Concepts for Drinking Water Supply and Sanitation

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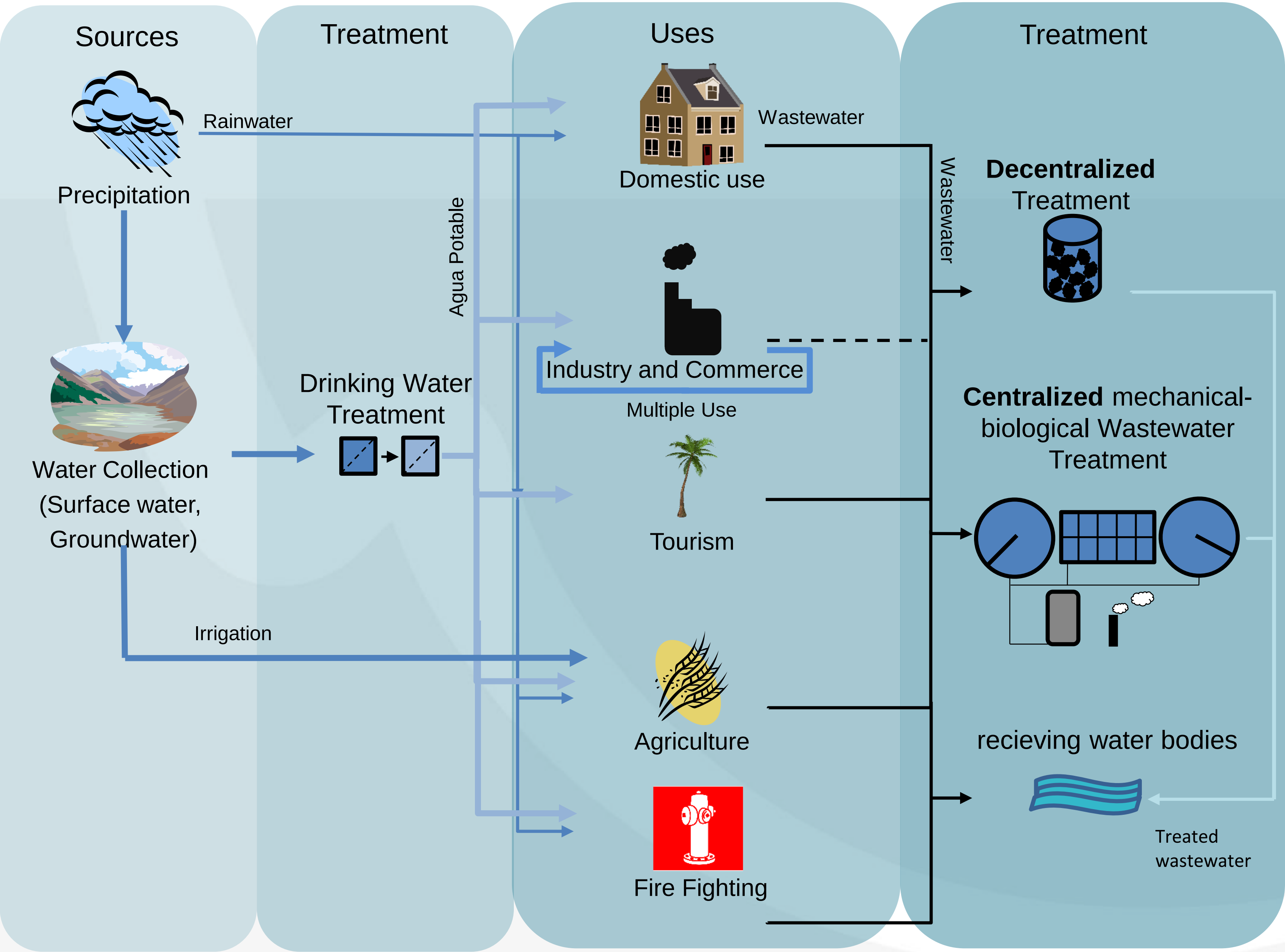
Agenda

- Introduction
- Drinking Water Management
- Wastewater Management
- Modular Concepts for Water Supply and Sanitation
- Conclusions

TRUST: PT3 – Modular Concepts for Drinking Water Supply and Sanitation



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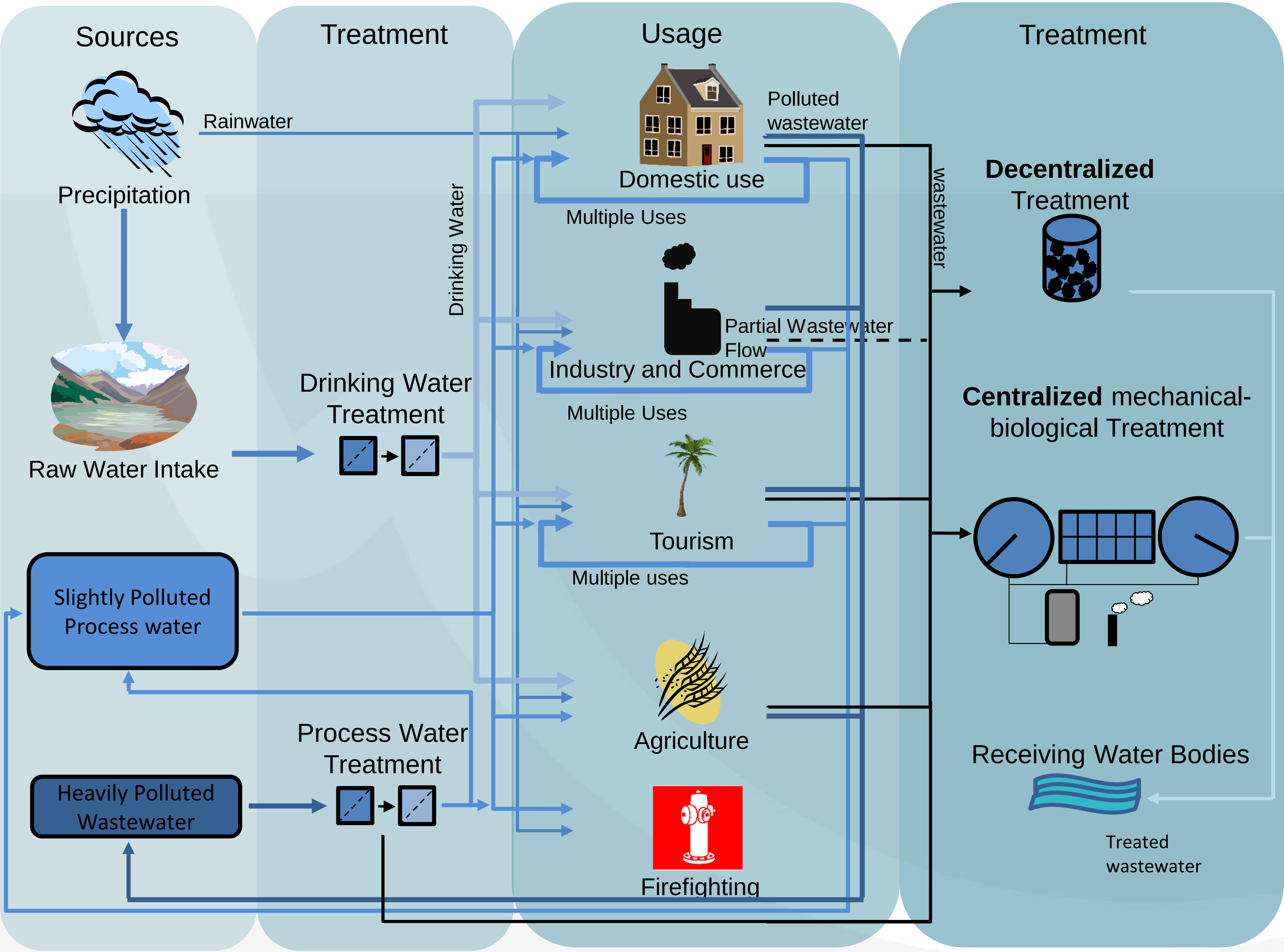
TRUST: PT3 – Modular Concepts for Drinking Water Supply and Sanitation

Water reuse



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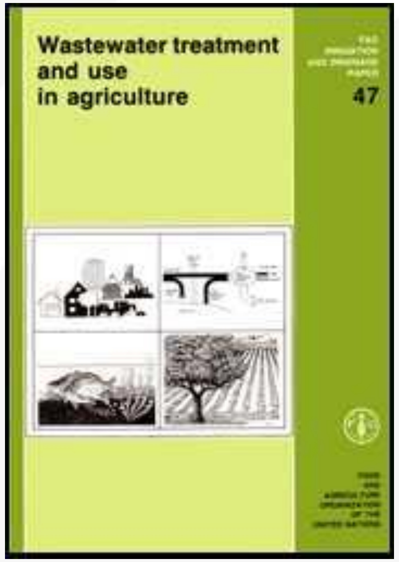
Example: Instructions and recommendations for water reuse



