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Flood Control by Construction Storm Water Wet Lands Using Permeable Concrete

Baji Mohammed Rehan[1], Mayank Gupta[2]*, Akhilesh Sharma[3], Shailendra Tiwari[4]

[1]Research Scholar, [2,3,4]Assistant. Professor

Department of Civil Engineering SIRT-E, Bhopal, Madhya Pradesh, India

Corresponding Author

Email id: mayanksirt.co.in@gmail.com

ABSTRACT

This Research Work has advised the use of Constructed Subsurface Wet lands having certain modifications such as use of Permeable Concrete , as an alternative to control flood damage by storing the excess flood water in it and later discharging it into the downstream after a gap of 24 to 36 hours. This Research Paper has shown the benefit of using Permeable Concrete in the Construction of the Subsurface Storm water Wetlands. This Research Paper has discussed as to how use of Permeable Concrete in the Construction of Subsurface Storm water Wet lands increases the Life Span of the Structure and reduces the Cost of Construction of the Structure. This Research paper has done a major study on overall economical construction of Constructed Subsurface wet lands by doing an analysis of Optimum Cost of Construction per single unit and at the same time doing an analysis of the Amount of Area to which one unit will serve the purpose.

Keywords: Flood Control, Construction Storm Water, Wet Lands, Permeable Concrete.

GENERAL

Disaster is defined as that particular period of time in which the Actual Functioning of Surrounding Environment has completely got changed from its natural stable state to a violent unstable state over a certain period of time [1].

CLASSIFICATION OF DISASTER

Classification of Disaster is basically done in Two Types.

The First Classification of Disaster is done on the Basis of Sources as to whether the factor behind triggering the disaster is Natural or Manmade. The Second Classification of Disaster is done depending upon the Magnitude of Damage done by the Disaster. If the Scale of the Destruction Caused by the Disaster is too high, then the Disaster is classified as Major Disaster and If the Scale of the Destruction caused by the Disaster is moderate, then the Disaster is classified as Minor Disaster [2].

Flood Disaster

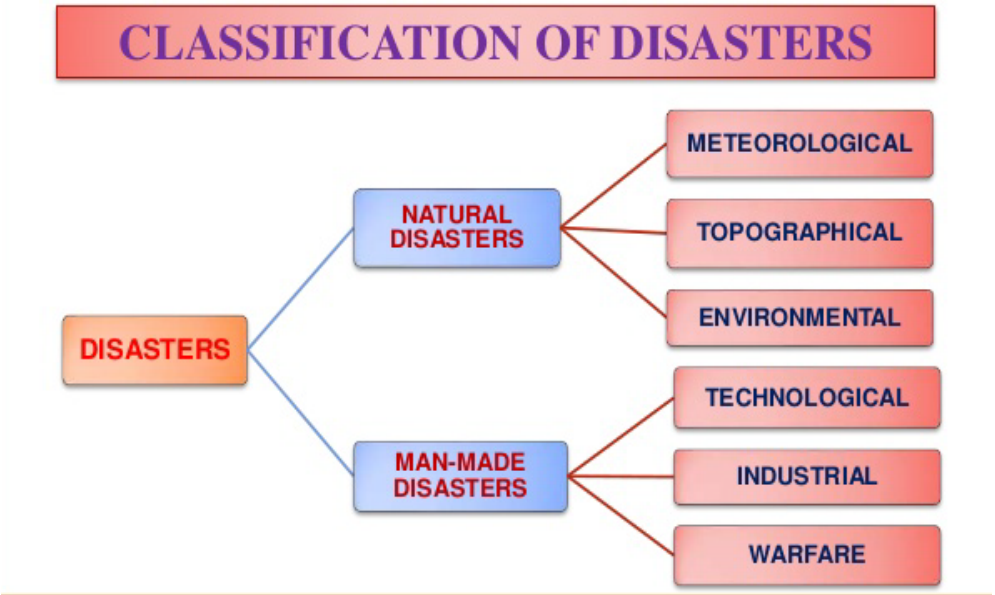
Flood Disaster is defined as that type of disaster where water submerges a portion of dry land up to a considerable depth and for a specific duration within which occupation of water causes considerable loss to Human, Animals, Vegetation and Human made Property.

Different Types of Flood Disaster

Following are the Different types of Flood Disaster:

1) Coastal Flooding
2) River Flooding
3) Flash Flooding
4) Ground Water Flooding
5) Drain and Sewer Flooding

Flash Flooding
It is defined as that type of Flooding which is caused by heavy and sudden rainfall where Ground cannot absorb the water at the rate at which rainwater is pouring on the ground. This type of Floods lasts for less duration but when its duration increases it moves with a great speed and can be dangerous [3].



