शिक्षा मंत्रालय
MINISTRY OF
EDUCATION
सत्यमेव जयते

AICTE
All India Council for Technical Education

आज़ादी का अमृत महोत्सव

Ministry of Housing and Urban Affairs
Government of India
सत्यमेव जयते

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

WATER CHANNEL AT SATPULA

Satpula, "The bridge with seven arches"

Remarkable ancient weir
Built 800 m east of the Khirki Masjid

Constructed in the reign of Muhammad bin Tughlaq (1325–1351)

Main Objectives

- **Storing of water for irrigation purposes, since tax was primarily collected through this scheme.**
- **Defence of newly built city Jahanpanah.**

It was constructed in response to the two calamities like famine and black fungus

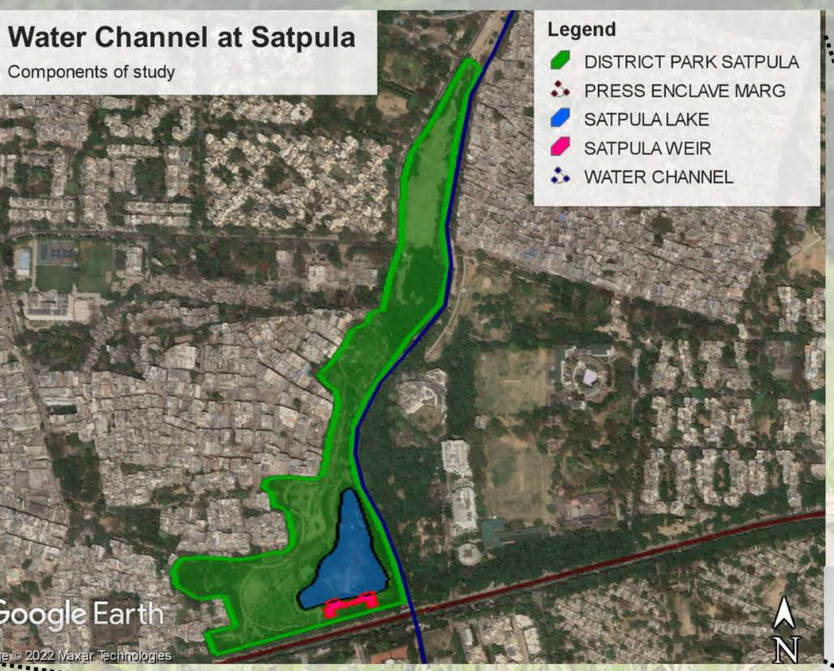
Satpula weir is a remarkable approach of Tughlaq dynasty towards the need of water management system.

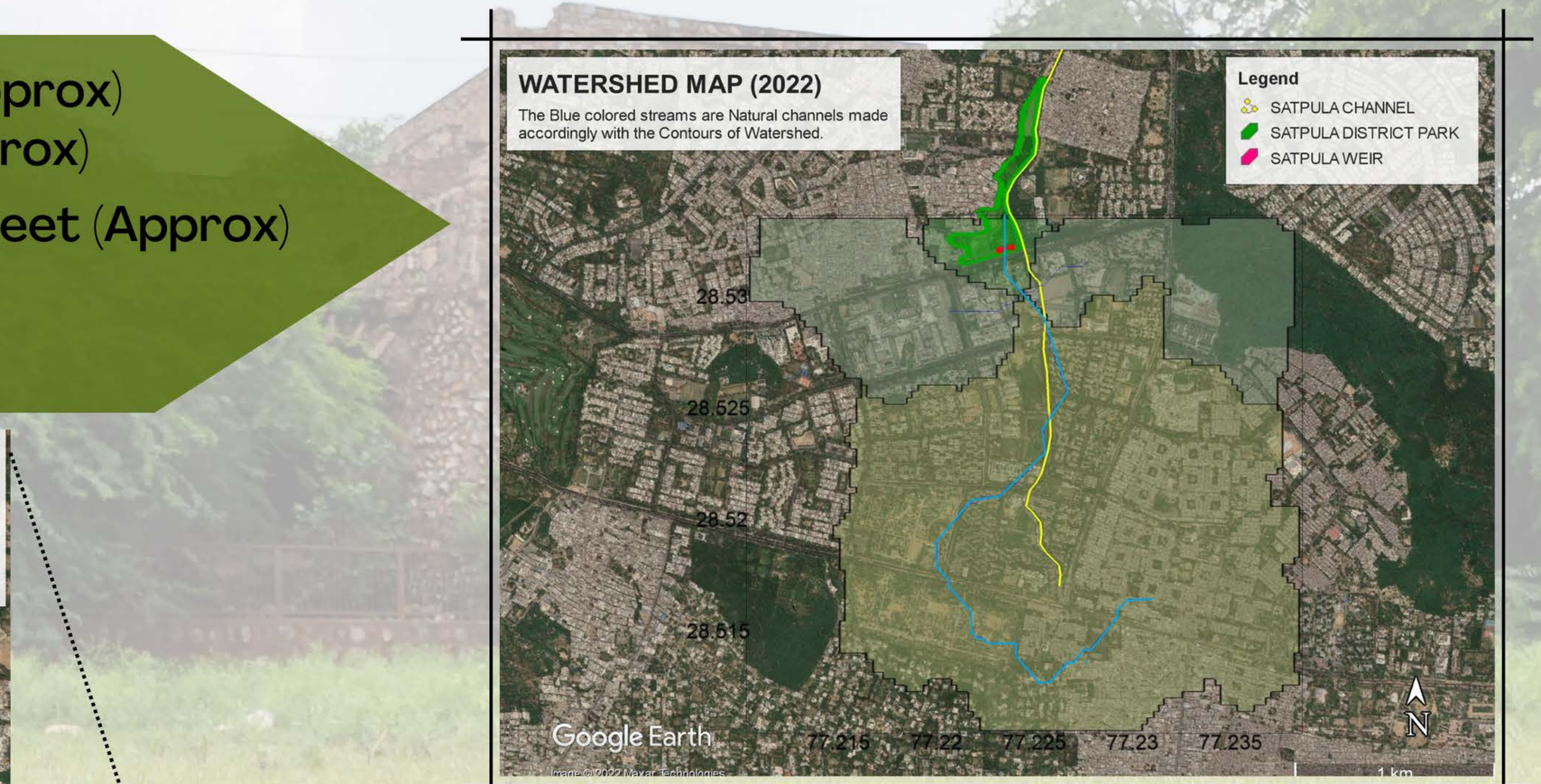
Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

WATER CHANNEL AT SATPULA

SALIENT FEATURES

- Park Area- 19.8 Acres (Approx)
- Lake Area- 3.1 Acres (Approx)
- Depth of Lake is 6.6 -8.2 feet (Approx)
- Latitude= 28°31'54.20"N
- Longitude= 77°13'24.65"E





We have tried to establish the natural channels based on contours using certain graphic tools, such as "Golden Software Surfer." Figure shows that the Satpula weir and natural stream intersect, that is not the case at the moment. The Satpula Channel was displaced either naturally or artificially as a result of the aggressive urbanisation and reduction in green footprint. This clearly illustrates the negative effects of urbanisation on the environment.

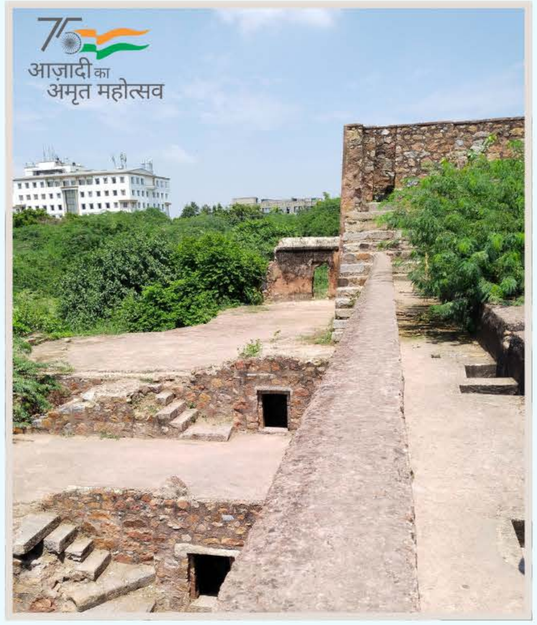
Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

WATER CHANNEL AT SATPULA

GEOGRAPHICAL ASPECTS

Satpula is located at the Geographically strategic position where on one side facing east was the present ridge of Greater Kailash-II and on their side towards the west is the fortification wall of Siri.

- Command areas were identified for supplying water to irrigate crops for large population located in south of Jahanpanah city.
- Built as the headworks or weir across the Satpula Nallah.
- A reliable water storage reservoir in the arid region of Delhi, which has the Thar desert on it's west.



The methodical study of the contours of the area reveals that the land on the upstream side of the weir is at a reasonably lower elevation so as to make its reservoir capacity more hence the weir is located at the right place.

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)

M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda

B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

आज़ादी का अमृत महोत्सव

COME AND EXPLORE
Water Channel at Satpula

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

LET'S TAKE A LOOK AT CULTURAL & RELIGIOUS ASPECTS..