FAO 1992

Health guidelines for the use of wastewater in agriculture and aquaculture

Report of a WHO Scientific Group

WHO 1989

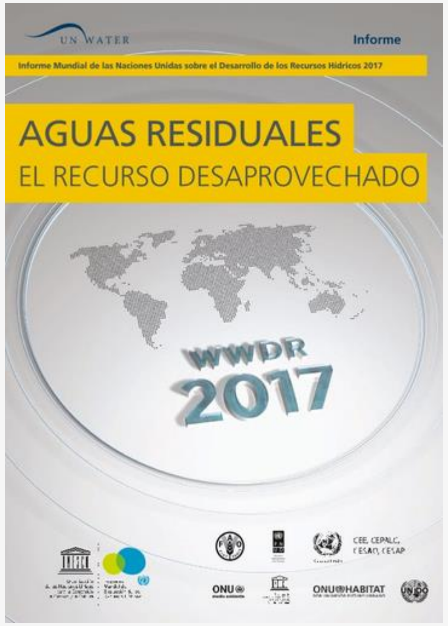
GUIDELINES FOR THE SAFE USE OF WASTEWATER, EXCRETA AND GREYWATER

Volume 2
Wastewater use in agriculture

World Health Organization

WHO 2006

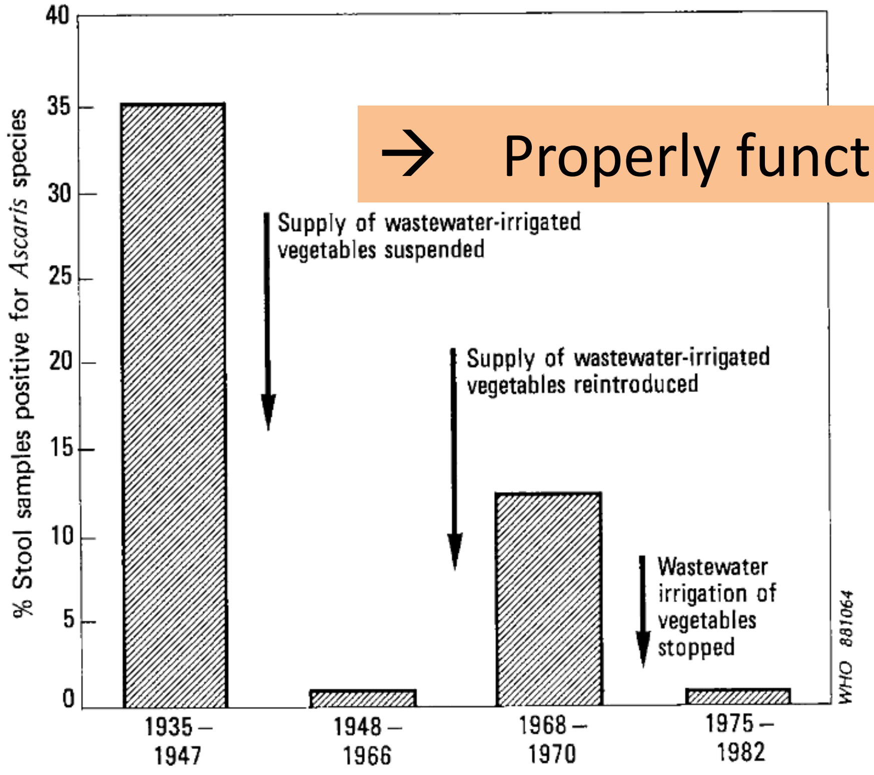
FAO 2010



UN WATER 2017

Safe reuse of treated wastewater

Fig. 3. Relationship between stool samples positive for *Ascaris* species in the population of western Jerusalem and the availability of vegetables and salad crops irrigated with raw wastewater in Jerusalem, 1935–1982*



*Redrawn from reference 6; used with permission.

WHO 1989

→ Properly functioning wastewater treatment is a prerequisite

Principales riesgos para la salud humana derivados del riego de hortalizas con aguas residuales

Tipo de riesgo	Riesgo para la salud	Quién está en riesgo	Cómo
Riesgos del trabajo (contacto)	• parásitos como helmithos, ascaris y anquilostomas • Enfermedades diarreicas, … que causan comezón y ampollas en las manos y los pies • Problemas de uñas como koiloniquias (uñas con forma de cuchara)	• Agricultores/ trabajadores de campo	• Contacto con agua de riego y suelos contaminados
		• Niños que juegan …	• Contacto con agua de riego y suelos contaminados
		… mercado	Exposición a suelos contaminados durante la cosecha • Lavado de verduras en aguas residuales
Riesgos relacionados con el consumo	• Principalmente infecciones bacterianas y virales como el cólera, la fiebre tifoidea, la hepatitis A y la enteritis viral, que causan principalmente diarrea. • Parásitos como helmithos/ascaris	• Consumidores de verduras	• Comer verduras contaminadas, especialmente las que se comen crudas
		• Niños que juegan en la plantación	• Chupado de la tierra

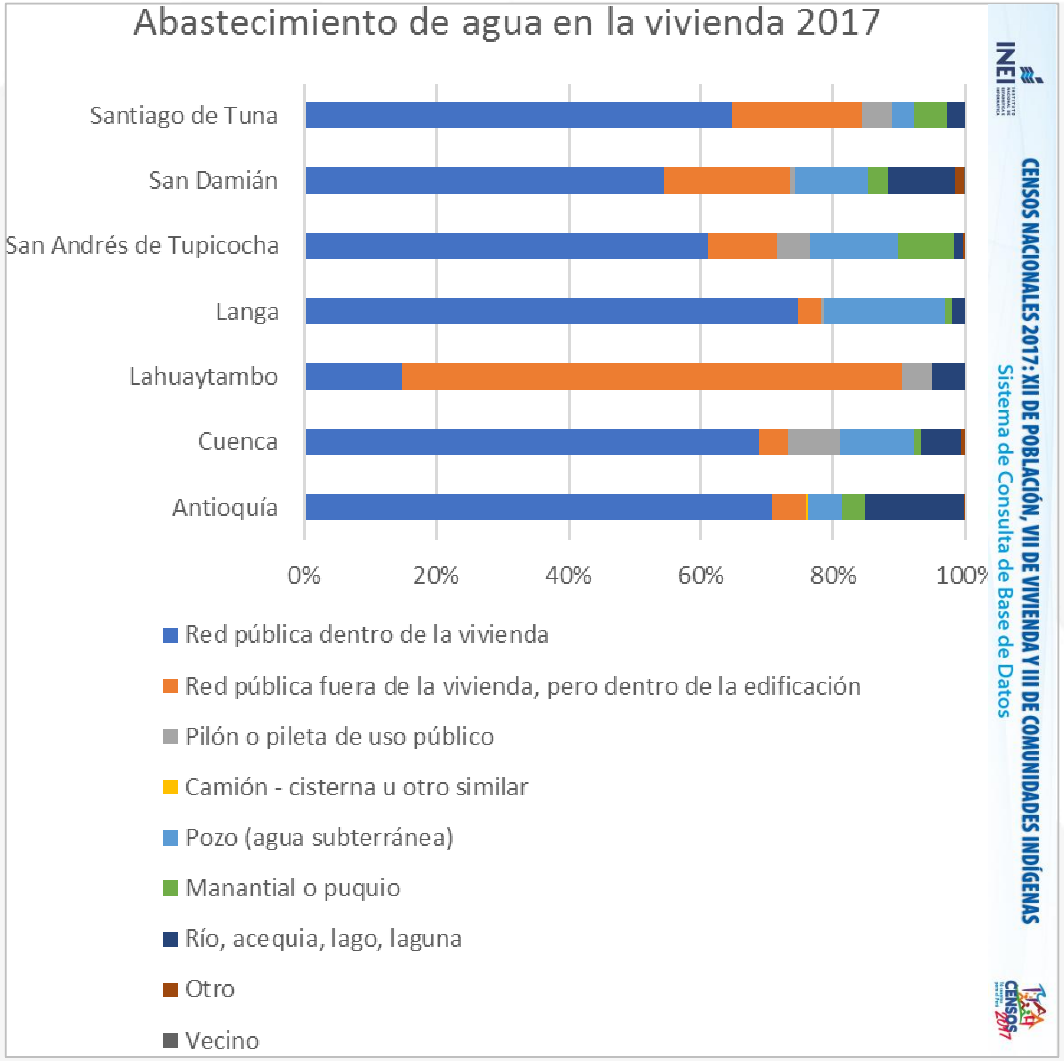
FAO 2012

The situation in the highlands of the Lurin River

Dams and reservoirs are used to store rainwater
→ Water for irrigation and human consumption

Drinking water sources

- Dams and Lagoons
- Springs
- *Chacras* (traditional trenches to increase infiltration of rainwater)
- Wells (ground water)



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Drinking water in the upper basin

Water Quality

Chemical:

