

URBAN DEVELOPMENT'S IMPACT ON WATER BODY SCIENCE AND THE ENVIRONMENT

¹Prashant Gusain, ²Pooja bhandari, ³Mohit Bisht

Assistant Professor
Department of Civil Engineering
Tulas Institute Dehradun

Abstract: Water is a crucial element of Earth and is necessary for all living. Along the banks of the rivers, ancient civilizations like Harappa, Mohenjo-Daro, the Nile Valley, and Mesopotamia grew and prospered. Water from the river was necessary for their survival. Water is still very important nowadays and is a crucial part of current development projects. Since water is one of the fundamental needs of all flora and is necessary for life to exist, new towns are planned with nearby water sources in mind. The water bodies and catchment area will guarantee a sufficient water supply for a variety of development and habitation-related operations. Urban development in India is chaotic and unplanned. Tremendous increase in population has caused large scale Urbanization and expansion of cities & towns. Better Urban facilities caused migration of people for search of employment, education and medical facilities to town centers and lead to growth & development of new towns and urban centers. The large-scale urbanization and unplanned growth has caused the encroachment on land and water sheds. The Urban development activities have paved the soft surfaces thus restricted the penetration of water into underground reservoirs and increased the surface run off. Large scale deforestation for industrialization and development of new towns has altered the eco system and created the environmental imbalance. Thus the unplanned urban development has affected the water bodies in many ways, such as shrinking of water bodies, pollution of water bodies and altering the water cycle. This paper aims to study the Impact of Urban Development on Water bodies and Environment.

Keywords: Urbanization, deforestation, aquifer, pollution, catchment area, food chain, glaciers, precipitation, water cycle.

1. INTRODUCTION

Water is an essential component of Earth and important for all life forms. It is the foundation on which human civilization has grown. Ancient civilization such as Harappa and Mohenjo-Daro, Nile valley, Mesopotamia developed and flourished along the river banks. The river water was essential for their livelihood.

Modern Urban centers are also built upon the same principles, where the source of water or catchment area is located with in close proximity of urban development.

Water is of great significance and essential component in modern-day development activities. Planning of new cities ensure that the catchment area or the water source is available near by since water is the basic requirement of all vegetation and living forms and life cannot sustain without it. Provision of water bodies and catchment area will ensure adequate water supply for various activities of development and habitation. In India the development is mostly unplanned and haphazard. Cities lack basic amenities and are over crowded. This imbalance and haphazard developmental have raised various environmental issues which needs immediate attention and care. The increase in Urbanization has increased population density and built up areas which directly affect the environment and water bodies by means of change in total runoff, alteration of peak flow characteristics, and decline in the quality of water.

The urban development activities have marked impact on water bodies. The expansion of cities and developmental work carried to meet the increasing demand of the urbanized population has caused the shrinking and pollution of water bodies. The primary reason for shrinking of water bodies is large amount of water drawn to meet the growing needs of population. Secondly increasing population has increased the hard cover and thus decreasing porosity and increasing flow of large quantity of water causing flood like situation. Thus major environmental issues of Urban development can be classified as:-

- 1) Shrinking of water bodies
- 2) Polluted water bodies
- 3) Altering water cycle

1. SHRINKING OF WATER BODIES

The water body shown below in figure –I is that of Aral Sea taken at different period of time in 1985, 1997 and 2009.



Figure –1a: SHRINKING OF ARAL SEA (1985)



Figure –1b: SHRINKING OF ARAL SEA (1997)



Figure –1c: SHRINKING OF ARAL SEA (2009)

While comparing the photograph of 1985, 1997 and 2009, shows that the kind of human development that took place over the decades have blocked the water channels that were originally reaching the Aral Sea, thus reducing the water content reaching the sea year by year.

People who were dependent on their livelihood because of the fishing activity in the sea have lost their food and means of livelihood. People who were cultivating land around the Aral Sea by using water from the sea, is no longer working there and all the farm land had dried up. The Quality of Land and soil has totally changed from a farm like land to desert like situation. From the above figure it is clear that how water bodies are shrinking and its impact on environment and human life.

