Introduction:

Untreated wastewater generated from various sources, particularly from households, causes environmental problems, such as diseases and the destruction of water resources and biodiversity. In the Philippines, wastewater treatment is quite challenging to implement due to financial and technological constraints. One approach to address these constraints is the use of nature-based solutions for wastewater treatment, particularly the Constructed Wetlands (CW). CW are engineered systems mimicking the process of natural wetlands: use of soil and plants to treat the wastewater. In the CW, the plants are usually grass due to their resistance to harsh conditions of wastewater, while the soil media or substrates used are gravel and sand for effective filtration and adsorption of the pollutants. Other pollutants and nutrients can be taken up by the plants for further treatment of the wastewater, while its deep and massive root systems provide the environment for microorganisms culture that can also be used for the removal of other organic matter in the wastewater. Aside from this, CW provides ecological benefits such as promotion of biodiversity conservation, aesthetic for tourism and even as a source of livelihood. CWs are relatively low-cost and require less technical support compared with conventional wastewater treatment systems. However, they are not widely adopted in the Philippines due to the large area requirement and limited large-scale sites in the country to showcase its effectiveness. Currently, there is no framework for CW to guide its implementation in the country which could improve its replicability.

This brochure endeavors to bridge that gap by presenting a framework guide for CW implementation in the Philippines.

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University of the Philippines LOS BAÑOS

CITY OF BAYAWAN OFFICIAL SEAL

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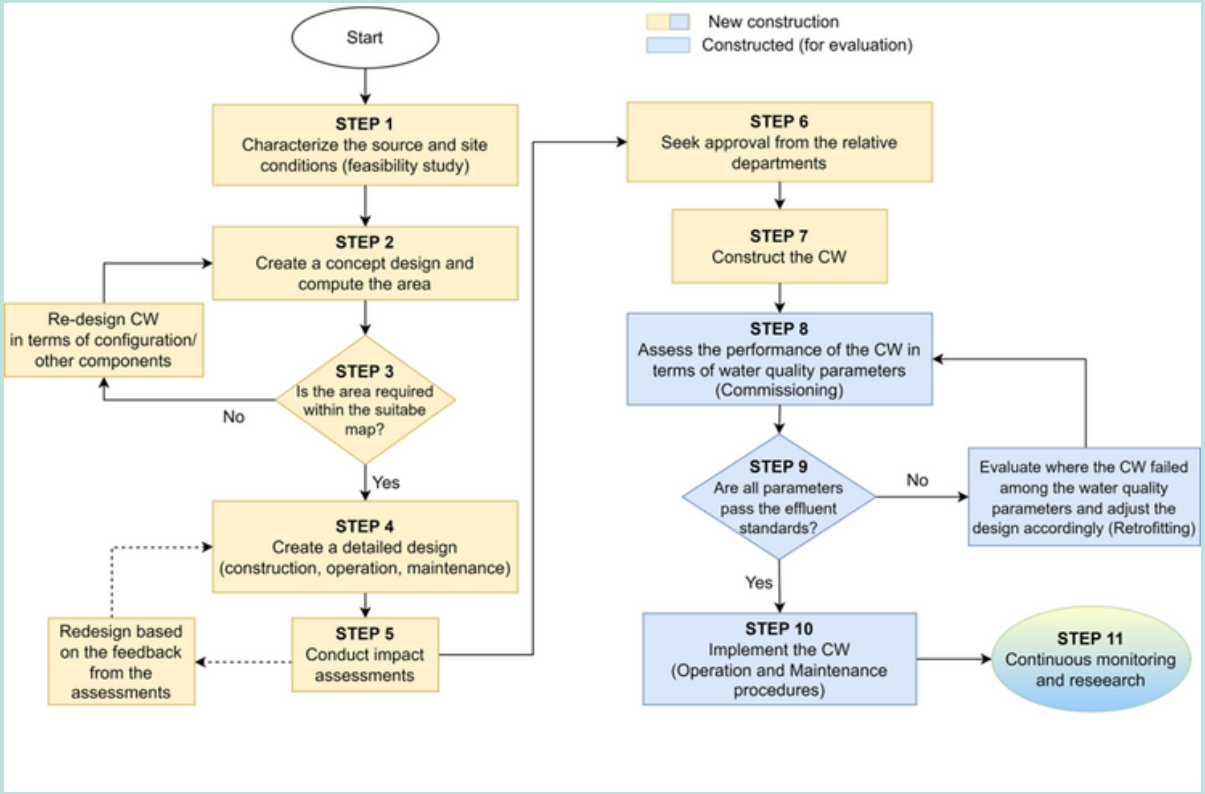
Philippines Wetlands

CW at Bayawan City, Negros Oriental, Philippines

Guide Framework for Constructed Wetlands Implementation in the Philippines

Constructed Wetlands (CW) Guide Framework



The framework can be used if new construction (Steps 1-11) or existing CW (Steps 8-11). Every step of the framework requires consultative meetings with stakeholders to promote community engagement and ownership of the CW system, thus ensuring sustainability.

