



# Understand Your System

*Andrea Pain, seecon international gmbh*

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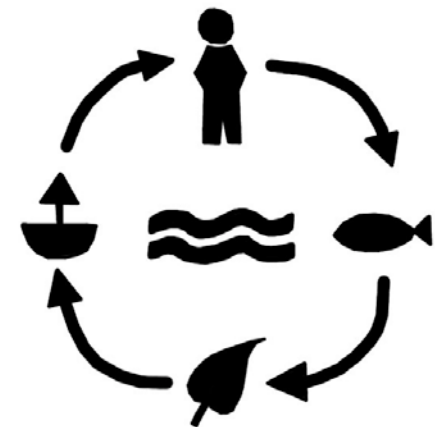
The contents of the SSWM Toolbox reflect the opinions of the respective authors and not necessarily the official opinion of the funding or supporting partner organisations.

Depending on the initial situations and respective local circumstances, there is no guarantee that single measures described in the toolbox will make the local water and sanitation system more sustainable. The main aim of the SSWM Toolbox is to be a reference tool to provide ideas for improving the local water and sanitation situation in a sustainable manner. Results depend largely on the respective situation and the implementation and combination of the measures described. An in-depth analysis of respective advantages and disadvantages and the suitability of the measure is necessary in every single case. We do not assume any responsibility for and make no warranty with respect to the results that may be obtained from the use of the information provided.



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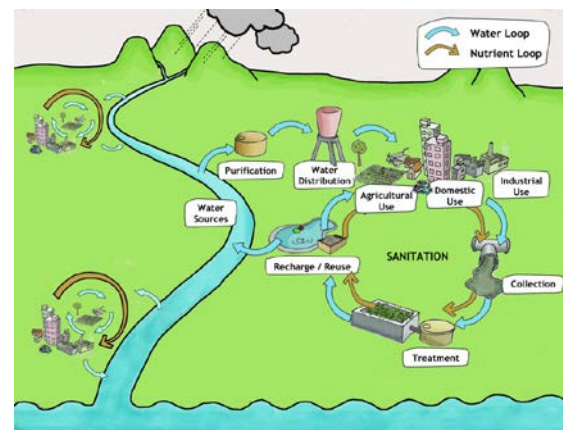
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# 1. Introduction

## What is “Understand Your System?”

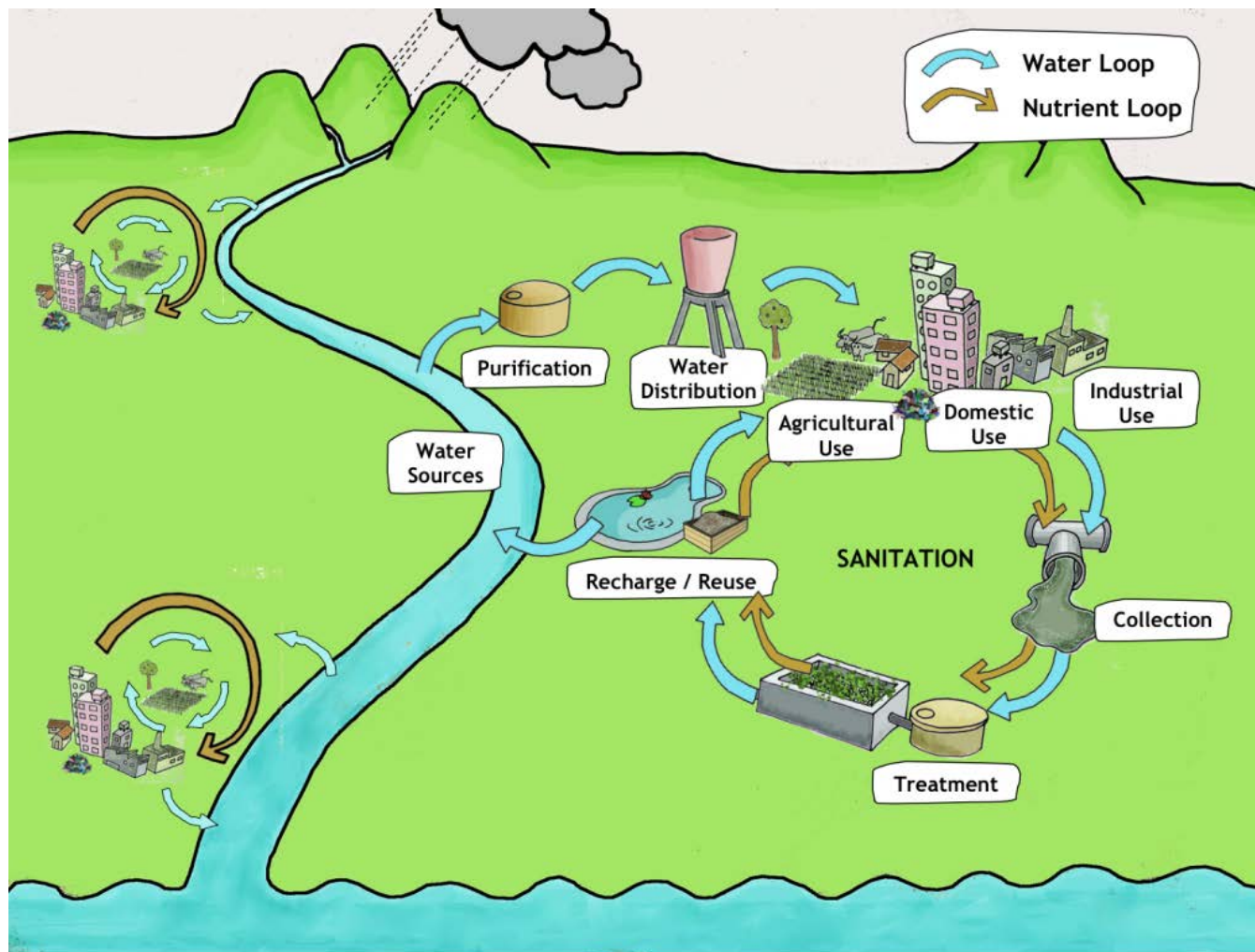
- Our goal: follow water and nutrient cycles in your system in order to:
  - Identify root causes of problems
  - See how problems may be linked
  - Gain an understanding of the interrelationship between **water, sanitation, and agriculture**
  - Identify potential areas of improvement and opportunities for synergy within water and nutrient cycles



Source: SEECON (2010)

# 1. Introduction

## Overview of “Understand Your System”



Source: SEECON (2010)

# 1. Introduction

## Unsustainableville: A Model System

As a practice, we will go through the steps of “Understand Your System” using a model where we will observe many of the problems that you may find in your own system

*Welcome to...  
Unsustainableville!*



Source: SECON (2010)

## 2. Outline of Your Area

### Defining System Boundaries

What is the basic outline of the area you are focused on?

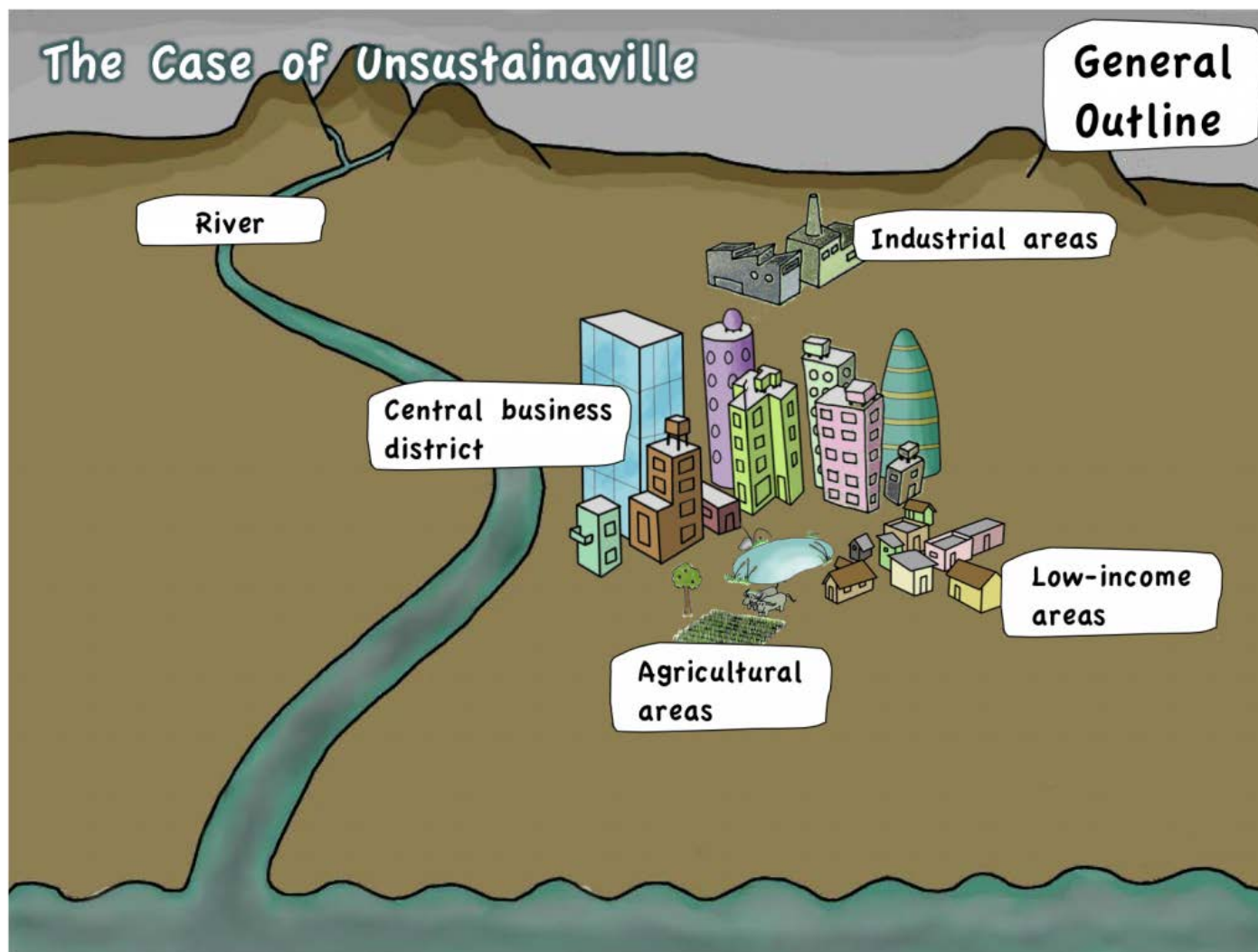
What are important geographical features?  
(lakes, rivers, mountains, towns, roads)

Are there any high- or low-income areas? Agricultural areas?  
Industrial areas? Residential areas?