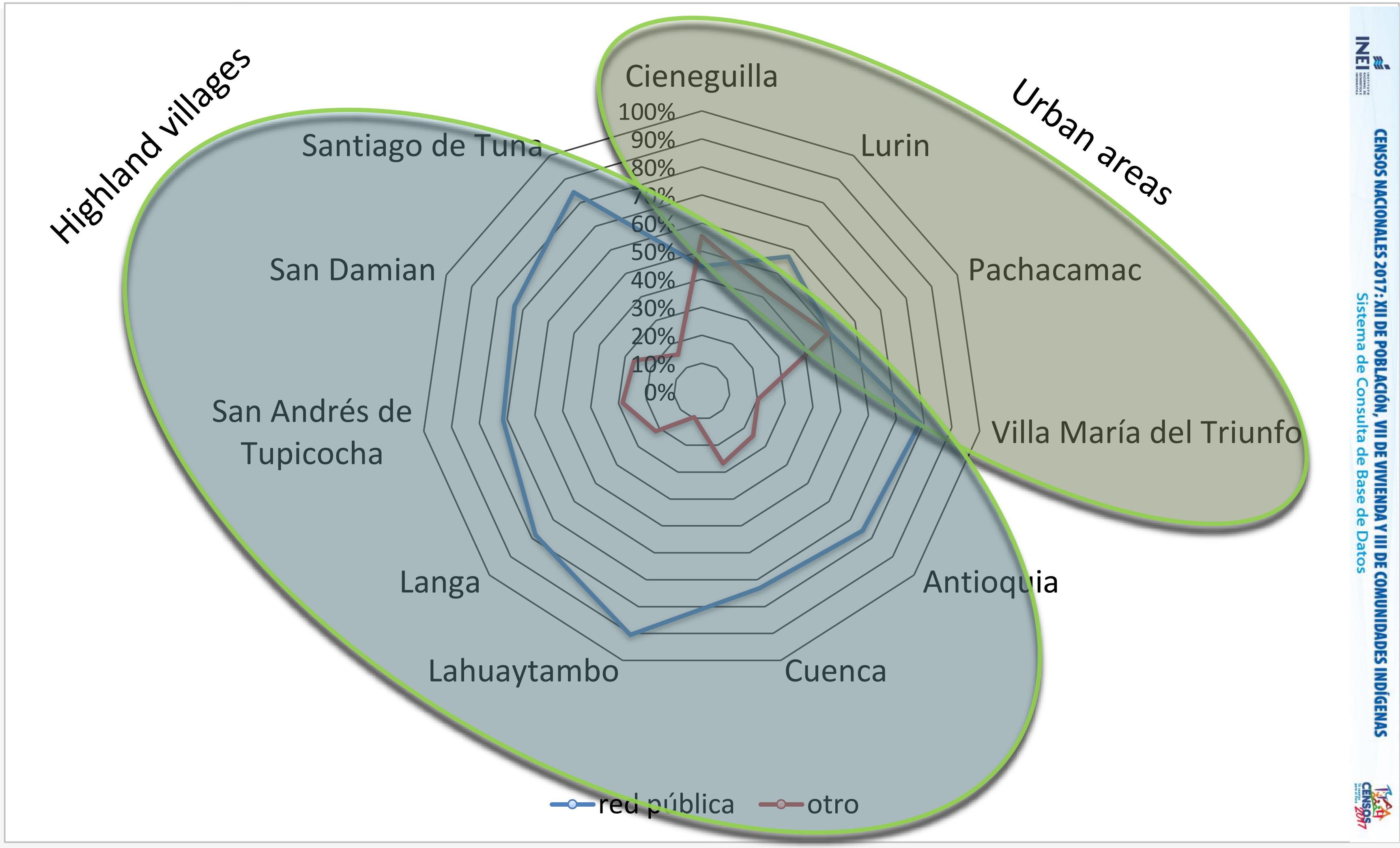
- no critical remarks

Microbiological:

- with critical observations such as bacteria, viruses, parasites

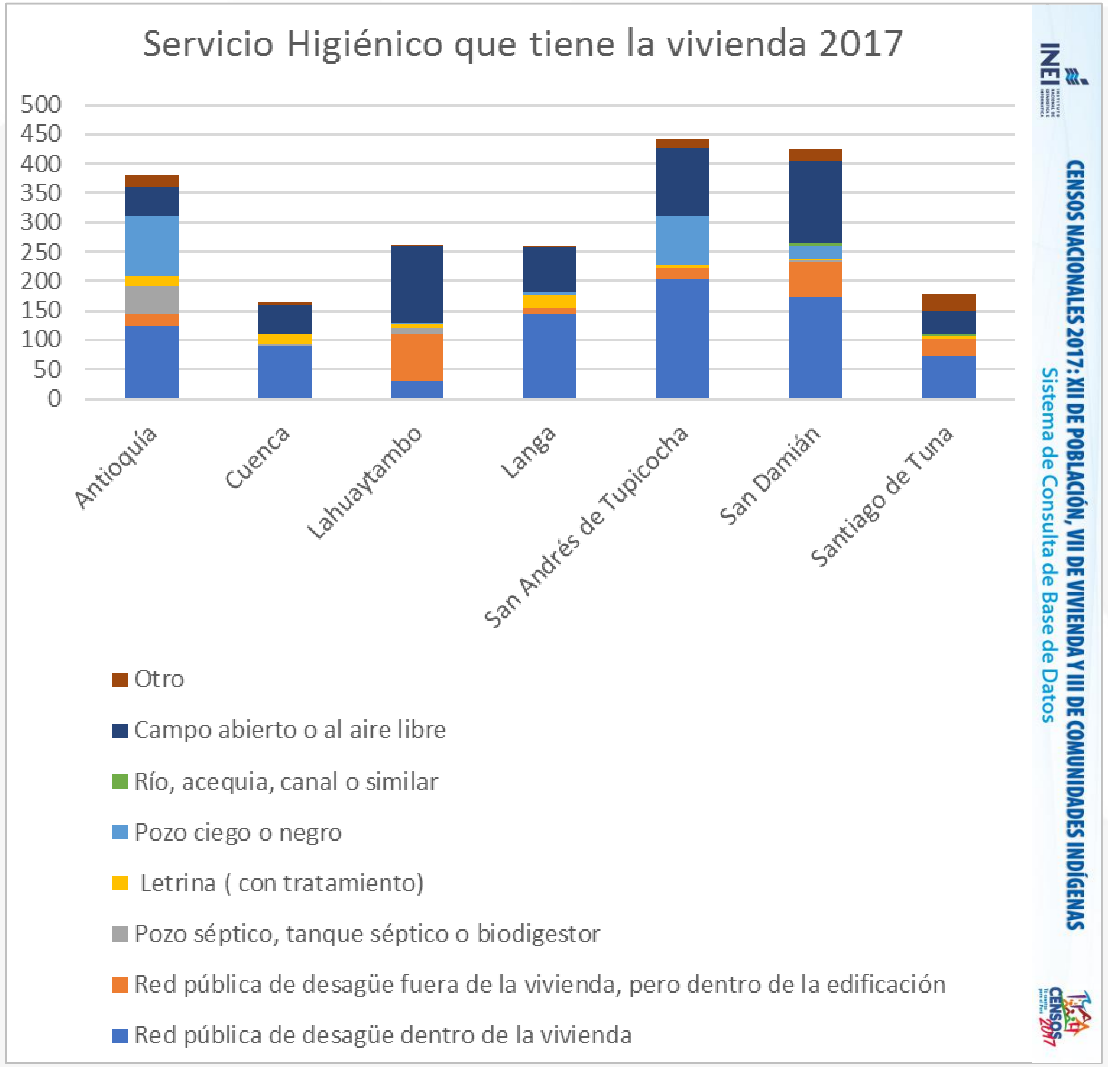
Lurin Basin: Water supply in the home

→ High connection rate to the public water supply system in the highland villages
→ In the lowland the connection rate is very low
→ Overall, the connection to public water supply is improvable



