EPS Part 1. Introduction

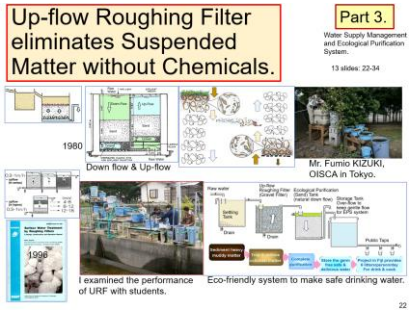
https://youtu.be/TtDTJaZdgtA

EPS Part 2. Mechanism

https://youtu.be/vURalvUF5qY

EPS Part 3. URF

https://youtu.be/zKRhAcoesVg



EPS Part 4. Bucket model

https://youtu.be/shl3fhmxQK4

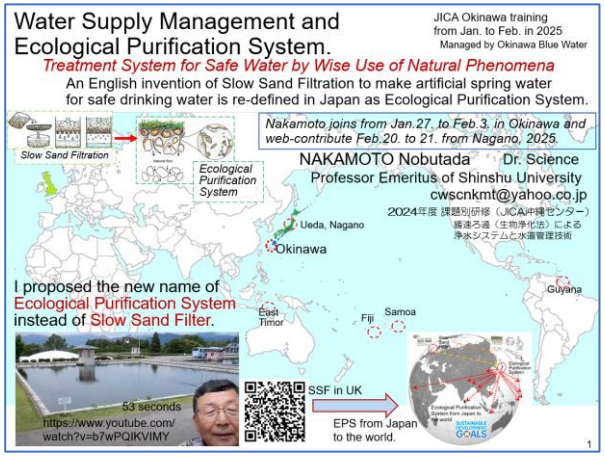
Water Supply Management and Ecological Purification System.

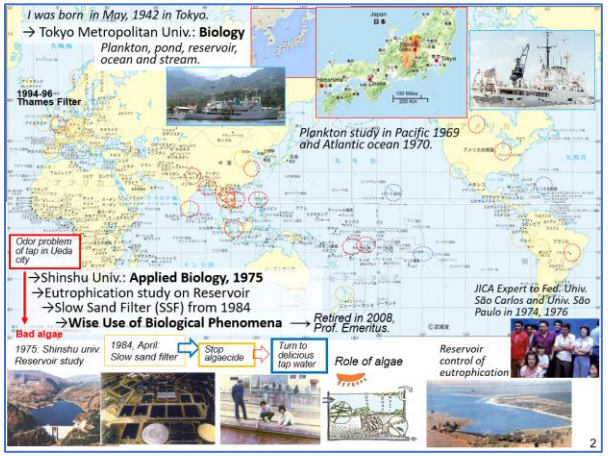
Part 1.

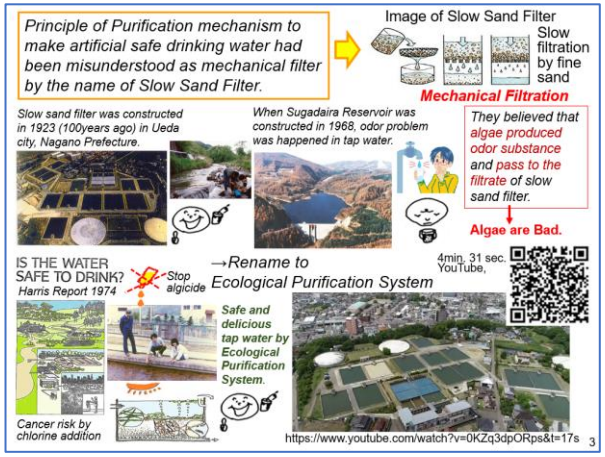
Introduction of JICA training by Nakamoto

7 slides: 1-7

Biologist of Nakamoto found SSF has been misunderstood by the name.







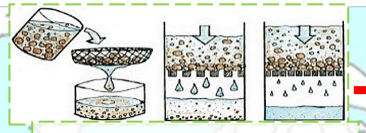
JICA training began in 2006 in Okinawa. This idea expands as our technology to the world.

Water Supply Management and Ecological Purification System.

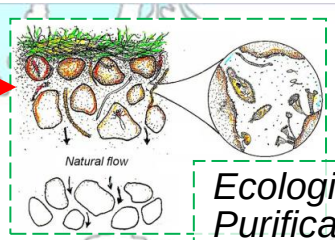
JICA Okinawa training
from Jan. to Feb. in 2025
Managed by Okinawa Blue Water

Treatment System for Safe Water by Wise Use of Natural Phenomena

An English invention of Slow Sand Filtration to make artificial spring water for safe drinking water is re-defined in Japan as Ecological Purification System.



Slow Sand Filtration



Ecological Purification System

Nakamoto joins from Jan.27. to Feb.3. in Okinawa and web-contribute Feb.20. to 21. from Nagano, 2025.

NAKAMOTO Nobutada Dr. Science
Professor Emeritus of Shinshu University
cwscnkmt@yahoo.co.jp

2024年度 課題別研修（JICA沖縄センター）
緩速ろ過（生物浄化法）による
浄水システムと水道管理技術

Ueda, Nagano

Okinawa

Guyana

East Timor

Fiji

Samoa

I proposed the new name of
Ecological Purification System
instead of Slow Sand Filter.

SSF in UK

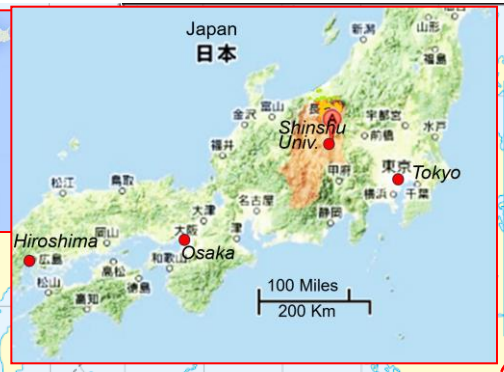
EPS from Japan to the world.

I was born in May, 1942 in Tokyo.

→ Tokyo Metropolitan Univ.: **Biology**

Plankton, pond, reservoir, ocean and stream.

1994-96
Thames Filter



Plankton study in Pacific 1969 and Atlantic ocean 1970.

Odor problem of tap in Ueda city

→Shinshu Univ.: **Applied Biology, 1975**

→Eutrophication study on Reservoir

→Slow Sand Filter (SSF) from 1984

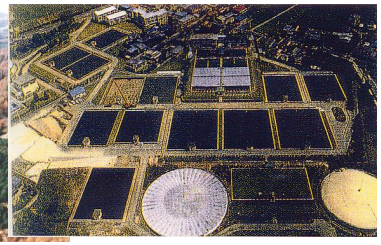
→**Wise Use of Biological Phenomena** ⟶ *Retired in 2008, Prof. Emeritus.*

JICA Expert to Fed. Univ. São Carlos and Univ. São Paulo in 1974, 1976

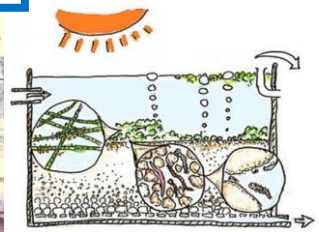
Bad algae

1975: Shinshu univ. Reservoir study

1984, April: Slow sand filter ⇨ *Stop algaecide* ⇨ *Turn to delicious tap water*



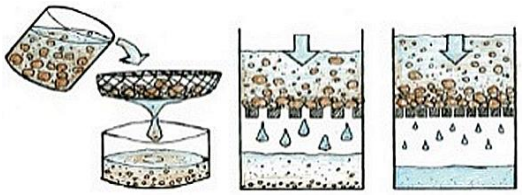
Role of algae



Reservoir control of eutrophication

Principle of Purification mechanism to make artificial safe drinking water had been misunderstood as mechanical filter by the name of Slow Sand Filter.

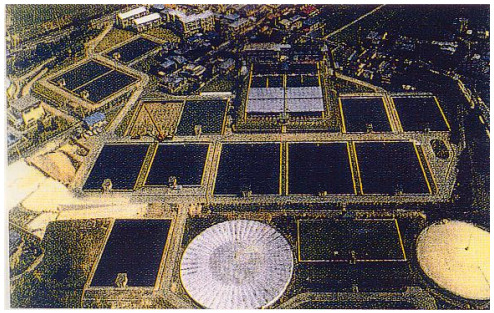
Image of Slow Sand Filter



Slow filtration by fine sand

Mechanical Filtration

Slow sand filter was constructed in 1923 (100years ago) in Ueda city, Nagano Prefecture.



When Sugadaira Reservoir was constructed in 1968, odor problem was happened in tap water.

They believed that algae produced odor substance and pass to the filtrate of slow sand filter.

Algae are Bad.

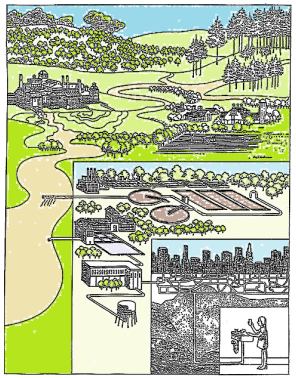
IS THE WATER SAFE TO DRINK?

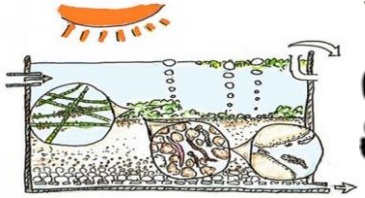
Harris Report 1974

Stop algicide

→Rename to Ecological Purification System

4min. 31 sec. YouTube,





Safe and delicious tap water by Ecological Purification System.

Cancer risk by chlorine addition

https://www.youtube.com/watch?v=0KZq3dpORps&t=178

JICA EPS training in Miyako-Jima, in Aug. 2011.

For rural people from 2013 in Fiji.

To make artificial spring water from surface water.

EPS Nagano Japan → Miyako-Jima Okinawa → Fiji Samoa → Pacific islands

EPS for Fiji village

SPREP
Secretariat of the Pacific Regional Environment Programme

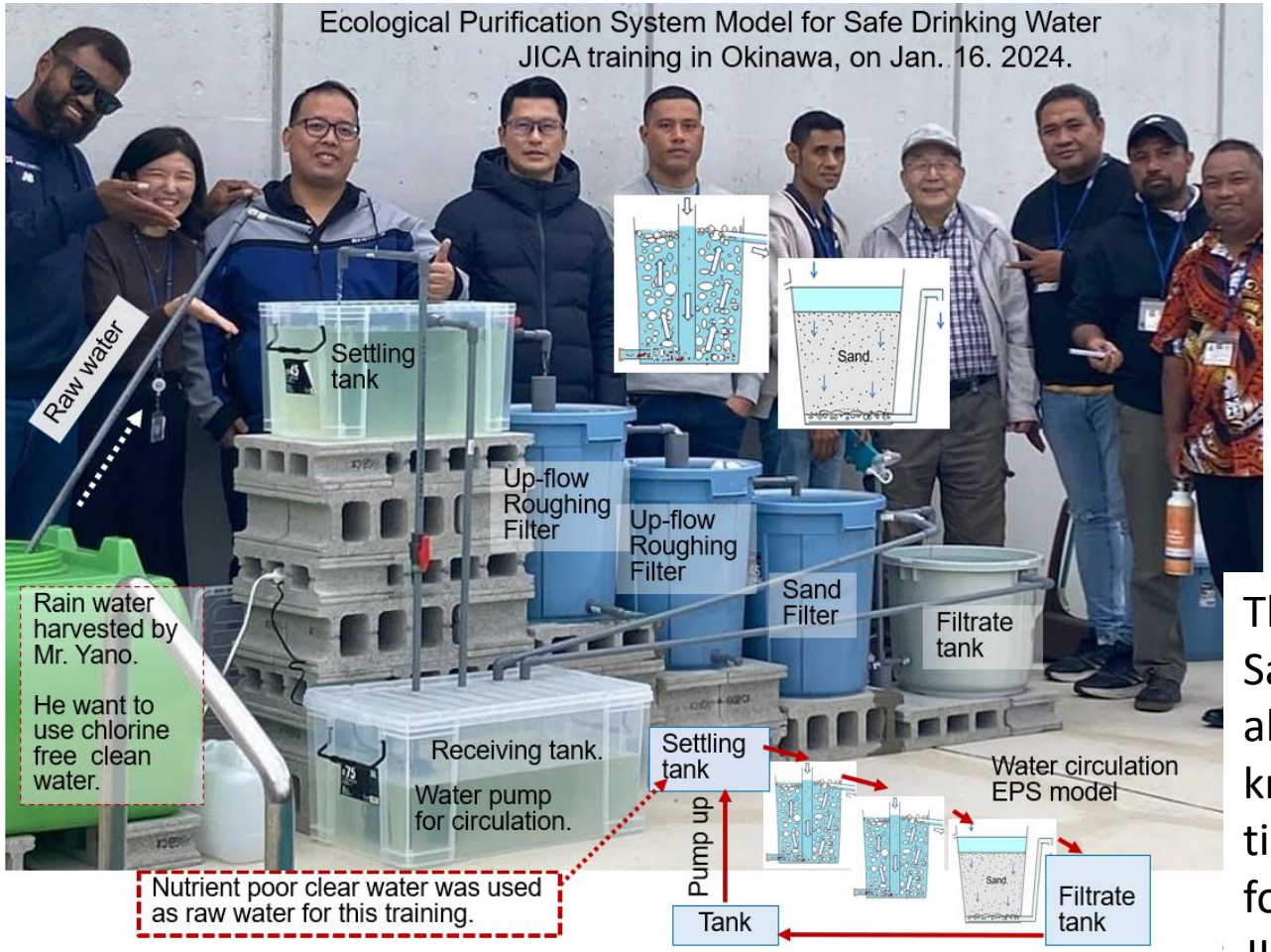
Pacific Regional Environment Programme

太平洋地域環境計画事務局

https://www.sprep.org/

Safe water access in rural areas to build climate resilience in Fiji, Papua New Guinea and Solomon Islands

https://www.sprep.org/news/safe-water-access-in-rural-areas-to-build-climate-resilience-in-fiji-papua-new-guinea-and-solomon-islands



2024/09/15

Thanks to Dr. Nakamoto, Yano San, Maho San, Mariko San and all EPS member for the knowledge & support all this time. I feel proud & thank full for the knowledge I gain from JICA KCCP Program. In addition, I want to share to all of you, up-flow filtration method is superb, value for money, maintenance & stress free as to compare to normal downflow filtration. From Mr. Mohamed Zairi, a trainee from Malaysia.

