



# Bago River Sub-basin Management Plan



# REPORT

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Summary The report presents the "Bago River Sub-basin Management Plan" a plan which has been prepared by the Bago River Sub-basin Committee, with input from the Bago Non-governmental Stakeholder Group during the period of 2016 - 2018. The process of developing this plan, including also the participatory process for input to the plan is described. Pressures and trends as identified for Bago and the ecological status of water body groups in Bago are described. The report includes an overview of abatement measures with reference to, ongoing measures and planned measures within the next five years.
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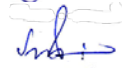












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# **Bago River Sub-basin Management Plan**

## Preface

The Bago River Sub-basin Management Plan has been prepared as a coordinated effort by the members of the Bago Sub-basin Area Committee. There has been dialogue with the Bago Non-governmental Stakeholder Group during the period of 2016- 2018 for input to this Plan. The main purpose of the plan is to improve the ecological status of the Bago River. It is the hope that the development of the plan and the plan itself will motivate to more environmental awareness and action in the government, and among civil society at large. The construction of the fence along the Bago market and the planting on the riparian zone alongside the Bago market, are good examples of local engagement for improving the ecological status of the Bago River.

Core actors within the Bago Sub-basin Area Committee for developing this plan have been the Bago Forest Department (FD), with Director Zaw Win Myint as head secretary of the Committee, supported by the co-secretaries, Bago Directorate of Water Resources and Improvement of River Systems (DWIR), represented by Director Htay Aung, and Bago Irrigation and Water Utilization Management Department (IWUMD), represented by Director Ko Ko Oo.

We would in particular like to acknowledge the contributions by the secretary U Aung Myo Htut and by co-secretaries Dr. Hein Thant Zaw and U Mg Mg Kyi of the Non-Governmental Stakeholder Group.

We would also highly appreciate the valuable contributions of the former Committee chair, U Kyaw Min San, and of the Bago Township Development Committee. The recently appointed chair, the Bago Ministry of Natural Resources, Forestry and Environmental Conservation (MONRFEC) Minister, Dr. Saw Nyo Win, has been central in communicating about the project and the implementation of the river basin management approach in Bago to the Chief Minister, and to the Bago Government.

The authors of the plan will follow the progress towards reaching the environmental objectives specified in this document by means of producing yearly progress reports for the abatement program, and by organizing half year Committee and Group meetings to discuss progress of ecological status and measures.

The preparation of this Plan has been facilitated by the Integrated Water Resources Management (IWRM) project, a collaborative project between the Watershed Management Division of the Forest Department (WMD FD) and the the Norwegian Institute for Water Research (NIVA) funded by the Norwegian embassy. The actual drafting of this report has been led by the project manager Ingrid Nesheim, NIVA, with contributions from Zaw Win Myint WMD FD, Toe Aung, WMD FD, Zaw Lwin Tun, IWUMD, Bo Ni, WMD FD, and Nikolai Friberg, NIVA.

The final approval of the plan will be in the form of a stamp and a signature by the secretariat of the National Water Resources Committee.

Bago, September 2018.

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## Summary

The River Basin Management Approach has been implemented during 2016 - 2018 in the Bago River Sub-basin, resulting in the development of this document, “The Bago River Sub-basin Area Management Plan”. The National Water Framework Directive (NWFD, 2014) has been the national reference for this process. The approach has been facilitated for by the IWRM project, a collaboration between the Watershed Management Division Forest Department (WMD FD), the Irrigation and Water Utilization Management Department (IWUMD) and the Norwegian Institute for Water Research (NIVA). The Bago Sub-basin Area Committee consisting of sector and environmental authorities, and the Bago Non-governmental Stakeholder Group have been central discussion and decision-making arenas for the development of this Plan.

Decision-making processes as part of this pilot have been supported by a common understanding of pressures and ecological status enabled by presentations prepared by FD, IWUMD and NIVA on monitoring results from the Bago Sub-basin. A team consisting of staff from WMD FD, IWUMD, and NIVA have been sampling for water quality analysis within the sub-basin. Analyses of chemical parameters and of invertebrates as indicators of ecological status, have been undertaken at the Water Quality laboratory at the Forest Research Institute in Nay Pyi Taw, at the IWUMD laboratory in Yangon, and at NIVA in Oslo.

The aim of good ecological status is in this river basin management pilot defined as: No eutrophication; Water bodies free of contamination, No soil erosion, Healthy river, lakes and streams, and Sufficient water flow. Reaching these environmental objectives will ensure, Safeguarding living oceans, rivers and lakes for the benefit, safety and enjoyment of present and future generations.

Pressures in the Bago River Sub-basin differs within the catchment. In the upper part of the catchment the main pressure is deforestation with impact on erosion and sedimentation downstream. In areas of dense settlements and specifically, the Bago City Area, Waw, Thanatpin and Kawa Township centers, main pressures are garbage and sewage. Downstream in the catchment, erosion and runoff from agricultural areas are other important impacts.

Abatement measures have been identified by each sector authority for reaching the environmental objectives in the Bago River Sub-basin area. The measures were identified to target specific pressures. Ongoing measures, short term planned measures and measures to be implemented within the next 5 years are listed. Information on monitoring efforts are provided. Terms of reference for the Committee and the Non-governmental Stakeholder Group are included in the Appendix of this document.



**Photos** (from left): A group photo from a meeting in the Non-governmental Stakeholder Group, 2016; From a Committee meeting in 2016; A meeting between the Group and the Committee in 2018 (Source: WMD FD).

# 1 Introduction

This report presents the, “Bago River Sub-basin Management Plan” a plan which has been prepared by the Bago River Sub-basin Committee, with input from the Bago Non-governmental Stakeholder Group during the period of 2016 - 2018. The Committee was established as an arena for coordination of water management tasks, and for water management decision making among Bago authorities. The mandate of the Committee has been to develop the Bago River Sub-basin Area Management Plan. The Non-governmental Stakeholder Group was established as a parallel arena for discussion of water related issues, and for the purpose of providing input to the work of developing this Plan. The Myanmar National Water Framework Directive (NWFD) has been the national reference for this process, while the EU Water Framework Directive (WFD) has been the main international reference. The IWRM project, which is a collaboration between Watershed Management Division Forest Department (WMD- FD), Irrigation and Water Utilization Management Department (IWUMD), Directorate of Water Resources and Improvement of River Systems (DWIR), and the Norwegian Institute for Water Research (NIVA), has supported and facilitated the River Basin Management Approach pilot in the Bago River Sub-basin Area.

The rationale of the River Basin Management Approach is that water flows through the catchment from lakes, rivers and groundwaters towards estuaries and to the sea. It follows from this, that water usage upstream for discharge or abstraction has impact on the situation downstream. Under this context, the overall long term sustainable development goal being defined in this pilot is:

***Safeguarding living oceans, rivers and lakes for the benefit, safety and enjoyment of present and future generations.***

This is specified as referring to:

1. No contamination
2. No eutrophication
3. Healthy river (biodiversity and habitats)
4. No erosion
5. Sufficient water flow



The aim of this Sub-basin Management Plan is to present actions for improved ecological status of the Bago River Sub-basin, based on the natural environmental situation, considering history, economic activities, trends in the sub-basin, it's stakeholders and the options available. The plan is based on a compilation of knowledge of ecological status of waters in the sub-basin, discussion of possible abatement measures considering, pressures analysis, social and political willingness to implement measures, and funding options – for reaching the NWFD's goal of good ecological status. The process of preparing the plan and the plan itself, are important tools for information sharing and communication between the authorities. Surface waters in the sub-basin have been classified with regard to ecological status, that is as either bad, poor, moderate, good, or very good (Figure 9). Five water body groups with regard to pressures and user criteria have been identified: Upstream Bago City Water Bodies, Bago City Water Bodies, Downstream Bago City Water Bodies, Reservoirs used for Drinking water and Irrigation, and Water Bodies Protected for Biodiversity. The Management Plan provides an overview of how the water body groups are affected by human impact, and also a table presenting implemented and planned measures. The sectors responsible for implementing the measures are listed. Ground water has not been the target of this current approach.



*Main pollution sources in the Bago River Sub-basin* are run-off (non-point source pollution) from farmland, sewage from scattered dwellings and urban areas in the catchment. A major run-off into rivers and streams occurs related to the monsoon season as heavy precipitation acts as surface wash-off for various pollutants. Identified industries in the catchment are mainly saw mills, and brick production industries in the Bago Township, but diffuse rather than points source pollution is associated. Typical for diffuse pollution, is that the sum of many, often small, pollution sources collectively result in a significant environmental impact downstream.

The Bago Sub-basin Management Plan is based on two main reports, Characterization of the Bago Sub-basin, Pilot implementing the EU Water Framework Directive (Eriksen et al. 2017) and, Environmental objectives and abatement measures for a healthy Bago River, A contribution to the Bago River Sub-basin Management Plan. (Nesheim et al. 2018.). Both reports are available for download at the project website (Box 1 below).