In India washing and bathing becomes luxury in Chennai as water crises grips the city. A deficit rainfall during the 2017 and failed monsoon in 2018 has resulted in depletion of ground water and near drying up of major water bodies/aquifers and has pushed residents at the mercy of water tankers. In Chennai several catchment and low-lying areas has been converted into residential

colonies. Thus rivers and lakes fed by these catchment areas have dried up. The development on low-lying areas leads to flood like situation in rainy season because water is unable to find any route to rivers and lakes. At the same time the hard surface hinders the penetration of water into the soil hampering the charging of water table.

2. POLLUTED WATER BODIES

The second impact of Urban Development on water bodies can be classified as Pollution of Underground aquifer and pollution of surface aquifer. Pollution has reached both of them in two ways. First category is point source of pollution and the second category is non point source of pollution. Due to pollution of water bodies by either of the ways it has become unsafe for use, particularly for drinking. It also stops to support many of the life forms, eco system, aquatic life, marine life etc which thrive in these water bodies.

2.1 Pollution of water bodies by sewage

There are several causes of this water pollution. One of the major causes is sewage disposal by urban areas. All over the world it is a traditional practice to dump the sewage into the rivers, lakes or other streams and converting them into large drains over a period of time. Huge rivers such as Yamuna originating from Himalayan glacier which is a perennial river which will not dry up has been converted to drain and its water is unfit for drinking although the glacier water is pure. Smaller rivers which were in existence earlier have dried up now and no longer visible. Gwalior has a huge nala passing through the city which was once a river named as SWARNKALA. Now people don't know about this river and it is no longer identifiable but the city was actually located on the bank of a river. Such is the case with most of the water bodies and the main reason behind is the increasing population which has led to growth of cities and development of new cities all of which are heavily dependent on water to perform their function. Excess demand of water and growth of towns is one of the major reasons behind shrinking and drying up of these water bodies.

The increasing population and urban development activities are also generating more and more of waste (domestic and industrial) and in absence of proper disposal mechanism we are dumping the waste into open fields, low lying areas or rivers which is polluting them. The industrial waste contains chemicals and heavy metals which pollute aquatic life, enter the food chain and affect human life.

In 1938, a Japanese factory discharged a significant amount of mercury metal into Minamata Bay, contaminating the fish stock there. It took a decade for the problem to come to light. By that time many local people had eaten the fish and around 2000 people were poisoned. Hundreds of people were left dead or disabled.

2.2 Pollution of water bodies by alien invaders

Pollution of water bodies are also caused by Alien invaders/ Invasive species. Alien Invaders are animals or plants from one region introduced into a different eco system. It is a phenomenon of over crowding or excessive growth of plant or animal. Common examples of alien invader species are:-

- A. Mediterranean sea- Alien algae called canlerpa taxi folia.



- B. In black sea, an alien jellyfish called Mnemiopsis leidyi reduced fish stocks by 90% after arriving in ballast water.

C. In San Francisco, Asian clams called *Potamocorbula amurensis* also introduced by ballast water have dramatically altered the ecosystem.



Water hyacinth is a good example of alien invader. The excessive fertilizers used in the fields are washed away by rains into water bodies. These water bodies become rich in nitrogen and leads to over growth of water hyacinth which covers up the whole surface of water body thus cutting off the entry of sunlight and eats up all the oxygen dissolved in water. Thus aquatic life dies up due to lack of sunlight and oxygen thus disturbing the whole ecosystem. Ultimately after consuming all the nutrition and oxygen, it will die up and thus whole water body will be abandoned and dead that is devoid of all life forms.



2.3 Pollution of water bodies by plastic waste

The plastic waste directly dumped or thrown into water bodies are cause of water pollution. The aquatic animals after consumption of these plastic waste materials are infected, dying or being paralyzed. The plastic may be consumed directly or after disintegration and comes back to food chain and also affect the human beings through the sea food.



2.4 Pollution of water bodies by religious ceremonies

Religious ceremonies are also one of the causes of water pollution by way of submerging idols and worship materials directly into the water bodies.