After 5months, still crystal-clear water produce


Sedimentation tank
Up-flow Roughing Tanks
Slow sand filter
Filtrate tank


Circulate water from filtrate tank
Raw water
Slow sand filter
Filtrate tank


Circulate system model of Ecological Purification System for safe drinking water.
Sedimentation tank (Raw water)
Up-flow Roughing Filter (URF) Tanks
Slow sand filter
Filtrate tank


Washing the sand


Up-flow Roughing Filter (URF) Tanks


Bottom drainage pipe of the slow sand filter

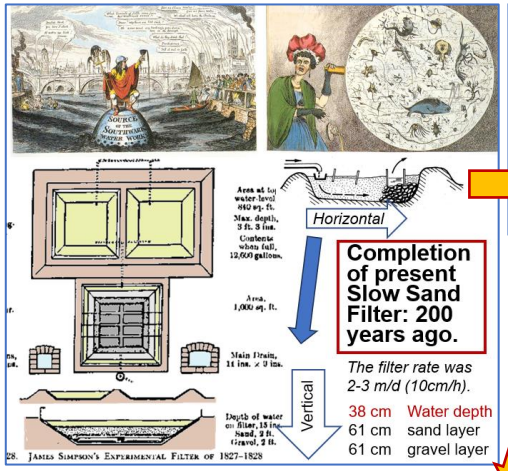

Pump for circulation
Inside of Filtrate tank

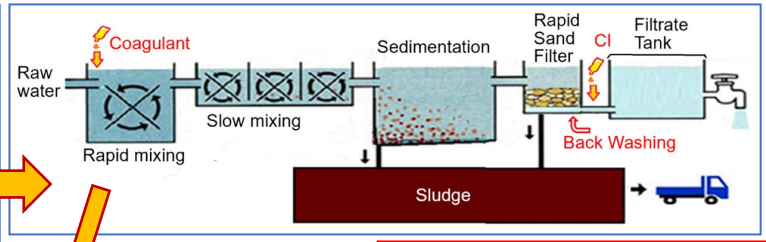

filtrate

Invention of **SSF** in UK and a new technology of **R**apid **S**and **F**ilter for turbid water in USA. Refocus to SSF as risk free safe treatment system.

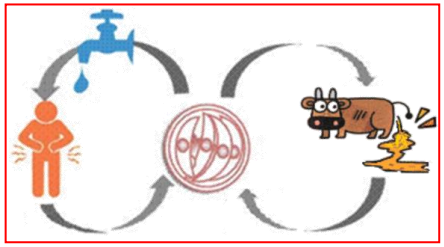
Part 2.

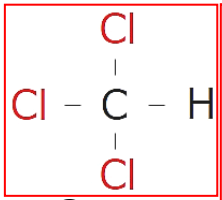
Water Supply Management and Ecological Purification System.
14 slides: 8-21





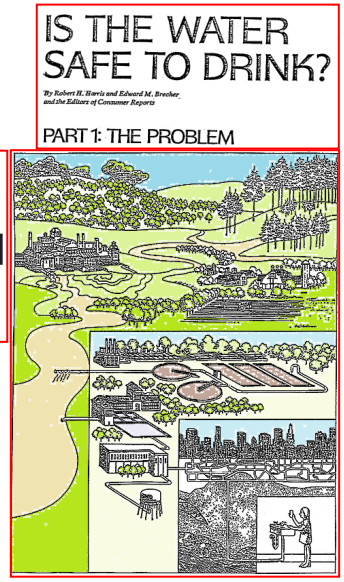
RSF was a commercial Filter.

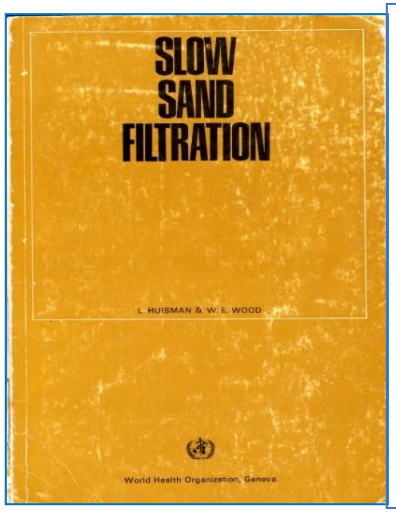




Cancer risk

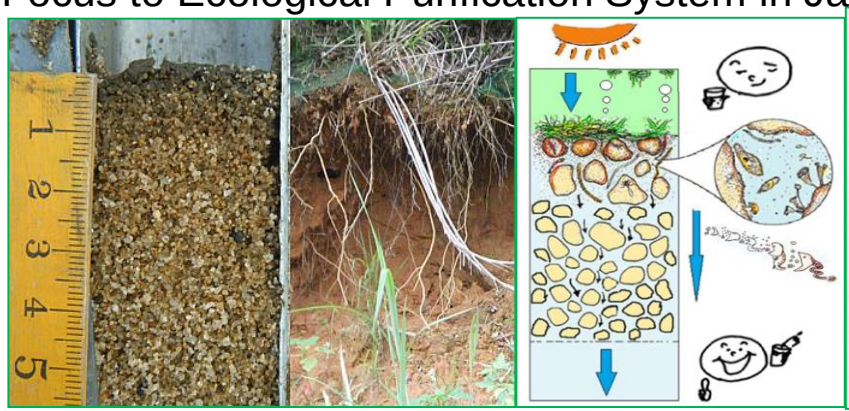
Crypto-sporidium outbreak





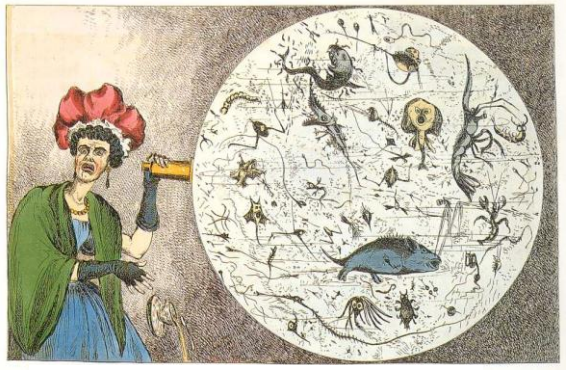
WHO published a manual of Slow Sand Filtration which is chemical free treatment for safe drinking water in 1974.

Focus to Ecological Purification System in Japan

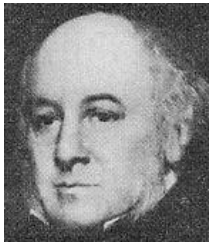


Delicious spring water

During the Industrial Revolution, the population gathered in cities. The rivers in cities were polluted.



James Simpson examined vertical type of slow sand filter from 1827-1828 and made a practical plant in 1829.



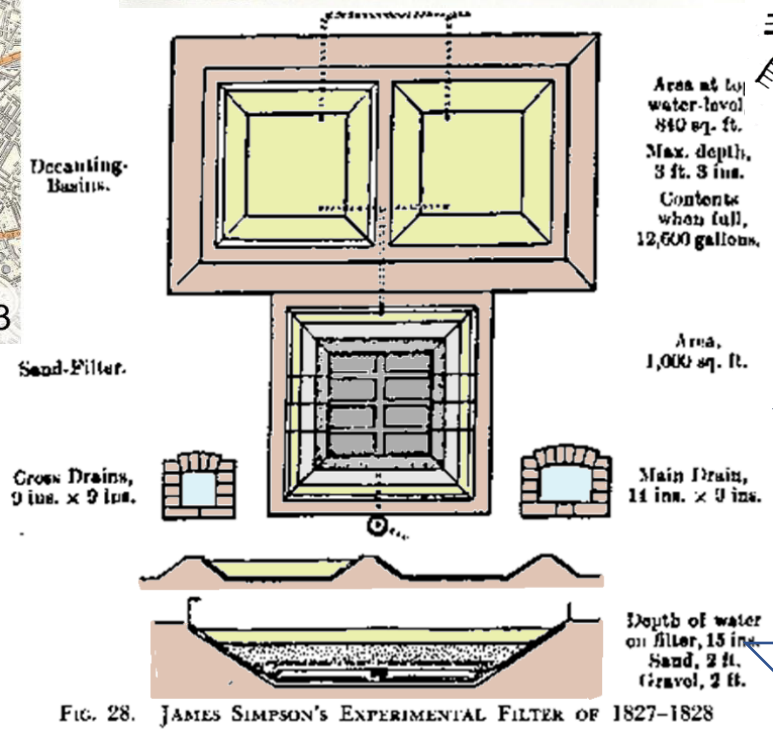
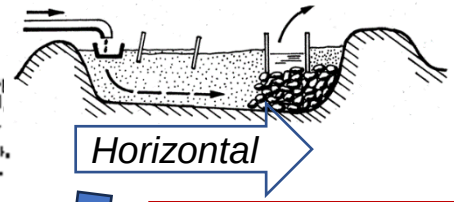


FIG. 28. JAMES SIMPSON'S EXPERIMENTAL FILTER OF 1827–1828

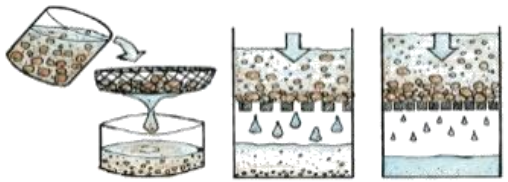


Completion of present Slow Sand Filter: 200 years ago.

The filter rate was 2-3 m/d (10cm/h).

Vertical

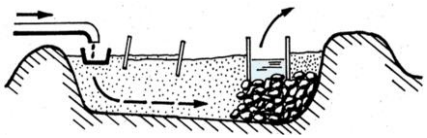
38 cm	Water depth
61 cm	sand layer
61 cm	gravel layer

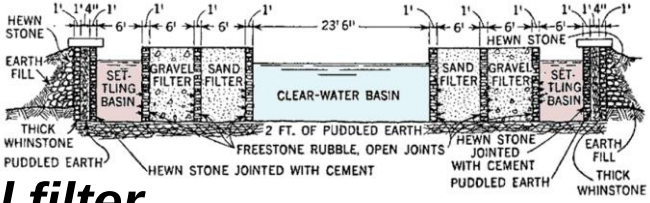


They believed that **Slow Sand Filter** purified by **slow** filtration with **fine sand**.

They believed this was **mechanical reduction** with **fine sand**.

Vertical of slow sand filtration was the key.





Horizontal filter

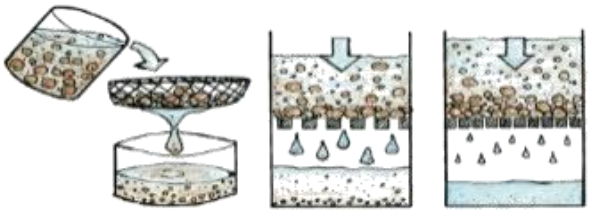


Image of Slow Sand Filter.

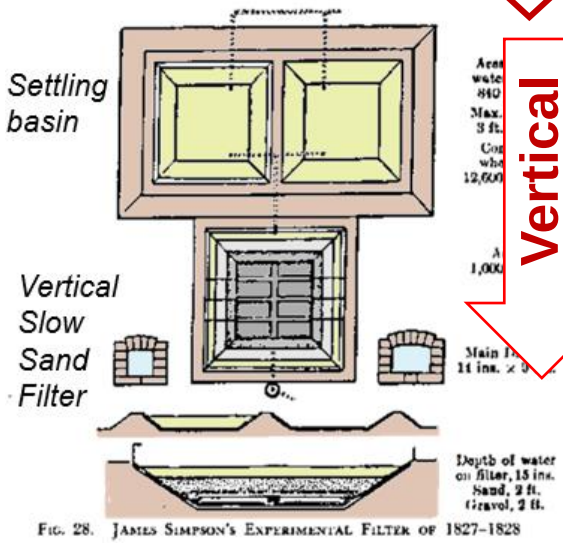


Fig. 28. James Simpson's Experimental Filter of 1827–1828

Vertical

Shallow depth

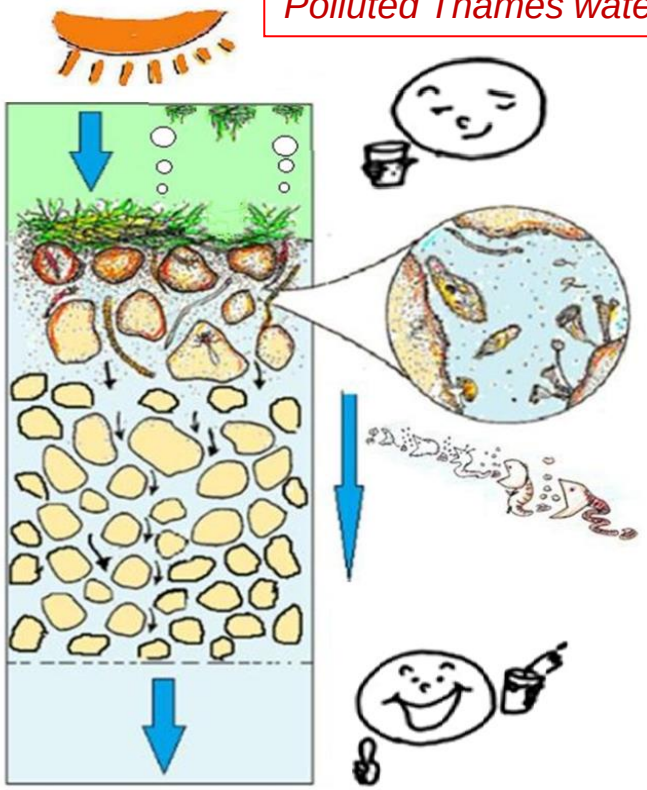
38 cm	Water depth
61 cm	sand layer
61 cm	gravel layer

Filter rate was 2-3 m/d (10cm/h).