Responsible for the development of the Bago River Sub-basin Management Plan is the Bago Sub-basin Area Committee. The Committee includes a chair person and the MONREC Minister was elected to be the chair; this was first Kyaw Min San, then it has been Saw Nyo Win. Zaw Win Myint (Bago FD) is the head secretary, Ko Ko Oo (Bago IWUMD) and Htay Aung (Bago DWIR) are co-secretaries. Other members of the Committee are, Environmental Conservation Department (ECD), Department of Agriculture (DOA), Department of Fisheries (DOF), Department of Rural Development (DRD), and the Bago Township Development Committee (Bago TDC). It has now been decided to include ECD and the Bago TDC as secretaries within the Committee. The overall purpose of the Committee's effort to develop this Sub-basin Management Plan is to contribute to the long term sustainable development goal of safeguarding living oceans, rivers and lakes for the benefit, safety and enjoyment of present and future generations. A Non-governmental stakeholder Group has provided input to the process of developing the plan. The secretary of this Group are, U Aung Myo Htut and co-secretaries are Dr. Hein Thant Zaw and U Mg Mg Kyi. Meetings in both the Committee and in the Group, have been held regularly in the planning process.

The combination of an administrative setup including establishment of the Sub-basin Area Committee, a Non-governmental Stakeholder Group, and also coordination of practical water management tasks, represents the first initiative for implementing the National Water Framework Directive in Myanmar. The NWFD is a Myanmar policy framework which specifies aims for coordination, involvement, monitoring, and river basin management to achieve good ecological status.

Chapter 2 of this report presents the background and the rational of the River Basin Management Approach, and the process of developing this plan, including also the participatory process for input to the plan. Chapter 3, presents pressures and trends as identified for Bago (see, Eriksen et al. 2017 for more elaborate information on this). Chapter 4, presents the ecological status of water body groups in Bago, and Chapter 5 presents an overview of abatement measures with reference to, ongoing measures and planned measures within the next five years. Chapter 6 presents the monitoring undertaken as part of this project, and the monitoring program which reflects the current plan for the next five years within the Sub-basin.

**Box 1. For more information:**

For information on the EU Water Framework Directive and regulations on water management at national and regional level, see the central website EU WFD: [http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html)

Publications in the IWRM project can be uploaded from: <https://www.niva.no/en/projectweb/myanmar/publications>

## 2 The process of developing the Bago River Sub-basin Management Plan

### 2.1 The background of the River Basin Management Approach

The River Basin Management approach has been identified as an important strategy; for meeting environmental aims in the EU Water Framework Directive (European Commission, 2000), in the UNSECO IWRM guideline (UNESCO, 2009), and in the Myanmar National Framework Directive (MNWFD) (NWRC, 2014). The basin approach takes a holistic perspective as water flows through a catchment from lakes, rivers and groundwaters towards estuaries and to the sea, and as it is developed based on coordinated decision making across environmental and sector authorities, with input from non-governmental stakeholders. The purpose of a river basin management plan is, based on water quality and quantity objectives, to select and decide upon the measures necessary to protect the water environment for good ecological status and for the uses required by society. This includes the protection of drinking water supplies, protection for recreational usage, protection of areas for conservation of biodiversity, and for the aim of a healthy river (good ecological status).

The rationale of the approach lies in the situation that all components within a catchment area are linked through the hydrological cycle and hence the component parts of a water system need to be understood in relationships with each other. The principle of the river basin management approach is emphasized as an important objective for Myanmar in both the National Water Framework Directive (NWFD) and the National Water Policy (NWP).

The NWFD, Objective 5, defines the approach by clarifying that,

*“River basin areas have to be designated, not according to administrative or political boundaries, but rather according to the river basin (the spatial catchment area of the river) as a natural geographical and hydrological unit”.*

The NWP, section 13.4 states that, IWRM taking river basin / sub basin as a unit should be the main principle for planning development and management of resources, and it further details,

*“Appropriate institutional arrangements for each river basin should be developed to collect and collate all data, inter alia to deal with and enable establishment of basin authorities with appropriate powers to plan, manage and regulate utilization of water resources in the basin”.*

The NWFD is an ecosystem based approach, by its focus on river basin management, and by its focus on ecological status classification. The main water quality element for assessing ecological status is biology. In rivers, macro invertebrates are the main indicator species, while in lakes and reservoirs, the indicator species are phytoplankton and macrophytes. The chemical, and the hydromorphology meaning embankments, the river bed, and water flow, are two other important water quality elements.

The NWFD refers to participation targets; In Principle 7, Restructuring Process (NWFD), which emphasizes the role of citizens and civil society groups: *“holding a number of public consultations at the regional and community levels, and in Principle 4 which requires local governments (Governments*

on State / Region level) to “encourage the active involvement of interested parties”. See also Box 2., about participation.



**Figure 1.** Macroinvertebrate community composition in streams with no or low organic pollution. Low pollution levels have higher diversity, but fewer individuals the species, an ecosystem with higher diversity levers are generally seen to be more robust.



**Figure 2.** Macroinvertebrate community composition in streams with high organic pollution. Polluted areas have less diversity, and more individuals of the species present.

**Box 2. About participation:**

Participation can be defined as a process by which individuals and groups of people come together in some way to communicate, interact or exchange information and provide input around a particular set of issues, problems or decisions and share in decision making to one degree or another. Thus, participation as a concept may cover everything from mere information sharing with stakeholders, to involvement of stakeholders in collaborative committees where discussions and planning of actions occur (Leigh 2004).

## 2.2 The process of developing this plan; Committee Meetings

The Bago Sub-basin Area Committee is an arena for coordination of sector and environmental authorities. The Committee was established as part of a pilot for testing the River Basin Management Approach in the Bago Sub-basin (Zaw Lwin Tun, 2016). Committee members attending meetings include staff from FD, IWUMD, DWIR, ECD, Bago Township Development Committee (Bago TDC) Department of Fisheries (DOF), Department of Agriculture (DOA), Department of Rural Development (DRD), General Administrative Department (GAD), from Bago District and Bago Region levels. The MONRFEC Minister, was elected as the committee chair and the current MONRFEC Minister, and hence the Committee chair is, Dr. Saw Nyo Win (from 2016 to 2017 this was Kyaw Min San). Zaw Win Myint (Bago FD) was elected as head secretary, and Ko Ko Oo (IWUMD) and Htay Aung (DWIR) were elected as co-secretaries. Starting from 2018, ECD, with Director Mai Esther, and the Bago TDC will be included as co-secretaries within the Committee. It was decided in this pilot to focus discussions on pressures and abatement measures in the following four case study area townships; Bago, Waw, Thanatpin and Kawa.

Pilot testing the River Basin Management Approach in the Bago River Sub-basin has been a process over three years. The process has included iterative discussions by sector and environmental authorities. Discussions were supported by a common understanding of pressures and ecological status enabled by presentations prepared by FD, IWUMD and NIVA on monitoring results from the Bago Sub-basin.

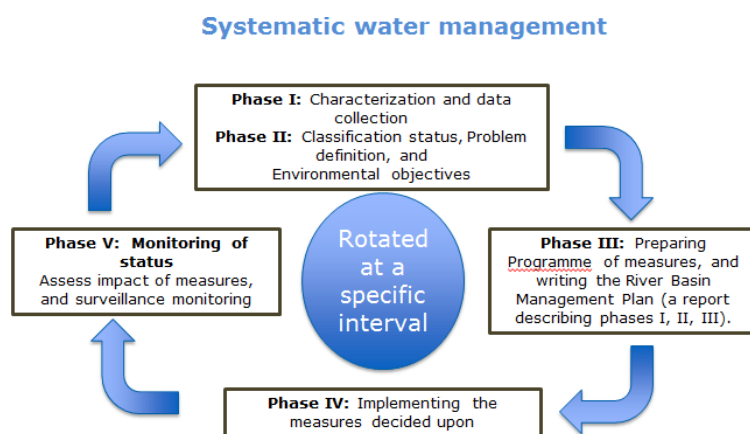
To enable preparation for the meetings, minutes from the previous meeting (s) were disseminated to Committee and Group members. This entailed a simple folder presenting the purpose of the project, update of monitoring results and minutes of main points already discussed (e.g. pressures, and environmental objectives and later also abatement measures). The folder was updated and revised after every new meeting. These factors have been important for a repetition of the issues to be discussed, and it has allowed for an understanding of the approach and points of discussion for new attendants. A note of potential relevant abatement measures prepared by the Forest Department and NIVA was disseminated to people, prior to the discussion of abatement measures.

Abatement measures have been discussed relative to *five water body group types* identified. The five water body groups which were identified based on water use criteria and the of types and levels of pressures included:

- (i) Upstream Bago City Water Bodies
- (ii) Bago City area Water Bodies
- (iii) Downstream Bago City Water Bodies
- (iv) Reservoirs and dam Water Bodies
- (v) Water bodies for Protection of Biodiversity.