Step 1: Suitability mapping for CW in terms of landuse, slope, soil type, distance to water bodies, protected areas, built-up areas, and population centres, and hazards maps

Steps 2-4, 7, 10: Design, construction, and operation and maintenance of CW can be patterned from the Bayawan City (complete manual can be found in their website)

Steps 5-6: Survey instruments can be provided by SCPW for the social acceptability and economic analysis of CW

Step 11: Platform for research advancements database in CW will still need to be established but can be consulted with various universities doing similar research studies, such as the Univeristy of the Philippines.

Site Development and Conceptual Design of CW at Bayawan City

Sector (DAO 2016-08 PSIC Code, Table 8):	Sewerage (37000)							
Significant Parameter[a]	Unit	Method[b]	Untreated Water (In)	Treated Water (Out)	Removal efficiency, % (In-Out)/In*100	DAO 2016-08 Effluent Standard A, B, C, D, SA, SB, SC, SD	Pass / Fail	Remarks
Ammonia as NH_3-N	mg/L							
BOD	mg/L							
Fecal Coliform	MPN/ 100mL							
Nitrate as NO_3-N	mg/L							
Oil and Grease	mg/L							
Phosphate	mg/L							
Surfactants (MBAS)	mg/L							

[a] *Other parameters can be added based on DAO 2016-08*
[b] *Possible references: EMB Memo Circular 2008-008 or any edition of Standard Methods for the Examination of Water and Wastewater*

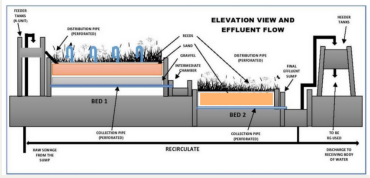
Guide table for CW performance monitoring (Steps 8-11)

CW operation, maintenance, and troubleshooting at Bayawan City for domestic wastewater treatment

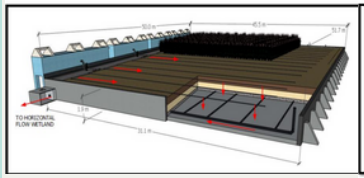
ITEM	FREQUENCY	ACTIVITIES
1	HOURLY	Always monitor the desired water level at the main sump, bypass line shall only be used in emergency cases.
2	DAILY (8 – 10 AM)	Operate the motor pump in filling-up two header tanks (Header Tank 1 and 2).
3	DAILY (3 – 5 AM)	Operate the motor pump in filling up two storage tanks (Header Tank 3 and 4).
4	DAILY (7 – 9 PM)	"Direct flowing" to vertical wetland bed. (Opened valve and motor pump is running.
5	DAILY (1 – 2 AM)	Storage tanks are dropped to vertical wetland bed.
6	DAILY (3 – 5 AM)	"Direct flowing" to vertical wetland bed.
7	DAILY	Pumping final effluent to elevated storage tank.
8	DAILY	Cleaning of work area and surroundings.
9	DAILY	Site security and record keeping of daily activities.
10	WEEKLY	Regular inspection and clearing of piping system.
11	WEEKLY	Regular inspection of electrical and control system.

ITEM	FREQUENCY	COMPONENT	ACTIVITIES
1	WEEKLY	Main Sump	Declogging of sludge in main sump.
2	MONTHLY	ABR	Cleaning of inlet screen in ABR suction pipe.
3	MONTHLY	Pumping Station	Greasing and oiling of motor pumps.
4	MONTHLY	Wetland Bed	Removing of weeds and cultivating of soil.
5	MONTHLY	Waste Water Facility	Inspect for and repair any structural damage and leaks.
6	QUARTERLY	Final Effluent Chamber	Taking sample for laboratory analysis as required by DENR-EMB.
7	EVERY 6 MONTHS	Wetland Bed	Flushing of pipes in wetland beds.
8	EVERY 6 MONTHS	Header Tank	Greasing of gate valve of header tanks.
9	EVERY 6 MONTHS	Final Effluent Chamber	Cleaning of final effluent chamber.
10	YEARLY	ABR	Declogging of sludge in Anaerobic Baffled Reactor.
11	YEARLY	Header Tank	Cleaning and removing of sludge in header tanks (if it is already dried up).
12	YEARLY	Wetland Bed	Repainting of wetland beds.
13	YEARLY	Wetland Bed	Trimming of the reeds.
14	YEARLY	Wetland Bed	Harvesting of reeds.
15	YEARLY	Wetland Bed	Replanting of withered reeds.

ITEM	TROUBLES	REMEDIES
1	Pump won't start.	a. Check electrical wirings.
2	Pump is running but no discharge.	a. Check pipe, maybe clogged-up inlet screen. b. Check inlet and outlet valves. c. Check sump level, maybe low level. d. Check accumulated sludge in sump.
3	Low discharge.	a. Check pipes for clogged-up. b. Check filters for clogged-up.
4	Uneven distribution of waste water to vertical wetland beds.	a. Check broken and clogged-up distribution pipes.
5	Withered reeds.	a. Replace and replant new reeds.



Vertical Constructed Wetland



Horizontal Constructed Wetland