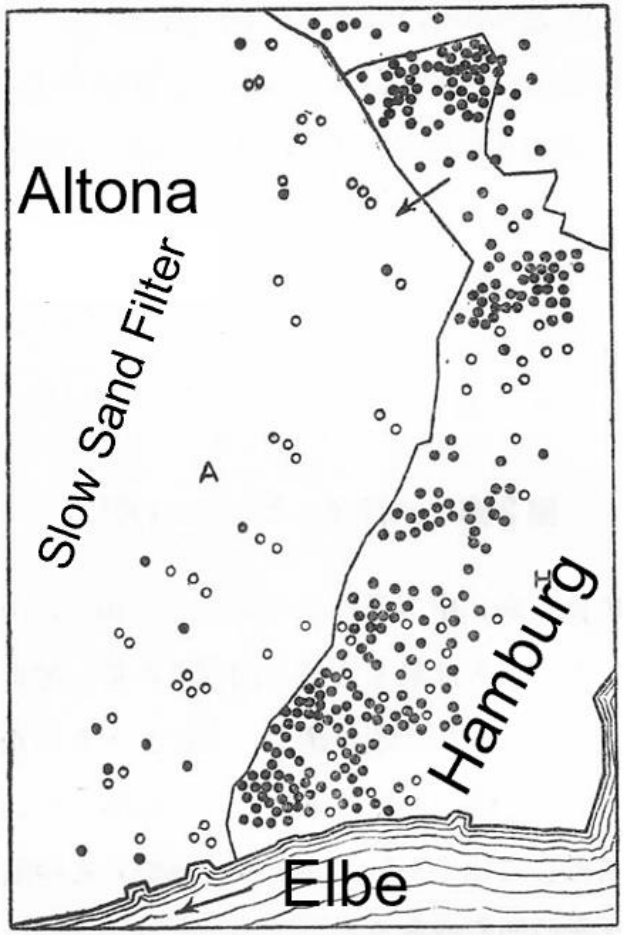
Simpson's filter is vertical. The sand will not move even if the flow speed changes high or slow.

The shallow depth and the vertical flow allowed creatures to be active and safe near the surface of sand layer.

Polluted Thames water



Germ free filtrate



The clear proof of the filtration was provided in **1892**. This was **133 years ago**. **Hamburg** suffered from a cholera epidemic that infected and caused more than 7,500 deaths, while **Altona** was few.

Dr. **Robert Koch** tested the bacteria in the water with slow sand filtration. When bacterial counts were less than ***100 colony-forming units per mL*** (cfu/mL), epidemics of cholera and typhoid were reduced.

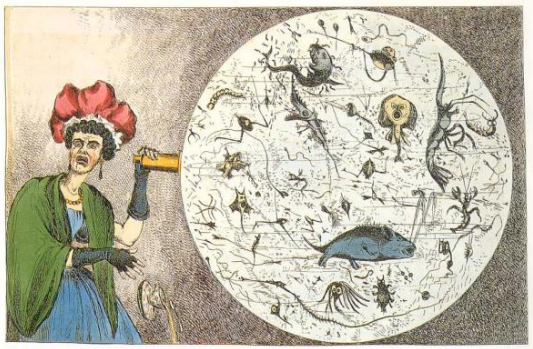
Present WHO safe standard for bacteria is referred to this 100 cfu/mL by Dr. R. Koch.

*They believed SSF was **mechanical reduction** of impurity by **slow** filtration with **fine sand**.*

*This idea is so called **Acceptable Risk**.*

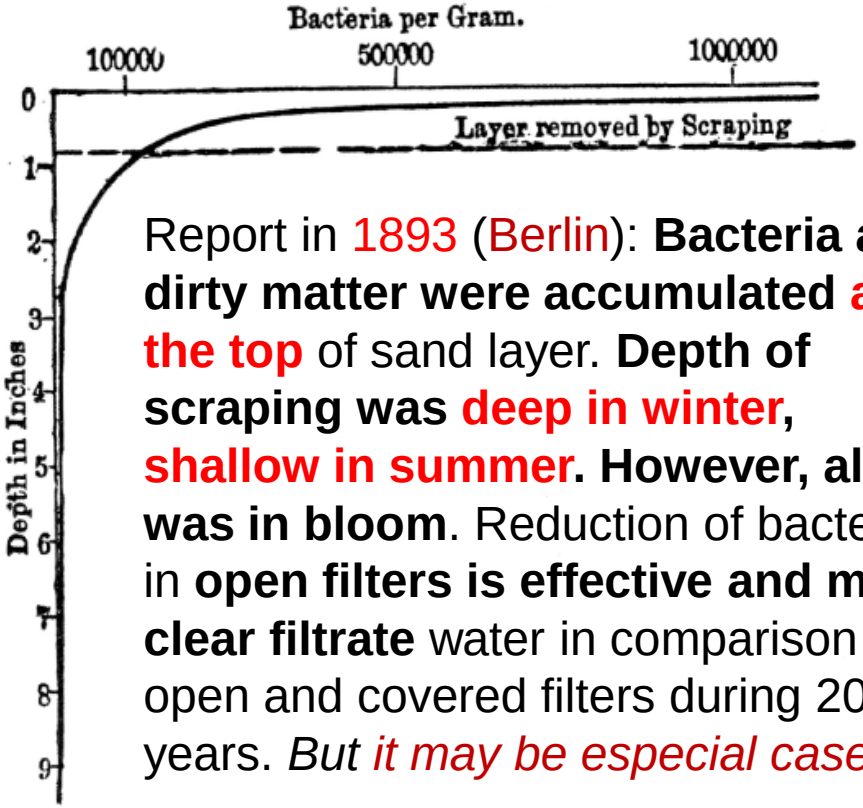
Wash our hands!
Reduce the risk.

It was found that SSF could eliminate pathogens and spread all over the world as English Filter.

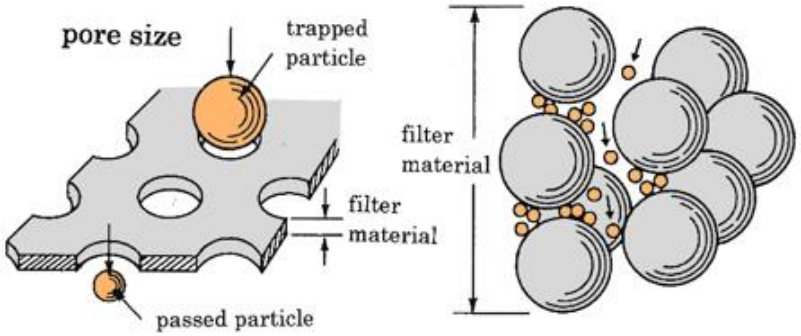


Monster Soup commonly called Thames Water on the Metropolitan Water supply in 1828.

1832 : The great common sewers discharged into the Thames river. This was the Source of the Southwark Water Works.



Report in 1893 (Berlin): **Bacteria and dirty matter were accumulated at the top** of sand layer. **Depth of scraping was deep in winter, shallow in summer. However, algae was in bloom**. Reduction of bacteria in **open filters is effective and more clear filtrate** water in comparison with open and covered filters during 20 years. *But it may be especial case.*

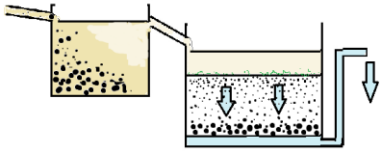


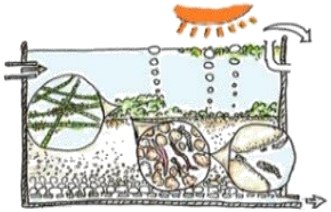
Removal of pathogens is not explained by these phenomena in comparison with size of microbial pathogens and opening space of sand grains. We can operate the filter without any clog during long filter run. **We can not explain the reduction mechanism of pathogens by physical phenomena.**

It was notified to **biological phenomenon**. However, he said that **physical process was main.**

M.N.Baker 1949. The Quest for Pure Water

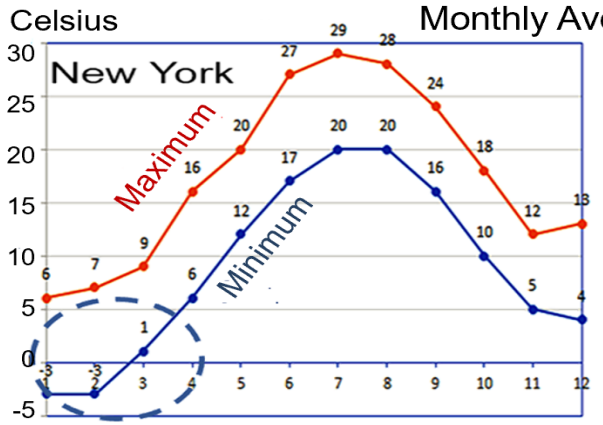
Covered filter,
Albany, NY, US

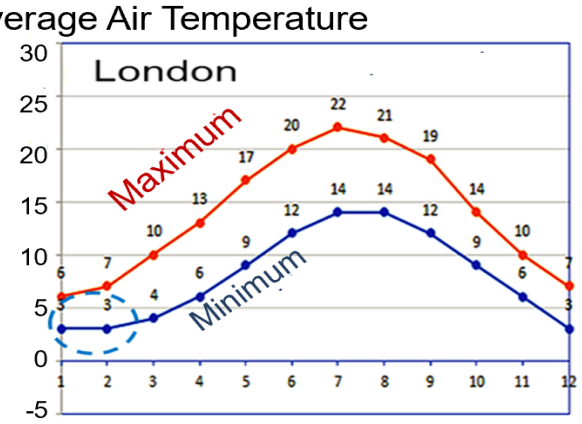




Safe drinking water was made by the biological activity.

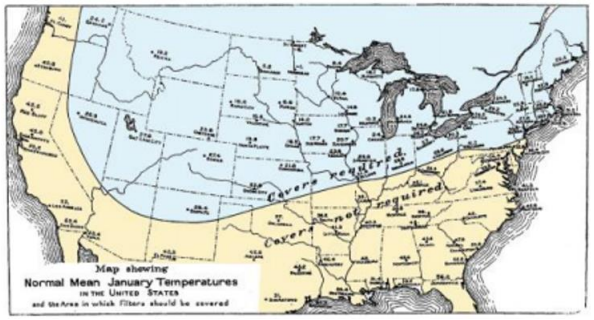
The average temperature in January is below 0℃.
Covered filter was required.



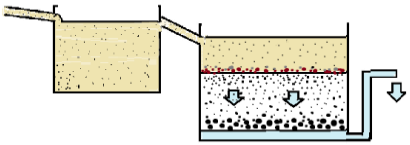


New York has cold winter and hot summers.

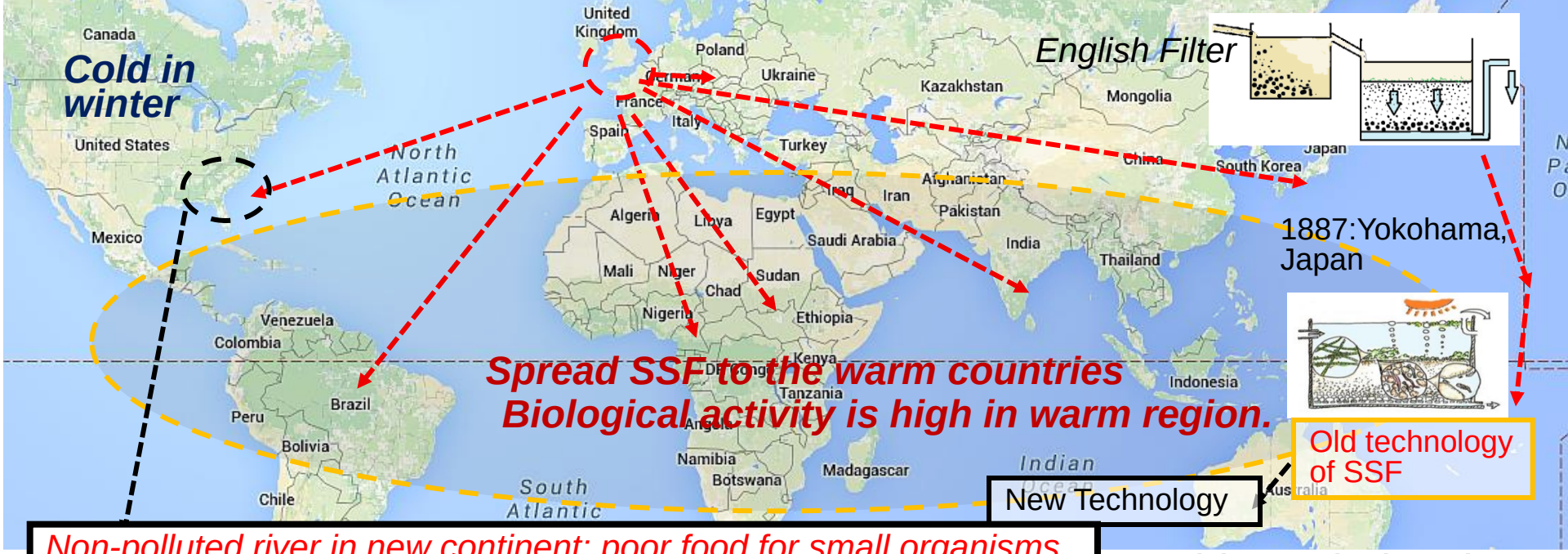
London is not cold even in winter due to the warm current.



