WATERAPP

KNOW YOUR WATER

Water Management for Housing & Industrial Complexes

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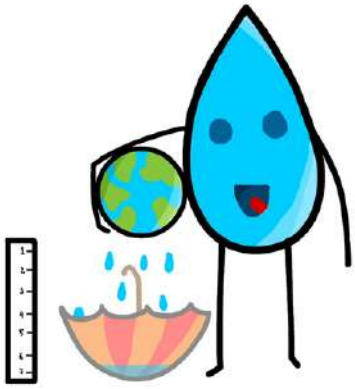
EMPOWERING WATER WARRIORS



Hello!

We are a Water Technology Startup that aims to secure sufficient water for everyone.

We create and deploy smart IoT devices that improve water consumption patterns and eliminate wastage.
Our customers are housing and industrial complexes where the current water management is ad hoc and inefficient.

This ebook is meant for the Water Warriors who want to do something about the impending 'water crisis'.

The following pages offer a starting point for 'Knowing your Water'. Our goal is to familiarize the layman with topics such as tank cleaning, water quality, tank size etc. so that they can take an active part in the water management of their community.

We hope you find it helpful!

Team WaterApp

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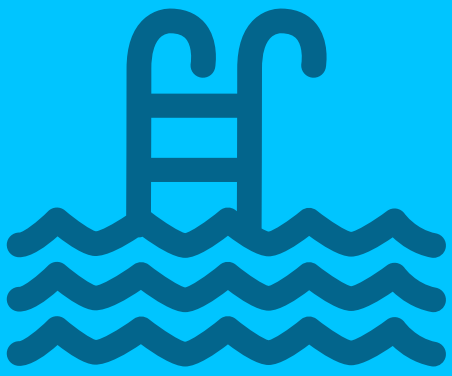

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CHAPTER 1

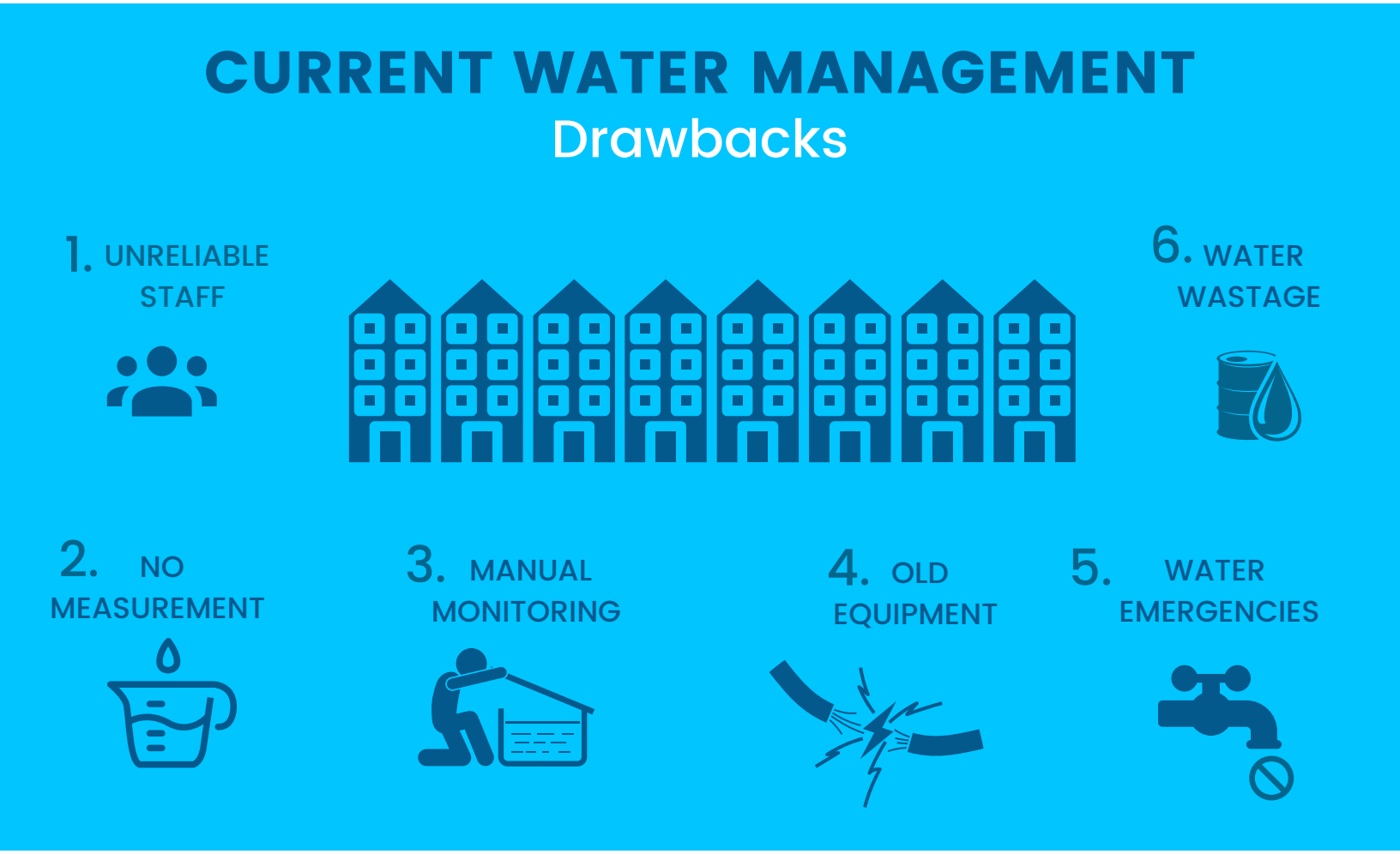
CURRENT WATER MANAGEMENT

MUCH TO BE DESIRED

Did you know that India has about 18% of the world's population today and only 4% of the world's water resources?

The residential sector is a major consumer of that water. Residential water management has not seen much innovation and happens mainly in the **reactive mode.**

Let's take a deep dive into understanding the challenges of water management of the residential sector.



1. Reactive Water Management

Typically, we see that water management happens AFTER the occurrence of the event. In simple terms, we see that, **typically the pump gets shut off AFTER water starts overflowing.**

Or the pump gets started after residents have run out of water and someone starts yelling from the bathroom or from the WhatsApp group.

REACTIVE WATER MANAGEMENT

Taking action AFTER the event has occurred

Water tank getting empty SUDDENLY

Water tank OVERFLOWING

Another example of reactive water management is having to call water tanker services AFTER you realize that you have run out of water.

This comes with a **double disadvantage** – not only do you have to pay a higher water tanker price but it's also possible that you would have to wait longer, especially if it's in the peak of summer.

2. Manual Monitoring

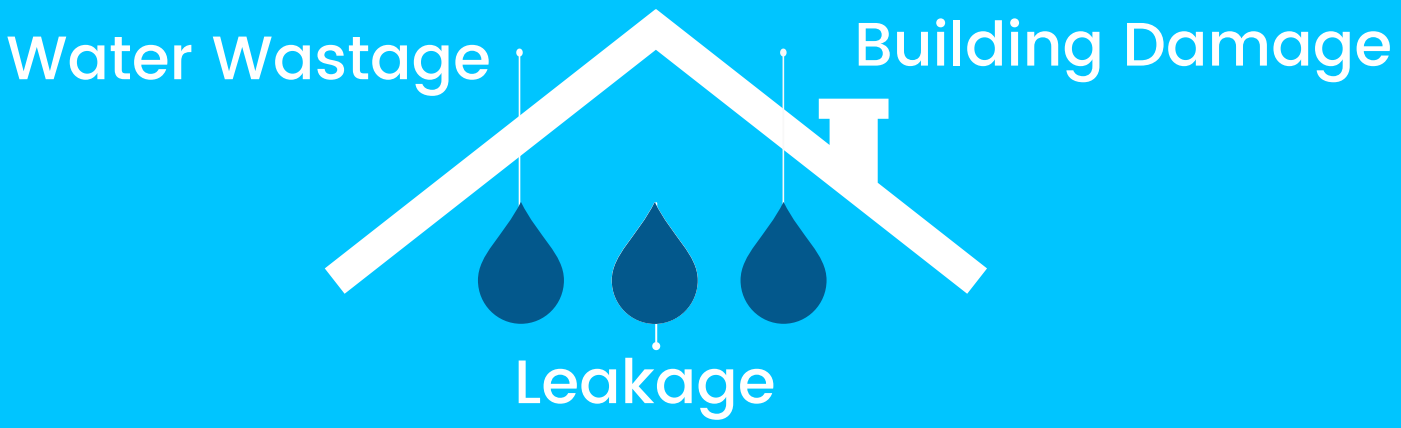
Many times, the security guard is in charge of water. The typical scenario is that this person switches the pump on and then proceeds to do other chores.

In the meanwhile, the tank fills and overflows after which he switches the pump off. If he is away from the tank, the water may overflow for a while before anyone notices.

A 10 min overflow can cause a wastage of 1500 liters – enough to wash 50 cars.

Not only is wasting water is a crime, over the long term, tank overflows cause more damage that what is apparent.

DAMAGE CAUSED BY TANK OVERFLOWS



When the Tank goes Empty!

An exactly opposite scenario takes place when the tank is empty. A resident may be in the bathroom or washing hands and the tap suddenly goes dry on them.

This results in **chaos and shouting** until someone starts the pump from downstairs. It is a tedious and time-consuming chore to stand next to the tank, waiting for it to fill up.

Climbing Tanks is Risky!

The Overhead tanks are located at a height above the terrace. The security guard has to climb atop a tentative ladder on the terrace so that he can open the lid of the tank and check the level of water inside. Sometimes, this needs to be done twice/ thrice a day.

3. Lack of Suitable Instrumentation

Until now, water management instrumentation has been expensive and unreliable. **Structured water management has been restricted mainly to the industrial sector** and has not entered the residential sector in a standardized way.

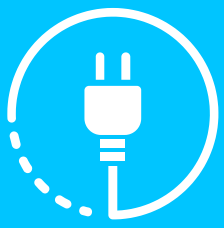
Residential water management equipment is limited to installing metallic water level sensors, float valves, tank overflow alarms and automatic water level controllers for tanks and pumps which is based on outdated technology.

In the next section, we examine the reasons for the lack of suitable instrumentation in the residential sector.

REASONS FOR LACK OF WATER MANAGEMENT EQUIPMENT IN THE HOUSING SECTOR

1. Construction is Unknown

2. Water Quality and TDS Levels vary



3. Equipment Corrodes

4. Wires Breakdown

5. Staff is Unskilled

6. Equipment is Costly

4. Zero Data Available

Given the haphazard water supply schedule on the supply side and unstructured water management on the demand side, the whole society just relies on **guesswork of an old timer fellow** who has been managing the water for a long time.

Drawbacks of Traditional Water Management

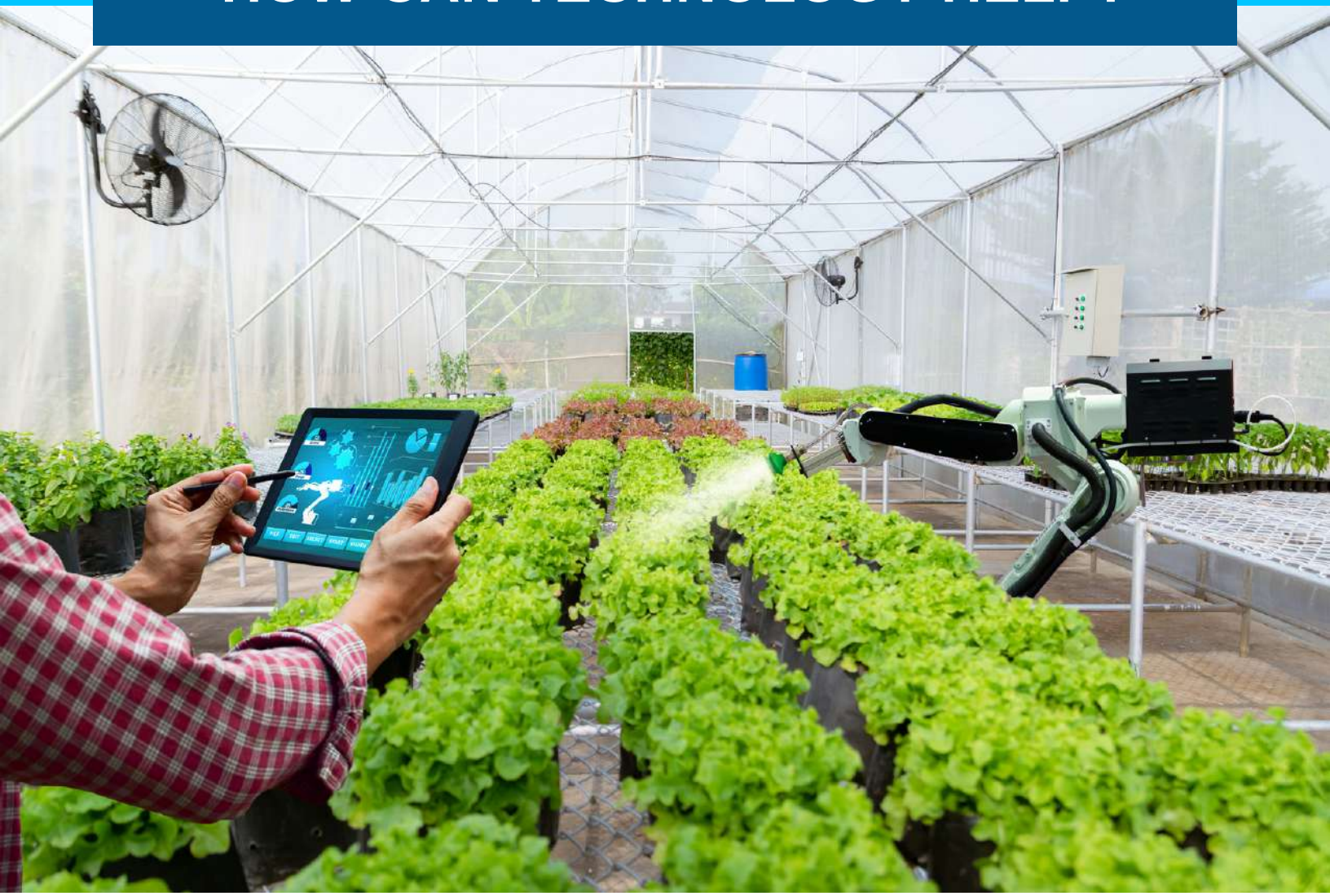
1) Dependence on a specific staff member
2) Frequent situations of tank overflows and dry taps
3) **No visibility** into the volume of water available for consumption
4) When supply is scarce, there is no easy way to gauge if water was received and whether tankers are needed
5) There is **no data on trends** of water received and consumed per tower etc.

The lack of data especially can result in inefficiencies in the system. For e.g. Society may be using way too much water in the garden without knowing it.

Once you are able to see the volume of water going into the garden, you can adopt techniques to reduce and then measure the water saved. Similarly, many such efficiencies can be built into water management once you can actually **"see"** how much water is being used where.

In the next chapter, we will see how technology can assist in the above scenarios and help societies to go from reactive water management to proactive management.

HOW CAN TECHNOLOGY HELP?

