# Present Scenario of Water Supply in Kolkata

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**Abstract -** *"Water" is quite an illusive term in many parts of India even at present date. In the following case study we have focused about water supply scenario of "The City of Joy" with the help of some past, present statistics and also predicted the likely outcome in near future. We have discussed about the sources of water supply, the existing Water treatment plants(WTPs) and the Booster Pumping stations in the city and whether it is capable to meet the ever growing demand of the city. We took a brief look at whether water crisis is prevalent in the city keeping in mind the various economic stratas of the society and what are the steps taken by authorities to meet the future water demand. In the end, we expressed our opinions about the causes and solutions to pollution of surface water sources and groundwater source contamination before arriving at conclusions of this research study.*

***Key Words*: Sources, Water Supply, Water Demand, Water Treatment Plants (WTPs), Crisis, Pollution, Pumping Station, Tala tank, Kolkata, Hooghly River, Ground Water.**

## 1. INTRODUCTION

Kolkata is one of the eight Metropolitan Cities of India and Capital of the State of West Bengal. The City located at $22^0$34'21.5220" North Latitude, $88^0$21'50.0112" East Longitude, is the main port entry in North Eastern India. It is 120 km distant from the Bay of Bengal and stands on the bank of the River Hooghly (Ganga). We all know that the population of Kolkata city is increasing and current population of Kolkata is more than 4.6 million. The resident population was 4, 496, 694 i.e 4.49 million in KMC area as per 2011 census.

Its Metropolitan Area, the population is estimated 14.38 million in 2014.

The huge infrastructural development works in different locations, stretched at either side of EM by pass along with added areas of Kolkata like Jadavpur, Garia , Behala apart from city proper and northern congruent parts , have been undertaken by both private and public sectors , are major issues for such influx of population.

Therefore, the pressure of using of domestic water has been raised abnormally high .This has resulted the huge demand for the supply of potable water, particularly in this growing areas.

Two planned townships in the greater Kolkata region are Bidhannagar, also known as Salt Lake City, located north-east of the city and Rajarhat, also called New Town, sited east of Bidhannagar Salt Lake Sector, are also witnessed with the same problem.

### 1.1 Brief History

During the earlier years of the eighteenth century under the regime of East India Company, the City used to get water from several tanks of which the most used one was the 'Lal Dighi' (present Benoy Badal Dinesh Bagh). As the demands increased a small pump house was constructed at Chandpal Ghat in 1820 to pump the river water and supply it untreated through brick channels for purposes other than drinking. A small water treatment plant (WTP) of capacity 6 MGD (27.3 MLD) was constructed at Palta, located at a distance of about 32 km north of Kolkata during 1864 and 1870 to provide potable water to the city. Water used to get transported to the city through a 42" (1067 mm) diameter cast iron gravity main along BT Road. Water supply through pressure mains was first introduced in 1905 through separate cast iron mains. Since then the capacity of the WTP was progressively increased and present capacity of the plant is 262 MGD (1191 MLD).

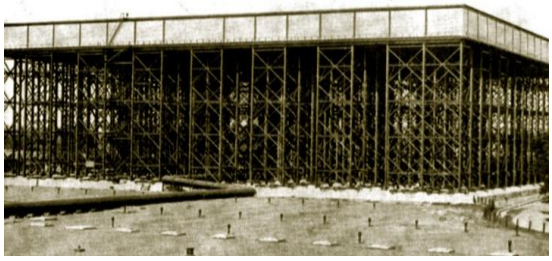

**Fig -1**: Kolkata Tala tank

Calcutta Metropolitan Water and Sanitation Authority (CMW&SA) presently known as KMW&SA was formed through enactment on 2.10.1966. it was created with the purpose of maintenance, development and regulation of water supply, sewerage and drainage services etc. for the CMA with a view to promote public health and for matters connected therewith. In the field of water supply, KMW&SA has constructed and was operating and maintaining 272 MLD at Garden Reach Water Works situated at the southern side of Kolkata from where KMC was getting water of 40 MGD. Since then the capacity of the WTP is progressively increased.