The turbidity of rivers in the continental plain is fine and difficult to sink.



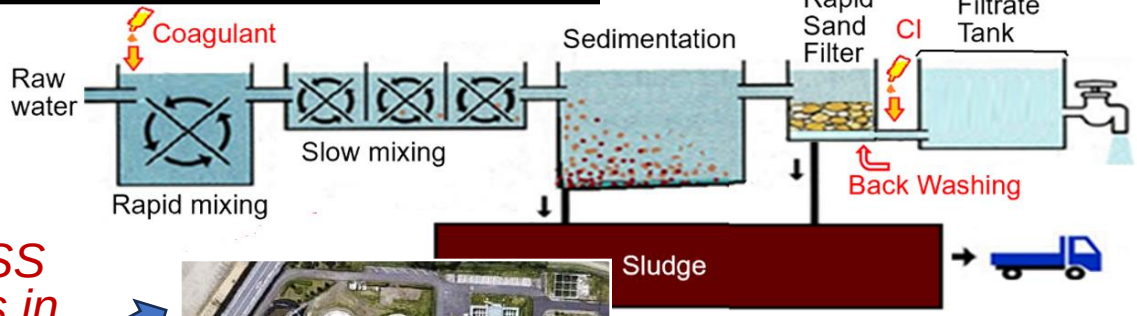
Winter temperatures in North America were cold and biological activity was weak. And the viscosity of water was high in winter.



Non-polluted river in new continent: poor food for small organisms
1882: NJ, USA, Coagulation treatment : Origin of Rapid sand filter
1910: NJ, USA, Chlorine treatment Completion of **American Filter**

Rapid Sand Filter is chemical treatment.

Fine much suspended solid

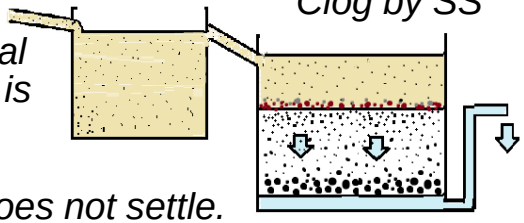


Non-polluted water contains fine SS and poor food for small organisms in continent rivers in USA.

Clog by SS

*Biological **activity** is weak in winter.*

Does not settle.

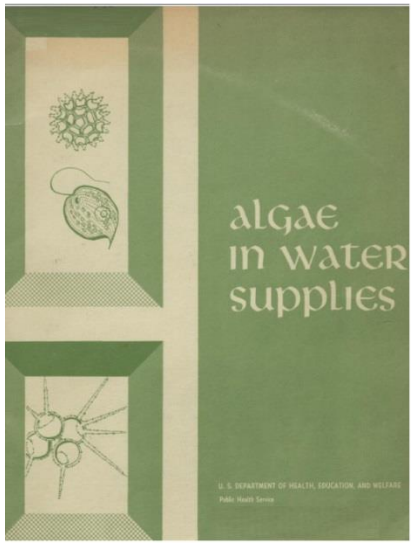


Filter easy to brock by suspended solid.

People loves new technology.

RSF spread to the world.

This is American Commercial Filter.

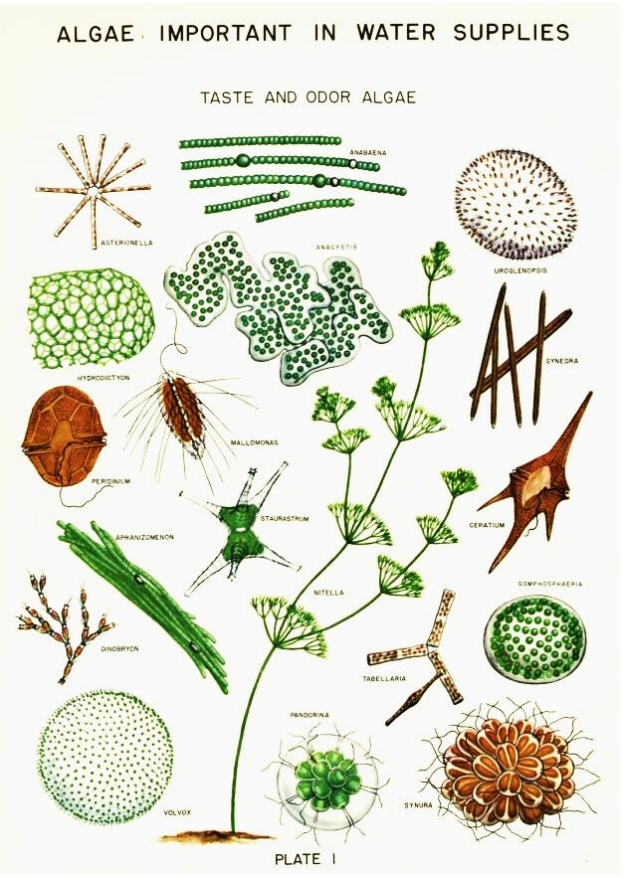


Algae in water supplies: an illustrated manual on the identification, significance, and control of algae in water supplies. C. M. Palmer 1962

http://digital.library.unt.edu/ark:/67531/metadc9129/m1/

Algae had been trouble for the conventional filter (rapid sand filter) in US. Taste and odor algae, filter clogging algae are important in water supplies (Rapid Sand Filter).

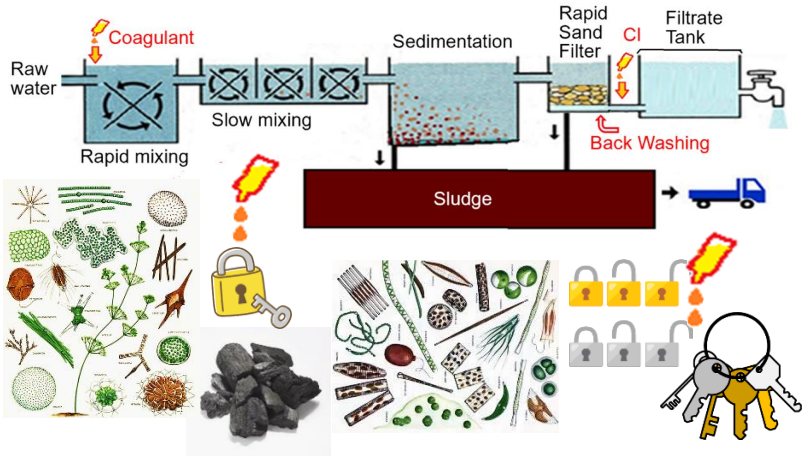
In slow sand filter, the algae and other aquatic microorganisms may play a ***useful part in the treatment process.***



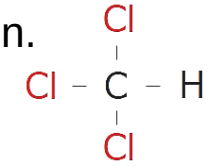
They form a loose, slimy layer over the surface of the sand and act as a filter. The algae in this layer release oxygen during photosynthesis, and the oxygen in turn is utilized by aerobic saprophytic bacteria, fungi, and protozoa which establish themselves in and on the filter. This permits the decomposition or stabilization of the organic material that was present in the raw water. In p.22.

Main focus of this book is ***how to kill algae*** *for* ***Rapid Sand Filter****.*

Refocus to Slow Sand Filtration as chemical free treatment instead of chemical treatment of Rapid Sand Filter.

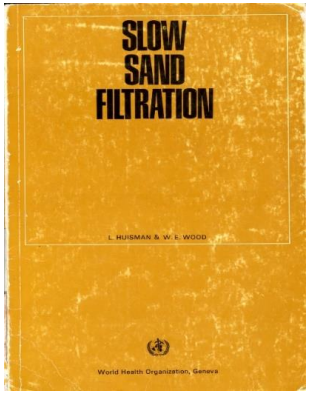


Rachel Carson 1962
Silent Spring.
Pesticides and herbicides have been pointed out the risk of chemical hazards through biological concentrations through the food chain.

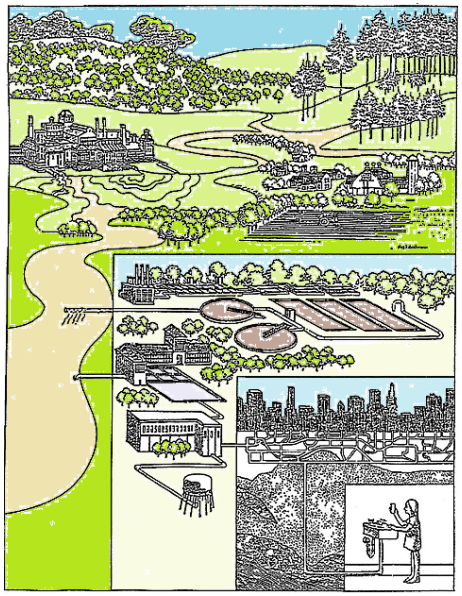


That was Chlorine compound.

Filter problem : Odor, taste and filter clog problem caused by algae. New chemicals were developed one after another.



WHO published a manual of Slow Sand Filtration which is chemical free treatment for safe drinking water in 1974.

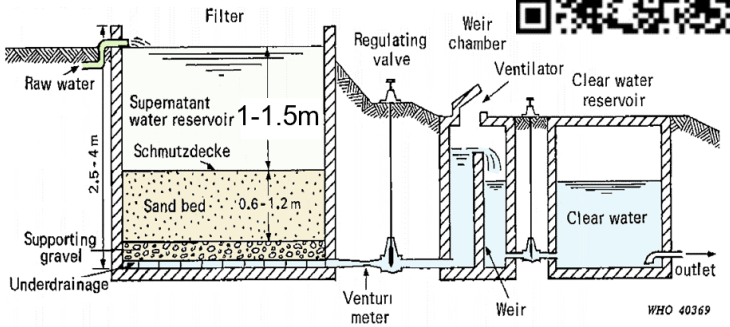


IS THE WATER SAFE TO DRINK?

By Robert H. Harris and Edward M. Brecher and the Editors of Consumer Reports

PART 1: THE PROBLEM

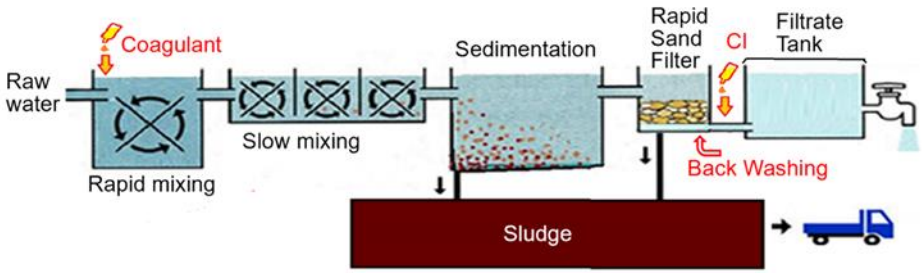
Robert H. Harris et. al. 1974 Consumer Report.
Chlorine sterilization is essential for rapid filtration of chemical treatment. There is a warning that trihalomethane, which are carcer risk substances, are generated by adding chlorine.

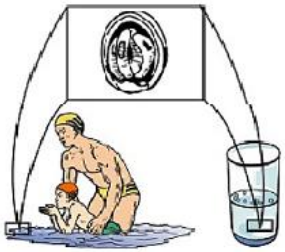


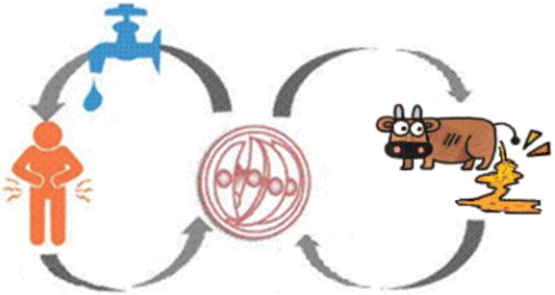
*Water depth is **1-1.5 m**.*

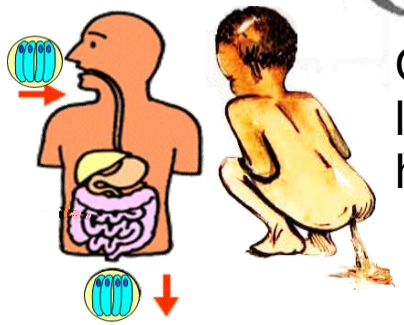
*Simpson filter in 1827 is **38 cm**.*

The diarrhea-causing crypt parasites passed through the backwashing process of the rapid sand filtration.









Only mammals with long intestinal tracts had watery diarrhea.

It became clear that RSF was a deadly process.

In April 1993, an outbreak of massive diarrhea in 400,000 people due to Crypto-protozoa occurred in Milwaukee, USA. The dormant protozoa had thick shells and passed through the rapid filter ponds and were not killed by the final chlorine.

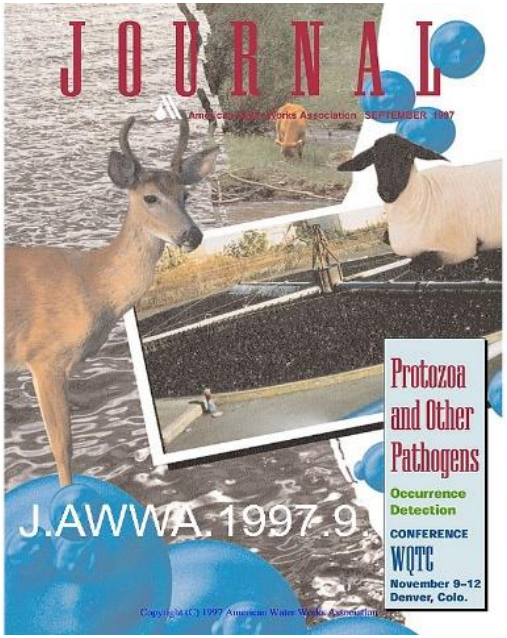
In In September 1994, the American Water Works Association held a slow filtration workshop in Salem, Oregon.

