories for the water quality survey as follows.

Three (3) private laboratories and a government laboratory were initially selected for the first sampling survey.

For the chemical analysis, there were no laboratories in Myanmar that could analyze all the required parameters of the Project. Thus, parameters that are testable or time-sensitive are tested in Myanmar but for the other parameters such as testing for pesticide and PCB etc., samples will be sent to neighborhood country such as Thailand for the analysis.

Because none of the CP organizations have an in-house laboratory designed for the environmental analysis, and strengthening of analytical capacity is beyond the scope of this Project. Nevertheless, Water and Sanitation Department (WSD) of YCDC has small laboratories to test drinking water sources and sewage water (24 parameters as of 2015). Similarly, MCDC WSD has laboratory that can test 30 parameters related with drinking and sewage water as of 2015. MCDC laboratory will soon be able to offer biological testing. These laboratories of YCDC and MCDC took part in the water quality survey, and analyzed parameters they could analyze in order to verify obtained data.

Deputy Director of ECD Yangon indicated that a laboratory has been constructed next to their office but they do not have budget to obtain equipment for the laboratory or human resources to run the laboratory. Similarly, many ECD officials, regardless headquarters or regional offices, expressed their desire to have own laboratories to test water quality related with environmental pollution.

Activity 2.2	To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas.
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Hlang river basin in Yangon and Doka Hta Waddy river basin in Mandalay were identified as pilot study areas. To propose monitoring plan, following information was collected in 2015: meteorology; hydrology; pollution source; past water quality data; and water use. At the time of Review, meteorological and hydrological information and data³ have not been provided by relevant authorities yet, but remaining information and data has been collected.

Activity 2.3	To develop criteria for selecting sampling points, sampling time, measurement parameters etc.
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Based on the collected information in Activity 2-2, the Project developed the criteria for selection of sampling points, time and measurement parameters. The main objectives of water sampling are to assess the status of water pollution in the pilot study areas and to identify the effects of pollution sources of river environment.

Activity 2.4	To develop a water quality survey plan.
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The water quality survey plan has been developed based on the meetings and workshop with MCDC, YCDC and ECD regional offices. The summary of plans as of December 2015 is shown below. This survey plan has been slightly revised at each survey based on the site conditions, results of previous surveys, and suggestions from CPs.

Table 12 Hlang River Basin Survey Plan

Item	Contents
Sampling point	Total 10 sampling points at each sampling time. Surface water only.
Sampling timing	Total four (4) samplings. 1 st sampling : Feb. 2016 (spring tide) 2 nd sampling : June 2016 3 rd sampling: Feb. 2017 4 th sampling: June 2017 Timing: Low tide and high tide (only at the representative point)
Parameters	Every sampling: pH, Salinity, Turbidity, Water temperature, ORP, Flow rate and water depth, TSS, TDS, BOD, COD, Color, Odor, Oil and grease, Total phosphorus, Total

³ The Project currently uses alternatively sourced meteorological and hydrological data.

	nitrogen, Total Coliform Additional 16 samples will be taken for 2 nd and 3 rd sampling and two (2) additional samples will be taken at 3 rd sampling.
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(Source: Project)

Table 13 Doka Hta Waddy River Basin Sampling Plan

Item	Contents
Sampling point	Total 10 sampling points at each sampling time. Surface water only.
Sampling timing	Total four (4) samplings. 1 st sampling : Feb. 2016 (spring tide) 2 nd sampling : June-July 2016 3 rd sampling: Feb. 2017 4 th sampling: June 2017 Timing: Low tide and high tide (only at the representative point)
Parameters	Every sampling: pH, Salinity, Turbidity, Water temperature, ORP, Flow rate and water depth, TSS, TDS, BOD, COD, Color, Odor, Oil and grease, Total phosphorus, Total nitrogen, Total Coliform Additional 16 samples will be taken for 2 nd and 3 rd sampling and two (2) additional samples will be taken at 3 rd sampling.

(Source: Project)

Activity 2.5	To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage.
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Drafting of water quality survey manual has been ongoing at the time of Review. The manual aims at improving quality and reliability of water quality survey by CPs. It will summarize: methodologies for developing a sampling plan; preparation and calibration of equipment for sampling and on-site measurement; methodology of sampling and on-site measurement; storage and preservation of samples and review of analytical data, etc.

Activity 2.6	To implement a water quality survey based on the water quality survey plan.
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By the time of Review, 1st and 2nd river water samplings have been completed. The summary of each sampling is shown below. The 3rd survey is to be implemented in December 2016.

Table 14 Summary of Hlang River Basin Survey

	Date	Participants	Contents
1 st	Feb. 22-24, 2016	Sub-contractor (sampling) YCDC (PCCD and WSD) ECD Yangon Experts	Water sampling in Hlaing river basin
2 nd	Jun. 20-21, 2016	Sub-contractor (sampling) YCDC (PCCD and WSD) ECD Yangon Experts	Water sampling in Hlaing river basin Sediment sampling in Hlaing river as a supplemental survey

(Source: Project)

Table 15 Summary of Doka Hta Waddy River Basin Survey

	Date	Participants	Contents
1 st	Feb. 17-18, 25, 2016	Sub-contractor (sampling) MCDC-WSD	Water sampling in Doka Hta Waddy river basin

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		ECD Mandalay Experts	Sediment sampling in Thaug Tha Man Lake as a supplemental survey
2 nd	Jun. 27-28, 2016	Sub-contractor (sampling) MCDC-WSD ECD Mandalay Experts	Water sampling in Doke Hta Waddy river basin

(Source: Project)

During interviews, CPs who were participated to the river water quality surveys expressed following skills and knowledges they gained through conducting the surveys with the Experts.

- It is important to identify sampling point and to consider the tide, water depth and other conditions when taking samples.
- It is important to properly preserve and transport collected samples.
- It is important to take safety measures during sampling activities such as wearing boots and life jackets.

Activity 2.7	To supervise the water sampling referring to the water quality survey manual.
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This activity will be implemented after the water quality survey manual has been completed. Key components of the manual, such as a field recording form, a water flow measurement form as well as a check list of water quality data, have already been developed and used in the past surveys.

Activity 2.8	To verify the results of the water quality survey using the water quality survey manual.
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This activity will be implemented upon the completion of the water quality survey manual. Meanwhile, the results of the past water quality survey have been checked with CPs, and short seminars on analytical quality control were held in Mandalay on 24th June 2016 and for Yangon on 1st July 2016 to provide basic scientific knowledge and techniques for data validation.

Activity 2.9	To prepare a water quality survey report
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The draft of first water quality survey report containing the results of 1st and 2nd water quality surveys was available at the time of Review.

OVI 2.1	Water quality survey reports are prepared in the pilot area by YCDC and MCDC.
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The draft first water quality survey report have been compiled. The report include the general characteristics of industries in pilot study areas. Currently more detailed survey about waste water treatment for 200 factories has been conducted and water samples from 50 selected factories will be collected, tested and analyzed. Once these information become available, water quality survey report will be completed. CPs have been participating river and industrial water samplings, and questionnaires surveys.

3-2-3 Output 3

Output 3 focuses on building database of water pollution. The Collection of information is still in process, other activities regarding database development are ongoing. By the end of additional survey, information of 200 factories will be accessible on the database. (OVI 1) The Team suggests the revision of OVI 2 to adjust the current situation of the Project. Table 16 indicates the summary of Output 3.

Table 16 Summary of Output 3

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Output 3	Database of water pollution sources and river water quality is developed.
OVI	3.1 At least 150 factories' information is accessible on the database. 3.2 Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.
Activity	3.1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results. 3.2 To develop a system concept. 3.3 To design the database based on the system concept. 3.4 To collect additional information required to develop the database. 3.5 To develop the database. 3.6 To conduct training on operation and utilization of the database. 3.7 To develop an operation and maintenance manual of the database.

The Review Team confirmed the following status of implementation of activities.

Activity 3.1	To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results.
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For the purpose of developing database, the following information and data have been collected and compiled into the prototype databases in 2015.

- a. Hlaign River basin pilot study area: information of selected 69 factories that discharge waste water.
- b. Doke Hta Waddy River basin pilot study area: information of selected 97 factories that discharge waste water.

Initially collected data and information were far from adequate for analyzing the situations of pollution sources in these pilot study areas. Hence, the Project decided to implement an additional pollution source survey. At the time of the Review, an additional questionnaire survey has already been completed to collect detailed information from 200 factories. In addition, waste water samples from 25 factories of each pilot study area are being collected and analyzed by the sub-contractor.

Activity 3.2	To develop a system concept.
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In 2015, YCDC, MCDC, ECD and the Experts discussed and agreed about following direction and concept of database system.

- Two types of database will be developed: 1. Pollution source database; 2. Water quality database.
- Database will be developed in two steps: 1. at initial step, prototype (pilot) database based on existing information and data will be developed; 2. in the secondary step, database will include existing information, as well as new data such as results of project activities.
- Database should be user-friendly so that it will be used sustainably. It will be linked with GIS system so that geographical analysis can be conducted for the pollution sources.
- As much as possible, the format of database will be standardized so that ECD or regional governments can also use the database to compare and analyze information and data at regional and national levels.

Activity 3.3	To design the database based on the system concept.
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A prototype database has been developed in later 2015 by using existing information to assess database design and data requirements. This process has been on-going.

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Activity 3.4	To collect additional information required to develop the database.
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As previously mentioned, the questionnaire survey has been completed and currently collecting water samples of selected factories. Upon the completion of additional surveys, detailed information of 200 factories and water quality results of 50 water samples from selected factories will be available for the database.

Activity 3.5	To develop the database.
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When all the necessary data become available, the database will be finalized.

Activity 3.6	To conduct training on operation and utilization of the database.
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Trainings about database and GIS have been conducted in Yangon and Mandalay as shown below.

Table 17 Summary of Database/GIS trainings

Subject	Yangon	Mandalay
GPS data collection	30 th Nov. and 1 st Dec. 2015	25, 26 th Nov. and 8 th Dec. 2015
Initial GIS database development	4 th Dec. 2015	10 th Dec. 2015

(Source: Project)

In GPS data collection training, participants collected geographical coordinates of selected factories using GPS (Yangon: 25 factories, Mandalay: 20 factories). In the initial GIS database development training, participants learned how to map such data using a GIS software.

During interviews, participants of the trainings expressed that the training was too short and they would like to have additional trainings on GIS.

Activity 3.7	To develop an operation and maintenance manual of the database.
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Operation and maintenance manuals for the database will be developed in early 2017.

OVI 3.1	At least 150 factories' information is accessible on the database.
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The Project has already collected general information of factories (70-Yangon, 97-Mandalay). Therefore, this OVI has already been partially achieved. At the end of additional survey, detailed information of 200 factories and analysis of water qualities of 50 factories will be available in the database. When collected data are incorporated into the database, OVI 3.1 is considered as achieved.

OVI 3.2	Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.
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As mentioned in OVI of Output1, contents of inspection will be determined after the inspection manual is shared by CPs. Therefore it is not possible to assess OVI 3.2. The Review Team suggests the revision of OVI 3.2 to adjust current situation of the Project. The suggested revision is referred in Annex 9.

3-2-4 Output 4

Output 4 focuses on building capacity of CPs to analyze and evaluate information collected from activities 1 through 3 and to compile as a water quality status report. As the information is still being collected, the remaining activities will be implemented when all the information become available. Table 18 indicates the summary of Output 4.

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Table 18 Summary of Output 4

Output 4	Capacity of interpreting the information for water pollution control measures is enhanced
OVI	A water quality status report in the pilot areas is prepared by MOECAAF, YCDC and MCDC.
Activity	4.1 To collect the information necessary for the water quality status report. 4.2 To interpret the collected information. 4.3 To prepare a water quality status report.

The Review Team confirmed the following status of implementation of activities.

Activity 4.1	To collect the information necessary for the water quality status report.
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Water quality status report aims at providing overall picture of status of water pollution in pilot study areas of Yangon and Mandalay. Information collected in Outputs 1, 2 and 3 will be analyzed, evaluated and compiled into the water quality status report. The proposed contents of status report are shown below. At the time of Review, readily available information has already been summarized in the zero draft of the water quality status report.

Table 19 Proposed Content for Water Status Report

Section	Contents
Introduction	Policies of water environmental management at national level
Water Quality Status in Hlaing River Basin	1 Natural condition 2 Social Conditions Administrative boundary, population 3 Organizations related to water environment management 4. Water quality 5. Pollution sources 6. Inspection to the factories 7. Identified issues on water environmental management
Water Quality Status in Doke Hta Waddy River Basin	1 Natural condition 2 Social Conditions Administrative boundary, population 3 Organizations related to water environment management 4. Water quality 5. Pollution sources 6. Inspection to the factories 7. Identified issues on water environmental management
Actions for next step for better water environmental management	
Conclusions and Recommendations	

(Source: Project)

Activity 4.2	To interpret the collected information.
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Two workshops were held to discuss about water quality status and problems regarding water environmental management in the pilot study areas in Yangon and Mandalay in June 2016. The summary of preliminary results of workshops are shown below. Similar workshops will be held when updated and upgraded information and data become available.

Table 20 Summary of Interpretation Workshop

Pilot sites	Water quality status	Identified issues in water environmental management to be addressed
Hlaing River Basin	1) Water Pollution Level	1) Organic Pollution

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	2) Industrial Pollution Sources 3) Other Pollution Sources 4) Water Use	2) Environmental impact by toxic, reactive, corrosive and other hazardous substances. 3) Eutrophication 4) Measures for Water Pollution Control
Doke Hta Waddy River Basin	1) Water Pollution Level 2) Industrial Pollution Sources 3) Other Pollution Sources 4) Water Use	1) Organic Pollution 2) Environmental impact by toxic, reactive, corrosive and other hazardous substances. 3) Eutrophication 4) Measures for Water Pollution Control

(Source: Project)

Activity 4.3	To prepare a water quality status report.
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The first water quality status report has been drafted.

OVI 4	A water quality status report in the pilot areas is prepared by MOECA, YCDC and MCDC.
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When all the information become available, the water quality status report will be prepared. However, it is challenging to draft all of the contents of the water quality status report by ECD, YCDC and MCDC without substantial support from the Experts. Therefore the Review Team suggests to modify OVI to fit the current situation of the Project. The suggested revision is referred in Annex 9.

3-2-5 Output 5

Output 5 aims at developing documents, technical manual and database to support EIA reviewing processes of ECD. Technical E-manual has been reviewed and redesigning is on-going (OVI 5.1). Official Submission Form has been already submitted for the approval (OVI 5.2). Table 21 indicates the summary of Output5.

Table 21 Summary of Output 5

Output 5	Necessary technical manuals and forms for the EIA review are developed.
OVI	The technical manual covers every sector of development projects and every step of the EIA procedure. 5.2 The draft official forms are internally approved.
Activity	5.1 To draft necessary legislation including Official Forms for the EIA. 5.2 To develop a technical Manual of the EIA process for review 5.3 To evaluate and update the Manual to meet the practical EIA review works 5.4 To develop a database for recording the EIA review operation 5.5 To establish an evaluation system for issuing license to EIA consultants

The Review Team confirmed the following status of implementation of activities.

Activity 5.1	To draft necessary legislation including Official Forms for the EIA.
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Draft Official Submission Forms have been submitted to the Minister of MONREC for its approval.

Activity 5.2	To develop a technical Manual of the EIA process for review
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As supporting tools for the ECD staff to review EIAs “Quick Assessment Guidance Note” was developed. The Note will be included in the E-manual which is now redesigned to improve the processing speed. When completed, E-manual can increase efficiency of EIA reviewing process of ECD staff by helping them making recommendations to EIA proponents. At the time of Review, coding of E-manual has been completed and data

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input has just started.

Two types of checklists has been drafted: 1. General checklist based on the E-manual was drafted and it has been used by ECD staff; 2. Sector specific checklists for 50 sectors is 20% completed.

Activity 5.3	To evaluate and update the Manual to meet the practical EIA review works
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This activity will be implemented after the completion of E-manual.

Activity 5.4	To develop a database for recording the EIA review operation
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Initial database has been redesigned to improve its efficiency. The final validation test is ongoing during this Review. CPs who have been initially trained and engaged in the building of database with the Expert left the division for transfers and for further study. An additional staff was assigned and has been trained by the Expert.

Activity 5.5	To establish an evaluation system for issuing license to EIA consultants
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Final draft of Consultant Licensing Scheme for licensing of EIA consultants have been completed. However, ADB has also been involved with technical assistance of Consultant Licensing Scheme and there seems to be confusion of demarcation of tasks between the JICA Project and ADB. The matter is already been addressed to the Director General of ECD to resolve the situation.

Public consultations on licensing of EIA consultants were held three (3) times. (2014⁴, August 2015 in Yangon, March 2016 in Nay Pyi Taw) Comments proposed during these consultations were incorporated into the draft documents.

OVI 5.1	The technical manual covers every sector of development projects and every step of the EIA procedure.
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E-manual is comprehensive that is covering all the sectors indicated Annex 1 of EIA Procedure and major steps indicated in the Procedure. As previously mentioned, E-manual is still undergoing its redesigning stage, once it is completed, OVI 5.1 is considered as achieved.

Already E-manual has been getting attention within ECD and externally. During the meeting with the Minister of MONREC in the Review, Director General of ECD expressed his high expectation on E-manual. Also, CPs and the Expert presented E-manual during IAIA international conference and they have been receiving inquiries from other countries.

OVI 5.2	The draft official forms are internally approved.
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Draft Official Submission Forms have been completed and submitted to the Minister for his approval. Hence OVI 5.2 has been achieved.

3-2-6 Output 6

Output 6 aims at building the capacity of ECD staff for EIA review processes. Activities such as conducting trainings, development of database for tracking system, public awareness materials such as leaflet and Website are on the track. Since E-manual is still under the development, achievement of OVI 6.1 will be upon the completion of manual. ECD staff had presented their EIA review process during international conference. (OVI 6.2) Table 22 indicates the summary of Output 6.

⁴ First public consultation was held before the commencement of Project.