To get started, draw a map identifying important features  
and areas

## 2. Outline of Your Area

### Defining System Boundaries

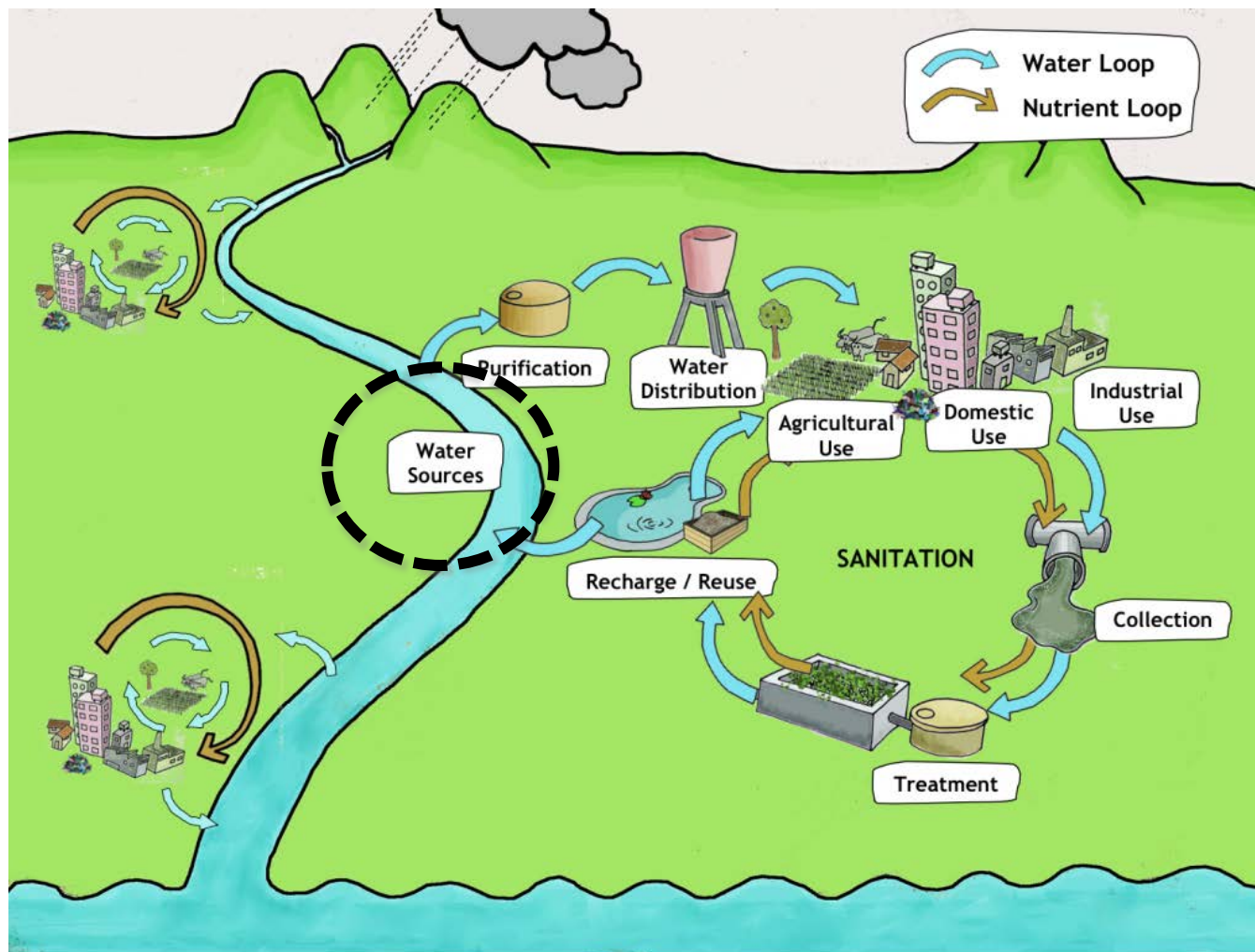


Source: SECON (2010)



### 3. Water Sources

## What are the Sources of Water?



Source: SEECON (2010)

## 3. Water Sources

### What are the Sources of Water?

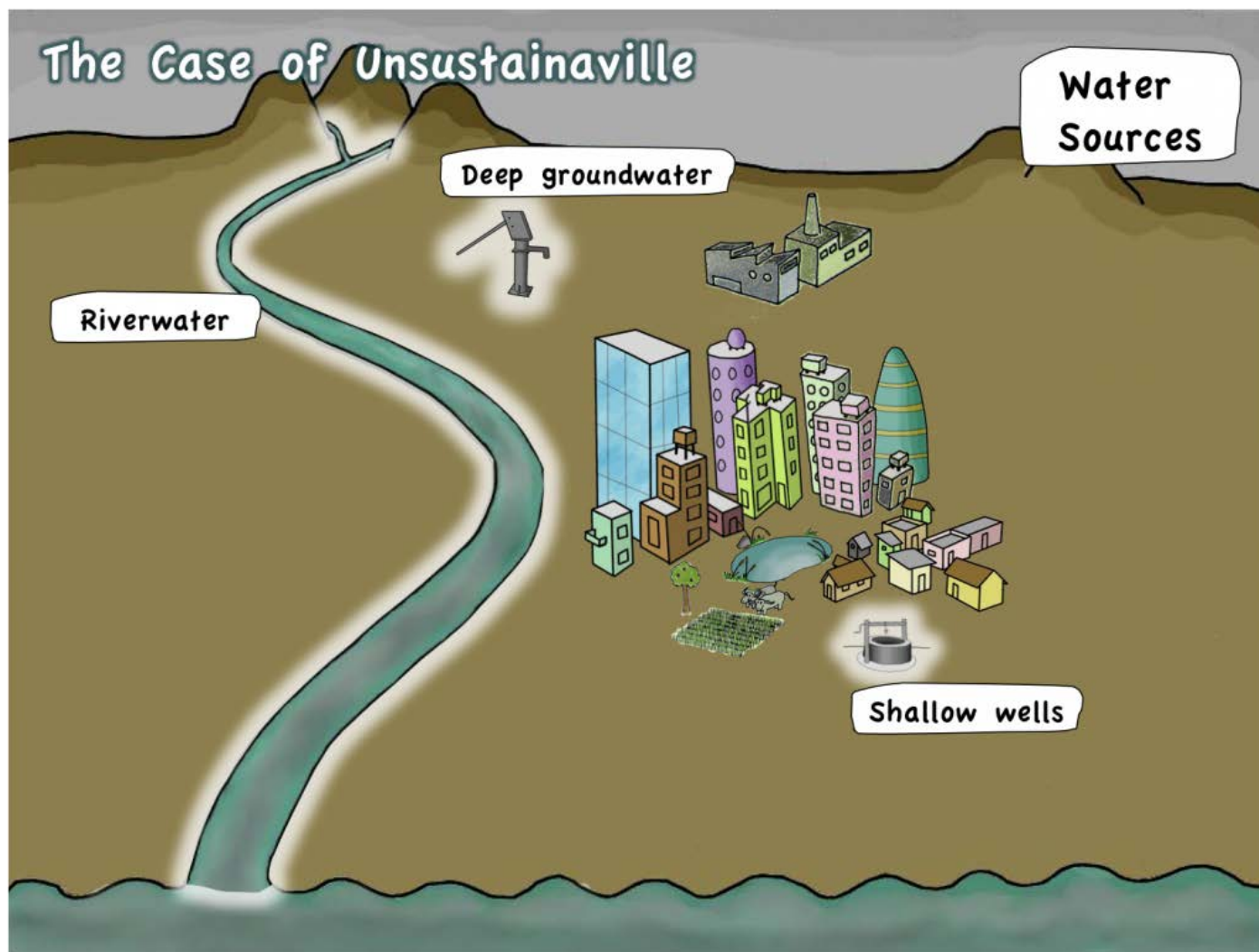
- What water sources are used?
  - Rainfall, surface water, ground water, wastewater?
- How is water collected?
  - Open dug well, bore well, rainwater harvesting? Individual collection or centralised water supply?
- Are there different sources of water for the different areas?

*Need help?*

Ask local stakeholders, governmental entity, or service providers responsible for water supply

## 3. Water Sources

### What are the Sources of Water?



Source: SEECON (2010)

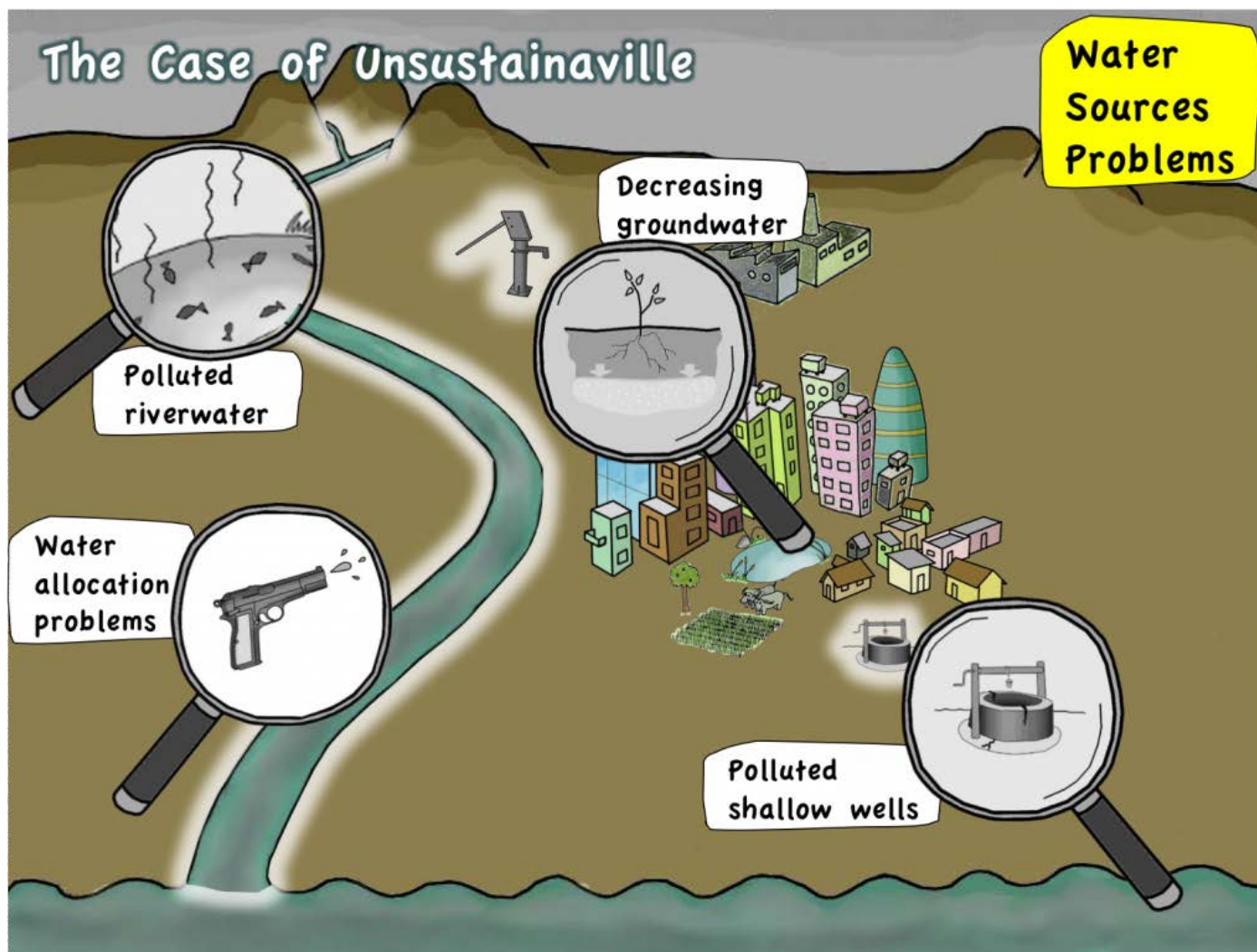
## 3. Water Sources

### What are the Sources of Water?

- Water sources **problems**: what should we look for?
  - **Is it sustainable?** Is there enough water for the community? Will there be enough in the future?
  - **Is it safe?** Are water sources polluted? Which ones? What are the major pollutants?
  - Is there **competition** for water resources (i.e. upstream vs. downstream communities, sectors within the community)?
- **Interlinkages** between water sources and other areas of the water and nutrient cycle:
  - What influences the quality of your water sources?
    - Examples: wastewater treatment, lack of wastewater treatment of the village upstream, water consumption of local industries or agriculture or households, etc.