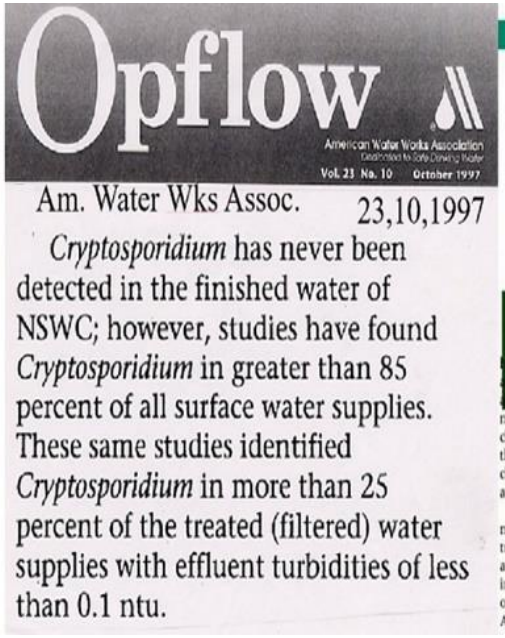
They said Refocus, Re-discovery, Timeless Technology for Modern Application.

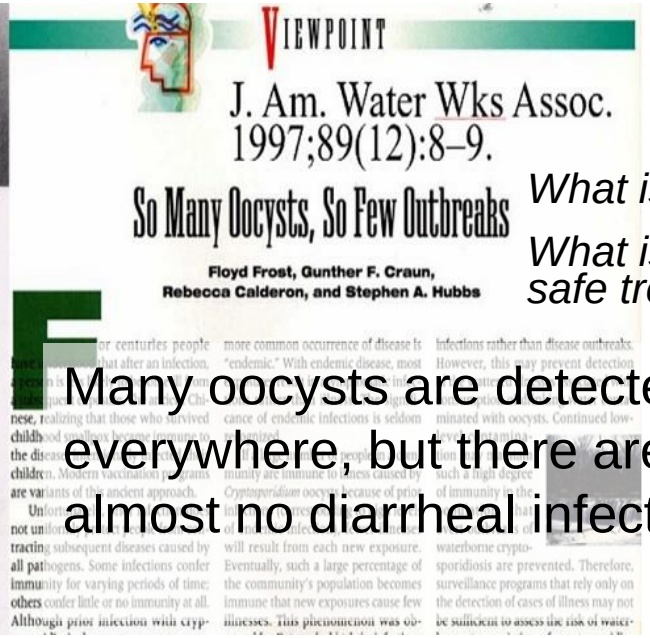
However, people loves New Technology.

With slow sand filtration, they can trust that it will be absolutely safe even if it is contaminated with crypto-protozoa. SSF plant was constructed in 1997 at Central Bridge, NY, USA.

Crypto-protozoa are detected in more than 85% of surface water, but no crypto-protozoa are detected in treated water.







What is real risk?

What is more safe treatment?

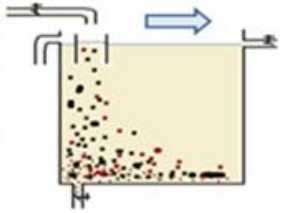
Many oocysts are detected everywhere, but there are almost no diarrheal infections.

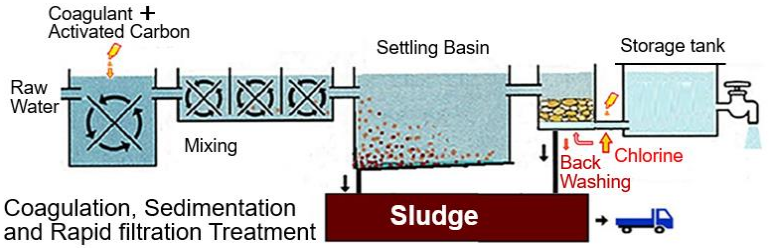
Turbidity mg/L

500
200
100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
0.001
0.0005
0.0002
0.0001

Storm event

Major turbid matter in mountain stream is easily set within several hours.





Coagulant＋Chlorine Rapid Sand Filter

2 degrees Jap. standard

After Crypto outbreak.

Recommended to 0.1 degrees

SS passes by backwash.

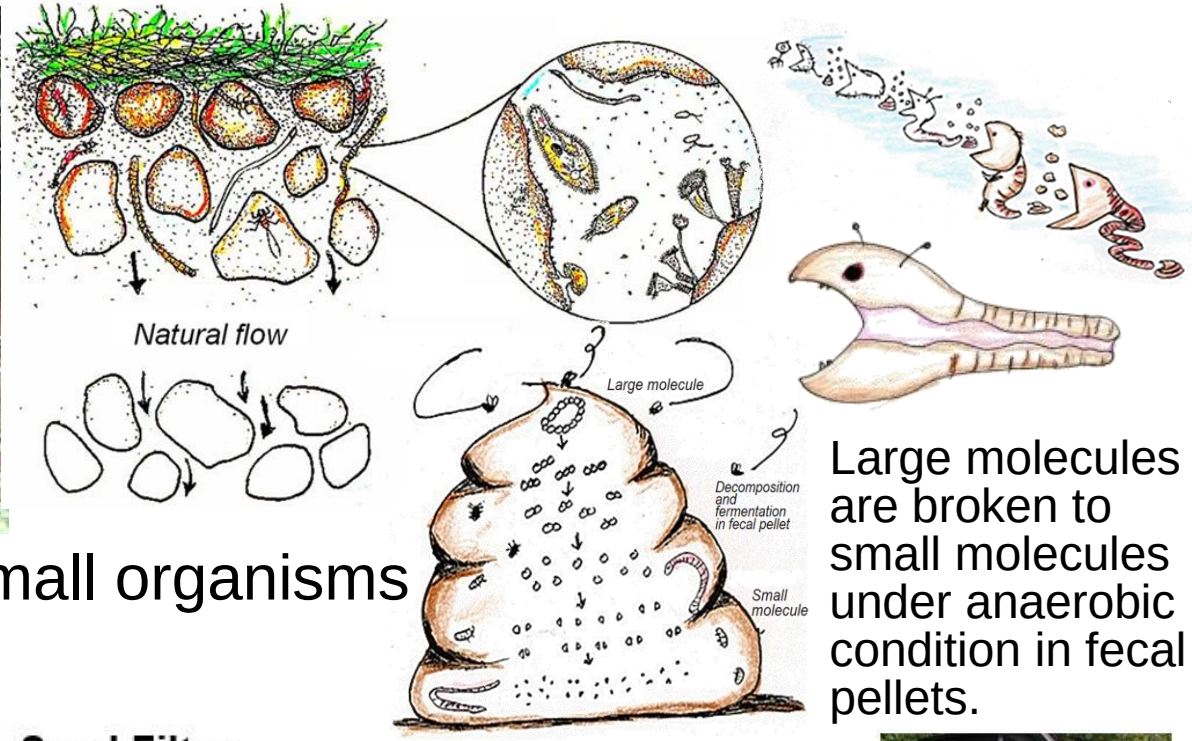
Chlorination is essential.

Purified by small organisms

Natural spring

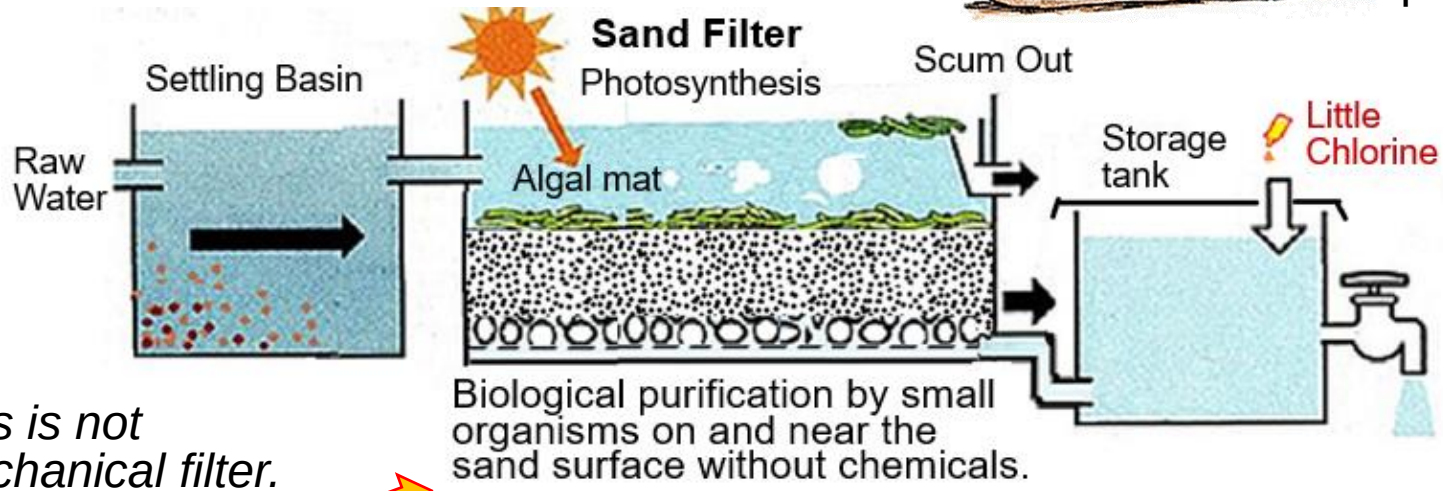
Super clean and delicious.

Artificial Natural spring water

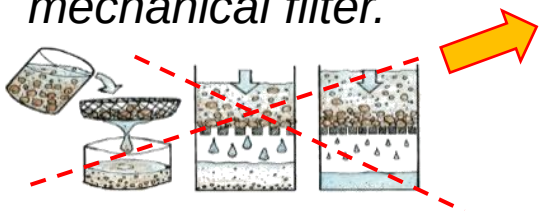


Large molecules are broken to small molecules under anaerobic condition in fecal pellets.

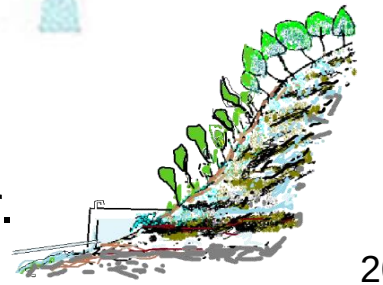
Purification is done by small organisms near the surface.



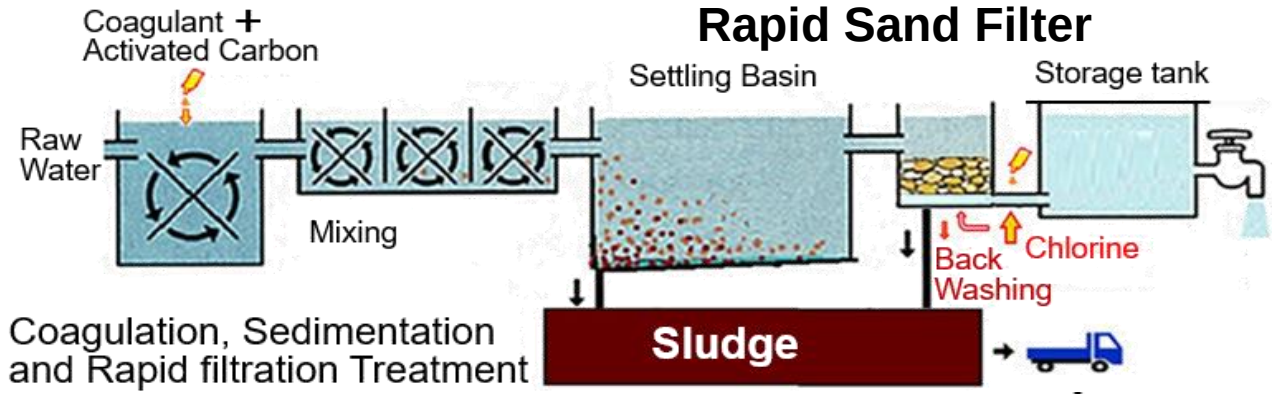
This is not mechanical filter.



Function of Slow Sand Filter is to make an artificial natural spring water.

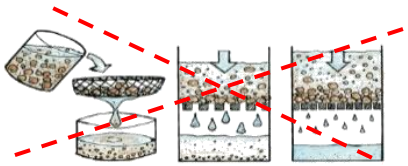


Rapid Sand Filter



Coagulation, Sedimentation and Rapid filtration Treatment

The turbidity is reacted with a flocculant to remove the precipitate, followed by rapid filtration. Remove turbidity by backwashing. A large amount of sludge treatment is required.



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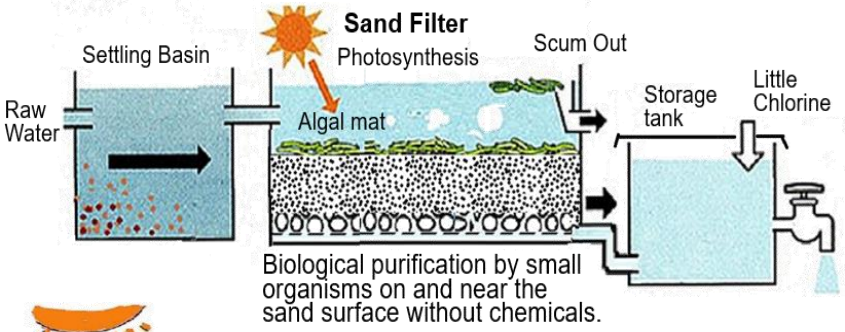
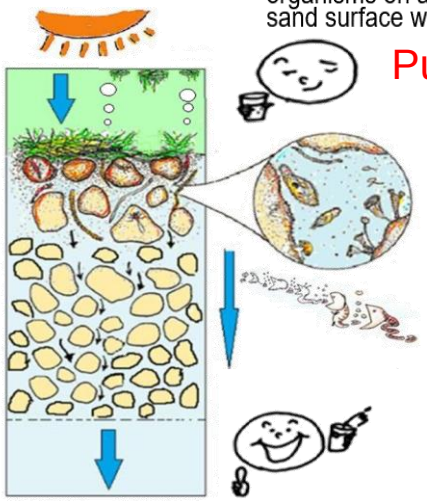
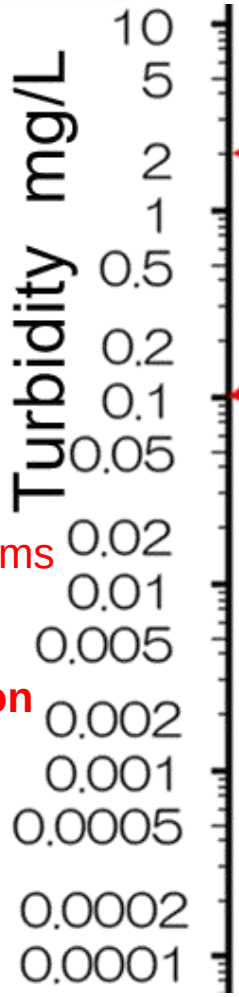




Purified by small organisms

Ecological Purification System

Real Purification of decomposition is done by small organisms without chemicals.