Discussions of possible measures in the sub-basin in the Committee and in the Group, did not go in detail on how, or where in the basin measures could be implemented. As part of prioritization among measures, members were asked to consider: Where; 2. When, Costs, (low moderate high), 3. Socially acceptable, 4. Politically acceptable, 5. In line with climate change mitigation objectives, and 6. Identify responsible institutions. The principle of cost-effectiveness was also an important principle in discussions, but sources of funding, and political and social will to implement measures were decisive factors. It was emphasized that awareness raising, for both government staff and for civil society, is critical for implementation of measures.

The Bago Forest Department as the head secretary subsequently after discussing prioritization of measures, interviewed sector authorities to collect information about ongoing abatement measures in the Sub-basin (Table 2). Finally, in a meeting on June 2018, including Committee representatives, and the secretaries of the Non-governmental Stakeholder Group, the table of mitigation measures included in this Plan were agreed (Chapter 5, Table 2).



**Figure 3.** Systematic water management for the development of Sub-basin Management Plan, adapted from systematic water management cycle of the EU WFD.

## 2.3 The participatory approach of developing this plan

Participation of stakeholders is central to governance, as participation is important for a legitimate approach. It can be argued that successful participation is a situation which is dependent on trust and good experience of meaningful former interaction. Presently, there is a need to advance on participation on river basin level (regional level) and on sub-basin level (local level). Municipalities, sectoral authorities, civil society, organizations and industries are necessary players who have either authority or interests related to water. We will continue the work to the best of our ability to increase participation and involvement for good ecological status of waters in Bago. Below we describe the process and the participatory approach of developing the Bago Sub-basin Management Plan.

Non-governmental stakeholders in Bago were first invited to workshop at the Shwe War Hotel in 2015 to discuss participation in water management. An outcome of this workshop was development of the Bago Non-governmental Stakeholder Group, the arena where non-governmental stakeholders could discuss water related issues to provide input to the process of developing the Bago River Sub-basin Management Plan. Subsequent of the workshop, the Non-governmental Stakeholder Group met during 2016-2018 to discuss all important processes/ steps of preparing the River Basin Management Plan; (i) Prioritization water management issues/ problems, (ii) Deciding on environmental targets, (iii) Consultation of Programme of Measures, and (iv) prioritization of measures. Invitation letters were sent to interested parties in sufficient time, two weeks prior to Group meetings. It has been an aim that Committee and Group members should have access to all relevant project information material.

The Bago Non-governmental Stakeholder Group consists of politicians, NGOs, CBOs and private actors. U Aung Myo Htut is the main secretary, and Dr. Hein Thant Zaw and U Mg Mg Kyi are co-secretaries. The main responsibility of these secretaries has been to invite interested parties and

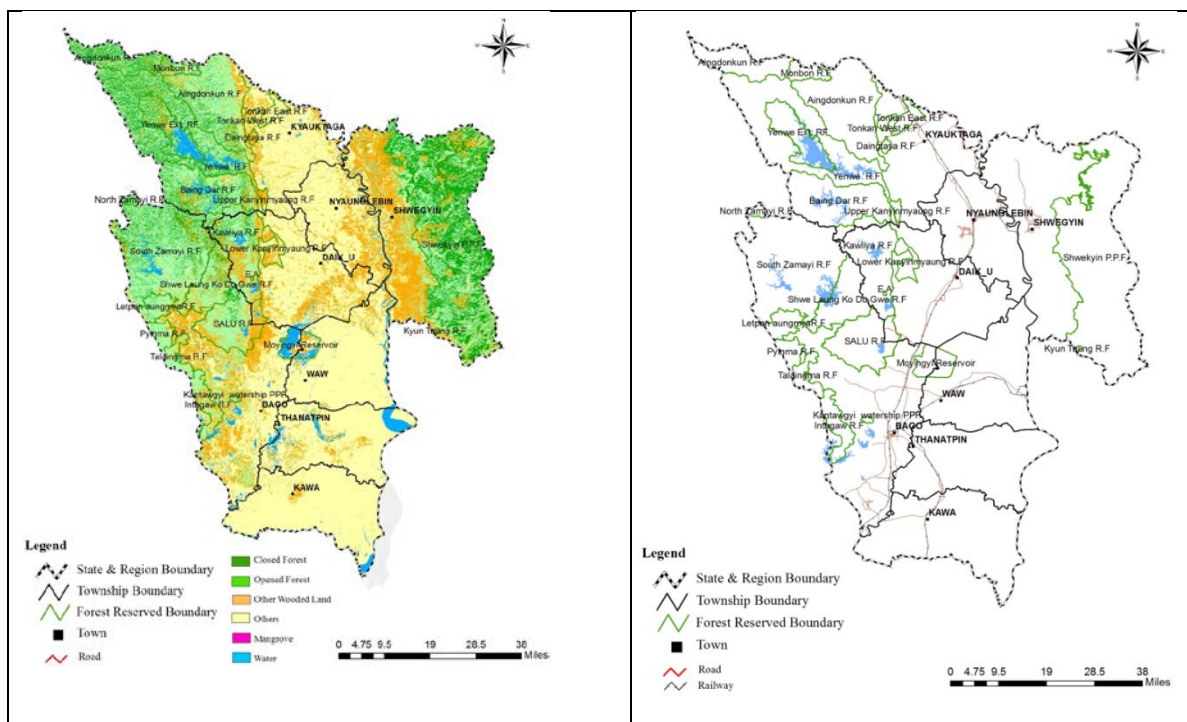
parties impacted to meetings, and to be responsible for the communication between the Committee and Non-governmental Stakeholder Group. There have been bilateral meetings with the secretaries of the Non-governmental Stakeholder Group to get feedback on the content of the Characterization of the Bago River Sub-basin Report (Eriksen et al. 2017), and to get feedback to the report on, Environmental objectives and abatement measures (Nesheim et al. 2018). See also terms of reference for the secretaries of the Non-governmental Stakeholder Group in Appendix B.

### **3 Bago River Sub-basin; pressures and trends**

The Bago River Sub-basin refers to the catchment of the Bago River which flows from the Bago Yoma mountain range at an elevation of 800 m.a.s.l. in the north, running south through meandering sections of over 331 km before it reaches the Yangon River near Yangon City (Haruyama 2013). The Sub-basin is situated between the Sittaung River on the east and the Ayeyarwaddy and the Myintmakha Rivers on the west. It is connected to the Sittaung River Basin by a 61-km long canal, and it flows further south into the Yangon River. Administratively and politically, the sub-basin primarily falls under the Bago District in the Bago Region. The total population in the Bago District was in 2014, 1,770,785. Among these, the majority, 73.8 % was rural and 26.2 % (Department of Population, Ministry of Immigration and Population 2015). The Bago City is the largest city in the Sub-basin with the highest population density in the area.

The upper part of the sub-basin, defined as upstream Bago bridge in Bago City, is characterized by forested areas including scrubland, deciduous and evergreen forests. Forestry is located in this area and available GIS data clearly show substantial deforestation during the last 15 years in the central and northern part of the Sub-basin (Figure 4). Forest cover have decreased significantly between 2010 and 2015 with a 21 % reduction of open forests and 10 % reduction of closed forests (Regional Forest Department, MONREC 2017). Land use in the lower sub-basin, downstream of Bago Bridge, are characterized by agriculture. Water from the Bago River is diverted for irrigation and for maintaining the water level of the Moeyungyi wetland during the dry season. The main use of water in the district is for irrigation, and 34.000 acres (13759 Ha) /year used for summer rice are irrigated from around the third week of November / first week of December until April/May. Flooding is a recurrent yearly problem in Bago City during the monsoon period. Poor drainage systems contribute to the flooding.

Most the population within the Bago district are farmers, and typical farm sizes are ten acres (50 % of the total number of farms). The majority rely on subsistence farming and fishing for their livelihood. Of the local population, farmers represent 40 %, fishermen comprise 30 %; and 20 % are self-employed, while the remainder of approximately 10% are in government service (Ministry of Agriculture and Irrigation, 2012). The area includes some scale industrial activities, more typically saw mills and brick manufactories. There are dams and hydropower stations, but overall industrial activities are few.



**Figure 4.** Left side, land use, land cover map, Bago District; right side, Bago District administration (Source: Maps 2015; GIS and Remote Sensing Section, Forest Department, MONREC).

### 3.1 Current pressures identified in the Bago River Sub-basin Area

Pressures in the Bago River Sub-basin differs within the catchment. In the upper part of the catchment the main pressure is deforestation with impact on erosion and sedimentation downstream. In areas of dense settlements, that is in particular the Bago City Area, and the Waw, Thanatpin and Kawa Township centers, the main pressures are garbage and sewage. Downstream in the catchment, erosion and runoff from agricultural areas are main impacts. In the report, Characterization of the Bago Sub-basin, Pilot implementing the EU Water Framework Directive, Eriksen et al. (2017) presents a more thorough description of pressures identified in the Bago Sub-basin.

