

# WATER AUDIT / BUDGETING



ગ્રીષ્મ- “બાયોમ”

*“Balance the Innovative Opportunities into Heave for the Management of environment to protect the earth.”*

*Biohm Consultare Pvt. Ltd.*

Address: 705, Luxuria Business Hub, Near VR Mall, Dumas Road, Surat-395007 (Gujarat) INDIA Tel: +91-261-2976611-12-13

Email: [info@biohm.in](mailto:info@biohm.in), [care@biohm.in](mailto:care@biohm.in), [consent@biohm.com](mailto:consent@biohm.com) Website: [www.biohm.in](http://www.biohm.in)

# THE FIVE MANTRAS OF BIOHM



- ❖ *Be Kind with Nature!*
- ❖ *Improve the Environmental conditions!*
- ❖ *Overcome the Pollution Potential!*
- ❖ *Hope for the Best. Do the things Right at very first.*
- ❖ *Manage the environment to protect the earth.*



# ABOUT BIOHM

- ❖ Biohm Consultare Private Limited (*BIOHM-बायोम™*) established in 2018 having its registered office at 705, Luxuria Business Hub, Near VR Mall, Dumas Road Surat.
- ❖ It comprises a team of highly talented professionals, who work in sync with clients ensuring that the defined assessment, survey or reporting is executed with high level of efficiency.
- ❖ Our proficient team consists of Environmentalists, Engineers, Chemists, Geologists, Industrial hygienists, Technicians, Research Associates, Sociologists, Policy makers, Economist, Legal Advisors and others with expertise in various key areas.
- ❖ The personnel with BCPL has a proven successful track record of working with industry and institutions and in executing multi-faceted projects funded by organizations like World Bank, Asian Bank, MoEFCC, SEAC/SEIAA, amongst others.





## BIOHM POLICY

- ❖ Biohm is dealing with Environmental Consultancy and Engineering Solutions which satisfies the statutory, regulatory, stakeholders' and others' requirement.
- ❖ BCPL has commitment towards quality services through systematic techniques confirming constant development through intermittent reviews of performance.



# BIOHM VALUES

## ❖ *Safety*

- We create a working environment that promotes safe performance.

## ❖ *Quality*

- We always strive for excellence in the services we provide and in the results we produce.

## ❖ *Integrity*

- We are committed to the highest ethical standards.

## ❖ *Creativity*

- We believe in looking at challenges and opportunities and in exercising our curiosity.

## ❖ *Accountability*

- We take responsibility for all of our decisions and actions.

## ❖ *Teamwork*

- We work together to succeed.



# BIOHM SERVICES

- ❖ Environment Clearance (EIA)
- ❖ Environmental Audit
- ❖ NOC– Forest Diversion / Non-Forest Land
- ❖ Forest Clearance
- ❖ Green Building Certification
- ❖ Infrastructure Development
- ❖ NOC- Storage of Diesel/Hazardous Chemical/PESO permission
- ❖ Wildlife Clearance
- ❖ Wildlife Conservation Plan/Mangrove Management Plan
- ❖ NOC– from Revenue Department /Authority
- ❖ Modelling Studies
- ❖ Half Yearly Environment Compliances
- ❖ Water Audit / Budgeting
- ❖ Marine Studies
- ❖ CGWA Permission
- ❖ Consent to Establish/Consent to Operate under Air and Water Act
- ❖ Land Use /Land cover studies
- ❖ Submission of Form V/Form IV – Env. Financial Statement
- ❖ Environment Legal Advice
- ❖ Geospatial Studies/ GIS Studies
- ❖ Waste Water Treatment – Consultancy, Design & Management
- ❖ DPR and Feasibility Report
- ❖ Geology and Hydrological Studies
- ❖ Design and Architect
- ❖ Authorizations for Hazardous Substances/Bio medical waste