Religious Aspects

- **Popular Sufi Saint Sheikh Yusuf Qattal, lived during the reigns of Ibrahim Lodi and Babur is believed to have performed religious devotions at this Satpula.**
- **The towers of Satpula served as Madrasa [the Arabic word for any type of educational institution, secular or religious (of any religion)]**

Inside View of Watch Tower

Outside View of Watch Tower

Cultural Aspects

- **During Tughlaq's reign Tri- weekly fairs were held at Satpula in the month of October viz., on Sundays, Tuesdays and Saturdays till the celebration of the festival of Diwali.**
- **The water at Satpula was considered as sacred owing to it's curative powers after Sufi Saint Nasir-ud-din Mahmud Chirag Dehlavi once performed Wudu (the ritual ablutions prior to Namaz) in the waters of Satpula.**

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

शिक्षा मंत्रालय
MINISTRY OF EDUCATION
सत्यमेव जयते

AICTE
All India Council for Technical Education

आज़ादी का अमृत महोत्सव

Ministry of Housing and Urban Affairs
Government of India
सत्यमेव जयते

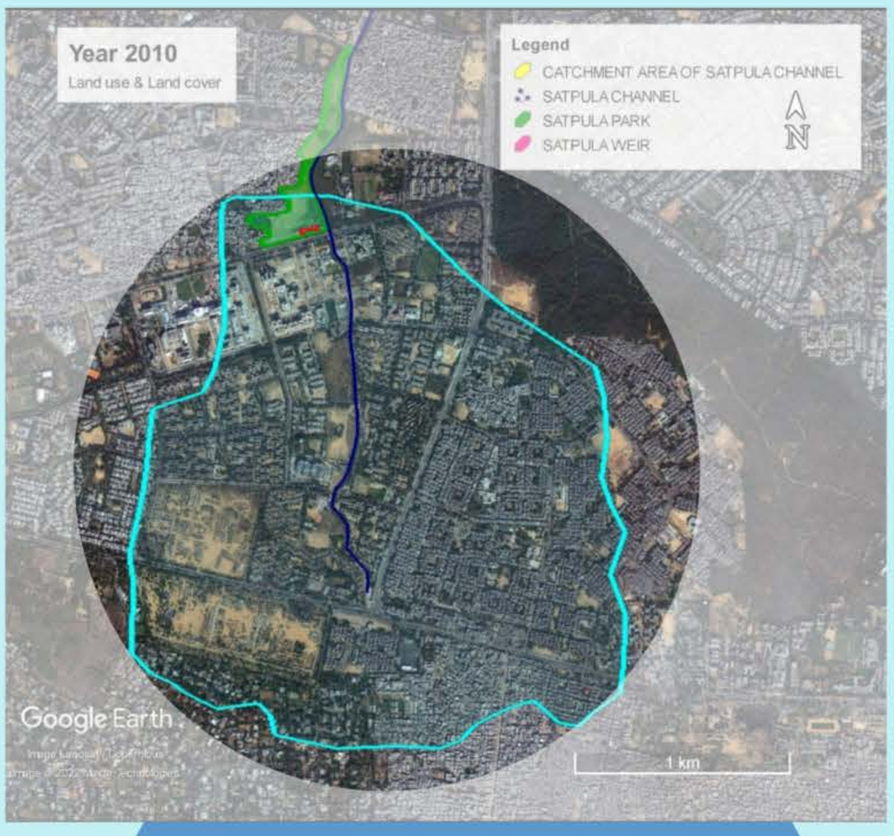
Mission Amrit Sarovar-Jal Dharohar Sanrakshan

WATER CHANNEL AT SATPULA

SPATIO-TEMPORAL ANALYSIS

CATCHMENT AREA

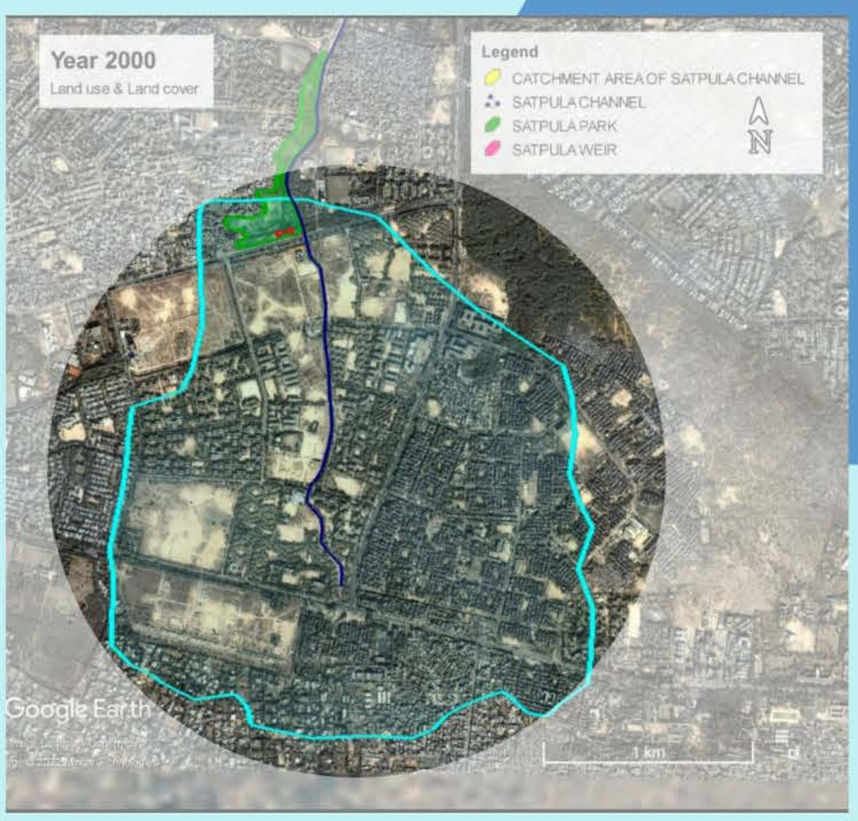
YEAR 2010



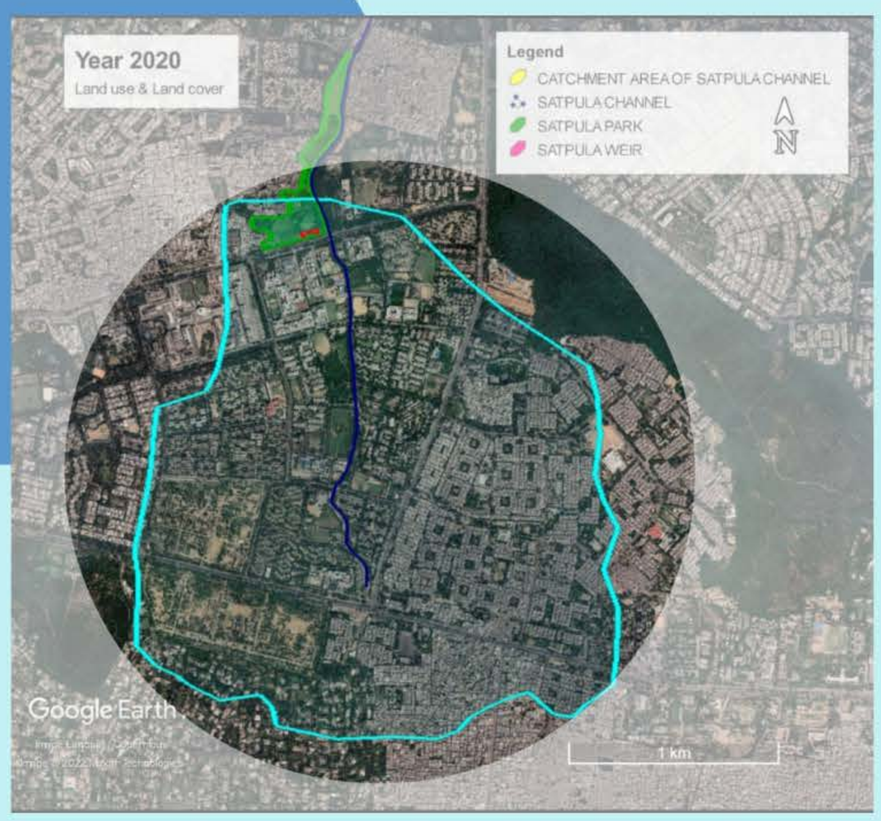
The decrease in green footprint in catchment area affected the infiltration and hence the Run-off generation.

Urbanization in the catchment area drastically increased, affecting directly the Quality and Quantity of Waste water in Satpula channel.

YEAR 2000



YEAR 2020



Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

शिक्षा मंत्रालय
MINISTRY OF
EDUCATION
सत्यमेव जयते

AICTE
All India Council for Technical Education

आज़ादी का अमृत महोत्सव

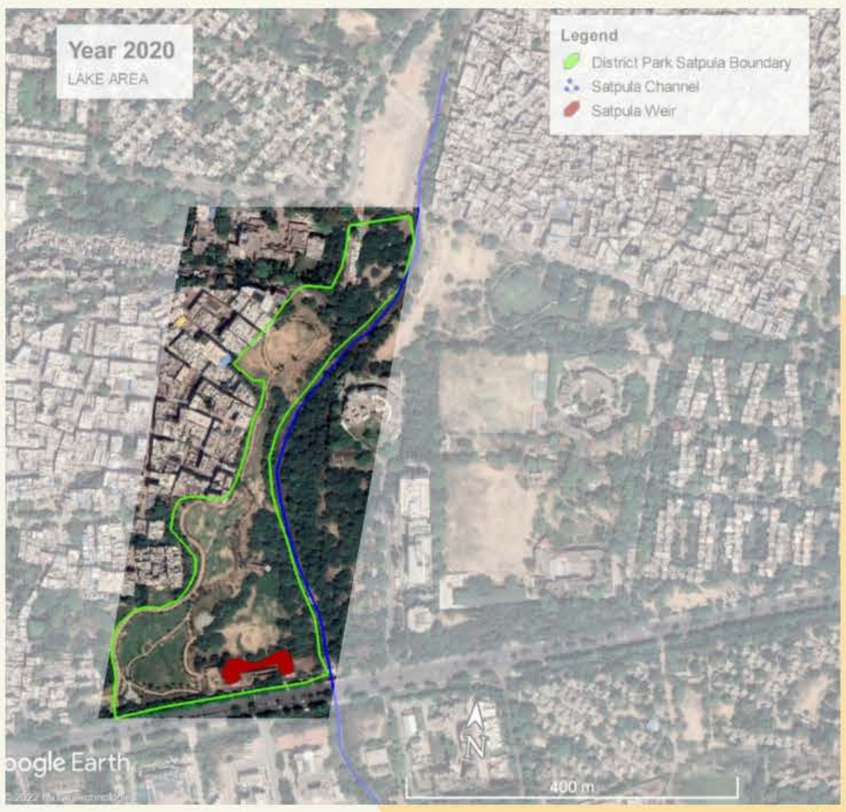
Ministry of Housing and Urban Affairs
Government of India
सत्यमेव जयते