Table 22 Summary of Output 6

Output 6	Capacity of MOECAAF and the EIA Report Review Body on the EIA review is enhanced.
OVI	EIA review works by MOECAAF are implemented based on the technical manual with a 80 % or more.
	6.2 EIA works by MOECAAF are presented to an international conference.
Activity	6.1 To implement basic and advanced EIA Training.
	6.2 To implement EIA review works based on the EIA procedure.
	6.3 To record the EIA review operation.
	6.4 To present leaflets and other materials for dissemination of EIA system
	6.5 To develop a WEB site to disclose EIA works based on the new EIA system
	6.6 To review and update the WEB site
	6.7 To presented activities on EIA review to an international conference

The Review Team confirmed the following status of implementation of activities.

Activity 6.1	To implement basic and advanced EIA Training-
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Following EIA related trainings were conducted by the time of Review. Advanced EIA trainings are planned in mid-December 2016. Trainings were provided in two days so that ECD staff can adjust their schedules. Training contents included theory, case studies and group work so that ECD staff can reflect the trainings into their daily EIA review works.

Table 23 List of EIA Trainings Provided

Title	Types	Data and venue	No. of participants
Off shore petroleum development	Advanced (sector specific)	12 Oct. 2015 JICA office , NPT	9 ECD staff (NRC and EIA division)
Hydropower development	Advanced (sector specific)	13 Nov. 2015 JICA office , NPT	9 ECD staff (NRC and EIA division)
1. Air Pollution 2. Water Pollution	Advanced (EIA)	9 Mar. 2016 ECD, NPT	25 ECD and line ministries
3. Integrated evaluation for EIA 4. Ecosystem service evaluation 5. Strategic Environmental Assessment	Advanced (EIA)	10 Mar. 2016 ECD, NPT	25 ECD and line ministries
1. Introduction of EIA, screening, scoping 2. Impact prediction 3. Alternative and impact evaluation	Basic (EIA)	25 July 2016 ECD, NPT	30 ECD (14 from branch offices, 13 NR&EIA, 1 Policy, 2 Administration)
4. Mitigation measure, management and monitoring 5. EIA quality review 6. Public consultation 7. Various EIA	Basic (EIA)	26 July 2016 ECD, NPT	30 ECD (14 from branch offices, 13 NR&EIA, 1 Policy, 2 Administration)

(Source: Project)

Activity 6.2	To implement EIA review works based on the EIA procedure.
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The Expert provides his support for ECD staff to conduct EIA reviews. Since expert's office is located next to the ECD staff, the staff are encouraged to bring questions about reviews of EIA reports. One interviewee expressed that this kind of support from the Expert is very useful as the staff have limited knowledge but have to review extensive sectors of EIA reports.

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Activity 6.3	To record the EIA review operation.
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CPs have been recording EIA review processes in the database. Database is updated regularly by designated officer making EIA review process easily traceable.

Activity 6.4	To present leaflets and other materials for dissemination of EIA system
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Draft leaflet introducing EIA procedure is currently reviewed by ECD.

Activity 6.5	To develop a WEB site to disclose EIA works based on the new EIA system
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Website (EIA portal) has been created adjunct with ECD's website and is operational at the time of Review. Translation of website to Burmese is ongoing which is expected to be completed soon.

Activity 6.6	To review and update the WEB site
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The contents of website will be updated when documents or new information become available.

Activity 6.7	To presented activities on EIA review to an international conference
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Three representatives from EIA division and the Expert participated in the Asia Environmental Impact Assessment Conference and 16th International Association for Impact Assessment (IAIA), Nagoya, Japan in 10-14 May 2016. They presented the project activities and issues related about EIA in Myanmar.

The Expert said that E-manual had collected attention from other participants. Participations of these conferences were very useful for CPs to establish network among EIA practitioners and researchers of other countries. Later, they were invited to another seminar organized in Thailand.

OVI 6.1	EIA review works by MOECAAF are implemented based on the technical manual with a 80 % or more.
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Since E-manual is still under development, it is not possible to determine the achievement of this OVI. The Review Team suggest this OVI to revise to focus on capacity building activities of Output 6. The suggested revision is referred in Annex 9.

OVI 6.2	EIA works by MOECAAF are presented to an international conference.
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CPs and the Expert presented about the development of EIA in Myanmar during Asia EIA Conference and IAIA in May 2016. The exposure to outside of country to present their work and establishing network with participants with other countries were beneficial to CPs at ECD.

3-3 Likelihood for Achieving Project Purpose

Table 24 Summary of Project Purpose

Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.
OVI	1. Consideration for the water status in the pilot study area is made.
	2. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.

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OIV 1. Consideration for the water status in the pilot study area is made.

Compiled water quality status report aims at analyzing and evaluating the results of water sample tests and questionnaire surveys, and identifying issues in water environmental management. This process will be completed once all the data and information were collected in the remaining project period. At the time of Review, there is no challenges were observed regarding this process, therefore OVI 1 is expected to be achieved by the end of the Project.

OVI 2 More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.

At this moment, Project Outputs and activities do not refer any safeguard policies of international organizations thus this OVI may not precisely reflect the Project Outputs and Activities. Therefore, the Review Team suggests to revise the OVI to fit with the Project. The suggested revision is referred in Annex 9.

3-4 Prospects for Achieving the Overall Goal

The Overall Goal will be measured 3-5 years after the project completion as a result of the achievement of Project Purpose. At this point, the likelihoods of achieving Overall Goal were assessed.

Table 25 Summary of Overall Goal

Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.
OVI	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.
	2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAAF.
	3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.

At this point, it is not possible to determine the likelihood of achieving OVIs of Overall Goals.

OVI 1 The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.

The Project is compiling the database about information of waste water treatment plants of factories in pilot study areas in Yangon and Mandalay. The database can provide the baseline information of industrial waste water in Yangon and Mandalay.

As the Experts point out, the key challenge of environmental water management is the lack of operational regulations and rules to enforce Environmental Conservation Laws and Rules. Similarly YCDC and MCDC have laws indicating no discharge of industrial waste water. Nevertheless, the only legally available enforcement is the issuing of business permit. Thus, the compliance of these laws remains as challenge.

Officials from YCDC, MCDC and ECD pointed out the needs for raising public and factory owners' awareness about industrial water pollution is necessary to increase the number of factories to have waste water treatment plants. The awareness raising to the factory owners are as important as the enforcement of laws to manage industrial water pollution.

During interviews with officials of YCDC and MCDC, needs to enhance knowledge and skills about waste water treatment were expressed. To respond to their requests, an Expert on waste water treatment will be

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dispatched in December 2016. The Expert will hold workshops on waste water treatment in early 2017 to increase the knowledge about waste water treatment of CPs.

OVI 2 Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECA.

The needs for setting up the standards for the industrial waste water were expressed by CPs officials. However, it is less likely that the guidelines will be developed by YCDC and MCDC within three years. The Review Team suggest the revision of this OVI to fit with the current situation. The suggested revision is referred in Annex 9.

OVI 3 Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.

Other donors are interested in providing assistance for development of environmental safeguard in Myanmar. ADB has been implementing project to build capacity of EIA review processes. Other donors such as Norway and IFC will develop EIA sector specific guidelines. At this moment, it is not possible to assess the possibility of development for advanced approaches of EIA as the donors are focused on the development of EIA. Therefore, the Review Team suggest to revise this OVI. The suggested revision is referred in Annex 9.

4. Implementation Process

Joint Coordinating Committee (JCC)

Record of Discussion stipulates that the function of JCC as follows:

- To formulate the annual work plan of the Project;
- To review and control overall progress of the Project in accordance with plans and RD;
- To discuss any other issue(s) pertinent to the smooth implementation of the Project.

By the time of Review, JCC have been held twice. Project Annual Work Plan has been approved by the first JCC. The first revision of PDM was approved at the second JCC in Dec. 2015. JCCs have been participated by ministry representatives such as Ministry of Transport, Health, Industry and Science and Technology, in addition to MONREC/ECD, YCDC, and MCDC.

In addition to JCC, Project Coordination Meeting (PCM) has been established to discuss technical issues of the Project implementation. PCM has been organized every 6 months and attended by CP officials involved with the implementation of the Project.

Implementation Structure

Figure 1 presents the participation of CP organizations and Experts in each Output. Outputs 1-4 are implemented by YCDC and MCDC, ECD regional offices in Yangon and Mandalay. Output 5 and 6 are implemented by EIA and Natural Resources division of ECD with an Expert specialized in EIA.

	Myanmar		Japan
OUTPUT1	YCDC ECD- Yangon	MCDC ECD- Mandalay	Experts (Water)
OUTPUT2			
OUTPUT3			
OUTPUT4			
OUTPUT5	ECD		Expert (EIA)
OUTPUT6			

(Source: Review team)

Figure 1 Implementation of Project Outputs

Experts for Output 1 to 4 (Water) are mainly based in Yangon and travel to Mandalay or Nay Pyi Tow for the meetings and activities. They are not housed in YCDC and MCDC, this may limit the communication and interaction with CPs only to the meetings and activities. Staff responded in the interviews that the amount of time the experts spend with CPs is better to be increased so that they can gain more knowledge and skills from them.

The Expert for Output 5 and 6 (EIA) is based in ECD headquarters in Nay Pyi Tow. Since his office is located next to the ECD EIA division, this makes interactions between expert and CPs more accessible.

Implementation based on PO

At the time of Review, the Project activities have been implemented in line with PO without any major delay.

Communication

From the respondents of questionnaires, communication among CPs and the Experts are considered as good and no particular issues were observed.

Budget

One of the key issues of implementation of the Project in Output 1 to 3 is the cost of CPs to participate water quality survey and other field activities. These costs are currently supported by JICA contrary to the agreement stipulated in RD. The matter is raised for JCC to be solved officially.

Implementation monitoring

The project activities are monitored by submission of monitoring sheets to JICA by the Experts. Activity reports describing detailed activities and key results of activities were compiled by the Experts shared among JCC members.

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5. Result of the Midterm Review

Based on collected information and data, the Team evaluated the Project achievements so far by using five evaluation criteria.

5-1 Relevance

Relevance with the National Strategy and Plan

In 2012, Myanmar enacted ECL and ECR which prescribe the urgent need to develop technical tools for EIA and Environmental Quality Standards such as effluent and emission standards. The same Law stipulates that businesses causing the pollution are required to install on-site facility in order to manage environmental pollution. Similarly, YCDC and MCDC have its own by-laws prohibit disposing or discharging waste water from industrial sources. The Project is to build capacity of ECD staff on EIA review process and basic human capacity to obtain data and information about industrial water pollution of Yangon and Mandalay which is in line with the environmental policy of Myanmar.

Needs of target group and areas

The results of interviews and questionnaires indicates the following key needs of environmental management of Myanmar are identified.

Lack of human capacity to be able to review EIAs: ECD was established in 2012 to implement ECL. Previously, environmental issues were dealt by the Forestry Department and the majority of ECD's staff have background in forestry related fields and fewer staff have other areas of expertise required for reviewing EIAs. Thus capacity building through EIA trainings and development of E-manual are responding to the needs of ECD.

Lack of data and information for water pollution source: Even though the by-laws of YCDC and MCDC prohibit the discharge of polluted waste water from factories, YCDC and MCDC lack detailed information about sources of discharged waste water and status of water quality. The Project is building the basic capacity of staff at YCDC, MCDC and ECD regional offices to collect and evaluate the information of industrial waste water therefore it is corresponding to the needs of CP organizations.

Relevance with Japan's assistance policy to Myanmar

The one of the pillars of Japan's assistance policy to Myanmar is the development of infrastructures for sustainable economic growth. Although environmental sector is not included as priority of Myanmar's assistance policy, infrastructure developments must take into account of environmental impacts. Strengthening capacity of EIA review and management of water pollution may fit to the assistance policy of Japan.

5-2 Effectiveness

The Project Purpose is clear and the achievements of Project Outputs will lead to the achievement of Project Purpose. Considering the degree of achievements of outputs at the point, it is likely that Project Purpose will be achieved by the end of the Project.

Some revisions of PDM were suggested to reflect the current implementing situation of the Project. The suggested changes of PDM are indicated Annex 9.

External factors

Several donors are involved with capacity building of EIA review process. Although the majority of donor activities are coordinated, some activities are overlapping. As a result, similar documents intended for the same usages were created by more than one donor. The matter has been already addressed and it is expected to be dissolved soon. Overlapping of activities may create unnecessary confusions among CPs or requires extra effort and time for adjusting or coordinating. Engagements of donors, including JICA, are better to be

coordinated in advance to avoid unnecessary confusions.

5-3 Efficiency

In general, project activities are implemented as planned and Outputs have been achieving. The Project is implemented efficiently considering the limited times allocated by Experts and CPs. One respondent suggested if Output 1 to 4 is implemented in one location instead of two, with current inputs of experts, capacity building activities may have been strengthened. As mentioned in the Effectiveness, well coordinate donor activities can contribute more efficient contributions for CPs as avoiding the duplication of activities so that resource can be reallocated for other activities.

5-4 Impact

At this point, it is not possible to assess the likelihood of achieving Overall Goal. However, achievement of Project Purpose, such as enhanced capacity of staff, water quality status reports, and E-manual for EIA review are expected to contribute for the achievement of Overall Goal of the Project.

Interviews of ECD officials indicate that responsibilities currently bared by ECD headquarters such as EIA reviews and follow-up of monitoring of ECC will be delegated to ECD regional offices once the ECD restructuring process is completed. In that case, E-manual and EIA tracking database developed can be utilized in regional offices as well as the headquarters

ADB is planning to develop guidance documents for monitoring, compliance and supervision of ECC. They are aware of the inspection manual for water quality testing developed by the Project and they may utilize the documents as a part of their activities.

5-5 Sustainability

Policy level

Current policy of environmental management is expected to continue in Myanmar. The development of EIA related tools is on-going and others donors such as ADB, Norway and IFC are involved in the sector specific guidelines. ECD is currently undergoing organizational restructuring to decentralize and delegate some of the tasks of headquarters to regional and lower level offices. Efforts to streamline and enhance EIA review process is expected to continue.

Pollution in Taung Thaman Lake in Mandalay brought pubic attention on water environmental pollution. MCDC and YCDC are aware of adverse effects of industrial waste water and need to control them. Precise development of policies regarding waste water in YCDC and MCDC are unknown. Nevertheless the efforts to control and monitor the water pollution are expected to be continued.

Human resources

Majority of responses of questionnaires showed their willingness to continue project activities after the completion of Project and the respondents are confident that they have enough human resources to continue.

The lack of expertise in specific environmental sectors and weak capacity of ECD staff remains as challenge. This will be crucial when responsibilities of EIA review and monitoring of EIA are delegated to ECD regional offices where the staff capacity is more limited compared with headquarters. The Project need to be conscious about this trend so that the trainings can be participated by staff from ECD regional offices.

Financial resources

Limited financial resources are the key constrains for continuation of project activities after the assistance from JICA is ended. This is particularly true for the activities that require collecting information of waste water to update water quality database, conducting on-site inspection and water sampling testing. YCDC, MCDC and ECD are advised to consider securing budget to continue project activities after the completion of Project.

6. Conclusion

Based on the available information, the Review Team reviewed 1. Verification of Achievement; 2. Implementation Process; 3. Review based on Five Evaluation Criteria.

As conclusion, the Project activities were implemented as planned without any major delays. Achievements of Project Outputs are on the track although some adjustments of PDM are required. Some notable issues such as donor coordination, budgetary issues regarding participation to field activities, and definition of inspections are all addressed and solutions have been proposed. There was no significant issues regarding implementation process as well.

In terms of the Relevancy, the Project is responding to the needs of CPs such as lack of human capacity in EIA reviewing processes of EDC and water pollution management at YCDC, MCDC and ECD, and lack of data and information for water pollution source. Those capacities are all required to implement Myanmar's Environmental Conservation Law and Rules.

As for the Effectiveness, although the Project purpose is clear and logic linking purpose and Outputs is sound, some revisions of PDM were suggested to reflect the implementation of the Project. Involvement by other donors to similar areas may be an important external factor to be addressed.

As for the Efficiency, the Project is implemented on time and efficiently as Project Outputs have been achieved or expected to be achieved considering the limited time allocated by Experts and CPs.

As for the Impact, it is too early to assess the likelihood of achieving Overall Goal of Project. Outcomes of the Project such as inspection manual and water quality database of Output 1 to 4 and E-manual and EIA tracking database of Output 5 and 6 can be potentially used by other organizations or in other regions.

As for the Sustainability, policies on EIA and pollution control and management are expected to be continued. CPs are willing to continue project activities after the completion of JICA's support. Financial sustainability may be a concern, without budget allocated activities, it will not be sustainable to continue project activities.

7. Recommendations

Based on the conclusion, the Review Team recommends the followings.

7-1 Recommendations for the Project

1. Revision of PDM and PO

Current PDM and PO do not necessarily reflect the current implementation of the Project. For achievement of Project Purpose and Outputs effectively, the Team recommends revisions of PDM indicated in Annex 9.

2. Inspection manual to be shared by YCDC and MCDC

Through the discussion and interviews with Experts and CPs, the Review Team found that the term “inspection” is not understood in the same way by Japanese and by CPs. Since inspection is the key activities of Output 1, it is important that both Experts and CPs agree on common understanding about inspection.

Therefore the Review Team recommends that current draft inspection manual to be shared among CPs participating in Output 1 activities and to agree on the definition of inspection and its activities that fit to the implementation situations of Yangon and of Mandalay.

7-2 Recommendation for ECD

1. Coordination of donor activities

As indicated in previous sections, the overlapping of activities by multiple donors will cause confusion among CPs and require extra effort and time for adjustment. Also, the resources used of the same activities can be allocated other necessary activities. It is the responsibility of Myanmar side who is the owner of donor funded projects to coordinate the activities of donors. Therefore, the Review Team recommends that ECD and other CPs to make efforts to coordinate donor involvements to avoid unnecessary duplications of work by donors.

2. Preparation for legal framework of inspection

The above confusion of “inspection” partly comes from the lack of legal document, clearly specifying the roles, responsibilities, definition, etc., on the environmental management system. Currently the GoM has Environmental Conservation Law and Environmental Conservation Rules, but during the course of development of environmental management system in the country, it would be needed to develop additional legal documents so as to operationalize the system. Therefore, it is recommended for ECD to prepare such legal framework in a near future.