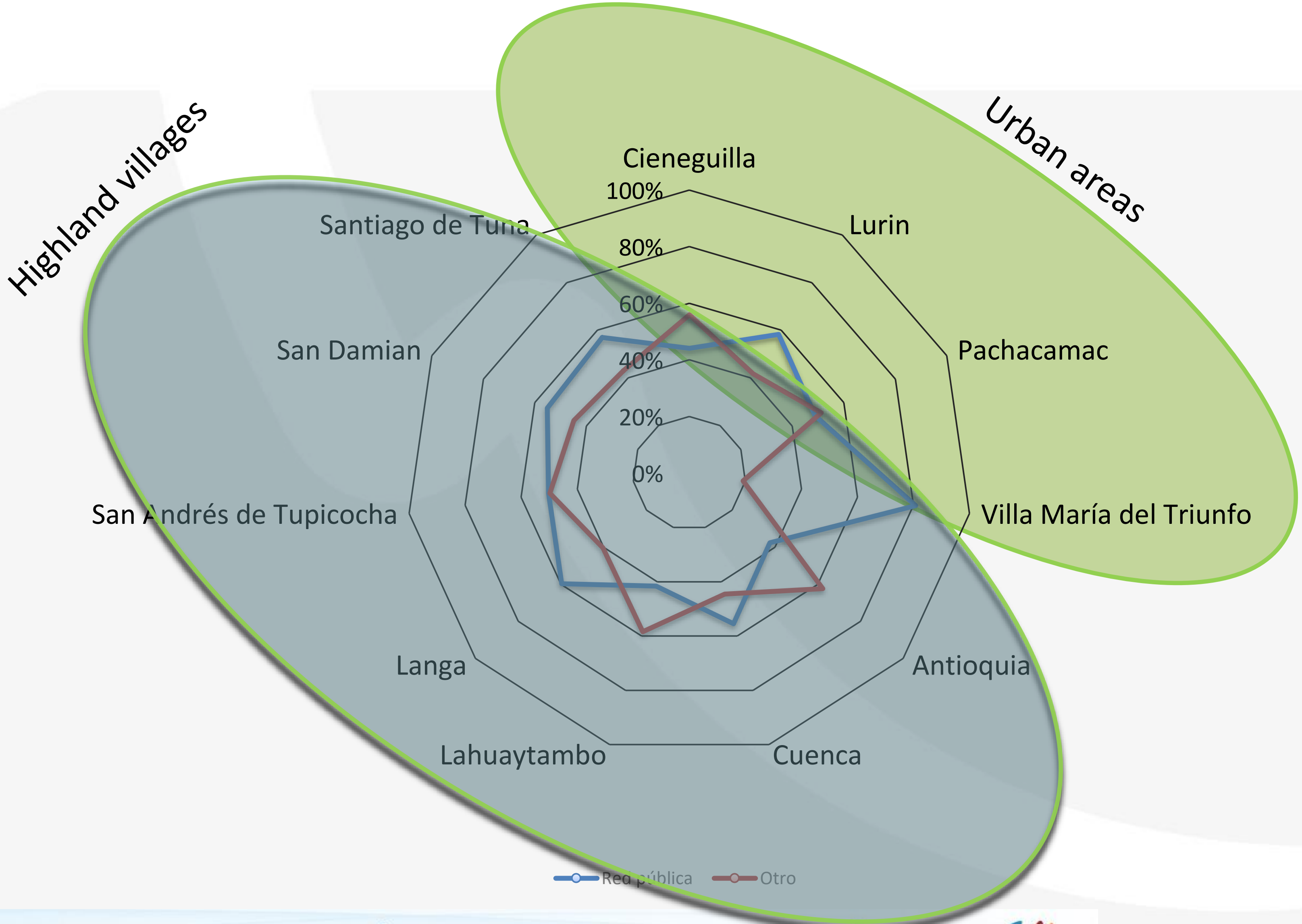
Sanitation

- Public Network
- Septic Tank
- Latrine
- Open Defecation



Sewer connection

→ The connection rate to the public sewer system is improvable (only 20-60 % in the catchment area)



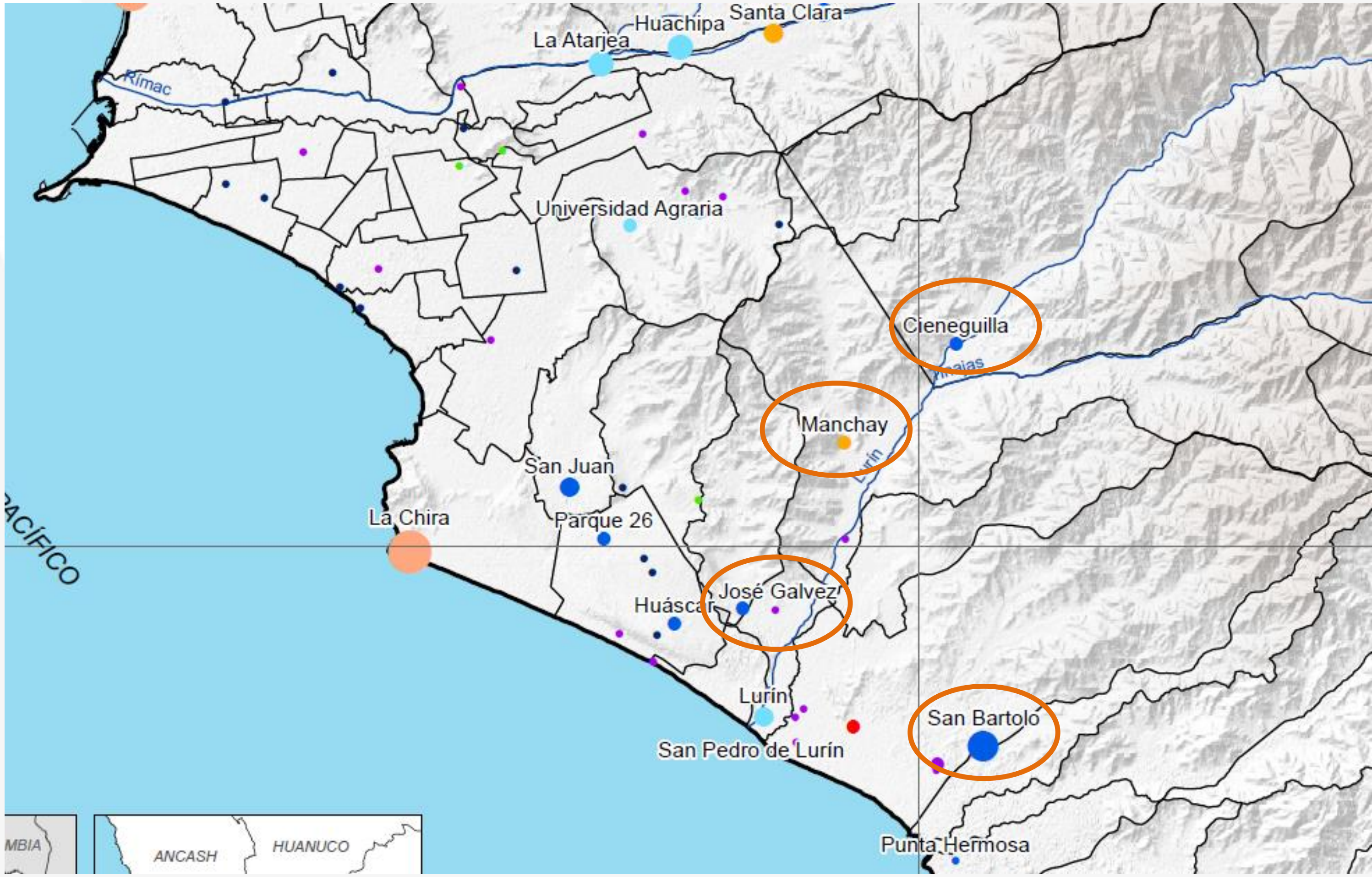
Sewer connection of homes

Infiltration into the aquifer:

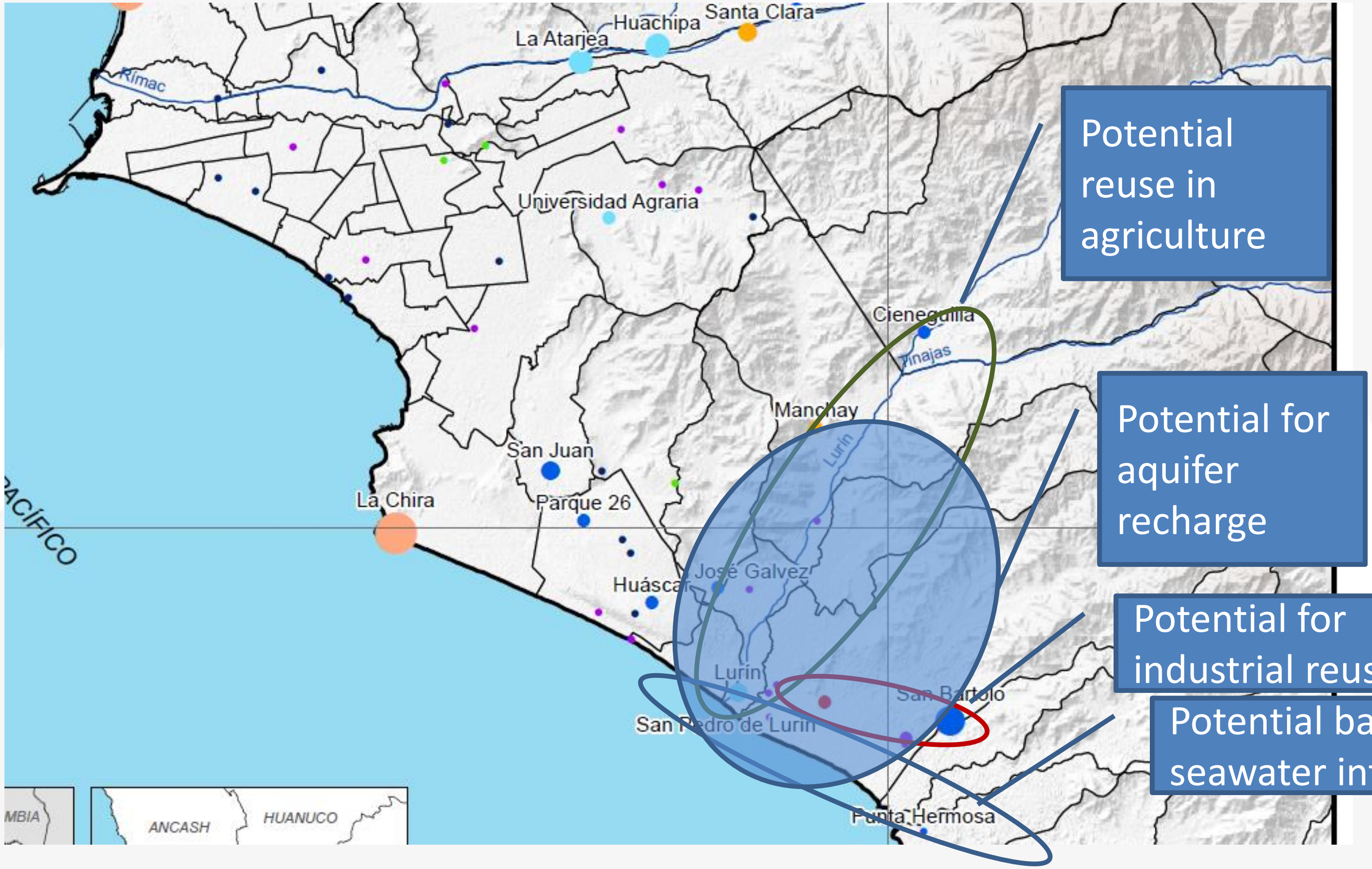
→Indirect Reuse

WWTP in the catchment area

- WWTP Cieneguilla: 120 L/s
- WWTP Manchay: 60 L/s
- WWTP José Galvez: 100 L/s
- WWTP San Bartolo: 0.8 – 1.7 m³/s
- 50% of households not connected to a PTAR (200,000 inhabitants), PTAR Lurin protected



Potential for wastewater reuse



- Agriculture: Irrigation
- Industry
- Infiltration to prevent seawater intrusion into the aquifer
- Aquifer recharge: indirect reuse as drinking water, irrigation, industry, ...

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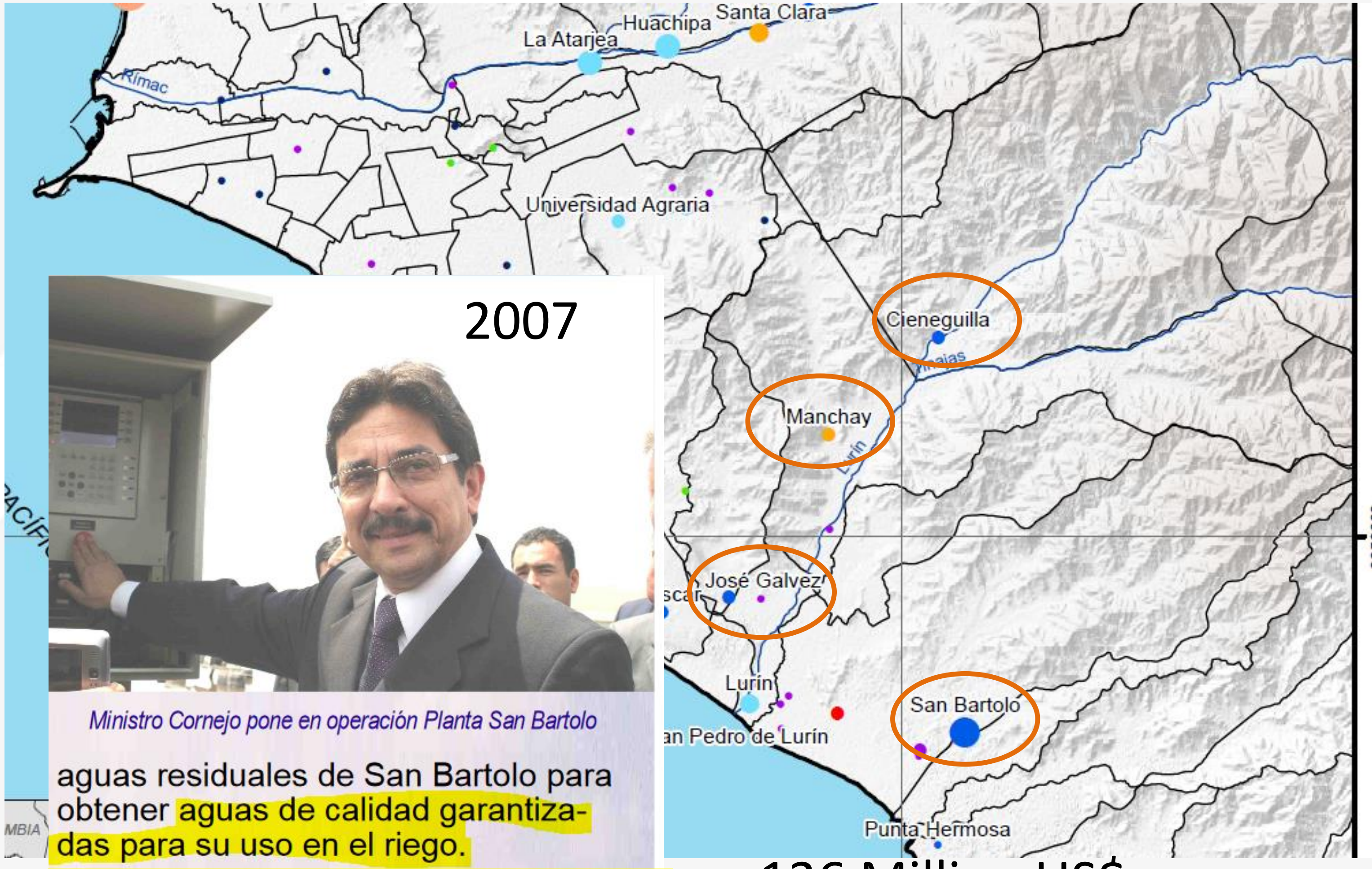
SUNASS 2015: WWTP is not working properly

WWTP in the watershed

- WWTP Cieneguilla: 120 L/s
- WWTP Manchay: 60 L/s
- WWTP José Galvez: 100 L/s
- **WWTP San Bartolo: 0.8–1.7 m³/s**



guaranteed quality water for use in irrigation

136 Million US$

Conclusions I

- The water and sanitation situation needs to be improved throughout
- The situation is different in the highlands and the lowlands
- Simple and economical systems are needed
- There is a reuse of wastewater with direct and indirect treatment with different qualities
- There are good and bad examples for wastewater treatment
  → Proper planning is necessary (some plants are non-operable)

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Drinking Water Management Results

1. The drinking water in the **upper part** of the Lurin Valley has a good physical and chemical composition, but is microbiologically contaminated
2. To ensure the quality of drinking water in the **upper** Lurin Valley, additional treatment with sand filtration and subsequent chlorination is necessary
3. The water of the Lurin River has a high percentage of wastewater
4. Groundwater and drinking water from the **lower** Lurin Valley have good physical-chemical and microbiological quality, but traces of anthropogenic substances have been found in groundwater

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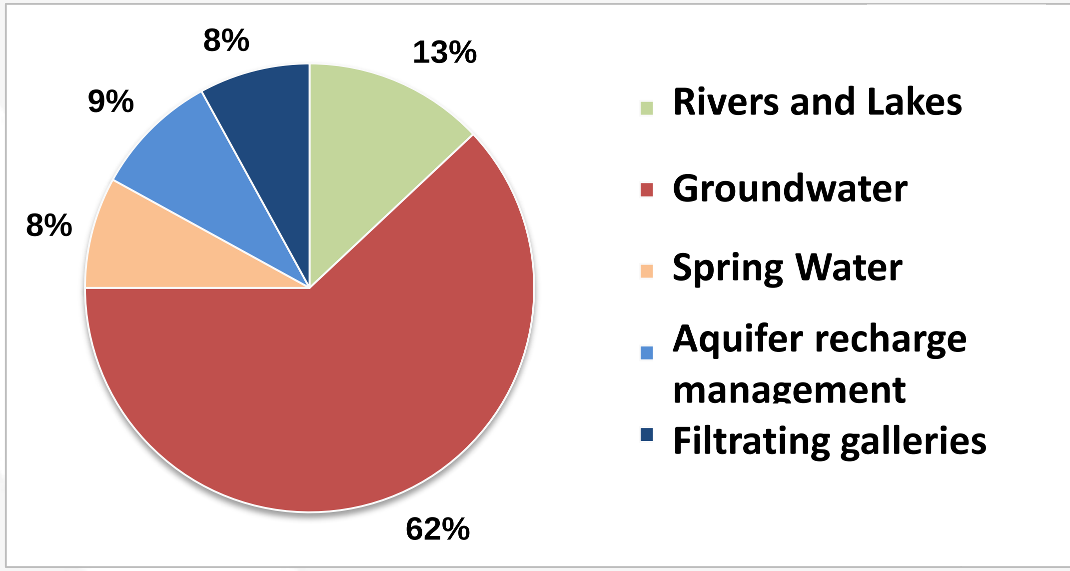
Wastewater Management Results