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

WATER CHANNEL AT SATPULA

SPATIO-TEMPORAL ANALYSIS

AREA IN AND AROUND SATPULA WEIR

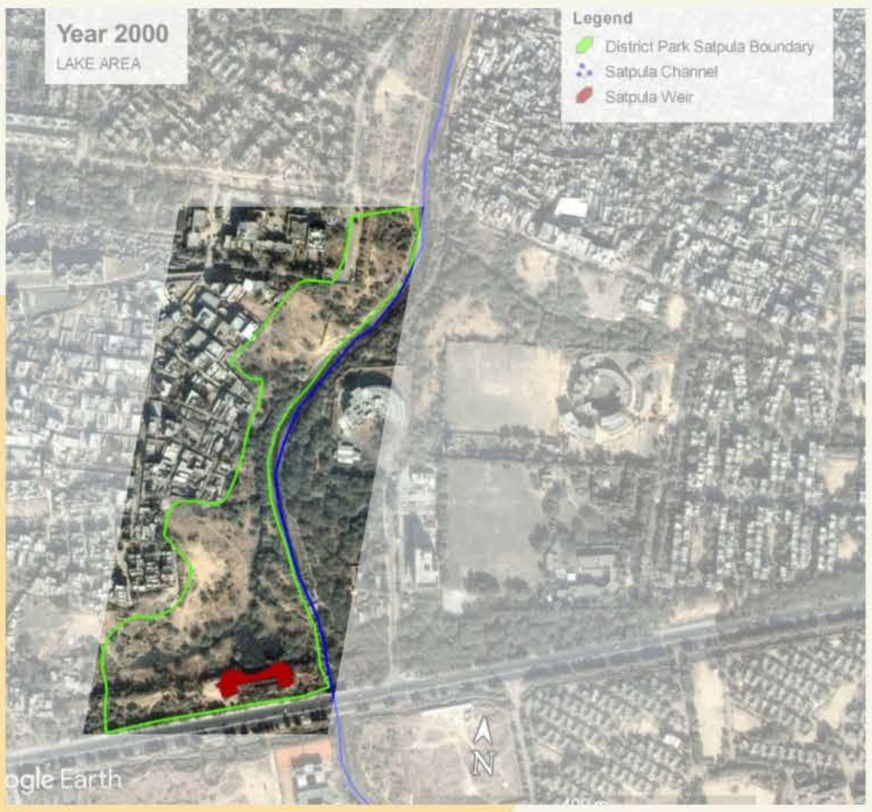


YEAR 2020

Recent Changes in Land use of Lake region were compared at time interval of 10 years.

It is clearly observed that part of the Lake area and its Surroundings has been developed into a park leaving the rest undeveloped that remains mostly dry.

Our idea is to adopt a decentralised approach for reviving this 3.1 Acre lake using Natural Treatment concepts coupled with the usage of renewable energy and rainwater harvesting techniques.



YEAR 2000

YEAR 2010

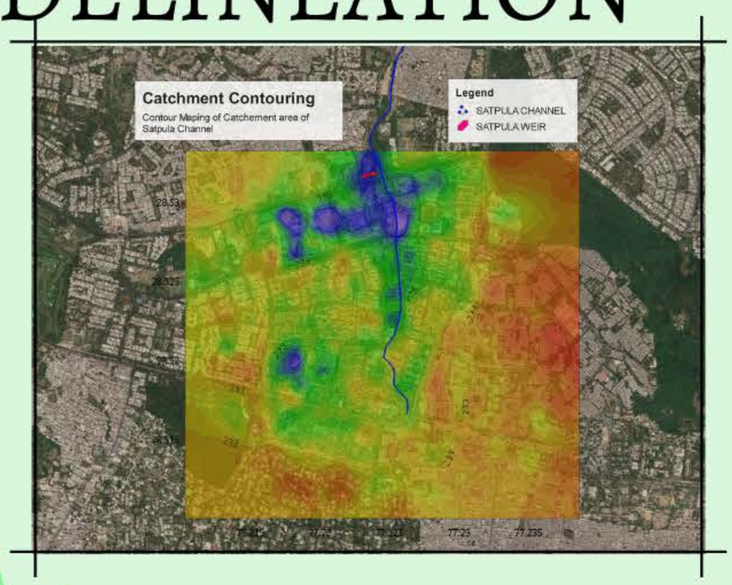
Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

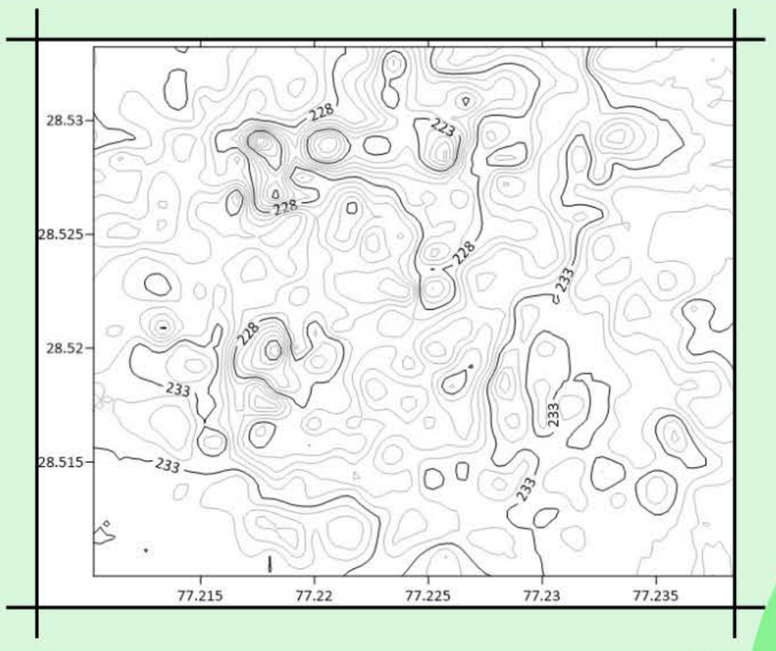
WATER CHANNEL AT SATPULA

HYDROLOGICAL STUDIES

CATCHMENT AREA DELINEATION

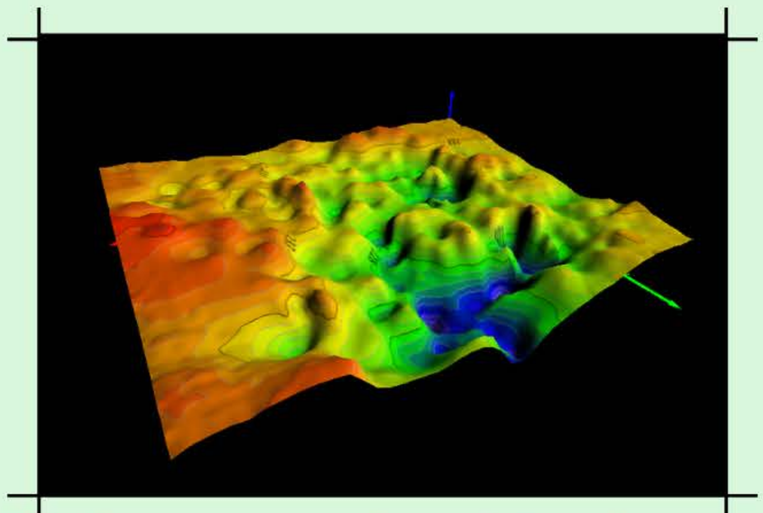
Step-01: Locating the study area in Google Earth.



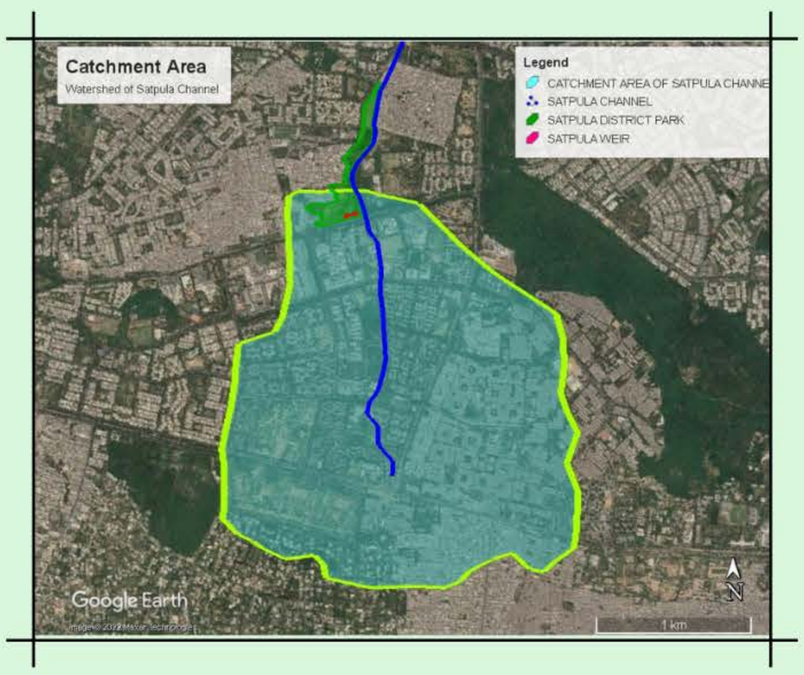


Step-02: Collection of the research area's geocoordinates at several locations.

Step-03: Contour plotting using Golden Software Surfer.



