

## 2.8 Myanmar



### 1 | Country Information

**Table 2.8.1** Basic indicators

Land Area (km <sup>2</sup> )	676,552 (2018)*	
Total Population	53.04 million (2019)**	
GDP (current USD)	86.93 billion (2019)**	
GDP per capita (current USD)	1,407 (2019)**	
Average Precipitation (mm/year)	2,340 (2008–2017)*	
Total Renewable Water Resources (km <sup>3</sup> )	1,168 (2017)	
Total Annual Freshwater Withdrawals (billion m <sup>3</sup> )	33.2 (2000)***	
Annual Freshwater Withdrawals by Sector	Agriculture	89% (2017)
	Industry	1% (2017)
	Municipal (including domestic)	10% (2017)

(Source: ADB 2017, \*CSO 2018, \*\*World Bank 2020, \*\*\*FAO 2016)



**Figure 2.8.1** Irrawaddy River in Nyaung-U, Myanmar

### 2 | State of Water Resources

Myanmar has an abundance of water resources, which are distributed unevenly spatially and temporally. Around 80% of the average annual rainfall of 2,340 mm falls during the monsoon season (May–October) and 20%

in the dry season (CSO 2018). The catchment area of Myanmar's eight principal river basins is approximately 737,800 km<sup>2</sup>, and there are two major natural lakes, the Inle Lake and Indawgyi Lake. Constructed reservoirs have a capacity of 15.46 km<sup>3</sup>. The potential volume of groundwater resources in the country is 580 km<sup>3</sup>, of which the estimated total renewable volume is 1,046 billion m<sup>3</sup> and per capita total internal water resources is 24,046 m<sup>3</sup>/capita/year (FAO 2016). Total water development is 33.2 billion m<sup>3</sup>, which represents 3% of the total renewable water resources in Myanmar. Approximately 91% of the total water withdrawal comes from surface water and 9% from groundwater. Groundwater is mostly used for domestic purposes (ADB 2017).

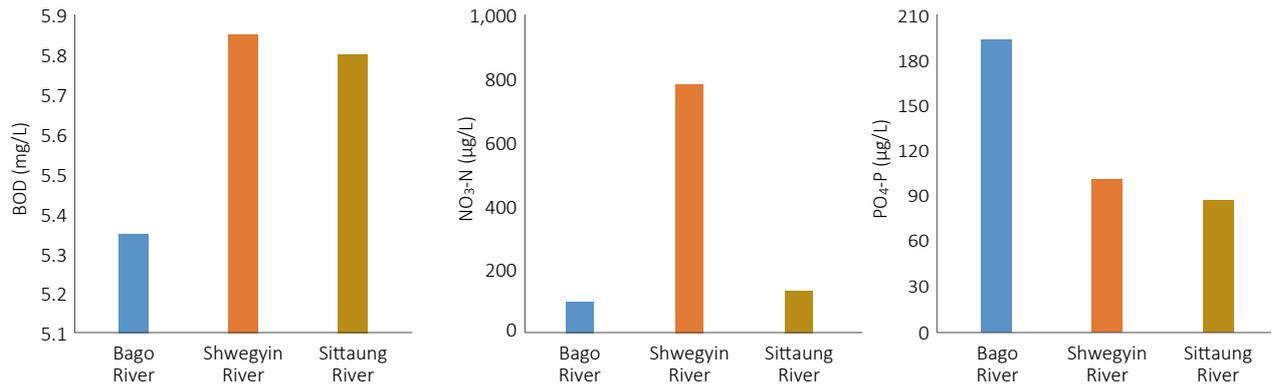
### 3 | State of Ambient Water Quality

#### 3.1 Rivers

Myanmar is heavily dependent on inland surface waterbodies for domestic use, agricultural irrigation and industrial production. Water quality monitoring data of Bago River, Shwegyin River, and Sittaung River revealed that water environment conditions in these three rivers are generally good, however they vary from river to river. According to the water quality monitoring data in 2020, NO<sub>3</sub>-N concentrations range from 97 µg/L in Bago River to 780 µg/L in Shwegyin River. In contrast, PO<sub>4</sub>-P concentrations in Bago River water are around double those of Shwegyin River and Sittaung River (Figure 2.8.2). Wastewater and sewage from settlement areas is the main source of high levels of phosphorus, while nitrogen comes from run-off of fertilizers from agricultural areas (NIWR 2018).