1. The aquifer in the Lurin Valley is fed by filtered river water.
2. Infiltrated river water or treated wastewater is effectively cleaned by passing through the soil.
3. In order to ensure the quality of the groundwater of the lower Lurin Valley in the long term, wastewater treatment is necessary.
4. **It is proposed to use the treated wastewater also for managed aquifer recharge.**

Perspective: Management of aquifer recharge / Soil-Aquifer Treatment

Ojectives

- Increase the amount of groundwater extraction
- Improvement of the quality of the subterranean passage
- Barrier against seawater intrusion



Example: Share of potable water sources in Germany

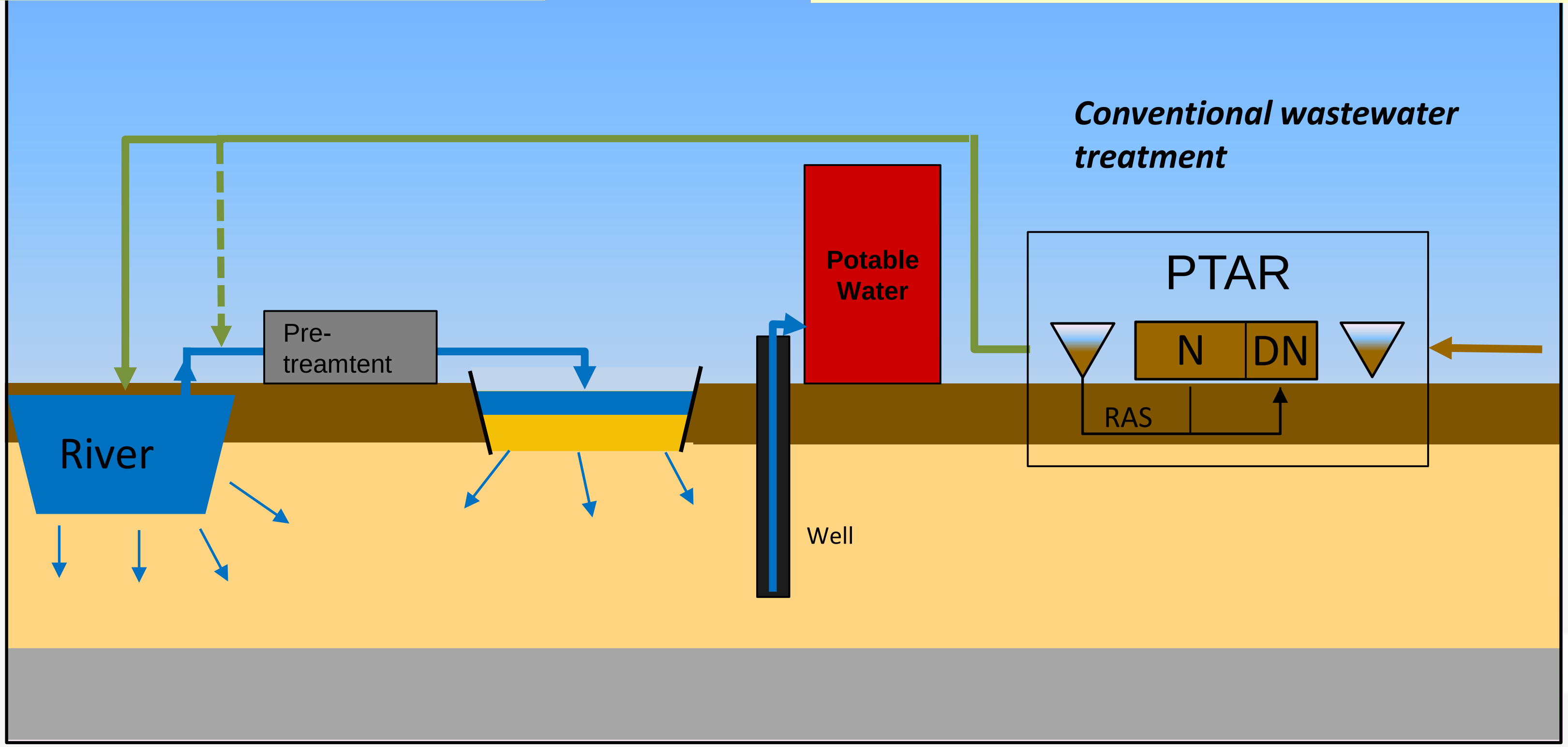
Prerequirements

- Suitable hydrogeological conditions
- Adequate water quality, especially if effluent from an WWTP is used
- Pre-treatment of toxic wastewater from industry

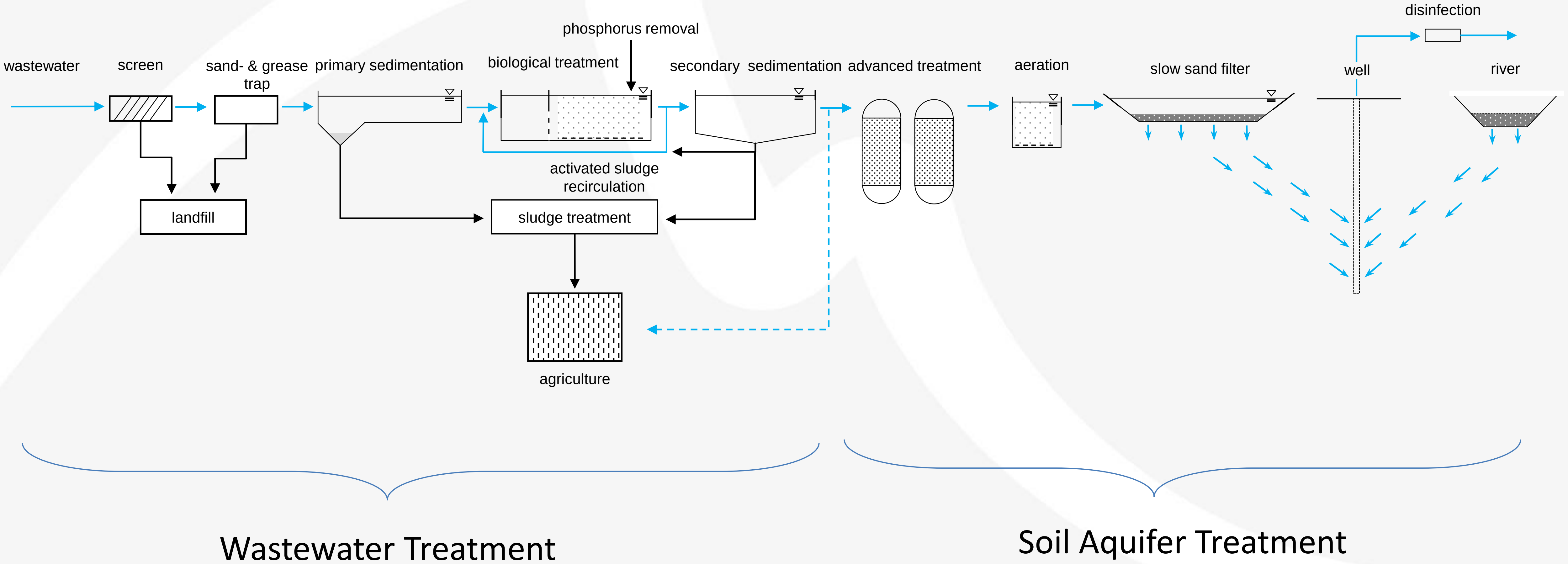
Integral concept in Lurin without expensive technology

Lurin Basin :
Proportion of purified wastewater in river water or infiltrated
= 5 - 100 %

Conventional :
Proportion of wastewater cleaned in the river water or infiltrated
= 5 - 50 %