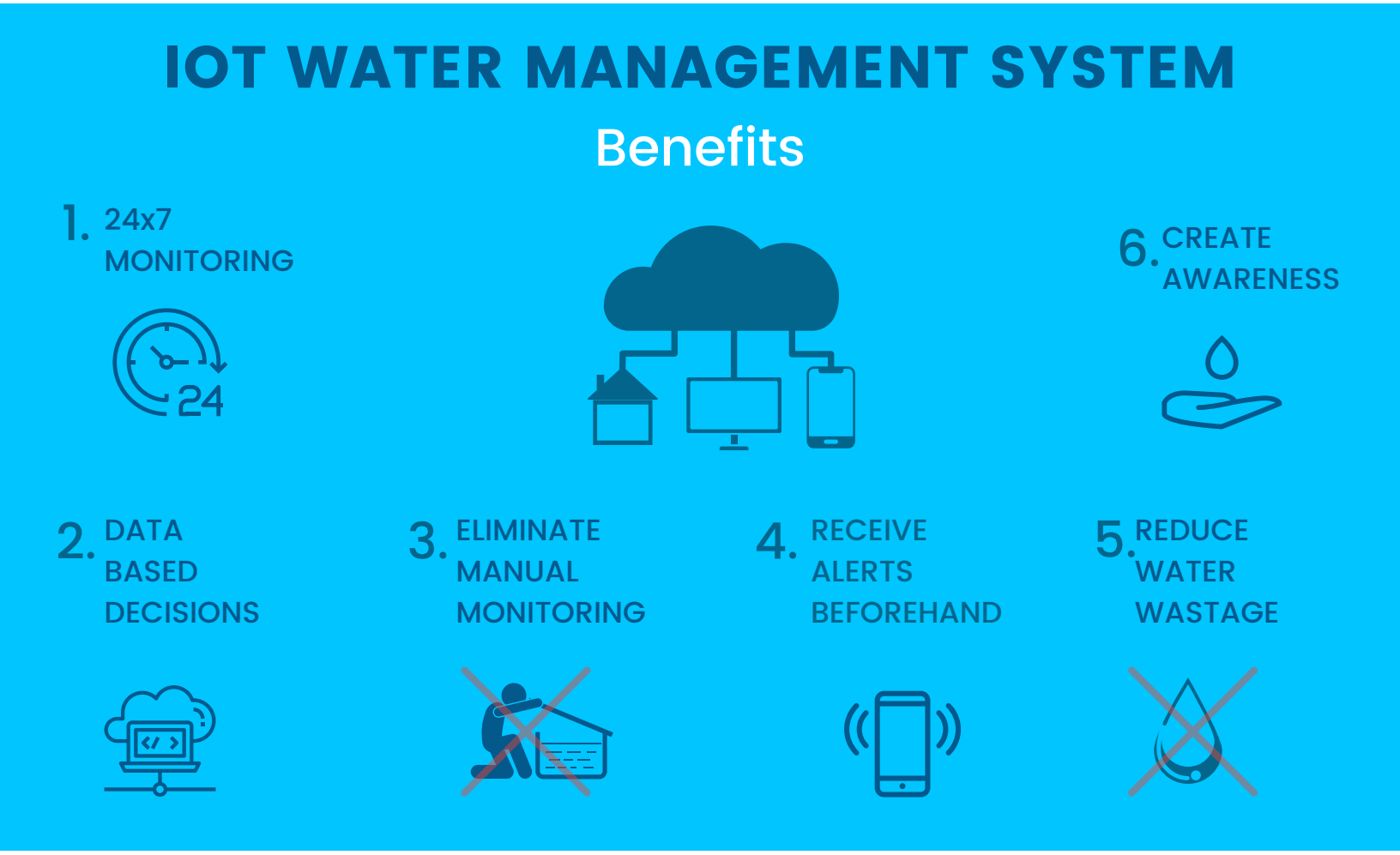


IOT - A NATURAL FIT

In the first chapter, we discussed issues with the current water management system. Here, we discuss ways in which these issues can be tackled effectively by technology.

Technology helps us track our water at all times. It equips us to see the movement of our water and its consumption on a **single platform.**

Data enables us to anticipate further issues.



In the following section we will discuss how technology provides a superior solution.

1. Eliminates Tedious Manual Tasks

Digital water level sensors enable you to **monitor water tanks 24x7** with no labor requirement. Equipment such as water tank overflow alarms and alerts, reduce the the need for physical surveillance.
Plus the **risk of climbing ladders** on terraces to check water tank levels is eliminated.
Reliable water management technology **reduces dependence** on a particular staff member and eliminates human error.

2. Provides Data

Currently, with the absence of data, one cannot create a unified system for water management. Plus, **water management is optimized as per the schedule of the staff member** who operates the water.

He switches the pump on and off based on a predetermined timetable and does not take into consideration the actual consumption of each tower or the volume of water available in each tank.

It is difficult to know the amount of water in your tanks by just looking into it. One cannot gauge the size of tank, water inlet height, location of the overflow pipe and leakages in the tank, etc.

It is a good idea to have this information handy. The availability of this data from various devices under one umbrella forms a **cohesive water management system.**

WATER MANAGEMENT

Data Based	Traditional
-Proactive	-Reactive
-Optimize Consumption	-Dependent on Staff
-Organized Management	-Unstructured

Technology helps you to see your water at all times.

Benefits of making Water Visible

- Know your water footprint
- Take **proactive measures** to prevent leakages, overflows and dry taps.
- Avoid last minute water cuts.
- Reduce overall consumption and save water.
- Book water tanker service in advance.
- Create awareness in the community with monthly reports.

3. Cut Down on Water Wastage

Water use is growing at twice the rate of population growth per day. Measuring your own **water footprint** can help you come up with strategies for sustainable water usage.

Once you see your individual water use pattern you can adopt relevant water saving tips such as watering your garden in the evening, saving the water used for washing veggies and reusing it in the garden, using a bucket of water for your bath instead of letting the shower run etc.

Are you someone that keeps the tap running while brushing your teeth?

CUT DOWN ON WATER WASTAGE

If your answer to this question is a ‘yes’, then it is high time you monitor your water habits.

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4. 24x7 Monitoring with IoT

IoT refers to the Internet of Things.
In layman's terms, it is a network of physical devices such as sensors that monitor various parameters in the field (e.g., temperature, water level, soil moisture etc.) and upload it into the cloud.

Based on the information received, the cloud algorithms determine whether the user needs to be alerted or not and send an alert to the user's mobile or other devices. Such a network gets **more intelligent and reliable** as it starts collecting more data from the field as more people start using it.

WaterApp is one such IoT based platform for water management.

The possibilities and advantages of IoT technology are endless.

1. Wireless

Wires are messy and complicated.
The current water management instrumentation such as water level controllers, water tank full alarms, ultrasonic level sensors require lengthy wires. There is a risk of wires getting cut during storms and emergencies. The system can fail during such times.

Thus, **wireless, solar powered technology** is a natural fit for water management for housing societies and industrial complexes.

2. Visibility

The biggest benefit of IoT is that all your devices come "online". Your data is visible to you at any point in time.

An Iot based water management systems helps you see your complete water situation at glance on your phone.
This feature is very helpful in times of emergencies and water scarcity situations.

3. Cloud Based Intelligence

The devices used today such as water flow meters, float valves and switches, water level sensors and controllers, water pumps operate independently by themselves. There is no system to link all their data together to get a full picture of the current water scenario.

IoT and cloud-based systems link up various independent devices to present a unified picture of the whole system at a glance.
This facilitates much better decision making.

How can cloud-based intelligence can lead to better decisions?

- Calling water tankers in advance
- Distributing water to different towers based on **actual water consumption** and not a pre set schedule basis
- **Rationing water** based on water supply and season – for e.g., housing societies can choose to pump less water to overhead tanks in summers and more in rainy season
- Cloud based systems provide **flexibility** to customize the solution based on each housing society and its usage
- Instrumentation can be modelled via **software**. This makes it easier to configure the levels of overflow pipes and inlets from the software itself rather than having to manually adjust and fit hardware multiple times on the site.

DESIRED FEATURES

Technology based Water Management

WIRELESS

No risk of wires getting cut

CONTACTLESS

No risk of corrosion due to contact with water

SOLAR POWERED

Can be installed anywhere

EASY TO USE

Can be used by semi literate staff

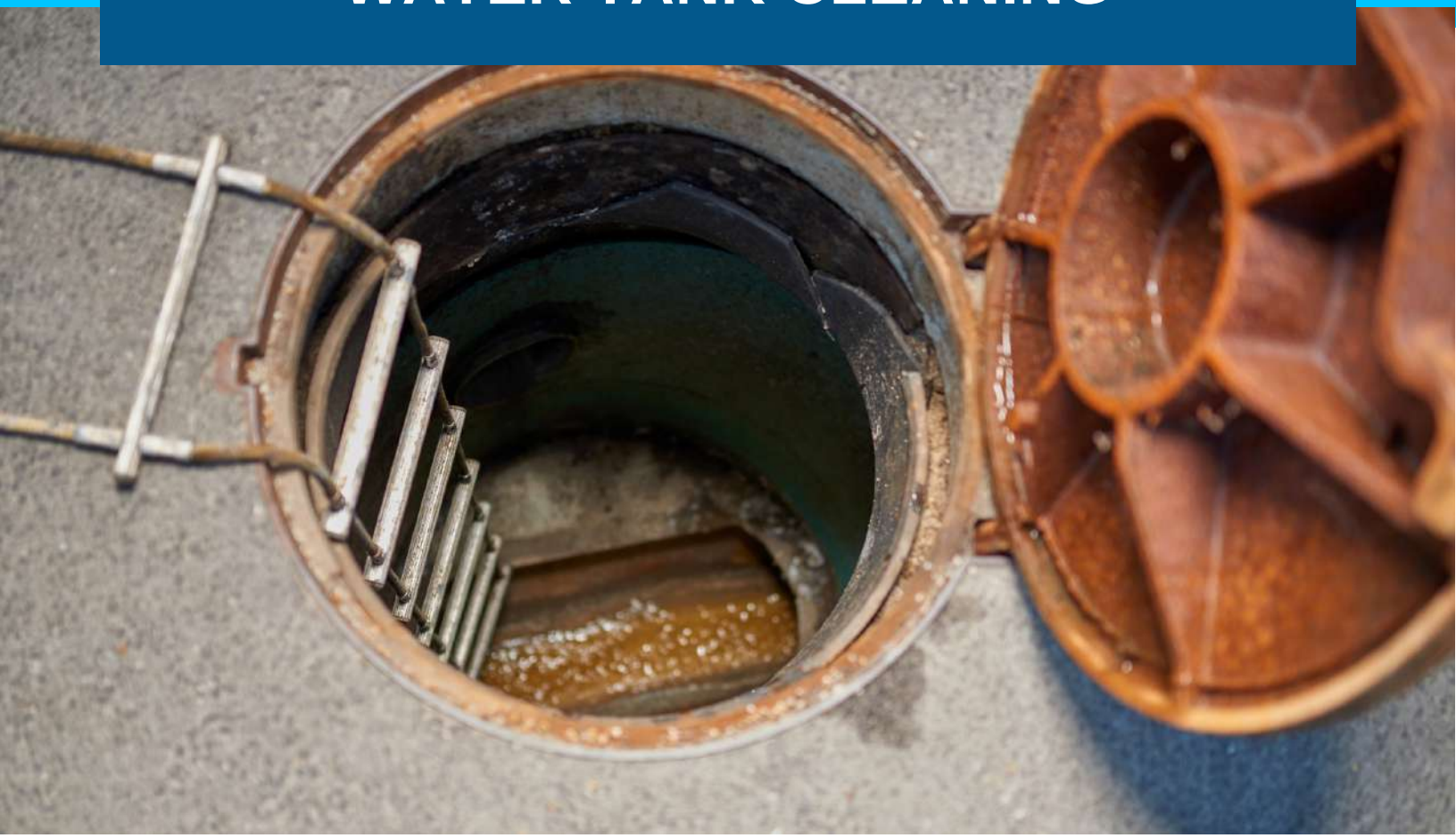
RELIABLE

Works during storms and other emergencies

In the next chapter, we will familiarize ourselves with water tanks and how its cleaning is an integral but ignored aspect of water management.

CHAPTER 3

WATER TANK CLEANING



WHY SHOULD YOU DO IT?

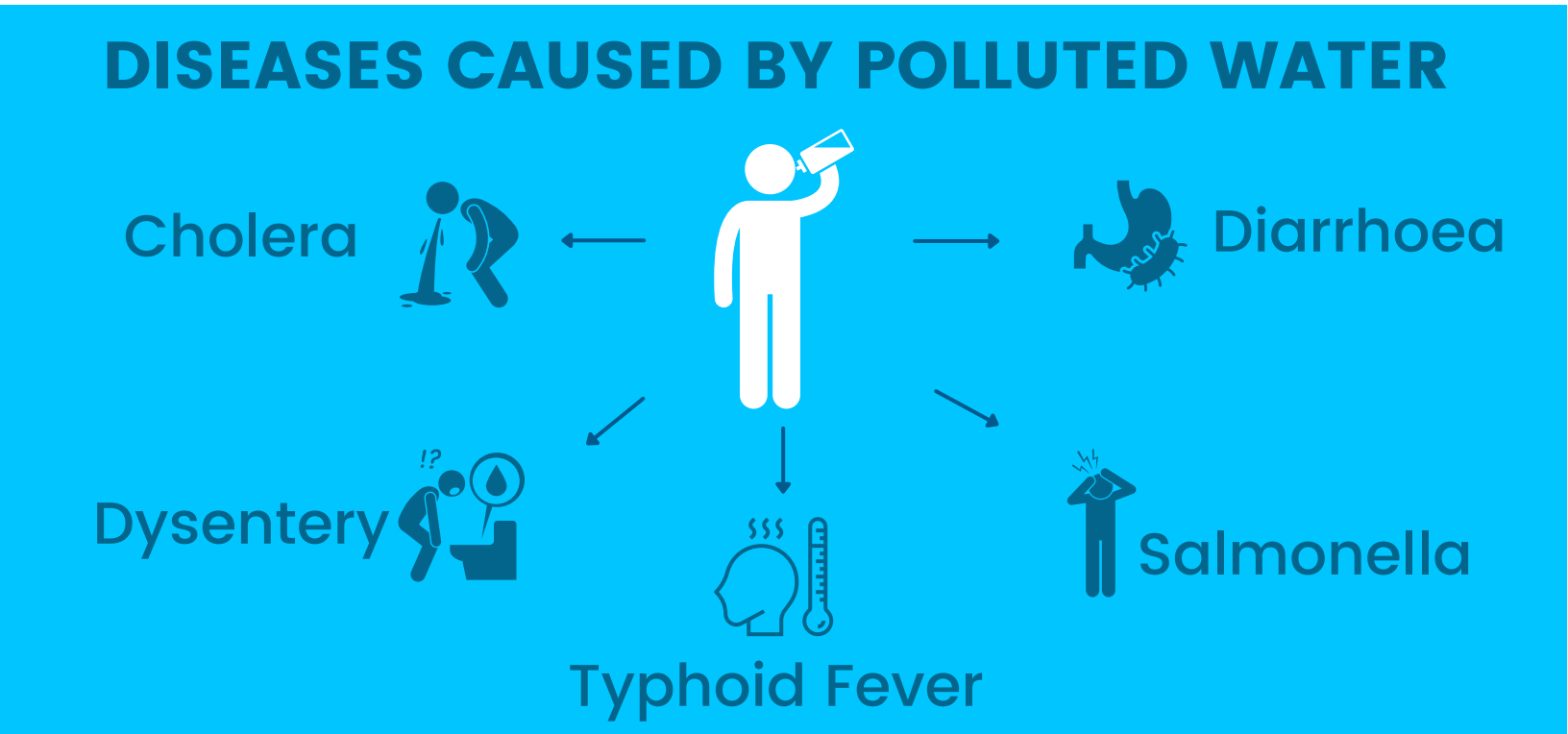
“It seemed like a mysterious illness, one by one almost all the residents of tower A started getting sick with stomach upset and diarrhea.”

One of our employees was narrating this suspense story to us on a Monday morning. Over the weekend, a lot of the residents of a particular tower in their housing society had fallen prey to some sort of a stomach infection.
While the residents of other towers were perfectly ok. After much thinking, detective work and questioning they found the culprit – **a dead rat in Tower A’s overhead water tank!**

As is the norm everywhere, the security guards were instructed to check the tank levels twice a day and turn the pump on accordingly. On that particular night, the security guard left the tank lid open for the overhead tank of Tower A. A rat fell inside and created a health epidemic over the next 2-3 days.
This incident demonstrates how important it is to maintain the cleanliness and security of our water tanks.

Why should we keep our tanks clean?

Just as we take care of our water filters - getting them serviced regularly, we must treat our water tanks as an extension of our water system. **Waterborne diseases cause up to 3.4 million deaths each year**, making it one of the largest causes of disease and death around the world.
Unhygienic water conditions are a major problem in India. Contaminated water can transmit diseases such as diarrhoea, cholera, dysentery, typhoid and salmonella.



Tank Cleaning Process

While all of us talk about tank cleaning, very few people have actually opened the lid of a water tank and peered inside.

To get more insight about the tank cleaning process, we spoke to Mr. Ajit Bapat, owner of a tank cleaning service in Mumbai.
Mr. Bapat has about 20 years of experience in the tank cleaning business and has offered his services to thousands of buildings across Mumbai, including the Sahar International Airport in Andheri and World Trade Center Building in Colaba.

He has also shared some tips related to the things the society residents or management committee members should watch out for when getting the tanks cleaned. We have shared them here.

Water Tank Cleaning Process

- Creating a **schedule** for cleaning underground and overhead tanks.
- **Intimating** the Managing Committee/ Society Manager. Clearly instructing them in advance to keep the tanks as empty as possible for the cleaning process so as to save water.

- Dewatering the Tanks
- *Dewatering is the process of removing water from an area.*

DEWATERING TANKS

It is the process of emptying the water tank before the cleaning process

Water Tank Cleaning Process (contd.)