**Table 1.** Meeting for the discussion of prioritized management issues in Bago (September 2016).

Bago Township	Thanatpin Township	Kawa Township	Waw Township
Sewage Garbage Sand mining Industrial waste River Bank Erosion and Sedimentation	Salt water intrusion Invasive shell species destroying paddy fields High concentration of phosphorus and nitrogen Groundwater pollution Riverbank erosion and sedimentation	Salt water intrusion Invasive shell species destroying paddy fields High concentration of phosphorus and nitrogen Riverbank erosion and sedimentation	Salt water intrusion Invasive shell species destroying paddy fields High concentration of phosphorus and nitrogen Riverbank erosion and sedimentation

Abstraction of water, according to communication with the secretaries of the Bago Sub-basin Area Committee, cause no significant negative impact on water availability. An issue with regard to the sufficient water in the dry season is reported however, for the Moeyungyi reservoir (Shrestha et al. 2017). This wetland is used to supply water to the Bago–Sittaung canal during the dry season as a source of irrigation water for rice farmers. There is also an issue on how the water flow management regime contributes to increased flooding and that drains in poor condition contribute to flow conditions (Members of the Bago Non-governmental stakeholder Group). Dredging and river improvement works were done in the tributaries to the Bago River (for more on flooding, see Kawasaki et al. 2017).

**Upstream in the Bago River catchment;** deforestation upstream the Bago City area cause soil erosion and increased turbidity in the river. The soil binding capacity of the forest is substantially reduced with removal of forests. With erosion, there is leaching of nutrients such as nitrogen and phosphorus which increase the nutrient situation downstream. The increased turbidity, cause downstream sedimentation. Furthermore, a combined effect of sedimentation and water abstraction/ diversion cause reduced discharge rates increasing salt water intrusion from the sea into the lower reaches of the Bago River. The impact of erosion and salt water intrusion is particularly high in the townships of Kawa and Thanatpin located further south.

**Dense settlements, the Bago City area and township centers;** disposal of garbage and sewage directly into the Bago River were identified by the Committee and the Group as the two major pressures in the Bago Sub-basin. Disposal of garbage block the drains, and sewage and waste water are harmful for usage of water for domestic purposes. Both are harmful for a healthy river. Bacteria (*E. coli* and faecal coliforms) are detected, indicating sewage or animal waste contamination.



**Figure 5.** The photo represents a garbage dump along the Bago River (Source: Nesheim, 2016).

**Agricultural plains downstream the Bago City Area;** Fertilizers used on agricultural plains at the onset of the monsoon and for summer crops alongside the Bago River cause runoff of nitrogen and phosphorus into the river. Runoff of nitrogen and phosphorus and sediments are particularly high in the rainy season. Animal husbandry alongside the river, or close to reservoirs, are destructive as trampling by animals destroys vegetation cover increasing run off to water bodies, and their dumping is a source of faecal microbes and nutrients. The high nutrient levels in the water may cause toxic algal blooms and reduce oxygen levels in the water; both of which are harmful for aquatic organisms.



### Sand mining and erosion

Sand mining was emphasized as an important problem in Committee meetings and in Bago Non-Governmental Stakeholder Group meetings. Pyinbongyi sand from the banks of Bago River is renowned for its high quality and there has in the recent decades been mushrooming of river sand mining activities. Related problems include riverbank erosion, river bed degradation, river buffer zone encroachment, and deterioration of river water quality.

### Electro shock and chemical fishing

Fish farmers culture common or desirable species, contributing to the disappearance of indigenous species. Electro shock, and chemical fishing is furthermore a problem in the Bago area. Fishing in the spawning period is not allowed, but the degree that this regulation is violated is not known.

**Alien species;** this pressure refers to invasive introduced species; in the Bago Sub-basin people complained about invasive shell species.

## 3.2 Trends of development and industrialization

Increased development and industrialization are expected in Bago:

There are plans to have 100% irrigation of crops. As a general estimate of water requirements for irrigation, 6 acre/feet is needed to irrigate 1 acre of land (statistical data from the Bago Irrigation Department, 2014).

*The Hantharwady Development Public Company will invest in Bago Region, Oathar town and Indagaw.* The company has secured state approval to invest a about K250 billion (\$184 million) for a mixed-use land development comprising housing and industrial park projects (Gaung, 2017).

*Yeni Industrial Township* in Bago Region: The Township is planned to accommodate several focused clusters of light industries, textiles and garments, paper and pulp, printing and packaging and warehousing (Golden Glory Group, 2018).

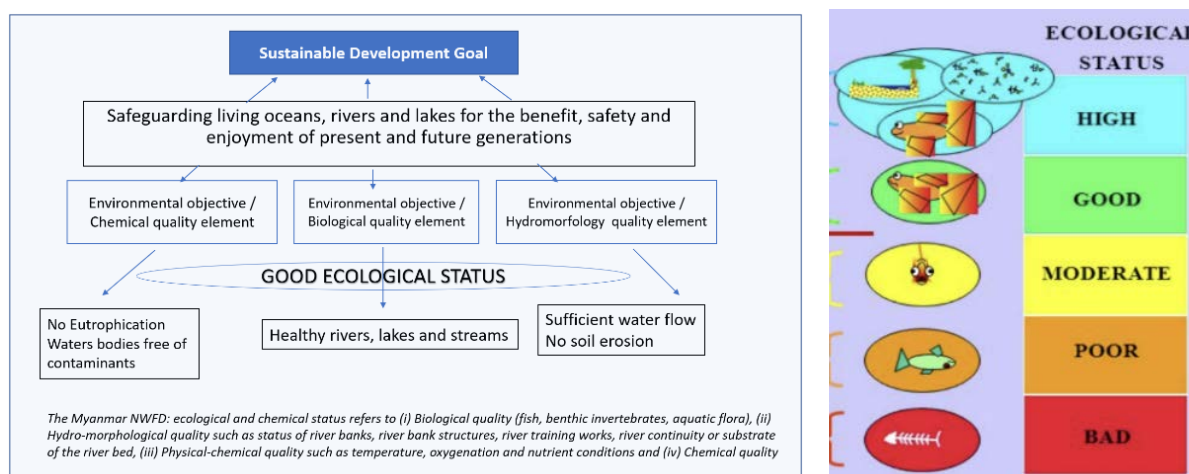


**Figure 6.** The picture illustrates an expected industrialization trend in Bago. (Source: Myanmar Carlsberg website, accessed May 2018).

## 4 Bago River water quality and the risk of not meeting good ecological status

The Committee and the Group discussed long term environmental objectives (Figure 7). The environmental objectives discussed included: No eutrophication; Water bodies free of contamination, Healthy river, lakes and streams, Sufficient water flow, and No soil erosion. Reaching these objectives will result in Good Ecological Status. Furthermore, a situation which satisfy these environmental objectives should allow for, Safeguarding living oceans, rivers and lakes for the benefit, safety and enjoyment of present and future generations.

The alternative to discuss of short term objectives, is discussion of realistic abatement measures for implementation. To facilitate for an overview for this discussion, the concept of water body groups was introduced; that is, water bodies were grouped according to; (i) *water use criteria*, (ii) *types of pressures*, and (iii) *the distance in status from reaching environmental objectives*. In total five water body groups were; Upstream Bago City Area Water Bodies, Bago City Area Water Bodies, Downstream Bago City Area water bodies, Reservoirs and dam Water Bodies, and Water Bodies protected for biodiversity. These water bodies are assessed below with reference to the risk of not meeting environmental objectives.



**Figure 7.** The figure on the left present the relationship between the environmental objectives in the project – good ecological status and the sustainable development goal. The figure on the right, presents the different normative ecological status classes as referred to in the EU WFD.

### 4.1 Upstream Bago City Water Bodies

Considering the ecological status assessment, i.e., the chemical, the biological and the hydromorphological elements, it appears that upper parts of the sub-basin system upstream of Bago city are mostly not at risk (Figure 9). Although a relatively large proportion of this area is influenced by human activity such as deforestation, agriculture and dams, the ecological status in this area is in general of good or high condition based on sampling and analysis in 2016 and 2017. The “no erosion objective” however, is challenged in deforested areas.

Results indicate high levels of sediment and nutrient transport in the rainy season. Excess sediment deposited on the river bed can have significant negative impacts on ecological status by clogging natural substrates and reduce habitat availability. At this moment, there is not sufficient knowledge available to quantify the effects of high sediment loads upstream of Bago City.

## 4.2 The Bago City Water Bodies

Water bodies within the limits of Bago City are deteriorated by various types of human activities and sewage inputs, resulting in the water bodies not reaching good ecological status (Figure 9). Their status should be improved by implementing several abatement measures.