### 1.2 Kolkata: Water Supply Statistics at a Glance

i) Water demand in 2012 >293 MGD
ii) Water demand in 2026 >402MGD

iii) Total daily potable water supply (in million litre)> 1350 MLD that is 300 MGD
iv) Per capita availability of water per day (in litre) >202 litres/per day including 30% UFW
v) Unaccounted water > 35%
vi)Treated surface water supply > 271 MGD
vii) Ground water supply: 25 MGD
viii) No. of Tube Wells Big diameter >439 (power driven)
ix) Small Diameter > 10,050 (hand driven)
x) Average supply hour: 8 hours
xi) No. of connections Domestic: 2,45,019
xii) Coverage of Household connection: 92.70%
xiii) % of house hold covered by surface water > 82.70%
xiv) % of house hold connection by ground water > 10%
xv) Industrial and Commercial > 25,000
xvi) Public Access Standard Posts (in nos.)> 17,019
xvii) Unfiltered water through street hydrants (in nos.) > 2000
xviii) No. of reservoirs Present> 7
ix) Under construction > 14
xx) No of Booster Pumping stations> 17+1 (Tala)
xxi) No of Booster Pumping stations (under construction) >5
xxii) Length of distribution net works > 5800KM

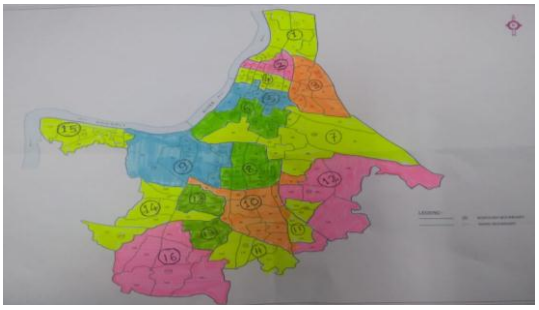

**Fig -2**: Present borough map of Kolkata

## 2. SOURCE OF WATER SUPPLY

Sources of water can be divided into two categories- Surface Water Source & Subsurface Water source. Kolkata city water supply is dependent on both surface water sources and ground water sources.

### 2.1 Surface Water Sources

According to the present scenario, we can divide the surface water sources into two main parts- River & Storage Reservoir.

- **River:** The western part of city follows along the right bank of river Hooghly. The river has perennial flow. The water resources of the river Hooghly is very much precious to us. All the surface water treatment plants at the present moment are located along the right bank of the river. Hooghly River is part of the Ganges River Delta system.

  Hooghly River starts at Farakka Barrage on the Ganges River more than 200km north of Kolkata and flows in a north-southerly direction towards the sea. Kolkata is on east bank of the river, about 120km upstream of its flow. Hooghly River is the main source of potable surface water for the city of Kolkata supplied from the age-old Palta Water Works now rechristened as Indira Gandhi Water Treatment Plant. The Palta Water Works, spreading over a sprawling stretch of 480 acres, was the first intake point constructed during 1864–1870 for generation and supply of water. Initiated with a capacity of 6 mgd (million gallon per day), filtered water was generated through sedimentation in pre and final settling tanks.

**Fig -3**: Main source of water supply Hooghly

- **Storage Reservoir:** Tala water tank of Kolkata Municipal Corporation was built in 1909. It has the capacity to hold 9 million gallons of water and is the largest overhead reservoir in the world. Except Tala there are many reservoir like- Subodh Mullick Square, Auckland Square, Behala, Md. Ali Park, Garfa, Park Circus, Ranikuthi, Kalighat, Bansdroni, Kasba, Bagmari, New Park, Daspara, Siriti, Anandapur, Gandhi Maidan, Telipara, Baishnabghata Patuli, Chetla, G J Khan Road, Khejurtala, Shanti Pally, Hatisur, Phool Bagan, Narkel Bagan, Lalgate, Mukundapur.

### 2.2 Subsurface Water Sources

Officially 15% of core Kolkata's water come from groundwater sources & in reality up to 25% to 30% of the water used in households is groundwater. According to the Central Groundwater Board (CGWB) Booklet the groundwater allocation for domestic and industrial uses within KMC area is about 320 MLD. The depth to the groundwater level in the confined aquifer in use varies from 12.09 to 19.59m below ground level in the pre-monsoon period, and 10.72 to 15.42m below ground level in the post-monsoon period. In 2006 groundwater withdrawal by KMC was 144.30 MLD and this has been reduced to 114 MLD in 2011. KMC is intended to further reduce and discourage use of groundwater. P.K. Sikdar, a researcher at the Indian Institute of Social Welfare and Business Management (IISWBM) pointed out, "Groundwater (availability) is rapidly shrinking in the city. It might lead to land subsidence as there is a layer of around 40 metres of clay underground and then sand that might give away." He also said, "Earlier, in the fifties, the groundwater used to flow from north to south but a change was noticed three decades ago when a groundwater pressure trough developed in the south-central part of Kolkata city due to heavy groundwater abstraction and the water started flowing into the trough from all directions," he said. "This pressure trough then began to widen slowly and still persists today. The pressure troughs remain even after