- Dewatering the tanks
- It is complicated to dewater the bottom 1 inch of water in any tank. The bigger the tank, the harder it is.
- Typically, a **vacuum** is used. However, if the tank is made of concrete, the bottom will be rough and grainy; hence a vacuum may not work and a dewatering pump should be used.
- If nothing works, the last resort is to use a broom, mop and dustpan to remove the water.
- Spray the sidewalls
- The side walls are sprayed with a mild solution of **Hydrogen Peroxide or Potassium Permanganate**
- The spray pump can be operated in a jet or spray mode. It also comes with a regulator so that its speed and power can be regulated
- **The pump has to be operated by an experienced person.**
- The side walls need to be sprayed powerfully so as to dislodge all the sludge and deposits along the wall. However, it should not be so strong that the water tank walls are damaged.
- The sprayer needs to consider whether the tank is made of RCC, steel, cement or other materials and use chemicals and spraying pressure accordingly.
- The bottom is sprayed and scrubbed much more rigorously than the side walls as **sticky deposits settle down at the bottom.**
- After spraying and washing with the cleaning solution, the sidewalls and bottom are sprayed and cleaned with regular water
- Overall, the sidewalls and the bottom are sprayed 4-5 times in total

Tank Cleaning

A step by step guide

STEP 01

Inform the Residents

So they can make the necessary arrangements

STEP 02

Plan

Create a plan for overhead and underground tanks

STEP 03

Dewater

The cleaners will empty the tanks first

STEP 04

Spray the Sidewalls

The cleaners will then spray the sidewalls and the bottom to remove sludge

STEP 05

Supervise the cleaning

Tank cleaning personnel are semi-skilled,

Most society residents have full time day jobs and look into society maintenance matters only when time permits. As a result, tank cleaning is simply **outsourced** to an external agency or the watchman and at the end of the day, the residents just assume that the tank has been cleaned.

Based on his years of experience, Mr. Bapat has advised the society residents to take care of the following things when getting their water tanks cleaned.

HELPFUL TIPS

- **Inform** residents in advance so they can make arrangements.
- **Plan beforehand** so that minimal water is wasted.

e.g. All the water from the UG tanks can be pumped to the OH tanks to get the UG tanks cleaned, and vice versa.

- Or you can choose to wash the parking garages etc on that day so that water in the tanks does not get wasted.

- **Supervising the activity**
- Tank cleaning personnel are semi-skilled, so make sure either you or the manager **supervises** the cleaning activity.
- Ask them about the chemicals they will be using for cleaning.
- Do ask the cleaning staff if they noticed any leakages, cracks in the side walls of the tanks just for your information.
- Create a **proper plan for emptying** the tanks before cleaning and filling them.
- Sometimes it takes a few hours for the overhead tanks to fill up so, create an appropriate schedule to minimize inconvenience.

HELPFUL TIPS (CONTD.)

How often to clean?

- WHO recommends that tanks be cleaned **once every 3 months.**
- Typically, in the Indian environment it is recommended to get tanks cleaned every 6 months.
- Is your tank located in a sunny area or a shaded area (sun rays are disinfecting)?
- Do your tanks typically store hard water or soft water?
- Are the tanks being supplied by underground pipes or overhead ones (UG pipes can carry the risk of contamination if the construction is very old)?
- What is the turnaround time for the water in your tank? Or for how long does the water stay stagnant in your tank?

TANK CLEANING CONSIDERATIONS

Water Quality - Hard or Soft?

Location - Shady or Sunny?

How long does the water stay stagnant?

Supply - Underground pipes or Overhead?

EXPERT'S RECOMMENDATION FOR ASIA

Residential tanks should be cleaned every 6 months.

This chapter has made it clear that water tanks are an **invisible but integral** part of the water system.
Regular tank cleaning is not something to be ticked off the check list like a fire drill. It is a fundamental responsibility that needs to be taken care of in the right way. If not done properly, it could be directly hazardous to health.
The above steps provide a proper guideline for effective cleaning of water tanks

In the next chapter, we explore the right equipment needed for water management.

"Raju, paani bandh karo!"

CUT DOWN ON WATER WASTAGE

Typical Scenario

Watchman is busy with other things as the tank overflows

CHAPTER 4

EQUIPMENT FOR WATER MANAGEMENT

Measuring and Managing Water

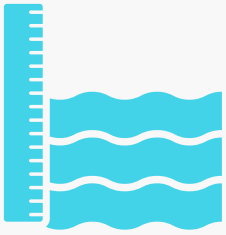
In chapter 1, we have discussed the various issues that housing/ industrial complexes face in managing water.

In this chapter we have listed the different instruments (along with their pros and cons) that can be used for water management so that reactive measures can be prevented. Hope this helps you to find the equipment that suits your needs.

Typically, water measurement and management has been restricted to the industrial sector, mainly because the equipment is expensive and not very user friendly. The instruments are disparate and not really connected to each other, so there is **no central dashboard** from where you can manage your water.

Based on their needs, different industries manage water in different ways, tracking the parameters that are important to them.
In the following section, we have classified the ways in which you can monitor your water and the equipment that could be used.

WATER LEVEL MONITORING



Water level monitoring is used to make sure that the water tanks are always full. This way, any process that depends on availability of water in the tank does not suffer. Monitoring also prevents overflows.

In case of groundwater or borewell, water level monitoring is done to prevent a condition called a **pump dry run.**
A dry run occurs when a tank or bore well has no water and still the pump is switched on; in such a case, the pump motor runs without water and can overheat and get damaged.

Level monitoring ensures there is water in the tank or the bore well before turning the pump on so that it can be protected from dry runs.

Equipment for Water Level Monitoring

1.Water Level Indicator

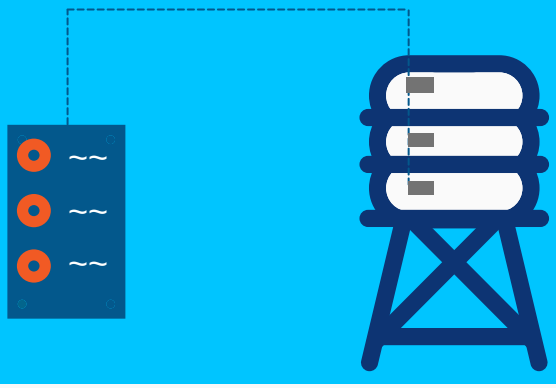
These are metal electrodes that you can suspend in your tanks at various levels. They are connected to a display box which is installed in an area where someone can constantly monitor it, for e.g. the lobby or the security cabin. The box displays the level of water in the tank with its LED indicators.

Water Level Indicator

It is a display box connected to multiple metal level sensors which are suspended in the tank. The box is installed in a common area and shows the level of water.

What does it look like?

How does it work?



Plus Points

- Cheap
- Easily Available
- Satisfies Basic Need

Minus Points

- Long Wires
- No service/ support
- Not accurate
- No alarm/ alert system

Equipment for Water Level Monitoring

2. Float Valve

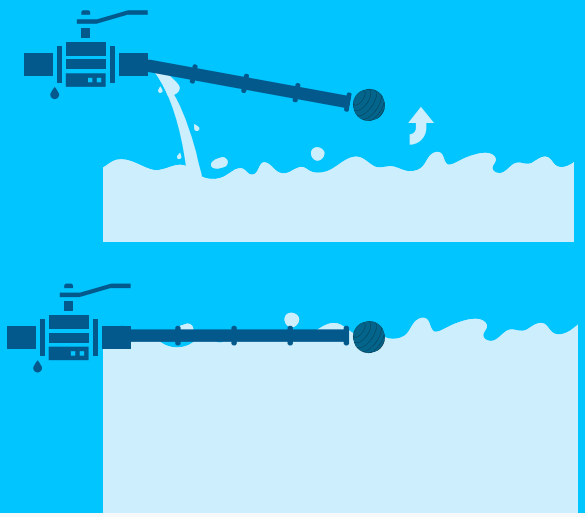
These are rudimentary rubber balls or floats that are attached to the inlet with a rod and suspended in the tank. As the water fills up, the float rises and causes the inlet to shut off. This helps to prevent overflows.

Float Valve

A Rubber ball or float is suspended in the tank and attached to a rod which is fitted to the inlet. As the tank fills up, float rises and causes the inlet to shut.

What does it look like?

How does it work?



Plus Points

- Cheap
- Easily Available
- Satisfies Basic Need

Minus Points

- Can't handle excess pressure
- Breaks down in time
- May not work in all environments
- Rudimentary

Equipment for Water Level Monitoring

3. Tank Overflow Alarm

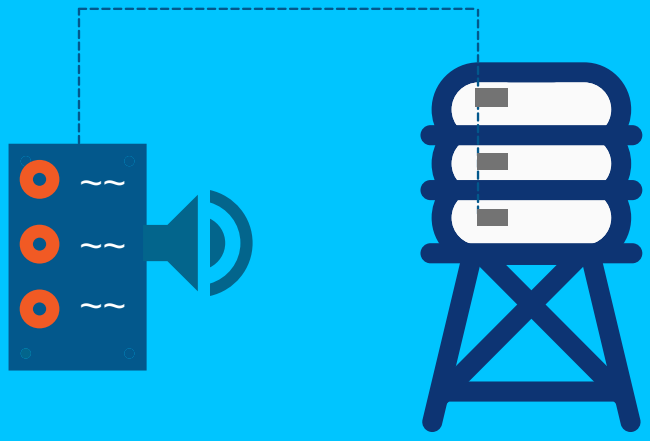
These are very similar to the water tank level sensors/ indicators described above except that they come with a loud siren that gets activated when the tank is full or empty.

Tank Overflow Alarm

The level display box includes a speaker which plays a loud sound when the water is low or overflowing. It is installed in a common area and connected to metal level sensors which are suspended in the tank

What does it look like?

How does it work?



Plus Points

- No need for constant monitoring
- Alarms alert you to switch pump on/off

Minus Points

- Hard to install
- Long wires
- No Auto ON/OFF
- Levels not visible from far
- Scaling causes malfunction

WATER LEVEL MONITORING AND CONTROL

It is preferable have the motor switch ON and OFF automatically based on water levels. The expectation is that when the water level is low, the pump should get switched on and continue filling the tank until it fills up completely. Once the tank is full, the pump should switch OFF automatically.

In such cases, devices called **controllers** are used. These are installed next to the pump and turn the pump on/off automatically based on the water levels.

Some controllers are sophisticated enough to provide protection against dry runs as well. If the overhead tank level is low, they will turn the pump ON ONLY if there is water in the underground tank. Otherwise the pump may burn down due to a dry run.

Equipment for Level Monitoring and Control

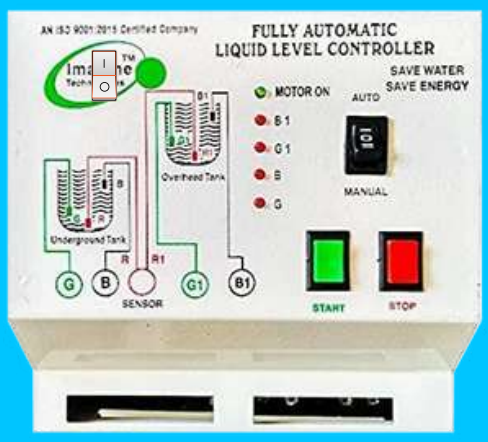
1. Water Level Controller

This is a combination of the water level sensors described above and a controller. The device needs to be installed next to the water pump and interfaces with the pump. It is generally used with a submersible pump. It needs **basic logic programming** to infer the water level sensor input that is coming in and then to operate the pump accordingly (switch on or off).

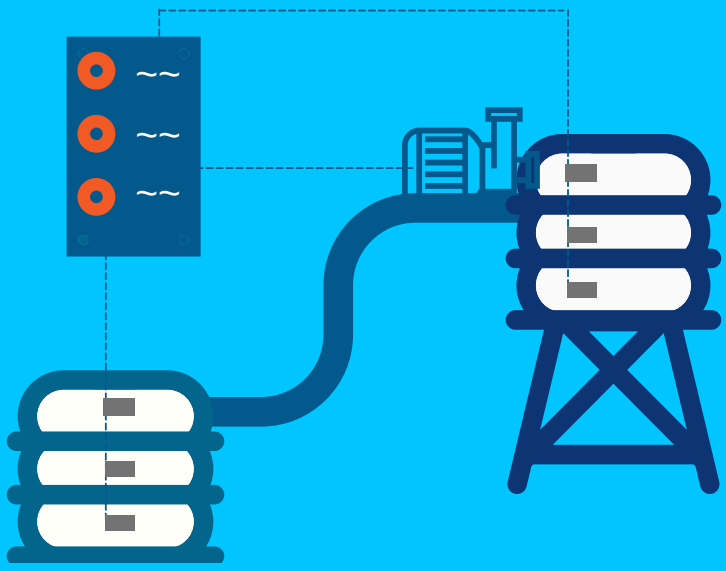
Water Level Controller

The controller comes with metallic level sensors and is connected to the pump. It senses the levels of water in the tanks and starts/ stops pump accordingly.

What does it look like?



How does it work?



Equipment for Level Monitoring and Control

1. Water Level Controller (contd.)

Water Level Controller

The controller comes with metallic level sensors and is connected to the pump. It senses the levels of water in the tanks and starts/ stops pump accordingly.

Plus Points

- Automatic operation
- No need of manual supervision
- Dry run protection

Minus Points

- Since it is installed near the pump, may not be visible for monitoring water levels
- Long wires - breakdown risk
- Probes get deposits due to hard water and stop working
- Professional Installation
- After sales support may be unreliable

Equipment for Level Monitoring and Control

2. Float Switch

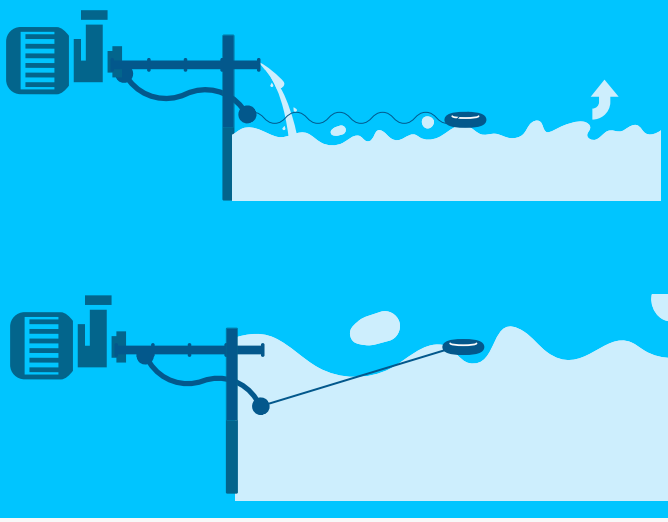
These are float valves which come with electrical connections to be connected to the pump. When the water reaches a certain level, the float becomes horizontal, electrical contact is made and the pump switches on or off as it is wired.

Float Switch

A float is suspended in the tank and also connected to the pump. As the float rises and becomes horizontal, electrical contact is made and the pump gets switched off.

What does it look like?

How does it work?



Plus Points

- Satisfies basic need of stopping overflow
- Cheap
- Easily available

Minus Points

- Cannot withstand pressure
- Needs to be installed near the pump
- Long wires

FLOW AND VOLUME MEASUREMENT

Flow measurement is used when you need to know the volume of water.

Whether you want to measure water supply or water consumption, one of the ways to do this is to measure the flow rate of the water flowing in the pipe and then multiply it with the time duration it has been flowing.

In the residential sector, flow meters or water meters are used to measure the volume of water consumed by each individual unit (townhome, villa, apartment) so that they can be billed accordingly.

Equipment for Flow/ Volume Monitoring

1.Flow Meter (Paddle Type)

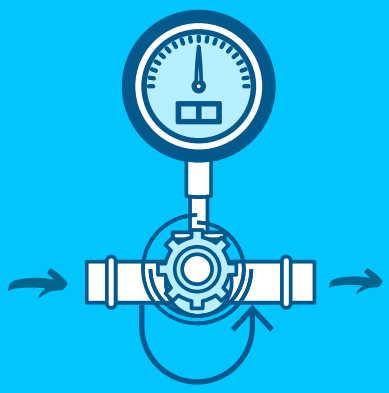
Also known as water meters, these have a paddle which rotates as water flows in the pipe. The number of rotations happening per minute help to measure the flow rate of the water flowing. Most flow meters now come with digital displays.

Flow Meter (Paddle Type)

A paddle is inserted in the middle of a pipe. As water flows through it, the paddle rotates. The meter counts the # of rotations per minute and displays the reading.

What does it look like?

How does it work?



Plus Points

- Affordable
- Serves the purpose of calculating flow and volume

Minus Points

- Needs pipe cutting for installation
- Stones, impurities can get stuck in the paddle
- Need to write down readings manually
- Needs water to be pressured so that the paddle will rotate

Equipment for Flow/ Volume Monitoring

2. Flow Meter (Ultrasonic)

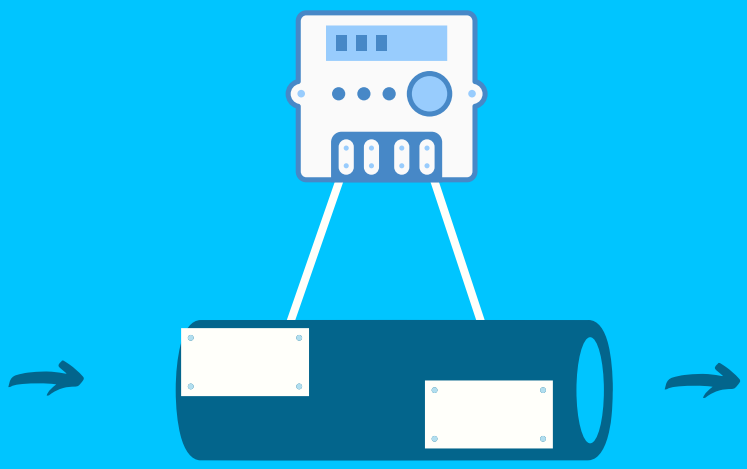
These are modern flow meters that make use of ultrasonic waves to measure the flow rate of water. They have digital displays. Some of them are also equipped with IoT technology and send readings via SMS or the cloud.

