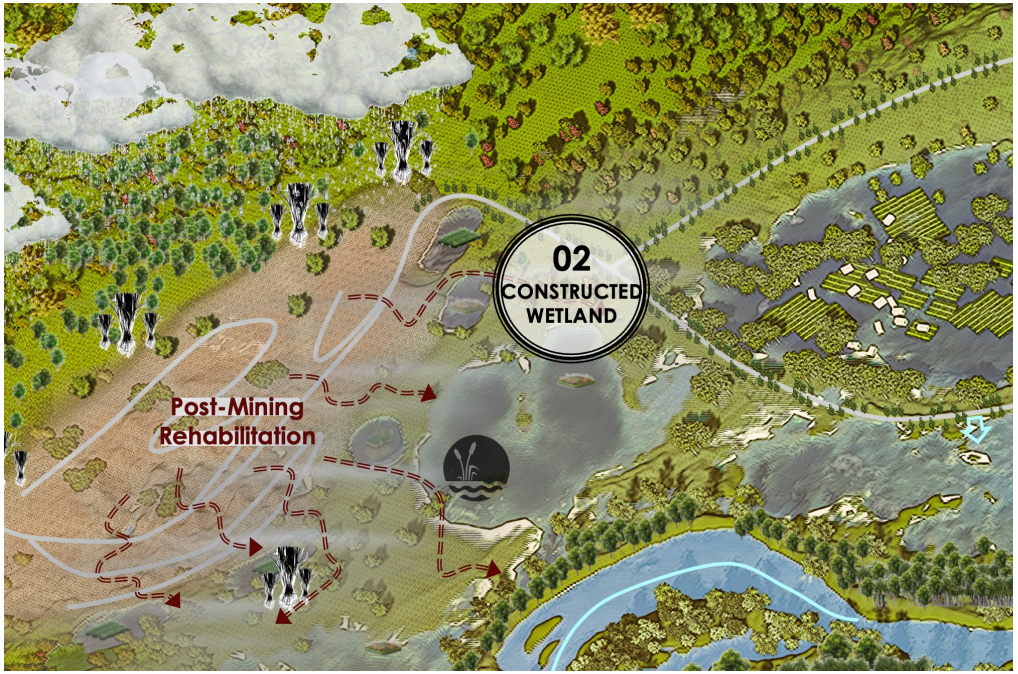
NbS-02: CONSTRUCTED WETLANDS



Constructed wetlands are artificial systems designed to replicate the vital ecological functions of natural wetlands. These wetlands are strategically placed along riverbanks or within floodplains to treat water, improve water quality, and enhance biodiversity. The primary focus is on managing water flow, reducing pollutants, and providing habitat for aquatic species in river systems.

It involves designing channels, shallow ponds, and marshy areas that allow for water filtration, sediment retention, and nutrient cycling. These features are integrated into the landscape to mimic the natural hydrology of riverine wetlands, helping to manage floodwaters and stabilize riverbanks. The artificial wetlands often include elements such as sedimentation zones, reed beds, and vegetated swales that improve the river's water quality by filtering out excess nutrients, sediments, and pollutants, particularly from agricultural or urban runoff.

LANDSCAPES SUPPORTED

EbA (ECOSYSTEM-BASED APPROACHES)

- ECOSYSTEM RESTORATION
- ECOSYSTEM-BASED DISASTER RISK REDUCTION
- ECOSYSTEM BASED ADAPTATION
- GREEN INFRASTRUCTURE
- INTEGRATED WATER RESOURCES MANAGEMENT

MAIN PROBLEMS ADDRESSED

- SOIL EROSION
- BIODIVERSITY LOSS
- FLOOD CONTROL
- DISASTER RISK REDUCTION
- CARBON SEQUESTRATION

ECOSYSTEM SERVICES AND ACTIONS

SUPPORTING

- Creates habitats for aquatic and terrestrial species.
- Supports soil formation and stability.
- Facilitates the natural cycling of nutrients like nitrogen and phosphorus.

REGULATING

- Store excess water during heavy rainfall, mitigating flood risks.
- Purifies water through sediment filtration.
- Stabilizes riverbanks to prevent erosion.
- Moderate local temperatures.

PROVISIONING

- Recharge groundwater and maintain base flows in rivers.
- Supports fish populations and can be used for sustainable aquaculture.

SOCIAL BENEFITS

- Serve as natural laboratories for studying ecosystems, biodiversity, and hydrology.
- Wetlands enhances mental well-being and provides spaces for relaxation and connection to nature.