Originally these idols were made of clay/mud and colored with natural/organic colors. Now because of large demand from over crowded cities the demand of these idols has increased. In order to meet out the increased demand the method of preparation of these idols have also changed. Now these idols are created from Plaster of Paris because of its quick setting property, to cut short the production time and increase the earning. Moreover the organic colors derived from nature has replaced by synthetic paints due to lesser amount of time and effort required to prepare the color. Thus using a cast and POP hundreds of idols can be created which otherwise took a longer time to dry up and manufacture. This has increased the revenue of crafts man but ultimately contributed to pollution of water bodies.

2.5 Pollution of water bodies by oil spills

Oil also contributes to water pollution by way of oil spills. The change in life style had made us more dependent on oil reserves for day to day functioning of our life. The oils in the process of processing and transportation may accidentally spill and lead to oil pollution. The oil spill on land may cause the land to become unfit for cultivation and polluting the whole water stream by covering the surface of water with a layer of oils. The oil layer over water makes it inhabitable for birds and other aquatic life forms. There is imbalance in whole of ecosystem and economy.

2.6 Pollution of water bodies by radio-active waste

The radio active waste dumped in water streams by industries is also causing water pollution. The radio active pollution of water has caused significant impact on human and aquatic life. It causes genetic mutations, diseases, soil infertility, cell destruction and burns.

ALTERING WATER CYCLE

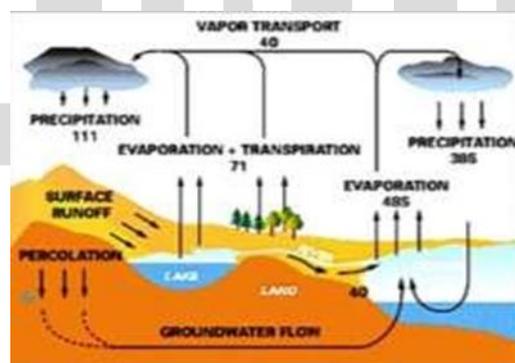


Figure-2: (WATER CYCLE)

The Urban development activity has altered the water cycle. We are having irregular seasonal intervals and rainfall. The rapid urbanization has led to large scale deforestation for increasing the cultivation of land and land required for industrial development. This large scale deforestation has reduced the quantity of transpiration through the trees and lesser amount of water is made available for cloud formation which means lesser quantity of precipitation in form of rain and snow.

The rapid urbanization has increased the waste generation in form of garbage and sewage which are generally dumped into open land or discharged into streams. Waste discharge from urban areas into streams has affected the quality of water of streams though over all quantity of water may remain the same mathematically. The lesser amount of cloud formation will cause less precipitation on hills and plains thus glaciers at uphill will not be properly recharged and depletion may continue at a faster pace. These glaciers are sources of water for rivers that originate from hills/mountains. The water in these rivers is available all the year around. The receding (due to melting) or vanishing of glaciers will affect the amount of water made available by these rivers. The lesser amount

ofrain fall will lead to less water for surface streams and ground water recharge thus lowering of water table. The less amount of rainfall will affect the dilution of sewage in the river and affect the self cleansing velocity of the river eco system. Deforestation will lead to loss of moisture from soil and cause desertification of soil over period of time. The loss of vegetation will increase the surface temperature and cause non periodic rainfall and melting of glaciers thus increasing the sea level.