the monsoon, suggesting that the discharge has been more than recharge."

He further said the groundwater level that was more or less near the sea level has dropped drastically by 15 to 16 metres in the past five decades.

## 3. TREATMENT & WATER SUPPLY

### 3.1 Surface Water Treatment Plants

- Palta Water Works (Indira Gandhi Water Works)
- Garden Reach Water Works (GRWW)
- Jorabagan Treatment Plant
- Watgaunge Treatment Plant
- Jaihind Treatment Plant

### 3.2 Capacity of WTP

**Table -1:** Capacity of WTP

| Name | Capacity (MGD) |
|---|---|
| Palta Water Works (Indira Gandhi Water Works) | 242 |
| Garden Reach Water Works (GRWW) | 190 |
| Jorabagan Treatment Plant | 8 |
| Watgaunge Treatment Plant | 5 |
| Jaihind Treatment Plant | 30 |
| Deep Tube well | 110 |

In 2019, a 90 MLD (20 MGD) WTP at IGWTP is recently constructed and a 225 MLD (50 MGD) Water Treatment Plant at Garden Reach Water Works is under construction.

#### 3.2.1 Palta Water Works

Palta water works (PWW) is the oldest water treatment plant in Asia. The British constructed a small 27.3mld plant between 1864 and 1870 at a location approximately 30km north of Kolkata (Latitude 22° 47'4.92" N, Longitude 88°21'53.68" E). Throughout the years the capacity of the plant was expanded and currently the capacity of water works is 1,191 MLD. Raw water is drawn from Hooghly River through 3 pumping stations and is treated through a series of clarifiers, settling tanks, filter beds, and chlorinators.

Five transmission mains transport treated water from Palta to Tala Reservoir and Pumping Station at a distance of 23km south from Palta. Tala is the master reservoir and pumping station of PWW from where the water is distributed over the urban supply area. Tala has 4 underground reservoirs (UGR) and one very large overhead reservoir (OHR) that is more than hundred years old. The Palta-Tala transmission pipes are also old; the oldest being installed in 1868

From Tala PS is conveyed to different KMC supply areas through intermediate Booster Pumping Stations (BPS) and zonal mains (ZM).

#### 3.2.2 Garden Reach Water Works

Garden Reach Water Works (GRWW) is located on the western boundary of Kolkata in Borough XV. Total capacity of the Garden Reach WTP is 864 MLD. Treated water from the Clear water reservoir (CWR) is pumped to reservoirs of Booster Pumping Station (BPS) located in Behala Chowrasta and also directly to the city service grid – Core Calcutta (CC) and South Suburban (SS).

