

Construction of Wetlands to Treat Sewage Water

A. N. Gonjari¹, Dnyanraj.K. Khandale², M. C. Thombre³, M G. Bedkute⁴, Ram.R. Rathod⁵,
B. Akshay.S. Japtap⁶

Lecturer, Department of Civil Engineering, JSPM's RSCOE, Polytechnic, Tathawade, Pune, India¹,

Student, Department of Civil Engineering, JSPM's RSCOE, Polytechnic, Tathawade, Pune, India²⁻⁶,

ABSTRACT: India is developing country which is polluted the water resources like rivers, lake, pond due to increase in industrialization, population and urbanization of cities. This quantity of wastewater and polluted water is treated and reuse by using wetland system. Wetland is the distinct ecosystem that is the flooded by water, either permanently or seasonally, where aerobic process is done. The wetlands are different from other water bodies is characteristic vegetation of tropical and aquatic plants. Wetlands is a use for water purification, water storage, & processing of carbon and other nutrients, stabilization of shorelines, and support of plants and animals. Purpose of construction of wetland is to treat the municipal waste water, partially treated industrial waste water. Primary treatment is required for large number of suspended solid or soluble organic matter. Constructed wetlands is designed by engineer and operated by expert or professional person for the use natural functions vegetation, soil, and organism to treat wastewater. Constructed wetlands have been both centralized and on-site waste water.

I. INTRODUCTION

1.1 Wetland

A wetland is the distinct of a ecosystem that is a flooded by water, either a permanently or a seasonally, where the oxygen-free processes prevail. The primary factor of that distinguishes a wetlands from the other land forms or a water bodies is the characteristic of vegetation of aquatic plants, adapted to a unique hydric soil. Wetlands of play a number of functions, including the water purification, water storage, processing of a carbon and other nutrients, stabilization of a shorelines, and a support of a plants and animals. Wetlands are also a considered of the most biologically diverse of a all ecosystems, serving as a home to a wide range of a plant and animal life. Whether any individual wetland performs these are functions, and the degree to which it the performs them, depends on the characteristics of that wetland and the lands and waters near it. Methods for a rapidly assessing these functions, wetland ecological health, and the general wetland condition have been a developed in a many regions and have the contributed to wetland conservation partly by raising public awareness of a functions and the ecosystem services some wetlands provide. A **constructed wetland (CW)** is an a artificial wetland to the treat municipal or a industrial wastewater, greywater or a storm water runoff. It may also be the designed for the land reclamation after mining, or as a mitigation step for the natural areas lost to land development.

Constructed wetlands are the engineered systems that use a natural functions of vegetation, soil, and the organisms to treat the wastewater. Depending on the type of a wastewater the design of the constructed wetland has to be a adjusted accordingly. Constructed wetlands have been used to a treat both centralized and on-site wastewater. Primary treatment is the recommended when there is a large number of a suspended solids or a soluble organic matter (measured as BOD and COD).

1.2 Sewage

Sewage (or domestic waste water or municipal wastewater) is a type of wastewater that is produced by a community of people. It is characterized by volume or rate of flow, physical condition, chemical and toxic constituents, and its bacteriologic status (which organisms it contains and in what quantities). It consists mostly of greywater (from sinks, tubs, showers, dishwashers, and clothes washers), blackwater (the water used to flush toilets, combined with the human waste that it flushes away); soaps and detergents; and toilet paper (less so in regions where bidets are widely used instead of paper).