7-3 Recommendation for YCDC, MCDC and ECD

1. Secure the budget for continuation of activities

The Team recognizes that the securing the budget for the field activities by CPs is challenging. Therefore temporarily measures will be made by JICA during the implementation of Project. However, the Team recommends YCDC, MCDC and ECD to consider to prepare budget for the continuation of project activities such as data collection and on-site inspection for database so that capacity of staff build by the Project can be further developed.

ANNEX 1 : Mid-term review schedule

	A	B	C	D	E	F
1	Consultant (Ms.Sugimoto)				JICA Mission (Mr. Ito and Ms. Hosogai)	
2	Day	Date	Time	Activities	Time	Activities
3	22-Oct	Sat				
4			PM	Nairobi >16:35 EK 720 via Dubai		
5	23-Oct	Sun	AM	Arrive in Yangon International airport 11:40		
6				Hotel in Yangon		
7	24-Oct	Mon	10:00 AM	Interview at YCDC office (PCCD / WSD),		
8			02:00 PM	Interview at ECD Yangon office, stay in		
9	25-Oct	Tue	10:00 AM	Move to Mandalay from Yangon, Interview at		
10			PM	Stay in Mandalay		
11	26-Oct	Wed	10:00 AM	Interview at ECD Mandalay office		
12			PM	Move to Nay Pwi Taw (by air, UB131 17:35-18:05). Stay in Nay Pwi Taw		
13	27-Oct	Thu	AM	Stay in Nay Pwi Taw		
14			1:00 PM	Interview at MONREC-ECD (DG/DDG and PCD). stay in Nay Pwi Taw		
15	28-Oct	Fri	AM	Move to Yangon from Nay Pwi Taw		
16			PM	Stay in Yangon		
17	29-Oct	Sat	AM	Drafting report		
18			PM	Drafting report, stay in Yangon		
19	30-Oct	Sun	AM	Drafting report		
20			PM	Drafting report, stay in Yangon		
21	31-Oct	Mon	AM	Interview at Yangon	11:00	Leave Narita for Yangon [NH813]
22			PM	Interview at Yangon	16:30	Arrive at Yangon
23			Evening	Meeting with the team	Evening	Internal meeting
24	1-Nov	Tue	AM	Move to Nay Pwi Taw, Meeting with Acting DG and DDG of ECD	AM	Move to Nay Pwi Taw, Meeting with Acting DG and DDG of ECD
25			PM	Courtesy call to Minister of MONREC, Meeting w/ NR & EIA Div. / Meeting w/ Pollution Control Div.	PM	Courtesy call to Minister of MONREC, Meeting w/ NR & EIA Div./ Meeting w/ PCD
26	2-Nov	Wed	AM	Interview with MOECA/ECD	AM	Move from Nay Pwi Taw to Mandalay (air)
27			PM	Interview with MOECA/ECD	PM	Courtesy call to Mayer and Committee Member of MCDC, Field Trip 1 in the pilot site of Mandalay
28	3-Nov	Thu	AM	Move to Yangon	AM	Meeting with MCDC and ECD-Mandalay
29			PM	Interview with YCDC /ECD Yangon office	PM	Field Trip 2 in the pilot site of Mandalay
30			Evening		Evening	Move to Yangon from Mandalay by air

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ANNEX 1 : Mid-term review schedule

	A	B	C	D	E	F
31	4-Nov	Fri	AM	Courtesy call to Mayor and Committee Member of YCDC/ Meeting with YCDC	AM	Courtesy call to Committee Member of YCDC/ Meeting with YCDC
32			PM	Meeting with ECD Yangon	PM	Meeting with ECD Yangon
33	5-Nov	Sat	AM	Drafting report	AM	Field Trip in the pilot site of Yangon
34			PM	Drafting report	PM	meeting with review team
35	6-Nov	Sun		Drafting report and team meeting	All day	Documentation and team meeting
36	7-Nov	Mon		Drafting report	AM	Meeting at JICA Myanmar Office
37				Move to Nay Pwi Taw from Yangon	PM	Move to Nay Pwi Taw from Yangon (air), Meeting with Dr. Usui
38	8-Nov	Tue		Preperation of JCC	All day	Preparation of JCC
39	9-Nov	Wed		JCC	All day	JCC
40				Leave NPT to Yangon	17:40	Leave NPT to Yangon (air)
41					18:25	Arrive at Yangon
42					22:10	Leave Yangon for Narita, Japan [NH814]
43	10-Nov	Thu	16:00	Leave Yangon to Kansai (MH)	6:45	Arrive at Narita, Japan

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Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<ol style="list-style-type: none"> The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA. 	<ul style="list-style-type: none"> Regulations Guidelines Annual report 	
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<ol style="list-style-type: none"> Consideration for the water status in the pilot study area is made. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on. 	<ul style="list-style-type: none"> Survey report EIA documents 	<ol style="list-style-type: none"> National effluent standard is developed.
<p>Output 1 Inspection procedure is standardized.</p>	<ol style="list-style-type: none"> More than 80% of the inspection is implemented according to the inspection manual by the end of the Project. 	<ul style="list-style-type: none"> Inspection report 	<ol style="list-style-type: none"> Responsibility of MOECAF, YCDC and MCDC for water pollution control does not change.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<ol style="list-style-type: none"> Water quality survey reports are prepared in the pilot area by YCDC and MCDC. 	<ul style="list-style-type: none"> Survey report 	<ol style="list-style-type: none"> YCDC and MCDC do not change inspection system as a water pollution control measures.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<ol style="list-style-type: none"> At least 150 factories' information is accessible on the database. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database. 	<ul style="list-style-type: none"> Database Database 	<ol style="list-style-type: none"> Responsibility of MOECAF for EIA review does not change. Relevant legislation of EIA does not significantly change.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.	• Status report	5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.	• Technical manual and forms	
Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.	1. EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAF are presented to an international conference.	• Evaluation report of EIA • Proceedings	
<Activities>	<Inputs>		
Output 1: Inspection procedure is standardized.	Japanese side		
1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)	• Experts. • Training in Japan and other country. • Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others.		
1-2 To evaluate present inspection procedure			
1-3 To develop an inspection manual	Myanmar side		
1-4 To implement inspection based on the developed inspection manual	• Counterpart personnel.		
1-5 To provide training on measures to control industrial effluent			
1-6 To revise the inspection manual			
Output 2: Capacity for water quality survey is enhanced.	Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		
2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances)			
2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas			
2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc.			
2-4 To develop a water quality survey plan			
2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage			
2-6 To implement a water quality survey based on the water quality survey plan			

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Narrative Summary		Objectively Verifiable Indicators	Means of Verification	Important Assumption
2-7	To supervise the water sampling referring to the water quality survey manual			
2-8	To verify the results of the water quality survey using the water quality survey manual			
2-9	To prepare a water quality survey report			
Output 3: Database of water pollution sources and river water quality is developed with GIS software.				
3-1	To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey			
3-2	To develop a system concept			
3-3	To design the database based on the system concept			
3-4	To collect additional information required to develop the database			
3-5	To develop the database			
3-6	To conduct training on operation and utilization of the database			
3-7	To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance.				
4-1	To collect the information necessary for the water quality status report			
4-2	To interpret the collected information			
4-3	To prepare a water quality status report			
Output 5: Necessary technical manuals and-legislation for the EIA operation are developed.				
5-1	To draft necessary legislation including Official Forms for the EIA.			
5-2	To develop a technical Manual of the EIA process for review			
5-3	To evaluate and update the Manual to meet the practical EIA review works			
5-4	To develop a database for recording the EIA review operation			
5-5	To establish an evaluation system for issuing license to EIA consultants			
Output 6: Capacity of MOECAAF and the EIA Report Review Body on the EIA review is enhanced.				
6-1	To implement basic and advanced EIA Training.			
6-2	To implement EIA review works based on the EIA procedure			
6-3	To record the EIA review operation			
6-4	To present leaflets and other materials for dissemination of EIA system			
6-5	To develop a WEB site to disclose EIA works based on the new EIA system			<Preconditions>
6-6	To review and update the WEB site			1. Japanese experts are assigned
6-7	To presented activities on EIA review to an international conference			2. C/Ps are assigned.

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A	B								C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	
3	Year									ANNEX 3 RO Year 18/12/2015												2nd Year												3rd Year																							
4	Month									2015												2016												2017												2018											
5	Year									1 2 3 4 5 6 7 8 9 10 11 12												1 2 3 4 5 6 7 8 9 10 11 12												1 2 3 4 5 6 7 8 9 10 11 12												1 2 3 4 5 6 7 8 9 10 11 12											
6	Month									6 7 8 9 10 11 12												1 2 3 4 5												6 7 8 9 10 11 12												1 2 3 4 5 6											
127	Output 4																																																								
128	Capacity of interpreting the information for water pollution control measures is enhanced.																																																								
129	4-1 To collect the information necessary for the water quality status report.																																																								
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145	Necessary technical manuals and legislation for the EIA operation are developed.																																																								
146	5-1 To draft necessary legislation including Official Forms for the EIA																																																								
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151	5-2 To develop a technical Manual for the EIA review works.																																																								
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156	5-3 To evaluate and update the Manual to meet the practical EIA review works.																																																								
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166	5-5 To establish an evaluation system for issuing license to EIA consultants.																																																								
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172	Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.																																																								
173	6-1 To implement basic and advanced EIA Training																																																								
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178	6-2 To implement the EIA review works based on the new EIA procedure																																																								
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183	6-3 To record the EIA review operation																																																								
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188	6-4 To present leaflets and other materials for dissemination of EIA system																																																								

Annex 4 Midterm Review Grid

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	A	B	C	D	E	F	G	H
1		Questions	Questions in detail		Necessary data	Data source	Data collection method	Results
2	A Confirmati on of achieveme nt	Likelihood of achieving for overall goal	Are overall goal OVIs likely to be achieved within a few years of project completion?	OVI1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.	No of factories with waste water treatment facilities (Baseline + current)	Regulations, factory visits, gov. reports/statistics	Literature review, field visits, interview	Likely
3				OVI2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF.	Guidelines	Guidelines		Likely
4				OVI3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	SEA, HIA, SIA	SEA, HIA, SIA , Government reports		Changed to fit to the Project Purpose
5		Likelihood of achieving for project purpose	Are Project purpose OVIs likely to be achieved at the end of Project?	OVI1. Consideration for the water status in the pilot study area is made.	considerations in the survey reports	Survey area reports	Literature review, field visits, interviews, questionnaires	Likely
6				OVI2. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	Analysis of EIA reports	EIA, EIA reports of projects		Change to fit to the project Outputs
7		Likelihood of achieving for project outputs	Is OP1-OVI likely to be achieved?	OVI1. More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.		project reports, Opinions(experts+CPs)	Literature review, field visits, interviews, questionnaires	Inspection need to be defined to evaluate
8				Are there any contributing and/or humpering factors for the achievement of OP1?	Analysis of inspection reports	Inspection manual, inspection reports, project reports		
9			Is OP2-OVIs likely to be achieved?	OVI 2. Water quality survey reports are prepared in the pilot area by YCDC and MCDC.		project reports, Opinions(experts+CPs)	Literature review, field visits, interviews, questionnaires	Data collection and drafting on going
10				Are there any contributing and/or humpering factors for the achievement of OP2?	Water quality reports	Water quality reports of pilot area by YCDC/MCDC		
11			Are OP3-OVIs likely to be achieved?	OVI 3.1 At least 150 factories' information is accessible on the database.		project reports, Opinions(experts+CPs)	Literature review, field visits, interviews, questionnaires	Achieved
12				OVI 3.2 Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	no of organization in the data base	Database		database, literature review, interviews, questionnaires
13		Are there any contributing and/or humpering factors for the achievement of OP3?			Inspection reports in the database			
14		Is OP4-OVIs likely to be achieved?	OVI4.1 A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.		project reports, Opinions(experts+CPs)	Literature review, interviews, questionnaires	Drafting is on going	
15			Are there any contributing and/or humpering factors for the achievement of OP4?	Water quality analysis by MOECAF/YCDC/MCD C	Analysis reports of the pilot areas.			
16		Are OP5-OVIs likely to be achieved?	OVI 5.1 The technical manual covers every sector of development projects and every step of the EIA procedure.		project reports, Opinions(experts+CPs)	Literature review, interviews, questionnaires	Redesigning of E-manual is ongoing	
17				OVI5.2 The draft official forms are internally approved.	Confirmation of sectors and steps in tech manual		Developed Technical manual	literature review, interviews, questionnaires
18			Are there any contributing and/or humpering factors for the achievement of OP5?	Approved Draft EIA	approved draft EIA			
19		Are OP6-OVIs likely to be achieved?	OVI6.1 EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more.		project reports, Opinions(experts+CPs)		Waiting for e-manual	

Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
20				OVI6.2 EIA works by MOECAAF are presented to an international conference.	Analysis of EIA reports	Technical guide, EIA evaluation reports	literature review, interviews, questionnaires	Achieved
21				Are there any contributing and/or humpering factors for the achievement of OP6?		Conference proceedings, presentations/papers		Donor activities need to be coordinated
22		Delivery of Project inputs		Have inputs from Japan been delivered as planned (quantity, quality, timing)?		project reports, opinions(experts+CPs)		Experts time allocation can be increased.
23				Have inputs from Myammer been delivered as planned (quantity, quality, timing)?	Equipment/tools,	project reports, experts/CP lists, expenditure reports, opinions(experts+CPs)	document review, interviews, questionnaires	Activities fees are not supported by Myanmar
24					Are there any persistant issues regarding delivery of project inputs?			Budget for cost of activity

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Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
25	B. Implementation verification	Implementation of Project activities	Are there any activities delayed to be implemented? If so, what is the reason of delay?					Additional data collection may delay Output 2-4
26			Are there persistent issue(s) regarding the implementation of activities?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	No
27			If there are issues, have the issues been addressed?					
28		Project management	Is JCC functioning according to its mandate to support implementation?			JCC minutes, project reports, opinions(experts+CPs)	document review, interviews, questionnaires	Yes
29			Is implementation system efficient to implement the project?			project reports, opinions(experts+CPs)	questionnaires	Activities in distanced 3 cities make less efficient
30			Are there serious issues regarding management of project?			JCC minutes, project reports, opinions(experts)		
31			Are existing regulations, rules, culture of Myanmar negatively or positively affecting on the implementation?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	Lack of rules/regulation for inspection/ weak
32			Are there any significant issues regarding management of project implementation?			project reports, opinions(experts+CPs), monitoring reports		
33			Is the project implementation monitoring system functioning?					OK
34			Have the results of monitoring been reflected in the project implementation?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	Yes
35		Communication	Do Japanese experts and C/Ps communicate well in the Project ?					Yes
36			Does C/P communicate each other well in the Project ?					Yes
37			In case of any communication related issues, has any solution been proposed and implemented?			budget, project reports, opinions(experts+CPs)		
38		Project Budget	Has project budget for each activities been obtained?					Not for budget for the participation of CPs
39			In case of budget related issues, has any solution been addressed and implemented?			opinions(experts+CPs)		Yes proposal will be discussed
40		Initiative/ownership of Project	(for Experts) Do CPs demonstrate initiative/ownership of the Project?			project reports, opinions(experts+CPs)	document review, interviews,	Yes
41			(for CPs) Do experts encourage C/Ps to have initiative/ownership of Project?		Status of equipment/tools	project reports, opinions(experts+CPs), tools/equipment	document review, interviews,	To extent yes. But burden of works of CP and weak capacity
42		Others	Are the tools and equipment required for the Project maintained properly?			project reports, opinions(experts+CPs)	questionnaires, site visits	Yes
43			Are there any internal/external factors to promote the implementation?					Strong interests by administrators
44			Are there any internal/external factors to hamper the implementation?			opinions(experts+CPs+ others)	document review, interviews, questionnaires	Involvement of other donors

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Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H	
45	C Relevance	Needs of target area/target group	Does the achievement of project purpose contribute for the improvement of Myammer's environmental management capacity?					Yes	
46			Are the needs for improving environmental management capacity of target groups high?					Yes	
47			Are the selection of tareget groups appropriate?				Aid policy	document review, interviews, questionnaires	Yes
48		Japan's assitance policy for Myammer	Does the Project correspond to Japan's aid strategy for Myammer?				opinions(experts+ JICA)	document review, interviews, questionnaires	Yes
49			Does the Project demonstrate Japan's advantage such as technology?				project reports, opinions(experts+CPs)		Yes
50	D.Effective ness	Achievement of Project purpose and outputs	Would Project purpose be achieved at the end of the Project?				document review, interviews, questionnaires	Yes	
51			Would the achievement of Project purpose and outputs improve target groups' capacity for water environmental management?					Yes	
52			Would the achievement of Project purpose and outputs improve target groups' capacity for EIA based evaluation?					Yes	
53			Are there any external factors that may humper or contribute for achieveing project purpose/outputs ?				project reports, opinions(experts+CPs), experts +CP lists, lists of training participants	document review, interviews, questionnaires, site visits	No. Timing for expert is short. Additional expert needed Need to hurry up for testing devise CPs were burdened with other tasks/ limited experties Budget for cost of activity
54	E. Efficiency	Appropriateness of project inputs to promote sound implementation	Are the human resource inputs from Japan (numbers, timing, duration, experties) appropriate for the efficient implementation of activities?				document review, interviews, questionnaires, site visits	No. Timing for expert is short. Additional expert needed	
55			Are the equipment related inputs from Japan (quantity, timing, quality) appropriate for the efficient implementation of activities?					Need to hurry up for testing devise	
56			Are the human resources inputs from Myammer (numbers, timing, experties) approprite for the efficient implementation of activities?t					CPs were burdened with other tasks/ limited experties	
57			Are the other inputs from Myammer (quantity, timing, quality) appropriate for the efficient implementation of activities?					Budget for cost of activity	
58			Are there any humpering factors for efficient imputs to the Project?						
59		Efficiency of project approach to achieve outputs and purpose	Is the approach taken most efficient to achieve project purpose and outpus?				project reports, opinions(experts+CPs)	document review, interviews, questionnaires	More or less
60	Is there more cost effective approach to produce project purpose than current one?								
61	Are there any humpering or contributing factors for cost effective achievement of project purpose /outputs?					project reports, opinions(experts+CPs)	document review, interviews, questionnaires		
62	F.Impact	Lincage between project purpose and overall goal	Judging from the current progress of project purpose, what is the likelihood of achieving overall goal?				document review, interviews, questionnaires	Difficult to judge	
63			Would achieveing project purpose lead to the improvement of water quality in tareget area?					Yes	
64			Would achieveing project purpose lead to more complecated EIA related problems in Myammer?					Yes	
65			Does the project have any plan/strategy for achieving over all goal?				project reports, pre-feasibility report, opinions(experts+CPs)	document review, interviews, questionnaires	No
66	External factors for achieving overall goal	Are there any external factors that may humper or contribute for achieveing overall goal?						Establishment of necessary rules, labolatory,	
67		Have any external factors been changed since inception of project?				project reports, opinions(experts+CPs)	document review,	New guideline on waste water	

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Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
68		Unexpected impacts of the Project	Are there any impacts (positive/negative) besides achievement of purpose that were not expected by the Project?				interviews, questionnaires	No
69			Are the project impacts affecting outside of target groups?			project reports, opinions(experts+CPs)	document review, interviews.	Not yet but likely

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Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H	
70	G.Sustainability	Sustainability of policy and strategy on water pollution and EIA	Have the policies and strategy for water pollution / EIA been changed since inception of Project?				questionnaires	Yes new ww guideline	
71			Are current policies and strategy for water pollution / EIA expected to be continued?					Yes	
72			Are there any political, social factors that may affect the Project?				project reports, opinions(experts+CPs)	document review, interviews, questionnaires	
73		Project sustainability by the target area/group after the completion of Project	Would target groups/governments like to continue after the completion fo JICA support?						Yes
74			For the continuation, do the group/government have enough financial resources?						No (water)
75			For the continuation, do the group/government have enough organizational/human resources?						Yes
76			If not continued, what is the reason of discontinuation?						
77			Are there any plans to expand or continue knowledge and technical skills aquired by the Project?				project reports, pre-feasibility report, opinions(experts+CPs)	document review, interviews	Not yet but likely
78		Other	Has any issues/concerns indicated during detailed planning survey been tackled?						