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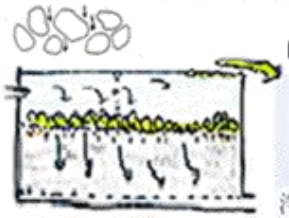


Purified by small organisms

Natural spring

Super clean and delicious.

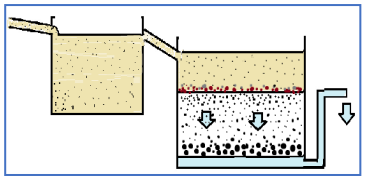
Artificial Natural spring water

Up-flow Roughing Filter eliminates Suspended Matter without Chemicals.

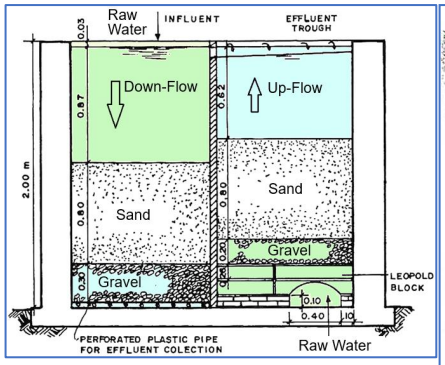
Part 3.

Water Supply Management and Ecological Purification System.

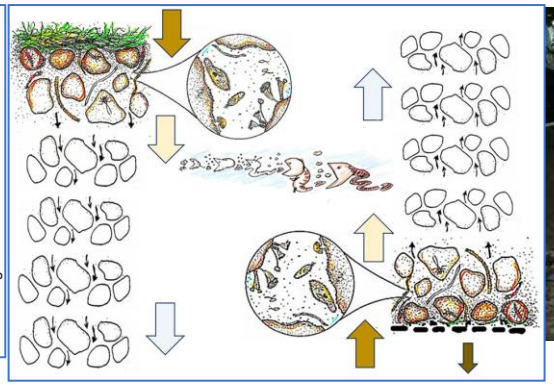
13 slides: 22-34



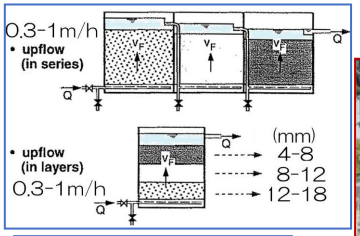
1980

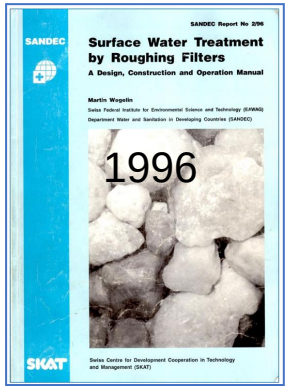


Down flow & Up-flow

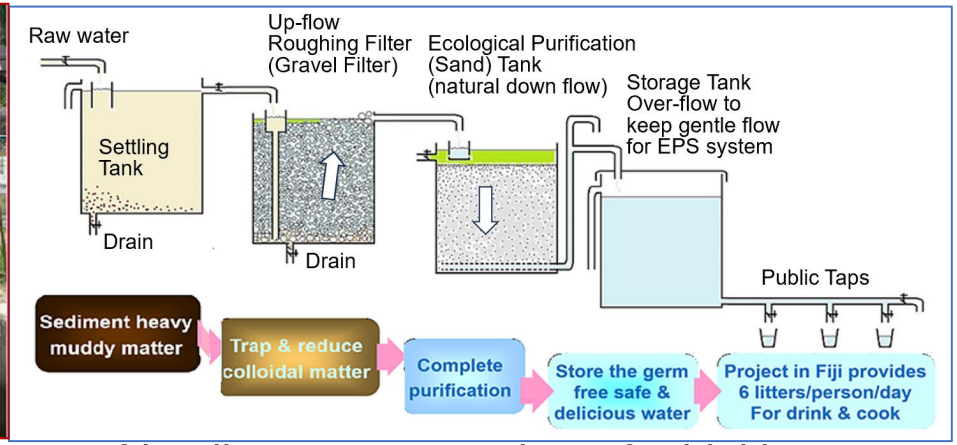


Mr. Fumio KIZUKI, OISCA in Tokyo.



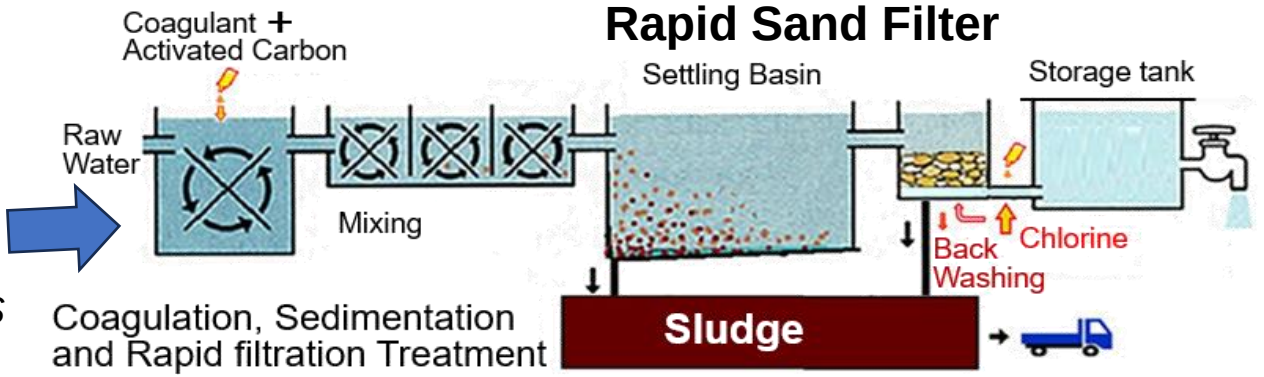


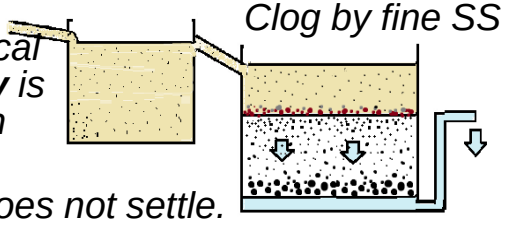
I examined the performance of URF with students.



Eco-friendly system to make safe drinking water.

Fine suspended solid in continent rivers in USA





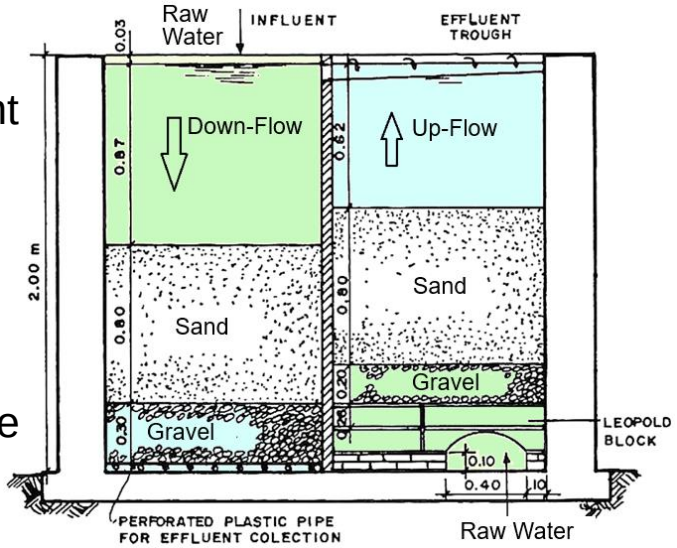
*Biological **activity** is weak in winter.*

Clog by fine SS

Does not settle.

Down flow and Up-flow Roughing Filter Experiment

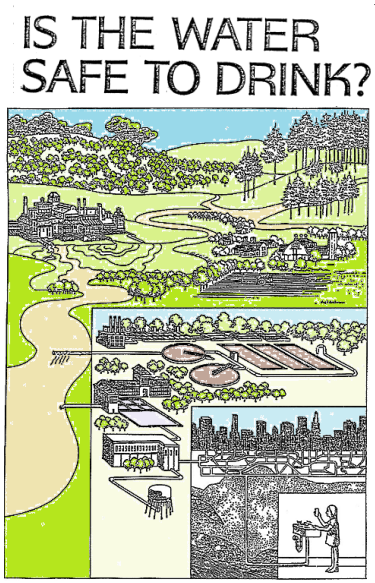
Master Thesis of Costa, R.H.R.: Univ. São Paulo, Brazil in 1980

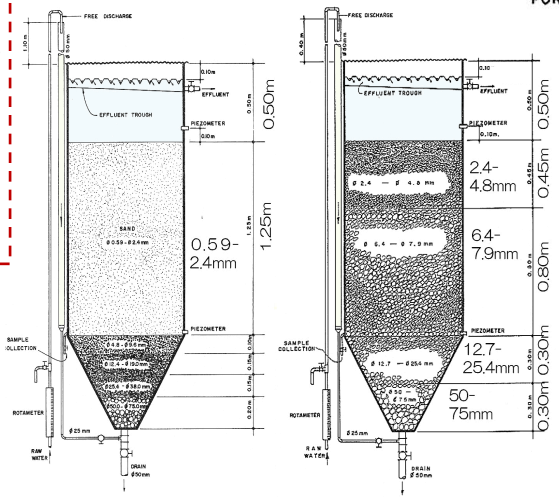


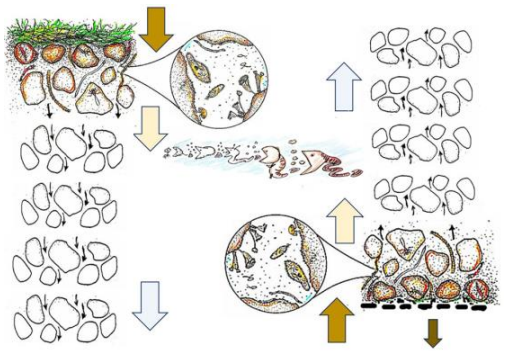
Up-flow Roughing Filter of different size of sand and small stone.

Robert H. Harris et. al. 1974 Consumer Report.

Chlorine sterilization is essential for rapid filtration of chemical treatment. There is a warning that tri-halo-methane, which are carcer risk substances, are generated by adding chlorine.





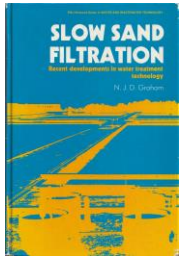


Research engineers researched ways to prevent turbidity without using chemicals.

Prof. Luiz Di Bernardo, Univ. São Paulo

Luiz Di Bernardo, Univ. São Paulo, Brazil: Roughing filter test (Master student report 1980)

1988

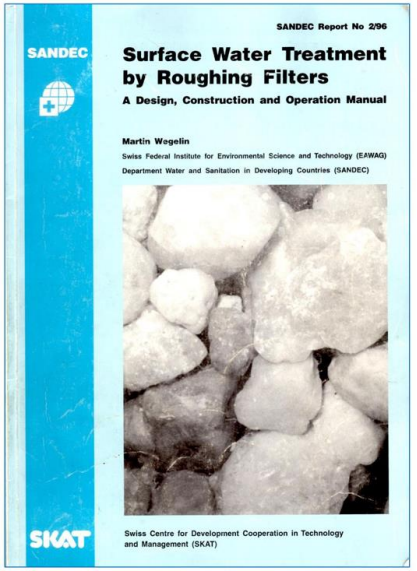


International pilot experiments in Columbia, (IRC：Holland), Peru, Brazil, UK, Switzerland etc.