### 3. Water Sources

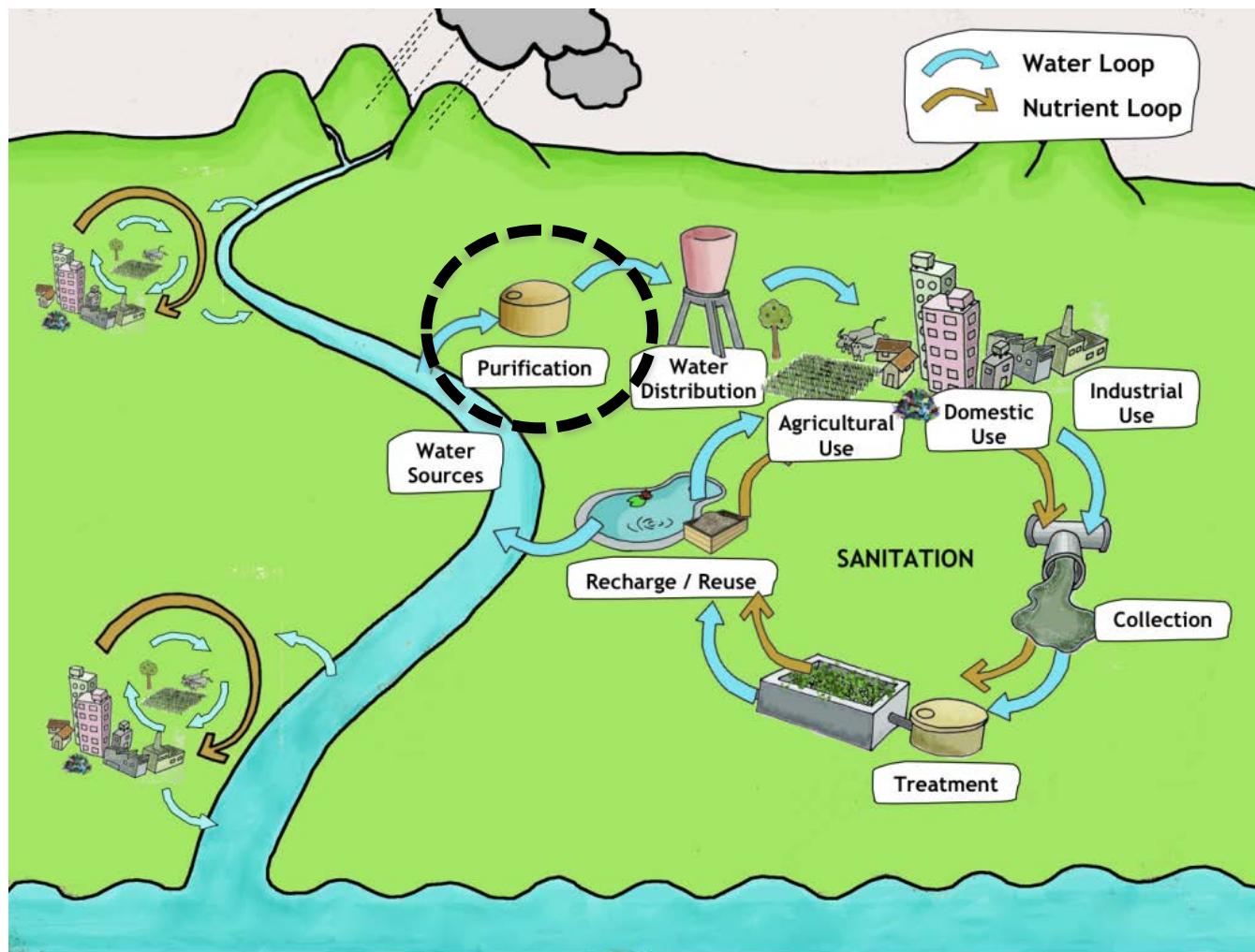
## What are the Sources of Water?



Source: SEECON (2010)

## 4. Purification

### How is Water Purified?



Source: SEECON (2010)

## 4. Purification

### How is Water Purified?

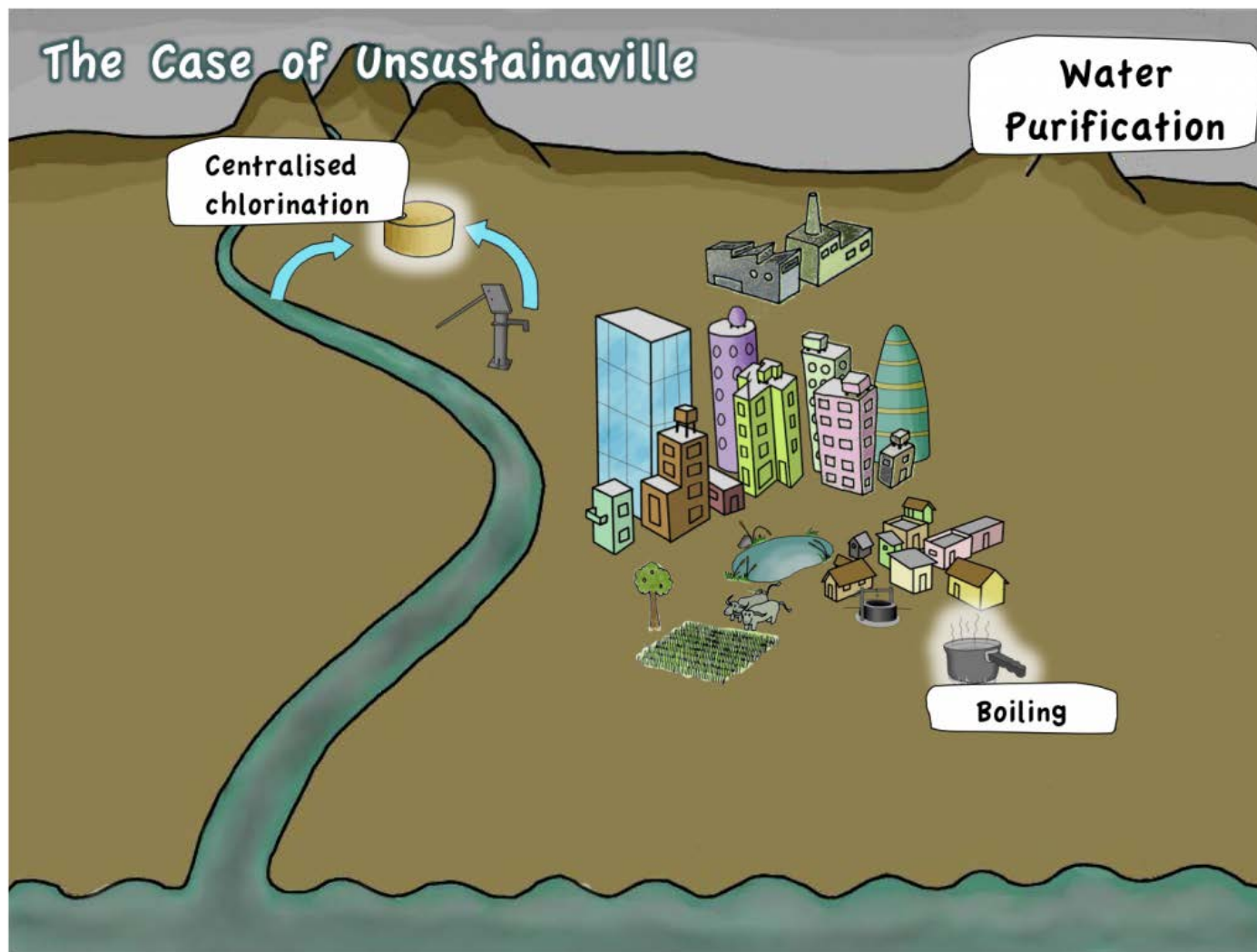
- Is the water in your area purified before being used for domestic, agricultural and/or industrial use?
- How is it being done? Household level, centralised, or both?
- Is the water quality sufficient for the respective purpose? If the water quality is not sufficient – what are the respective effects on agriculture, industry and domestic users?
- Can you identify sources of pollution? Which stakeholders are involved here?

*Need help?*

Sit with stakeholders (water suppliers and water users); conduct laboratory tests to determine water quality

## 4. Purification

### How is Water Purified?



Source: SEECON (2010)



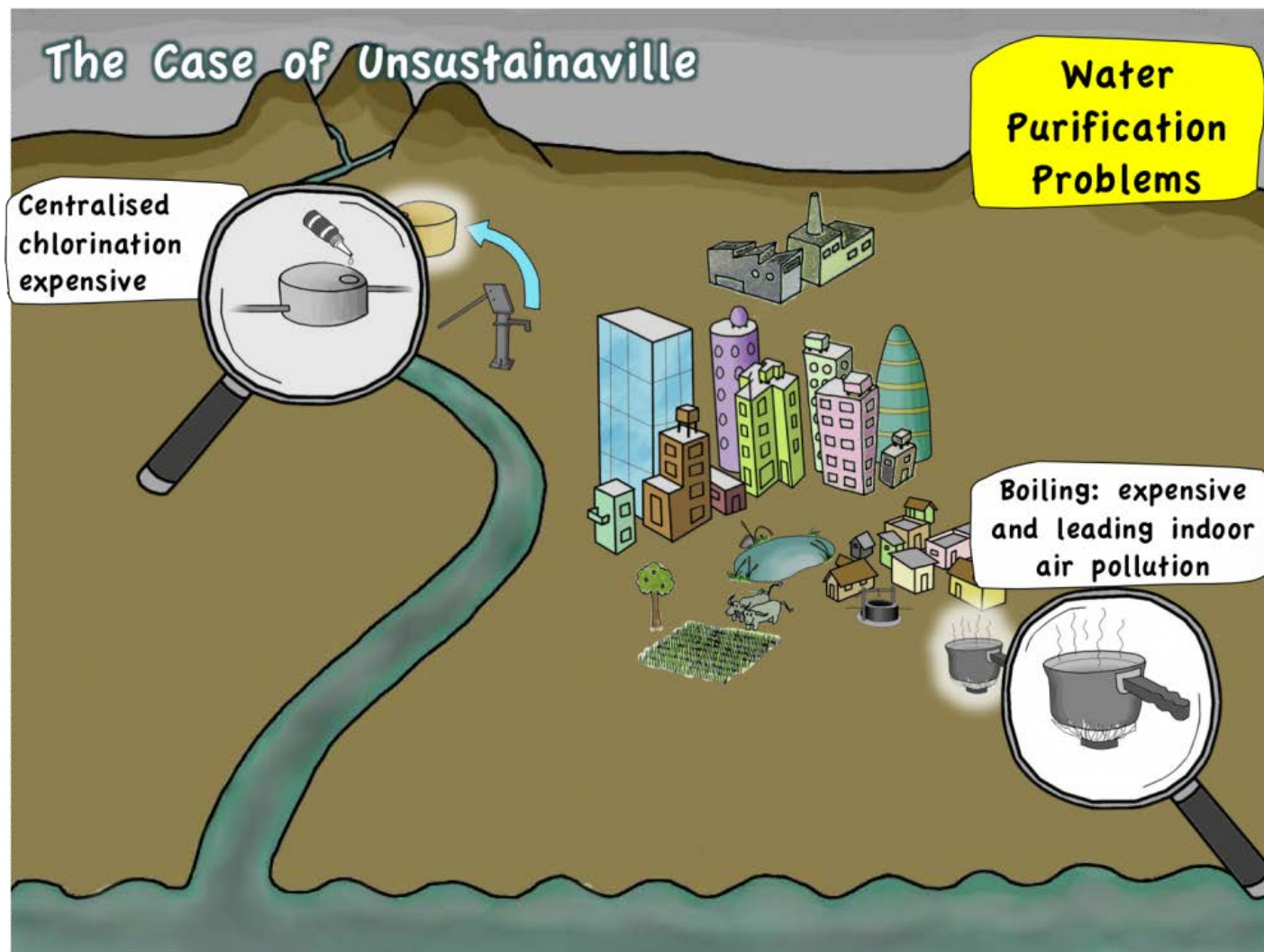
## 4. Purification

### How is Water Purified?

- Purification **problems**: what should we look for?
  - **Is it effective?** Does it address all relevant pollutants?
  - **Is it appropriate?** Is your method affordable? Are necessary resources readily available (e.g. money, expertise, equipment)?
  - **Is it sustainable?** Are there negative environmental impacts? Health impacts? Are people aware of these negative impacts? Is Operation and Maintenance ensured?
- **Interlinkages** between water purification and other areas of the water and nutrient cycle:
  - Pollution sources influence purification needs. Are there primarily organic pollutants (e.g. from agriculture and households)? Is turbidity an issue? Are there chemical pollutants? What are the sources of contamination?