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Annex 5 List of Experts

Name	Expertise	Organization	Man Month (day)
Itaru Okuda (Dr.)	Leader/Industrial Effluent Management	Nippon Koei	138
Shunsuke Hieda	Water Quality Survey	Nippon Koei	116
Tomoe Takeda	Water Sampling and On-site Management	Nippon Koei	133
Hiroaki Nakagawara	Database development with GIS	Nippon Koei	107
Kanji Usui (Dr.)	EIA Technical Manual and Reviewing Process	Independent	310
Total			804

(Submitted by the Project for the Midterm Review)

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Annex 6 List of Counterpart Trained in Japan

	Name	Organization	Date
1	Mr. Zaw Moe	MONREC	May 22-28, 2016
2	Mr. Thin Thin Nu	MONREC	May 22-28, 2016
3	Mr. Zaw Tun Aung	MONREC	May 22-28, 2016
4	Mr. Myint Sein	YCDC	May 22-28, 2016
5	Mr. Zaw Zaw Tun	MCDC	May 22-28, 2016
6	Ms. Thwe Hnin Anug	MCDC	May 22-28, 2016
7	Mr. Min Maw	MONREC	Sep.28 – Oct.4, 2016
8	Mr. Myo Thein	YCDC	Sep.28 – Oct.4, 2016
9	Mr. Khin Maung Thin	MCDC	Sep.28 – Oct.4, 2016
10	Mr. Bawi Kyone	YCDC	Sep.28 – Oct.18, 2016
11	Ms. Thwe Naing Oo	YCDC	Sep.28 – Oct.18, 2016
12	Mr. Win Swe	MCDC	Sep.28 – Oct.18, 2016
13	Mr. Aung Zaw Moe	MCDC	Sep.28 – Oct.18, 2016
14	Ms. Khin Myo Sat Aye	MONREC/ECD	Sep.28 – Oct.18, 2016
15	Mr. Pyae Phyaw Kyaw	MONREC/ECD	Sep.28 – Oct.18, 2016
16	Ms. Thet Wai Hnin	MONREC/ECD	Sep.28 – Oct.18, 2016

(Submitted by the Project for the Midterm Review)

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Annex 7 List of Equipment Provided by Japan

Output	Item	Amount
Output 1-4	Laptop computer	2
	Color printer	1
	Projector	1
	GPS	3
	Photocopier	2
Output 5&6	Laptop computer	2
	Desktop computer	4

(Submitted by the Project for the Midterm Review)

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Annex 8 List of Counterpart

Organization	Name	Title	Output
MONREC/ECD	Mr. Hla Maung Thein	Director General	
MONREC/ECD	Mr. Sein Htun Linn	Deputy Director General	
MONREC/ECD	Mr. Than Aye	Deputy Director General	
MONREC/ECD/PCD	Mr. Min Maw	Director	Output 1-4
MONREC/ECD/PCD	Dr. Tin Aung Win	Assistant Director	Output 1-4
MONREC/ECD/PCD	Ms. Mya Theingi	Staff Officer	Output 1-4
MONREC/ECD/PCD	Ms. Khin Myo Sat Aye	Deputy Staff Officer	Output 1-4
ECD Mandalay	Mr. Ko Ko Aye	Director	Output 1-4
ECD Mandalay	Mr. Thant Zin Htun	Assistant Director	Output 1-4
ECD Mandalay	Mr. Pyae Phyoo Kyaw	Deputy Staff Officer	Output 1-4
ECD Yangon	Ms. Khin Thidar Tin	Director	Output 1-4
ECD Yangon	Mr. Aung Lay	Assistant Director	Output 1-4
ECD Yangon	Ms. Thet Wai Hnin	Deputy Staff Officer	Output 1-4
ECD/NR&EIA Div.	Dr. San Oo	Director	Output 5&6
ECD/NR&EIA Div.	Mr. Htin Aung Kyaw	Assistant Director	Output 5&6
ECD/NR&EIA Div.	Ms. Yi Yi Cho	Staff Officer	Output 5&6
YCDC PCCD	Dr. Aung Myint Maw	Assistant Chief Engineer	Output 1-4
YCDC PCCD	Mr. Bawi Kyone	Assistant Head of Dept.	Output 1-4
YCDC WSD	Mr. Thwe Naing Ooo	Assistant Head of Dept.	Output 1-4
YCDC WSD	Ms. Khin Aye Myint	Executive Engineer	Output 1-4
YCDC WSD	Ms. Aye Thuzar	Assistant Engineer	Output 1-4
YCDC WSD	Ms. Ei Khaing Mon	Assistant Engineer	Output 1-4
MCDC Cleansing	Mr. Than Htut	Assistant Director	Output 1-4
MCDC Cleaning	Mr. Win Swe	Staff Officer	Output 1-4
MCDC WSD	Mr. Tun Win	Deputy Assistant Supervisor	Output 1-4
MCDC WSD	Mr. Khin Mg Thin	Division Chief, Deputy Head of Dpt.	Output 1-4
MCDC WSD	Ms. Tin Tin Hla	Laboratory Supervisor	Output 1-4
MCDC WSD	Mr. Aung Khin Myint	Junior Engineer	Output 1-4
MCDC	Ms. Su Su Mon		Output 1-4
MCDC	Ms. Hnin Yi Phue		Output 1-4

(Submitted by the Project for the Midterm Review)

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Annex 9 Suggested Changes of PDM

	PDM (18 Dec. 2015)	PDM (suggested)	Reason
Overall Goal (OVI 2)	Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF.	Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC.	Changed to the level achievable in three years
Overall Goal (OVI 3)	Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	Improvement of EIA procedure is identified by ECD through EIA reviews	Refocused on EIA procedure than other documents
Project Purpose (OVI 2)	More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.	Refocused on project outputs (EIA) instead of other policies
Output 1 (OVI 1)	More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.	Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.	Difficult to quantify no of inspections thus focused more on using inspection manual
Output 3 (OVI 2)	Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	Results of river water quality survey is accessible on the database.	Adjusted to the outcomes of Output 3.
Output 4 (OVI 1)	A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.	Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.	Refocused on understanding of the content of report
Output 5 (OVI 1)	The technical manual covers every sector of development projects and every step of the EIA procedure.	The technical manual covers every sector* of development projects and every major stage indicated in the EIA procedure. (*sectors are indicated in Annex A of EIA procedure.)	Reference is added to clarify
Output 6 (OVI1)	EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more.	More than 80% of ECD officers in charge of EIA reviews received completion certificates from the Advanced EIA trainings.	Focus on achievements of capacity building
Output 6 (OVI2)	Added	Statistics of EIA reviews are presented.	
Output 1 Activity 4	To implement inspection based on the developed inspection manual	To implement trial inspections based on the inspection manual	Inserted trial as inspection is yet to be defined.
Output 1 Activity 6	To revise the inspection manual.	To evaluate the trial inspection procedures	

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Following suggested changes are: change of organization's name or grammatical amendments.

	PDM (18 Dec. 2015)	PDM (suggested)
Output 6 OVI2	EIA works by MOECAAF are presented to an international conference.	EIA works by MONREC are presented at an international conference.
Output 6	Capacity of MOECAAF and the EIA Report Review Body on the EIA review is enhanced.	Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.
activity 5-1	To draft necessary legislation including Official Forms for the EIA.	To draft legislation on demand including Official Submission Forms for the EIA.
activity 5-2	To develop a technical Manual of the EIA process for review.	To develop a technical Manual of the EIA review process.
activity 5-3	To evaluate and update the Manual to meet the practical EIA review works.	To evaluate and update the Technical Manual to meet the ongoing EIA review processes.
activity 5-4	To develop a database for recording the EIA review operation.	To develop a database for recording the EIA review.
activity 5-5	To establish an evaluation system for issuing license to EIA consultants.	To draft legislations for issuing licenses to EIA consultants
activity 6-1	To implement basic and advanced EIA Training.	To implement basic and advanced EIA trainings.
activity 6-3	To record the EIA review operation.	To record the EIA reviews.
activity 6-5	To develop a WEB site to disclose EIA works based on the new EIA system.	To develop a WEB site to disclose EIAs based on the new EIA system
activity 6-7	To presented activities on EIA review to an international conference.	To present activities on EIA review at an international conference

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Annex 10 Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<ol style="list-style-type: none"> The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. <u>Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC.</u> <u>Improvement of EIA procedure is identified by ECD through EIA reviews.</u> 	<ul style="list-style-type: none"> Database (baseline) Questionnaire strategy Proposal for EIA procedure revision 	
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<ol style="list-style-type: none"> Consideration for the water status in the pilot study area is made. <u>More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.</u> 	<ul style="list-style-type: none"> Survey report EIA documents 	<ol style="list-style-type: none"> National effluent standard is developed.
<p>Output 1 Inspection procedure is standardized.</p>	<ol style="list-style-type: none"> <u>Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.</u> 	<ul style="list-style-type: none"> Records of Inspection 	<ol style="list-style-type: none"> Responsibility of <u>MONREC</u>, YCDC and MCDC for water pollution control does not change.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<ol style="list-style-type: none"> Water quality survey reports are prepared in the pilot areas by YCDC and MCDC. 	<ul style="list-style-type: none"> Survey report 	<ol style="list-style-type: none"> YCDC and MCDC do not <u>stop</u> inspection system as a water pollution control measures.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<ol style="list-style-type: none"> At least 150 factories' information is accessible on the database. <u>Results of river water quality survey is accessible on the database.</u> 	<ul style="list-style-type: none"> Database Database 	<ol style="list-style-type: none"> Responsibility of <u>MONREC</u> for EIA review does not change. Relevant legislation of EIA does not significantly change.
<p>Output 4 Capacity of interpreting the information for water pollution control measures is enhanced</p>	<ol style="list-style-type: none"> <u>Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.</u> 	<ul style="list-style-type: none"> Presentation materials 	<ol style="list-style-type: none"> The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAP.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 5 Necessary technical manuals and forms for the EIA review are developed.</p>	<p>1. The technical manual covers every sector (1) of development projects and every <u>major stage indicated in the EIA procedure.</u></p> <p>2. The draft official forms are internally approved.</p>	<ul style="list-style-type: none"> • Technical manual and forms 	
<p>Output 6 Capacity of MOECA and the EIA Report Review Body on the EIA review is enhanced.</p>	<p>1. <u>More than 80% of ECD officers in charge of EIA reviews received completion certificates from the Advanced EIA trainings.</u></p> <p>2. <u>Statistics of EIA reviews are presented.</u></p> <p>3. EIA works by <u>MONREC</u> are presented <u>at an international conference.</u></p>	<ul style="list-style-type: none"> • Evaluation report of EIA • Proceedings 	
<p><Activities></p> <p>Output 1: Inspection procedure is standardized.</p> <p>1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)</p> <p>1-2 To evaluate present inspection procedure</p> <p>1-3 To develop an inspection manual</p> <p>1-4 <u>To implement trial inspections based on the inspection manual</u></p> <p>1-5 <u>To provide training on measures to control industrial effluent</u></p> <p>1-6 <u>To evaluate the trial inspection procedures</u></p> <p>Output 2: Capacity for water quality survey is enhanced.</p> <p>2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances)</p> <p>2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas</p> <p>2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc.</p> <p>2-4 To develop a water quality survey plan</p> <p>2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage</p> <p>2-6 To implement a water quality survey based on the water quality survey plan</p> <p>2-7 To supervise the water sampling referring to the water quality survey manual</p> <p>2-8 To verify the results of the water quality survey using the water quality survey</p>	<p><Inputs></p> <p>Japanese side</p> <ul style="list-style-type: none"> • Experts. • Training in Japan and other country. • Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. <p>Myanmar side</p> <ul style="list-style-type: none"> • Counterpart personnel. • Office space accessible internet under the secure conditions with desks, chairs, meeting table(s) 		

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Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
manual 2-9 To prepare a water quality survey report			
Output 3: Database of water pollution sources and river water quality is developed with GIS software. 3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance. 4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and-legislation for the EIA operation are developed. 5-1 To draft legislation <u>on demand</u> including Official <u>Submission</u> Forms for the EIA 5-2 To develop a technical Manual of the EIA <u>review process</u> 5-3 To evaluate and update the <u>Technical Manual</u> to meet the <u>ongoing EIA review processes</u> 5-4 To develop a database for recording the EIA <u>review</u> 5-5 To <u>draft legislations</u> for issuing licenses to EIA consultants			
Output 6: Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced. 6-1 To implement basic and advanced EIA <u>trainings</u> 6-2 To implement EIA review works based on the EIA procedure 6-3 To record the EIA <u>reviews</u> 6-4 To present leaflets and other materials for dissemination of EIA system 6-5 To develop a WEB site to disclose <u>EIAs</u> based on the new EIA system 6-6 To review and update the WEB site 6-7 To <u>present</u> activities on EIA review to an international conference			<Preconditions> 1. Japanese experts are assigned 2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

(1) sectors are indicated in Annex A of EIA procedure.

MINUTES OF MEETING
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
ENVIRONMENTAL CONSERVATION DEPARTMENT, MINISTRY OF NATURAL
RESOURCES AND ENVIRONMENTAL CONSERVATION OF THE REPUBLIC OF THE
UNION OF MYANMAR
ON
THE TERMINAL EVALUATION AND 4th JOINT COORDINATING COMMITTEE
FOR
THE PROJECT FOR THE CAPACITY DEVELOPMENT IN BASIC WATER
ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN MYANMAR

The Japan International Cooperation Agency (hereinafter referred to as "JICA") has dispatched the Terminal Evaluation Survey Team to Myanmar (hereinafter referred to as "the Team"), from 2nd to 23rd of February, 2018 to conduct the Terminal Evaluation Survey of "The Project for the Capacity Development in Basic Water Environment Management and EIA System in Myanmar" (hereinafter referred to as "the Project") through the discussion with the Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation (hereinafter referred to as "ECD-MONREC") and relevant counterpart organizations.

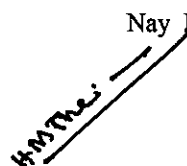
During the survey, the Team and the all counterpart organizations had a series of discussions and exchanged views for the purpose of working out the detailed contents of the Terminal Evaluation Report, as well as the 4th Joint Coordinating Committee (JCC) meeting were held.

As a result of the discussions, both sides confirmed the contents described in the attached report.

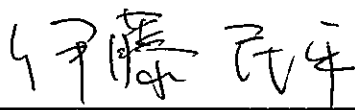
Nay Pyi Taw, 22nd February, 2018



Mr.Nobuo IWAI
Senior Representative
Myanmar Office
Japan International Cooperation Agency



Mr.Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resources and
Environmental Conservation
the Republic of the Union of Myanmar



Dr.Mimpei ITO
Leader
Terminal Evaluation Survey Team
Japan International Cooperation Agency

Main Points Discussed

1. The Team confirmed that the great effort made by the Myanmar side and basic tools developed by the Project, such as the manual for inspection, water quality survey and EIA related technical manuals contributed a lot for the improvement of environmental management of Yangon City Development Committee, Mandalay City Development Committee and ECD-MONREC. The Team expects that continuous practices by the Myanmar side to accumulate experiences are necessary to utilize above mentioned tools effectively and also ECD-MONREC plays further roles as leading agency to push the environmental management forward.
2. Now the roles and responsibilities of the organizations related to the field of environmental management are still in the development and in the near future, this situation needs to be settled by setting the legal framework up based on Environmental Conservation law, 2012 and other relevant laws and regulations. Still sector based individual regulations, national environmental standards and guidelines are necessary to prepare with the aim of strengthen the enforcement of laws and regulations. This kind of discussion will also be included in the process of roadmap making in Output 4.
3. The Team stressed that the significance of establishment of a national environmental laboratory to monitor an accurate environmental data, since the reliable data is the very fundamental for setting up a national environmental standards. Currently most of available data measured by domestic laboratory has a wide range results and it is difficult to tell which data is accurate or not.
4. Both side recognized the importance of collaborative work among the regional government, City Development Committee, Ministry of Industry, Ministry of Construction and ECD-MONREC for making written strategy in line with Environmental Management Plan and Environmental Compliance Certificate for waste water management in industrial zones. The Team recommended that building the centralized waste water treatment facility could be one of the reasonable options therefore conducting feasible study for the construction of the facility as soon as possible is necessary.