3D Representation of Catchment Area



Step-04: Catchment area delineation using the Ridge line technique.

Observations from Catchment Area

- Catchment area is found out to be Fan shaped.
- Catchment area is equal to 4.5 sq. Km.
- From Digital Elevation Modelling (DEM), we can see that its a variable topography with pondage near the Satpula weir region.

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

आज़ादी का अमृत महोत्सव

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

WATER CHANNEL AT SATPULA

HYDROLOGICAL STUDIES

COMPUTATION OF DISCHARGE

Satpula Channel Discharge

Rainfall Run-off

Depends upon

- Precipitation of area
- Characteristics of catchment area.

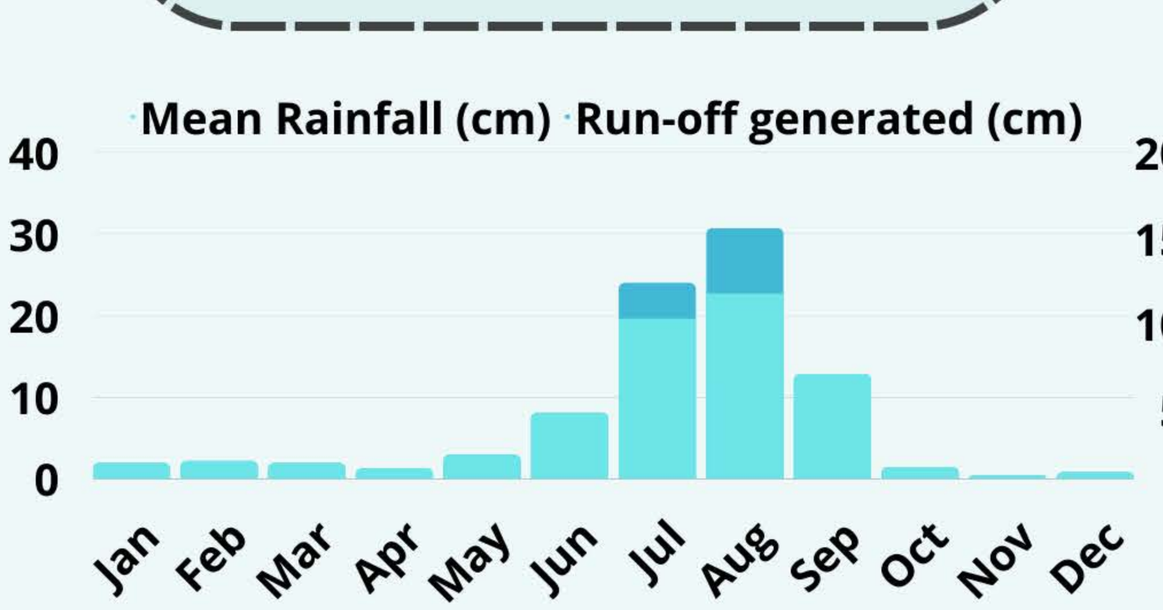
Using rainfall data from the Indian Meteorological Department (IMD), the Khosla Formula is used to determine the run-off generation, which is equal to 559 ML per annum.

Sewage waste water

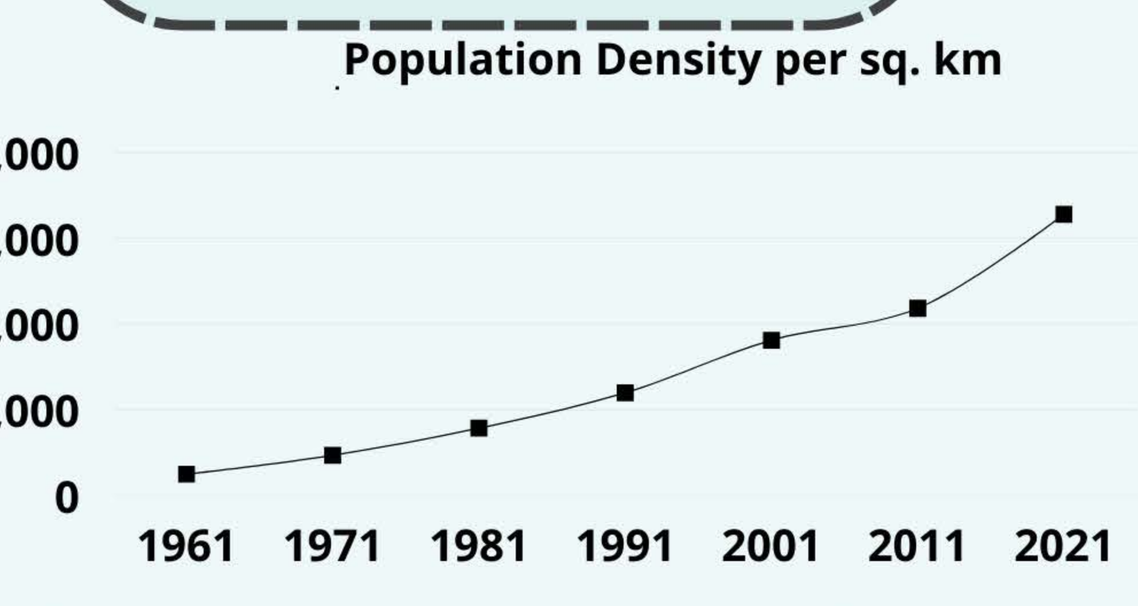
Depends upon

- Population of area
- Per capita usage of water

Forecasted population for 2021 based on information from the Census Board. Sewage is produced at a rate of 14.18 ML per day.



Runoff is only generated in the Monsoon months i.e. July and August.



The exponential growth in population directly impact the quality as well as quantity of discharge in satpula channel.

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)

M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda

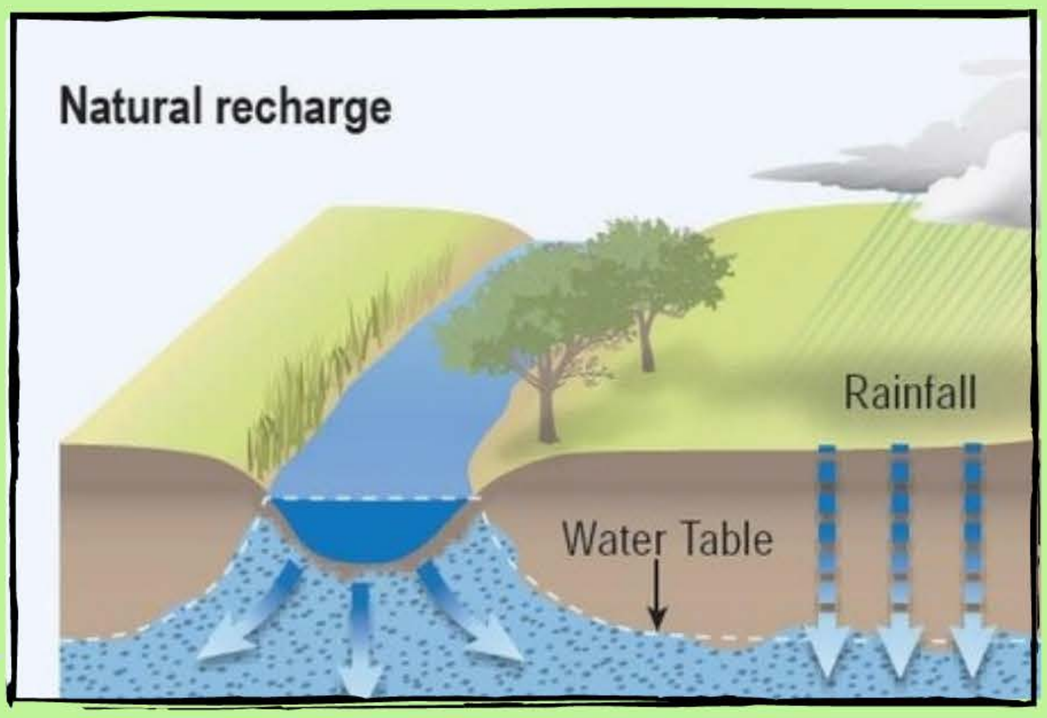
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

WATER CHANNEL AT SATPULA

WHY REJUVENATION?

GROUND WATER RECHARGE

The Ground water table of NCT Delhi is rapidly decreasing at an alarming rate which need to be consider now. By having a functional lake, the water at the lake will seep into the soil and by this the recharging of ground water level will happen.



TN:This figure is used as a reference and is not subjected to water body

ECOLOGICAL BALANCE

Lakes act as one of the best habitat for many Migratory birds (Fauna), results in the preservation of biodiversity of the area.

FLOOD CONTROL

Lake restoration mostly includes removal of sedimented silt to increase the volume of the lake. By so, the lake capacity of storing runoff and storm water from the surrounding area increases and hence the risk of flooding of bank reduces.