## 4. Purification

### How is Water Purified?



Source: SEECON (2010)

## 5. Water Distribution

### How is Water Distributed?



Source: SEECON (2010)

## 5. Water Distribution

### How is Water Distributed?

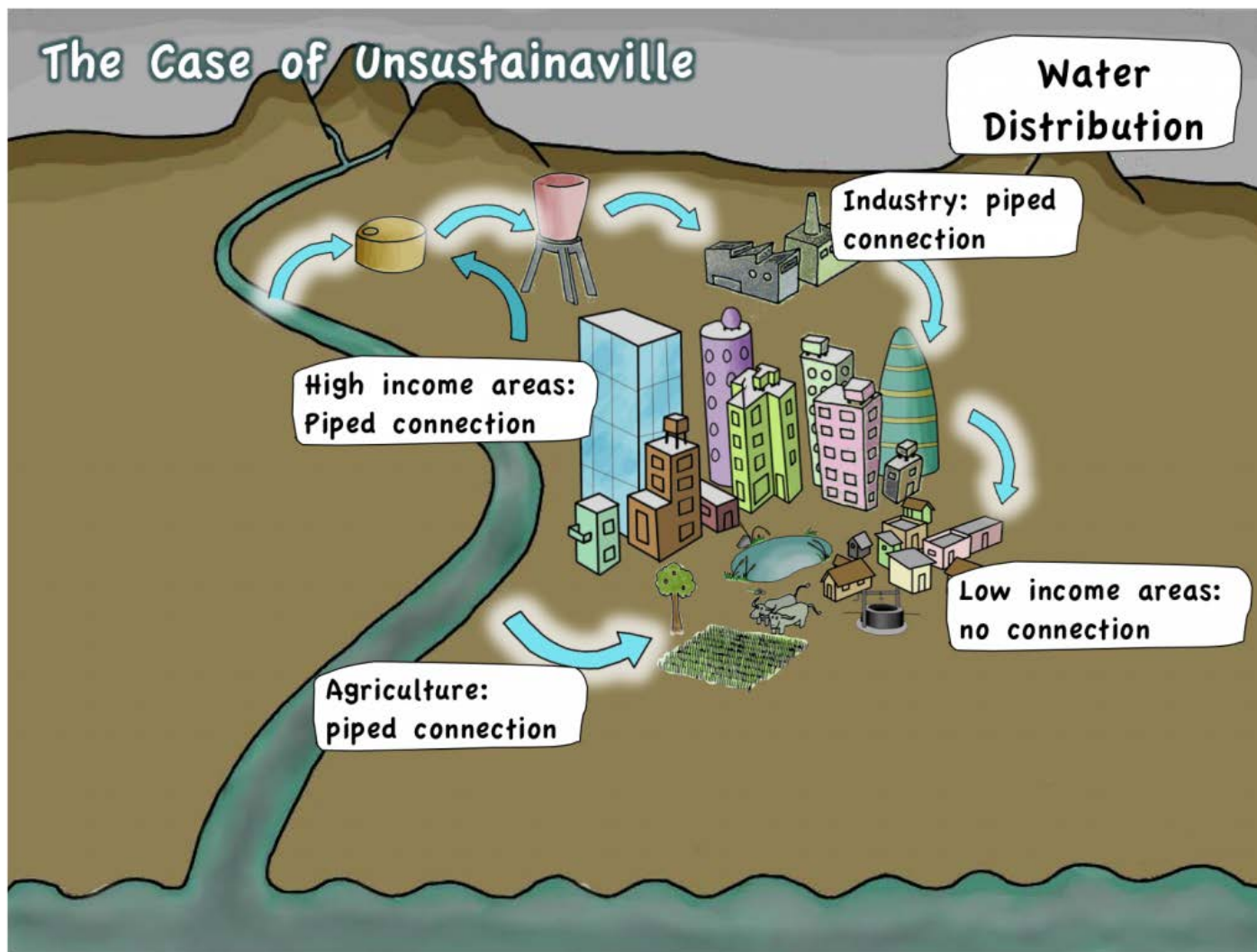
- How is the water distributed to the different users? Is it a centralised distribution system or individual collection, or a combination of the two?
- Are there problems with water distribution, i.e., water loss, illegal water tapping, pollution?

*Need help?*

Call up the local water provider or community-based associations and NGOs working with water

## 5. Water Distribution

### How is Water Distributed?



Source: SEECON (2010)

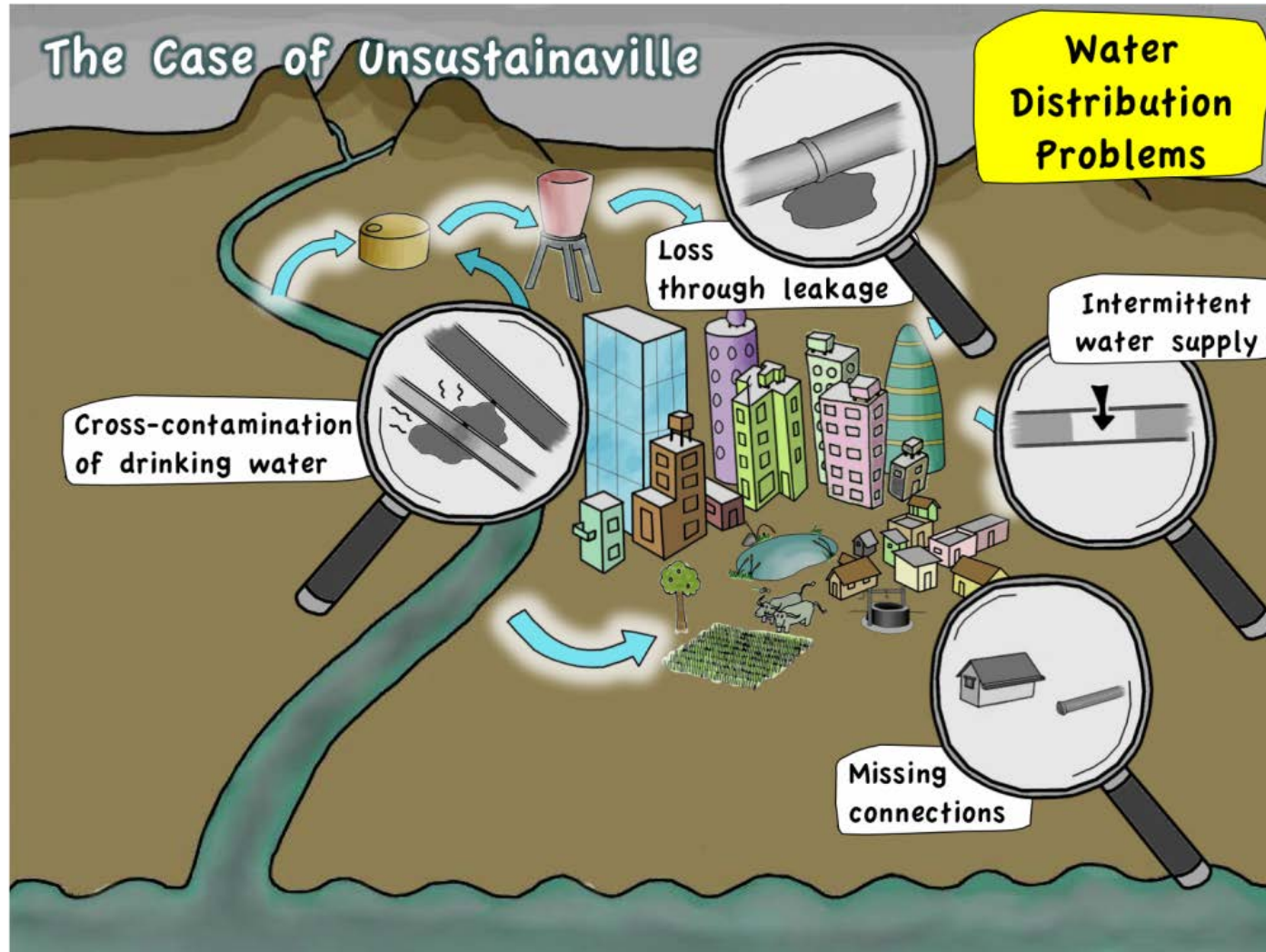
## 5. Water Distribution

### How is Water Distributed?

- Distribution **problems**: what should we look for?
  - **Is it effective?** Is there water loss in distribution system?
  - **Is it adequate?** Does it have adequate capacity for the population?
  - **Is it sustainable?** Are resources available over the long-term?
  - **How does water pricing work?**
- **Interlinkages** between water distribution and other areas of the water and nutrient cycle:
  - Distribution depends on water collection (household vs. centralised) and availability
  - Quality of distribution system may influence purification (i.e. is there contamination in distribution system?)

## 5. Water Distribution

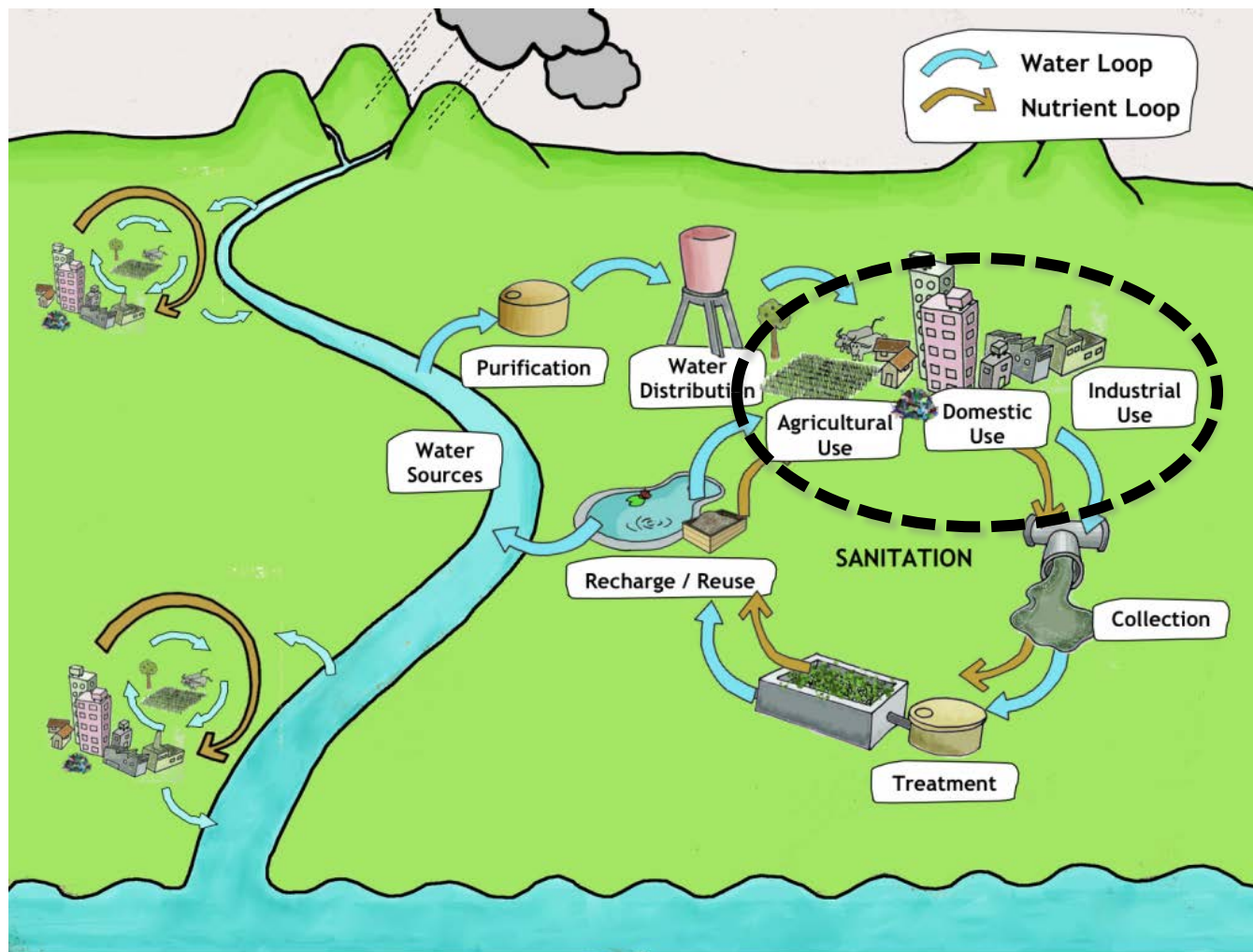
### How is Water Distributed?