#### 3.2 Lakes and Reservoirs

Myanmar has a number of natural lakes, including Indawgyi Lake, Inle Lake, Inya Lake and Sunye Lake, which serve as source of waters for various purpose, and their biodiversity and scenic beauty make them popular tourist attractions. However, in recent years these lakes have faced degraded lake environments, such as increased water pollution, deforestation and illegal dumping of garbage. Inle Lake is the second largest natural lake. It has a surface area of 116 km<sup>2</sup> and total water inflow volume of 1,132 million cubic meter per year and is one of the major sources of water in the lake basin area. Annually it receives more than 0.3 million tourists (NIWR



**Figure 2.8.2** Water quality of selected rivers in Myanmar, 2020 (Source: FRI 2020)

2017). However, degradation of the lake environment is set to hinder its ecosystem services, and a water quality survey conducted during 2017–2018 raised concerns over water quality deterioration. It also reported that the values of COD were high for both 2017 and 2018 (Table 2.8.2), which indicates continued organic pollution.

**Table 2.8.2** Water quality of Inle Lake, Myanmar, 2017–2018

no	parameter	value (2017 rainy season)	value (2018 rainy season)
1	Turbidity (Degree)	9.0	9.9
2	Dissolved Oxygen (mg/L)	5	5
3	Chemical Oxygen Demand (COD) (mg/L)	12	10

(Source: Yuasa et al. 2019)

### 3.3 Coastal Water

Myanmar has a 2,400 km long coastline bordering the Bay of Bengal and Andaman Sea. Pollution of coastal water comes from coastal land as well as far inland. Major pollutants in coastal water include chemicals, nutrients, and heavy metals carried from farms, factories, and cities by streams and rivers into the sea. The marine water bodies around the country are also sometimes deteriorated by oil spills and leaks.

### 3.4 Groundwater

Groundwater is a vital source of water in many parts of Myanmar, and in some areas provides 80% of drinking and irrigation water supply (Viossanges et al. 2017). However, the limited amounts of data make it difficult to form a picture of overall groundwater quality (van Geen et al. 2014, Bacquart et al. 2015), and the usability of groundwater is affected by water quality issues. Elevated arsenic concentrations in groundwater exceeding the WHO guideline value for drinking water (10 µg/L) have been reported in many areas. Table 2.8.3 shows that of the 30,420 samples tested in the Dry Zone, 2% of them exceeded the arsenic value set in the National Drinking water Guideline (50 µg/L), whereas 80% of samples

exceeded the WHO guideline value of 10 µg/L. In some locations, fluoride, nitrate, salinity, iron, manganese, and aluminum also exceeded WHO drinking water guidelines (Pincetti-Zúniga et al. 2020).

**Table 2.8.3** Arsenic concentration in groundwater of Sagaing, Mandalay and Magway Regions

Region	Total samples	Percent of total sample		
		<10 µg/L	10–50 µg/L	>50 µg/L
Sagaing	8,611	79	19	2
Mandalay	21,257	81	18	1
Magway	552	81	17	2

(Source: Pavelic et al. 2015)