In the main stream of the Bago River, both total phosphorous and nitrogen increase substantially to around 40 µg/L Tot-P and 400 µg/L Tot-N immediately downstream of city. This is a more than 3-times increase in phosphorous concentration, and a doubling for nitrogen concentration, compared with measurements taken in the main stream of the Bago River just upstream of the city limits. In the Mazin Chaung stream, that drains the Mazin reservoir, the increase in phosphorus is pronounced. The water leaving the reservoir is very low in Tot-P with a concentration around 7 µg/L, while the concentration is 40 µg/L just before the confluence with the main stem of Bago River after passing through the city. The high concentrations of phosphorous likely stem from waste water and sewage from settlement areas, while nitrogen stem from agricultural areas (application of fertilizers). Bacteria (*E. coli*) is recorded in water samples downstream of the city but not above, indicating the effect of untreated sewage being discharged to the river in Bago City.

## 4.3 Downstream Bago City Water Bodies

The assessments of water bodies below Bago City indicate that they are not fulfilling the environmental criteria of good ecological status (Figure 9). Concentrations of Tot-P and Tot-N are very high compared with upper parts of the Sub-basin with values of > 1000 µg/L recorded for both nutrients. This can be related primarily to input of sewage from Bago city, extensive agricultural areas along the downstream parts of the river as well as other human activities.

## 4.4 Dams and reservoirs Water Bodies

Two reservoirs in the Bago Sub-basin have been investigated regarding water quality.

The catchment of Kandawgyi reservoir, which is an important source of drinking water for the Bago City, drains an area of protected public forest, a protection that has been in force since 1997. In addition, more than 50 % of catchment area is occupied by a private rubber plantation. The Myanmar Drinking water standard is the reference document related to water bodies used for drinking water. Water quality in the reservoir is overall good with a low concentration of Tot-P of 8 µg/L and only trace amounts of other chemical substances. However, total nitrogen concentration was 390 µg/L Tot-N which is fairly high compared with other places in the Bago sub-basin. More information is needed on background concentrations in this area as well as additional sampling of e.g. pesticides would be informative in a drinking water context.

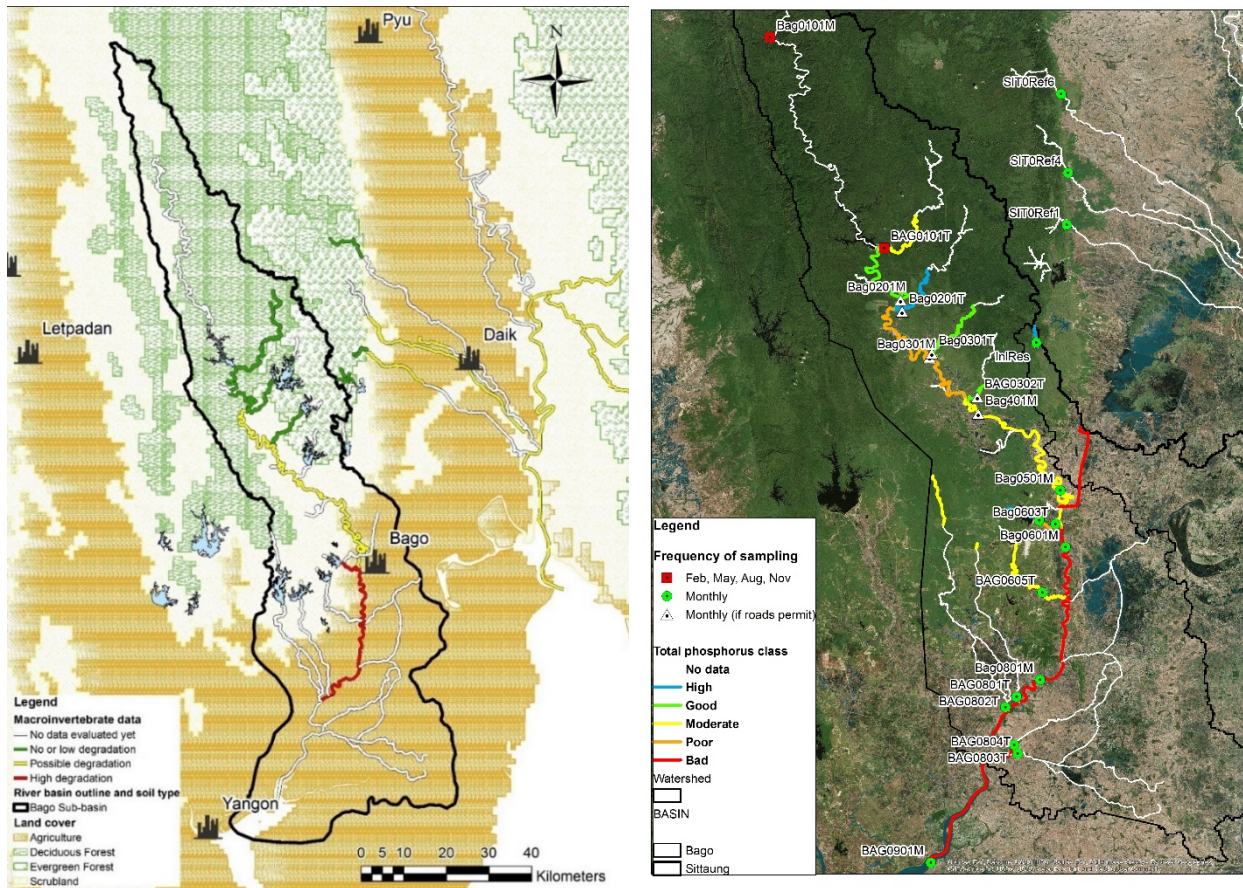
The Mazin reservoir is used for irrigation purposes primarily, i.e. not drinking water, and the catchment is also partly covered by rubber plantations. Chemistry is very similar to that of Kandawgyi, with 7 µg/L Tot-P and 388 µg/L Tot-N. There are only trace amounts of other substances.

## 4.5 Water body for protection of Biodiversity; the Moeyungyi Wetland Wildlife Sanctuary

This nature reserve within the Bago Region was established in 1988 and became the first Ramsar site in Myanmar in 2004. The protection of Moeyungyi is important and it should be prioritized as an integrated part of the River Basin Management plans for the Bago Sub-basin Area (Draft management plan for the Moeyungyi Ramsar site, MONREC, 2017). The wetland consists of a shallow and turbid lake which could be in danger of eutrophication, and of impacts from pesticides and various toxic compounds that enters the wetland from the surrounding areas. Average Tot-P and Tot-N values, measured at 6 stations in the reservoir in November 2015, were 25  $\mu\text{g P/l}$  and 318  $\mu\text{g N/l}$ , respectively. These are relatively low concentrations considering the perceived risk of eutrophication. Filling of the reservoir during the rainy season has most likely diluted the nutrients in the reservoir in November, as samples taken in May 2015, at the end of the dry season, showed much higher TP and TN concentrations; 185  $\mu\text{g P/l}$  and 1700  $\mu\text{g N/l}$ , respectively.



**Figure 8.** Upper left (1), is represent upper part of the Bago catchment, (2) is the Bago River along Bago City; (3) Is from restoration of drains within the City, (4) Agricultural areas downstream Bago City, (5) Kandawgyi Reservoir, (6) Moeyungyi Ramsar site (Sources: Bago Forest Department, Marit Mjelde, Ingrid Nesheim).



## 5 Abatements measure programme

**Table 2.** The table presents abatement measures for reaching good ecological status of Bago River Sub-basin (Figure 9).