# BIOHM SERVICES

- Environment Clearance (EIA)
- Forest Clearance (FC)
- Wildlife Clearance (WC)
- CRZ Clearance
- Green Building Certification
- Consent to Establish/Consent to Operate under Air and Water Act
- Authorizations for Hazardous Substances/Bio medical waste
- No Objection Certificate – Forest Diversion / Non-Forest Land
- Wildlife Conservation Plan/Mangrove Management Plan
- No Objection Certificate – from Revenue Department /Authority
- No Objection Certificate - Storage of Diesel/Hazardous Chemical/PESO
- CGWA Permission
- Infrastructure Development
- Water Audit/Budgeting
- Carbon Credit Scheme
- Half Yearly Environment Compliances
- Submission of Form V/Form IV - Environment Financial Statement
- Environmental Audits
- Safety Audits
- Modelling Studies
- Geospatial Studies/GIS Studies
- Geology and Hydrological Studies
- Social Studies (SIA), R&R, RAP
- Land Use /Land cover studies
- Marine Studies
- Environment Legal Advice
- Waste Water Treatment –Consultancy, Design & Management
- Design and Architect
- DPR and Feasibility Report
- Environmental Testing
- Risk assessment – HAZOP, Hazid, Tree Analysis, QRA, RRA, etc.



# WATER

- ❖ Water is life and virtually everything we do or use each day involves water.
- ❖ We need water from fork to field.
- ❖ Water is one of the important object on the earth which is used by all the living entities.
- ❖ There is enough freshwater on the planet but It is distributed unevenly and Too much of it is wasted, polluted and unsustainably managed.
- ❖ Accurate consumption of water and its preservation are highly essential for keeping life secure on earth.
- ❖ And for that Water audit is a way to determine the availability of water in a particular area and to utilize it in the most respected manner.



# GLOBAL SCENERIO

- ❖ Total amount of water on earth is 1.4 billion cubic kilometers of which total 41,000 cubic kilometers of renewable water is falling on continents and islands each year.
- ❖ Against this water availability, the world's total population to be satisfied was 5.3 billion in 1990 and is likely to touch 9.1 billion in 2025 (projected on high growth rate).
- ❖ The limits of renewable fresh water supply requires an appreciation of how little of the planet's 1.4 billion cubic kilometers of water actually fits into that category.
- ❖ Only 2.5% is fresh water fit for drinking, growing crops and meeting industrial uses. Moreover, 69% of that is locked in polar ice caps and mountain glaciers or stored in underground aquifers.
- ❖ As per the present scenario more than 28 nations are water scarce where the quantity of renewable fresh water is less than 1000 cubic meters.
- ❖ An assessment indicates that this number will be double by year 2025 as about 20 more countries will be added to this list.



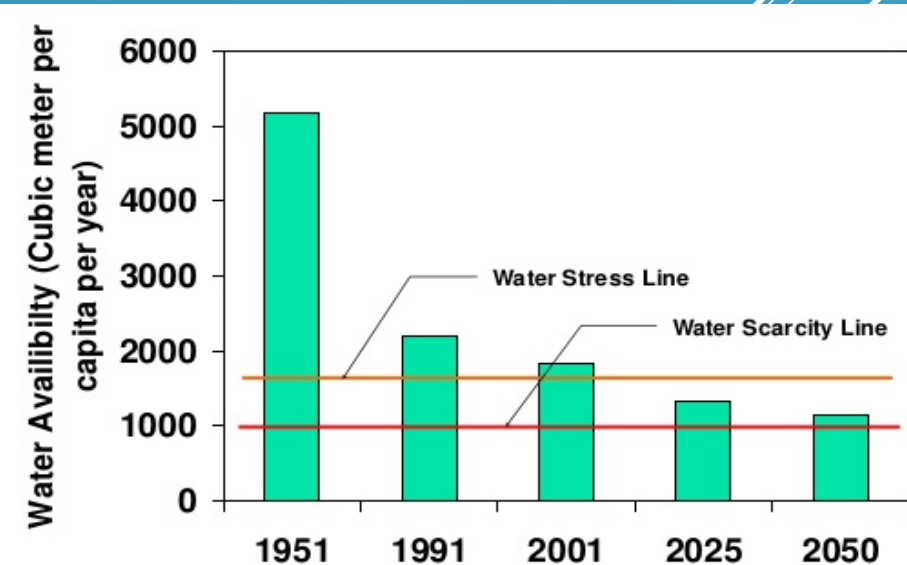
# INDIAN SCENERIO

- ❖ In India, nearly 62,000 million liter sewage is generated per day in urban areas.
- ❖ In rural India, an estimated 600 million plus people lack sanitation facilities.
- ❖ Out of the total sewage generated from urban areas, only 23,277 million litre is treated.
- ❖ An estimated 61.5% of the Indian population is rural and dependent on agriculture amounting to one-third of the country's GDP. (GDP of india is 6.6% in 2017)
- ❖ As per a Ministry of Agriculture report released in 2014, only 46 per cent of the cultivated land in India is available for irrigation.
- ❖ India is likely to face Water Stress by 2025 and Water Scarcity by 2050.