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5. For the EIA component, the second phase project will be designed the main target will be the improvement of existing tools, policy reviews and providing recommendations on current EIA system. Also the second phase will continuously focusing on the capacity development of EIA staffs through providing training workshops. In the field of EIA, several donors are actively working together with EIA Division in ECD. ECD shall take necessary action for the effective and smooth coordination of each project by avoiding the overlap of the activities done by donors.

Attachments:

- 1) TERMINAL EVALUATION REPORT
- 2) Presentation materials made by the counterpart organizations

20/04

20/04

THE PROJECT FOR
CAPACITY DEVELOPMENT IN BASIC WATER
ENVIRONMENT MANAGEMENT AND EIA SYSTEM
IN MYANMAR

TERMINAL EVALUATION REPORT

February 22, 2018

JICA Evaluation Team

TABLE OF CONTENTS

1. OUTLINE OF TERMINAL EVALUATION	5
1.1 Background	5
1.2 Purpose and process	5
1.3 Schedule and Members	7
1.4 Constraints	7
2. OUTLINE OF THE PROJECT	8
2.1 Background to the Project	8
2.2 Basic Information	8
3. PROGRESS AND ACHIEVEMENTS	11
3.1 Progress in achieving Output Indicators	11
3.2 Progress in Achieving Project Purpose Indicators	16
3.3 Prospect for Achieving Overall Goal Indicators	17
3.4 Inputs for the Project	19
3.5 Implementation Progress and Process	20
4. EVALUATION RESULTS	22
4.1 Relevance	22
4.2 Effectiveness	23
4.3 Efficiency	24
4.4 Impacts	25
4.5 Sustainability	26
5. CONCLUSION	28
5.1 Summary Progress and Findings	28
5.2 Key outputs and outcomes	28
5.3 Bottlenecks and Challenges	28
5.4 Evaluation Result	28
6. Recommendations	29
6.1 Actions before the end of the Project	29
6.2 Actions for the future	30

ANNEX

- Annex 1: Project Design Matrix
- Annex 2: List of Key CPs
- Annex 3: Evaluation Schedule
- Annex 4: List of Equipment Provided
- Annex 5: List of participants to the training in Japan

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
CP	Counterpart
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EIA	Environmental Impact Assessment
GIS	Geographic Information System
IAIA	International Association for Impact Assessment
IEE	Initial Environmental Examination
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
MCDC	Mandalay City Development Committee
M/M	Minutes of Meeting
MOECF	Ministry of Environmental Conservation and Forestry
MONREC	Ministry of Natural Resources and Environmental Conservation
OECD-DAC	Organization for Economic Co-operation and Development – Development Assistance Committee
PCCD	Pollution Control and Cleansing Department
PCM	Project Coordination Meeting
PDM	Project Design Matrix
R/D	Record of Discussion
YCDC	Yangon City Development Committee
WSD	Water and Sanitation Department

1. OUTLINE OF TERMINAL EVALUATION

1.1 Background

"The Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar ("the Project") is a bilateral technical cooperation implemented by the Government of the Republic of the Union of Myanmar ("the government"), with support from the Japan International Cooperation Agency (JICA). The objectives of the Project are to 1) enhance the capacity of the city development committees in Yangon and Mandalay to develop basic water pollution control measures, based on obtained and interpreted information, and to 2) strengthen the institutional framework for Ministry of Natural Resources and Environmental Conservation(MONREC) to review the environmental impact assessment(EIA).

Launched in June 2015 and implemented for three years, the Project will complete its activities in June 2018. To review the outcomes and impacts of this Project, JICA organised a three-member evaluation mission in February 2018, in accordance with the Project's Record of Discussion (R/D) which requires a terminal evaluation six months before the end of the Project. This Terminal Evaluation Report presents the findings of the mission, the evaluation of the achievements and outcomes to date, and the recommendations of future actions to be taken by the Project and by the CP organisations.

1.2 Purpose and process

1.2.1. Purpose of the Terminal Evaluation

The main objective of evaluating JICA-supported projects are to 1) ensure accountability to project stakeholders in Myanmar and Japan, by making the project's outcomes public, and to 2) improve the project cycle management, by feeding evaluation results to the remaining project activities as well as for the future activities by the government. For the terminal evaluation of this Project, the assessment of its effectiveness, efficiency, and sustainability (see 1.2.3), and the recommendation of future actions, will be the main objectives of its evaluation.

1.2.2. Process of Evaluation

- (1) **STEP1: take stock of the Project's achievements.** The Evaluation Team carried out literature review, a questionnaire survey, and interviews with CPs, to see the extent to which the agreed performance indicators in the Project Design Matrix (PDM) (Annex 1) are met. In the process, outcomes and challenges not captured in the PDM were also noted.
- (2) **STEP2: Evaluate the achievements against five OECD's evaluation criteria.** The Project's performance in attaining the indicators was assessed in light of the "Relevance", "Effectiveness", "Efficiency", "Impact", and "Sustainability" of this Project, five criteria proposed by the Development Assistance Committee (DAC) of the Organization for Economic

Cooperation and Development (OECD) (see 1.2.3). For each criterion, the Evaluation Team assigned a rating such as "high", "relatively high", "moderate", or "low".

(3) STEP 3: Identify future actions and lessons learned.

The Team then drew lessons learned from the evaluation results as a feedback for other JICA projects in the future, and recommended the actions to be taken by each CP organisation.

1.2.3. Evaluation Criteria

Concept ¹	Key Evaluation Questions
RELEVANCE Whether Project's design and approach are appropriate to key policies and beneficiary's needs	<ul style="list-style-type: none"> • Is the Project consistent with policies of both the Myanmar- and Japanese government? • Does the Project respond to Myanmar's development needs? • Does the Project meet capacity needs of counterpart organisations? • Is the project design/approach appropriate to achieve the project objective?
EFFICIENCY Whether inputs and activities are managed efficiently	<ul style="list-style-type: none"> • Is the implementation process (i.e., project management) efficient? • Were adequate inputs from CPs and from JICA provided in a timely manner? • Was there any effort to improve project's efficiency (e.g. cooperation with other donors)?
EFFECTIVENESS Whether six Outputs all together have achieved Project's primary objective	<ul style="list-style-type: none"> • Has the Project achieved its primary objective ("Project Purpose"), and the indicators to assess the achievement of the Purpose? • How useful were project activities to achieve the Project Purpose? • What factors were useful or detrimental to achieving the Project Purpose?
IMPACT Impact over time and across sectors	<ul style="list-style-type: none"> • Is the Project's Overall Goal (see 3.3) likely to be attained 3-5 years after the Project? • Were there other noteworthy impacts from the Project, whether positive or negative?
SUSTAINABILITY Whether activities and outcomes of this Project will last	<ul style="list-style-type: none"> • Are the policies in place to sustain the outcomes of this Project? • Within or among CP organisations, are the roles and responsibilities for future activities clear? Are appropriate staff members assigned to manage future activities and monitor the outcomes? • Is the capacity of the CPs sufficient to continue the now expert-supported activities on their own? • Is sufficient financial resources secured for future activities?

1.2.4. Data collection

¹ These definitions and key questions are not direct citations from the OECD guidance document, but were prepared in reference to the OECD papers and to JICA's evaluation guidelines.

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<i>Data collection method</i>	<i>Source of information</i>
1) Literature review	<ul style="list-style-type: none"> The Project's progress reports; its written outputs including Inspection Manual (2016), Pollution Source Survey Report(2016), the presentation on the Water Quality Status report; official forms for EIA; the records of inputs JICA's Detailed Design Survey and Mid-term Review reports for this Project Government's documents, including the Environmental Conservation Law (2012), Environmental Conservation Rules(2014), National Environmental Quality (Emission) Guidelines (2015), and the Environmental Impact Assessment Procedure(2015)
2) Questionnaires	A set of evaluation questions responded by the Project's counterpart (CP) organisations (see Table xx) and by Japanese expert team (JET).
3) Interviews	Individual interviews with the CPs and JET in Yangon, Mandalay, and Nay Pyi Taw (see Annex 2 for the List of key CPs).
4) Direct observation	Visits to the factories and pilot sites in Yangon and Mandalay, and the observation of written products, databases, and the equipment provided by JICA.

1.3 Schedule and Members

1.3.1 Schedule

The evaluation in Myanmar took place on 2 - 23 February 2018, as shown in Annex 3.

1.3.2 Evaluation Team Members

Mimpei ITO - Team Leader Director, Environmental Management Team 1 Global Environmental Department's Environmental Management Group- JICA
Mizuki HOSOKAI - Evaluation Planning Program Officer, Environmental Management Team 1 Global Environmental Department's Environmental Management Group- JICA
Emi YOSHINAGA - Evaluation Analysis Evaluation Specialist - Japan Development Service Co. Ltd

1.4 Constraints

Due both to the number of stakeholders for the WEM component and to the availability of the CPs, there were more meetings arranged with the WEM members. The information in this report, therefore, inevitably contains more facts on the WEM component.

2. OUTLINE OF THE PROJECT

2.1 Background to the Project²

Myanmar has faced considerable challenges in environmental management, ever since the country's transition to civilian rule in 2011 fuelled investments and industrial growth. To address the challenges, the Environmental Conservation Law (ELC) was enacted in 2012, followed by the development of Environmental Conservation Rules (ECR) in 2014 to implement the Environmental Conservation Law. The two regulations were the first and only laws existent in the country that served as guidance documents for the government, until other regulations are issued in 2015.

There are numerous regulations and guidance to be prepared for the implementation of the ECL, among others the standard for environmental quality. However, both the baseline data and the capacity of a newly-established Environmental Conservation Department (ECD) of the former Ministry of Environmental Conservation and Forestry (MOECA) were insufficient for effective environmental monitoring. Likewise, the capacity development for the efficient EIA review was urgent, as the industrial development suddenly increased the number of projects for EIA reviews.

Based on the situation surrounding environmental management in Myanmar, the government requested JICA the implementation of "The Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar", to enhance the capacity of the now MONREC for efficient EIA review, and the capacity of Yangon City Development Committee (YCDC) and Mandalay City Development Committee (MCDC) for effective water environmental monitoring. The cooperation started in May 2015, for the period of three years.

2.2 Basic Information

2.2.1 Activities, Outputs, and Goals

(See also the Project Design Matrix (PDM) in Annex 1 for details of activities)

- (1) **Structure** (Table 2-1). The Project has two components: 1) water environmental management (WEM), to enhance capacity for developing basic water pollution control measures based on obtained and interpreted information, and 2) the development of the institutional framework of the EIA reviews. Each component has its own implementation arrangements and indicators, but they all together are meant to contribute to the government capacity for improved environmental management and monitoring.
- (2) **Members and their roles and responsibilities.** See Table 2-2 for details.
- (3) **Venues of Pilot Activities.**

² Quoted from the Midterm Review Report and revised.

For water quality surveys (Output 2), water samples were collected from Hlaing River in Yangon, and Doke Hta Waddy River in Mandalay¹.

Table 2-1. Project Structure

	WEM	EIA
<u>Overall Goal</u>	Impact of industrial effluents from industrial zones on river water quality is alleviated.	Advanced EIA approach for complicated issues is taken into account.
<u>Project Purpose</u>	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.
<u>Outputs</u>	<p><u>Output 1.</u> Inspection procedure is standardized.</p> <p><u>Output 2.</u> Capacity for implementing water quality survey to obtain reliable information is enhanced.</p> <p><u>Output 3.</u> Database of water pollution sources and river water quality is developed.</p> <p><u>Output 4.</u> Capacity of interpreting the information for water pollution control measures is enhanced.</p>	<p><u>Output 5.</u> Necessary technical manuals and forms for the EIA review are developed.</p> <p><u>Output 6.</u> Capacity of MOECAP and the EIA Report Review Body on the EIA review is enhanced.</p>
<u>Venue of activities</u>	Yangon and Mandalay	Nay Pyi Taw (MONREC-ECD headquarters)

3)	Mandalay City Development Committee(MCDC)	WSD	Implementation of Output 1-4 activities
		Cleansing Department(CD)	Implementation Output 1 and 3 activities
4)	ECD Regional Offices in Yangon and Mandalay		Participation to Output 1-4 activities

Table 2-2. Members and their Roles and Responsibilities

	<u>Participating agencies</u>	<u>Responsibilities</u>
1)	MONREC-ECD	Senior management
		Overall supervision of the Project
	EIA division	Implementation of Output 5-6 activities
2)	Pollution Control Department(PCD)	Supervision of Output 1-4 activities
	Yangon City Development Committee (YCDC)	Implementation of Output 1-4 activities
	Water and Sanitation Department(WSD)	Implementation of Output 2 activities (water quality survey, laboratory analysis, data-basing and reporting)

3. PROGRESS AND ACHIEVEMENTS

3.1 Progress in achieving Output Indicators

OUTPUT 1: "Inspection procedure is standardized."

1-1 "Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD."

(ACHIEVED)

- The objective of Output 1 is to help the CP organisations in Yangon and in Mandalay develop a standard practice for environmental compliance inspections. The Project did so by reviewing the information on the sources of water pollution, studying the types of existing inspections, training the CPs on industrial effluent control measures, and preparing an inspection manual as a common reference for novice officers.
- Drafted in August 2016 and updated in October 2017 to reflect the recent policy developments (see 3.5 for details) the manual is the first government's guidance document for environmental compliance inspection. The Burmese version of the manual was also prepared and distributed to the ECD regional offices nation-wide, and is used to train new officers at the ECD headquarters. During the interviews, the CPs uniformly praised the usefulness of the Output 1 activities and of the manual, to understand the basic process of inspection.
- Even so, MCDC and YCD Yangon responded that they don't fully use it for current inspections, mainly for the following reasons.
 - (1) The inspections in response to the complaints are hard to standardise, because each case is different and is better dealt respectively.
 - (2) Some CPs currently do not conduct regular inspections, for which this manual could be useful.

The Evaluation Team also noted that the information in the manual is kept to basic rather than specific, to accommodate future policy updates. For the manual to be more specific, relevant government's legal framework – such as environmental quality guideline and water quality standard - is prepared.

To sum, if taken at face value, the indicator is attained only to some extent; the Evaluation Team nevertheless concluded that the reasons for not always utilising the manual are plausible, that the preparation of the manual as the first guidance on inspection was meaningful, and that the objective of Output 1 was satisfactory met.

OUTPUT 2: Capacity for implementing water quality survey to obtain reliable information is enhanced.

2-1 "Water quality survey reports are prepared in the pilot areas by YCDC and MCDC."

(ACHIEVED)

- The purpose of Output 2 is to help the CPs in Yangon and Mandalay plan, implement, and prepare reports on the results of the water quality surveys of Hlaing River and of Doke Hta Waddy River. Because the focus of the activities was on raising the CPs' awareness on the river water quality and on improving their skills for quality report-writing, the implementation of the water quality surveys and the laboratory analysis were outsourced to private companies.
- By the end of 2017, four water quality surveys were carried out, and the fifth last survey is to take place in February 2018. According to the interview with the ECD headquarters, the data collected through surveys helped unveil the situation of the two rivers that have long been unknown, and serve as critical references for the preparation of water quality standard in the near future.
- The indicator was achieved also by the end of 2017, because the result of the fourth survey was summarised into a report by the each CP department. For the first three surveys, the laboratory analysis results were not reliable enough; for the fourth, water samples were analysed in Japan to ensure accuracy. The experience suggests the importance of the capacity of the laboratory as a pre-requisite for water quality monitoring¹.
- Participants to the water quality report-writing training were limited to three for each department, to ensure the depth and effectiveness of the training. The expectation is for the limited number of training beneficiaries serve as the knowledge hubs of their departments. Such a knowledge-sharing is important particularly for the regional ECD offices, whose staff is rapidly increasing in number.

OUTPUT3:

"Database of water pollution sources and river water quality is developed."

3-1: At least 150 factories' information is accessible on the database.

(ACHIEVED)

- The objective of Indicator 3-1 is to develop a database as a tool to manage pollution source information, and to encourage an evidence-based reporting and decision-making for pollution source control.
- This indicator has been achieved by the end of 2017. The information on 202 factories (100 in Yangon and 102 in Mandalay) was collected through two outsourced Water Pollution Source Surveys conducted in 2016 and 2017, and was made available in an excel database linked to the GIS. The same surveys also collected waste water samples from total 100 factories, the results of their

¹ To note, the ECD headquarters plans to establish an environmental laboratory by 2019, and ECD regional offices are gradually being equipped with necessary laboratory supplies, which may provide solution to the accuracy issue.

analysis are accessible also on the database. ECD Mandalay is even taking a further initiative to apply the format for other sector data management.

- The interviews with relevant stakeholders revealed that the Pollution Source Surveys has attracted an attention of the Project participants and donors. The results contain the details of factories and of the impacts of their activities that were hard to obtain before the Project, and indicate the importance of raising factory owners' awareness on the environmental impacts of their activities. For the survey, good cooperation was made with Norway to harmonise the questionnaire format.
- Although the CPs are being trained in the database operations, the future of the database within some CP organisations appears somewhat uncertain. This relates either to 1) the unavailability of staff (the data management staff is or cannot be not assigned, for the lack of clear roles and responsibilities within the organisation, or for the frequent staff turnover) or 2) the limited availability of computers and the shortage of knowledge on excel, or 3) the lack of clarity for each organisation which data and parameters they should regularly monitor. Making the purpose and mandate of monitoring clear, and making data management an organisational practice, is critical for the future environmental monitoring.

3-2: Results of river water quality survey is accessible on the database.