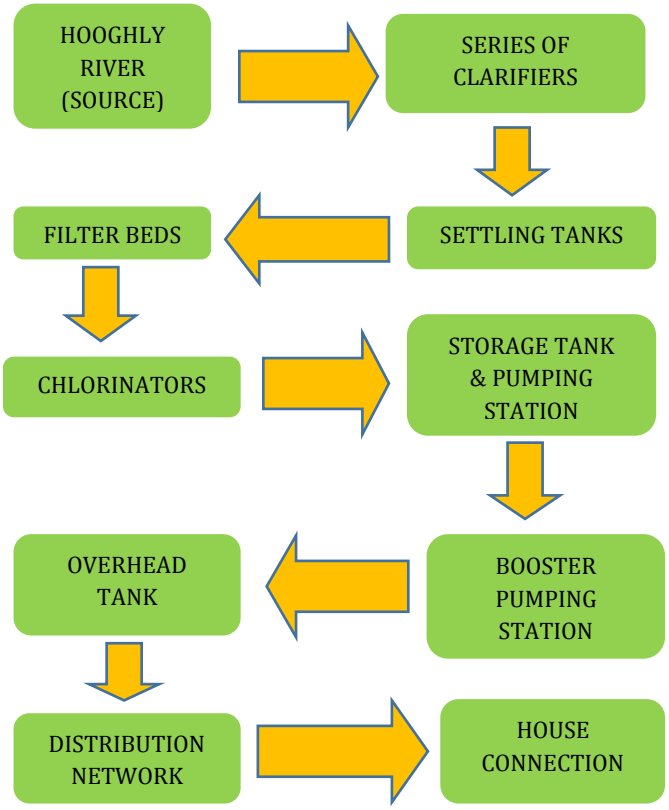


**Chart -1**: Basic Flow Diagram of Palta & Garden Reach Water Treatment Plant

#### 3.2.3 Watgunj

This 5MGD water treatment plant cum booster pumping station is being constructed with the aid of new technology at Watgunj Square to supply water from Palta Water Works and meet the requirement of filtered water for th eresidents of Watgunj and Hastings area.

#### 3.2.4 Jorabagan

This 8MGD water treatment plant and 3.5 MGD underground reservoir cum booster pumping station will filter and supply water generated at Mullick Ghat Pumping Station to the water scare area of Chitpur, Nimtala, Sovabazar and adjoining areas of North Kolkata.

### 3.3 Pumping Station with Reservoirs

Tala, Subodh Mullick Square, Auckland Square, Behala, Md. Ali Park, Garfa, Park Circus, Ranikuthi, Kalighat, Bansdroni, Kasba, Bagmari, New Park, Daspara, Siriti, Anandapur, Gandhi

Maidan, Telipara, Baishnabghata Patuli, Chetla, G J Khan Road, Khejurtala, Shanti Pally, Hatisur, Phool Bagan, Narkel Bagan, Lalgate, Mukundapur.

### 3.3.1 Bagmari

This 6MGD underground reservoir cum booster pumping station ,which is one of the largest boosting sations in the city. With a total of 29.36 km of distribution line,it shall supply water from Palta Water Works to the residents of Maniktala, Ultadanga, Bagmari and adjoining areas thus substantially reducing the dependence on ground water in these areas.

### 3.3.2 Ranikuthi

This 3.5 MGD underground reservoir cum booster pumping station is ready to serve the residents of Tollygunge,Dhakuria and adjoining areas. Located by the side of Ranidighi in Tollygunge,this station would supply filtered water of Garden Reach Water Works through an elaborate distribution pipeline network.

### 3.3.3 Kasba

This 3.5 MGD underground reservoir cum booster pumping station, which is commissioned in February 2020, will get water from Palta. The citizens of the fast growing area of East Kolkata shall be receiving treated water from this booster station. This will also substantially reduce the dependence on ground water in these areas.

### 3.3.4 Tala Tank

In 1706 there were only 17 water bodies in Kolkata in addition with Hoogly river, on which the native population was entirely dependent for its water supply. But there were scarcity of pure drinking water due to multipurpose usage of these water bodies by the native residents. Therefore the tanks got polluted and British didn't accept it as a hygienic source for drinking. In 1709, Lal Dighi or the Great Tank was refurbished which became the purest source of water for another 100 years.

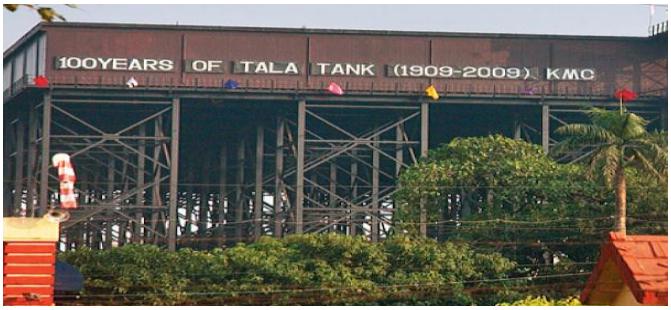


**Fig -4**: Centenary Celebration Mark by Kolkata Municipal Corporation

## 3.4 Early History of Water Supply: Wellington Square Reservoir & Palta Water Works

In 1820 a small pumping plant was set up at Chandpal Ghat for lifting river water into open masonry aqueducts which then supplied water using gravitation to areas like Tala, Chowringhee, Park Street, parts of Lalbazar and Bowbazar. During winter to spring the water was safe for consumption but during monsoon it became saline. In 1865 Municipal Engineer William Clark proposed plan include an intake and settling tanks at Palta, North of Kolkata and an aqueduct 66,600 ft (16 km) long, bringing the supply to Tala and on to Wellington Square. . Subsequently, Palta water works began in 1864 to 1870 on about 482 acres of land to supply filtered water to the residents of the city, now renamed as Indira GandhiWaterWorks