Water stress: per capita availability of 1000-1700 m<sup>3</sup>/ year.

Water scarcity: per capita availability of 500-1000 m<sup>3</sup>/ year.

[Source: Baidyanathan, Water, Page 44-45, 2011]



# CONT.....

- ❖ According to the Central Pollution Control Board(CPCB), municipal sewage is major source of water pollution in India, particularly in and around large urban centers.
- ❖ Groundwater in India depleted at 10-25 mm per year between 2002 and 2016.
- ❖ Average rainfall declined, from 1,050 mm in the summer cropping season of 1970 to less than 1,000 mm in 2015.
- ❖ In the winter cropping season average rainfall declined, from Rs 150 mm in 1970 to about 100 mm in 2015.
- ❖ Dry days during the monsoons have increased, from ~40% to 45% in 2015.
- ❖ As per the recently released Water Management Index of the NITI Aayog, India is facing one of the worst water crises and a number of cities are expected to run out of water by 2020.
- ❖ 600 million people face high to extreme water stress.
- ❖ 75% of households do not have drinking water on premise, 84% rural households do not have piped water access.



# WATER ACT, 1974

- ❖ It was enacted on 23<sup>rd</sup> March 1974.
- ❖ Water Act, 1974 include 8 chapters with 64 sections.
- ❖ Water Act 1974 aims to prevent and control water pollution.
- ❖ Under Water Act, 1974, pollution control boards were created, who are responsible for implementation of its provisions.
- ❖ One of the important provision of the Water Act, 1974 is to maintain and restore the 'Wholesomeness' of our aquatic resources.

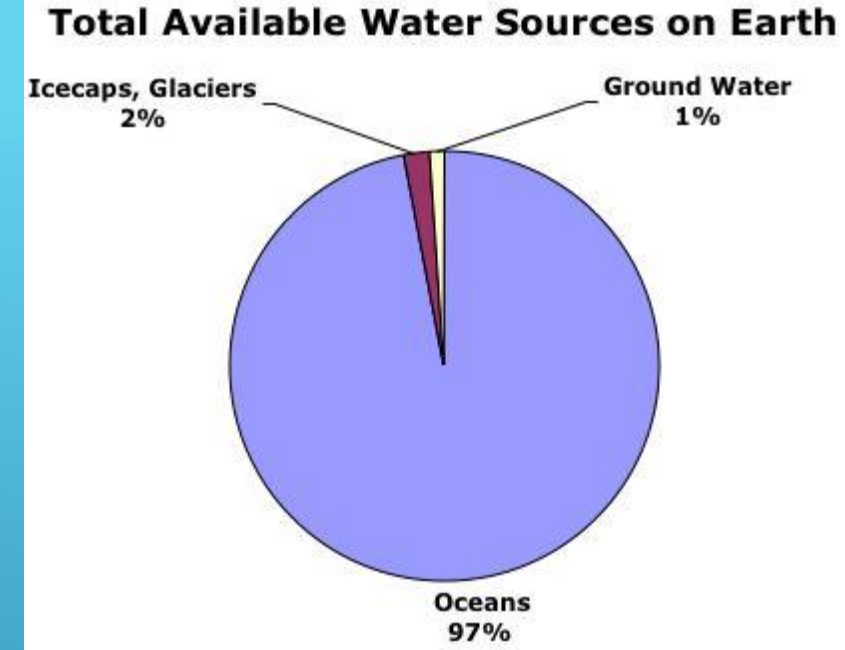


# SOURCES OF WATER

- ❖ 97% of water on Earth is salt water and only 3% is fresh water.
- ❖ Slightly over 2/3rd of this is frozen in glaciers and polar ice caps.
- ❖ The remaining unfrozen freshwater is found mainly as groundwater.