(ACHIEVED)

- The objective of Indicator 3-2 is to develop a database, to help manage the monitoring data and encourage an evidence-based reporting and decision-making for water quality control.
- This indicator is achieved. By the end of 2017, the data collected through four water quality surveys under Output 2 were made available on the database. The WSD of YCDC is taking even a further step to apply the format of the database for other sector data management.
- As with Indicator 3-1, the prospect for the database to be updated and managed is uncertain, for the reasons described in Indicator 3-1.

OUTPUT4:

"Capacity of interpreting the information for water pollution control measures is enhanced."

4-1: Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.

(LIKELY TO BE ACHIEVED)

The indicator is not yet achieved, but likely to be, if further training is provided.

- The water quality status report is a synthesis report summarising data and analysis collected through Output 1-3, prepared by the Japanese experts. The objective of this Indicator is to develop the CPs' capacity to understand the report, and to communicate their understanding to policy makers so that the outputs from this Project will be utilised at policy level.
- The indicator is yet to be attained, because the preparation of the report is still ongoing. According to the Japanese experts, the basic concept of the report was discussed with the CPs in Nay Pyi Taw, Yangon and Mandalay in late-January to early February, and further explanation sessions will be provided in February-March to ensure that the CPs understand the report. The report will then be finalised by March 2018.
- Once the report is prepared, MONREC-ECD will present the report to its Minister, and the MCDC, to the Committee members and the mayor of Mandalay city, according to their questionnaire responses. YCDC said in the interview that it will decide whom to present after

scrutinising the report. Before presenting the report to the decision makers, however, MCDC and ECD Mandalay voiced the need for further explanation to really understand the analysis shown in the report. If some more training is provided to reinforce CPs' understanding of the report, the attainment of the Indicator appears likely for most of the CP organisations.

OUTPUTS:

"Necessary technical manuals and forms for the EIA review are developed."

5-1: The technical manual covers every sector (1) of development projects and every major stage indicated in the EIA procedure.

(LIKELY TO BE ACHIEVED)

- The objective of this Indicator is to develop a technical manual as a tool to help the ECD conduct the EIA reviews, efficiently and in accordance with the EIA Procedure issued in December 2015. With this tool, the Project expects that the EIA reviews will improve in terms not only of the speed but also of the quality. The sector here includes the nine sectors in which the Initial Environment Examination (IEE) or the EIA may be required for any business. The nine sectors and its 141 sub-sectors are listed in the Annex A of the Procedure⁵.
- The manual being developed by the Project is an electronic knowledge management system called the 'E-expert', composed of two sub-systems: 1) an automated reasoning system, and 2) a knowledge database that saves necessary data for all nine sectors. Two together, the technical manual will cover all the nine sectors above and every major stage of the EIA review.
- The indicator is likely to be achieved by the end of the Project. As of February 2018, the development of 1) is complete; for 2), eight of the nine sectors except for mining are still under construction. The preparation of the manual has taken time because the volume of information included in the system was added upon the government's request, to embrace not only the nine sectors but also their 141 subsectors. Nevertheless, the work is expected to be complete by April 2018.
- While waiting for the manual, the Project produced a general- and sector-specific checklist as a guidance for the reviews, which has so far utilised fully.

5-2: The draft official forms are internally approved.

(ACHIEVED)

- The objective of this indicator is to have in place various templates to be attached to the application for the EIA review submitted by project proponents.
- The indicator is achieved by January 2017. The forms including the Project Proposal, Consultant Selection, EIA report, IEE report, EMP Report, and Monitoring Report were prepared, approved by MONREC Minister on 31 January 2017. The forms were supposed to be posted online for the proponents to download; as of February 2018, however, the forms are not uploaded yet, reportedly because of the trouble between the ECD and the web company. The Evaluation Team urges the ECD to take a soonest action to solve the trouble, so that the forms can fully serve their original purpose.

⁵ <http://www.myanmar-responsiblebusiness.org/resources/environmental-impact-assessment-procedures.html>

- As part of Output 5 activities, the Consultant Licencing Scheme was prepared by the ECD with assistance from the Project. Although the discussion to finalise the scheme is on-going ever since, the ECD hopes to make the scheme operational April 2018.

OUTPUT6:

“Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.”

6-1: More than 80% of ECD officers in charge of EIA reviews received completion certificates from the Advanced EIA trainings.

(ACHIEVED)

- The objective of this indicator is to strengthen the capacity of the ECD staff at the headquarters in Nay Pyi Taw for the EIA review. The advanced training will be provided only to the staff who completed the basic training also organised by the Project. By the end of the cooperation, total 197 government officers, including ECD regional offices and line ministries, are expected to complete the advanced training.
- According to the ECD’s PCD, there are 20 officers at the ECD’s EIA division designated to undertake the EIA reviews. From the interview with the EIA division and with JET, all of the staff received the EIA division has received the advanced training, although new staff are constantly updated and have to be trained on a regular basis.

6-2: Statistics of EIA reviews are presented.

(ACHIEVED)

- The Indicator aims to ensure that the EIA Tracking System created under Activity 5-4 are utilised. The system is a comprehensive database that shows the progress of all the reviews.
- This indicator is achieved. The spreadsheet as a basis for the Tracking System was developed in 2015, and was converted to the Tracking System that was developed in December 2016. The information on the review is recorded in the database ever since, and is presented to the ECD management upon their request.

6-3: EIA works by MONREC are presented at an international conference.

(ACHIEVED)

This indicator is achieved by the time of the Midterm Review in November 2016. The ECD presented the overview of its EIA work at the 16th annual conference of the International Association for Impact Assessment (IAIA) in Nagoya-Japan in May 2016 and at the IAIA’s 17th annual conference in Montreal-Canada in November 2016. The ECD’s knowledge on the EIA works was also shared with another EIA project in Cambodia supported by JICA, when its mission visited Myanmar in October 2017.

3.2 Progress in Achieving Project Purpose Indicators

Project Purpose:

“Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.”

Indicator 1:

“Consideration for the water status in the pilot study area is made.”

(LIKELY TO BE ACHIEVEMENT, under certain conditions)

- The objective of the Project Purpose Indicator 1 is to encourage the government to utilise the Project’s outcomes for policy-making, when “the results of water quality status report in the pilot areas are presented to the decision makers by MONREC, YCDC and MCDC (Output Indicator 4-1)”.
- The indicator is likely to be achieved fully, if:
 - (1) further explanation sessions for Output 4 is provided, so that the CPs can present the water status with confidence (see Output Indicator 4-1 for the reason).
 - (2) appropriate opportunities are arranged, for the CPs to present the Project’s work to senior officials.
 To note, MCDC and the Japanese experts respectively indicated that they may organise the Project’s completion ceremony, inviting stakeholders across sectors. If realised, such events will augment the prospect for this Indicator to be achieved.

Indicator 2: “More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.”

(ACHIEVEMENT UNLIKELY)

The achievement of this Indicator by the end of this Project appears difficult. The Project can complete the development of the technical, but not the training on the operation of the manual. As explained in Indicator 5-1, the delay in preparing the manual is because the number of sectors and sub-sectors covered in the manual increased from nine to 141 upon the request of the government. The need to increase the scope of work arose only after the Project started, as the number of EIA submission skyrockets in the last two years.

To note, the preparation of the second phase of this Project is currently underway. Because the technical manual is an important output of this Project, the training on the operation of the manual may need to be included in the next phase.

3.3 Prospect for Achieving Overall Goal Indicators

Overall Goal:

"Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approaches for complicated issues are taken into account."

Indicator 1:

"The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project."

(LIKELY TO BE ACHIEVEMENT)

The project members unanimous expressed that the number of factories equipped with waste water treatment facilities would increase, because 1) the number has slightly but certainly increased during the Project, and because 2) the discussion is ongoing/starting to establish central treatment facilities. To what extent the number will actually increase in the future depends on 1) what the baseline data of this indicator is, 2) whether or how soon the central waste water facilities will be realised, and 3) the awareness-raising and incentive for factories to establish ones. There is a need to specify who will monitor the number.

- According to the CPs in Yangon, the number has increased during the Project, as a result that the government has strengthened the inspections in response to the complaints from residents. In Mandalay, too, the number of distilleries with the facilities increased from two to four during the Project. The distilleries in Mandalay – the main source of the river water pollution to date – are also beginning to take initiative to establish their own plants, after the regional government's order to shut down the operations of four distilleries in August 2017.
- Mandalay is discussing the introduction of the central waste management facilities in industrial zones, and so has Yangon just begun considering the option⁶. But many challenges are ahead in realising the scheme, from the issues of cost-sharing, community organisation, to awareness-raising of factory owners and the incentive for them to cooperate, indicating that the facilities may not be established anytime soon.
- The baseline for this indicator could be the number of plants with the *primary* waste water treatment facilities⁷, to ensure more factories will undertake the minimum treatment of their waste water. The results of the first Pollution Source Survey, that investigated 100 factories in Yangon and another 100 in Mandalay in August to November 2016, provide a reference baseline data (Table 3-1).

Table 3-1 The Number of Factories with Waste Water Treatment Facilities /100 factories surveyed in Yangon and in Mandalay each

	# of factories with primary facilities	# of factories with secondary facilities /100
Yangon	53	4
Mandalay	46	1-4, depending on the types of facilities

Source: *Pollution Source Survey Report* (March 2017), prepared by the Project

Indicator 2:

"Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC."

(DEPENDS ON THE CP)

The need for creating waste water management strategies in industrial zones exists at all level. Whether any specific strategy will be drafted in 3-5 years, however, depends on the CP organisation. Whether they can gain cooperation from relevant government stakeholders is a key to achieving this goal.

- For YCDC, the achievement of the indicator appears difficult at this moment. Based in Myanmar's most populated city, YCDC has more stakeholders to coordinate than its counterparts in Mandalay, and feels that its authority to make decisions on creating such a strategy is limited. For YCDC to continue the activities they learned from the Project in the future, the involvement of the regional government will be necessary, as well as the clarification of the roles and responsibilities for waste water management among government stakeholders in Yangon.
- For MCDC, the attainment of the indicator is realistic. The city is more compact in size, and its government structure less complex than Yangon, allowing faster decision-making. With the cooperation from relevant stakeholders such as Ministry of Industry and MONREC-ECD, MCDC believes that it can formulate a unique action plan for waste water management.

Indicator 3:

"Improvement of EIA procedure is identified by ECD through EIA reviews."

(ACHIEVEMENT LIKELY)

- According to the Midterm Review of this Project, the intention of this Indicator is to ensure that the ECD will utilise the outcomes of the Project for further improvement of the EIA reviews in the future. The EIA procedure here could include both the general EIA review process, and the EIA Procedure as a legal framework for the review.
- The achievement of this indicator is highly likely, because the ECD's EIA division feels the need for improving the EIA review process. The areas of improvements as felt by the EIA division are:
 - the number of sectors/sub-sectors for the EIA review, shown in the Annex A of the EIA Procedure,
 - the method of negotiating with factories, particularly in mining sector, to gain their understanding on the need for the EIA, and
 - The number of ECD staff and their capacity for the review

⁶ Depending on the types of facilities required for factories, the introduction of secondary treatment facilities could impose enormous financial burden if each individual factory should set ones up on their own. The facilities also require significant plot of land to be made available. The central facilities, if realised, are likely to provide a solution to this challenge.

⁷ Including screens, equalisation tank, settling basin, oil separator, and chemical coagulation, among others.

3.4 Inputs for the Project

3.4.1 Inputs from Myanmar side

1. Counterpart staff	Assigned as per the R/D, from the ECD headquarters, the ECD's regional offices in Yangon and Mandalay, the YCDC, and the MCDC. See "Table 2-2 Members and their Roles and Responsibilities" for participating departments.
2. Office space and other necessary facilities	The R/D stipulates that some "suitable office space with necessary equipment such as telephone and internet connection" be provided to the JET. <ul style="list-style-type: none"> For the WEM team, an office space was offered in the ECD headquarters Nay Pyi Taw, although the team preferred to be based in Yangon and did not take the offer. For the EIA expert, an office space is provided in the ECD headquarters.
3. Other inputs	<ul style="list-style-type: none"> Transportation cost for training was borne by each CP organisations. Accommodation cost during the EIA training, and miscellaneous payment for surveys organised by the WEM team were incurred by JET. Although the issue with the payment for the WEM surveys was discussed and settled during the Midterm Review, the issue indicates the need for aligning each other's expectation to JICA assistance before any cooperation starts. Means of transport for the EIA expert within Nay Pyi Taw was offered, if not utilised.

3.4.2 Inputs from the Japanese side

As per the R/D, following Japanese experts were assigned.																													
	<table border="1"> <thead> <tr> <th>Name</th> <th>Expertise</th> <th>Organization</th> <th>Total input (# of days)⁸</th> </tr> </thead> <tbody> <tr> <td>Itaru Okuda</td> <td>Leader/Industrial Effluent Management</td> <td>Nippon Koei</td> <td>277</td> </tr> <tr> <td>Shunsuke Hieda</td> <td>Water Quality Survey</td> <td>Nippon Koei</td> <td>203</td> </tr> <tr> <td>Tomoe Takeda</td> <td>Water Sampling and On-site Management</td> <td>Nippon Koei</td> <td>256</td> </tr> <tr> <td>Hiroaki Nakagawara</td> <td>Database development with GIS</td> <td>Nippon Koei</td> <td>236</td> </tr> <tr> <td>Toshiyuki Nishio</td> <td>Industrial effluent treatment</td> <td>Nippon Koei</td> <td>55</td> </tr> <tr> <td>Kanji Usui</td> <td>EIA Technical Manual and Reviewing Process</td> <td>Independent</td> <td>546</td> </tr> </tbody> </table>	Name	Expertise	Organization	Total input (# of days) ⁸	Itaru Okuda	Leader/Industrial Effluent Management	Nippon Koei	277	Shunsuke Hieda	Water Quality Survey	Nippon Koei	203	Tomoe Takeda	Water Sampling and On-site Management	Nippon Koei	256	Hiroaki Nakagawara	Database development with GIS	Nippon Koei	236	Toshiyuki Nishio	Industrial effluent treatment	Nippon Koei	55	Kanji Usui	EIA Technical Manual and Reviewing Process	Independent	546
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1. Japanese Experts																													
2. Equipment (Annex 4)	Equipment for office and for surveys was provided by the Japanese side. The detail is shown in Annex 4.																												

⁸ Actual inputs in Myanmar as of December 2017.

3. C/P Training (Annex 5)	Three training courses were organised in Japan, with total 29 participants from CP organisations and line ministries. The list of participants and overview of the courses are shown in Annex 5.
4. Other operational cost	Total 341,762,192 Kyat, including the planned expense for the WEM team and the expense for four laptop- and two desktop computers for EIA work, were borne by the Japanese side. The main expenditure items are transport and vehicles, local consultants for surveys, air fare and communication, among others.

3.5 Implementation Progress and Process

3.5.1 Developments within the Project

(1) Implementation since the Midterm Review

- Activities for WEM are generally on time. All the planned activities are expected to complete by the end of this Project in June 2018.
- Some activities for Output 5 are taking more time than planned, due to the reasons described in Output 5 Indicators; activities related to Output 6 are implemented as planned, although the need for the Project to implement more EIA training for regional ECD offices is increasing.

(2) Progress in implementing the key recommendations of the Midterm Review

- Sharing of the inspection manual:** the inspection manual has been translated into Burmese and distributed by MONREC-ECD to all the ECD offices in the country, as well as to the new staff. Among the CPs, YCDC fully utilised it for inspection; ECD in Mandalay 60%, and ECD Yangon and MCDC has not yet utilised it but refer to it as appropriate.
- Donor coordination:** as far as the Evaluation Team understood, the overlap of activities between JICA and other donors was naturally settled as the donors coordinate their activities as the need arise. Because the donors for EIA are increasing, constant efforts are necessary in the future, for the ECD to set up a coordination mechanism both with the government and among the donors.
- Budget:** at the time of the Midterm Review, miscellaneous payment for field activities was an issue for the water environment management component of the Project. This issue was settled in the latter half of the Project, through preparing and agreeing on the detailed agreement between the CPs and JET. Although the discussion on the cost-sharing has ever since not recurred in the latter half of the Project, it indicates the importance of aligning each other's expectation to JICA's assistance before any project starts.

3.5.2. Developments surrounding the Project

(1) *The change in the government's leadership, organisations, environmental management policy.*

Ever since President Htin Kyaw assumed the office on 30 March 2016, several changes were observed in the government organisations and in environmental management policies, such as following.

- The former MOECAF was transformed into MONREC, combining the natural resources, forestry, and mining into one ministry.
- The political attention on the environmental issues and management has increased, according to the interviews with the CPs.
- The responsibility of the ECD, both of headquarters and its regional offices, has expanded. On 10th January 2018, MONREC issued a notification to the factories operating in nine prioritised industrial sectors to prepare an Environmental Management Plan (EMP), and to obtain an Environmental Compliance Certificate (ECC) from the ECD⁹. The notification has several implications to the Project: first, the mandate and workload of the EIA division of the ECD will increase, because the division is responsible not only for the EIA/IEE review, but also for assessing the EMP and issuing the ECC; second, the mandate of the regional ECD offices will likewise expand, to monitor estimated total 30,000 EMP implementation in the future. To secure enough human resources to deal with the mounting tasks, the ECD has just initiated a process to raise its staffing level to 20,000 over the next nine years. The training for growing number of new recruits is, therefore, the centre of the ECD's attention at this moment.

(2) Donor activities

- ADB's Project for "Environmental Safeguard Institutional Strengthening"¹⁰ (26 Jan 2015 - 31 Dec 2018) has activities in the areas of assistance of this Project, providing training and the assistance for preparing related policies and guidelines. ADB recently focuses its work on the development of national water quality standard, the environmental compliance audit in mining sector, and the preparation of the EIA guideline in the sector.
- Norway provides support to MONREC's Forest Department, through its "Integrated Water Resources Management – Institutional Building and Training Project (2015-2018)". The project has water quality monitoring and data-basing component in Inly Lake and the Bago river basin, and both JICA and the Project are regularly exchanging information with the Norway's activities. Other donors who reportedly provide support in waste water management includes the Netherlands and France in Mandalay, and the United Nations Industrial Development Organisation for waste water treatment facility construction in Yangon.
- For EIA, donors other than ADB also support the preparation of sector-specific EIA guidelines, including the International Financial Corporation for hydro-energy, Norway for oil and gas, and the Vermont School of Law for public consultation. The Netherlands reportedly plans to support the preparation of the Strategic Environmental Assessment guidelines, but the details need further investigation.