## 4 | State of Wastewater Treatment

Underinvestment in urban wastewater treatment infrastructure has resulted in significantly deficient wastewater treatment services throughout Myanmar. Only around 10% of wastewater generated is treated (United Nations World Water Assessment Programme 2017), and there are only two sewerage systems, one in each of the major cities of Yangon and Naypyidaw, which can collect only small amounts of the wastewater generated. The current capacity of Yangon city's sewage treatment facilities is 12,302 m<sup>3</sup>/day (ECD 2019) covering only 7% of the city's population. That of Nay Pyi Taw city is 1,600 m<sup>3</sup>/day, which services about 20% of the newly developed area of Naypyidaw, and 80% of areas still rely on septic tanks or pit latrines with slab (ECD 2019). Mandalay is a major city in central Myanmar with a population 1.2 million but lacks a central wastewater management system. Rapid growth of industrial sectors also increases the risk of water pollution due to insufficient capacity to manage industrial wastewater. A total of 41 industrial zones have been established in Myanmar, most of which lack centralized wastewater treatment facilities, although new industrial zones are planned to be equipped with them. In recent years the Government of Myanmar has undertaken several projects

with the support of development partners, such as a project to upgrade the current capacity of wastewater treatment to 112,000 m<sup>3</sup>/day in partnership with the Japan International Cooperation Agency (JICA), a project to establish an industrial wastewater treatment facility in Mandalay city under an environmental cooperation agreement with Japan, and a project to construct a central industrial wastewater treatment system with capacity of 230 m<sup>3</sup>/day in Mandalay Industrial Zone (2) with financial aid from the Responsible Business Fund (Win 2019).

**Table 2.8.4** Domestic wastewater treatment practices in urban areas

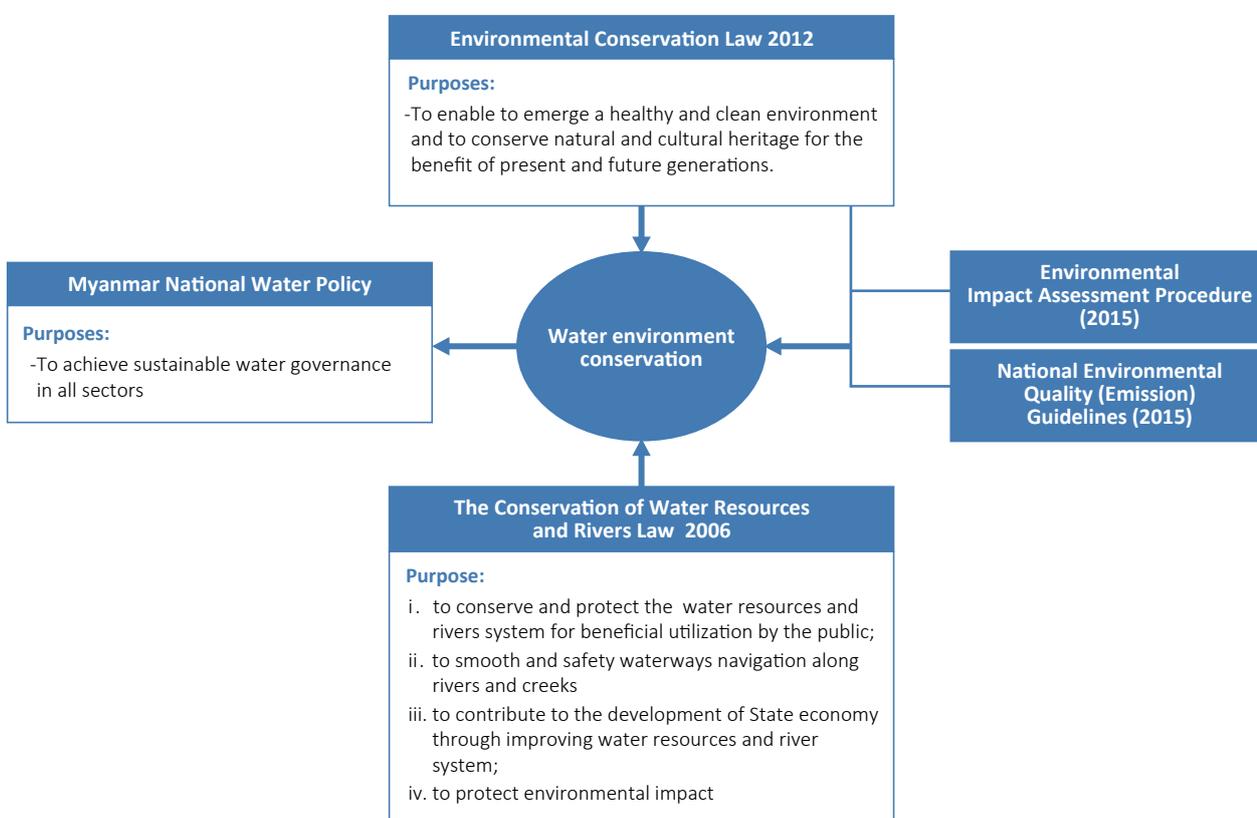
City name	Population (million)	Wastewater management practices
Yangon	5.2	i. Centralized wastewater treatment (12,302 m <sup>3</sup> /day)
		ii. Septic tank
		iii. Pit latrine
Nay Pyi Taw	0.9	i. Centralized wastewater treatment (1,600 m <sup>3</sup> /day)
		ii. Septic tank
		iii. Pit latrine
Mandalay	1.2	i. Septic tank
		ii. Pit latrine