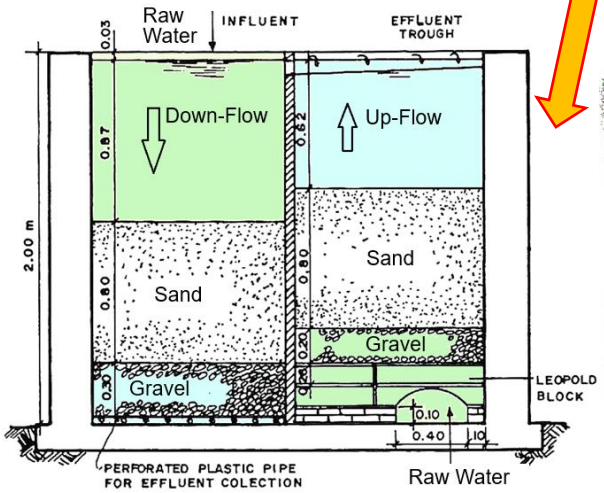
1996

Martin Wegelin

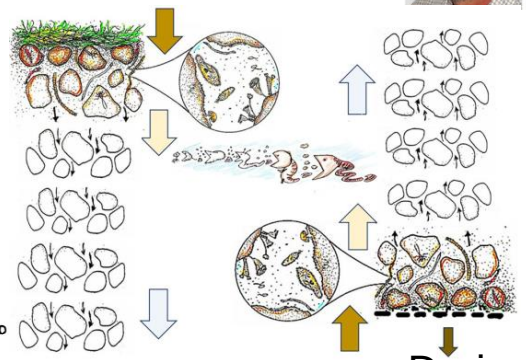
Swiss Federal Institute of Aquatic Science and Technology



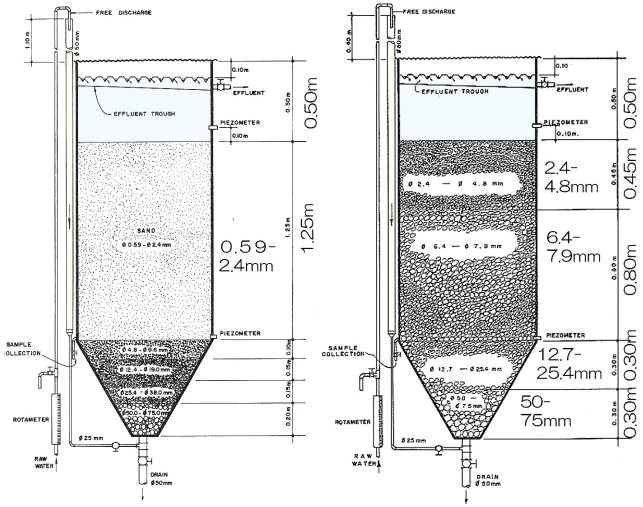
https://www.ircwash.org/sites/default/files/Wegelin-1996-Surface.pdf



Down-Flow and Up-Flow

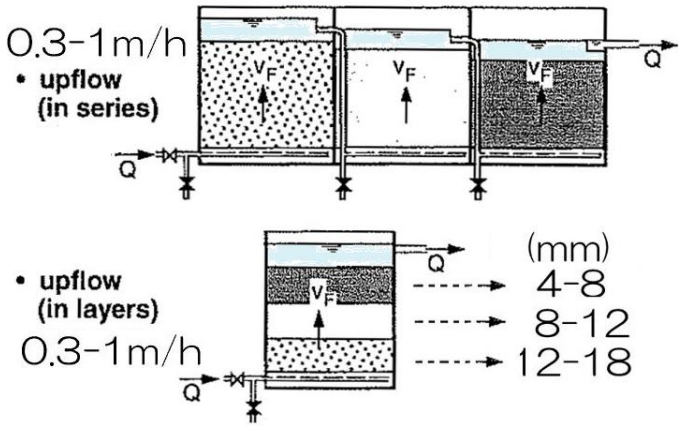


Down-Flow and Up-Flow



Sand URF and Gravel URF

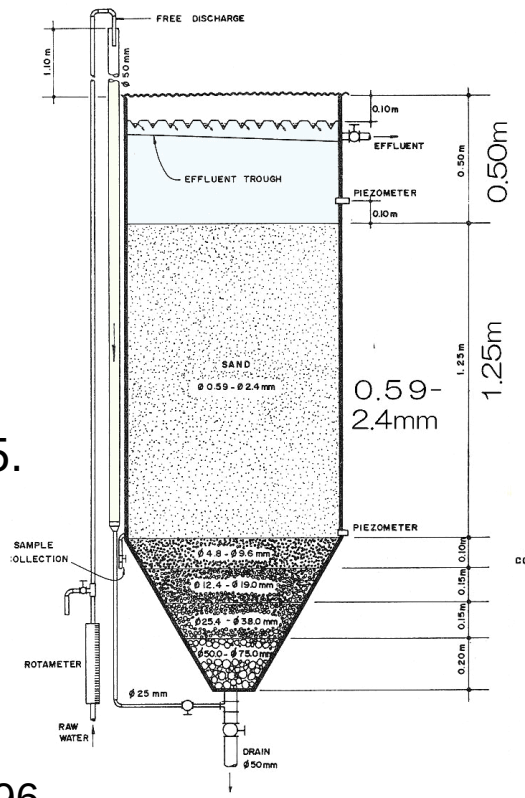
Nakamoto was a JICA advisor of the control of a reservoir ecosystem to São Paulo Univ. in 1974 and Federal Univ. of São Carlos in 1976.

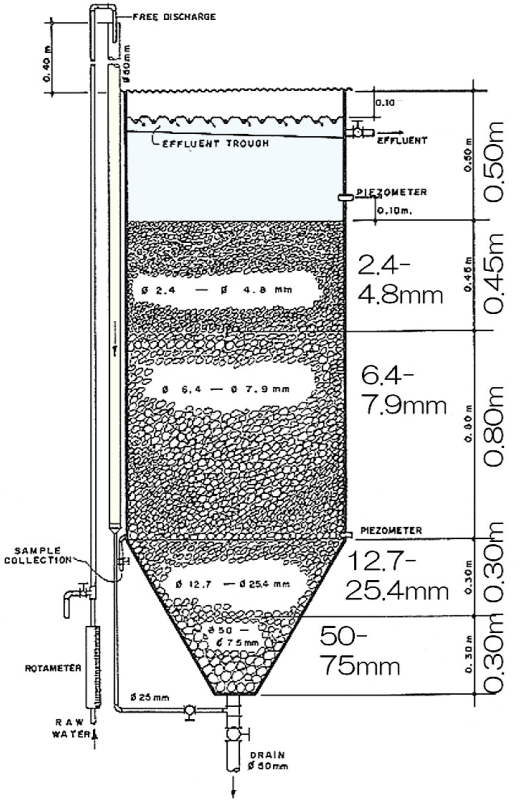


They believe the main action is based by mechanical reduction.

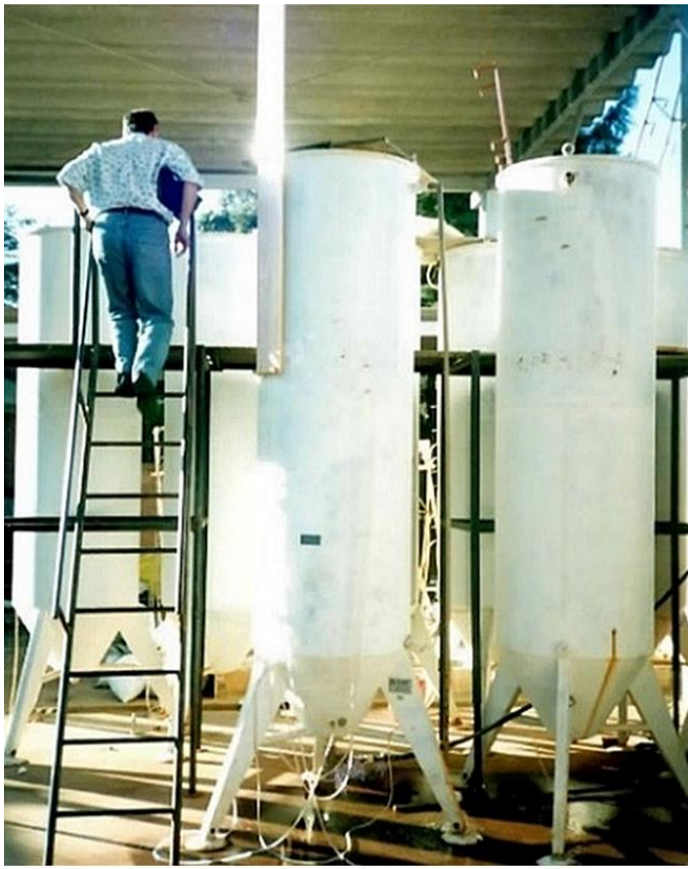
Luiz Di Bernardo examined chemical free roughing filter from 1980 in Brazil.

He reported the results in 1988, in London.

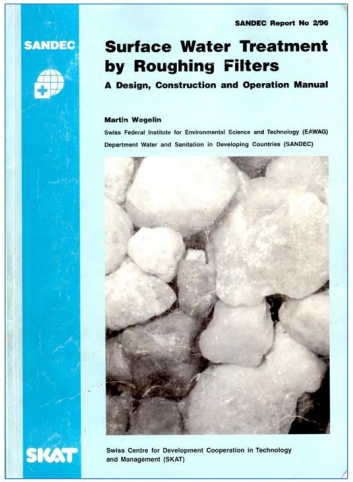




I visited São Carlos, Brazil in Aug. 1995.
He still examined URF.



1996

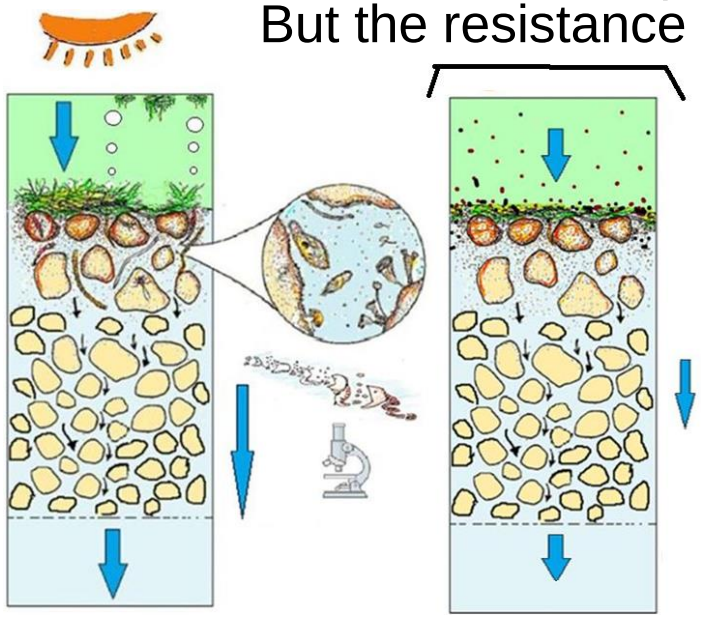


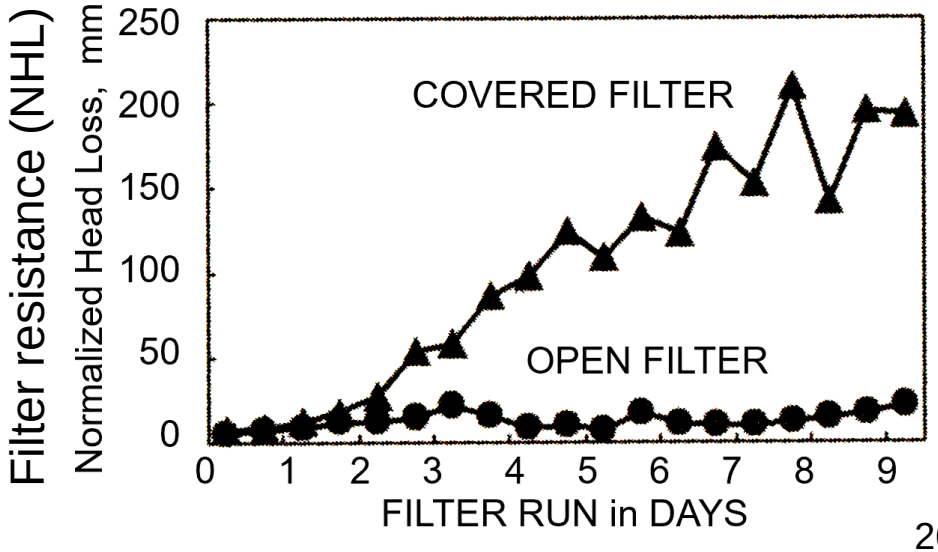
I examined URF with students from 1996, I noticed a large contribution of biological action in URF.

Multiple Roughing Filters to eliminate SS from an irrigation canal water.

Effect of open filter and covered filter.

Filter resistance (NHL) of Open filter was almost constant.
But the resistance of Covered filter increased almost every day.





Mr. Fumio KIZUKI
OISCA (The Organization for Industrial, Spiritual and Cultural Advancement-International)

There are sedimentation tank, several gravel filter, and slow sand filter. Polluted water turns to safe and reliable water quality.

Polluted water of River Kanda, Tokyo is pumped up.

No detection of coli-form bacteria, lead, herbicides of Atrazine and Simazine. Nitrate N concentration : 2.0 mg/l, Nitrite N: 0 mg/l, pH8.5, total hardness: 250 mg/l and residual chlorine 0 mg/l.

OISCA Tokyo: polluted water (Kanda river)→gravel filter → gravel filter →small sand filter→ safe water

Sri Lank: three Up flow roughing filters → sand filter → safe drinking water (300 liters / day). This water is the demand of safe drinking and cooking water for 5-6 families.

Wise use of natural phenomena.
We can easily get safe drinking water by ourselves. Mr. Fumio KIZUKI knew this EPS and applied it for villagers.

Three points worth to remember

1. Knowing is NOT enough; we must APPLY it to something useful.
2. Willingness is NOT enough; we must PUT it into the PLAN and ACTION.
3. Putting the PLAN into action is NOT enough; we must ACCOMPLISH the goals.

OISCA International

Niko-San participated OISCA training in Fukuoka, Japan, in 2007 during 1 year. He remember my work on Ecological Purification System.