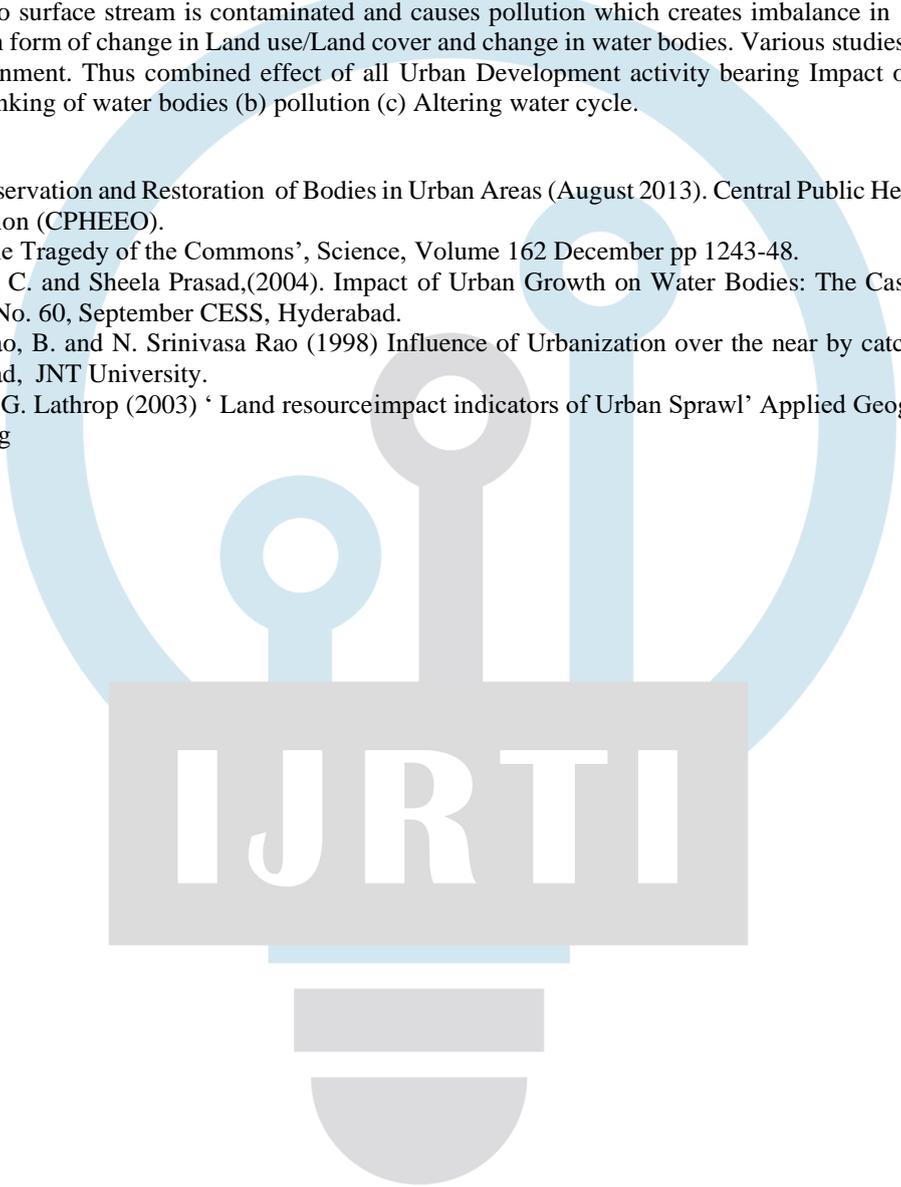
3. CONCLUSIONS

Urbanization is a sign of contemporary growth. The utilisation of natural resources increases after urban development. Two fundamental natural resources—land and water—are needed to begin any development endeavour. Land is the resource on which development activity or any built form such as roads, buildings, market, malls, sports stadiums, educational institutes, hospitals, small and heavy industries, entertainment, museums, parks etc. are built. Water is basic ingredient of all life forms. It is used in horticulture, washing and hygiene, beautification and ornamentation purpose.

In order to meet the need of urbanization/development human beings are exploiting excessive ground and surface potable water which when returned to surface stream is contaminated and causes pollution which creates imbalance in ecosystem. Significant impact has been seen in form of change in Land use/Land cover and change in water bodies. Various studies have shown its impact on ecology and environment. Thus combined effect of all Urban Development activity bearing Impact on Environment can be summarized as (a) shrinking of water bodies (b) pollution (c) Altering water cycle.

REFERENCES

1. Advisory on Conservation and Restoration of Bodies in Urban Areas (August 2013). Central Public Health and Environmental Engineering Organization (CPHEEO).
2. Hardin Garret 'The Tragedy of the Commons', Science, Volume 162 December pp 1243-48.
3. Ramachandraiah, C. and Sheela Prasad,(2004). Impact of Urban Growth on Water Bodies: The Case of Hyderabad, 2004, CESS Working Paper No. 60, September CESS, Hyderabad.
4. Venkateswara Rao, B. and N. Srinivasa Rao (1998) Influence of Urbanization over the near by catchments of the city' - A case study of Hyderabad, JNT University.
5. Hasse J.E. and R.G. Lathrop (2003) ' Land resource impact indicators of Urban Sprawl' Applied Geography 23(2-3):159-75
6. www.iucngisd.org



IJRTI