Department	Pressure	Impact of pressure	Related environmental objective	Abatement measure			Time-line	Where	Effectiveness of measure (expected effect)	Incentive & enforcement	Funding
				Ongoing (i)	Planned implementation 2018 (ii)	To be implemented within 5 yrs (iii)					
Forest Department (FD)	Deforestation	Soil erosion, sedimentation, reduced water quality	Healthy rivers, No erosion	Ban on logging	Extension of reserved forests and protected public forests	Buffer zone in the Bago upstream area, restoration program	10 years	Bago Mountain Range	Relatively good, illegal logging continues to some extent. Measures, (i), (ii) only marginal <i>effect on the river ecosystem</i>	Monitoring and Patrolling in the reserved and protected public forests; collaboration with police force and general administration department are needed.	Regional plus Union Government
				Reforestation plantation	Awareness raising of people		10 years	Bago, Taungoo, Tharyarwaddy, Pyi Districts	Measures, (i) only marginal effect on the river ecosystem as reforestation occurs away from the river.	<i>Protect</i>	Regional plus Union Government
					Awareness buffer zone		Unlimited	Bago	Time is needed for impact, but sustainability is high if awareness is duly raised.	Distribution of knowledge materials	Regional plus Union Government
	Use of fertilizers / pesticides in tree plantations	Contaminated waters	No contamination, Healthy rivers, lakes and reservoirs			Avoid deforestation in buffer zone	Unlimited	Upstream Bago Rivers ditto	Maintaining buffer zones improves the river ecosystem	Erosion Control and Granting community-based forests - enforcing rules and regulation	Regional plus Union Government
						Reforestation buffer zone	Unlimited			Erosion control and granting community-based forests - enforcing rules and regulations	Union Government
						Termination of leasing rubber plantations in the catchment of Kandawgyi	Unlimited	Kandawgyi	Reduced contamination of water is expected after time.	Introduction of practicing payment for ecosystem services and water pricing	Bago Township Development Committee

Department	Pressure	Impact of pressure	Related environmental objective	Abatement measure			Time-line	Where	Effectiveness of measure (expected effect)	Incentive & enforcement	Funding
				Ongoing (i)	Planned implementation 2018 (ii)	To be implemented within 5 yrs (iii)					
Irrigation and Water Utilization Management Department (IWUMD)	Flood Sedimentation	Inundation	To increase farmers' income and local people's well fare through increased agricultural productivity by inundation prevention with improved irrigation facilities.	Repairing & maintenance works of Bago River  Flood protection  Provide storage reservoirs in Bago River Sub-basin  Strengthen and reshaping work for Bago flood protection embankment (Bago and Waw TS)	Excavation work of natural drainages in the Bago City area; river basin and facilitated with outlet structures construction works.  Re-excavation of drainages channel; convey to the Bago River from the boundary of Bago University Area.	Bago Sittaung Rivers flood protection work: - Strengthening work of ousting embankments,  - Construction of flood prevention dikes,  - Re-excavation of natural streams, creeks in unsilted condition  Construction of sluice gates in Thanatpin Township	Continuous	Within Bago (east) Region especially Waw, Thanatpin, Kawa and Bago Townships	Measures will mitigate flooded area & decrease period of inundation in low lying area of Bago River Sub-basin downstream	Irrigation Law (2017)	Regional Government
Directorate of Water Resources and Improvement of River Systems (DWIR)	Sand mining	Bank erosion	Development of river channel to reduce erosion	Protection for bank erosion:		River bend cutting	Depend on budgets	Along the Bago River channel	River bank erosion reduced, and flood mitigated	The Conservation of Water Resources and Rivers Law (2006)	Regional plus Union Budget
	Flooding	Degradation of water quality	Healthy rivers, lakes and streams	- retaining wall,  revetments, groyne etc.		Protection for bank erosion				The Conservation of Water Resources and Rivers Rule (2013)	
	Sedimentation		Reduce bank erosion	Control license for sand mining along Bago river  No more sand mining allowed in Bago City Area		Inspect and control license for sand mining	Unlimited	Along the Bago River channel	River bank erosion reduced, and fish habitat restored	Impacts of sand mining like erosion and fish habitat destroy can be reduced	No special fund needed

Department	Pressure	Impact of pressure	Related environmental objective	Abatement measure			Time-line	Where	Effectiveness of measure (expected effect)	Incentive & enforcement	Funding
				Ongoing (i)	Planned implementation 2018 (ii)	To be implemented within 5 yrs (iii)					
Environmental Conservation Department (ECD)	Waste water disposal from the industrial zone and city area  Polluted water	Contaminated water  Destruction of water and river ecosystems  Reduced water quality	No contamination (toxic, polluted water)  Good ecosystem status, healthy rivers	Inspection of industry for waste water disposal and EIA regulation; Enforcement to follow the guidelines of EIA, IEE, EMP  Measuring water quality  Monitoring of waste water discharge	Data collection - inspect industry after complaint  Measuring River water quality,  Monitoring on the discharge of waste water  Develop Regional Action Plan for waste water management	Regular monitoring downstream point source pollution  Implementing Regional Waster Water Action Plan	Continuous	Bago River	Extension work can raise the awareness of the people and increase their willingness to conserve the water <u>environment</u> , <u>this</u> will reduce contaminated water to some extent	Law enforcement, ECD will provide certificate to the industry who obey law and rules	Regional Government
Department of Fisheries (DOF)	Extinction of native fish species due to herbicides/ pesticides  Waste water disposal into natural ponds  Sedimentation due to natural and man-made issues  Reduced fresh water fishing area boundaries  Poor conservation of the environment	Reduced fresh water fish resources  Reduced number of fish species  Destruction of ecosystems  Reduced production of fish resources	Sustainable fish production	Field inspection, observation and data collection  Extension works by posters and pamphlets  Law enforcement  Breeding fish species which are in danger of extinction  Increased breeding of fish species	Input of necessary infrastructure into the lab to test fish diseases, soil and water quality  Initiate awareness raising training  Expert and qualified staff recruited or trained staff/capacity building	Data collection of fish resources in Bago Region,  Breeding of fish species which are in danger of extinction in	Continuous	Fresh water fishing areas in the whole Bago River  Domestic fishing allowed in lakes all over Bago Region	Fish production increased for regional and local food security	Long term permission for local fishermen  High production per acre techniques (incentive)  Expand acres of fish breeding lakes  Introduce fish breeding with Pen culture/ Cage Culture systems in natural ponds, lakes and dams,  Introduction of capture base culture system	Union Government



Department	Pressure	Impact of pressure	Related environmental objective	Abatement measure			Time-line	Where	Effectiveness of measure (expected effect)	Incentive & enforcement	Funding
				Ongoing (i)	Planned implementation 2018 (ii)	To be implemented within 5 yrs (iii)					
Department of Agriculture (DOA)	Pesticides	Contamination Toxicity	Health risk	Awareness raising and inspection in accordance with Pesticide Law	Extension work - training/discussion  Protection and suppression of integrated pesticides  Model plot which show good agriculture practice  Organic Farming	Extension and awareness raising by testing the pesticide residues in the water  Awareness raising on Integrated nutrient management  Try to test heavy metals in the lab	To be initiated in 2019 and continuous	Bago Thanatpin Waw Kawa	Reduced run off of pesticides to the river, long term effect expected.	Collaboration with farmers	Regional plus Union Government
	No systematic use and excessive utilization of chemical fertilizers,  Weak to use natural fertilizer	Eutrophication, imbalanced nutrient, Weak soil improvement  Toxic soils in the agricultural fields  Algal blooms,  Low oxygen level, Soil acidity	No Eutrophication; Healthy rivers	Soil testing to balance the use of fertilizers and the needs of plants  Awareness raising and Inspection work in accordance with Fertilizer Law  Model plot which show good agriculture practice  Organic Farming	Extension work (Training/ Discussion)  Model plot which show good agriculture practice  Organic farming	Extension and awareness raising by testing the pesticide residues in the water	To be initiated in 2019 and continuous	Bago Thanatpin Waw Kawa Townships	Low impact on River water	Collaboration with farmers	Regional plus Union Government

Department	Pressure	Impact of pressure	Related environmental objective	Abatement measure			Time-line	Where	Effectiveness of measure (expected effect)	Incentive & enforcement	Funding
				Ongoing (i)	Planned implementation 2018 (ii)	To be implemented within 5 yrs (iii)					
Department of Rural Development (DRD)	Intrusion of waste water into drinking water well and lakes	Contaminated water Toxic water	Provision of safe drinking water quality from wells and lakes in line with the Myanmar Drinking Water Standard	Construction of wells and lakes: 64 shallow wells, 3 deep wells by machine; 5 wells by hand; 1 soil lake, 304 other lakes  Provision of electricity in villages: Mya Sein Yaung Project lend 100 lakhs per village (as capital supply)	102 shallow wells and 234 deep wells made by machine.  A hand dug well  35 Soil lake, other 119 lakes.  Total (491) wells and lakes are planned during 2018	From 2016-17 to 2020-21:  570 shallow wells and 859 deep wells made by machine.  37 wells by hand. 127 Soil lakes, other 1165 lakes.  Total (2758) wells and lakes are planned	Unlimited	Bago, Taungoo, Pyi and Tharyarwaddy Districts	-	-	Regional plus Union Government, and UNICEF
	Scarcity of drinking water										
Bago Township Development Committee (Bago TDC)	Waste & waste water	Cloaked drains Poor water quality Flooding Health risks Poor environmental conditions	Sufficient water flow No eutrophication No contamination of water Healthy rivers, lakes and streams	Truck to collect waste Garbage collection campaigns 3 garbage bins in city centre, emptied every day	Garbage bins near the public places Fencing alongside the Bago market to prohibit throwing of waste to river Inspection of waste handling by shopkeepers in Bago City	Awareness -sign alongside river Awareness information folder for school Recycling awareness	Unlimited (yearly)	Bago Township	Awareness raised to improve waste collection in Bago City area,	Award giving and penalty	Tax and revenues from people of Bago City
	Sewage	E. coli bacteria in water, nutrient pollution reduced level of oxygen in water health risks poor environmental conditions	No eutrophication No contamination of water Healthy rivers, lakes and streams	NIL	Regular awareness campaigns Patrolling along the Bago river, in particular in Bago City Area	Treatment plant established Regular Awareness campaigns	Unlimited (yearly)	Bago Township	Pollution reduced and river water quality improved for domestic water use, and water ecosystem restored	Award giving and penalty	Tax and revenues from people of Bago City