Source: SEECON (2010)

## 6. Water Use

### How is Water Used?



Source: SEECON (2010)



## 6. Water Use

### How is Water Used?

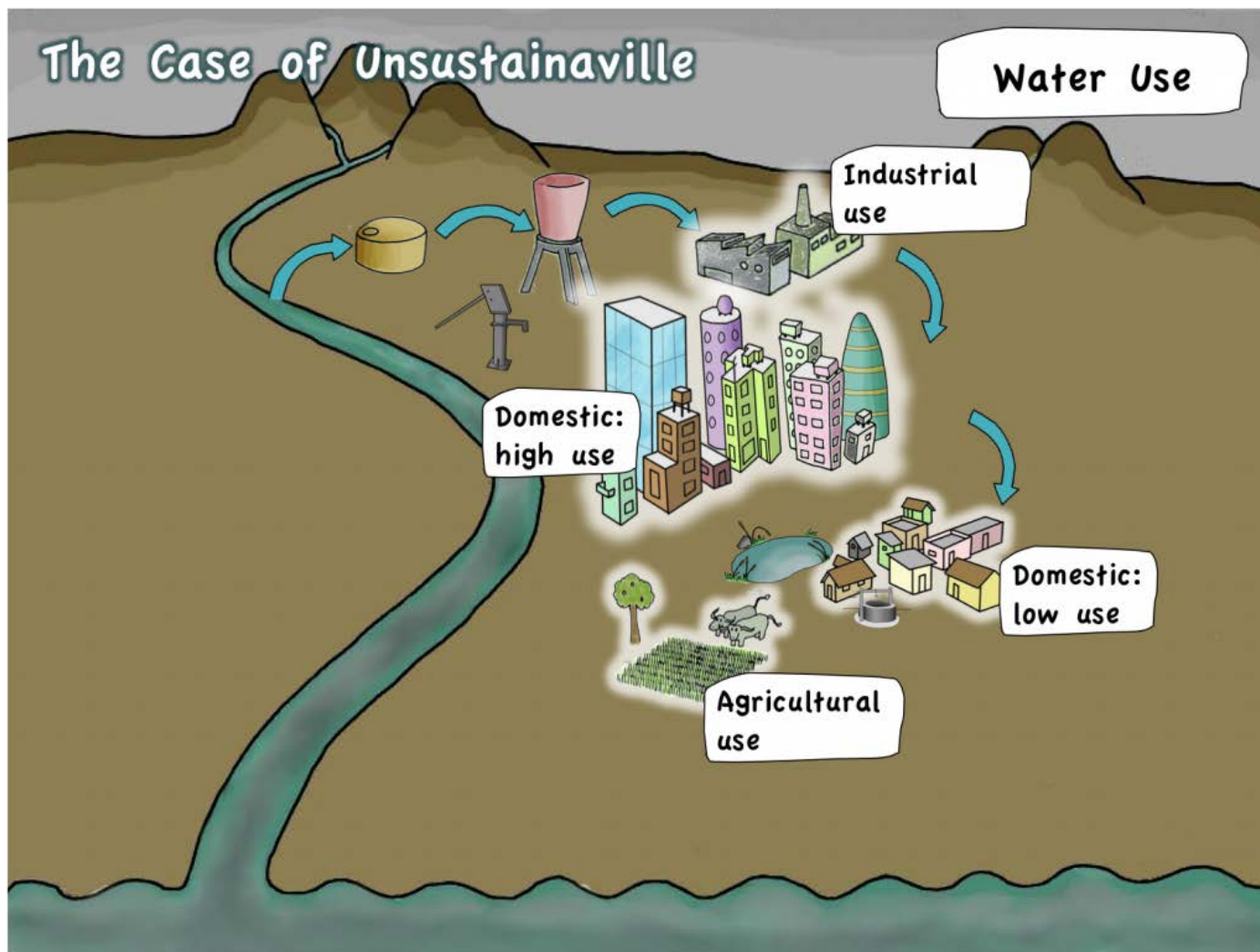
- Who are the main water users?
  - Households, agriculture, industry, etc.?
- For which purposes is water used in your area?
  - Consider purposes such as tourism, electricity generation, fishery, transport, etc.
- How much water is used? For what purpose?

#### *Need help?*

You may find information and statistical figures from the local statistical bureau, or from the different stakeholders (industrial or agricultural associations) themselves

## 6. Water Use

### How is Water Used?



Source: SEECON (2010)

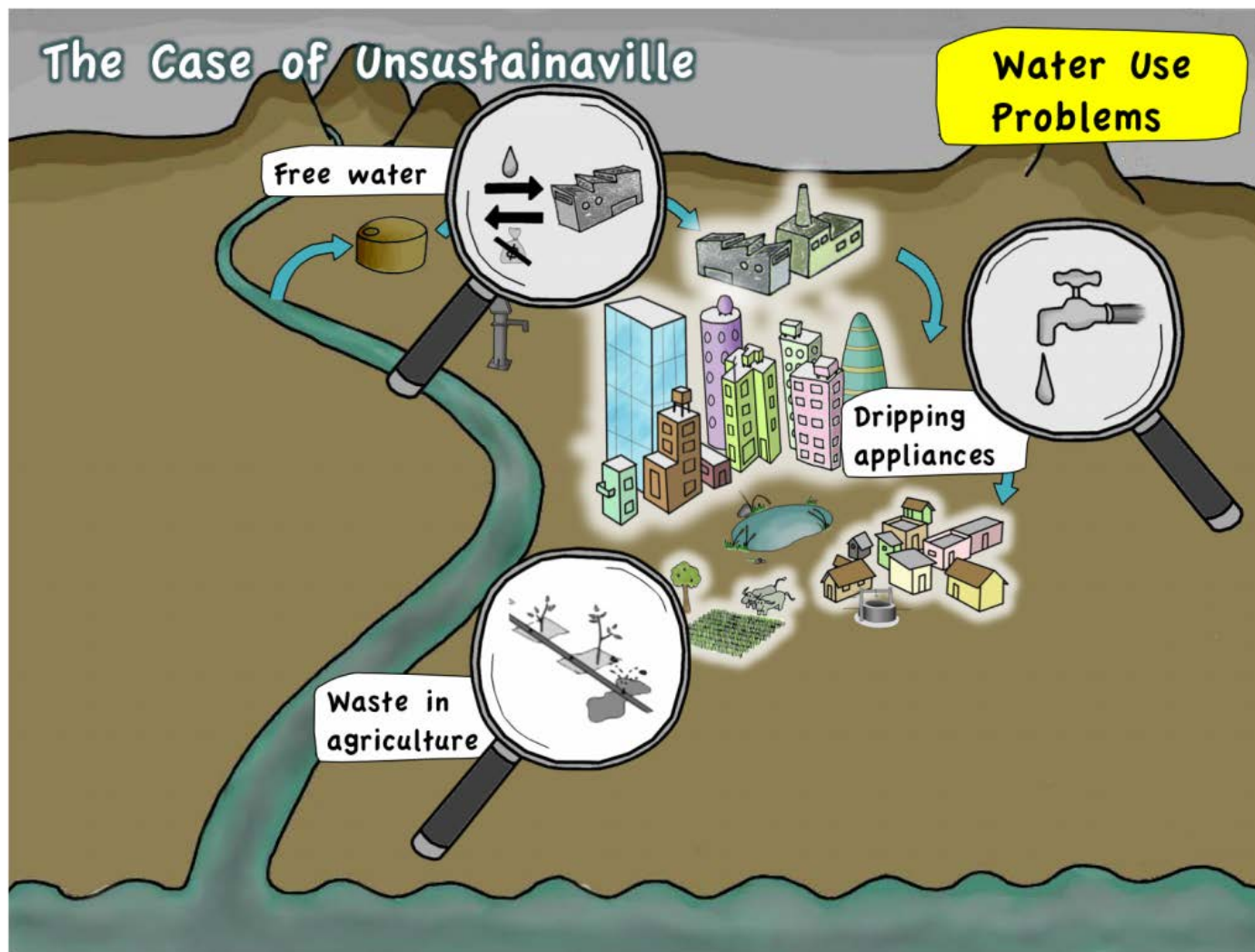
## 6. Water Use

### How is Water Used?

- Water use **problems**: what should we look for?
  - **Is it efficient?** Are large quantities of water lost unintentionally (via distribution system, etc.)?
  - **Is it sustainable?** Are certain water users consuming too much water?
  - **Are there economic barriers?** Is there an incentive to save?
  - **Are there social barriers?** Is the community aware?
- **Interlinkages** between water use and other areas of the water and nutrient cycle:
  - The way water is used has a direct influence on the composition of wastewater, and again on the methods of treatment that are adequate

## 6. Water Use

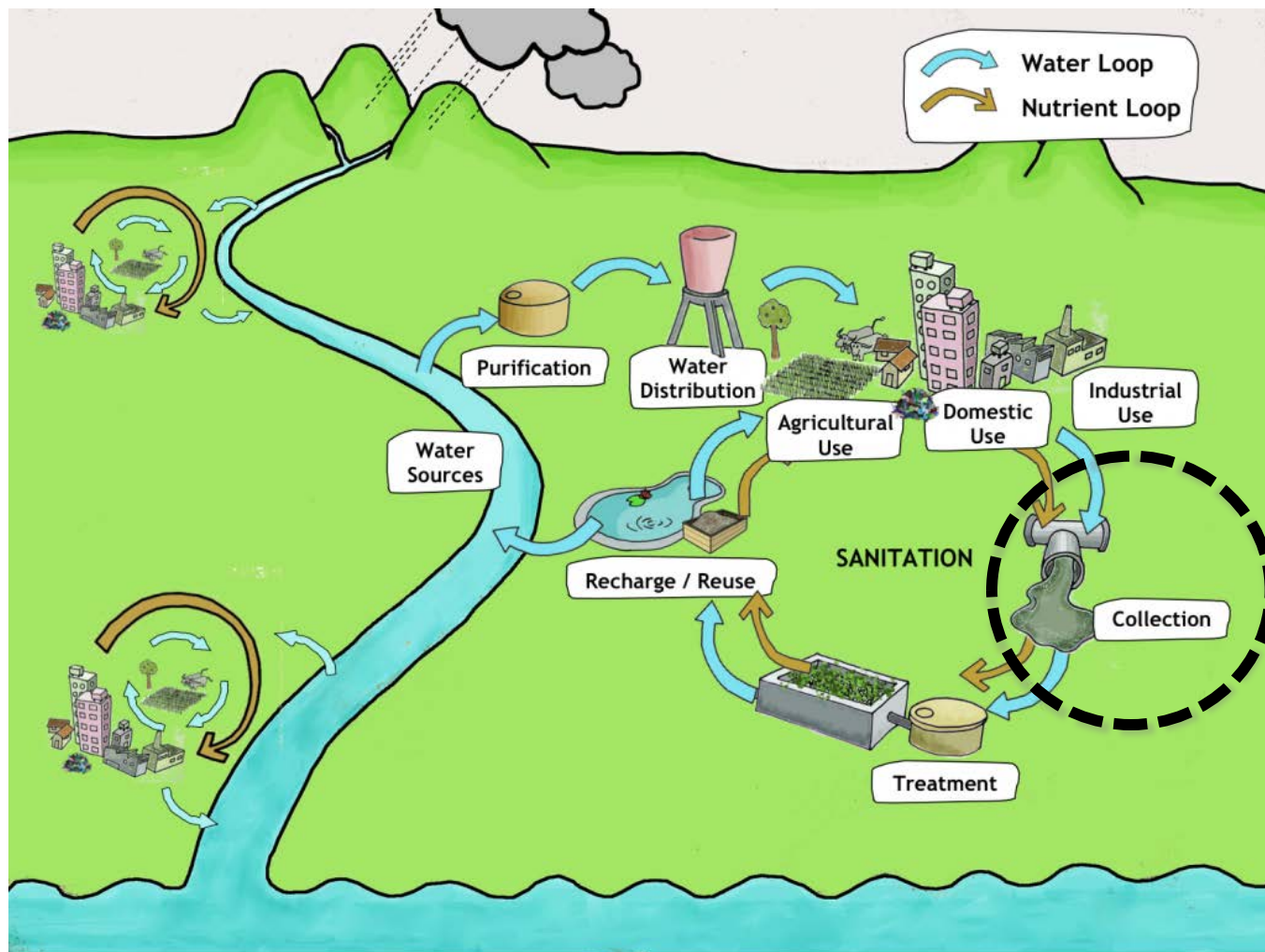
### How is Water Used?



Source: SEECON (2010)

## 7. Collection

### How is Wastewater Collected?



Source: SEECON (2010)

## 7. Collection

### How is Wastewater Collected?

- Where does the used water go?
- Is it collected (e.g. open drainage, piped sewer network, septic tanks, etc.)?
- Is there a centralised sewer networks? Are all parts of your area connected to it? Or do decentralised, household-based solutions prevail?