(Source: ECD 2019)

## 5 | Frameworks for Water Environmental Management

### 5.1 Legislation

The current legislative framework for water environment management in Myanmar is shown in Figure 2.8.3. Maintaining a healthy and clean environment and conservation of natural and cultural heritage for the benefit of present and future generations is the objective Environmental Conservation Law 2012. Article 7 stipulates that EIAs and SIAs must be carried out for projects that may cause significant impact on the environment, the EIA process of which – according to Environmental Impact Assessment Guideline 2015 – must start with submission of project proposals to the Environmental Conservation Department. The National Environmental Quality (Emission) Guidelines was approved in 2015, which provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health, and includes industry-specific guidelines on air pollution, wastewater, noise and odour. The objectives of the Conservation of Water Resources and Rivers Law 2006 are to conserve and protect water



**Figure 2.8.3** Legislative framework of water environment management in Myanmar

resources and river systems for beneficial public use and smooth and safe navigation, and contribute to the state economy through improving water resources and mitigating environmental impacts.

## 5.2 Institutional Arrangement

In Myanmar, several ministries deal with water environment management. Table 2.8.5 shows a list of agencies and their responsibilities for water environment

conservation. Control of the disposal of wastewater from residences, office buildings and factories is the responsibility of the Ministry of Natural Resources and Environmental Conservation (MONREC). The Ministry of Planning, Finance and Industry is responsible for regulating industrial water use and discharge, and the City Development Committee is responsible for water supply and sanitation respective cities.

**Table 2.8.5** Institutional arrangement for water environment management in Myanmar

Department	Ministry/organization	Responsibilities
Environmental Conservation Department	Ministry of Natural Resources and Environmental Conservation	Formulation of national environmental quality standards, including water quality standards, water quality monitoring, enforcement
Forestry Department	Ministry of Natural Resources and Environmental Conservation	Reforestation and conservation of forest including watershed areas
Irrigation and Water Utilization Management Department	Ministry of Agriculture, Livestock and Irrigation	Provision of irrigation water for farmland
Water Resources Utilization Department	Ministry of Agriculture, Livestock and Irrigation	Irrigation and rural water supply
Directorate of Water Resources and Improvement of River System	Ministry of Transport and Communication	River gradging, navigation and prevent river water pollution
Directorate of Industrial Supervision and Inspection	Ministry of Planning, Finance and Industry	Industrial water use and discharge
Department of Metrology and Hydrology	Ministry of Planning, Finance and Industry	Water assessment of major rivers
Department of Urban and Housing Development	Ministry of Construction	Domestic water supply
Department of Public Health	Ministry of Health and Sports Environmental Health,	Water quality assessment and control
Department of Development Affairs	Ministry of Border Areas Development Affairs	Rural water supply and sanitation
Department of Research and Innovation	Ministry of Education	Formulation National Standards
Water and Sanitation Department	City Development Committees (Yangon, Mandalay, Nay Pyi Taw)	Water supply and sanitation in city areas