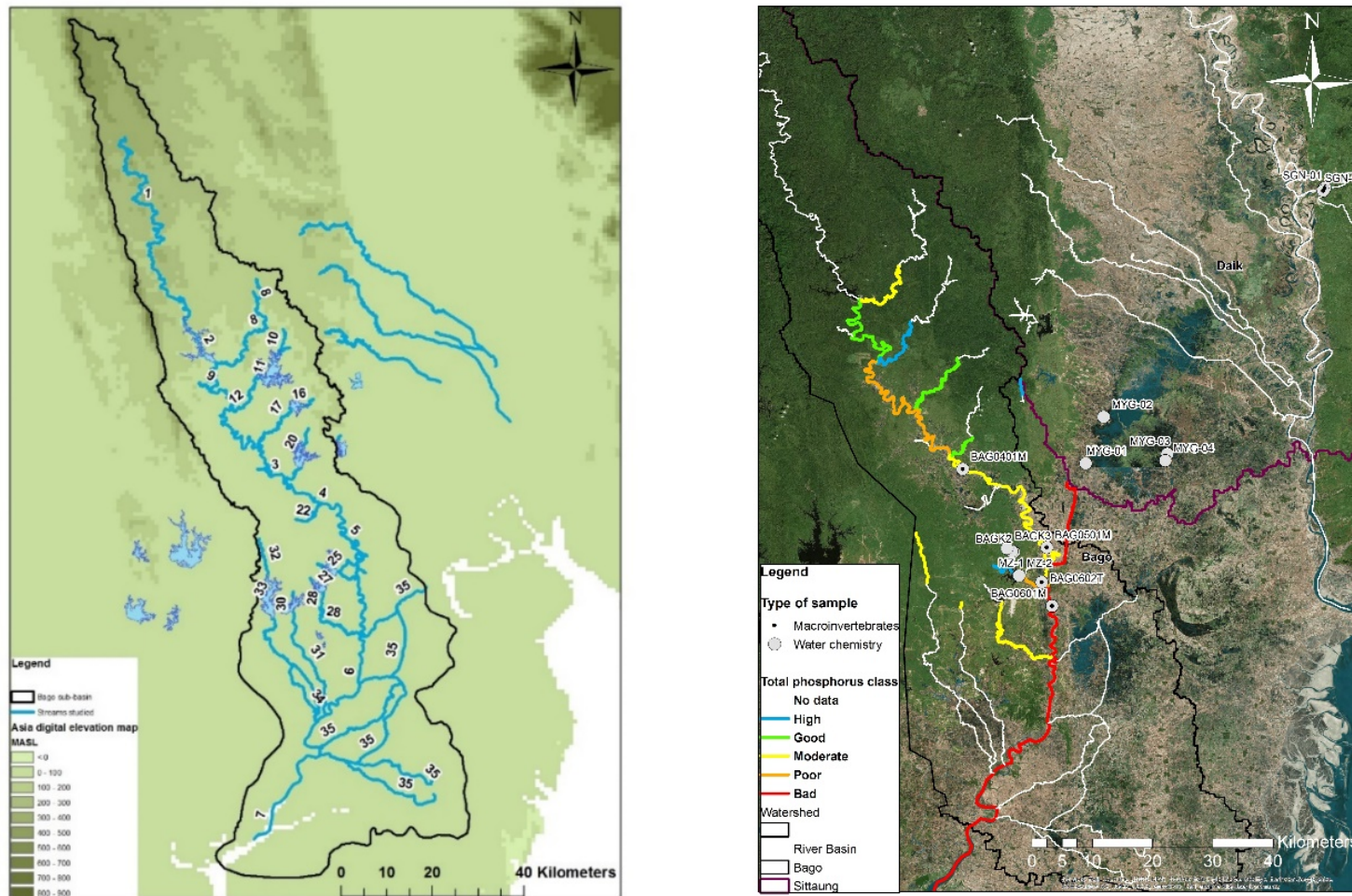
## 6 Monitoring programme in Bago Sub-basin

A monitoring program is a required part of a water management plan for surface and ground waters and for protected areas (Nesheim and Platjouw 2016). During 2015, 2016, and 2017 *surveillance monitoring* of chemical, biological and hydromorphological parameters were undertaken in, to a variable extent, 44 stations within the Bago River Sub-basin to establish an overview of water quality status (Figure 10a). This overview of water quality status has been used to determine the *operational monitoring* program. Operational monitoring, that is the assessment of changes in water status classification has been undertaken at a sub-set of stations in the past 2 years using repeated sampling since November 2017 (Figure 10, and Table 3). This program has focused primarily on monitoring water bodies at risk, having moderate and poor ecological status, and on water bodies of particular human usage or need for protection. The current monitoring program includes sampling stations in areas of significant human pressures i.e. dense settlement areas and areas with agricultural fields close to the river, industry, and in water bodies of specific human usage or management purposes, i.e. Kandawgyi, Mazin, Moeyungyi. The network of operation monitoring stations will be continuously revised based on results from the sampling programme, both from evaluation of samples already taken (macroinvertebrates) and ongoing sampling.

Water bodies not at risk, having high or good ecological status in areas with a low risk of impact were grouped and monitored less frequently (Table 3). Regarding operational monitoring, neighboring waterbodies with the same status class are often merged to create less monitoring sites.

**Table 3.** Monitoring frequency for different water quality elements (Eriksen et al. 2017). Note, water discharge measurements should if possible utilize existing hydrological information.

Quality elements	Frequency waterbodies at risk/possibly at risk	Frequency waterbodies not at risk
Macroinvertebrates	Once a year (in the dry season)	Every six years (in the dry season)
Discharge measurements*	Monthly to quarterly	Quarterly every six years
Morphological surveys	Every 3 years (in the dry season)	Every six years (in the dry season)
Physico-chemical elements	Every third month	Quarterly every six years



**Figure 10.** Left: The 35 water bodies for the Bago River sub-basin presents monitoring stations in Bago Sub-basin in 2016 (Source: From Eriksen et al. (2017)). Right: Overview of current monitoring stations samples supported by the IWRM project. Chemical water quality parameters have been sampled monthly by a team from FD and IWUMD. NIVA has monitored biological water quality two times a year.

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## **Appendix A. Mandate and terms of reference for the Bago Sub-basin Area Committee**

*Introduction:* The Myanmar National Water Framework Directive (NWFD) specifies the goal of river basin management in Myanmar by implementing and developing River Basin Area Water Management Plans.

The IWRM project (a collaboration between the Forest Department, MONREC and NIVA in Norway) is pilot implementing the sub-basin management in the Bago Sub-basin. As part of this project, two institutions have been established in Bago, a Bago Sub-basin Committee which consists of sector and environmental authorities, and a Bago Sub-basin Non-governmental Stakeholder Group. The Committee is responsible for the development of a holistic Sub-basin Water Management Plan. The development of this plan is based on several decision-making steps, including;

- (i) deciding upon main pressures, that is deciding upon prioritized water management issues,
- (ii) deciding upon short term environmental goals, and
- (iii) deciding upon abatement measures for implementation

The process of developing this plan shall involve feedback and input from Non-governmental Stakeholder Group related to each of the above decision making steps.

### Terms of Reference for the Bago Sub-basin Area Committee

Mandate of the Chair and Responsibilities of Secretaries of the Committee were confirmed and agreed by the parties June 2018. The TOR has been discussed in bilateral meetings with the chair and the secretaries in 2017. The secretaries of the Bago Non-governmental Stakeholder Group have commented on draft versions of the TOR.

- a) The Sub-basin Area Committee (hereafter the Committee) shall include all relevant sector and environmental authorities within the Sub-Basin Area, this refers to such as, water related regional level departments, Hluttaw regional level, and Township Development Committees shall get invitations to meetings, including agenda and background information.
- b) The Committee shall include as the minimum three elected secretaries, one head secretary and co-secretaries. The elected secretaries need to be institutions with a core role regarding the use or management of water resources.
  - (1) In the Bago Sub-Basin Area Committee, the FD is the main secretary and the IWUMD, and the DWIR are co-secretaries. ECD, and the Township Development Committee will be co-secretaries from 2019.
- b) The Committee shall include one chair person. In the Bago Sub-Basin Area Committee, the Bago Ministry of Natural Resources, Forests and Environmental Conservation (MONRFEC) Minister is elected to be the chair.
- c) The Committee has responsibility for ensuring coordination of practical water management tasks, that is a cost efficient and effective monitoring program in the sub-basin, specific institutional monitoring (sampling, analysis, and interpretation of samples) and making data available (access to database).
- f) The committee has responsibility for the development of a holistic river basin management plan. The plan shall include information on the following topics:
  - (1) A description of water users, water usage, specification of economic uses, description of pressures in the Sub-basin.
  - (2) Data on water quality and quantity and a risk assessment of not reaching the environmental objectives.
  - (3) Description of monitoring efforts; location of sampling stations, and the parameters analyzed.
  - (4) A table of prioritized programme of measures. The table should as far as possible have information on (i) costs of measures, timeline, where in the sub-basin the measure will be implemented, the expected effectiveness of the measures relative to the pressure and the environmental objective, timeline, incentive / enforcement, and funding.
  - (5) A description of the process of developing the plan, including the steps and approaches for

involvement of Non-governmental Stakeholders in the Sub-basin.