TN:This figure is used as a reference and is not subjected to water body

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia , Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

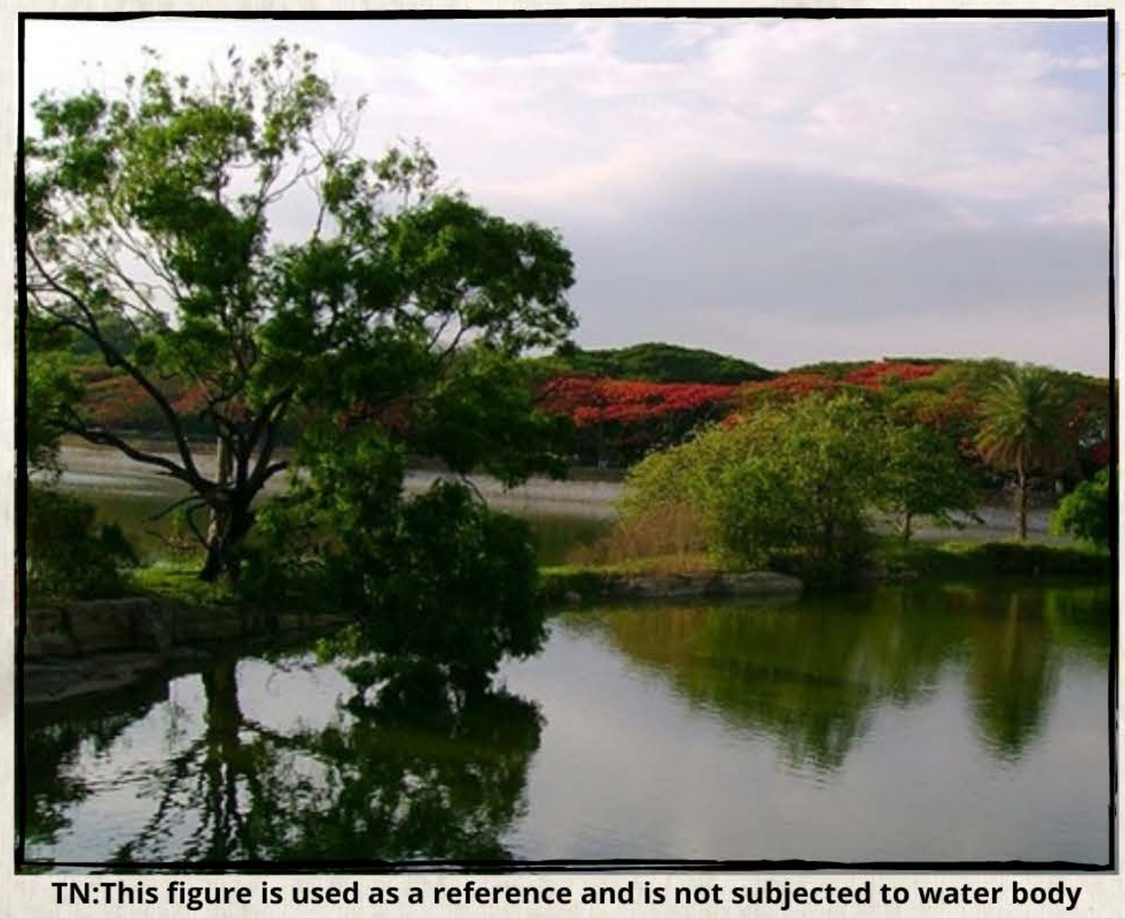
WATER CHANNEL AT SATPULA

WHY REJUVENATION?

DROUGHT CONTROL

A well functioning lake can ease the impact of droughts by storing large amount of water at the time of rain and releasing it during times of water shortage.

TN:This figure is used as a reference and is not subjected to water body



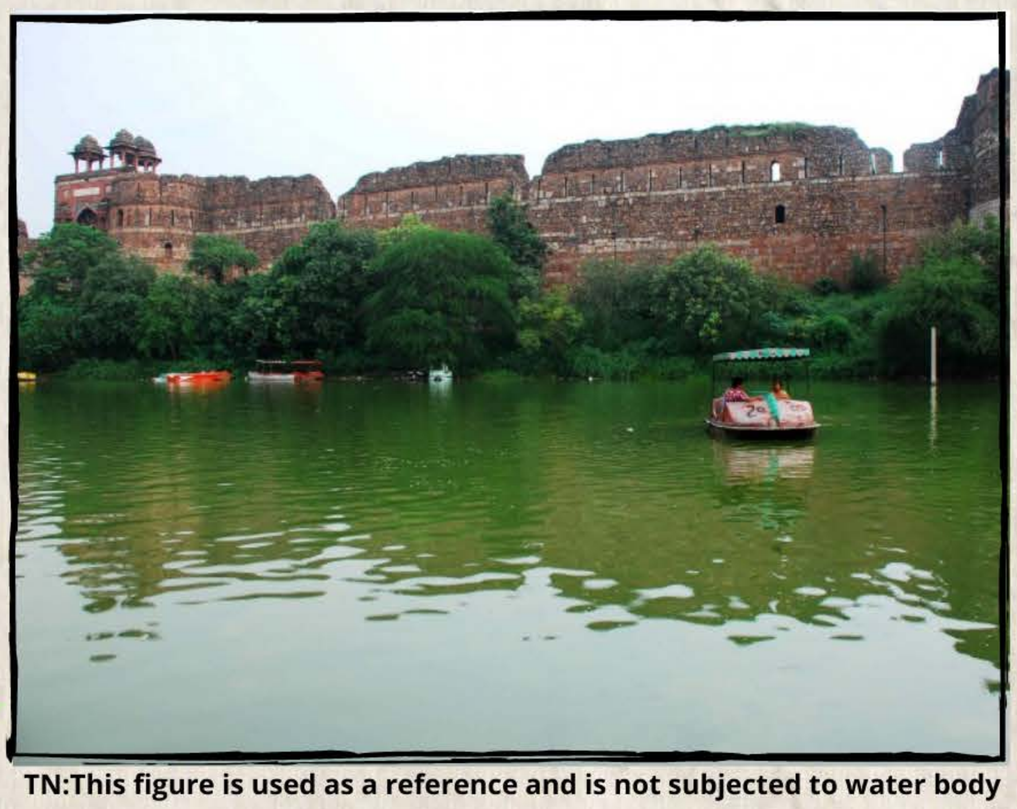
TN:This figure is used as a reference and is not subjected to water body

SOURCE OF HORTICULTURE

It has been observed that lake surroundings have flourishing vegetation which makes the environment of the lake pleasing and promote the locals to contribute in horticulture advancement by doing plantation, their maintenance, etc.

SOCIAL GATHERING PLACE

The parks along with lakes is a great gathering place for locals and serve as a tourist attraction to enjoy the beauty of the lake and other fun activities like picnic, boating, etc.