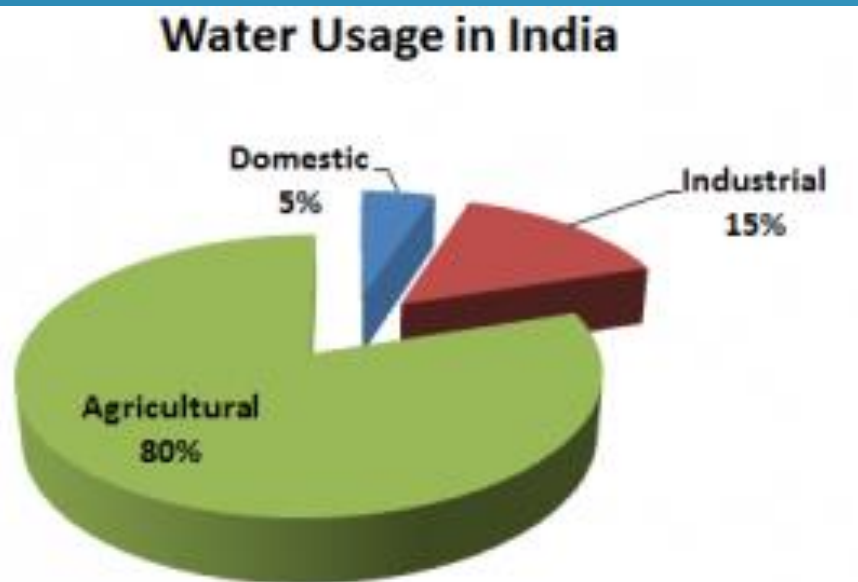
The various sources of water are :

- ❖ Surface water
- ❖ Under river flow
- ❖ Ground water
- ❖ Desalination
- ❖ A water supply system or water supply network



# USAGE OF WATER IN INDIA

- ❖ More than 60 percent of India's irrigated agriculture and 85 percent of drinking water supplies are dependent on groundwater.
- ❖ India has 18% of world population, having 4% of world's fresh water, out of which 80% is used in agriculture.
- ❖ India receives an average of 4,000 billion cubic meters of precipitation every year. However, only 48% of it is used in India's surface and groundwater bodies.
- ❖ The increased demand in water combined with the pollution of water has had many adverse effects on the environment, growth and economy of many countries.





# WATER CONSUMPTION

#	Types Of Consumption	Normal Range (Lit/capita/day)	Average	%
1	Domestic Consumption	65-300	160	35
2	Industrial and Commercial Demand	45-450	135	30
3	Public Uses including Fire Demand	20-90	45	10
4	Losses and Water	45-150	62	25



# WATER AUDIT

- ❖ The perfect tool for efficient water management.
- ❖ Water Audit is a qualitative and quantitative analysis of water consumption to identify means of Reducing, Reusing and Recycling of water --- 3R of Water.
- ❖ Water auditing is a method of quantifying waterflows and quality in simple or complex systems, with a view to reducing water usage and often saving money on unnecessary water use.
- ❖ Water Audit of a water supply scheme can be defined as the assessment of the capacity of total water produced by the Water Supply Authority and the actual quantity of water distributed throughout the area of service of the Authority, thus leading to an estimation of the losses.
- ❖ International Water Association (IWA) / American Water Works Association (AWWA) initiated a large scale effort to assess reduced above related problem with the help of audit.
- ❖ With the help of water audit, we identify and quantify what steps can be taken to reduce water use and losses.
- ❖ Water audit and its analysis which can solve not only many water related problem but also saves precious resources and public money.



# OBJECTIVE OF WATER AUDIT

- ❖ Objectives of water audit is to find out physical losses due to pipe leakage and over flow, losses due to metering errors, unauthorized connections and free water supply given by respected authority for different uses.
- ❖ To identify and priorities areas which need immediate attention for control.
- ❖ To identify risks and wastages.
- ❖ For efficient use of existing water resources.
- ❖ To Detection and prevention of wastages and leakages.
- ❖ To utilize water resources effectively and more efficiently.
- ❖ To keep check on unwanted excess usage of water, Helpful for planning in development of a water storage structures like dam, lake, bunds etc.