## 3.5 Survivor of the Earthquakes & Bomb Threats

This 111 year old structure (counted from 1909), has developed only 14 leaks in its century old record of uninterrupted service, which is really unbelievable. Similarly the earthquake of Bihar and Bengal in 1934 also proved many speculations wrong. A 2013 estimate of KMC stated that the cost of overhauling won't be less than Rs.25 Crores which is 227 times more than the cost of construction of Rs.11 Lacs. This B T Road behemoth which has never ever faltered so far undoubtedly has a place in the City's heritage map.

## 3.6 Land History and Construction of Tala Tank

Kolkata is one of the eight Metropolitan Cities of India. The population is estimated to be i.e. 14.75 million in 2019. Therefore, the pressure of using of domestic water has been raised abnormally high. This has resulted the huge demand for the supply of potable water, particularly in this growing areas. Wellington Square reservoir with its 790000 gallons capacity seemed to be insufficient to full fill the demand. Need of something larger felt. Hence, the plan to set up Tala Tank popped up, which is the world's largest overhead steel tank. The total land was donated by a well known philanthropist Babu Khelat Chandra Ghosh. For his remarkable contribution the adjoining lane was later renamed Khelat Babu Lane.

Tala Tank was no less than a feat for civil engineering and metallurgy. This tank is an iconic landmark of Kolkata city. According to the City's renowned historian P T Nair, the area was called TALA because of the presence of 'TALAO'.The Tala tank was designed by the chief engineer of Kolkata Corporation, W.B.MacCabe. It was manufactured by Clayton, Son & CO. from Leeds, United Kingdom. Also Indian firm T C Mukherjee & Co. was entrusted with the work of piling. Sir R N Mukherjee's firm Martin Co. did the reinforced concrete foundation, the roof job done by Arracon & Co. and Babu Kali Sunkar Mitter.

The construction work of this Iron & Steel marvel started on November 18, 1909 in the presence of the then Lt. Governor of Bengal Sir Edward Baker. It was permitted on May 16, 1911 although the work was completed by January 12.

The whole tank is supported by steel columns and girders, it is 33.5 m high from its ground base, 98 m in length, 98 m in width. The tank is 5.5 m deep and devided into four compartments, which are independent of each other and can be cleaned and repaired anytime without disconnecting the water supply. The support component and tank weighs 44,000 metric tons and the water itself weighs 36,000 metric tons. It can hold a total of nine million gallons of water.

The unique feature of the tank is that there are no separate pipelines for filling up and delivery, for this if the

pumping engine at Palta is not capable of sending down sufficient water to meet the demand in the middle of the day when consumption is heavy, then the Tala tank comes into operation. When sufficient water is not coming down to fill the town mains, water from the tank automatically flows in to the mains to keep supply equal to the demand. The tank is refilled again at night hours when the demand falls, by the same set of pipelines.

## 4. CRISIS

### 4.1 What is the present and future water crisis condition in Kolkata?

India has the most number of people who lack access to clean drinking water. Drinking water imposes a huge financial burden to some of the country's poorest population. As per UN, "water security" refers to the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality of water for supporting livelihood.

In comparison to India, Kolkata can be counted in one of the "water-rich" cities. However, there is an irony. Nearly 35% of city's population live in slums and only receive water through a few stand posts. Most of the water is actually seized by middle and upper strata of the society and various commercial establishments. So, there is a disparity in availability of water among different sections of society. The city's groundwater is lately under the scanner because of contamination by arsenic, heavy metals like mercury, lead etc. and salinity incursion. Heavy metal contaminated water poses great threat to human life, making them susceptible to chronic water borne diseases. Significant arsenic contaminated water might cause Arsenicosis, a disease which affects lungs, skin, kidneys and liver. Groundwater contamination is confirmed even in some of the city's urban pockets like Jadavpur etc. In 2006, groundwater withdrawal by KMC was 144.3 MLD which was reduced to 114 MLD in 2011. KMC is intended to reduce and discourage the use of groundwater even further.