Flow Meter (Ultrasonic)

Two transducers on either edge of the pipe track the upstream/ downstream flow of water in the pipe. The display meter displays the flow rate accordingly.

What does it look like?

How does it work?



Plus Points

- May not need pipe cutting
- No risk of impurities getting stuck
- Can send readings over the internet

Minus Points

- Very expensive
- Installation can be tricky
- Need to incur recurring data charges

Equipment for Flow/ Volume Monitoring

3. Solenoid Valves (with Flow Meter)

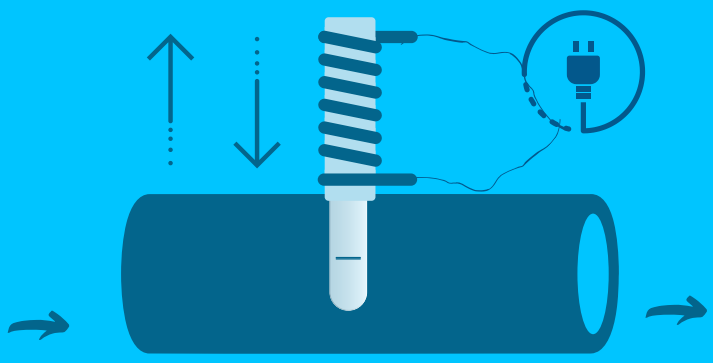
Solenoid valves are installed in pipes to allow or stop the flow of fluid. They are operated electromagnetically. In the residential sector, they are used in schemes such as pre-paid water meters which allow or stop flow of fluid based on payment and usage.

Solenoid Valves

A plunger is inserted in the middle of pipe. When the coil is electrified, it creates a magnetic filed and pulls the plunger up allowing the water to flow.

What does it look like?

How does it work?



Plus Points

- Can be used to control flow of water
- Can restrict supply to a particular water line if leakage is detected

Minus Points

- Need to install in each water supply line
- May result in billing disagreements if working is inaccurate

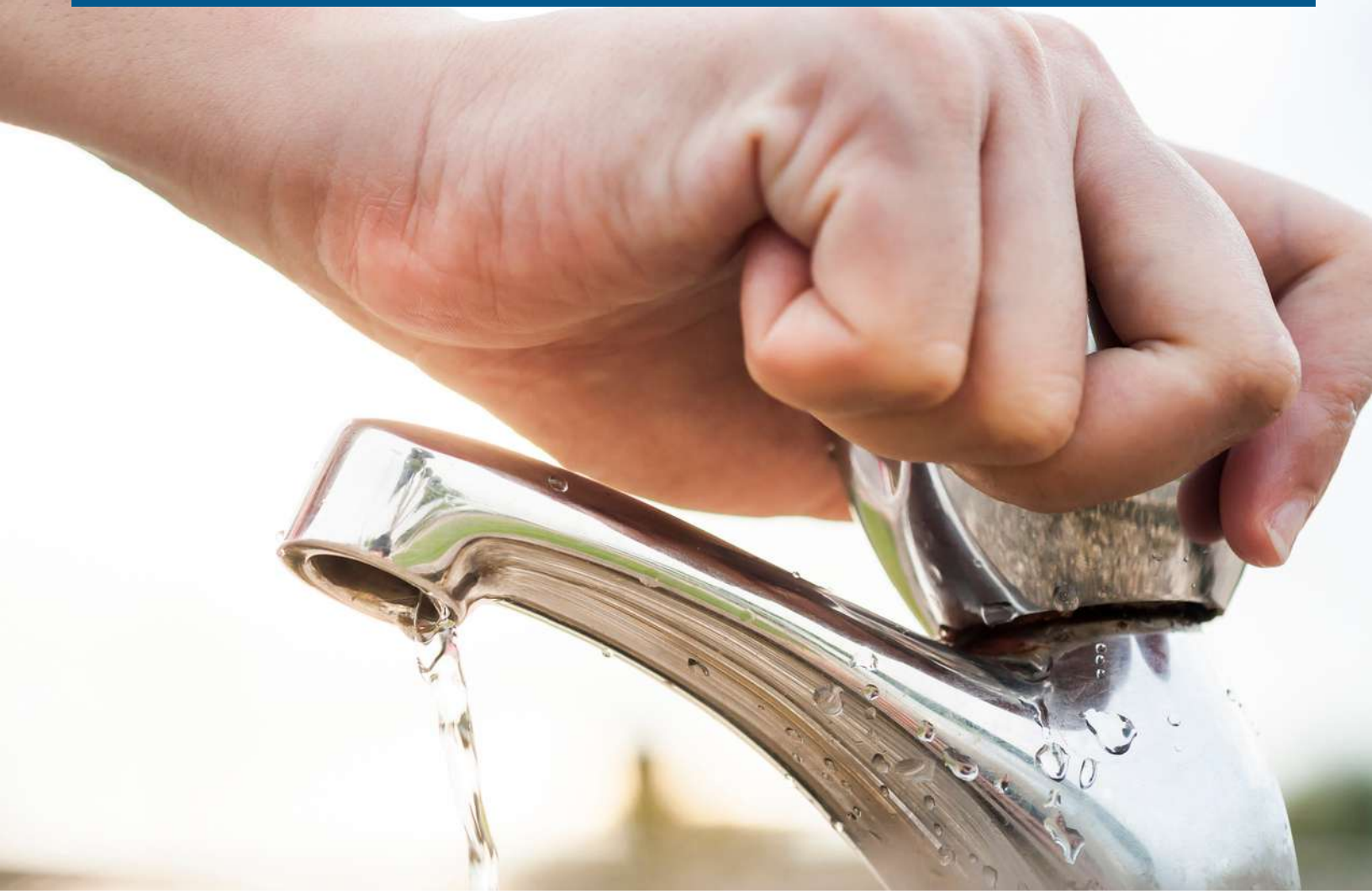
So what we see is that there is a variety of different instruments available in the market today to fulfil the different water management needs but there is no single platform where the data and alerts coming from each sensor, indicator or controller can be collected.

A Water management system should ideally cover the entire flow from water supply to individual water consumption to waste water treatment and recycling.

In Chapter 2 we have discussed how IoT technology provides a perfect base for developing a smart and easy to use water management system.

In our next chapter we will go over some useful Water Saving Tips that can be implemented by communities.

WATER SAVING TIPS FOR COMMUNITIES



WATER IS FINITE

In the previous chapter we have covered equipment that is typically used to manage water.
In this chapter we will go over some on ground tips that communities can implement to save water. Perhaps the most basic and easy-to-understand reason to save water is that our **water supply isn't unlimited**. In this chapter we present some tips for water saving.

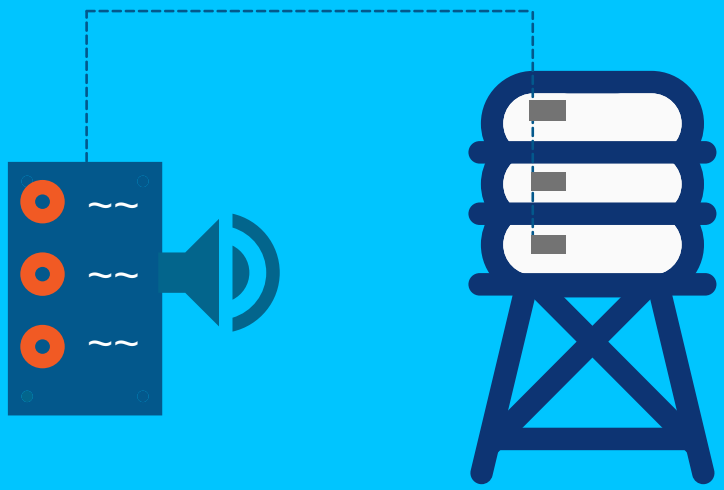
1) Prevent Overflows

Allowing water to overflow is equivalent to committing a crime.

- Overflows not only cause water wastage, but they also cause other damages such as leakages in the construction.
- In most cases overflows occur because of **negligence**.
- The watchman switches the pump ON and forgets about it while he's doing other things. Meanwhile the tank overflows.
- Human errors can be avoided with instrumentation such as overflow alarms and float switches. In chapter 4 we have described all the different equipment that can be used for water measurement and monitoring.

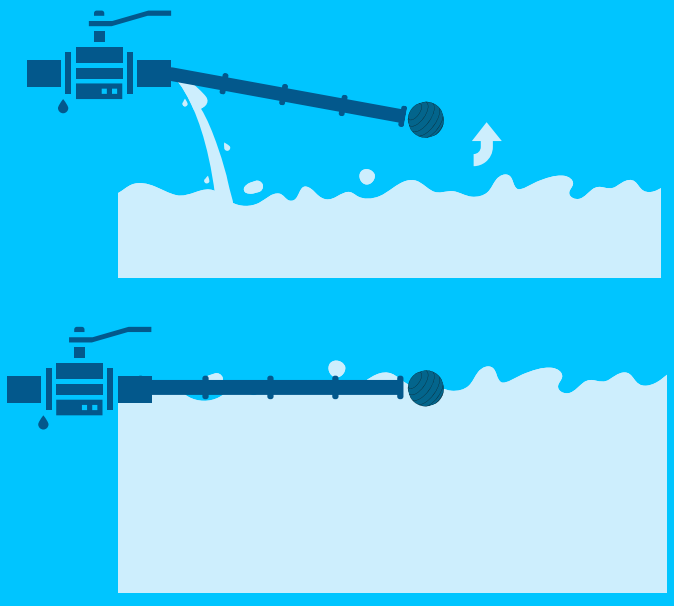
Overflow Alarm

The level display box includes a speaker which plays a loud sound when the water is low or overflowing. It is installed in a common area and connected to metal level sensors which are suspended in the tank



Float Valve

A Rubber ball or float is suspended in the tank and attached to a rod which is fitted to the inlet. As the tank fills up, float rises and causes the inlet to shut.



Please refer to chp 4 for more on this

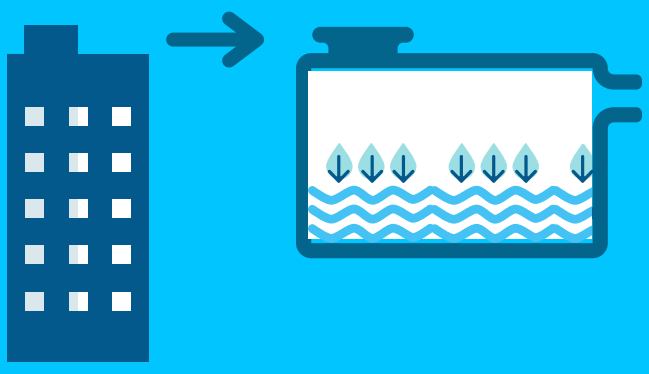
2) Operate with Reduced Pressure

If managed properly, managing pressure can be a novel but effective way of reducing water consumption.

- With automatic pumping , the overhead tank is fully filled and gets refilled once the level becomes low.
- During scarcity, this overhead tank can be **filled up to 60-70%** capacity instead of 100%. This reduces the pressure of water flowing in the pipes and taps.
- Thus, when the tap runs, water will flow at a reduced pressure and less water will be consumed in the same duration.
- When watering the garden, we can keep the valve of the hose only **half open** so that water flows with lower pressure and watering can be done carefully with minimal wastage.
- We can also use devices such as **aerators** that mix air with water. This reduces the volume of water flowing through the tap but the feel of the flowing water remains unchanged.

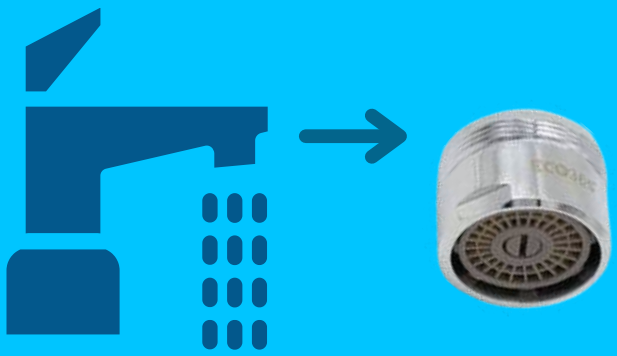
Keep OH tank half full

Keeping the tanks at 50% full level instead of 100% reduces the water pressure flowing through the taps which helps to conserve water.



Aerator Devices

Aerator devices are attached to the tap head and mix air into the flowing water. This helps to maintain water pressure while reducing water consumption at the same time.



3) Create Water Awareness in the Community

Social campaigns help to draw the public's attention to the water situation. Here are some ways to create awareness

Publish Reports

- **Publishing** per tower statistics on water consumption, expenditure
- When residents see such reports, it motivates them to reduce wastage

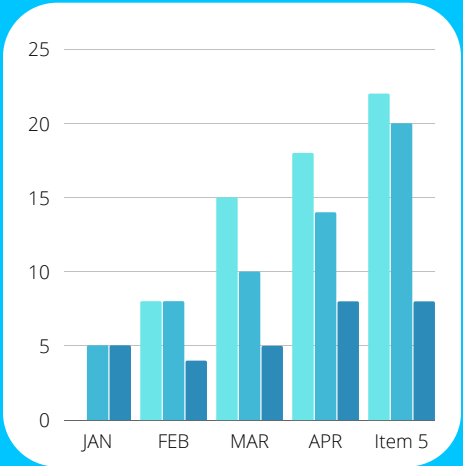
Educate Residents

- Proactively share some water saving tips
- E.g. During summers, request residents to wipe their cars with a wet cloth instead of washing them with a pipe

Gamification

- Societies can use gamification strategies to create water awareness within their residents.
- E.g. Declaring an annual award for the tower that consumed the least volume of water in that year.

Water Reports



Gamification

4) Divert Unused Water

We have noticed that societies initially receive water from the Municipal Corporation into their drinking water tank. Typically, there is a float valve installed at the top of the tank which shuts off when the tank is full. In general, drinking water tanks are built to store a large volume of water – much more than what is typically consumed on a daily basis.

In times of water scarcity, societies can choose to store a little bit more (say 20% more) than their daily requirement in their drinking water tank and **divert the rest** of the corporation's water to their **domestic** tank.

This way, they reduce the number of tankers ordered. The **hardness** of their domestic water also gets controlled as it gets mixed with the corporation’s water.

5) Practice what you Preach

If the management committee wishes to inspire its residents to save water in their homes, the committee should incorporate water saving practices at the **community level**. They can start with simple, demonstrable practices.

E.g. *Watering gardens in the evenings instead of mornings, so that losses due to evaporation can be avoided.*

Equipment such as water level indicators, overflow sensors and pump controllers control unnecessary overflows and leakages.

In this chapter we discuss how modern technologies such as IoT can provide better water management. Techniques like **water harvesting** and **drip irrigation** can also be adopted for water conservation.

To summarize, we all know that charity begins at home. Communities can bring about effective change with just a few simple practices described above.

WATER SAVING TIPS

For Progressive Communities

1. 

PREVENT OVERFLOWS

2. 

REDUCE OH PRESSURE

3. 

CREATE AWARENESS

4. 

DIVERT UNUSED WATER

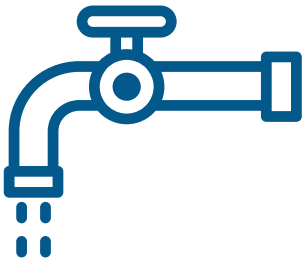
5. 

CONSERVE AT SOCIETY LEVEL

Today, industries already have strict norms and regulations for water usage, but it's time to bring this awareness into the residential sector as well.

In the next chapter we will go over a highly debated topic in communities - is it a good idea to install water meters in individual flats?

MORE WATER SAVING TIPS

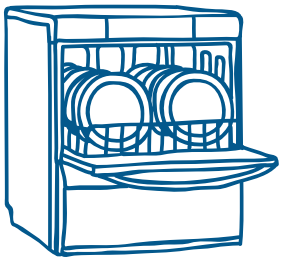


TURN TAPS OFF

Turn off taps while brushing, shaving, washing clothes or utensils.

REDUCE SHOWERS

Take baths with bucket instead of showers.



DISHWASHER

Use automatic dishwashers/washing machines for full loads only.

WATER SAVING SHOWER HEADS

Use water saving shower heads to reduce water consumption.

TIPS FOR YOUR GARDEN

Put a layer of mulch around the plant to reduce evaporation.