# BENEFITS

- ❖ Water audits provide decision making tools to utility managers, directors, and operators. i.e., knowing where water is being used in the system allows to make informed decisions about investing resources such as time, labor and money.
- ❖ Water audits allow respected authority to efficiently reduce water losses in the system.
- ❖ It reduces the cost incur for electricity, chemicals, and maintenance cause due to losses in the system.
- ❖ Reducing water use at the source may even result in delaying or avoiding capital investments such as a new well, more treatment technology (ETP/STP) or additional water permission.
- ❖ Water Audit also identify which water uses are earning revenue for the utility and which water uses are not.
- ❖ This leads to more financial capacity in the water system, reduced cost per customer and better management of the water resource.
- ❖ Creating awareness among water users i.e., customers can see and understand that the utility is taking proactive steps to manage wasted water.



# WATER AUDIT ACTIVITY

## *Pre-Audit Activity*

- ❖ The pre-audit activities will involve a detailed literature review of the current usage of water throughout the facility.
- ❖ The scope of work for this task will include an on-site survey and assessment of water-using hardware, fixtures, equipment, landscaping, and management practices to determine the efficiency of water use and to develop recommendations for improving water-use efficiency.

## *Base-Line and Benchmarking*

- ❖ The base-line benchmarking will involve preparing the questionnaire format for individual water use, gardening, process use, waste water treatment plant and recycling.
- ❖ An exact breakdown of the when, where and how of water consumption and wastewater management will also be conducted.



## *Conducting the Water Audit*

- ❖ Various aspects of water use such as sanitation, mechanical systems, preservation, irrigation and others will be thoroughly examined in the auditing.
- ❖ Water auditing process shall include study of availability of rain water in your area and possibilities for rainwater harvesting and its preservation.
- ❖ The scope of work shall also include the study of possibilities of water recycling and wastewater management.
- ❖ After collecting and compiling all available audit data, a comprehensive water audit report shall be prepared.





# METHODOLOGY FOR WATER AUDITING

- ❖ The standard water balance or methodology is the framework for categorizing and quantifying all water uses in the water audit.
- ❖ It is also called a water balance because when it is completed, all uses of water in the system equal the amount of water input by the sources
- ❖ The standard water balance is really a series of simple equations.
- ❖ This is the most common way to view the standard water balance and developed by American Water Works Association (AWWA) and International Water Association (IWA) in 2000.
- ❖ The water audit calculation is being done by Water Audit AWWA software v5.0  
<https://www.awwa.org/>



# IWA STANDARD WATER BALANCE CHART

System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption (including water exported)	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered Consumption	
			Unbilled Unmetered Consumption	
	Water Losses	Apparent* Losses	Unauthorised Consumption	Non- Revenue Water (NRW)
			Metering Inaccuracies	
		Real* Losses	Leakage on Transmission and/or Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
		Leakage on Service Connections up to the measurement point		



## CONT.

- ❖ Begin by reading the graphical standard water balance from the left side, starting with the System Input category.
- ❖ It is important to understand that the vertical height of each category represents a proportional amount of water.
- ❖ Thus, the height of the System Input category represents all water pumped by the system in a given time period.
- ❖ This amount of water can be broken down into two additional categories, Authorized Use and Water Losses. Therefore,  $\text{Authorized Use} + \text{Water Losses} = \text{System Input}$ .
- ❖ This vertical height water measurement holds true across the entire standard water balance.



# DEFINITION OF KEY VARIABLES IN THE WATER BALANCE

## System Input Volume

- ▶ The volume of treated water input to that part of the water supply system to which the water balance calculation relates.

## Authorized Consumption

- ▶ The volume of metered and (or) unmetered water taken by registered customers. Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, these may be billed or unbilled, metered or unmetered.

## Water Losses

- ▶ The difference between System Input Volume and Authorized Consumption.

## Billed Authorized Consumption

- ▶ Those components of Authorized Consumption which are billed and produce revenue.

Billed Authorized Consumption = Billed Metered Consumption + Billed Unmetered Consumption

## Unbilled Authorized Consumption

- ▶ Those components of Authorized Consumption which are legitimate but not billed and therefore do not produce revenue.

Unbilled Authorized Consumption = Unbilled Metered Consumption + Unbilled Unmetered Consumption



# CONT.

## Apparent (Commercial) Losses

- ▶ Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use). Commercial losses may also be referred to as Apparent Losses or Non-Technical Losses.