Kolkata is likely to face water crisis in near future, unless some bold steps are taken. Till the end of 2020, water crisis is not likely to occur in the city. By 2025, the city's groundwater demand is expected to be skyrocketed by 25%.

### 4.2 Causes of water crisis in the city in near future

- Rapid population growth

| City | Area (sq. km) | Year | Population | Population density (persons per sq. km) |
|---|---|---|---|---|
| Kolkata | 3,638.49 | 1971 | 7,420,000 | 2,039 |
| | | 1981 | 9,030,000 | 2,482 |
| | | 1991 | 10,890,000 | 2,993 |
| | | 2001 | 13,217,000 | 3,632 |
| | | 2011 | 14,112,536 | 3,879 |

**Fig -5**: Rapid population growth of Kolkata down the decades

- Unplanned urbanisation in many areas of the city
- Groundwater sources becoming abandoned due to presence of contaminants.
- Colossal wastage of water through leaky water distribution system, broken stand posts, household and domestic activities.
- Pollution of surface water sources and making them unsuitable for use.
- Over exploitation of existing groundwater sources and alarmingly lowering the groundwater table in those areas.

### 4.3 How to combat the foreseeable water crisis problem in near future?

#### 4.3.1 Steps taken by authorities

- Increasing the capacities of existing major WTPs. Supplying over 450 MGD of water to the city, Palta Water Works(PWW) and Garden Reach Water Works (GRWW) are the major existing WTPs of Kolkata. Keeping in mind, the future water crisis consequence, an additional WTP of 50 MGD and 20 MGD in GRWW and PWW respectively was constructed in 2019 by KMC.
- Assessment of wastage of piped water with the help of "Water Loss Management" studies.

#### 4.3.2 Some other steps that can be taken

- Construction of new WTPs. Although plot procurement is an issue in metro city like Kolkata, still it can be thought of as a solution to meet the ever increasing demand of the city.
- Installation of Water Meters for domestic as well as commercial purposes to reduce wastage of water.
- Promotion of Rooftop Rainwater Harvesting system. This system is very useful for proper utilisation of rainwater and it proved to be beneficial in many parts of the country.
- Introducing some advanced global technologies. This include recycling of wastewater into potable water like NEWater technology (Singapore). Another technology that can be introduced is desalination of seawater, a new technology which is used at present in parts of U.A.E. Although initial investment is high in these technologies but reviews suggest that these yield promising returns in long run.

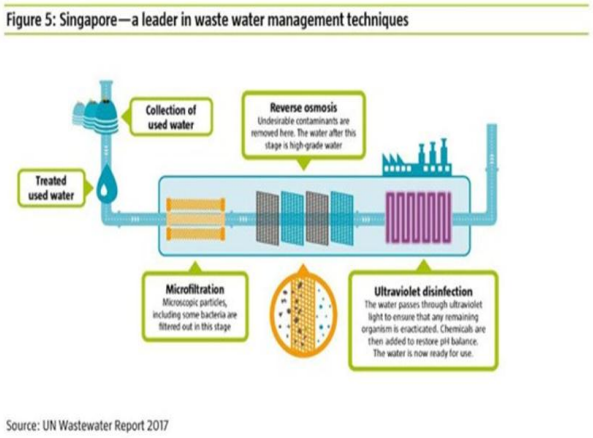


**Fig -6**: NEWater technology that is successfully working in Singapore

- Channelising huge quantities of rainwater to reach the underground aquifers at different points to increase the quantum of groundwater.

### 4.4 Pollution of surface water sources in Kolkata

#### 4.4.1 Causes of surface water pollution

Suface water pollution in Kolkata can be attributed to the following causes-

- **Sewer leakage & Wastewater treatment causes:** Leaking sewage water from the wastewater distribution network come in contact with surface water and polluting the surface water source, direct disposal of sewage in Hooghly river without treatment.
- **Human causes:** Direct disposal or dumping of wastes and garbages in Hooghly river, people excreting, bathing directly in surface water sources and making use of the water for domestic purposes.
- **Water transport & Other causes:** Fuel, oil spillage, immersion of idols in river after festivals, disposal of ashes of dead bodies after cremation. Water transport causes insignificant amount of pollution in Kolkata, other causes are linked with the religious and spiritual beliefs of people, an issue which cannot be addressed.