## 5.3 Ambient Water Quality Standards

### Ambient water quality standards

Myanmar currently has no ambient water quality standard. However, with the objective of stipulating national standards, as provided for under Paragraph (10) of the Environmental Conservation Law (*“the Ministry may stipulate the suitable surface water quality standards, water quality standards for coastal and estuarine areas, underground water quality standards, atmospheric quality standards, noise and vibration standards, emissions standards, effluent standards, solid waste standards and other environmental quality standards”*), the Environmental Conservation Department of MONREC in cooperation with other line ministries and international experts has been working on a draft of the surface water quality standard. Part of this

process involved conducting a review of the standards of neighboring countries and developed countries, which led to over 600 parameters being selected for the screening process. Progress was then made on developing a draft for surface water quality standards. The draft was submitted to the National Surface Water Quality Standards, which include 36 parameters with threshold values for protecting aquatic ecosystems and human health. The Environmental Conservation Department (ECD) of MONREC aims to put into effect the National Surface Water Quality Standard in 2021 to thus establish a surface quality standard.

### Water quality monitoring framework

Although there is no water quality standard in Myanmar, ECD and the Forestry Department of MONREC are

responsible for managing water quality monitoring. As such, ECD monitors river water quality at 15 sampling points, lake water quality at 21 monitoring points and groundwater quality at three monitoring points quarterly or twice a year for 18 water quality parameters. The

Forestry Department monitors water quality for 30 parameters at 26 sampling points for rivers and eight monitoring points in dams. Details of the water quality monitoring framework are shown in Table 2.8.6.

**Table 2.8.6 Water quality monitoring framework of ECD and Forestry Department**

Item	ECD	Forestry Department
Monitoring parameters	Temperature, Turbidity, Total dissolved solids (TDS), Conductivity, pH, Dissolved oxygen (DO), COD, BOD, Salinity, Total Ammonia, Total Nitrate, Total Phosphate, Copper, Lead, Arsenic, Mercury, Iron, Cadmium	pH, Conductivity, Color, Total Alkalinity, Turbidity, BOD, COD, Calcium, Magnesium, Potassium, Sodium, Chloride, Sulfate, Ammonia, Fluoride, Nitrate, Nitrite, Total nitrogen, Total phosphorus, Bromine, Mercury, Copper, Lead, Arsenic, Cadmium, Nickel, E.coli Bacteria, Orthophosphate, Silicon, Chromium
Number of sampling points	Rivers: 15 sampling points Lakes: 21 sampling points Groundwater: 3 sampling points	Rivers: 26 sampling points Dams: 8 sampling points
Frequency of monitoring	Seasonal (quarterly or twice/year)	Bimonthly
Frequency of publishing monitoring reports	Quarterly	-

## 5.4 Effluent Standards

### Effluent standards

The National Environmental Quality (Emission) Guidelines (NEQEG) was released on 29 December 2015. These guidelines provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution and provide protection for human and ecosystem health. A total of 71 industry-specific effluent levels have been set out in the NEQEG. The guidelines for effluent levels cover thermal power, geothermal power, wind power, oil and gas, petroleum refining, natural gas processing, natural gas liquefaction, crude oil and petroleum product terminals, electric power transmission and distribution, gas distribution systems, petroleum-based organic chemicals manufacturing, plantation industrial/crop production, annual crop production, mammalian livestock production, poultry production, aquaculture, forest harvesting operation, meat processing, poultry processing, fish processing, food and beverage processing, dairy processing, vegetable oil production and processing, sugar manufacturing, breweries and distilleries, textiles

manufacturing, tanning and leather finishing, sawmilling and manufactured wood products, board and particle-based products, pulp and/or paper mills, printing, large volume inorganic compounds manufacturing and coal tar distillation, petroleum-based polymers manufacturing, coal procession, nitrogen fertilizer manufacturing, phosphate fertilizer manufacturing, pesticide manufacturing, oleochemicals manufacturing, pharmaceuticals and biotechnology manufacturing, glass, and glass and mineral fibre manufacturing, ceramic tile and sanitary ware manufacturing, base metal smelting and refining, integrated steel mills, foundries, metal, plastic and rubber products manufacturing, semiconductors and other electronics manufacturing, solid waste management facilities, wastewater treatment facilities, health care facilities, and others.