II. RELATED WORK

[1] Constructed Wetlands as a Sustainable Solution for Wastewater Treatment in Small Villages. M.L. Solano; P. Soriano; M.P.Ciria

With the aim of solving the waste water treatment problem in small villages, treatment performance of a pilot scale subsurface-flow constructed wetland (SFW) was evaluated for removal efficiency of biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total and faecal coliform and faecal streptococci bacteria from raw municipal waste water. Studies of the composition and thermal behaviour of the harvested biomass were achieved in order to assess their possible utilisation as a fuel. Two different hydraulic application rates (150, and 75 mm day) and two macrophytes, cattail (*Typha* sp.) and reed (*Phragmites* sp.), were assayed. High levels of BOD, COD and TSS removal for all treatments were obtained. The best removals were obtained in those beds with the lowest hydraulic application rate. With regard to the type of plant, no significant differences were found between cattail and reed performance; however, cattails showed to be by far (almost a factor of) the greatest producer of biomass (22 t [d.m.] ha). Both cattails and reeds presented high heating values (17–20 MJ kg). According to these results, it can be concluded that the wetland system utilised in this research could be a suitable solution for raw waste water as a stand- alone treatment, although a previous pre- treatment in order to remove grit, heavy solids and floatable materials would be necessary. Besides, the obtained biomass could be utilised as fuel in a small boiler for domestic uses.

[2] Constructed Wetland for Wastewater Treatment and Reuse: A Case Study of Developing Country Atif Mustafa

Treatment performance of a pilot-scale constructed wetland (CW) commissioned in a developing country was evaluated for removal efficiency of biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), ammonia-nitrogen (NH₄-N), ortho-phosphate (PO₄-P), total coliforms (TC) and faecal coliforms (FC) from pre-treated domestic waste water. Monitoring of wetland influent and effluent was carried out for a period of 8 months. Treatment effectiveness was evaluated which indicated good mean removal efficiencies; BOD (50%), COD (44%), TSS (78%), NH₄-N (49%), PO₄-P (52%), TC (93%) and FC (98%). The studied constructed wetland reduced concentrations of all contaminants present in the pre-treated waste water. The performance of contaminant removal varied throughout the monitoring period. The treated effluent from the constructed wetland can be reused for landscape irrigation. Few samples of BOD and TSS were within the US EPA reuse limits which shows that the constructed wetland can effectively treat the waste water and fulfil the reuse limits occasionally. Faecal coliforms were not fully removed but the limits for reuse were achieved occasionally. For developing countries like Pakistan with limited technological advancement and energy problems, constructed wetlands which have a zero or very low energy requirement can be used in the treatment trains.

[3] Design of a Constructed Wetland for Wastewater Treatment and Reuse in Mount Pleasant, Utah. YueZhang

Municipalities in the Inter mountain West are facing water shortages based on their current population growth projections. Utah has the second highest per-capita culinary water use in the United States. Among other cities, Mount Pleasant, Utah, is seeking innovative and cost- effective ways to reduce culinary water use. This study presents a feasibility analysis of and a design for using a free water surface constructed wetland system to treat the city's waste water. The study further presents a cost-benefit assessment of using the treated water for landscape irrigation in the city. The study is based on an analysis of existing waste water quality, local climatic and site biophysical conditions, and future water use projections. The proposed constructed wetland system is composed of two reactors in series: a stabilization lagoon followed by a constructed wetland. The study involves retrofitting the existing waste water sewage lagoons and iv designing a constructive wetland and a storage pond for reclaimed water. The study results show that after a relatively long retention time, the overall biochemical oxygen demands will be reduced by 93.6% to 97.8% and the total suspended solids will be reduced by 87.2% to 87.9%. The treated water is sufficient to irrigate approximately 45 acres of turfgrass or 37 acres of pasture grass. In contrast to complex high- maintenance treatment systems, constructed wetlands provide ecologically-sustainable waste water treatment. For municipalities that are facing similar challenges, this study provides an example of reducing culinary water use and achieving other sustainable development goals by reclaiming and reusing treated waste water.

[4] Wetlands and agronomic application of treated wastewater – A set of experimental studies in Sicily (Italy).

Mario Licata, Maria Cristina Gennaro, Teresa Tuttolomondo, Claudio Leto, Salvatore LaBella.