TN:This figure is used as a reference and is not subjected to water body

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

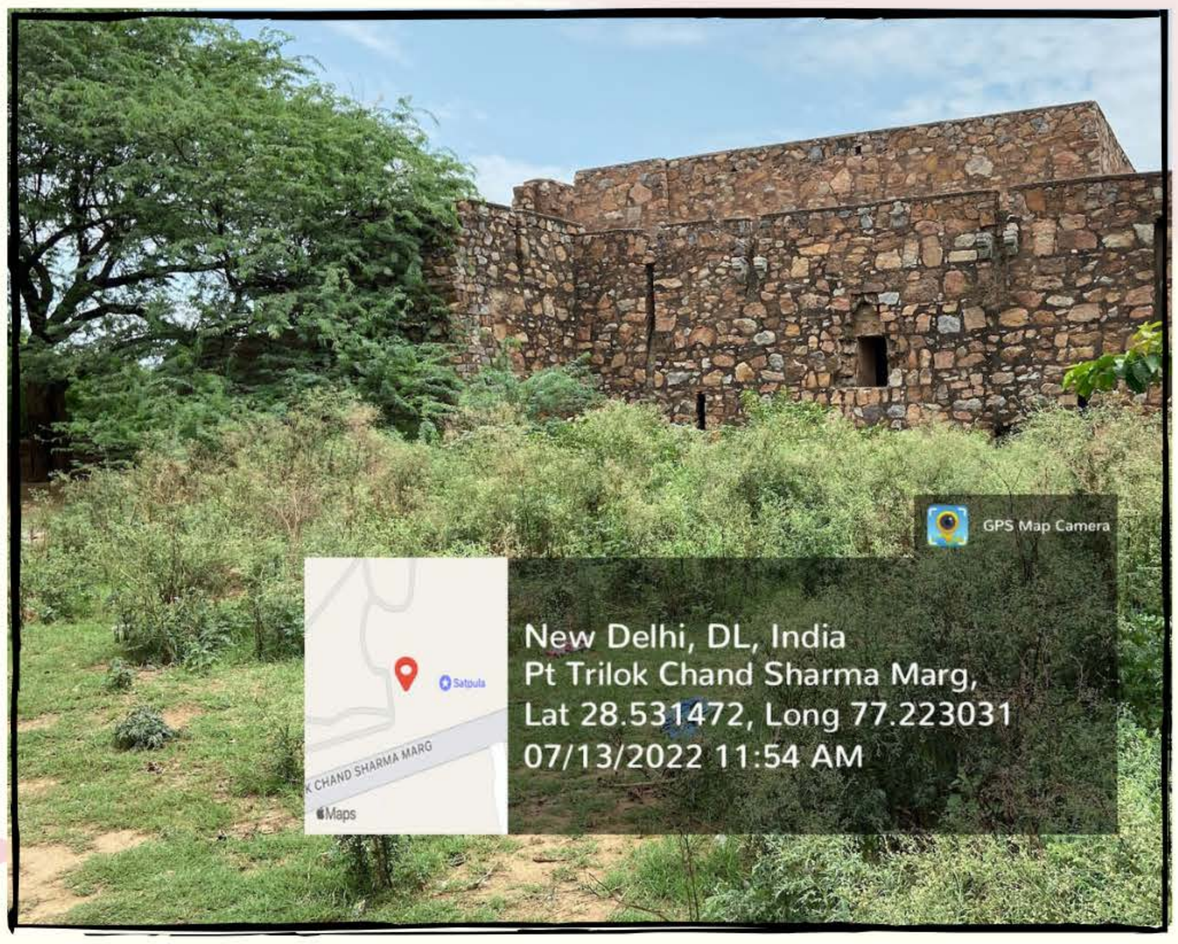
WATER CHANNEL AT SATPULA

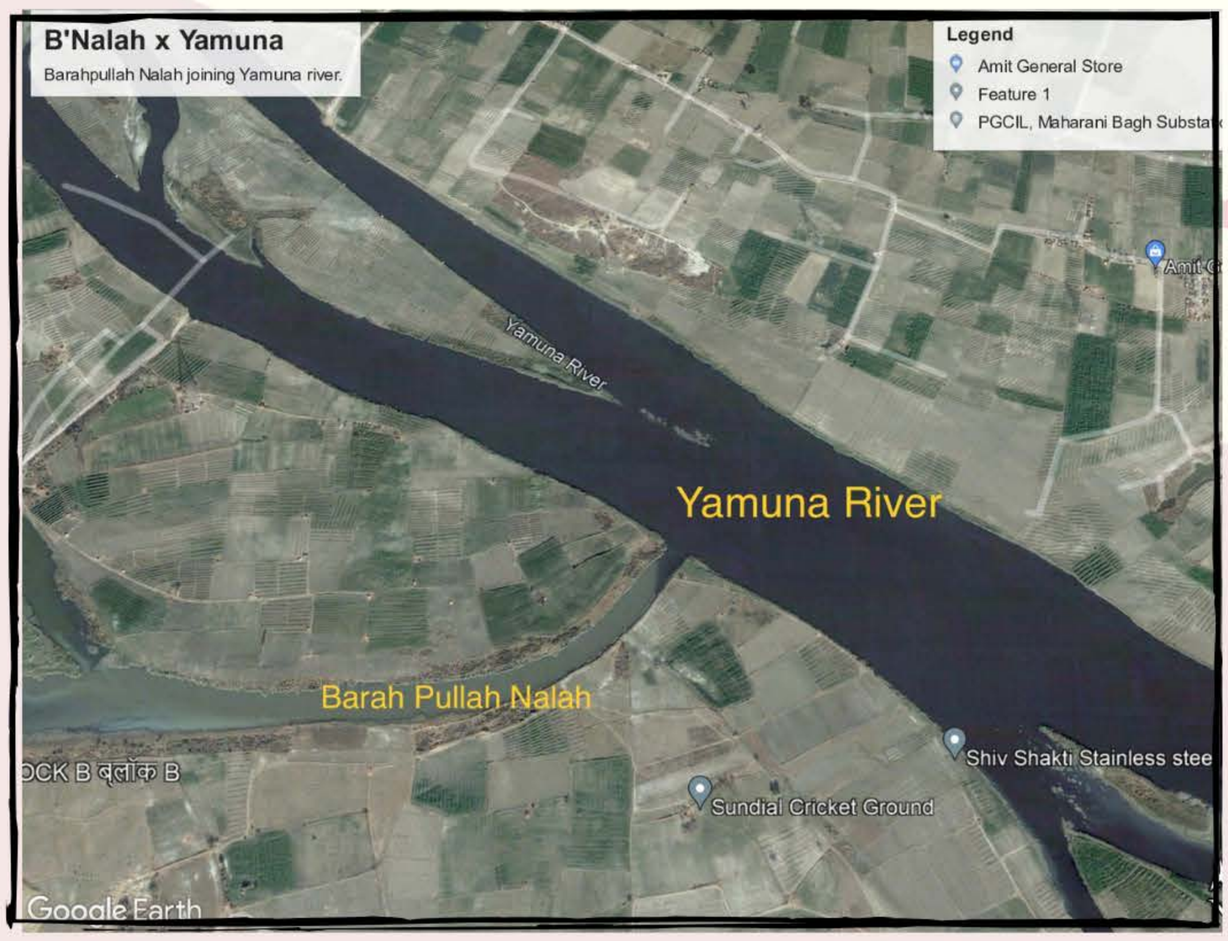
WHY REJUVENATION?

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

Preserving the Heritage

Rejuvenation aims to resuscitate the dying urban void into a liveable community open space while enhancing the ecology as well as appreciating the unacknowledged heritage of the water channel at Satpula and Satpula Weir.





Contribution Towards Yamuna's Quality

Water channel at Satpula joins the Barapulla Nalah in downstream which later ends up in Yamuna River. So, rejuvenation of Satpula channel will not only confined to a particular channel but will improve the condition of river yamuna.

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

WATER CHANNEL AT SATPULA

REJUVENATION TECHNIQUE

Stages/Parts/Components

1.Treatment of water of Satpula channel using In-situ Bio-remediation technique.

2.Revival of lake near Satpula weir using the above treated water of satpula channel as source.

3.Draining the water out of lake from the other end back satpula channel.

4.Restoration and re-strengthing of Satpula weir for Heritage Conservation and Tourist Attraction.

In situ-Bioremediation Technique

Constructed Wetland System for water channel at Satpula

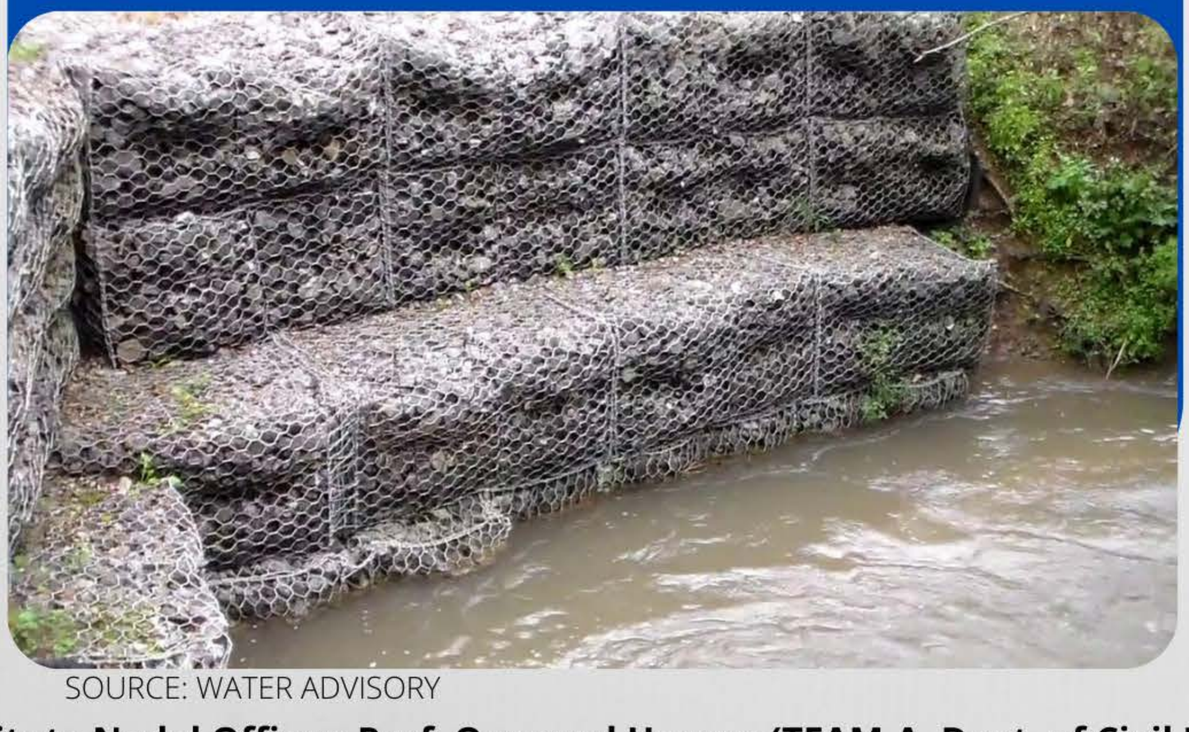
- Works on same principle of conventional STP
- A typical CW system should have the following components:

a) Screens (iron mesh having 4-10 mm aperture)

b) Gabions (Gravel or boulders wall) at regular interval and separating the treatment units.

c) Aerobic oxidation pond with depth less than 1 m.

e) Aquatic Plants that consume nutrients from waste water eg. Algae, water hyacinth, etc.

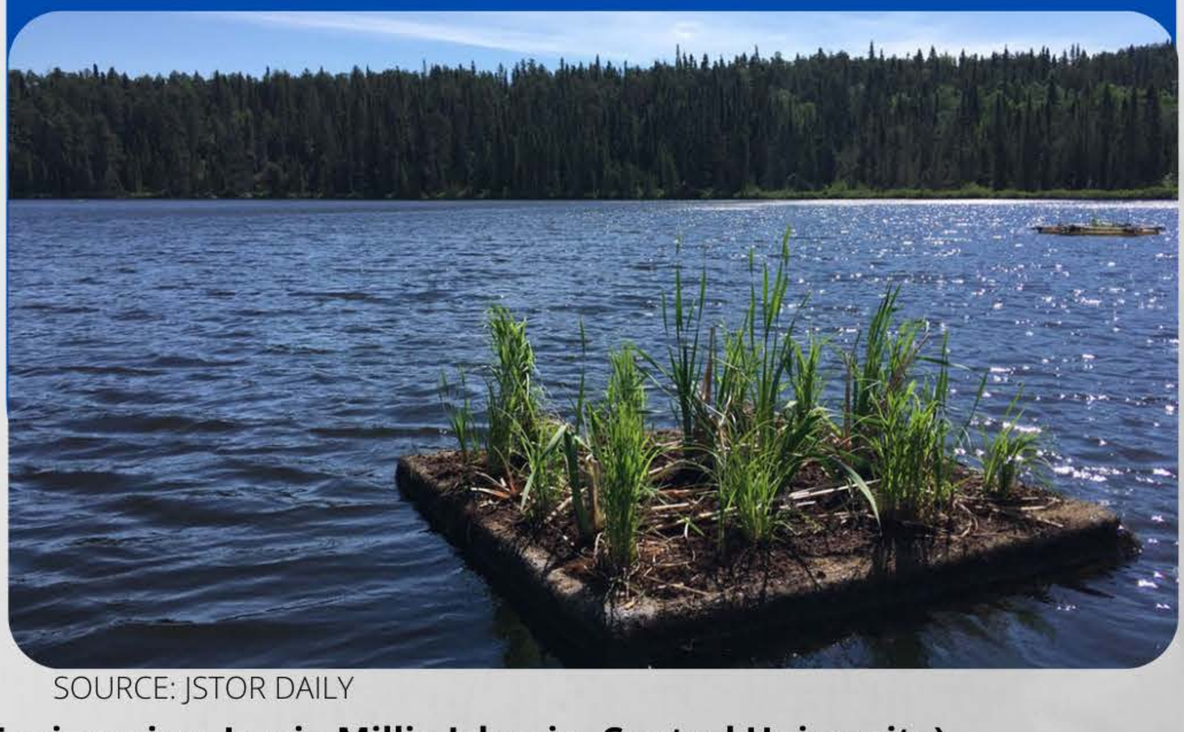


SOURCE: WATER ADVISORY

SOURCE: JSTOR DAILY

Aquatic Phytoremediation

Plant technology used to remove pollutants from surface waters and restore impacted water bodies (rivers, streams, lakes, ponds)



SOURCE: JSTOR DAILY

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)

M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda

B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

WATER CHANNEL AT SATPULA
ACTION PLAN

1 Detailed Study and Analysis

- Detail hydrologic & hydraulic survey of catchment, water channel and lake need to be carried out for various seasons.
- Study of drainage network contributing to the discharge in channel
- Identification of sources of pollution
- Detailed water quality analyses of the water channel at different times of year.