General process, alternative with activated sludge



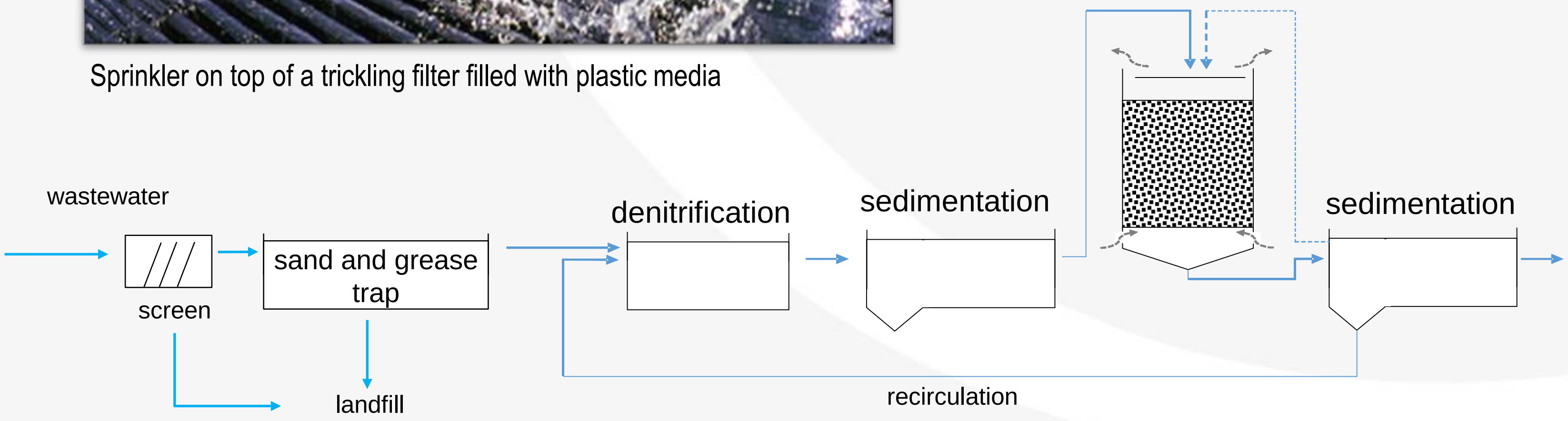
Economic concept with trickling filter

Topview of a trickling filter filled with lava rocks (Sindelfingen, Germany)

Sprinkler on top of a trickling filter filled with plastic media

Plastic media

Lava rocks



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Capactity Development in Peru

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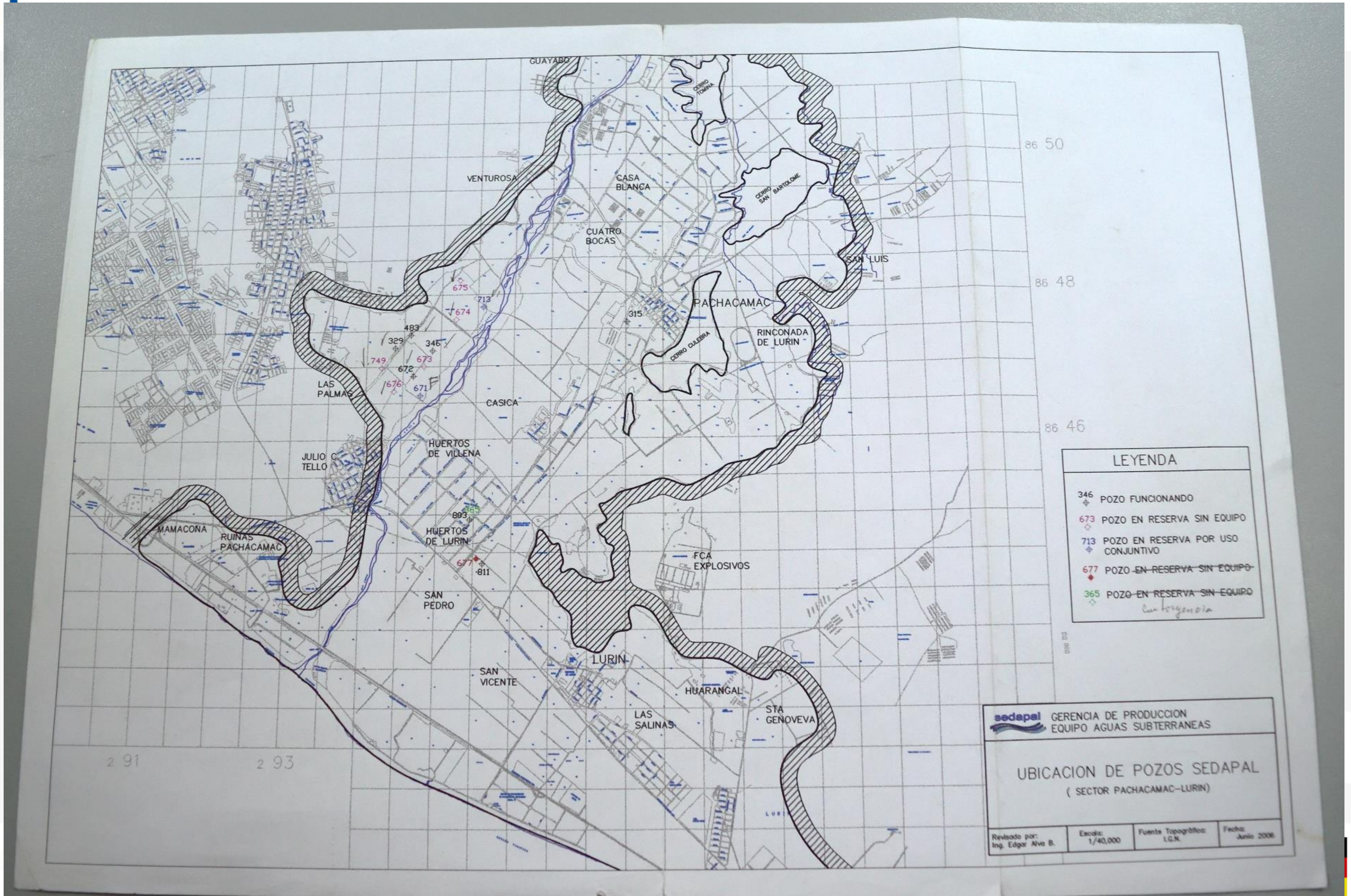
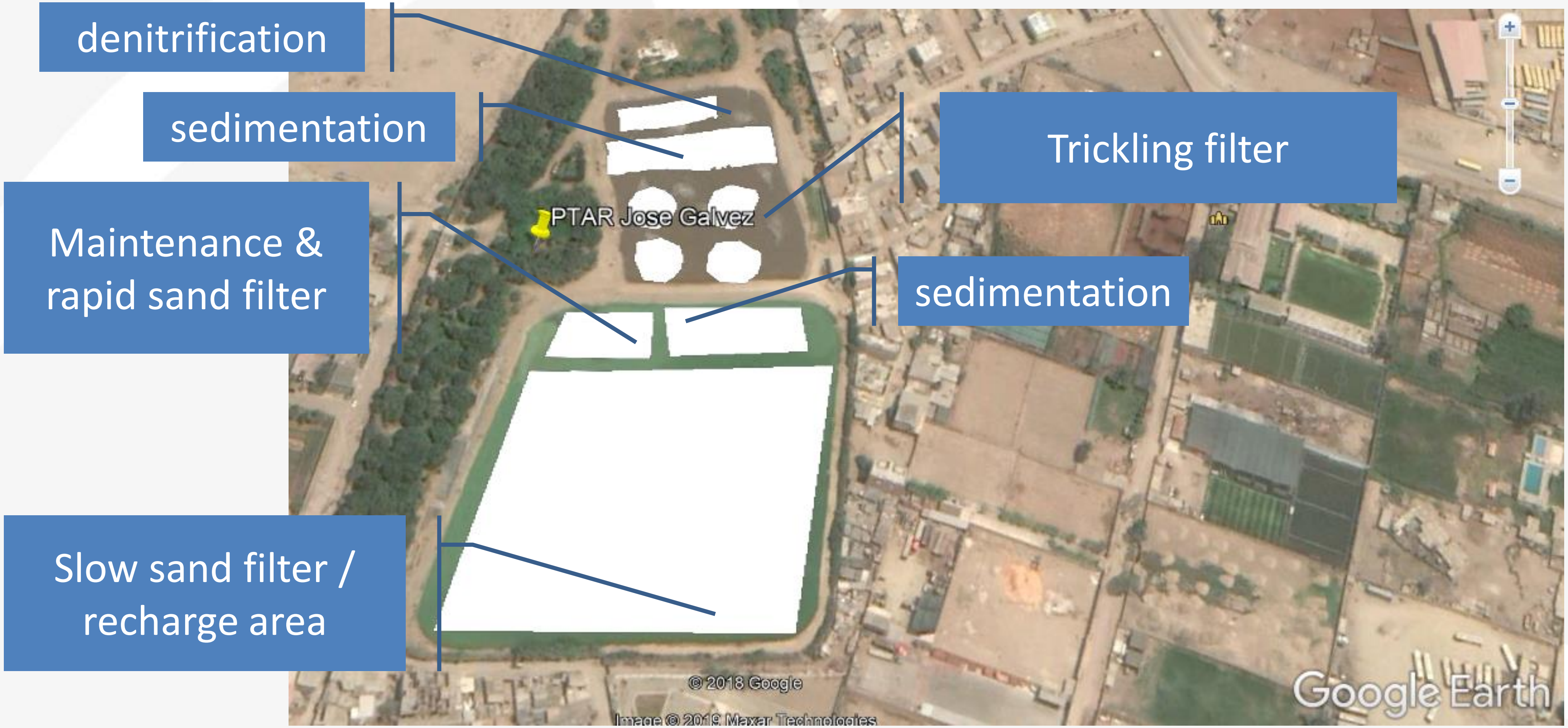
WWTP Jose Galvez