## Real (Physical) Losses

- ▶ Physical water losses from the pressurized system and the utility's storage tanks, up to the point of customer's meter. Physical losses are also referred to as Real losses or Technical losses.

## Billed Metered Consumption

- ▶ All metered consumption which is also billed. This includes all groups of customers such as domestic, commercial, industrial or institutional.

## Billed Unmetered Consumption

- ▶ All billed consumption which is calculated based on estimates or norms but is not metered.

## Unbilled Metered Consumption

- ▶ Metered Consumption which is for any reason unbilled.

## Unbilled Unmetered Consumption

- ▶ Any kind of Authorized Consumption which is neither billed nor metered.

## Unauthorized Consumption

- ▶ Any unauthorized use of water. This may include illegal water withdrawal from hydrants, illegal connections, bypasses to consumption meters or meter tampering.





# Kalol: Water balance chart

System input volume 6,299	Authorised consumption (54.2%) 3,414	Billed authorised consumption (53.7%) 3,381	Billed unmetered consumption (53.7%) 3,381	Revenue water (53.7%) 3,381
		Unbilled authorised consumption (0.5%) 33	Unbilled consumption (0.5%) 33	Non- revenue water (NRW ) (46.3%) 2918
	Water losses (45.8%) 2,885	Apparent losses (16.8%) 1,058	Un-authorized consumption (16.8%) 1058	
		Real losses (29%) 1,827	Leakage on service connections up to point of customers (15.6%) 980	
			Leakage on transmission mains (9.9%) 624	
		Leakage and overflows at utility's storage tanks (3.5%) 223		

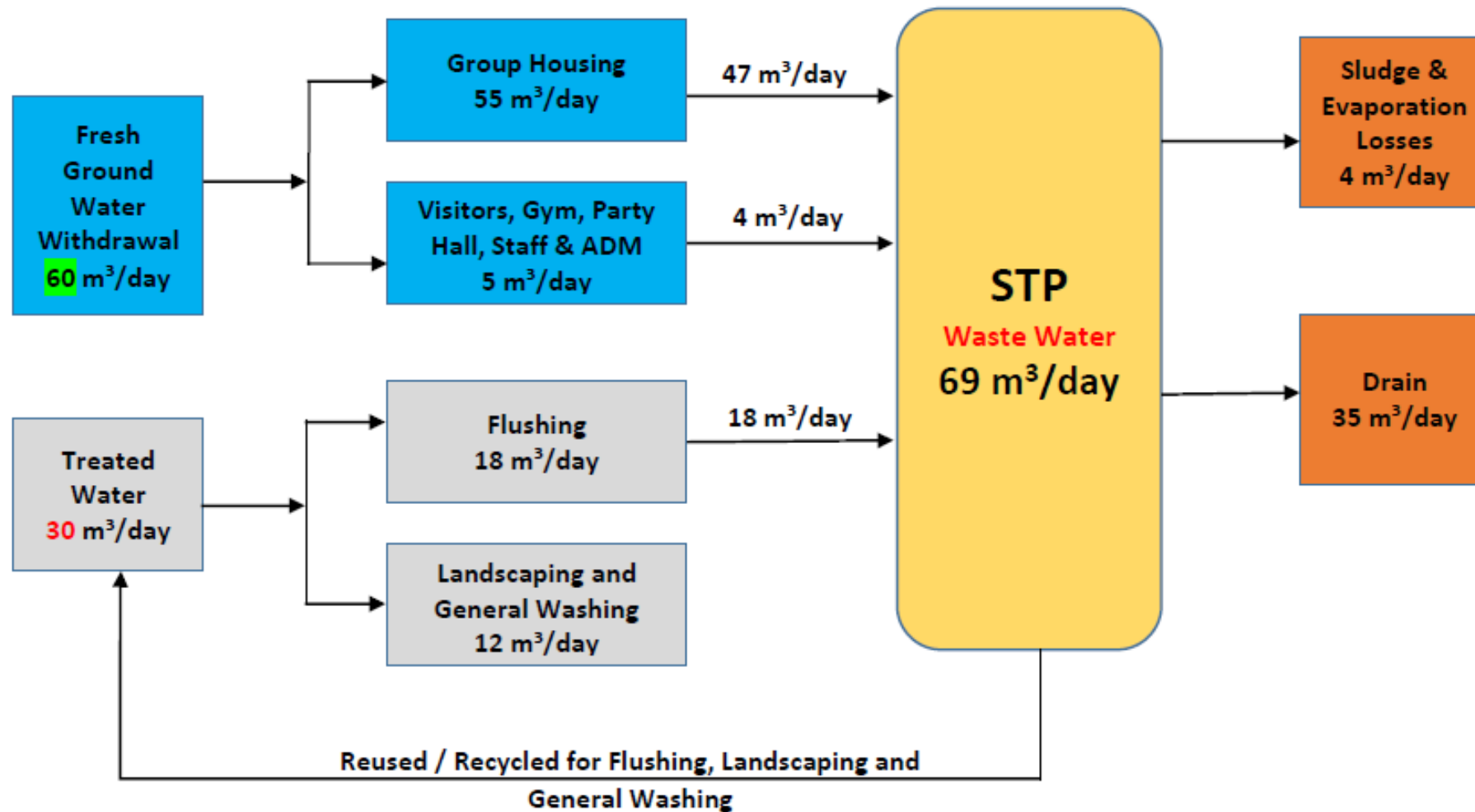
Quantity are in "Million liters per year"