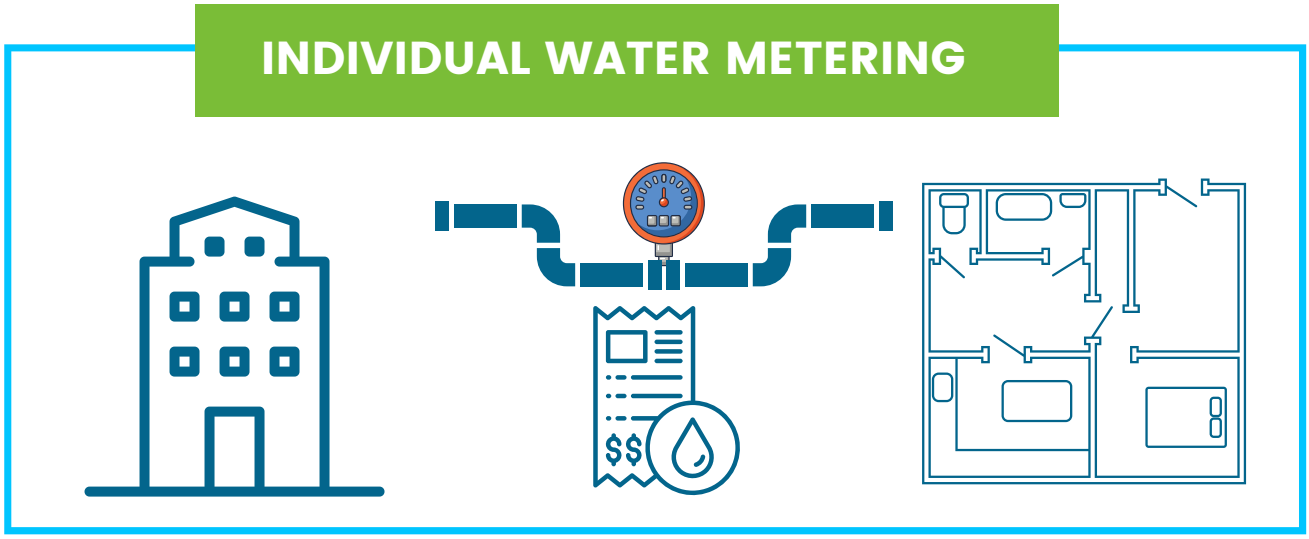
INDIVIDUAL WATER METERING

IS IT PRACTICAL?

In the previous chapter we have covered some practical tips for saving water in communities.

With growing water costs, housing societies are looking at ways in which they can get residents to cut down on water wastage and use water responsibly.

One of the ways to do this would be to install individual water meters so that residents can be billed for their water consumption.
While, on paper, this sounds like a simple and obvious solution, it can get very **tricky to execute** in reality. Let's examine it in depth.



What is Individual Water Metering?

Typically, housing societies in India pay their water bills out of the society maintenance funds on a collective basis.
Water costs are divided equally among all residents and there is no provision to charge households based on their individual water consumption.
Individual water metering enables the society to monitor the volume of water **utilized by each flat** and bill them accordingly.
It involves installing water meters in each inlet pipe coming into the flat, checking readings and billing accordingly. Various water technologies for metering and billing are available in the market today. We have summarized them in the following pages

1.Prepaid Water Meters

Residents can choose to install prepaid water meters where a fixed volume of water is available to each flat without any charge. After that threshold is reached, the resident would have to charge the water meter to receive more water.

2. Pay As You Go

Residents receive a monthly water bill based on the volume of water consumed each month.

3. Manual Reading

These are old type water meters which show readings in a digital format. They do not have the capability to transmit their readings wirelessly. Typically, the security guard or some other maintenance person takes periodic rounds to note down the meter reading in a register. The customer is then sent a bill as per that reading.

4. Technology - Leak Detection, Wireless

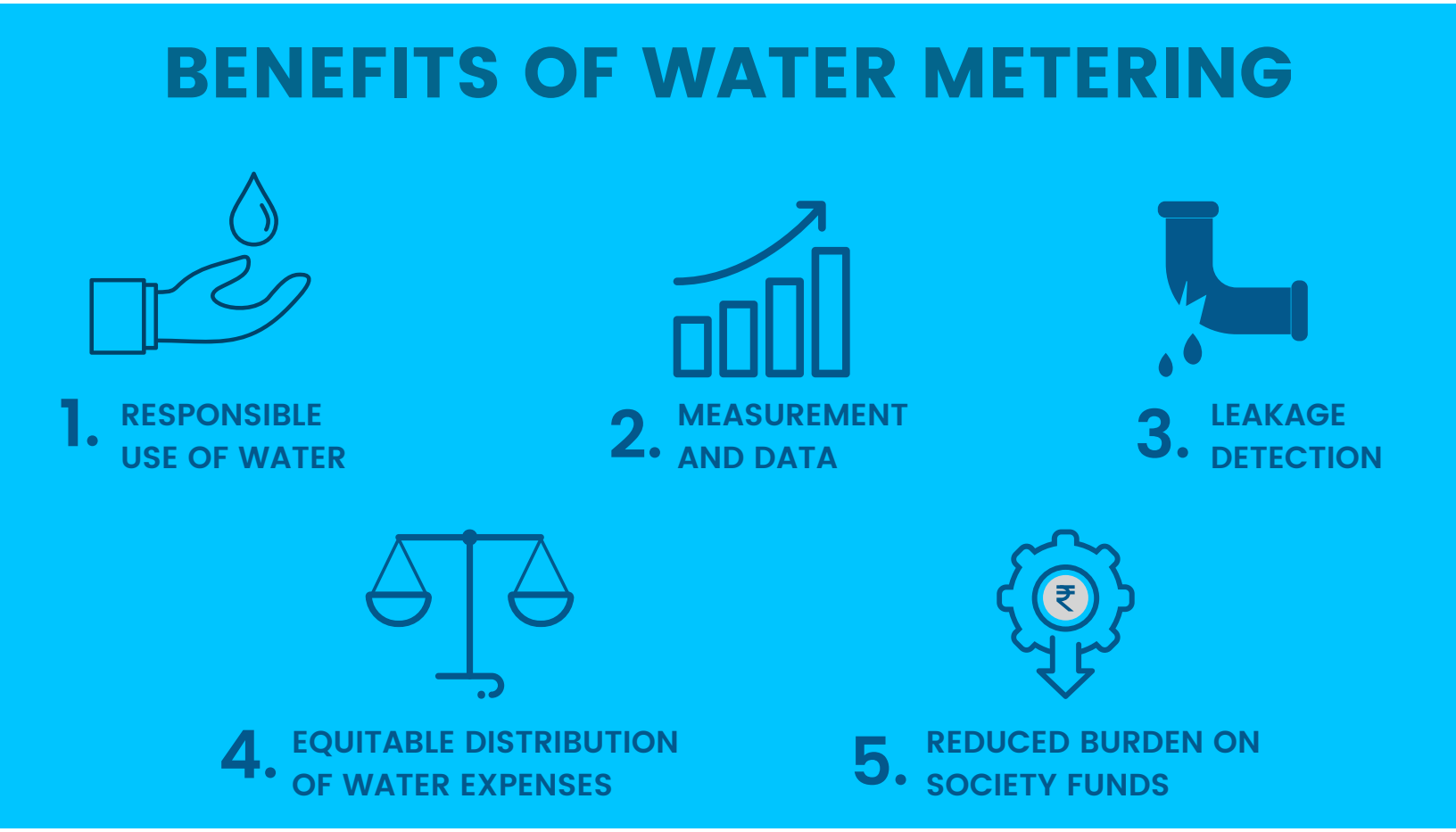
These days, we have IoT enabled water meters which have the capability to transmit readings wirelessly. A complete billing system is integrated into the product so that the customer receives and pays their bill digitally on a regular basis.

These systems have advanced analytics and algorithms built into them so that they can **detect leakages and raise an alert** if needed. They also provide central dashboards and water management apps so that users can study and analyze their water consumption.

5. Supply Control and Cut Off

In addition to water meters, these systems also come with solenoid valves. These valves have the capability to shut off the water supply from the pipe in case of leakages, or if the bill has not been paid.
In IoT enabled systems the valves can be controlled remotely via a phone or PC.

Now that we have seen the various types of water metering solutions available today, let us look at the benefits of having such a system in your community.



1) Responsible Use of Water

The first and the most obvious benefit is that everyone becomes conscious of their water consumption.
When people are directly billed for their water usage, they automatically start implementing ways of reducing their consumption.

2) Leakage Detection

By tallying the water usage of its residents with the total water received for that period, society can detect if there are any leakages, losses or inefficiencies in their structure.

3) Measurement and Data

Water related data and numbers are available to residents which can be analyzed and optimized.
E.g., if the society sees a major chunk of its water consumption comes from watering the community gardens rather than from individual flats, it can focus its efforts on reducing the water needed for gardening by adopting techniques such as mulching.
Data analysis can provide multiple ideas for water conservation, unique to each society.
In this chapter, we have described some of the drawbacks of the current residential water management system and how it can be improved with instrumentation.

4) Equitable distribution of Water Expenses

If a society is paying heavily for their water usage, it is natural to have a feeling of **discontent** amongst its members especially if they

see others wasting water or if many members are sharing one apartment.
Holding every house responsible for their water bill helps to create a feeling of fairness among the members. Members are more likely to cooperate when paying maintenance charges.

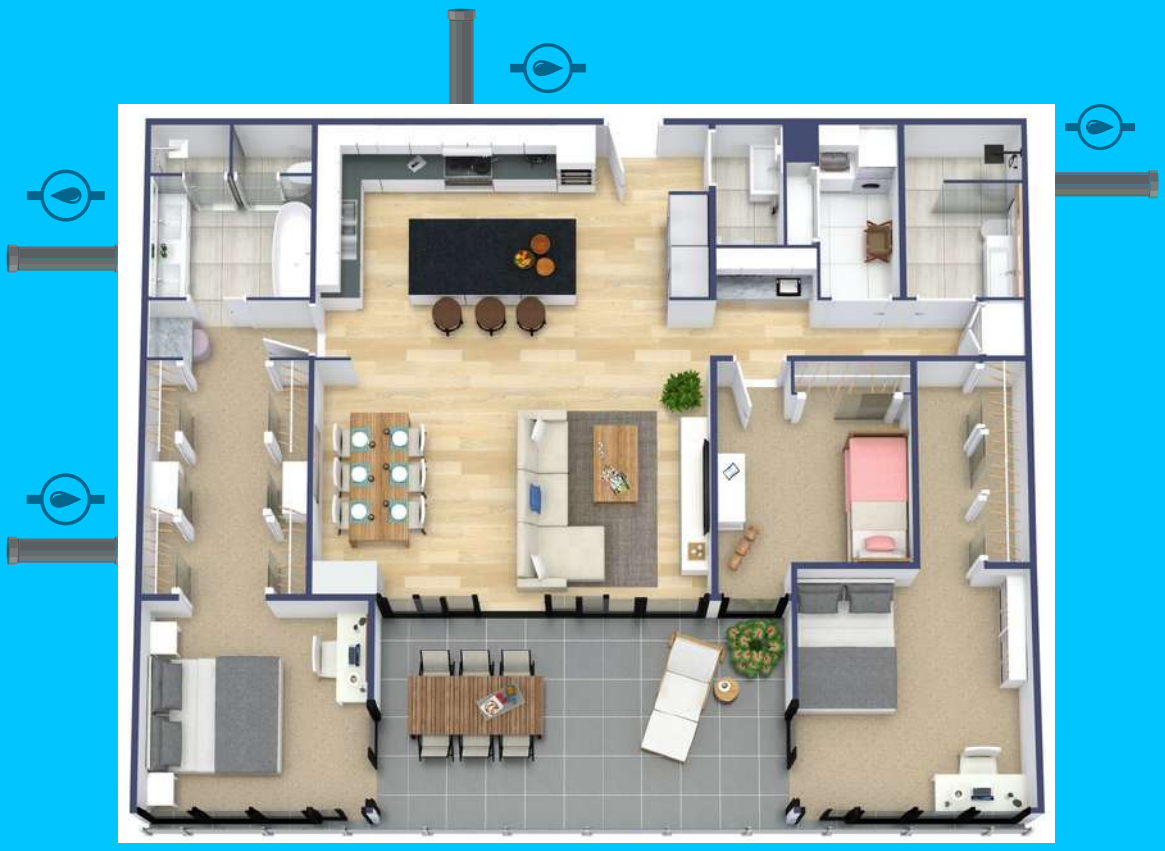
5) Reduced Burden on Society Funds

Sometimes, when the builder or corporation does not provide water to the society and the society needs to spend out of its pocket for water, a **major chunk of the maintenance charges** get used up in water expenses.
These charges increase during summers when there is water scarcity. It is difficult to plan for them and water metering and individual billing helps to take that load off the society.

While there are many benefits and very few cons to having an individual water metering system, it has not become popular in India yet as there are many challenges involved in the installation and implementation of such a system. Let’s take a deeper look.

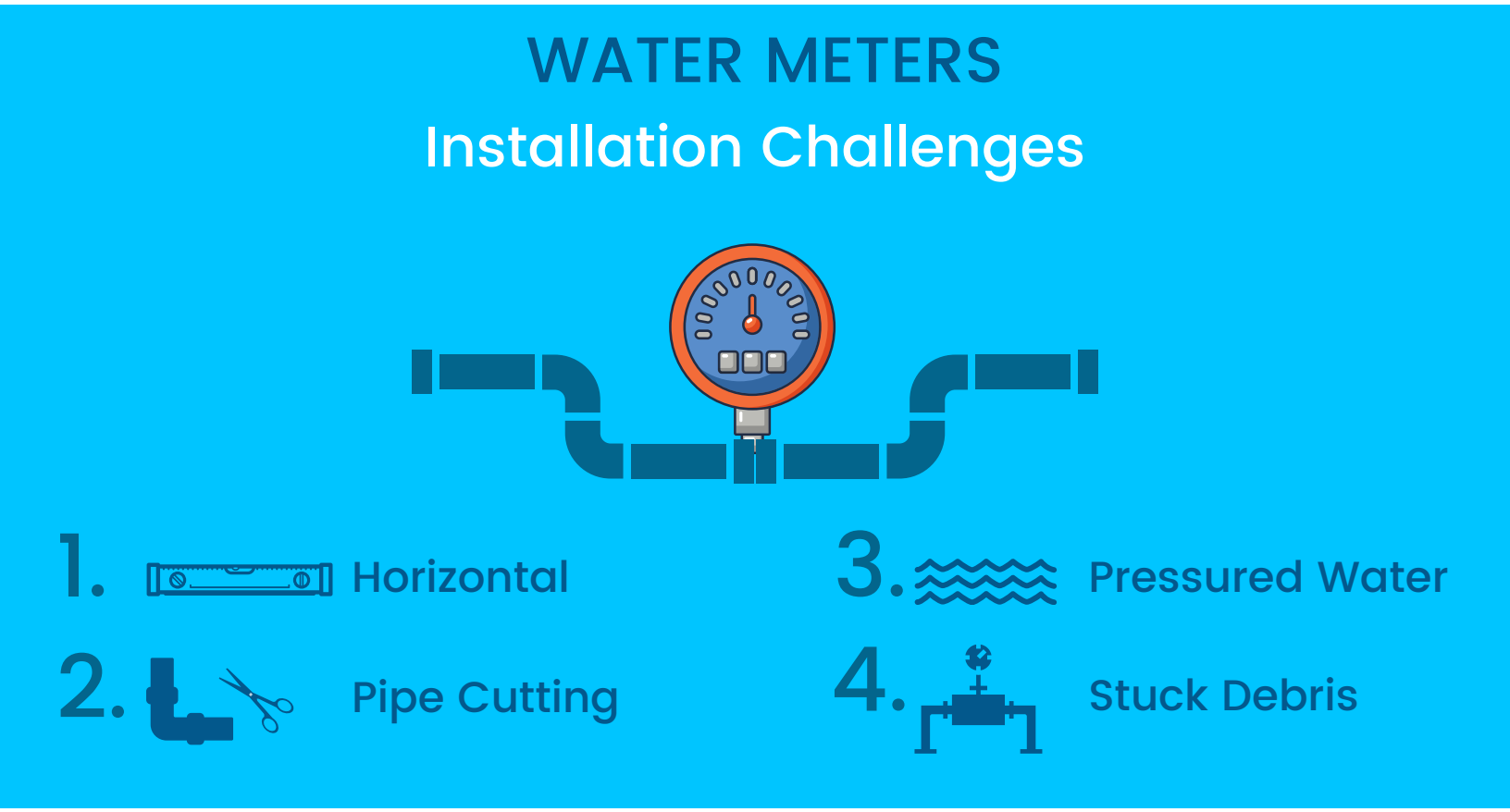
CHALLENGES IN WATER METERING

Multiple Inlets need Multiple Water Meters



1) Multiple Inlets

Typically housing societies are constructed such that there are multiple water pipes coming into a single flat. For e.g. each bathroom has a pipe, the kitchen has a separate inlet and sometimes the flushing water comes in from another inlet. In such cases water metering for individual flats becomes **highly expensive** as water meters need to be installed in each inlet coming into the apartment.