*Need help?*

Further information may be available through  
the town or city planning



## 7. Collection

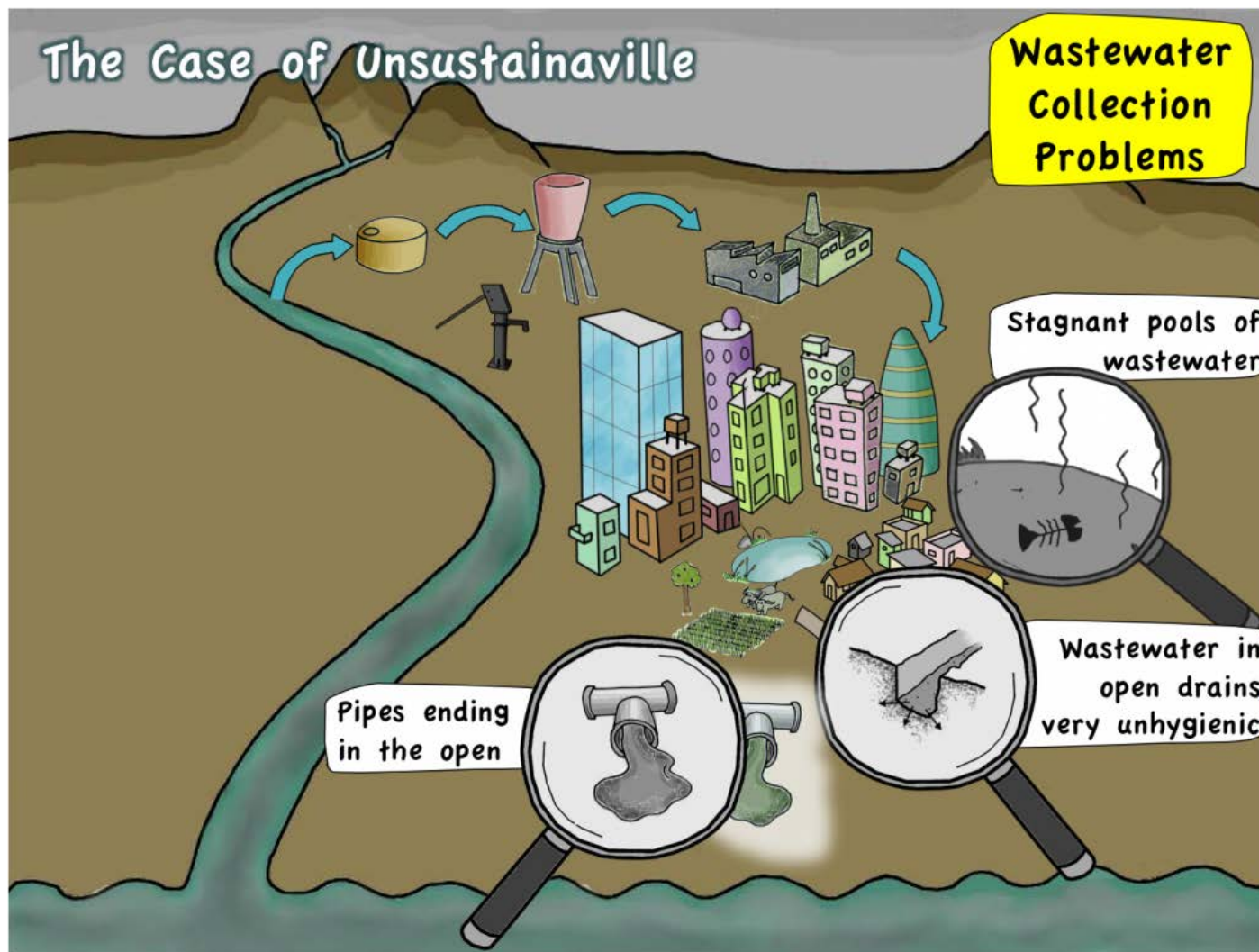
### How is Wastewater Collected?

- Wastewater collection **problems**: what should we look for?
  - **Is it safe?** Is wastewater transported to treatment plants? Are there leakages where wastewater might contaminate fresh water?
  - **Is it adequate?** Is infrastructure in place and maintained? If not, why? Are there economic, legal, or social barriers?
- **Interlinkages** between wastewater collection and other areas of the water and nutrient cycle:
  - Is wastewater (i.e. “used water”) collected at all? If it is, is it treated, and how? If it is not: Which other areas does this influence? The water that is used and discharged within your locality influences the water sources of those further downstream.



## 7. Collection

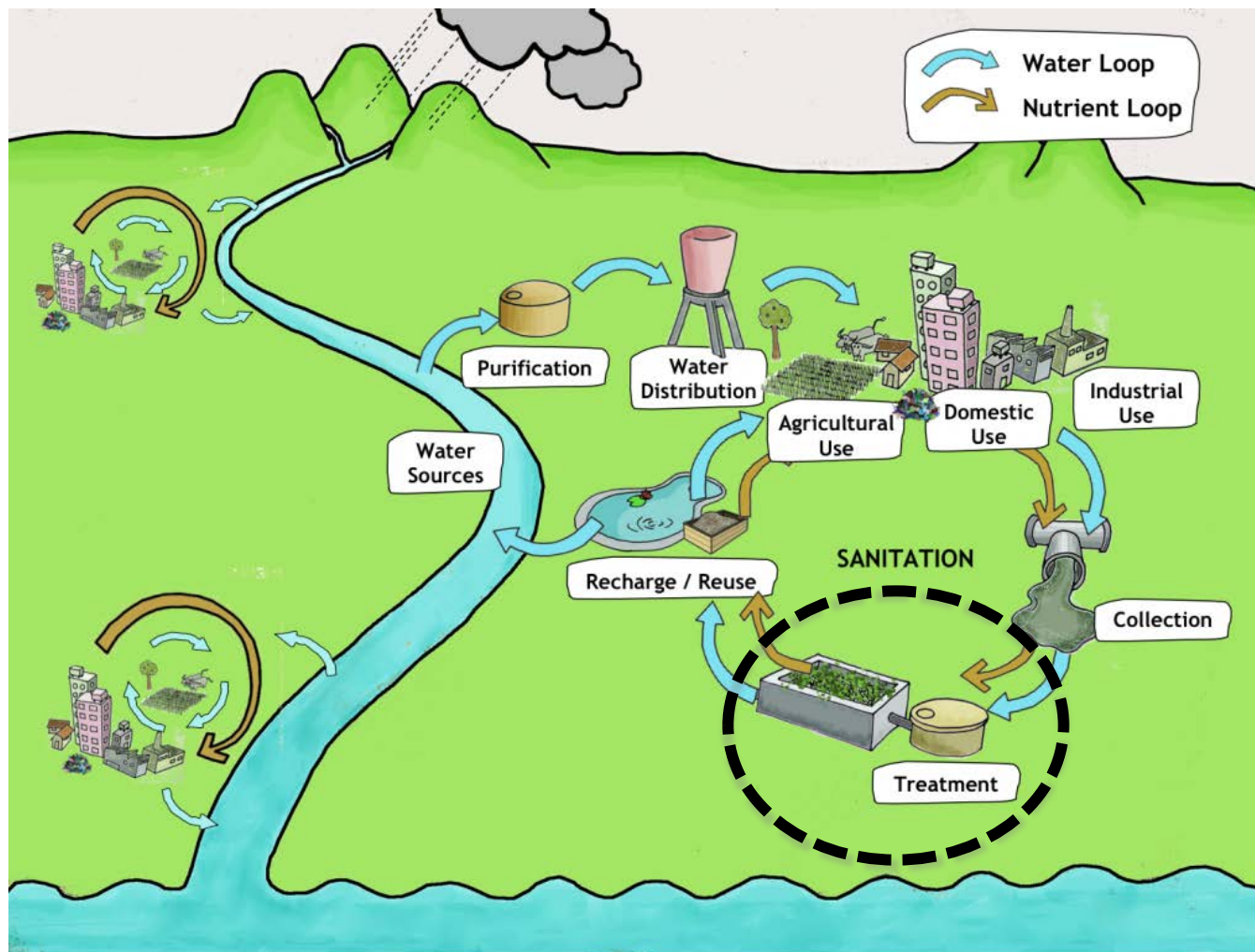
### How is Wastewater Collected?



Source: SECON (2010)

## 8. Treatment

### How is Wastewater Treated?



Source: SEECON (2010)

## 8. Treatment

### How is Wastewater Treated?

- Is industrial/domestic/agricultural wastewater treated? In a centralised or individual manner? Up to which level?
- Do individual or centralised treatment methods prevail?
- What about areas that are not connected to the sewerage? Is wastewater treated there in any manner?

#### *Need help?*

Call up sewage treatment plants or the city planning authority for more information.  
Individual stakeholders (such as large industries) should also be able to answer your questions.  
For an in depth analysis, laboratory analyses of effluents may be required.

## 8. Treatment

### How is Wastewater Treated?



Source: SEECON (2010)

## 8. Treatment

### How is Wastewater Treated?

- Wastewater treatment **problems**: what should we look for?
  - **Is it adequate?** Do current practices have adequate capacity for the volume of wastewater produced? Are there any legal aspects to consider? Are there any social or economic barriers?
  - **Is it sustainable?** Are resources readily available for operating and maintaining the treatment system? Who is maintaining the system and is his health protected? Are treated water and wastes causing any pollution? Are energy, nutrients or other products recovered?
- **Interlinkages** between wastewater treatment and other areas of the water and nutrient cycle:
  - If wastewater is discharged without treatment, it negatively influences both the quality of the water for those living further downstream, and hence their purification methods, limits the purposes that water can be used for, and the availability of nutrients in agriculture

## 8. Treatment

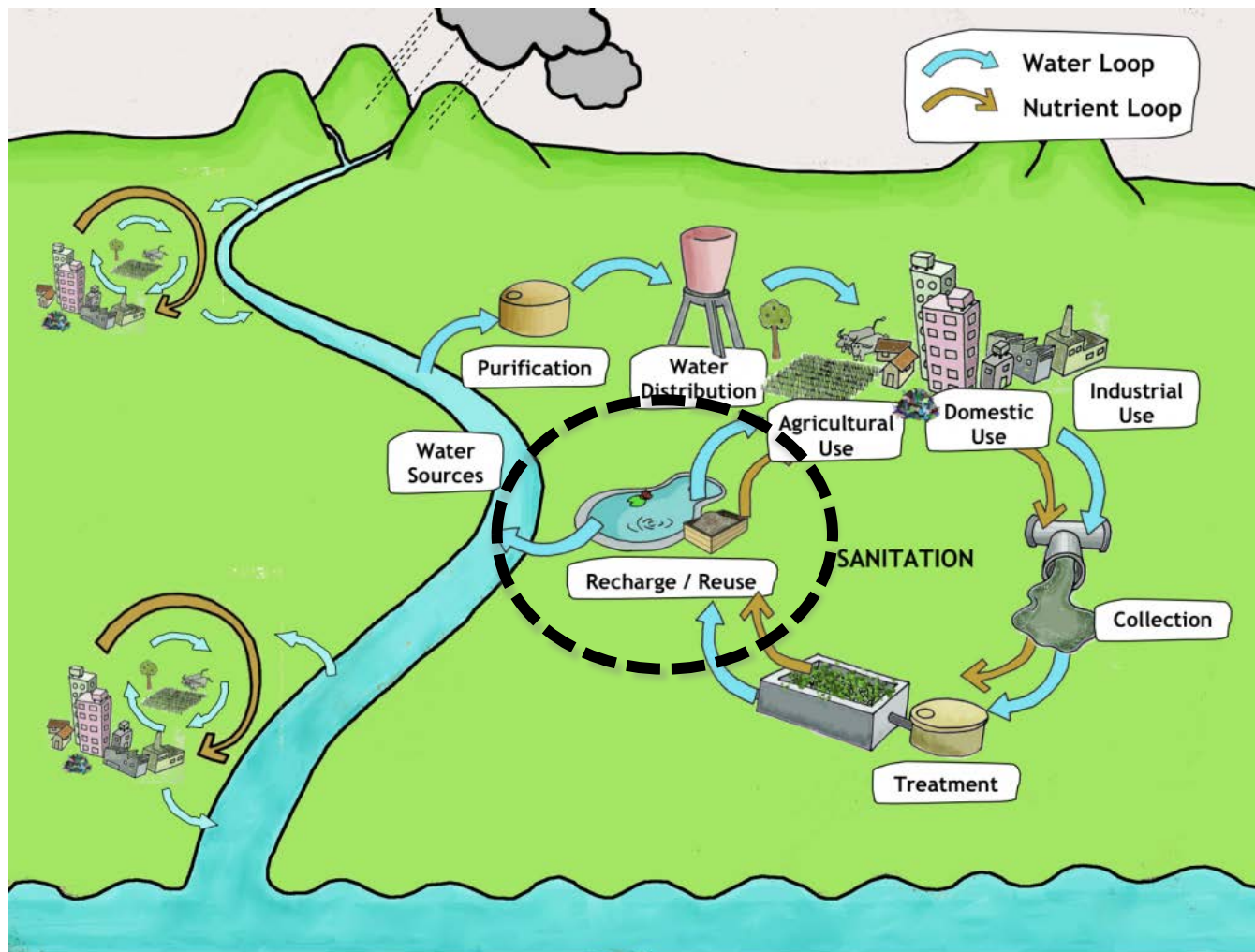
### How is Wastewater Treated?