Location of PTAR Jose Galvez



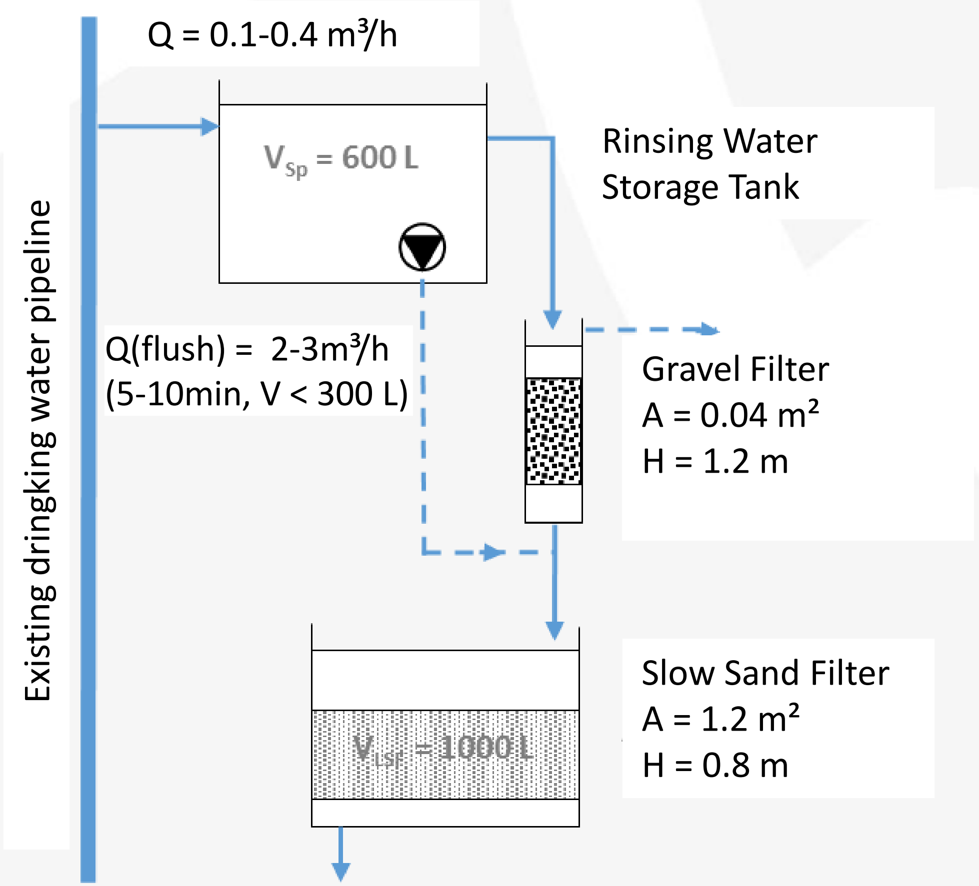
WWTP Jose Galvez: new design



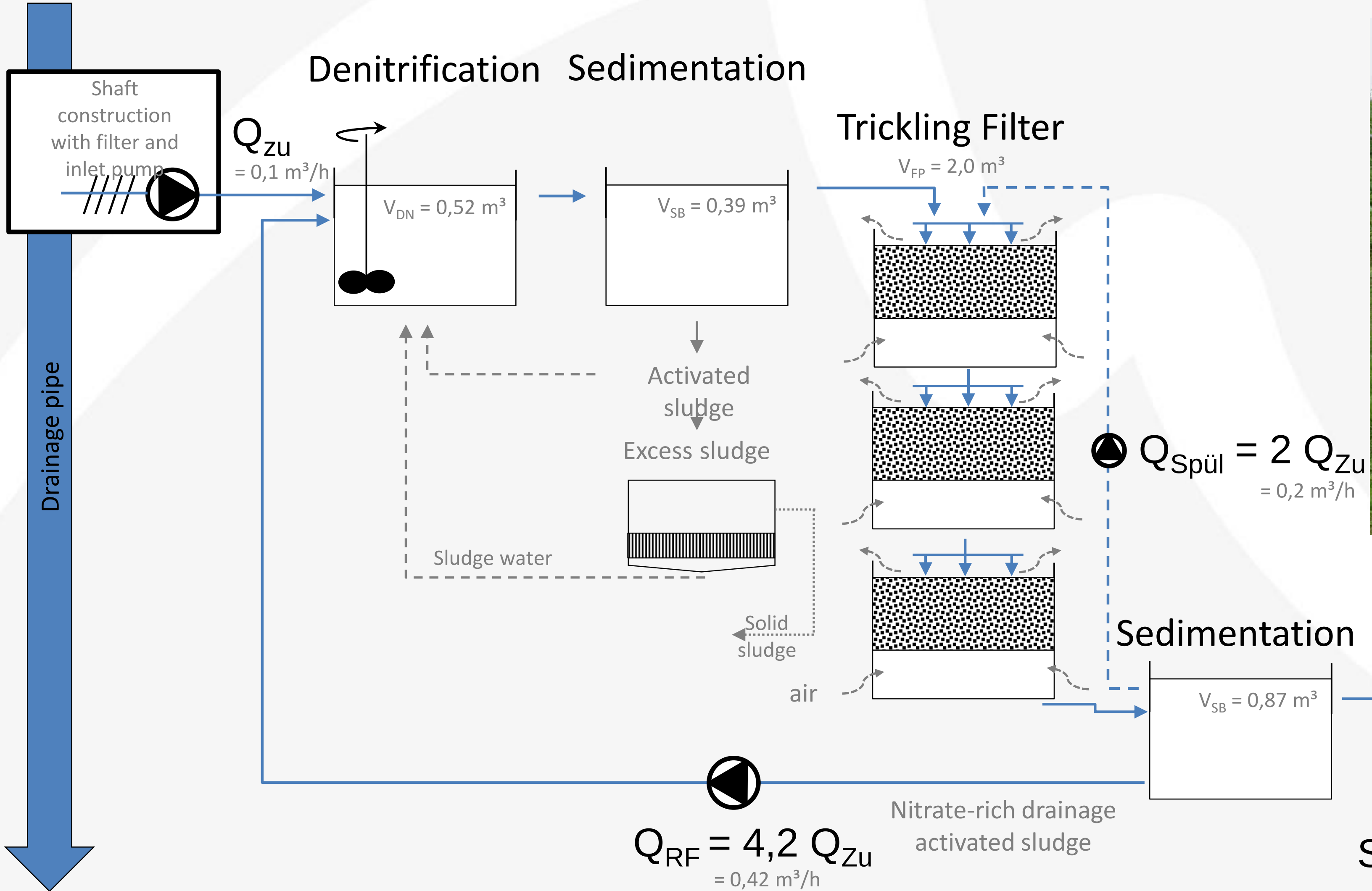
Case Study: Tupicocha

- Community located in the upper basin of the Lurin River
- ~ 3200 m above sea level
- ~ 800 inhabitants (population center)
- The main income of the population is agriculture
- Water supply infrastructure (pipes to the Ururí lagoon)
- Wastewater is collected in a sewer system and disposed of or used for irrigation during the dry season without treatment

Pilot Plant: Drinking Water Treatment



Pilot plant: Wastewater Treatment



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Case Study: Tupicocha

- *Construction of both pilot plants (from March 2020)*
- *Pilot plant monitoring*
  - *Physical parameters (on site: pH, conductivity, turbidity, temperature, etc.)*
  - *Chemical parameters (in situ: COD, NH_4-N, NO_3-N, Ptot, etc.)*
  - *Biological parameters (measurement in Germany, TZW)*
- *Preparation of operation and maintenance manual for drinking water and wastewater treatment systems*
- *Practical training for JASS operators in the operation of drinking water and wastewater treatment systems*
- *Training workshops on Municipal Technical Assistance (ATM) for municipal officials and Sanitation Management Board (JASS)*
- *Activities with the community on water care and water quality control in the home*

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Conclusions – Water Treatment

- The implementation of a wastewater management requires the participation of different actors
- Solving wastewater management problems is a long-term process
- It is important and necessary to plan for adequate WWTPs and to protect biological WWTPs from toxic substances or inhibitory shocks from industry
- In the Lurin River Basin there is an opportunity for the management of aquifer recharge

  Pre-requirements:

  - Adequate water quality, especially if effluent from the PTAR is used;
  - Pre-treatment of toxic waste water from industry

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