⁹ Notification No.3/2018, "To undertake Environmental Management Plan –EMP for On-going Factories under Nine Prioritised Sectors" (tentative translation by the Project).

¹⁰ <https://www.adb.org/projects/48145-001/main#project-pds>

4. EVALUATION RESULTS

4.1 Relevance

Key Evaluation Criteria for "Relevance"

- Consistency with policies of both the Myanmar- and Japanese governments
- Relevance to Myanmar's development needs and to the capacity needs of CP organisations
- Relevance of the Project's design/approach appropriate to achieve the project objective

The relevance of this Project is HIGH, for the following reasons.

(1) *Relevance to the government's policies*

By government policies it means for ECD the Union government's Law on Environmental Conservation (Law No.9/2012), the Environmental Conservation Rules (2014), and the Environmental Impact Assessment Procedure (2015)¹¹; for YCDC and MCDC, the regulations of the city government committees such as the YCDC law (2013) and the MCDC law (2014) provides a basis for their involvement in the environmental monitoring in Yangon and Mandalay. The government's order in January 2018 on the stronger environmental compliance audit in nine sectors (see 3.5 Implementation Process) only re-enforced the relevance of the project activities.

(2) *Consistency with the social demand and with the capacity needs of the CP organisations*

- The Project started amid of a rising social demand for better environmental pollution control, as the country's transition to civilian rule in 2011 fuelled investment and rapid industrial growth. Of different types of pollutions caused by the industrial growth, untreated industrial waste water in industrial zones in major cities was the most urgent, but the government had neither the reliable data that are critical for assessing the seriousness of the pollution and its impacts, nor the know-how to collect, monitor, and analyse the information. The implementation of this Project was timely and highly appropriate to both the social backdrop in Myanmar and to the needs of the government.
- Industrial growth has augmented the need for EIA as a policy tool to control the pollution. As of this evaluation, the number of the EIA reports to be reviewed is reportedly ten times more than in 2012¹²; the EIA division has only ten staff to review 2,300 projects that are outstanding. The introduction of the EMP will add the number of the reviews for existing operations, and will make the improvement of the EIA review process even more necessary. The assistance for faster and quality reviews, through the creation of necessary tools, is highly relevant to this context.

(3) *Consistency with Japan's aid policy and its comparative advantage*

¹¹ Created with the support from ADB, specifying the MONREC's responsibility and authority to review, monitor and inspect the activities that may have adverse impacts on environment, to whose implementation both the EIA and water environment components of this Project directly contribute to.

¹² According to the EIA division, there were some 200-300 applications at the time the ECD was established.

The Project was found consistent with Japan's aid strategy in the environmental sector, with the priority of its assistance for Myanmar¹³, and with Japan's comparative advantage in environmental management.

- (4) *The design of the Project* is generally appropriate. Its focus and the relationship between outputs are clear, and are understood well by the CPs. Nevertheless, the Evaluation Team also noted that the changing role and responsibilities among regional- and local stakeholders needs to be taken into consideration for the future project design. As the government decentralises, the role of the regional governments in environmental management appears increasing, particularly in Yangon. Its involvement is more important than ever, when the city government makes policy decisions.

ministry had only the forestry background, and the city governments in Yangon and Mandalay did not have experience in such a rush industrial growth. The system related industrial pollution control and environmental compliance audit is still very much in the making.

Given the context, the Project was successful in stimulating the awareness and capacity development of the CP organisations, made available the important tools and information, and in paving the way for future discussions and activities.

- (3) *That said, the experience and results of the Project depends on the context of each city.*

Among the CPs involved in this Project, the members in Mandalay appeared to have more reasons to commit themselves to this Project, ever since the city experienced a critical fish-death incident in early 2015. The timing of the Project coincided well with the needs. The decision-making for the Project-related issues might have been more difficult in Yangon than in Mandalay, because the city is larger in size, and because the roles and responsibilities between the regional government and YCDC is changing.

4.2 Effectiveness

Key Evaluation Criteria for "Effectiveness"

- The extent to which the Project Purpose and its indicators were met
- Usefulness of the Project's activities and outputs to achieve the Project Purpose
- The factors that were useful or detrimental to achieving the Project Purpose

The Effectiveness of this Project is HIGH, for the following reasons.

- (1) *The level of the attainment of the Project Purpose Indicators is, overall, acceptable.*

- Indicator 1. "Consideration for the water status in the pilot study area is made." is likely to be achieved, if Output 4-1 indicator is achieved; Output Indicator 4-1 will be attained, if some more explanation sessions on the water status report is provided to the CPs, and if and an appropriate opportunity is set up to present the Project's outcomes.
- The attainment of Indicator 2. "More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project." is unlikely during the Project, because the scope of work significantly increased during the Project (see Project Purpose Indicator 2). The reason for the Project to take time to develop the technical manual is, therefore, justifiable.

- (2) *Given the context surrounding the Project, the Project was successful.*

The history of environmental management in Myanmar is extremely short, and the Project had to start from the scratch in building the concept. In assessing the effectiveness of this Project, the context surrounding the Project is as important as the level of attaining each performance indicators. The Project started when the government had very limited legal documents or institutional memory, thus no guidance to refer to; before the birth of the ECD in 2012, the

To sum, the factors that contributed to the Project Purpose are:

- the growing and more explicit social demand for improved environment,
- political attention, and
- the interest and commitment of each CP member/organisation.

The factors that posed challenges to the implementation may include:

- the context of each city, including the changing role that the regional government plays in the WEM, and
- the sudden increase of the ECD work, especially of the ECD's EIA division, when the division is still understaffed.

4.3 Efficiency

Key Evaluation Criteria for "Efficiency"

- Efficiency of project management and implementation
- Appropriateness of inputs in terms of quantity and quality
- Any other efforts or events that increased/decreased efficiency, such as donor coordination

The Efficiency of this Project is RELATIVELY HIGH.

- (1) *Project management*

- For a project involving a wide range of stakeholders in three cities, the Project is managed well. Even though all the CPs are extremely busy, they are well-informed of the objectives and activities of the Project, and are committed. Owing to their commitment, the

¹³ Of three focus areas of Japan's assistance in Myanmar, both the water environment and EIA components of this Project directly contribute to the 'Capacity Building and Institution Development / System improvement that support sustainable economic and social development', and 'Development of Infrastructure and Related Systems which requires sustainable economic development'.

activities did not experience a major delay¹⁴, and the key outputs are expected to be produced by the end of the Project in June 2018.

- At respective Output level, the water quality report-writing training under Output 2 was less than planned. The shortage of reliable laboratories was the reason (see 3-1, Output 2 Indicators).

(2) *Inputs.* As described in “3.5 Implementation Process”, the payment for the field-level activities – such as transportation for meeting and per diem - was an issue for the water environment component of the Project. The issue suggests the importance of aligning each other’s expectation to JICA’s assistance before any project starts.

(3) *Coordination.* For the WEM component, some good practice of donor coordination was observed, such as the harmonisation of a pollution survey questionnaire format with the Norwegian Institute for Water Research or the coordination of inspection-related training with ADB. For the EIA component, identifying the Project’s roles and responsibility in relation to other donors was a huge challenge at the beginning. The issue was naturally settled as both the donors and the ECD coordinates their activities as the need arise. Because the donors for EIA are increasing, constant efforts are necessary in the future for the government to host an inclusive platform for aid coordination.

4.4 Impacts

Key Evaluation Criteria for “Impact”

- The prospect for the Overall Goal of the Project to be achieved
- Whether other impacts/spill-over effects have been observed, whether positive or negative

Impact of this Project is RELATIVELY HIGH, because the outcomes of the Project satisfy the criteria, as follows:

- *The attainment of Overall Goal Indicators is likely for two out of three indicators.* For Indicator 2. “Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC”, cooperation is necessary from wider stakeholders, such as the regional government. See “3.3 Prospect of Achieving Overall Goal Indicators” for detailed explanation.
- *Knowledge sharing and application is taking place.*
 - Knowledge on inspections: the method of inspection from this Project has been applied to air pollution inspections by the CP members, as well as to Ministry of Industry and General Affairs Department with whom the CPs jointly conduct environmental compliance inspections.
 - Database applied to other sectors: some CPs informed that they are replicating the database

format from Output 3, to manage the data for other sector work they have.

- Pollution Source Survey is referred to not only by the CPs, but also by other donor.

4.5 Sustainability

Key Evaluation Criteria for “Sustainability”

- Whether policies are in place to sustain the outcomes of this Project
- Within or among CP organisations, whether are the roles and responsibilities for future activities clear
- Whether the capacity of the CPs is sufficient to continue the now expert-supported activities on their own?
- Whether financial resource is secured for future activities?

Sustainability of this Project is MODERATE.

(1) *Policy environment.* In terms of policies, the activities and the outcomes of the Project are highly sustainable.

As described in 4.1, water pollution control and of the efficient EIA review are at the heart of the government’s policy and political attention, and its importance is expected to augment further with the industrial growth. For the sustainability of each Output activities, specific laws and guidance – such as the water quality standard, comprehensive river water monitoring system, and the guidance on the regional implementation of the EMP monitoring, for example – will need articulating in the near future¹⁵. The existing guidelines may also need revising, to reflect more up-to-date situation of environmental management in Myanmar¹⁶.

For pollution control measures to be effective, the awareness-raising of the factory owners are also critical (see Output Indicator 3-1 for more information).

(2) *Organisational issues.* For some CP organisations, their current mandate and the staff assignment may pose a challenge for the sustainability.

- The ECD will continue to play a key role in environmental management, as its mandate expands with the introduction of the EMP and ECC.
- For MCDC, frequent staff turnover is a hindrance to the lasting institutional memory, although so far the clear policy guidance has helped bind the organisation.
- For YCDC to continue the activities particularly related to WEM, the roles and responsibilities for a comprehensive river water monitoring in Yangon needs to be better defined. Without such a framework, some parts of the water quality monitoring and data management may fall through the cracks.
- Although the ECD’s EIA division has a clear and lasting mandate, the staff to undertake the EIA review is insufficient. The efficiency of the EIA work in the future depends both on how

¹⁵ According to the interview, ADB is currently assisting the ECD for the preparation of water quality guideline.

¹⁶ Including updating of the reference values of the National Environmental Quality (Emission) Guideline, or the Annex A of the EIA Procedure.

¹⁴ Except for the technical manual development, for a justifiable reason. See Project Purpose Indicator 2 for details.

well the technical manual will be utilised to reduce the volume of work, and how much staff increase the division can afford.

(3) *Knowledge and skills.* There are some technical capacity challenges to sustainability.

- The Project was highly successful as an introductory project, stimulating awareness and capacity development in the field of the Project's assistance. There are activities that will continue once the CPs know why and how¹⁷; for other activities, such as the data interpretation under 4, the CPs do not yet feel full-fledged to perform them by their own.
- For ECD regional offices, the education for the growing number of new staff is a bottleneck to the future monitoring of the EMP implementation. For the project outcomes to contribute to their assignment, knowledge-dissemination from the project members to the new staff will be the key.
- For EIA, to have the technical manual in place, and to continue the EIA training for new recruits and for ECD regional offices is essential to sustain the work of the EIA division. Because the volume of work and the number of the staff in ECD regional offices are rapidly increasing, the capacity development needs will stay as huge as ever.

(4) *Utilisation of the tools.*

- Output1: Inspection manual is expected to be used in the future, as per the interview with the ECD headquarters (see Indicator 1-1).
- Output 3: The future of the databases for pollution sources and water quality depends on the purpose of monitoring the data is better defined in laws and regulations, as well as the roles and responsibilities among different organisations to undertake the monitoring.
- EIA: The tracking system is already in use, and is likely to be used in the future. Some stakeholders expect that the technical manual could be more user-friendly so that it will continuously be used without the guidance from the Japanese expert. Because the electronic technical manual is still under construction, insufficient time for the training of the manual cast a concern over sustainability, to which the second phase of this Project is likely to provide a solution.

(5) *Budget.* So far as the Evaluation Team understood, the budget for future activities in the field of the Project's assistance – compliance inspections, water quality monitoring, data management, among others -- is not the most critical bottleneck. If the CPs know their priorities, and if they are able to present well to decision-makers, the budget is likely to follow. For this very reason, the Project focused on training the reporting skills of the CPs, and has made the development of a written strategy by YCDC and MCDC an indicator for the Overall Goal (see 3.3). The continuation of the activities from this Project by all the CPs, and the brainstorming for such a strategy/action plan by YCDC and MCDC, are keys to sustainability and to the attainment of the Overall Goal.

¹⁷ The activities such as inspection procedures, and the frequency and spots of water sampling.

5. CONCLUSION

5.1 Summary Progress and Findings

Launched in May 2015, the Project will complete its three-year cooperation in May 2018.

The Project started when the government had very limited legal documents or institutional memory, thus no guidance to refer to. All the CPs were extremely busy, but they were well-informed of the objectives and the activities of the Project, and committed. Owing to their commitment, the activities did not experience a major delay, and most of the key outputs are expected to be produced by the end of the Project in June 2018. The overall level of the attainment of the Project Purpose Indicators is also acceptable. Given the context surrounding the Project and the achievement it has made, it is fair to assess that the Project was successful.

5.2 Key outputs and outcomes

- (1) WEM: The Inspection Manual, which is now the first government's guidance document for environmental compliance inspection/ Water Quality Survey Report and Water Status Report/ Pollution Source Survey Report, which helped unveil the pollution source information that were unknown/pollution Source database and water quality database with GIS/ enhanced capacity in inspection, and water quality survey and analysis method.
- (2) EIA: General- and sector-checklists, to guide the EIA reviews / the official forms to be filled out by EIA consultants/ Tracking System, to record the process of the EIA reviews /a prototype of the E-manual in mining sector, to be followed by the full-manual/capacity development for total 197 officers on EIA, including line ministries and ECD regional offices.

5.3 Bottlenecks and Challenges

- The context of each city, including the changing role that the regional government plays in the WEM
- The sudden increase of the ECD work, especially of the ECD's EIA division, and the shortage of ECD staff

5.4 Evaluation Result

- Relevance: *High*, for its consistency with policies and needs, and for appropriate project design
- Effectiveness: *High*. Given the context and achievements, the Project was successful.
- Efficiency: *Relatively High*. Although the Project lacked some inputs and coordination in the first year, the members were highly committed, and the Project was managed well.
- Impact: *Relatively High*, because the Overall Goals are likely to be achieved, and knowledge-sharing has been observed.
- Sustainability: *Moderate*. For some CPs, the mandate and the staff assignment still need to be clarified, and capacity development should continue.

6. Recommendations

6.1 Actions before the end of the Project

Recommended actions	Project members in charge of the actions (Members who will cooperate or participate)					
	ECD-PCD	ECD-EIA	ECD regional	YCDC	MCDC	JET
(1) To the extent possible within the remaining cooperation period, strengthen the capacity development for Output 4. Organise another training session, as necessary.						X
(2) Organise an opportunity to present the water status report to decision-makers, within the current assignment of the Japanese experts.	X		(X)	X	X	
(3) Ensure that the development of the technical manual under Output 5 will complete.						X
(4) Ensure that the official forms for EIA consultants created under Output 5 will be uploaded in the EIA portal site, as soon as the website is renewed in April 2018.		(X)				
(5) As part of Output 4 activities, conduct a brainstorming exercise, for YCDC and MCDC to choose the types of written strategies to be prepared under Overall Indicator 2 "Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC."				X	X	X

29

6.2 Actions for the future

Recommended actions	CPs in charge of the actions				
	ECD-PCD	ECD-EIA	ECD regional	YCDC	MCDC
(1) Utilise the data and information obtained from the Project for the preparation of future policies, guidelines and standards, including the Environmental Quality Standard, or the environmental statistics.	X				
(2) Ensure the soonest possible endorsement of the Consultant Licensing Scheme prepared through this Project, and make it operational.		X			
(3) Start the preparation of the written strategies for waste water management mentioned in (4) of "Actions for before the end of the Project", in cooperation with MONREC and with other relevant ministries such as Ministry of Construction and Ministry of Industry.				X	X
(4) Ensure that the outputs and tools developed through the Project are utilised in the future, including the manuals, databases, the EIA Tracking System, and the E-manual.	X	X	X	X	X
(5) Coordinate the donor assistance, so that the demarcation between the donors is clear.		X			
(6) Integrate the monitoring of the key parameters for water quality – such as the ones selected for the Project's water quality surveys—into the routine tasks of each organisation.			X	X	X
(7) Share the knowledge gained from the Project, within, between, and outside of the CP organisations.	X	X	X	X	X
(8) Take concrete actions to raise awareness of factories and businesses on the environmental impacts of their activities.	X		X	X	X

30

Annex 1: Project Design Matrix

as of 2016/11/07

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: ECD of MONREC, PCCD of YCDC, and WSD of MCDC.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.</p>	<ol style="list-style-type: none"> 1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC. 3. Improvement of EIA procedure is identified by ECD through EIA reviews 	<ul style="list-style-type: none"> • Database (baseline) Questionnaire • strategy • Proposal for EIA procedure revision 	
<p><Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.</p>	<ol style="list-style-type: none"> 1. Consideration for the water status in the pilot study area is made. 2. More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project. 	<ul style="list-style-type: none"> • Survey report • EIA documents 	<ol style="list-style-type: none"> 1. National effluent standard is developed.
<p>Output 1 Inspection procedure is standardized.</p>	<ol style="list-style-type: none"> 1. Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD. 	<ul style="list-style-type: none"> • Records of Inspection 	<ol style="list-style-type: none"> 1. Responsibility of MONREC, YCDC and MCDC for water pollution control does not change.
<p>Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.</p>	<ol style="list-style-type: none"> 1. Water quality survey reports are prepared in the pilot areas by YCDC and MCDC. 	<ul style="list-style-type: none"> • Survey report 	<ol style="list-style-type: none"> 2. YCDC and MCDC do not stop inspection system as a water pollution control measures.
<p>Output 3 Database of water pollution sources and river water quality is developed.</p>	<ol style="list-style-type: none"> 1. At least 150 factories' information is accessible on the database. 2. Results of river water quality survey is accessible on the database. 	<ul style="list-style-type: none"> • Database • Database 	<ol style="list-style-type: none"> 3. Responsibility of MONREC for EIA review does not change. 4. Relevant legislation of EIA does not significantly change.
<p>Output 4 Capacity of interpreting the information for water pollution control measures is enhanced</p>	<ol style="list-style-type: none"> 1. Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC. 	<ul style="list-style-type: none"> • Presentation materials 	<ol style="list-style-type: none"> 5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECA.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p>Output 5 Necessary technical manuals and forms for the EIA review are developed.</p>	<ol style="list-style-type: none"> 1. The technical manual covers every sector (1) of development projects and every major stage indicated in the EIA procedure. 2. The draft official forms are internally approved. 	<ul style="list-style-type: none"> • Technical manual and forms 	
<p>Output 6 Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.</p>	<ol style="list-style-type: none"> 1. More than 80% of ECD officers in charge of EIA reviews received completion certificates from the Advanced EIA trainings. 2. Statistics of EIA reviews are presented. 3. EIA works by MONREC are presented at an international conference. 	<ul style="list-style-type: none"> • Evaluation report of EIA • Proceedings 	
<p><Activities> Output 1: Inspection procedure is standardized. 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement trial inspections based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures</p> <p>Output 2: Capacity for water quality survey is enhanced. 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual</p>	<p><Inputs> Japanese side • Experts. • Training in Japan and other country. • Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others</p> <p>Myanmar side • Counterpart personnel.</p> <p>• Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)</p>		

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report			
Output 3: Database of water pollution sources and river water quality is developed with GIS software. 3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance. 4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and-legislation for the EIA operation are developed. 5-1 To draft legislation on demand including Official Submission Forms for the EIA. 5-2 To develop a technical Manual of the EIA review process. 5-3 To evaluate and update the Technical Manual to meet the ongoing EIA review processes. 5-4 To develop a database for recording the EIA review. 5-5 To draft legislaions for issuing licenses to EIA consultants			
Output 6: Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced. 6-1 To implement basic and advanced EIA trainings. 6-2 To implement EIA review works based on the EIA procedure 5-3 To record the EIA reviews. 5-4 To present leaflets and other materials for dissemination of EIA system 5-5 To develop a WEB site to disclose EIAs based on the new EIA system 5-6 To review and update the WEB site 5-7 To present activities on EIA review to an international conference			<Preconditions> 1. Japanese experts are assigned 2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
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(1) sectors are indicated in Annex A of ELA procedure.