Source: SECON (2010)

## 9. Recharge/Reuse

### How is Wastewater Reused?



Source: SEECON (2010)

## 9. Recharge/Reuse

### How is Wastewater Reused?

- Is the wastewater (in general, for domestic, agricultural or industrial areas) recycled or is it just discharged?
- Has this created any problems so far?
- Are there potential users for treated wastewater? Who could that be?

*Need help?*

Call up sewage treatment plants, or the city planning authority for more information.  
Individual stakeholders (such as large industries) should also be able to answer your questions.



## 9. Recharge/Reuse

### How is Wastewater Reused?



Source: SECON (2010)

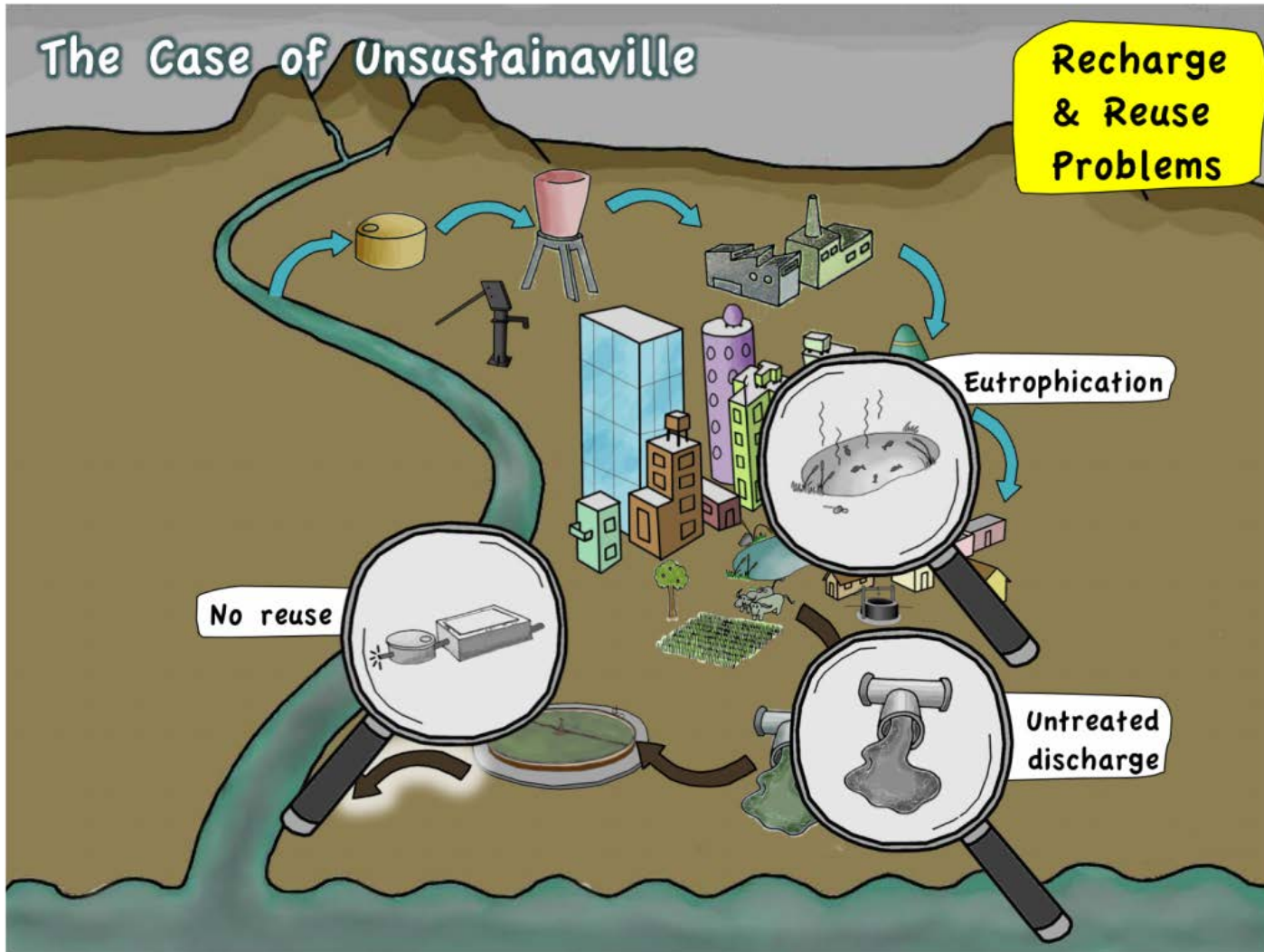
## 9. Recharge/Reuse

### How is Wastewater Reused?

- Wastewater reuse **problems**: what should we look for?
  - **Is it practiced?** Is wastewater reused or recharged at all? If not, is it disposed of safely? Is there a risk of contaminating water sources?
  - Are there economic, legal, or social barriers for wastewater reuse?
- **Interlinkages** between wastewater reuse/recharge and other areas of the water and nutrient cycle:
  - Wastewater discharge/recharge/reuse is influenced by the preceding treatment steps, and influences almost all other areas of the water and nutrient cycle
  - Wastewater may contaminated water sources, influence purification needed, distribution
  - Wastewater reuse reduces demand for fresh water

## 9. Recharge/Reuse

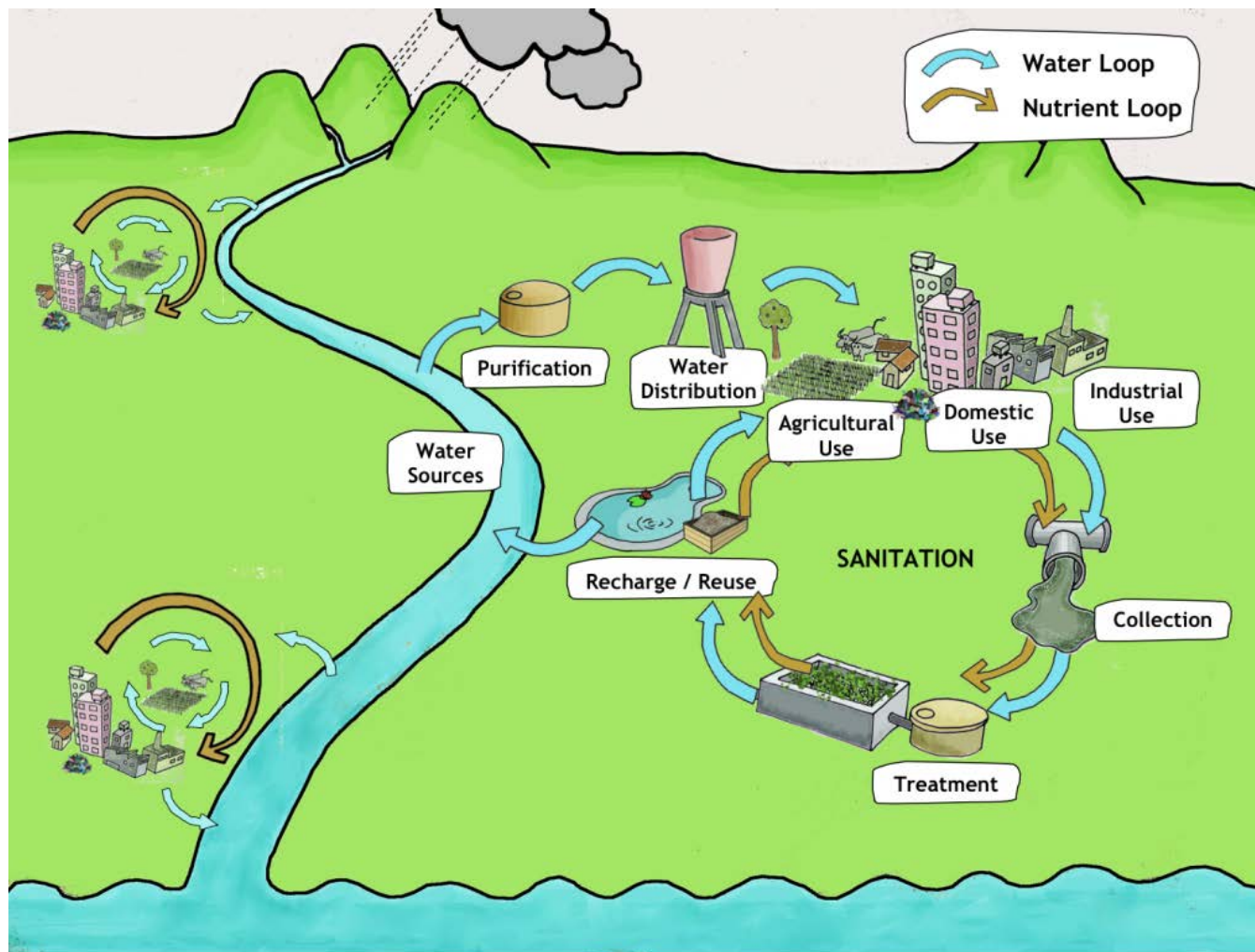
### How is Wastewater Reused?



Source: SEECON (2010)

## 10. Solid Waste and Nutrients

### How are Nutrients Managed?



Source: SEECON (2010)

## 10. Solid Waste and Nutrients

### How is Solid Waste Managed?

- What types of solid waste are produced?
- What types of solid waste are collected? How?
- How are different solid wastes treated?

*Need help?*

The city planning authority should be able to answer your questions about solid waste management.

## 10. Solid Waste and Nutrients

### What Sources of Fertilisers are Used?

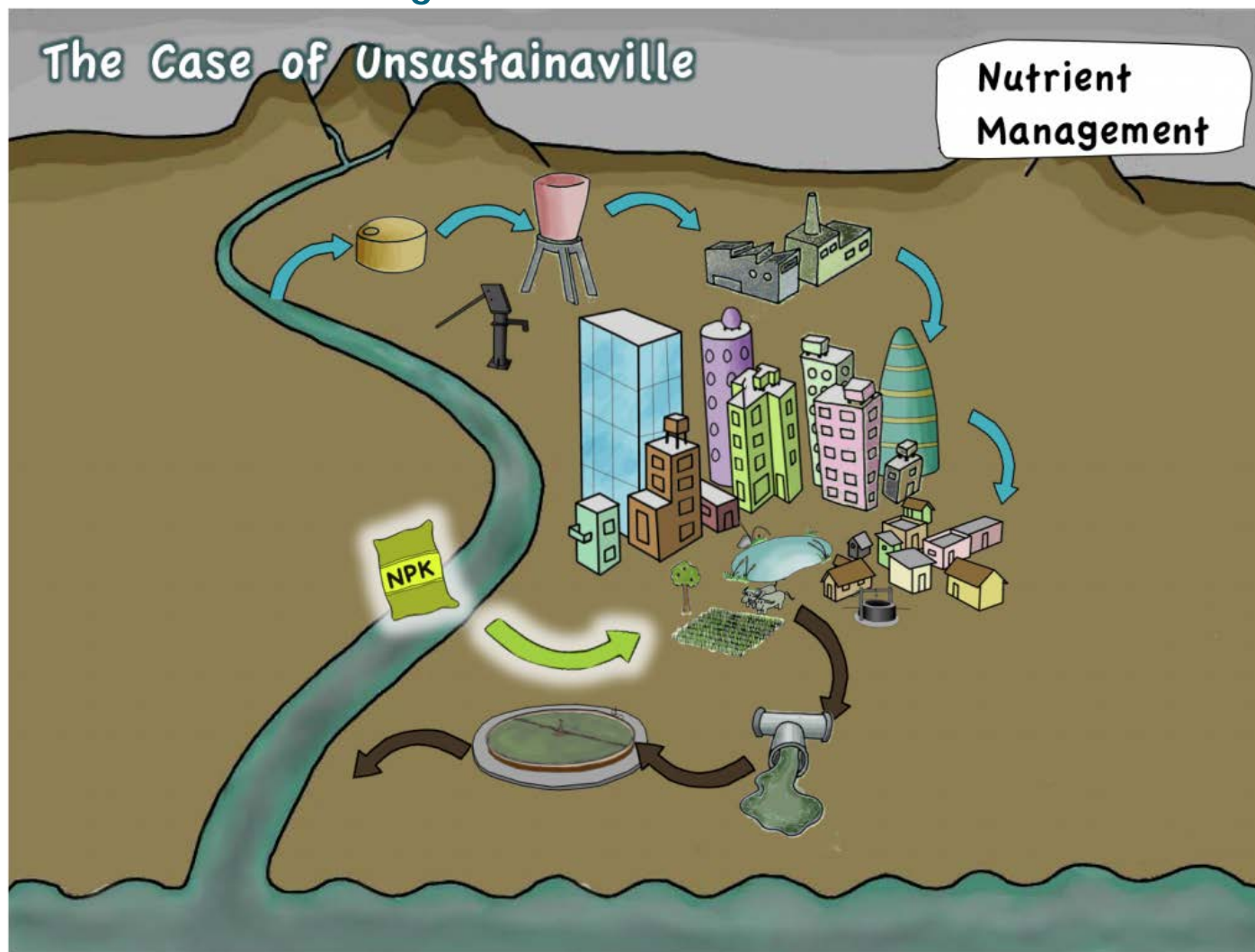
- Is fertiliser used in agriculture/gardening in your area?
- Is artificial or organic fertiliser used? How high is the consumption?  
Is fertiliser affordable for all?
- What happens with organic waste?