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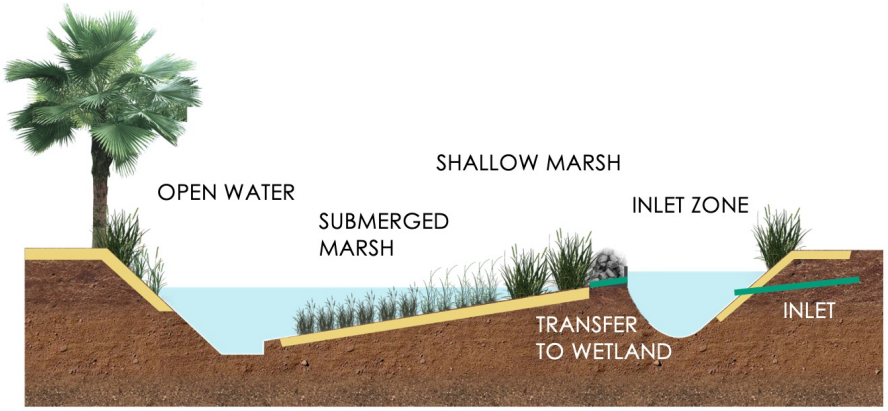
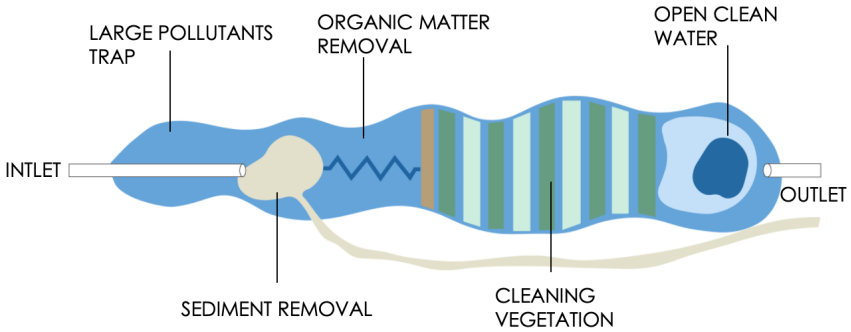


Constructed wetland for storm water management - section



Schematic Plan View

Schematic section

PROJECT'S CHALLENGES & RISKS

- **Pollutant Overload:** Wetlands may become overwhelmed if pollutant loads exceed their natural capacity to filter and process waste.
- **Biodiversity Risks:** Introducing non-native or invasive species during wetland construction may disrupt local ecosystems.
- **Design Complexity:** Creating a wetland that mimics natural processes requires expertise in hydrology, ecology, and engineering.
- **High Initial Costs:** Constructed wetlands require significant upfront investment for design, construction, and planting.

NbS co-BENEFITS AND THEIR INDICATORS

- **Carbon sequestration**
  Amount of carbon stored in wetland vegetation and soil (measured in tonnes of CO_2 equivalent).
- **Soil erosion control**
  Reduction in sediment loads in adjacent waterways.
- **Cost Savings in Flood Management:**
  Reduction in flood damage costs compared to baseline before wetland construction.
- **Water Quality Enhancement**
  Reduction in sediment, nutrient, and pollutant levels (nitrogen, phosphorus, heavy metals).
- **Improved Hydrological Balance:**
  Stabilization of river flow regimes (e.g., reduction in seasonal flow variability).
- **Disaster Risk Reduction**
  Reduction in the frequency and severity of flood and drought events in the surrounding area.

COST ANALYSIS

- **Direct Costs**
  Land acquisition, construction, monitoring, and equipment and materials.
- **Indirect Costs**
  Loss of income from alternative land uses (e.g., agriculture or development.
- **Time Horizon**
  Initial establishment and functional optimization (3–10 years).
  Full operational lifespan (10–50 years or more)
- **Direct Benefits**
  Flood risk reduction, water quality improvement, resource harvesting.
- **Indirect Benefits**
  Biodiversity gains, climate regulation, recreation, health benefits.
- **Risk Assessment**
  Budget , wetland underperformance, delays in securing permits, declining performance due to sedimentation, pollutant overload…

REFERENCES:

Malaysia, Putrajaya Constructed Wetland
Canada, Ontario, Amherstview Constructed Wetland
USA, Ohio, Olentangy River Wetland Research Park (Columbus)

IMPLEMENTATION OPPORTUNITIES:

Indonesia, Jakarta, Ciliwung river to address industrial and domestic pollution.

Philippines, Central Luzon , to treat pesticide and fertilizer runoff from rice paddies.