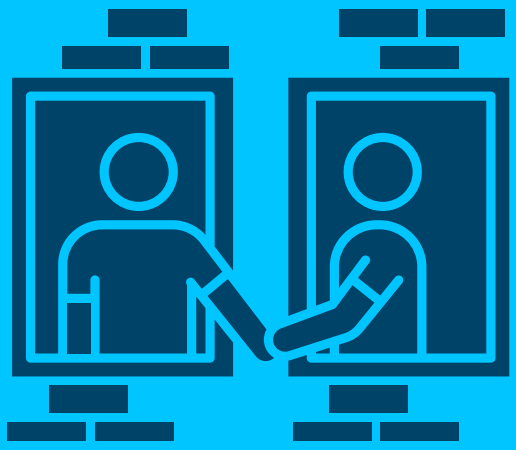
2) Tricky Installation

Water meter installations are quite complex as they require the level to be **perfectly horizontal** and involve cutting of pipes. Sometimes **debris** such as stones, pebbles, leaves, twigs can flow with the water and and get stuck in the meter and obstruct it. The only way to fix it is to open up the connection.
Some types of meters require water pressured water to be flowing in the pipes for accurate measurement. It can be challenging to find a spot with like that for each inlet.

As water meters derive water volumes indirectly, equipment **calibration** is a very important aspect of installation. The meters need to be calibrated accurately else the readings will be inaccurate.

RESIDENTS' COOPERATION

very important for Effective Water Metering



3) Residents' Cooperation

Housing societies are governed by the laws of cooperative bodies. Not much authority is vested in the hands of the managing committee members. If residents choose not to cooperate, not much can be done.

Housing societies are loose bodies consisting of people from **different cultures, backgrounds, attitudes and age groups.** Sometimes residents may choose to disagree with the water meter readings, distrust the billing company or tamper with the water meters.

If the flats are **unoccupied** most of the time, the owners refuse to pay minimal charges or residents refuse to pay for the time that they were away on a vacation. If the system goes down for a certain period, there can be conflicts around how to account for water usage during down time.

This puts additional responsibility on the shoulders of the managing committee which is already working on a voluntary basis. In addition, **bylaws** of housing societies are structured in such a way that they disallow cooperative housing societies to charge individual apartments for water. May be the society has to come up with creative solutions to reduce water consumption before navigating this terrain.

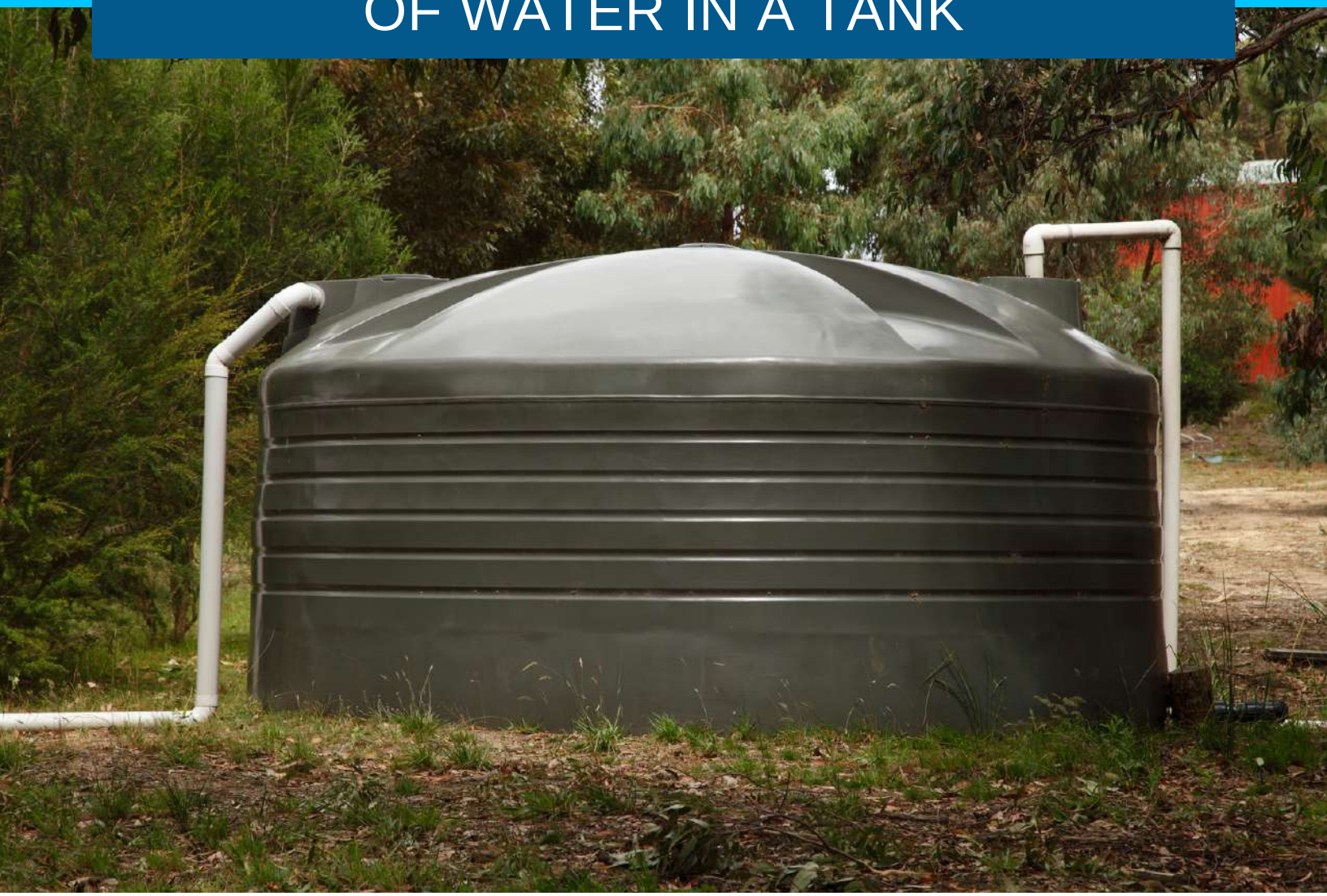
As described above, while an individual water meter sounds like the perfect solution to make each household accountable for its water consumption, it can be quite a challenge to actually implement it in practice.

Each society is unique in terms of its construction, people and water situation. Thus it's up to the society to validate the pros and cons of such a solution within the context of its conditions, and decide the best way forward.

In the next chapter, we will learn more about how to measure the volume of usable water in a tank.

CHAPTER 7

MEASURING THE VOLUME OF WATER IN A TANK



FUTURE WARS WILL BE FOUGHT OVER WATER

Often referred to as the **water wars thesis**, it suggests that future wars will be fought over water, not oil.

Even in countries with adequate water resources, water scarcity is not uncommon. Every day, usable water is becoming scarce and water costs are rising.

This economic water scarcity arises due to a lack of water infrastructure or due to the poor management of water resources.

This needs to be solved at the local as well as central level. The common people need to be interested in conserving and managing their water.

Management begins with Measurement

For any water saving practices to become effective, it is important to first measure the volume of water received, used and available.

Volume of water flowing through a pipe can be measured with equipment such as a digital flow meter. The equipment that can be used for water volume measurement has been described in this previous chapter. Other equipment such as water level indicators or water level sensors typically give only an indication of the water height.

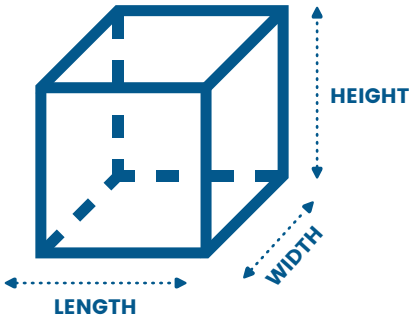
Today, we shall take a look at the different ways in which tanks are constructed and connected and how to measure the volume of water in a tank based on the same information.

Tank Volume Measurement

Generally speaking, the overall physical tank volume is already known beforehand. It is mentioned in the M. E. P. architectural diagrams constructed by the architects. If such a diagram is not available, one can calculate the tank and water volume by measuring the dimensions of the tank and using the following formulae.

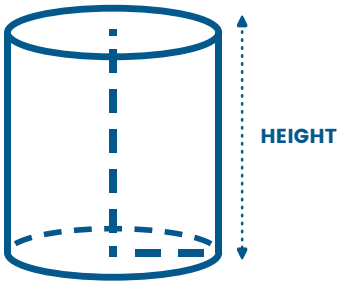
TANK VOLUMES

RECTANGULAR TANK



VOLUME
= LENGTH X BREADTH X HEIGHT

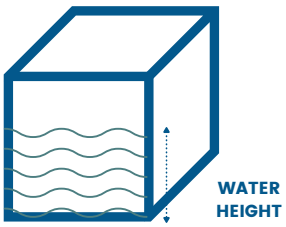
CYLINDRICAL TANK



VOLUME
= AREA OF BASE X HEIGHT

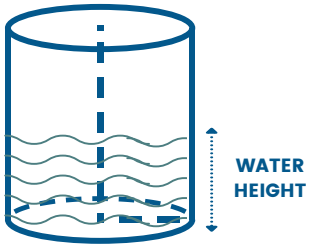
WATER VOLUMES

RECTANGULAR TANK



VOLUME
= LENGTH X BREADTH X WATER HEIGHT

CYLINDRICAL TANK



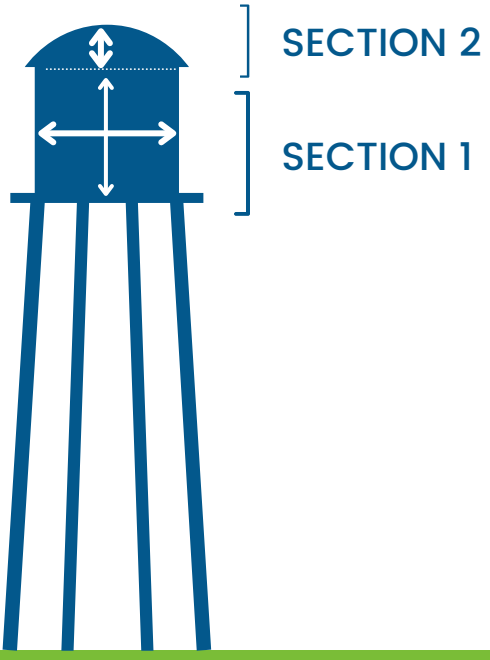
VOLUME
= AREA OF BASE X WATER HEIGHT

Irregularly Shaped Tanks

We hardly ever find tanks that have irregular shapes. This may also be due to aesthetic reasons, in order to conform to the overall theme of the project's construction or due to various other reasons.

In such cases, we can split the shapes into multiple regular shaped components and determine the volume of each individual shape. All these volumes can then be added together to get an overall volume. Here is an example of an irregular tank and its volume calculation.

IRREGULARLY SHAPED TANK



TOTAL VOLUME = VOLUME OF SECTION 1 + SECTION 2

Usable Volume: Accounting for Fire Tank Volume

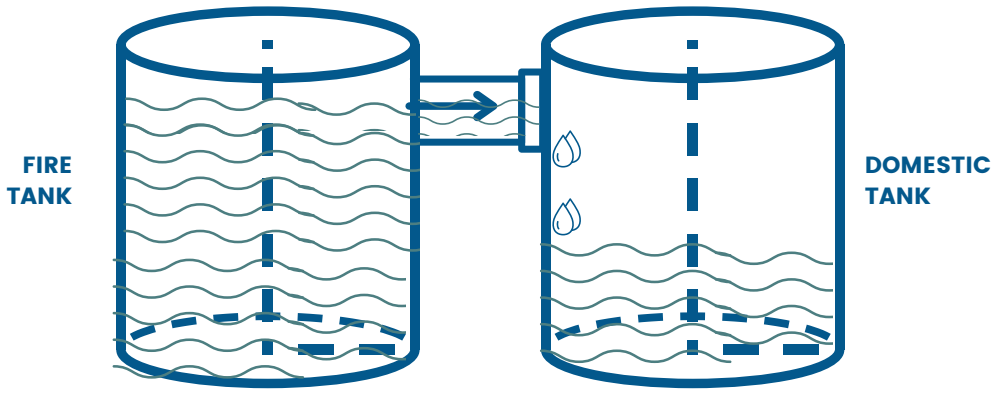
Modern tanks are constructed so as to take into account fire safety as well. Sometimes there is a separate storage tank for storing the water that may be needed during a fire emergency. Typically, this tank fills up first and its overflow is drained into the domestic tank.

In other cases, the main tank is constructed in a way that a separate compartment has been created for storing the **dead stock** of fire water. All these constructions are done to ensure that the fire tank portion is always filled up before the domestic tank and that it never gets empty.

In these cases, to get an accurate estimate of the volume of water available, one also needs to calculate the volume of USABLE water in addition to the volume of TOTAL water stored.

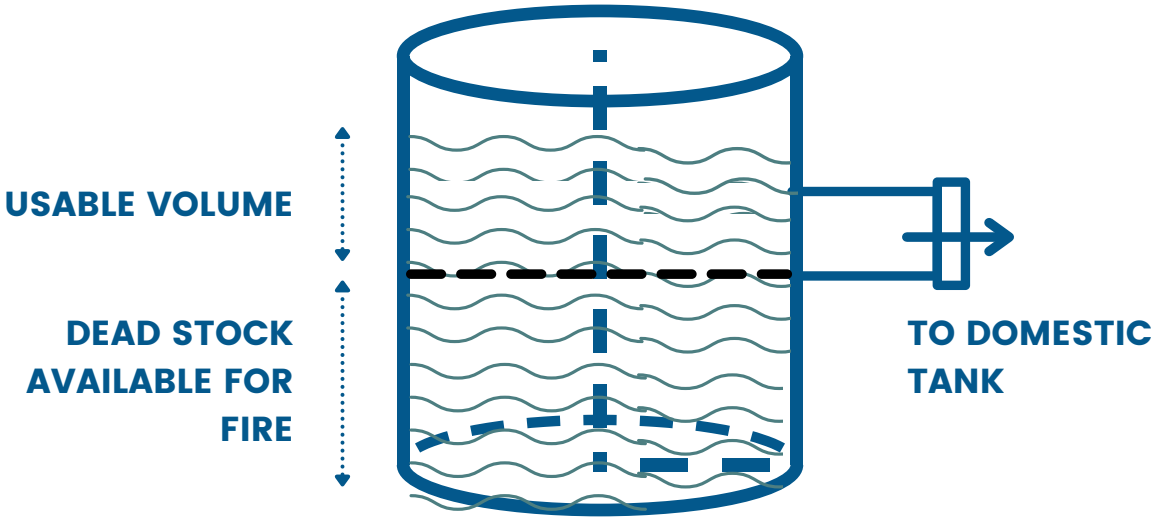
Let us take a look at these diagrams to understand better:

TOTAL VOLUME VS. USABLE VOLUME



TOTAL VOLUME = VOLUME OF FIRE TANK + DOMESTIC TANK
USABLE VOLUME = VOLUME OF DOMESTIC TANK ONLY

DEAD STOCK MAINTAINED FOR FIRE



Internal Partitions

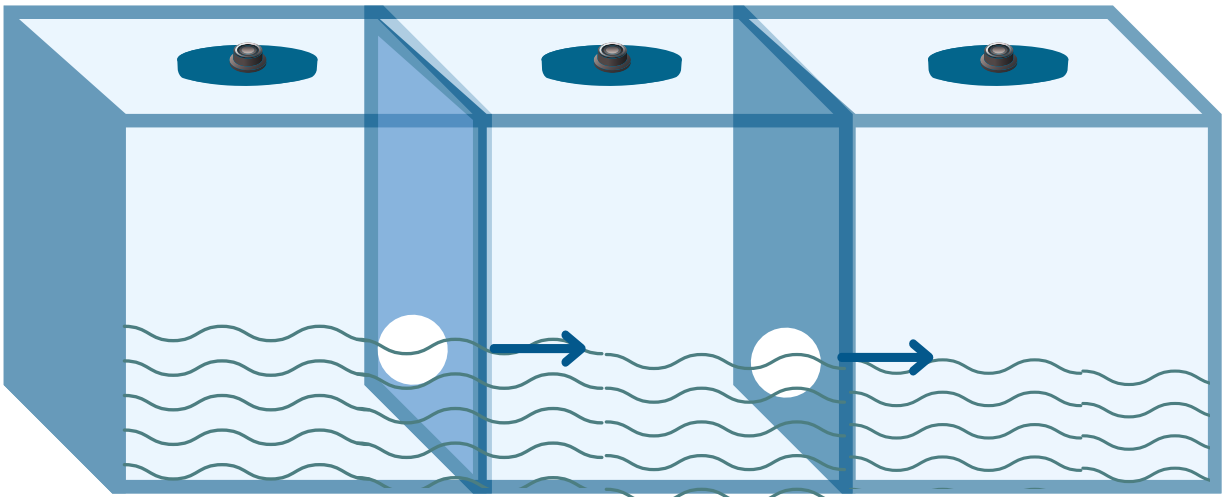
Generally residential projects are constructed such that one or two underground tanks store and supply water to multiple overhead tanks of multiple buildings. Hence the underground tanks are huge with large capacity. **Instead of having individual walls for tanks, the tanks are built with separate interconnected partitions.**

This makes it possible to store water from different sources in different compartments (for e.g., drinking water from the corporation can be stored in a separate compartment while domestic water from tankers, bore etc can be stored separately).