Source: One India

Source:www.cntraveller.in

2 Contruction Phase

Water Channel at Satpula

- Redesigning of the water channel
- Design & construction of diversion canal along the length of channel in the wetland system area, which will also serve as a bypass for the SW discharge.
- Design & Construction of Weir, gabions, ponds, gravel beds, etc in the Bio-remediation unit.
- Introdution of aquatic plants for phytoremediation.

Satpula Weir/ Lake Region

- Restoration & reinforcement of satpula weir for make it accessible.
- Removal of scribble form the monumnets walls.
- Removal of trees & shrubs from the lake area.
- Excavation in certain parts of the lake and Stone pitching of the side slopes
- Introduction of water fountains, Paddle boats and other recreational facilities in the lake and park

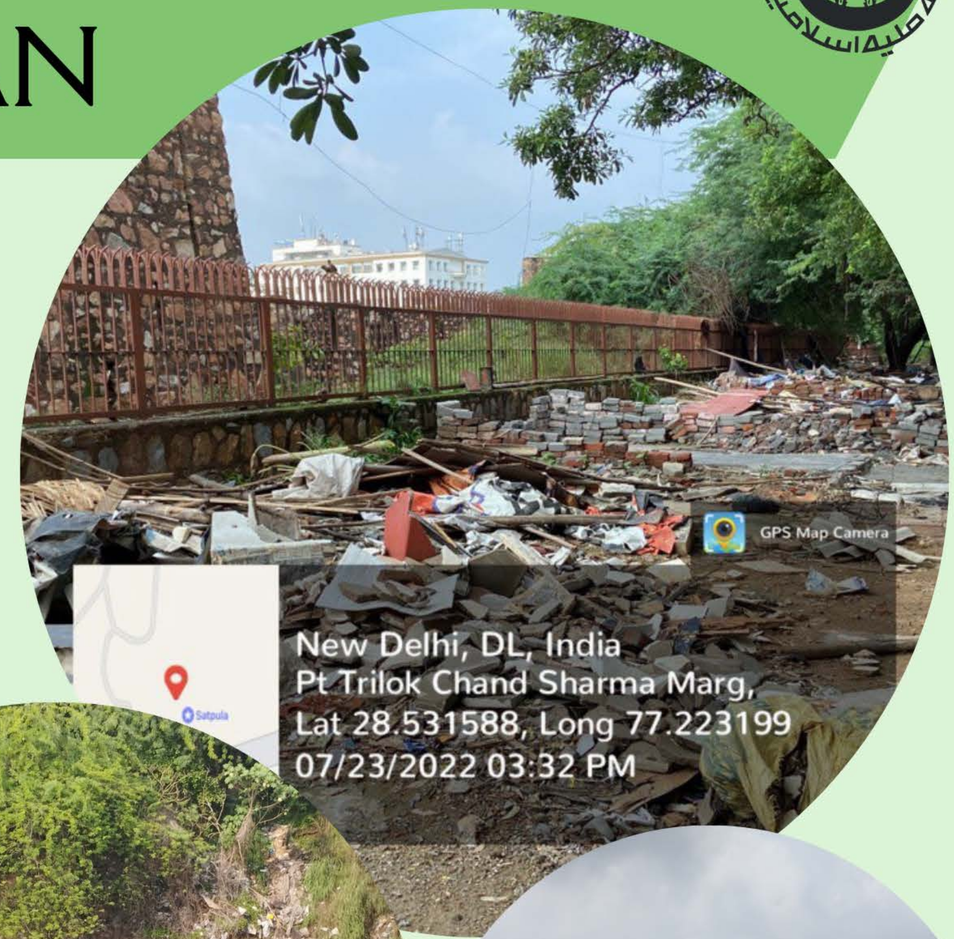
Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

WATER CHANNEL AT SATPULA

ACTION PLAN

Operation & Maintenance

- **Setting of water depth control structures.**
- **Schedule for cleaning and maintaining inlet and outlet structures, valving and monitoring devices.**
- **Schedule for inspecting embankments and structural stability of Satpula weir.**
- **Check on of accumulated sediments in lake area to maintain its water holding capacity.**
- **The wetland should be periodically checked to ensure the uniform flow of water through it.**
- **Assessement of water effluent quality from constructed wetland at regular intervals to check the proper functioning of treatment process.**
- **Mosquitoes are common in natural wetlands and can be expected in constructed wetlands. Mosquitofish (Gambusia) can be introduced to prey on mosquito larvae.**