- **Meteorological Disasters:** Floods,Tsunami,Cyclone etc.
- **Topographical Disasters:** Earthquake,Volcanic Eruptions,Landslides etc.
- **Environmental Disasters:** Global warming ,Ozone depletion,Solar flare etc.
- **Technological:** Transport failure,Public place failure,Fire
- **Industrial:** Chemical spills,Radioactive spills
- **Warfare:** War,Terrorism,Internal conflicts,Civil unrest etc.

LITERATURE REVIEW [4,5]

1) **Artificial Wetlands for the treatment of Storm water (Thomas. J. Charlisle & George Mulamoottill)**: This paper highlights the problem caused by storm water in major urban areas by taking an example of an urban city, Ontario in USA. As an alternative, This paper has stressed on the construction of artificial wetlands by conducting an examination of three areas in U.S.A.

2) **Assessment of Flood Mitigation Measure for Mithi River (Rituparna Choudary, B.M. Patil, Vipin Chandra, Uday B. Patil, T. Nagendra) (2016)** This case paper discussed that Significant increase in conveyance will cause rapid flushing of the floods and increase the quantum of influx and afflux thereby improving the water quality during the flood season

3) **Description and Impact of the Mumbai Monsoon flood of July 2005 (Richard W. Dixan, B. Hema Malini, Bharti Ayyalesomayjula) (2008):** This case paper discusses in detail that at the time of Floods , River gets clogged up with the drainage water due to inadequate waste management and disposal of sewage. Open gutters in Urban Areas carry both storm water drainage and sewage line there by causing floods.

OUTCOMES OF LITERATURE SURVEY

In the Research Papers discussed above, Emphasis of Efficient Working of Subsurface Constructed Wetland Cells is mostly focused on Flood Water Intake Volume and Efficient Removal of Pollutants in Storm Water. Here Efficient Working of Constructed Wetland has been mostly restricted to Treatment of Storm Water. On the Other Hand, Research Papers which have been done on Floods have done their Research mostly on Damage Assessment by Floods. Whereas Limited Research has been done on Controlling the Flood Disaster by Planing, Erecting and Monitoring Methods. In this Research Paper We have focused our Research as to how Flood Damage Control can be done by Economical Method of Construction which also should have long durability of Service Life. Moving ahead in the same direction, we have advised the Use of Permeable Concrete or Pervious Concrete in the Construction of Constructed Wetland Cells and have analyzed as to how the latter use will reduce the Cost of Construction and will increase the Service Life of the Structure. To Support Our Research, At the End of Our Research Paper , We have Design , Cost , Ratio of Land analysis and also have shown the Dimensional and Working Parameters difference between the Conventional Model and Our Designed Model. Moving ahead on the Same Guide Lines of the Research Work, in this Research Work We have discussed as to how these Maintenance Cycle Periods can be extended by adopting Pervious Concrete Walled Cells. Further in this Research Work, It is discussed as to how Percolation of Wet Land Soil can be controlled to a Greater Extent by Pervious Concrete Walled Cells. And as a result, It has also been discussed as to how the Service Period of Wetland Cell can be extended by adopting the Pervious Concrete Walled Cells [6,7].

RESULTS AND DISCUSSION

S. No	Conventional Storm water Wetland Cell	Designed Storm water Wetland Cell
1	Size of the Wetland Cell– 2.5MX1.5MX.8M	Size of the Wetland Cell–2.5MX2.5 MX.8M
2	Cross section Area – 3.75 m2	Cross section Area – 6.25 m2
4	Hydraulic Loading – 0.8m3/(m2/day)	Hydraulic Loading – .89m3/(m2/day)
4	Recommended Flow – 3m3/day	Recommended Flow – 3.75m3/day
5	Retention Period Time – 24h , 48h , 72h , 96h & 120h.	Retention Period Time – 36h to 48h
6	Depth of Coarse Gravel Layer in the Cell – 50 cm	Depth of Coarse Gravel Layer in the Cell – 60 cm

Following are the Designed Parameters of the Subsurface Constructed Storm water Wetland Cell

1) Size of the Subsurface Constructed Storm water Wetland Cell–2.5M X 2.5M X.8M
2) Cross section Area of the Wetland Cell – 6.25 m2
3) Hydraulic Loading of the Wetland Cell – 0.89m3/(m2/day)
4) Recommended Flow of the Wetland Cell – 3.75m3/day
5) Retention Period Time of the Wetland Cell – 36h to 48h
6) Depth of Coarse Gravel Layer in the Wetland

CONCLUSION

1) In this Research Work, A Case study of Flooding of Banks of Mithi River having a length of 17.84 km and catchment area of 7295 hectares was taken.
2) On an average , Mumbai receives an rainfall of 0.1 mm for an span for 107 days every year
3) This Research Paper concludes that the Flood damage done by the above rainfall can be controlled by constructing a Unit of Constructed Subsurface Wet Land on a span of area of (4.5m X 4.5m) of 2 Unit Cells serving an Average Area of 0.08 sq km at an cost of Rs 1,67,850

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