Constructed wetlands are sustainable technologies for the treatment of waste water. These biological systems have been widely studied throughout the world for more than 30 years; however, most studies have focused on the effects of design and engineering on pollutant removal from waste water. Undoubtedly, agro- technical aspects have been given too little consideration by research. This paper reports the main results of a set of experiments carried out on two pilot horizontal subsurface flow systems in Sicily (Italy). *Festuca*, *Lolium* and *Pennisetum* spp. in combination and three emergent macrophytes—*Arundo donax* L., *Cyperus alternifolius* L. and *Typha latifolia* L.—alone, were assessed. The aim of the study was to demonstrate that, under predetermined hydraulic and design conditions, the choice of plant species and the management of the vegetation can significantly affect the pollutant removal performance of constructed wetlands. In addition, waste water (after treatment) can also be used for agricultural purposes leading to increased sustainability in agricultural systems. *Arundo* and *Typha*-planted units performed better than *Cyperus*-planted units in terms of chemical, physical and microbiological contaminant removal. All the species adapted extremely well to wetland conditions. Polyculture systems were found to be more efficient than mono cultures in the removal of dissolved organic compounds. The reuse of treated waste water for the irrigation of open fields and horticultural crops led to significant savings in the use of freshwater and fertilizers. The results of physical-energy characterization of *A. done* above-ground plant residues and pellets highlighted the fact that a constructed wetland could also be a potential source of bioenergy.

[5] Domestic wastewater treatment performance using constructed wetland. J. S. Sudarsan, Reenu Lizbeth Roy, G.Baskar, V.T.Deeptha, S. Nithiyanantham.

Constructed wetlands are treatment systems that use natural processes involving wetland vegetation, soils, and their associated microbial assemblages to improve water quality. These systems can be used commercially for efficient biological treatment of waste water, and it will also act as a better eco-friendly method when compared with other conventional treatment methods. A constructed wetland pilot scale unit was constructed in the SRM University campus which was allowed to treat waste water from the sewage treatment plant III. The pilot scale unit was designed based on EPA and CPCB guidelines. The dimension of the constructed wetland was 250 9 150 9 80 cm with a slope of 0.01 (1 %). The design is as per Darcy's law. The wetland unit has a cross section of 3.75 m² and has been designed with hydraulic loading of 0.8 m³ /(m² /day) and recommended flow of 3 m³/day. The retention time provided for the unit was 24, 48, 72, 96, and 120 h. *Phragmites Australis* also known as common reed was the wetland plant species planted in the unit. Six field trials were carried out during the project and with average removal efficiencies of 75.99 % for BOD, 76.16 % for COD, 57.34 % for TDS, 62.08

III. CONCLUSION

1. In the river water sample growth of plan is better than the sewage water.
2. outlet characteristics of river water is in between permissible limit.
3. sewage water is also the best source for the vegetation wetland is good method for treatment of sewage and river water. % for Nitrate, 58.03 % for Phosphate, 57.83 % for Potassium.

REFERENCES

1. Constructed Wetlands as a Sustainable Solution for Waste water Treatment in Small Villages. M.L. Solano; P. Soriano; M.P. Ciria. *Biosystems Engineering* (2004) 87 (1), 109–118
2. Constructed Wetland for Waste water Treatment and Reuse: A Case Study of Developing Country. Atif Mustafa.
3. *International Journal of Environmental Science and Development*, Vol. 4, No. 1, February 2013.
4. Design of A Constructed Wetland for Waste water Treatment and Reuse in Mount Pleasant, Utah. Yue Zhang. UTAH STATE UNIVERSITY Logan, Utah 2012.
5. Research focusing on plant performance in constructed wetlands and agronomic application of treated waste water – A set of experimental studies in Sicily (Italy) Mario Licata, Maria Cristina Gennaro, Teresa Tuttolomondo, Claudio Leto, Salvatore La Bella, July 9, 2019