At the same time, the tanks are connected from within via pipes or valves between the partitions. This way, **excess water** from one section can be emptied into the other section.
For e.g. excess drinking water can be let into the domestic tank.

One advantage of this type of construction is that one water level indicator or sensor system can be used for all the tanks.
In such cases, it is difficult to take measurements from outside. It's best if one can receive a construction diagram from the builder.

TANKS CONNECTED WITH INTERNAL PARTITIONS

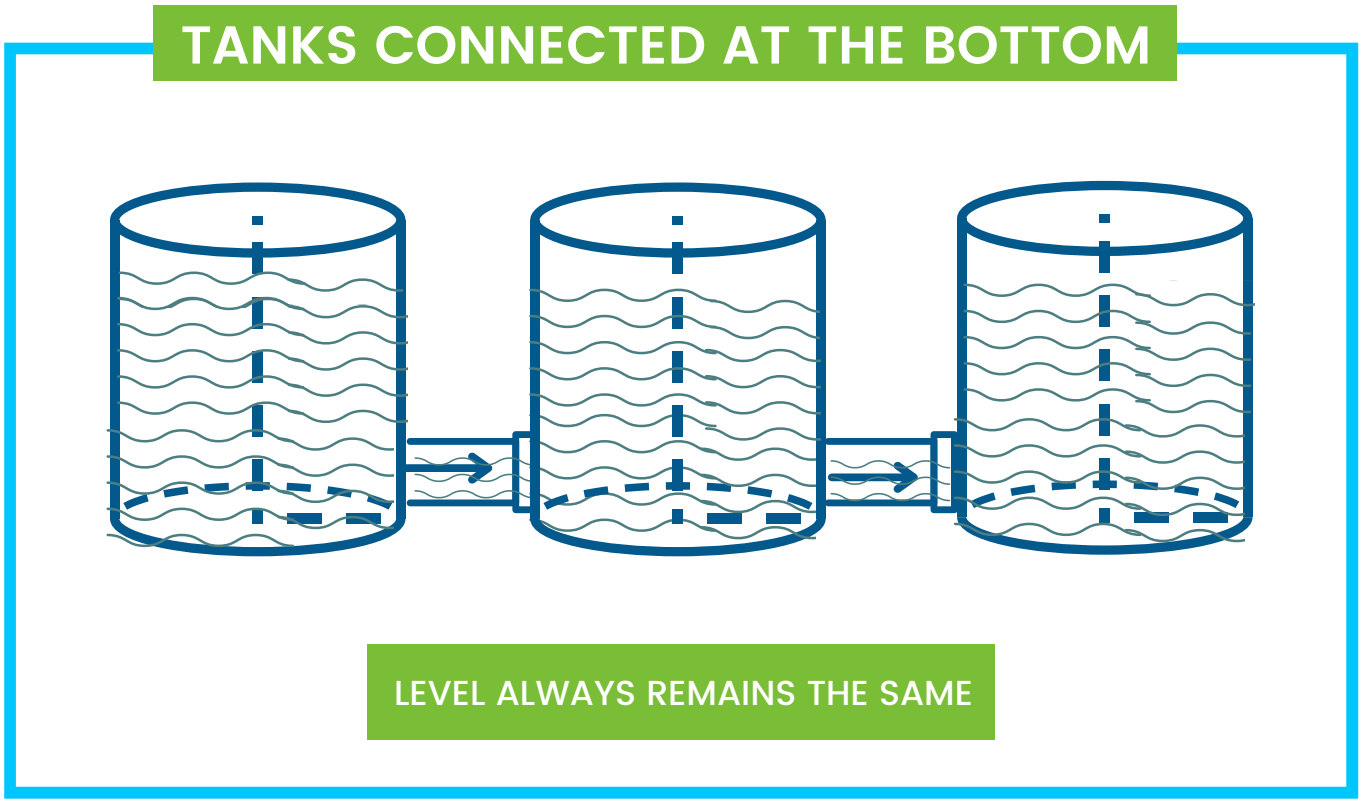


TOTAL VOLUME = VOLUME OF PARTITION 1 + PARTITION 2 + PARTITION 3

Connected Tanks

As explained, there are many advantages to connecting tanks together.

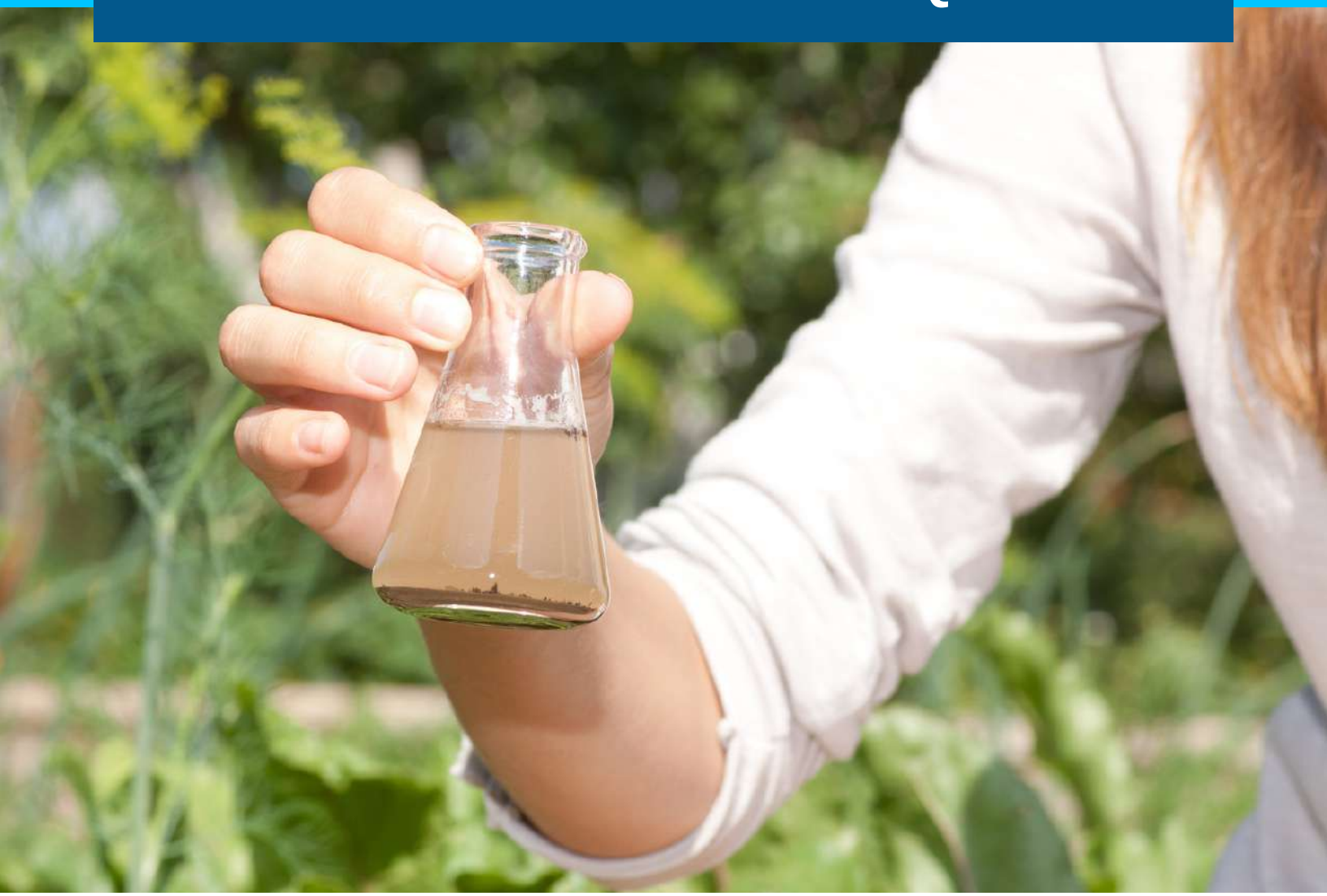
- Overflow of one tank can be let into the other tank instead of water going waste.
- If the tanks are connected at the bottom, the level of all tanks would be the same and one water level indicator is sufficient for multiple tanks.
- When tanks are connected in smart ways; it is possible to reserve a portion of the water for fire emergencies and yet have enough water available for domestic use.



We see that water volume measurement is not as simple as multiplying length, breadth and height. Before finding the volume, one must first understand the connections and interconnections within the tanks.

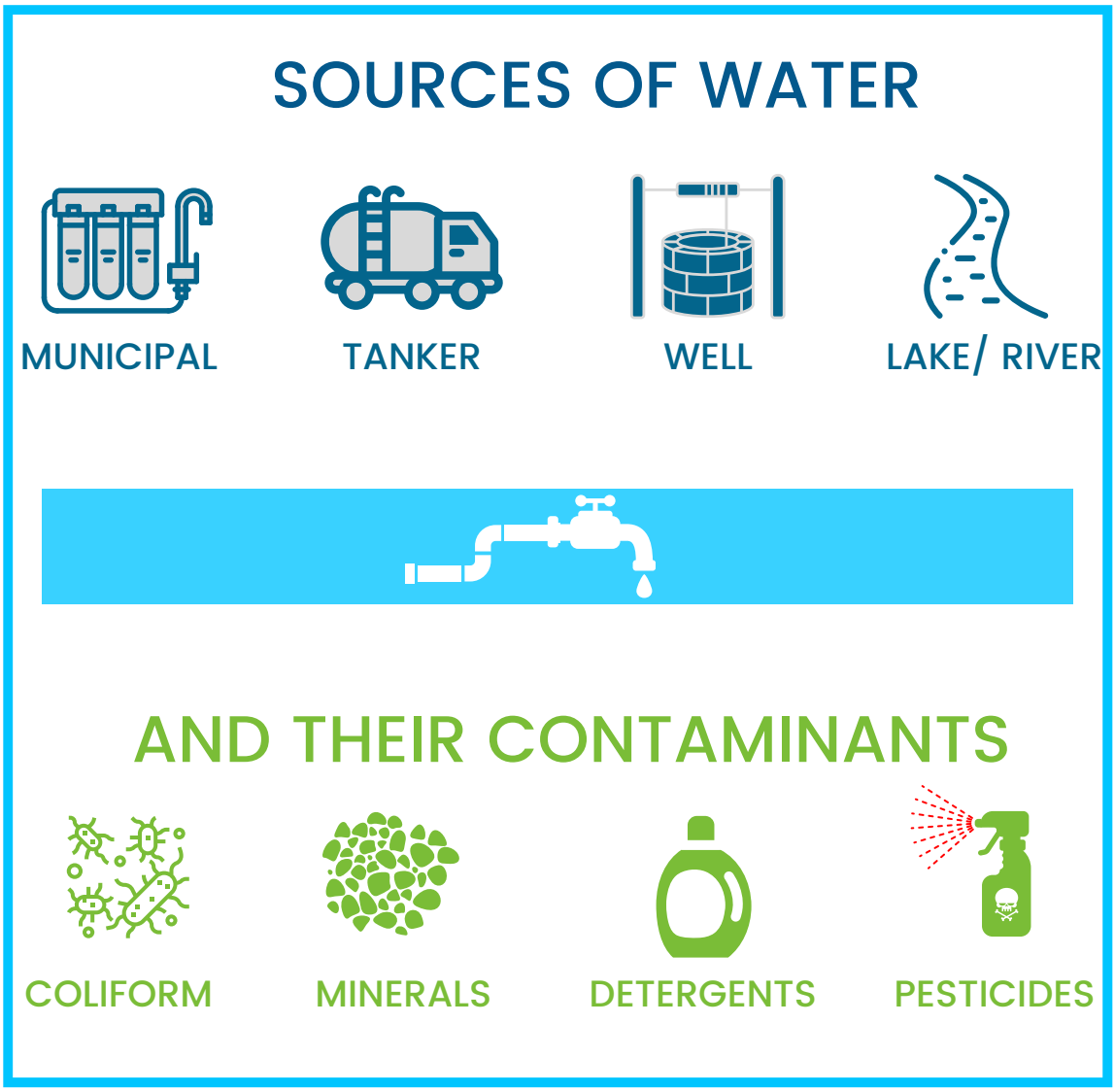
In the next chapter, we will go deeper into the quality of water stored in these tanks, both, overhead and underground tanks.

UNDERSTANDING WATER QUALITY



WATER QUALITY AFFECTS LIFE QUALITY

Water comes from multiple sources. Its quality varies depending on the source of water and the treatment it receives. Typically, in the Indian metro cities, water supplied by the local municipal corporation is considered to be safe for drinking, cooking, bathing and washing. It goes through a thorough **filtration**, **treatment** and **chlorination** process before it reaches our doorstep.

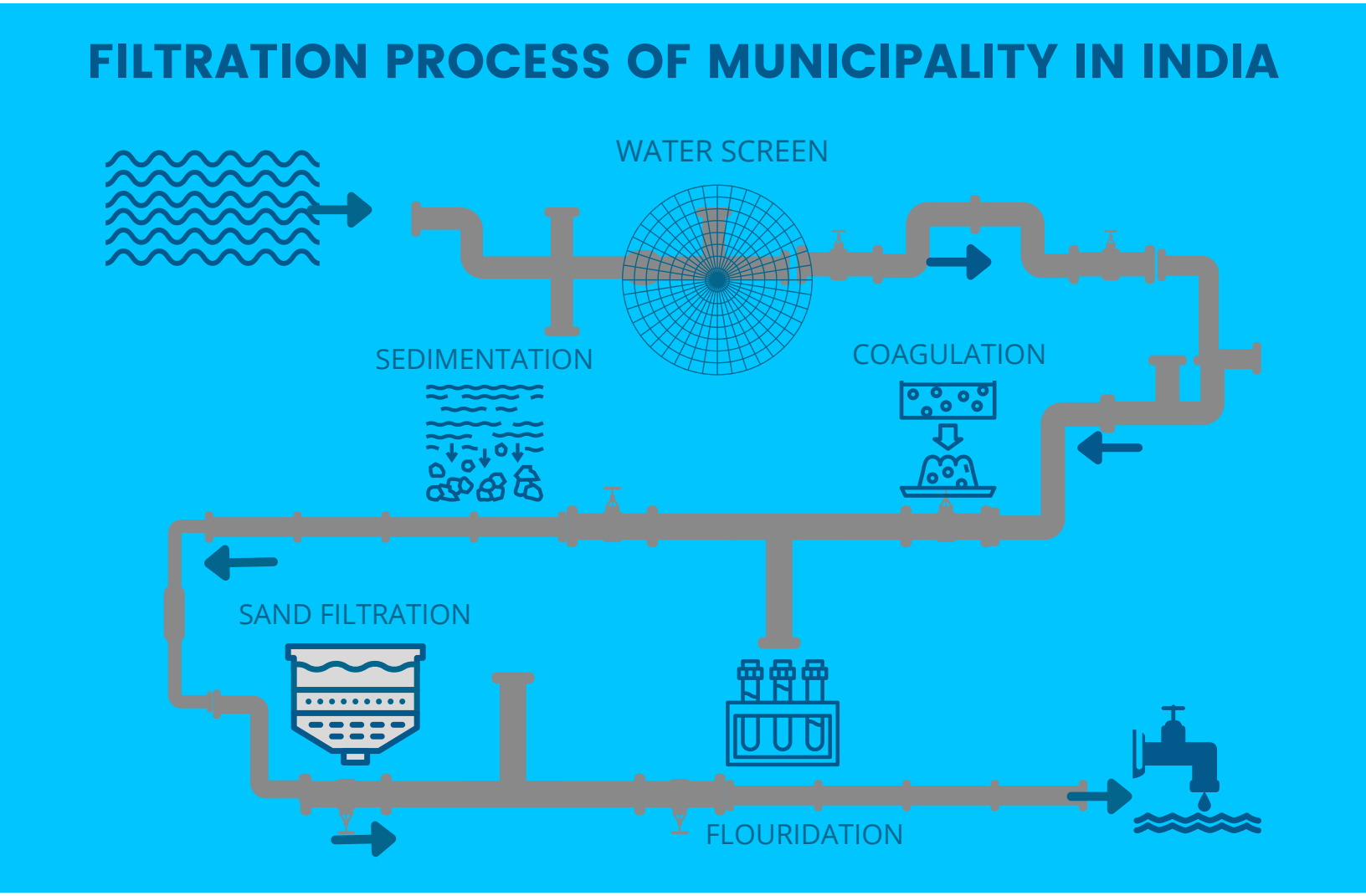


Beyond this, most urban households use a water filter to filter the incoming water so that it is safe for drinking. However, for the purposes of bathing and washing, municipality supplied tap water is considered quite safe.