- (g) Approval of the Sub-basin Management Plan: The river basin management plan when completed shall be sent to the NWRC for approval.
- h) The water management cycle, with reference to the National Water Framework Directive, refers to a ten-year cycle, therefore a the Sub-basin Management Plan need to and the plan shall be updated every fifth year.
- (i) Committee meeting frequencies: During development of the plan, the Committee need to meet as a minimum three times a year – to discuss, - coordination of practical water management tasks, and - decision making with reference to the water management cycle (1. characterization, 2. prioritized water management issues (pressures), programme of measures and prioritized programme of measures). During the phase of implementing measures, the Committee should meet at the minimum two times a year to discuss progress, and possible adjustments on agreed mitigation measures.
- (i) Relationship to other committees and institutions: Information about the intention to develop the Sub-basin management plan, the time table of the development, and important milestones of developing the plan should be passed on to other relevant committees in the (environmental and climate change committee) region – district – townships. Information needs to be forwarded to the Hluttaw regional level.
- (j) Support for the Non-governmental Stakeholder Group, including budget; see the TOR of the NGS Group.

#### Mandate & Responsibility of the Chair

- a) The chair has the overall responsibility for - that the secretaries perform according to their mandate
- b) Overall responsibility for decision making in the committee
- c) Overall responsibility for that the, Sub-Basin Area Management Plan is developed.
- d) Overall responsibility for sending the Sub-Basin Area Management Plan to the NWRC. If *Basin Committee* exists being responsible for the development of a *Basin Plan* consisting of all the Sub-basin Area Plans, then it is the responsibility of the Basin Committee Chair to submit the Plan to the NWRC for approval. The Committee members are responsible for gaining accept of the plan by the Union level Department prior to sending the plan to the NWRC.

#### Responsibilities of Secretaries of the Committee

- a) The secretaries are responsible for sending out invitations to Committee meetings according to the agreed work plan and timeline for developing the plan. Invitations need to be received at the minimum two weeks before the meeting. Invitations need to specify the agenda and the place for meetings.
- b) The secretaries are responsible for suggesting the agenda of meetings to the Committee chair. After acceptance from the chair, invitations including the agenda can be sent to Committee members
- c) Invitations shall be sent to all relevant sector and environmental authorities within the Sub-Basin Area.
- d) The secretaries are responsible for preparing minutes – and for sending out minutes to Committee members.
- e) Responsible for making available relevant known background information (including such as pressures, and data on water quality and quantity) to Committee members.
- f) The secretaries are responsible for making sure that the Non-Governmental Stakeholder Group is well functioning – meaning that NGOs, CBOs, private and civil society - are as appropriate invited to meetings, and that two secretaries of the NGS are invited to Committee meetings to ensure transparency.
- g) A budget and additional human resources need to be made available to the institutions holding the main secretary. The budget also needs to cover necessary support for the Non-governmental Stakeholder Group; this may refer to such as printing expenses, or expenses related to sending invitations and rent of location for meetings. It is suggested that the regional government could support these activities.



## **Appendix B. Terms of reference for the secretaries of the Non-governmental Stakeholder Group**

*Introduction:* The Myanmar National Water Framework Directive (NWFD) specifies the goal of river basin management in Myanmar by implementing and developing River Basin Area Water Management Plans.

The IWRM project (a collaboration between the Forest Department, MONREC and NIVA in Norway) is pilot implementing the sub-basin management in the Bago Sub-basin. As part of this project, two institutions have been established in Bago, a Bago Sub-basin Committee which consists of sector and environmental authorities, and a Bago Sub-basin Non-governmental Stakeholder Group. The Committee is responsible for the development of a holistic Sub-basin Water Management Plan. The process of developing this plan shall involve feedback and input from Non-governmental Stakeholder Group related to each of the above decision making steps.

The development of this plan is based on several decision-making steps, including;

- (i) deciding upon main pressures, that is deciding upon prioritized water management issues,
- (ii) deciding upon short term environmental goals, and
- (iii) deciding upon abatement measures for implementation

The Non-governmental Stakeholder Group is established to provide an arena for discussion of water issues, and specifically, the main decision making points needed to develop the Sub-basin Management Plan. It is the responsibility of the Committee Chair to establish a Non-governmental Stakeholder Group (hereafter the, Group) in the sub-basin. Once the Group is established, including support for election of secretaries, the Group itself needs to be responsible for its organization and administration. Possible members of the group are main NGOs, CBOs and main civil society actors on regional and sub-basin level.

The *Committee* is responsible for providing if needed, a location where the Group can meet, and budget to allow for printing of material, and sending invitation letters. The *Committee* shall prior to meetings make available the following information:

- (i) information about the chemical and physical water quality data and the biological water quality data if this exists - preferably as part of access to the water quality database, or as part of information provided for by the Committee.
- (ii) Information about current decision-making issues as discussed by the Committee, and a summary of the minutes.

### **Mandate and responsibilities of the Non-governmental Stakeholder Secretaries**

Three elected secretaries are responsible for administrating the Group. The secretaries need to receive support for their continuous election from the other Group members every year. After three years, replacement of secretaries should be encouraged. Mandate and responsibilities were approved by the parties June 2018.

#### **a) Invitations, and enabling involvement:**

- a. The secretaries are responsible for sending invitation to members, to NGOs, CBOs, and civil society actors, including agenda for the meeting, at least two weeks before the meeting. The meeting should be organized in an easily accessible place. Invitations must be forwarded by the appropriate means.
- b. The secretaries are responsible for consideration of gender issues, by ensuring that, attendants at Group meetings also include women, and that gender issues when relevant are considered.
- c. The secretaries are responsible for ensuring the voice of marginal groups, by involving the, and ethnic groups; the secretaries are also responsible for being considerate of ethnic sensitive issues so as not to offend – or foster conflicts.
- d. The secretaries are responsible for providing for and enabling a Group discussion arena where all speeches are listen to and noted. This means that opinions are reflected in meeting minutes.

#### **b) Information sharing and passing on information from Group discussions**

- a. The secretaries are responsible for receiving information from the Committee, reading and passing

on the information to actors on Townships, and where relevant village level within the Sub-basin. Specific ward or tract administrations need to be informed in particular if, pressures, abatement measures discussed concerns the respective villages. The secretaries may delegate this task to other members in the Group, but the secretaries are responsible for that information from the Committee is forwarded to relevant actors.

- b. At least two of the three secretaries are responsible for attending the Committee meetings based on invitations, preparing minutes, and passing on the minutes to Group members.
- c. The secretaries are responsible for preparing minutes from Group meetings, which reflect the various viewpoints of members. Minutes should be disseminated to those attending the respective meeting for comments. Minutes needs to be sent to the Committee.

c) Conflicts

- a. In the case of conflicts in the Group, the secretaries must negotiate to reduce conflicts. Different opinions among the Group however, is not problematic. Different opinions may be accounted for in the minutes which are passed on to the Committee.
- b. In the case that conflicts appear to be non-negotiable, it is recommended to present the issue in a written format to the Chair, to seek assistance on how to solve conflicts.
- c. In specific cases, where the conflict level is high, sub-groups may be established. As this is also matter of budget and resources, this need should be presented in a written letter to the chair. Such sub-groups, may also contact national level NGOs to present their issue and for support.

d) Elections

- a. Election of secretaries should take place as soon as possible after the Group has been established. In the period before secretaries has been elected the Group can seek support for certain administrative assignments from the Committee.
- b. The election needs to take place at a Group meeting. People may offer their service to be secretaries. If more than three people would like to take the position as secretaries, anonymous election should be arranged. Every year, the current secretaries need to receive support from the other members in the Group; this can occur as a simple statement in a meeting. If a current secretary lack support from the rest of the Group, or if a person currently acting as a secretary no longer wants to have this position, a formal letter to the Group needs to formulated describing the situation. If the Group cannot solve this situation, the Committee chair can be approached on the matter. The Committee chair, and its secretaries need to be informed if there is a change of Group secretaries.

## NIVA: Norges ledende kompetansesenter på vannmiljø

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