*Need help?*

Farmers' associations or agricultural research institutes (agricultural university etc.) may help you to answer this question.

## 10. Solid Waste and Nutrients

### How Are Nutrients Managed?



Source: SEECON (2010)

## 10. Solid Waste and Nutrients

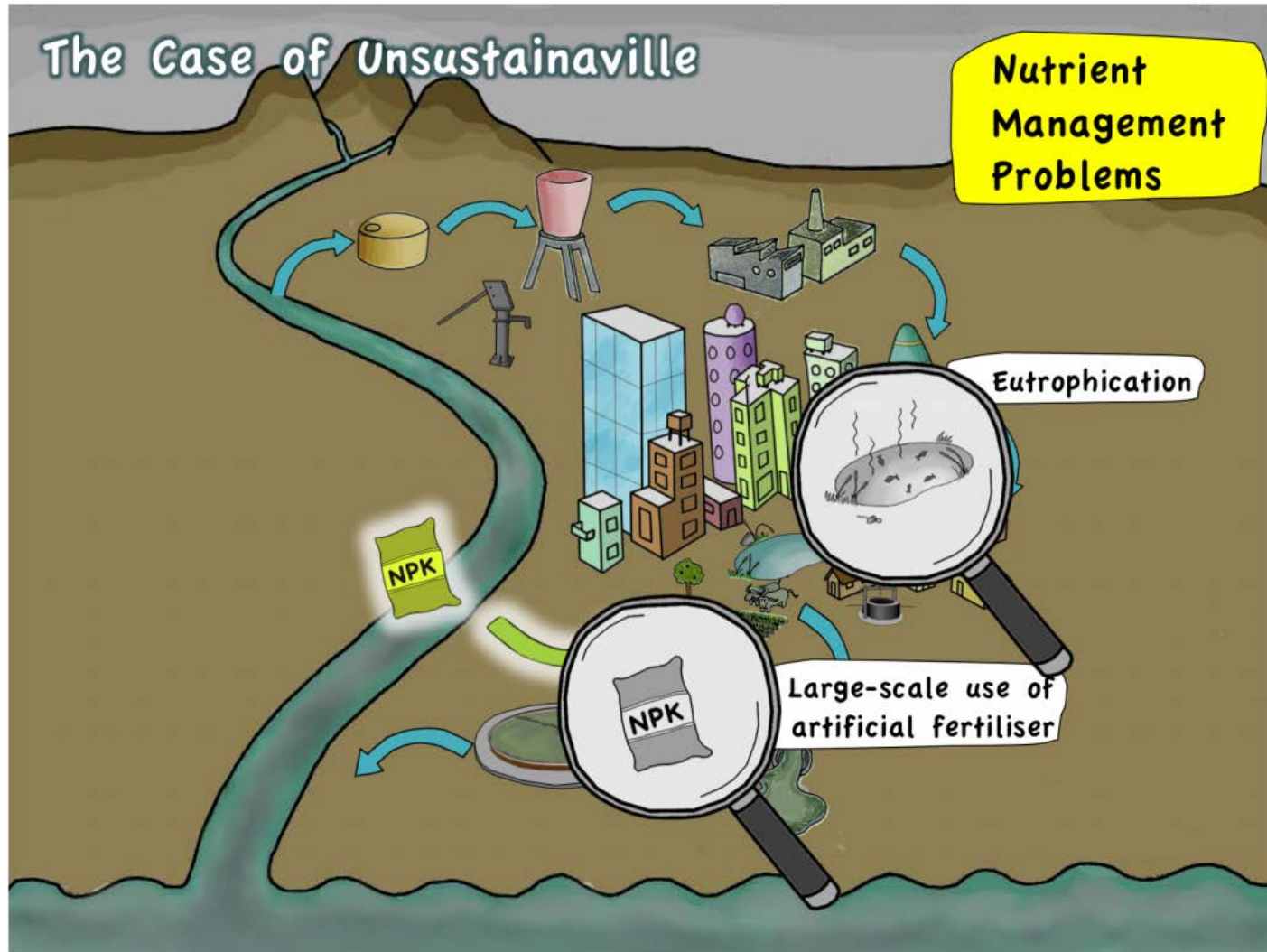
### How Are Nutrients Managed?

- Nutrient management **problems**: what should we look for?
  - **Is it practiced?** Are farming practices using appropriate levels of fertilisation? Is farm runoff managed to protect water sources? Is there a risk of contamination from improperly managed solid waste?
  - What causes improper nutrient management? Are there economic, legal, or social barriers?
- **Interlinkages** between nutrient management and other areas of the water and nutrient cycle:
  - Overuse (of both organic and artificial fertilisers) may lead to water pollution through runoff. A high consumption of artificial fertiliser may for instance decrease the demand for organic fertiliser.



## 10. Solid Waste and Nutrients

### How is Wastewater Reused/Recharged?

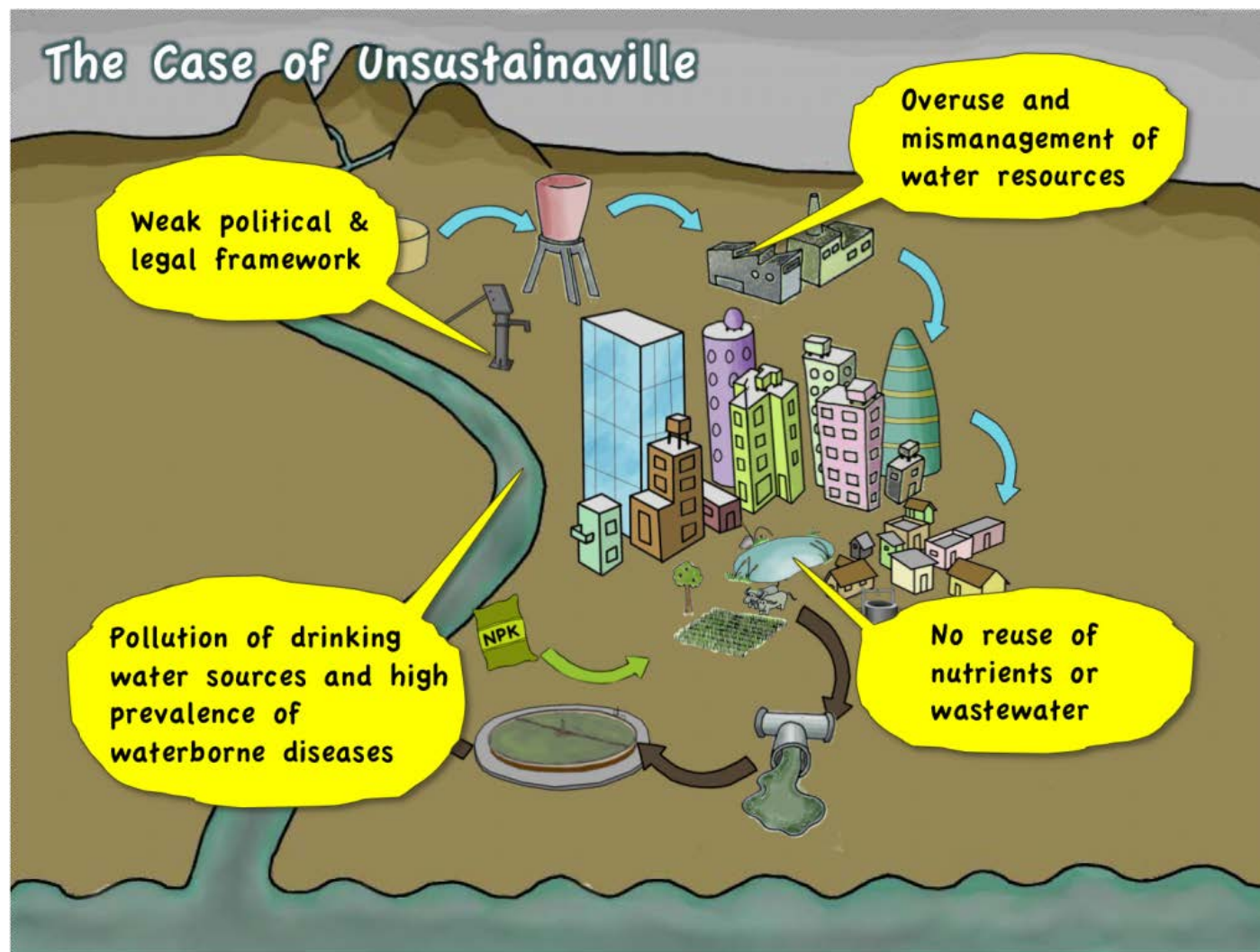


Source: SEECON (2010)



# 11. Next Steps

## Identifying Root Causes



Source: SECON (2010)

# 11. Next Steps

## Identifying Root Causes

**Weak political and legal framework** responsible for:

- Wastewater discharged into the open (also by industries) without any legal consequences
  - Leads to a severe pollution of groundwater and surface water sources.
  - Water that is used to supply the distribution grid is of a bad quality, and chlorination cannot deal with all the pollutants present.
- The policy that industries get their water for free undermines any endeavours to cut down water use.

**Strategy:** use software tools, such as creating an enabling environment, command and control tools, or planning and process tools

## 11. Next Steps

### Identifying Root Causes

**Overuse and Mismanagement of Water Resources** responsible for:

- Lack of awareness of residents of city water problems leads to lots of water wasted, lots of wastewater generated, wastewater treatment plant overloading, discharge of raw wastewater and negative consequences on human health and environment
- Groundwater depletion leads to use other water sources (i.e. river water) and allocation problem for downstream residents
- Small scale farmers relying on shallow wells threatened by groundwater depletion.

**Strategy:** increase awareness of problem (see [awareness raising](#), [advocacy tools](#)), make a water plan (see [IRWM](#), [water safety plans](#))

## 11. Next Steps

### Identifying Root Causes

**No Reuse of Nutrients or Wastewater** responsible for:

- Groundwater is used as a source of water, but none of this water is used to recharge groundwater sources after treatment. This leads to the fact that the groundwater level is decreasing.
- Valuable nutrients present in wastewater are not used, so farmers have to buy artificial fertilisers that are imported from abroad, weakening the local economy
- Nutrients present in the wastewater are just wasted, leading to eutrophication and pollution of water sources.

**Strategy:** learn more about [reuse and recharge](#) with the SSWM Toolbox

## 11. Next Steps

### Identifying Root Causes

**Pollution of Drinking Water and High Prevalence of Waterborne Diseases** responsible for:

- Methods of drinking water purification are not known or not sufficient, leading to many infant deaths and a high prevalence of waterborne diseases.
- When people are ill, they cannot attend school or work; increasing poverty levels

**Strategy:** learn more about water treatment with [water purification](#) and about disease prevention with [health and hygiene issues](#) in the SSWM Toolbox

## 12. Conclusion

### How to Proceed

- Refer to the Planning and Process Tools section to find approaches on how problems can be tackled
- For each step in the water and nutrient cycles, refer to Implementation Tools to get ideas about ways you can improve your local system



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