#### 4.4.2 Solutions to surface water pollution problems

- Checking of joints of water and sewer pipes periodically.
- Replacement of old sewer and water pipes by new ones.
- Frequent monitoring of discharge COD of industrial effluent.
- Checking of permissible limit of BOD before discharge from Sewage treatment plants (STPs).
- Construction of new STPs in areas where direct disposal of sewage in Hooghly river is prevalent.
- Avoiding disposal of wastes and garbages directly in Hooghly river.
- Construction of public lavatories.
- Imposing strict regulations, fines and penalties for using river water for domestic use.
- Spreading awareness among people about the harmful effects of polluting surface water sources in Kolkata.

### 4.5 Solutions to groundwater contamination problems

- Frequent checking of arsenic and heavy metals present in groundwater extracted by Deep Tube-wells.
- Construction of sanitary landfills at garbage disposal grounds to prevent leaching of hazardous chemicals.

## 5. CONCLUSION

Kolkata is among the eight metropolitan cities of India. Down the decades, the city population has increased manifolds. One of the direct impact of this rapid population growth is the increase in water demand of the city. Most of the water distributed within the city is extracted from Hooghly river. Although the capacities of major WTPs of the city, namely Palta Water Works was increased in 2019 and Garden Reach Water Works is under construction, the city is still likely to face a water crisis problem in near future. Adding to this is the problem of lowering of groundwater table at alarming rate and presence of contaminants in groundwater in some areas. It is possibly the best time to adopt rainwater harvesting techniques or switch to advanced global technologies to avoid this foreseeable water crisis problem.

## REFERENCES

[1] Water pollution an introduction : retrieved from https://www.explainthatstuff.com/waterpollution.html

[2] India: Choke Point Kolkata: retrieved from https://pulitzercenter.org/reporting/india-choke-point-kolkata

[3] Chapter 5 urban structure of kolkata city problems and prospects. retrieved from pdfhttp://shodhganga.inflibnet.ac.in/bitstream/10603/70824/15/15_

[4] Water Supply: retrieved from https://www.google.com/search?q=history+of+water+suply+in+kolkata&rlz=1C1JZAP_enIN809IN809&oq=history+of+water+suply+in+kolkata&aqs=chrome..69i57.12295j1j8&sourceid=chrome&ie=UTF-8.

[5] Water Supply: Kolkata Municipal Corporation retrieved from https://www.kmcgov.in/KMCPortal/jsp/WaterSupply.jsp.

[6] Palta, North 24 Parganas : retrieved from Wikipedia. https://en.wikipedia.org/wiki/Palta,_North_24_Parganas.

[7] Jora bagan water treatment plant : retrieved from https://www.google.com/search?rlz=1C1CHBD_enIN813IN813&biw=1536&bih=706&tbm=isch&sa=1&ei=VIW1XIW-IoO8rQGwrK2YAQ&q=Jora+bagan+water+treatment+pl

ant&oq=Jora+bagan+water+treatment+plant&gs_l=img.12...0.0..11093...0.0..0.0.0.....1.....gws-wiz-img.6_jhSSZdk4E.

[8] Sources of surface water in Kolkata: retrieved from https://www.google.com/search?rlz=1C1CHBD_enIN813IN813&biw=1536&bih=754&tbm=isch&sa=1&ei=0YG1XNLiA5r59QOd9qvABQ&q=sources+of+surface+water+in+kolkata&oq=sources+of+surface+water+in+kolkata&gs_l=img.3...22406.25192..25571...0.0..2.1088.4848.0j4j2j1j0j1j2j1.....1....1..gws-wiz-img.XFr04ClrhZ0.

[9] Overhaul of world's largest overhead reservoir in Kolkata begins: retrieved from https://timesofindia.indiatimes.com/city/kolkata/overhaul-of-worlds-largest-overhead-reservoir-in-kolkata-begins/articleshow/63267881.cms.

[10] Water Stations: Kolkata Municipal Corporation: retrieved from https://www.kmcgov.in/KMCPortal/jsp/WaterStations.jsp.

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