Sometimes, in those areas where the municipality supplied water is limited, the residents use it for drinking purposes only. They have to depend on bore water or tanker water for domestic use. In such cases, **water quality is not known**. Some of the well-to do residents/ housing societies have even installed water treatment plants on their site to treat this water.

What is "Safe Water"?

There is very little awareness or testing for water quality and most people are unaware if the water they use for drinking, cooking, bathing etc. is safe or not.



Typically, the residential sector is familiar with equipment such as water level sensors or controllers or water meters. These instruments help to measure the volume and level of water, however water quality instrumentation such as TDS meters or pH meters has not yet made inroads into the residential segment.

The parameters of what can be termed as “Safe Water” depend on how that water is going to be used.

For e.g. water that is used for drinking/ cooking needs to be absolutely devoid of bacteria and other microorganisms whereas water used for gardening needs to have a certain quantity of dissolved salts and minerals for best results.

Acceptable Water Criteria

In India, the Central Pollution Control Board (CPCB) has developed the concept of designated best use of water and the quality parameters permissible for that use. Five broad classes of water and their acceptable water quality parameters have been defined

BEST USE CLASSIFICATION OF WATER

As per Central Pollution Control Board , India

CLASS A

DRINKING 1

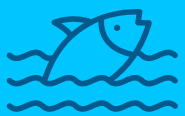
CLASS B

BATHING

CLASS C

DRINKING 2

CLASS D



WILDLIFE & FISHERIES

CLASS E

IRRIGATION, INDUSTRY

CPCB: WATER QUALITY CRITERIA

CLASS	DESIGNATED BEST USE	CRITERIA
A	Drinking Water Source without conventional treatment but after disinfection	• Total Coliforms Organism MPN/100ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand 5 days 20 °C, 2mg/l or less
B	Outdoor Bathing (Organized)	• Total Coliforms Organism MPN/100ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/l or more • Biochemical Oxygen Demand 5 days 20 °C, 3mg/l or less

CPCB: WATER QUALITY CRITERIA (CONTD.)

CLASS	DESIGNATED BEST USE	CRITERIA
C	Drinking Water Source after conventional treatment and disinfection	• Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 and 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20 °C, 3mg/l or lesss 20 °C, 2mg/l or less
D	Propagation of Wildlife and Fisheries	• Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 and 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20 °C, 3mg/l or less

CPCB: WATER QUALITY CRITERIA (CONTD.)

CLASS	DESIGNATED BEST USE	CRITERIA
E	Irrigation, Industrial Cooling, Controlled Waste disposal	• 1. pH between 6.0 and 8.5 • 2. Electrical Conductivity at 25 °C micro mhos/cm, maximum 2250 • 3. Sodium absorption Ratio Max. 26 • 4. Boron Max. 2mg/l
	Below E	• Not meeting any of the above criteria

More info can be found here

Further guidelines are available from the Indian Bureau of Standards for finer evaluation of water quality. For e.g., IS 10500 (2012) describes the Indian Standard specification for drinking water.

It contains descriptions of characteristics such as acceptable color, odor, taste, pH value and turbidity of water. It specifies the substances that are undesirable in excessive amounts, toxic and radioactive substances and also sets permissible limits for pesticide residues and microbial load.

The six main indicators of water quality are: **dissolved oxygen, turbidity, bioindicators, nitrates, pH scale, and water temperature.**

pH is a measure of how acidic/basic water is.
The range goes from 0 to 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. The pH of water is a very important measurement concerning water quality.

Bioindicators specify the permissible number of organisms such as coliforms and bacteria that are present in 100 ml of the water.
For e.g., for class A type of water Total Coliforms Organism MPN/100ml shall be 50 or less while for class B type of water Total Coliforms Organism MPN/100ml shall be 500 or less. MPN is the most probable number.

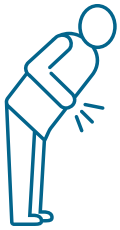
Effects of Sub Par Water Quality

People are becoming more aware of the importance of measuring water quality. We are seeing commercials of home water purifiers and similar equipment that tout their water as being bacteria free and pure.

The ill effects of consuming water that is of dubious quality are known to all. The effects can range from anywhere from **having a stomach infection to organ failure.**

The effects of prolonged exposure to high amounts of toxic substances can be serious and life threatening. If you are not sure of the source of your drinking water, it's best to get it tested regularly

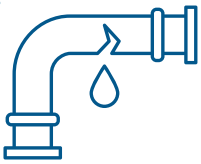
DANGERS OF BAD WATER QUALITY

1. 

SICKNESS

2. 

ORGAN FAILURE

3. 

PIPE DAMAGE

4. 

SCALING

5. 

FAUCET DAMAGE

6. 

DRY SKIN

7. 

WHITE STAINS

8. 

HAIR FALL

Hard water also causes a lot of damage to our skin and hair. Many people suffer from conditions such as **dry skin and hair fall** caused due to excessive hard water.

In addition, hard water causes **damage to plumbing** equipment such as pipes, faucets and taps. It leaves **white stains** on tiles and flooring.

As water becomes more scarce, we may have to accept water coming from all available sources. In such situations, it is important to be fully aware of the quality of water we are using.

Ways to maintain Water Quality

Here are some basic things that housing societies/ residences can do to ensure they are using good quality water:

- If you are not sure of the source of your water, you should get water quality analysis done from a reputed lab **every 6 months** for drinking water.
- In addition to installing water management equipment such as water level indicator and controllers, you can also install a **TDS sensor** so you know the quality of water you are using.
- Get a home water filter/ purifier unit for drinking water. If that is not possible, the traditional method of boiling water can be utilized.
- Make provisions to store drinking and domestic water in **separate tanks.**
- Maintain a regular tank cleaning schedule. If drinking and domestic tanks are separate, it reduces inconvenience.
- You can choose to invest in an RO unit if you feel the need to do so. Pls note that **RO units need regular maintenance** and also result in water wastage owing to the backwash.
- You can also opt for other eco-friendly water softening options such as an electronic anti scale system.

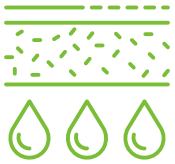
WAYS TO MAINTAIN WATER QUALITY

1

WATER QUALITY ANALYSIS

Get quality analysis done from a reputed lab every 6 months. Install TDS meter.

2



FILTER DRINKING WATER

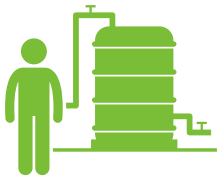
Getting a home filter/purifier or boiling your drinking water is important.

3

SEPARATE WATER TANKS

Make provisions to store drinking and domestic water in separate tanks.

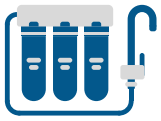
4



REGULAR TANK CLEANING

Maintain a regular tank cleaning schedule.

5



SOFTENER

Invest in RO or an Electronic Anti-Scale System and maintain it

Water quality is a science inside of itself. In this chapter we have just covered some basic points that everyone needs to be aware of in their everyday life.

In the **next** chapter we will take a look at the water tanker market – how it works and how it can be improved.

WATER TANKER ECO SYSTEM

UNREGULATED MARKET

“Within minutes his boss arrived on the site and threatened everyone with dire consequences if we went ahead with the new system!”

We were doing a trial run of our new digital flow meter equipment on our customers’ premises.
Their monthly tanker spend goes up to Rs. 10 lakhs. They were planning to install equipment that can measure the volume of water actually delivered by each tanker.

As soon as the security guard connected the equipment to a tanker, the tanker operator immediately called his boss and we got the above frantic call from them. The customer, succumbed to the threats and chose not to go ahead with the system.

The current tanker water market in India, is a huge mess resulting in **price gorging and abuse to environment.**
There is a lot of scope to regularize this market so that everyone benefits; the customers, the tanker companies and most importantly, the environment.
Let us take a look at the issues plaguing the current water tanker market.

Issues with the Current System

1) No Volume Measurement

Typically, it is assumed that a typical water tanker is able to carry up to 10,000 liters of water.
In the residential sector, there is no standard practice of actually measuring the volume of water delivered by a tanker. Most housing societies simply assume that the tanker has delivered 10,000 liters of water and pay accordingly.
Some of the societies have devised innovative ways of water tanker volume measurement such as suspending a rope or climbing atop a height and opening the lid of the tanker to check if it is full.
However innovative, these are **rudimentary ways** and accurate volume measurement is not possible.

Many times we see that the lid of the tanker is not closed properly or the valves are leaking and the **tanker is spilling water all along** the road.
This is pure wastage of water and can be easily prevented.
However, since no one measures the volume of water received and the supplier receives a fixed amount per delivery **there is very incentive for the supplier to stop the wastage.**

WATER TANKER ECOSYSTEM

Rudimentary Ways of Volume Measurement

Security guard checking if a water tanker is full before taking delivery

2) Unregulated Mafia

In a country like India where the groundwater extraction is not properly regulated, tanker companies are owned by the local landlords. As cities are getting urbanized, farmlands are getting transformed into housing complexes for IT workers.

The local municipalities are not able to expand their infrastructure at a similar pace and not able to meet the water demands of these high-rise complexes. Hence housing societies have to call in water tankers from the local areas. An entire industry has developed around this.

Local land owners who are politically connected have drilled **borewells in their ancestral lands** and are extracting groundwater and selling it to those who want it via their tanker companies.

In the summer months, the demand for water tankers is very high and supply is low. So, the tanker owners start dictating the prices and their territories which results in a very mafia like situation where the housing society does not have much choice left in terms of whom they can buy their water from and for how much.

3) Unstructured Market

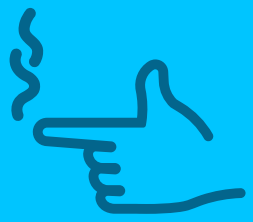
Given the above-mentioned factors such as **local ownership of tanker companies, connections to politicians, heavy dependence on local availability** – it's not a surprise that this market is highly unstructured.

There is no regulation on the quality or volume of water delivered. In times of high demand, sometimes tankers arrive very late into the night or in the early mornings. Sometimes, they are on back order and need to be booked 2-3 days in advance.

WATER TANKER ECOSYSTEM

An Unstructured Market

MAFIA-ISQ WORLD

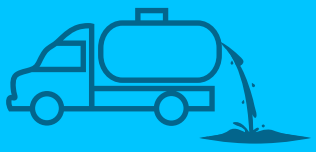


Consumers are forced to pay the rates dictated by the tanker companies

CLOSED SYSTEM

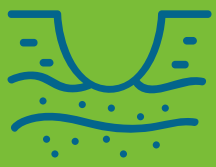
There is no visibility wrt other tanker companies and their availability

OLD EQUIPMENT



There is no incentive for tanker companies to upgrade leaky equipment

GROUNDWATER EXPLOITATION



Lack of tracking causes companies to over extract groundwater

This is highly unstructured, unregulated market which results in lots of inefficiencies for multiple parties:

- Residential communities are forced to accept the tanker mafia vendor of their area. Thus, they have to accept the quality, rate, volume and timings of water delivery **dictated** by him.
- In times of low supply, there is **no central platform** or visibility to check tanker availability
- As there is no regulation of water quality the tanker companies are using old, crude equipment with no incentive to upgrade

- Groundwater is getting increasingly **depleted**, resulting in disastrous consequences for the entire region

Clearly, there is a need for regularization and standardization in the water tanker eco system. This kind of system would benefit everyone.

Features and Benefits of a Digital Water Tanker System

1) Regular Volume Measurement with IoT devices

Equipment such as water meters and flow meters make it very convenient to measure the volume of water received from a tanker.

IoT technology enables the customer to see the reading in **real time**, before the tanker leaves the premises; so that the tanker operator can be paid accordingly.

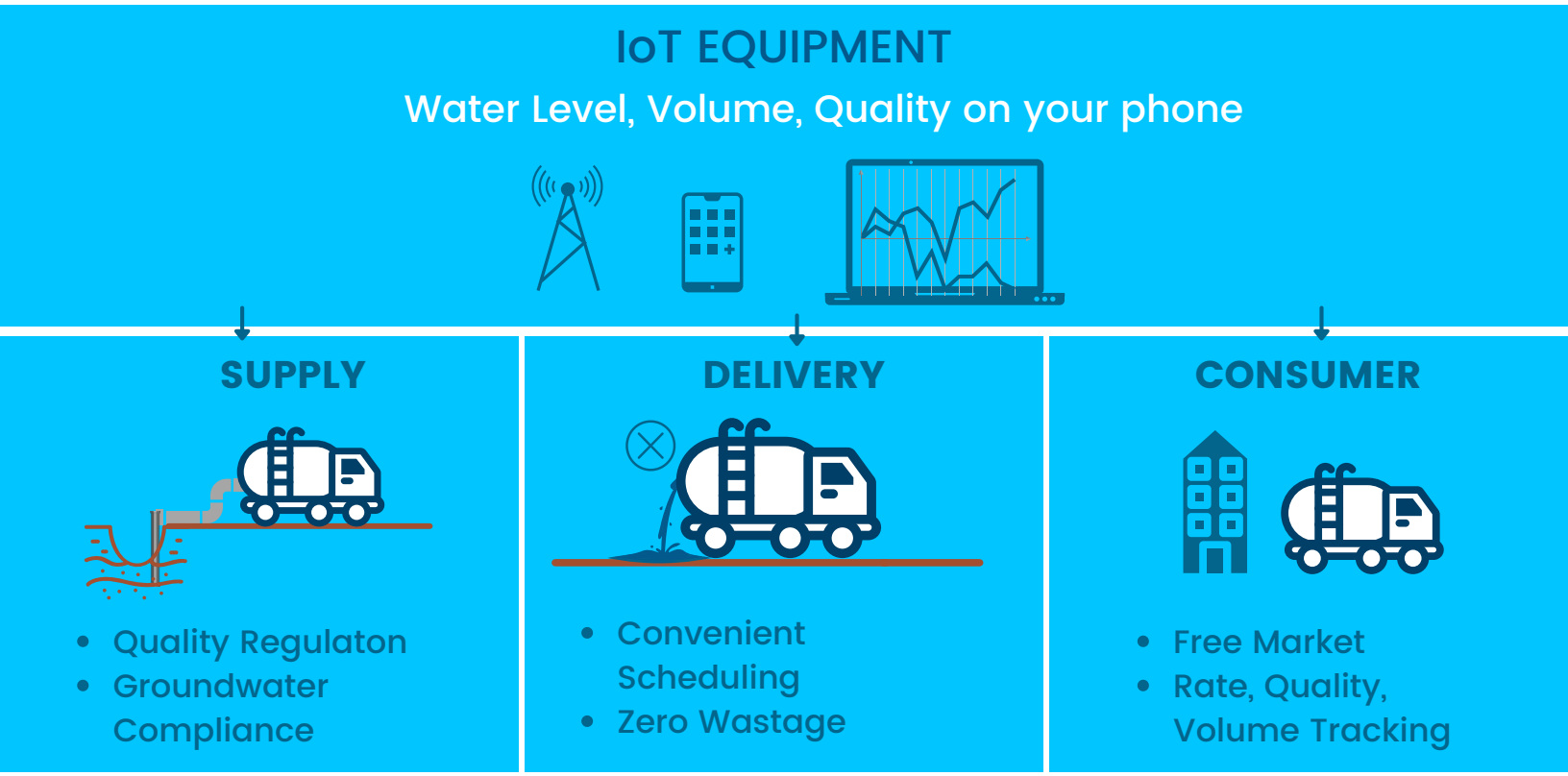
Since the readings are digitized and stored, housing societies can run **daily/ monthly reports** to get visibility into their tanker spend

Another benefit of measuring water received from a tanker would be that tanker owners would become **sensitive to the water that gets spilled on the road** during delivery.

Since they are getting paid based on the actual volume of water supplied, they will ensure that the tanker lids are shut and leaky valves are repaired so that no wastage occurs during delivery.

DIGITAL PLATFORM FOR THE WATER TANKER ECOSYSTEM

BENEFITS FOR ALL



2) Centralized Platform for Tanker Ordering

A centralized platform for tanker ordering and visibility can create multiple benefits for all parties involved including suppliers and consumers both.

Tanker companies can serve customers beyond their immediate areas and customers would have a range of tanker companies to order from – thus cutting out on mafia.

If water quality, volume, delivery time stats are maintained it helps to make the ecosystem professional and everyone benefits from regularized pricing and quality.

A formal system of recording orders and deliveries helps to create convenient schedules and avoid emergencies such as searching for tankers at the last moment.

3) Prevent Over-Exploitation of Ground Water

Instrumentation such as DWLR or IoT Piezometer can help to record and keep a track of the volume of water extracted from the ground

Currently there is no system to track the amount of water that extracted from the ground and this is already creating trouble for the farmers as they are unable to find water for their crops.

In a few years, as the extraction and selling of groundwater continues unchecked this will have disastrous consequences for the entire economy.

Thus, we have gone over the flaws of the current water tanker market and also seen the benefits that can result from making small changes to the system. The instrumentation required for this is available in the market today. It needs to be put together into a coherent system.