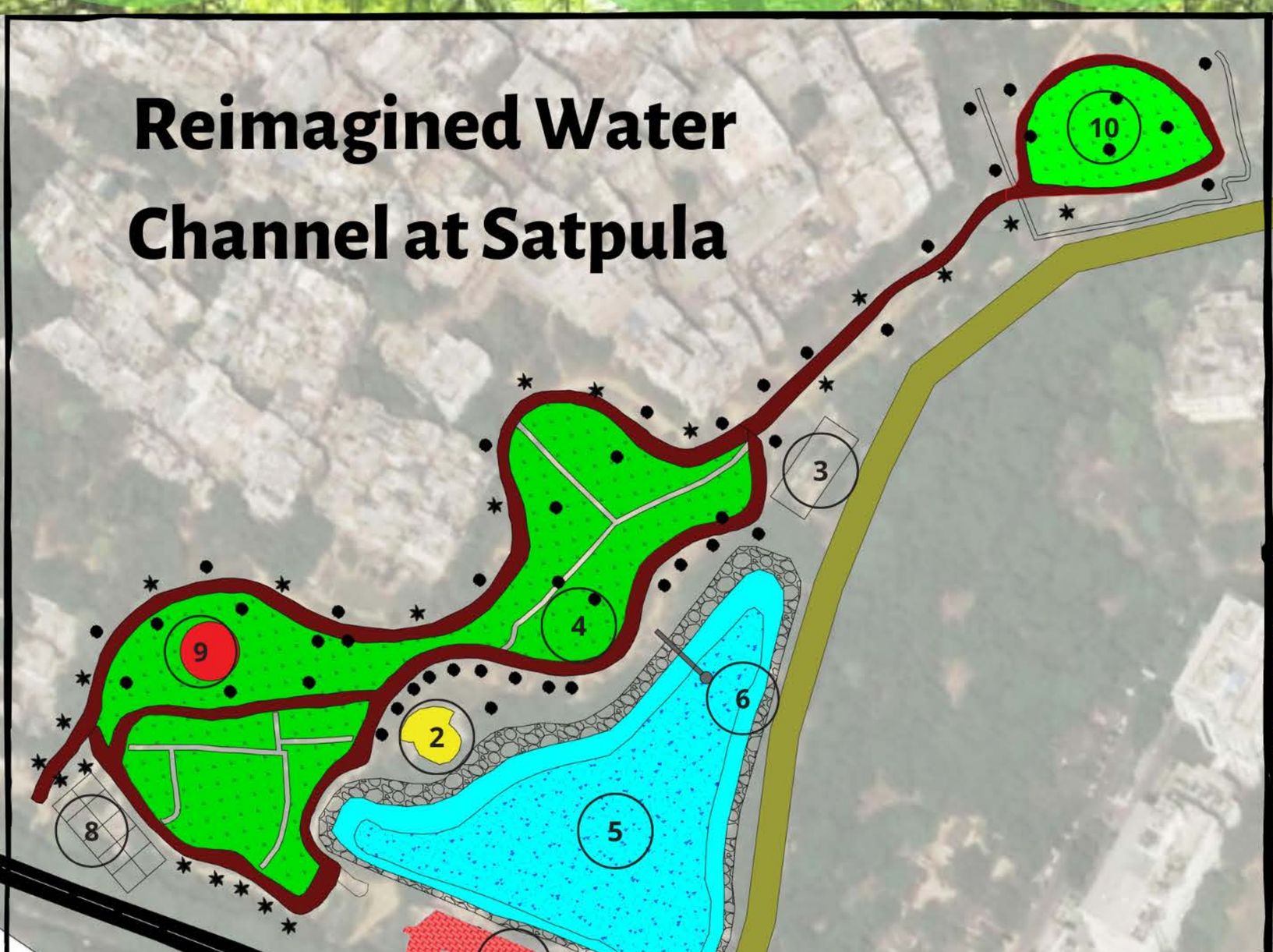


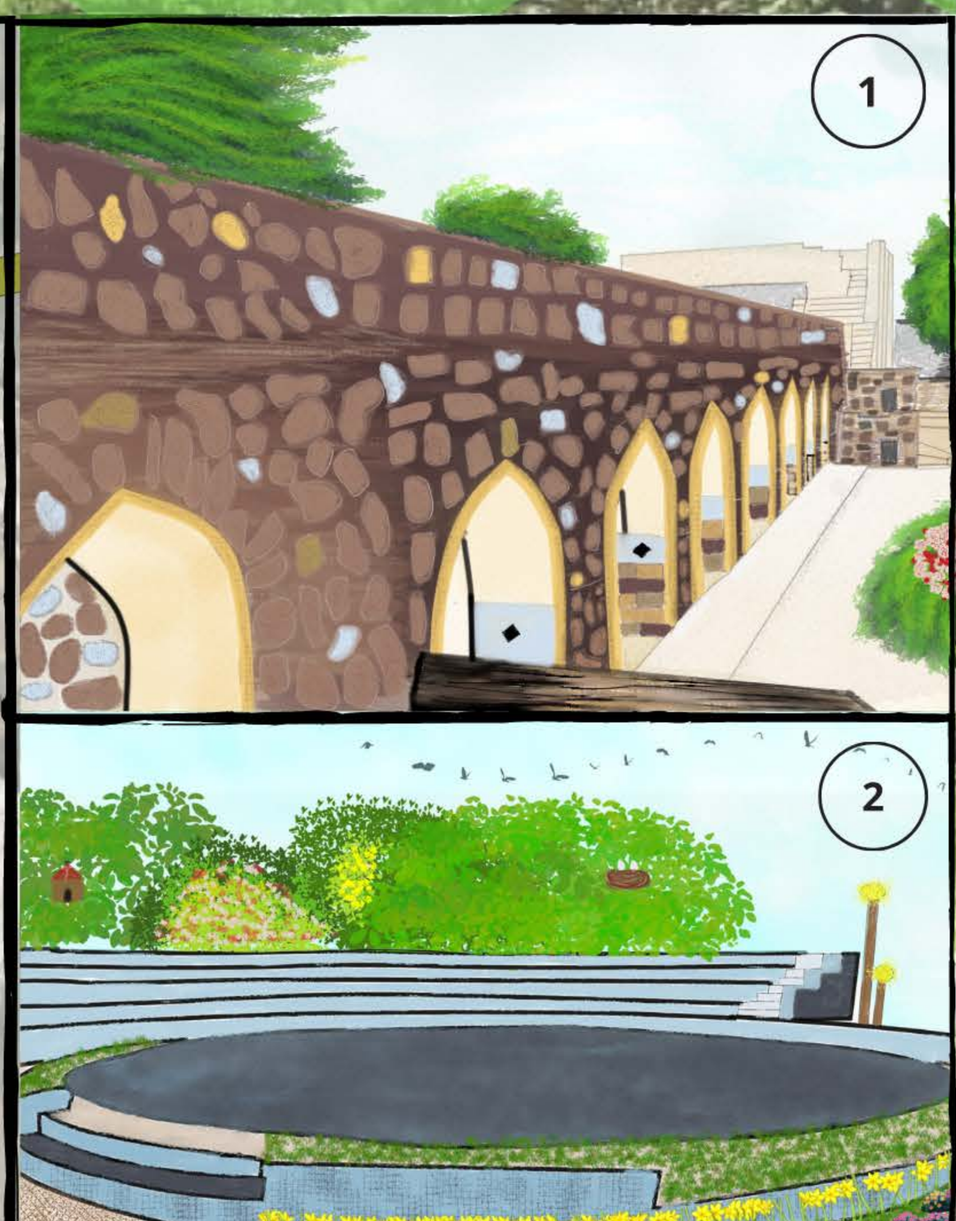
Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)
M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda
B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

Water Channel at Satpula

Reimaging.Rejuvenate.Reconnect

Mission Amrit Sarovar-Jal Dharohar Sanrakshan





LEGENDS

1- Weir
2- Amphitheatre
3- Restrooms
4- Jogging Track with benches
5- Lake Area
6- Lake view point
7- Channel
8- Main Entrance
9- Open Air Gym
10- Yoga Area

Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)

M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda

B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar

WATER CHANNEL AT SATPULA

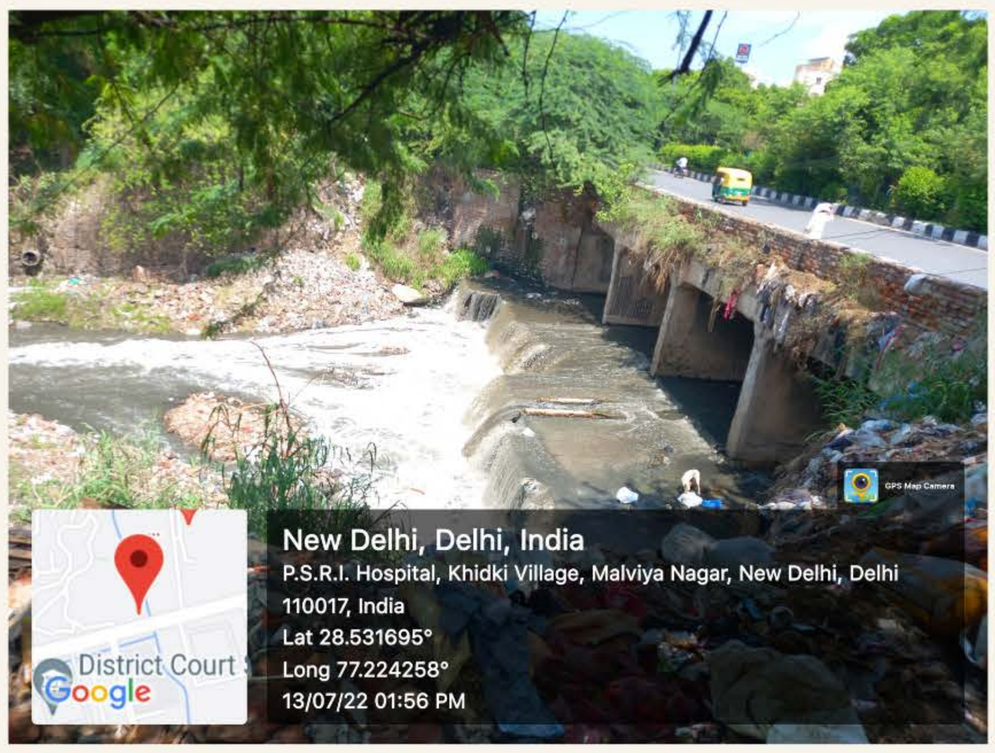
FIELD VISITS

Mission Amrit Sarovar-Jal Dharohar Sanrakshan

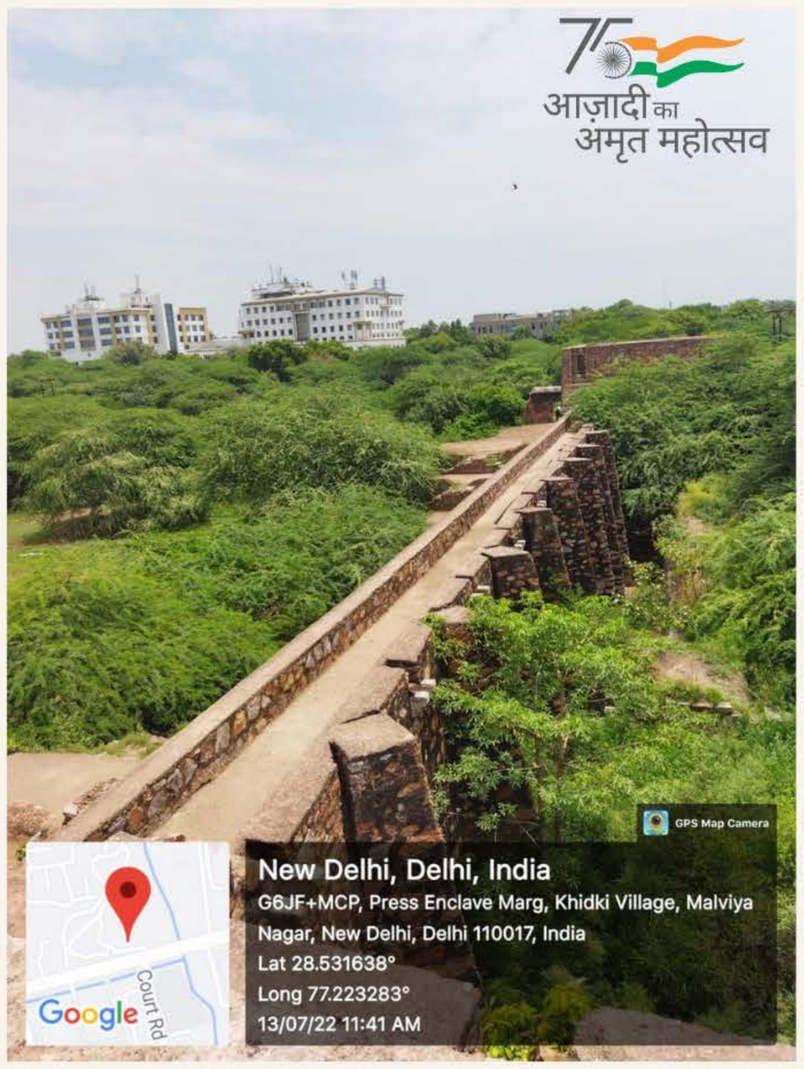
Team visit to ASI office

Preliminary visit to water channel

Team at Water Channel at Satpula



Detailed Total Station survey



Institute Nodal Officer: Prof. Quamrul Hassan (TEAM-A, Dept. of Civil Engineering, Jamia Millia Islamia, Central University)

M.Tech Intern: Rajina Suhel Choudhury, Safder Ali, Sayma Parveen, Shahnawaz Jami, Ubaid Ullah Khan, Ziaul Huda

B.Tech Intern: Aiman Kafeel, Akib Khan Warsi, Alok Mishra, Deepanshu Mishra, Janee Baboo, Mohammad Arib, Mohammad Jafar Khan, Sarthak Kumar, Yasir Waqar