### Effluent inspection procedure

The Pollution Control Division of ECD, General Administration Department, Directorate of Industrial Supervision Inspection, and Directorate of Industrial Collaboration are responsible for inspection of effluent quality. Table 2.8.7 describes the responsibilities of each

**Table 2.8.7 Effluent quality control agencies and their responsibilities**

Agency	Responsibilities
Pollution Control Division of ECD	Monitor the effluent quality regularly
General Administration Department	Manage and issue liquor licenses
Directorate of Industrial Supervision Inspection (DISI)	Encourage the development of private industrial enterprises in accordance with the Industrial Enterprise Law
Directorate of Industrial Collaboration	To formulate policies and laws to accelerate growth of industries

agency. DISI performs monitoring using an online monitoring system for wastewater discharged from alcohol factories. Local and regional offices of ECD are tasked with regular monitoring of effluent quality, and ECD headquarters is directly involved in effluent monitoring upon notification of major environment pollution issues.

### Measures against non-compliance

When violations of effluent standards are found, a written warning is sent to industries to correct current activities to comply with the relevant laws and effluent guidelines. If this fails to solve the pollution issue, an operation suspension notice is issued.

## 5.5 Major Policies on Water Environmental Management

The Myanmar Sustainable Development Plan (MSDP) 2018–2030 is a document laying out a vision for the country toward sustainable development, and Goal 5 emphasizes sound management of natural resources and environment for prosperity of the nation. The National Environmental policy of Myanmar (2019) sets a vision for a clean environment with a healthy and functioning ecosystem to ensure inclusive development and wellbeing for all people in Myanmar. Myanmar National Water Policy (NWP) sets its vision as, “in 2040 Myanmar will become water efficient nation with well-developed and sustainable water resources based on a fully-functional integrated water resources management system”. The objectives of the NWP are to establish an Apex body for strengthening inter-ministerial coordination for water management, invest in water sector infrastructures, institutions and capacity building, improve efficiency on the water supply and demand sides, and enhance water information, knowledge, technology and cooperation.

## 6 | Recent Developments in Water Environmental Management

There are several developments in government policies that will have significant impacts on water environment management, as follows:

- i. Drafting of the national surface water quality standard. ECD aims to finalize and complete the approval process of the draft national surface water quality standard in 2021.
- ii. Implementation of Project on Capacity Development in Enforcement and Promotion of Environmental Compliance.
- iii. Ongoing project for establishing a National Water Quality Monitoring System and Building the National Laboratory to Improve the National Capacity for Water Quality Management in Myanmar.
- iv. Implementation “Integrated Water Resources Management – Institutional building and trainings” project by Forestry Department, with specific outcomes of (1) ecological water quality status assessment; (2) functioning Myanmar National Water Quality Laboratory; (3) database and data user interface tools, for communication of environmental status by FD; (4) implementation of the Myanmar National Water Framework Directive - in selected Myanmar sub-basins; (5) development of monitoring and risk assessment plans in areas of mining activities.

## 7 | Challenges and Future Plans

Based on the current state of water quality management in Myanmar, some key management challenges are identified as follows:

	Description	Actions to be taken
<b>Institutional challenge</b>	i. Formulation of environmental water quality standards, monitoring and inspection of water and effluent quality	i. Organize monitoring and inspection teams at national, state, regional, city and township levels, including relevant departments.
<b>Enforcement challenges</b>	i. Lack of human resources and capacity of regional offices ii. Lack of incentive policies	i. Recruit new human resources and arrange capacity building training. ii. Formulate incentive policy for enforcement of environmental pollution.
<b>Resource and financial challenges</b>	i. Lack of financial capacity for establishing laboratory and technical training	i. Enhance cooperation with development partners to establish laboratory and capacity development training program on water and effluent quality monitoring.