# SAMPLE WATER BALANCE DIAGRAM

## 4. Net Ground Water Requirement = 60 m<sup>3</sup>/day - **CONSIDERED FOR NOC**



# CHECKLIST

<b>Objectives</b>	<b>Include in Audit? YES/NO</b>
General objective – e.g. to carry out a comprehensive water efficiency audit to achieve the	
Identify current water usage patterns	
Benchmark water use against standard or best industry practices	
Describe the current hydraulics system and identify any deficiencies	
Identify water conservation opportunities (including reuse and rainfall capture)	
Document the extent of existing water efficiency, reuse and rainfall capture	
Recommend plumbing retro-fit and other water saving initiatives, demonstrating the costs and savings including payback period.	
<b>General methodology</b>	
To carry out a comprehensive water audit in an efficient manner that is least disturbing to the building/centre occupants, the audit may involve:	
On-site investigation to quantify water usage at each of the following:	
Amenities – toilets, basins, showers, urinals and kitchen fittings	
Air conditioning systems and cooling towers	
Cleaning and house keeping	
Grounds maintenance	
Fire Services	
Other water-using fixtures and equipment	



	Yes/No
Review of owner's plumbing maintenance practices	
Leakage measurement through flow metering	
Review existing water meter size (for possible downsizing)	
Review building's water reuse arrangements (if any are in place)	
<b>Specific measures:</b>	
Meeting with Building Management to discuss audit, access to information, documentation and a walk-through of the building/centre	
Inspecting water services, meters, pumps, reservoirs, tanks and water fixtures throughout the building/centre	
Inspecting all relevant water services plans	
Obtaining water meter readings from the local provider for the past 3 years and assessing this information to determine usage trends	
Installing a pulse unit and data loggers for submeters (existing or specifically installed for audit)	
Installing acoustic flow meters to monitor flow profile and usage – at supply-to-main domestic storage and fire hydrant tanks; and at water-out-of-main domestic water tanks	
Flow testing water fixtures throughout the building/center	
Analyzing data obtained to determine daily usage and base flows	
Installing people counters at entrances to support normalisation of usage data	
System modelling over X days to identify usage for various areas or equipment within the building/centre	
Assessing base flow in system and calculating water charges	
Identifying and assessing water saving options	



# CONCLUSION

- ❖ Water Audit study shall be covered the holistic approach towards total water resource, distribution and its efficient use to reduce the capital and operating cost as an added advantage over the optimized use of water resource with environment protection.
- ❖ If there is no water on Earth, there will be no life, no environment.
- ❖ When it comes to water conservation, the key is to stop wasting and to know what is happening to water around us by proper and honest auditing.
- ❖ Water Audit provides answers to all WHATs, WHYs and WHEREs of the water related problems, HOWs are to be devised and implemented by us and result is water gets conserved leading to a better tomorrow!



*THANKING YOU*