Annex 2: List of Key Counterparts

Organization	Department	Name	Title
MONREC	ECD	Mr. Hla Maung Thein	Director General
		Mr. Sein Htun Linn	Deputy Director General
	ECD (PCD)	Mr. Min Maw	Deputy Director
		Dr. Tin Aung Win	Assistant Director
		Ms. Khin Myo Sat Aye	Deputy Staff Officer
	ECD (EIA)	Dr. San Oo	Director
		Mr. Htin Aung Kyaw	Assistant Director
	ECD Yangon	Ms. Khin Thidar Tin	Director
		Mr. Aung Aung Lay	Assistant Director
		Ms. Thet Wai Hnin	Deputy Staff Officer
	ECD Mandalay	Mr Tin Min Maung	Director
		Mr. Thant Zin Tun	Assistant Director
		Ms Daw Aye Moe Kyaw	Deputy Staff officer
		(Mr. Pyae Phyo Kyaw)	(Former Deputy Staff Officer)
YCDC	PCCD	Dr. Aung Myint Maw	Deputy Head of Department
		Mr. Bawi Kyone	Assistant Head of Department
		Ms Yadanar Wuttyi Soe	Deputy Supervisor
	WSD	Mr. Wai Lwin	Assistant Chief Engineer
		Ms Daw Khin Aye Myint	Executive engineer
MCDC	WSD	U Myo Thant	Deputy Director
		Mr. Khin Maung Thin	Division Chief/Deputy Head of Department
		Ms. Thwe Hnin Aung	Head of Division
		Mr. Aung Khin Myint	Junior Engineer
		Ms. Tin Tin Hla	Laboratory Supervisor
		Ms. Hnin Yi Phue	Laboratory Staff
	CD	Mr. Than Htut	Head of Division
		Mr. Win Swe	Staff Officer

Created based on the information from JET and from the interviewed CPs.

Annex 3: Evaluation Schedule

Day	Date	Time	Hotel	Activities	JICA HQ
February 2	Fri			Departure from Tokyo Arrival in Yangon	Evaluation consultant
February 3	Sat		Yangon	Meeting with Japanese experts (Water Env team)	JICA HQ
February 4	Sun		Yangon	Preparation for interview	
February 5	Mon		Yangon	Meeting with YCDC (PSSD) Meeting with YCDC(WSD)	
February 6	Tue	AM PM	Yangon	Meeting with ECD Yangon Meeting with Myanmar Chamber of Commerce (UMFCCI)	
February 7	Wed		Mandalay	Departure for Mandalay Meeting with ECD Mandalay	
February 8	Thu	AM PM	Mandalay	Courtesy call to MDCDC Committee Member Meeting with MDCDC (WSD) Factory visit/return to Yangon	
February 9	Fri	AM PM	Yangon	Visit to JICA Myanmar office Preparation of draft evaluation report	
February 10	Sat	AM PM	Yangon	Meeting with Norway Insitute for Water Research Preparation of draft evaluation report	
February 11	Sun	AM PM	Yangon	Preparation of draft report	
February 12 (holiday)	Mon	AM PM	Yangon	Preparation of draft report	
February 13	Tue		Yangon	Meeting with EIA expert Project site visit (Hlaing Tharyar)	
February 14	Wed	AM PM	Yangon/ Nay Pyi Taw Nay Pyi Taw	Departure for NPT Meeting with ECD's Pollution Control Section Meeting with Deputy Director General of MONREC-ECD	
February 15	Thu	AM PM	Nay Pyi Taw	Preparation of draft evaluation report Meeting with ADB	
February 16	Fri	AM PM	Nay Pyi Taw	Meeting with ECD's EIA section director Preparation of draft evaluation report	
February 17	Sat	AM PM	Nay Pyi Taw	Drafting of evaluation report	
February 18	Sun		Yangon(JICA HQ) Nay Pyi Taw(Consultant)	Drafting of evaluation report	Departure from Narita Arrival in Yangon
February 19	Mon		Nay Pyi Taw		Departure from Yangon
February 20	Tue		Nay Pyi Taw	Internal meeting Meeting with Japanese experts Courtesy call to Director General of MONREC-ECD	
February 21	Wed		Nay Pyi Taw	Courtesy call to Union Minister of MONREC Finalisation of the report/preparation for JCC	
February 22	Thu		Nay Pyi Taw /Yangon	JCC Departure from Nay Pyi Taw to Yangon	
February 23	Fri			Reporting to Embassyand JICA office Departure from Yangon for Japan	
February 24	Sat			Arrival in Japan	

Annex 4: List of Equipment Provided

Laptop computers(with GIS)	2
Projector	1
GPS	3
Colour printer	1
Multiple printer(black & white)	1
Multiple printer(colour)	1
Water Flow Meter (for river flow)	1
Desktop computer Inverter UPS for power shortage	7
Portable scanner	1
Camera	1
Water Quality Meter	5
Water Flow Meter (for inspection activity)	5
COD Monitoring Set	1
Total Nitrogen Analysis Set	1
Laptop computer for EIA	2
Desktop computer for EIA	4

Annex 5: List of participants to the training in Japan

	Participants	Organization	Course title
1st training in Japan (22-28 May 2016)			
1	Mr. Zaw Moe	MONREC	1 st study program in Japan for the Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar
2	Mr. Thin Thin Nu	MONREC	
3	Mr. Zaw Tun Aung	MONREC	
4	Mr. Myint Sein	YCDC	
5	Mr. Zaw Zaw Tun	MCDC	
6	Ms. Thwe Hnin Anug	MCDC	
2nd training in Japan (28 September – 4 October 2016)			
7	Mr. Min Maw	MONREC	Planning and Implementation of Water Quality and Pollution Source Control (1)
8	Mr. Myo Thein	YCDC	
9	Mr. Khin Maung Thin	MCDC	
10	Mr. Bawi Kyone	YCDC	
11	Ms. Thwe Naing Oo	YCDC	
12	Mr. Win Swe	MCDC	
13	Mr. Aung Zaw Moe	MCDC	
14	Ms. Khin Myo Sat Aye	MONREC/ECD	
15	Mr. Pyae Phyo Kyaw	MONREC/ECD	
16	Ms. Thet Wai Hnin	MONREC/ECD	
3rd training in Japan (28 August – 14 September 2017)			
17	Ms. Khin Thida Tin	MONREC/ECD	Planning and Implementation of Water Quality and Pollution Source Control (2)
18	Mr. Thant Zin Tun	ECD Mandalay	
19	Mr. Bawi Kyone	YCDC	
20	Mr. Soe Zaw	YCDC	
21	Ms. Yadanar Wuttyi Soe	YCDC	
22	Mr. Zaw Min Oo	MCDC	
23	Mr. Aung Khin Myint	MCDC	
24	Ms. Kyawt Kay Khaing	MCDC	
25	Ms. Saw Sanda Win	Ministry of Transportation	
26	Ms. Khaing Khaing Soe	Ministry of Health and Sports	
27	Mr. Tun Tun Aung	Ministry of Agriculture, Livestock and Irrigation	
28	Ms. Swai Thi Htut	Ministry of Industry	
29	Mr. Kyaw Zin Tun	Ministry of Education	

MINUTES OF JOINT COORDINATING COMMITTEE MEETING NO.5

PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER
ENVIRONMENT MANAGEMENT AND EIA SYSTEM
IN
THE REPUBLIC OF THE UNION OF MYANMAR

Nay Pyi Taw, 17 May 2018

for 岩井伸夫

Mr. Masayuki Karasawa
Chief Representative
JICA Myanmar Office



Mr. Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resources and
Environmental Conservation



Dr. Itaru Okuda
Leader, JICA Exert Team

These are the minutes of the Joint Coordinating Committee (JCC) meeting No.5 of the project entitled "Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar", which has been implemented in accordance with the Record of Discussions (R/D) agreed on 23 December 2014 between the then Ministry of Environmental Conservation and Forestry (MOECAFF; superseded by Ministry of Natural Resources and Environmental Conservation (MONREC) in 2016) and Japan International Cooperation Agency (JICA).

The meeting was held on 17 May 2018 at the conference room of Environmental Conservation Department (ECD) of MONREC in Nay Pyi Taw. The agenda of the meeting and the list of participants are given in Attachments 1 and 2. Based on the presentations and discussions, the JCC members agreed on the following matters:

(1) Closing of the Project Activities in Myanmar

The committee members confirmed that all project activities in Myanmar have been executed successfully according to the Project Design Matrix (PDM) and the Plan of Operation (PO). The members agreed to close the project activities in Myanmar as of 17 May 2018.

(2) Distribution of Final Report

JET shall finalize the final report of the project (Water Environment Management Component only), and submit the required numbers of hard copies and soft copies to JICA by 5 June 2018. JICA shall send 21 hard copies of the report together with 21 sets of electronic copies of the report to ECD. ECD shall distribute the report to all members of JCC.

(3) Trial Use of EIA E-Manual

ECD shall thoroughly test the EIA E-Manual developed in the project, and feed-back the experiences and issues to JICA.

(4) EIA Consultant Licensing Scheme

ECD shall finalize the Myanmar version of the EIA Consultant Licensing Scheme.

(5) Sharing of the Project Outcomes through the ECD Website

ECD shall share the outcomes of the project widely with the general public through ECD's website and/ or other relevant means of ECD.

End

Attachments:

Attachment 1: Agenda of the Joint Coordinating Committee Meeting No.5

Attachment 2: List of participants

Attachment 3: List of members of Joint Coordinating Committee

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**JICA Project for Capacity Development
in Basic Water Environment Management and EIA System
in the Republic of the Union of Myanmar**



**Agenda of Final Seminar in Nay Pyi Taw
and Joint Coordination Committee Meeting No. 5**

- Objectives:**
- To share final outputs of the Project
 - To share recent activities of water environment management in Myanmar
 - To conclude the project activities in Myanmar
- Date and Time:** 17th (Thursday) May 2018, 09:00-12:00
- Place:** Meeting Room of ECD, MONREC
- Participants:** Representatives of ECD, Yangon ECD Region, Mandalay ECD Region/
MONREC, YCDC, MCDC, MOH, MOTC, MOI, MOE, MOALI, Embassy
of Japan, JICA, and JET
- Language:** English (consecutive translation available for discussions)

Time	Contents	Speaker
09:30-09:35	Opening remarks	Director General, ECD, MONREC
<i>Session 1: Introduction of Project Activities</i>		
09:35-09:45	Overall project activities	JET (Dr. Itaru Okuda)
09:45-10:05	Water quality monitoring	JET (Ms. Tomoe Takeda)
10:05-10:30	Industrial pollution sources	JET (Dr. Itaru Okuda)
10:30-11:00	Water quality status and case studies for water environment management in Myanmar	JET (Mr. Shunsuke Hieda)
11:00-11:10	Report of activities on EIA Component	EIA Division of MONREC-ECD
<i>Session 2: Water Environment Management Activities in Myanmar</i>		
11:10-11:25	Activities of pollution control and domestic wastewater control in Yangon by YCDC	YCDC-PCCD
11:25-11:40	Activities of pollution control and domestic wastewater control in Mandalay by MCDC	MCDC-WSD
11:40-11:55	Activities of nationwide water environment management by ECD	ECD HQ
11:55-12:25	Discussions and comments on Final Report	-
12:25-12:30	Signing of Minutes of Meetings	Representative of MONREC Representative of JICA Myanmar Office
12:30	Closing remarks	Representative of MONREC Representative of JICA Myanmar Office

List of participants of Joint Coordinating Committee Meeting No.5

No.	Name	Title	Name of Organization
Participants from Myanmar Side			
1.	Mr. Hla Maung Thein	Director General	ECD, MONREC
2.	Mr. Min Maw	Deputy Director General	ECD, MONREC
3.	Dr. Tin Aung Win	Assistant Director	ECD, MONREC
4.	Ms. Saw Sandar Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
5.	Dr. Khaing Khaing Soe	Deputy Director	MOHS
6.	Dr. Thar Htet Kyaw	Deputy Director	MOST
7.	Mr. Tun Tun Aung	Assistant Director	MOALI
8.	Ms. Swe Thi Htut	Assistant Director	MOI
9.	Mr. Bawi Kyone	Assistant Department Head	PCCD, YCDC
10.	Mr. Wai Lwin	Assistant Department Head	WSD, YCDC
11.	Mr. Khin Maung Thinn	Assistant Director	WSD, MCDC
12.	Ms. Thin Thin	Assistant Director	ECD Mandalay
13.	Ms. Thet Wai Hnin	Deputy Staff Officer	ECD Yangon
14.	Mr. Tin Min Htoo	Assistant Director	ECD, MONREC (EIA)
15.	Dr. Tin Tin Than	Deputy Director	ECD, MONREC (EQS)
16.	Dr. Win Win Mar	Assistant Director	ECD, MONREC
17.	Ms. Mya Thandar Tin	Assistant Director	ECD, MONREC
18.	Ms. Pan Ei Phyu	Staff Officer	ECD, MONREC
19.	Ms. Myat Su Yee	Staff Officer	ECD, MONREC
20.	Ms. Aye Ma	Staff Officer	ECD, MONREC
Participants from Japanese side			
21.	Mr. Nubuo Iwai	Representative JICA Myanmar Office	JICA Myanmar

Attachment 2: List of participants

22.	Mr. Hayato Nakamura	Project Formulation Advisor	JICA Myanmar
23.	Ms. Thet Thet Zaw	Assistant Program Officer	JICA Myanmar Office
24.	Mr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
25.	Mr. Shunsuke Hieda	Deputy Team Leader, Water Quality Survey	JICA Expert Team
26.	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
27.	Ms. Ei Ei Mon	Environmental Expert	JICA Expert Team
28.	Ms. Ni Lar Wynn	Environmental Expert	JICA Expert Team
29.	Ms. Betty Ni Ni Chan	Project Coordinator	JICA Expert Team
30.	Ms. Thet Su Su Hnin	Assistant Environmental Expert	JICA Expert Team
31.	Ms. May Thinzar Kyaw	Junior Assistant Environmental Expert	JICA Expert Team

Attachment 3: List of members of Joint Coordinating Committee

List of members of Joint Coordinating Committee

As of 17 May 2018

No.	Name	Title	Organization
Members from Myanmar Side			
1	Mr. Hla Maung Thein	Director General (DG)	ECD, MONREC
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MONREC
3	Mr. Htun Naing Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport
4	Dr. San Oo	Director	ECD, MONREC
5	Dr. Kyi Lwin Oo	Director	Occupational and Environmental Health Sub- Department, Department of Public Health, Ministry of Health and Sports
6	Dr. Thar Htet Kyaw	Deputy Director (DD)	Research and Innovation Department, Ministry of Education
7	Ms. Mya Mya Thet	Assistant Director (DD)	Department of Industrial Inspection and Supervision, Ministry of Industry
8	Mr. Bawi Chung	Assistant Department Head	Pollution Control and Cleansing Department, Yangon City Development Committee
9	Mr. Khin Mg Thinn	Assistant Director (Engineering)	Water and Sanitation Department, Mandalay City Development Committee
10	Mr. Tun Tun Aung	Assistant Director	MOALI
11	Mr. Min Maw	Director	ECD, MONREC
12	Dr. Tin Aung Win	Assistant Director	ECD, MONREC
Members from Japanese Side			
13	Mr. Masayuki Karasawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team

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Attachment 3: List of members of Joint Coordinating Committee

No.	Name	Title	Organization
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team
20	Mr. Toshiyuki Nishio	Industrial Effluent Treatment	JICA Expert Team

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