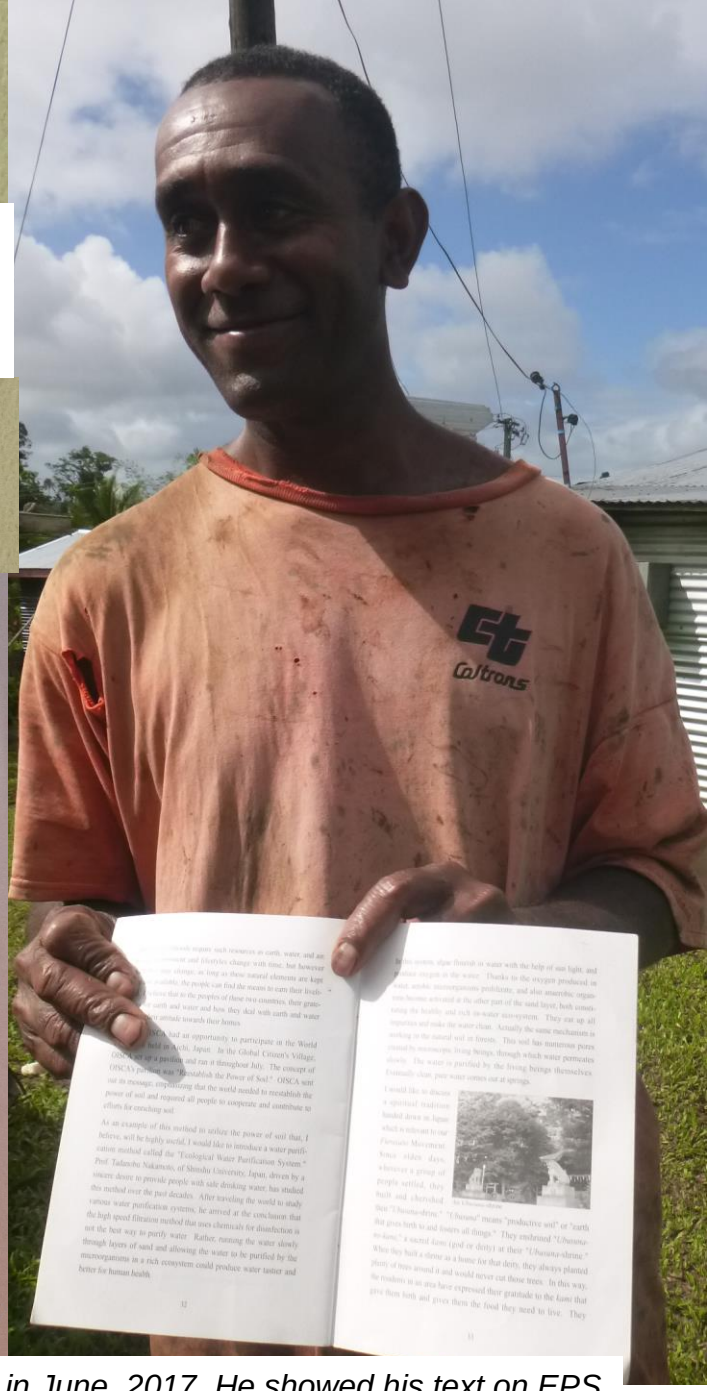
Yoshiko Y. Nakano

September 2006

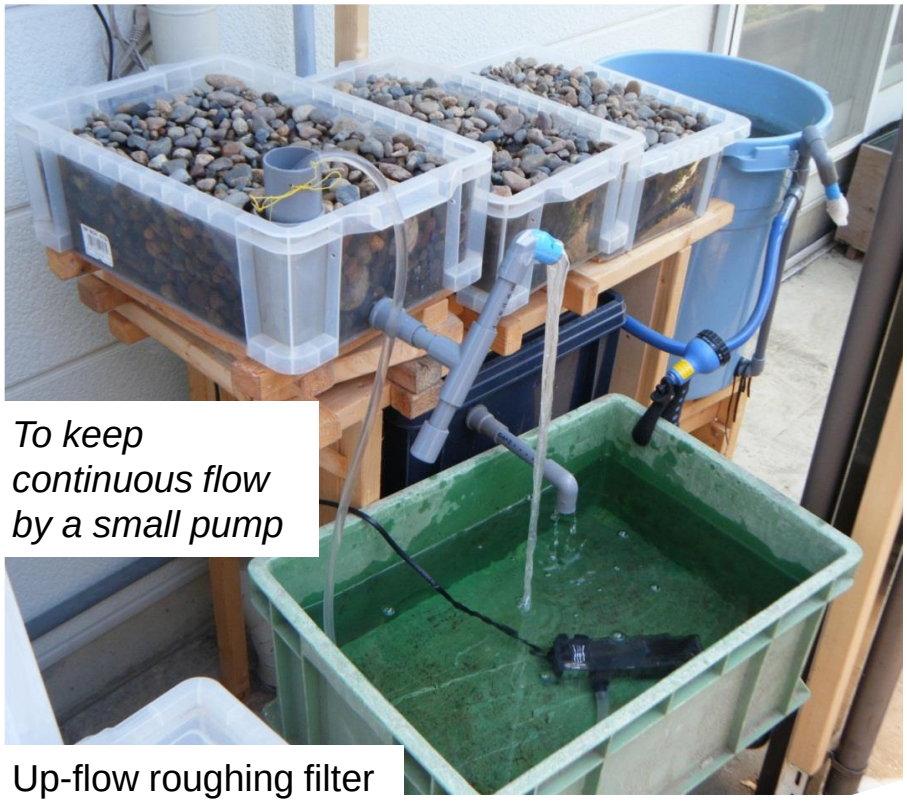
As an example of this method to utilize the power of soil that, I believe, will be highly useful, I would like to introduce a water purification method called the "Ecological Water Purification System." Prof. Tadanobu Nakamoto, of Shinshu University, Japan, driven by a sincere desire to provide people with safe drinking water, has studied this method over the past decades. After traveling the world to study various water purification systems, he arrived at the conclusion that the high speed filtration method that uses chemicals for disinfection is not the best way to purify water. Rather, running the water slowly through layers of sand and allowing the water to be purified by the microorganisms in a rich ecosystem could produce water tastier and better for human health.

Nobutada

2017/ 6/20



I met Niko-San in Fiji, in June, 2017. He showed his text on EPS.

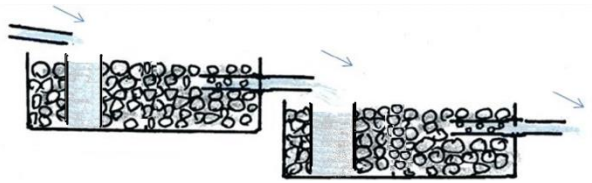


To keep continuous flow by a small pump

Up-flow roughing filter

To make subsurface suspension free clean water in the flood plain.

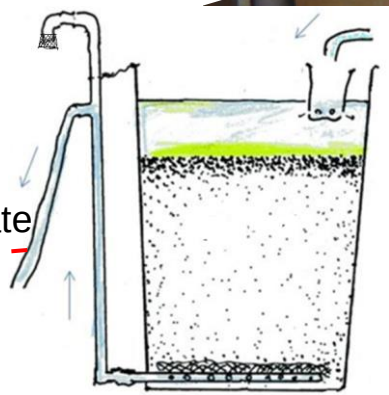
keep out small animals



Filtrate storage tank

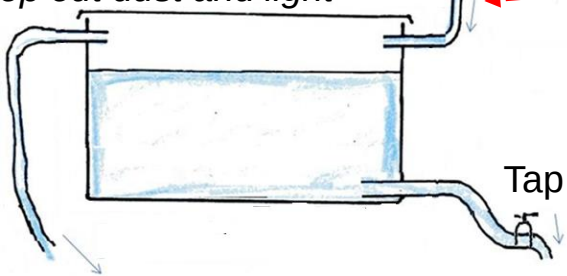
keep out dust and light

Filtrate

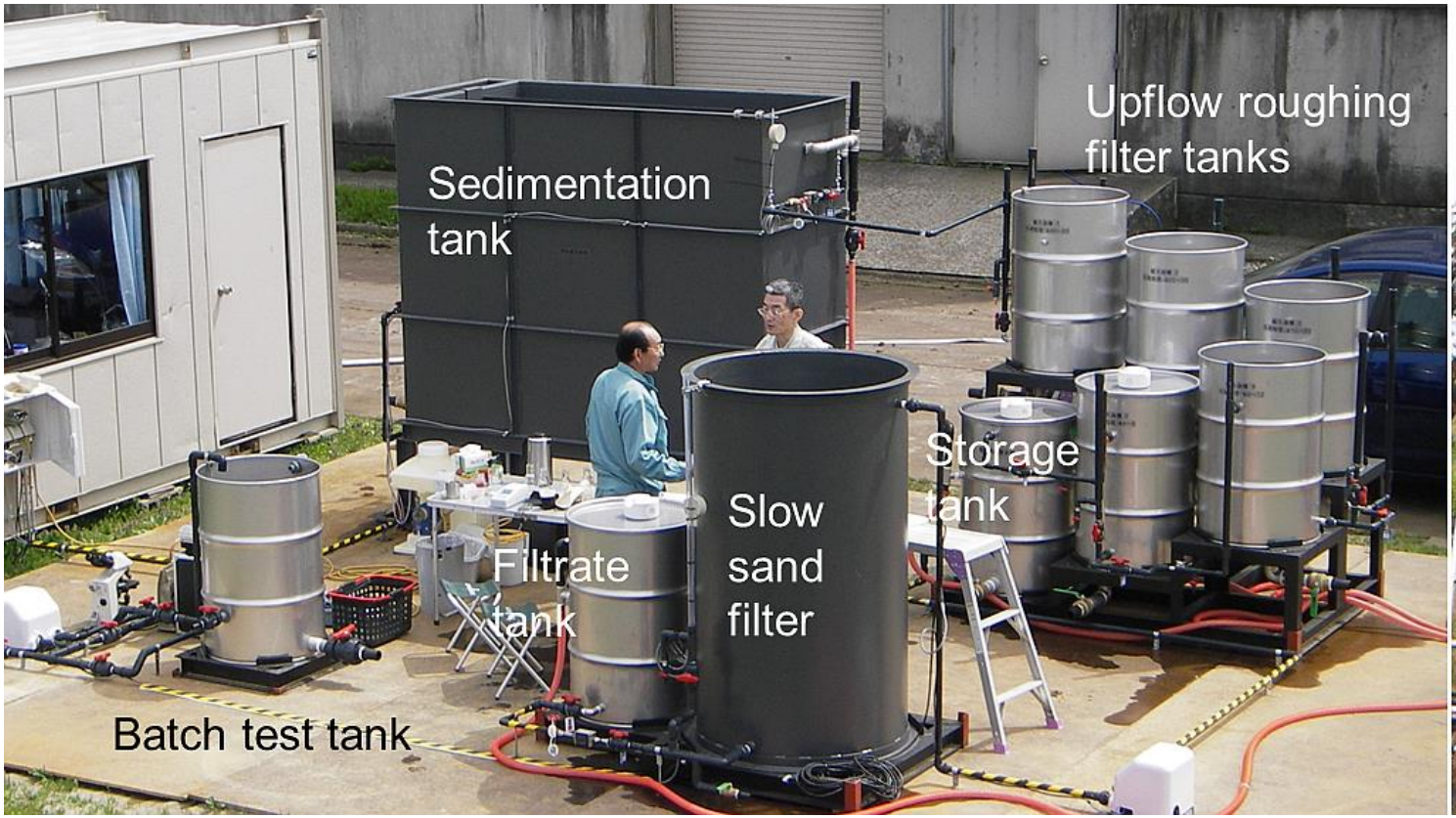


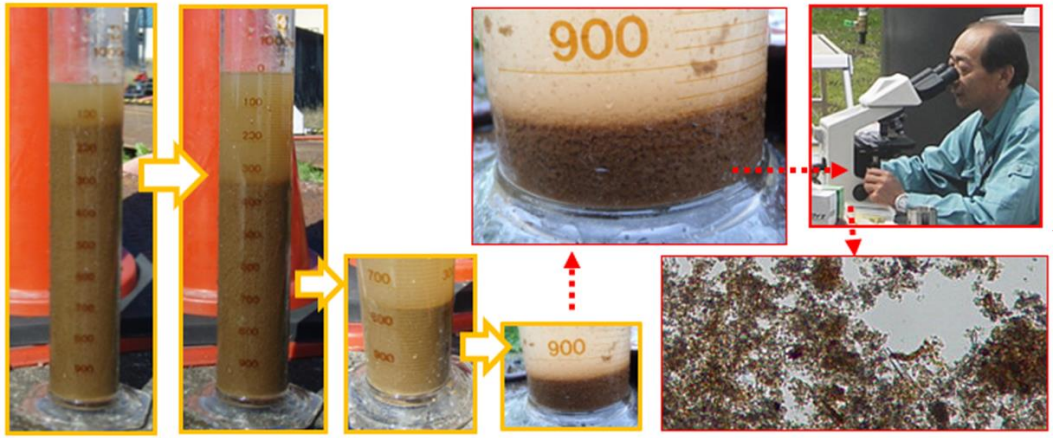
Over flow

Tap



Under drainage porous pipe covered with mesh cloth.

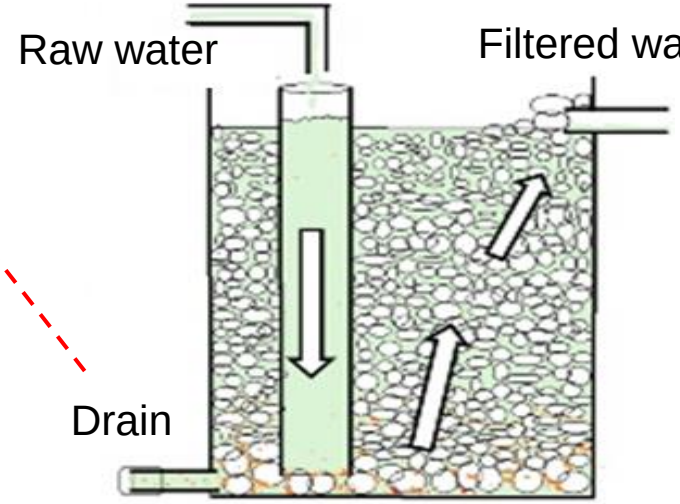




Drained sludge from URF settled Quickly.

Coagulated particles like an activated sludge.

Up-flow Roughing Filter (Gravel Filter)



In Japan, river water is usually clear and small amount of water.

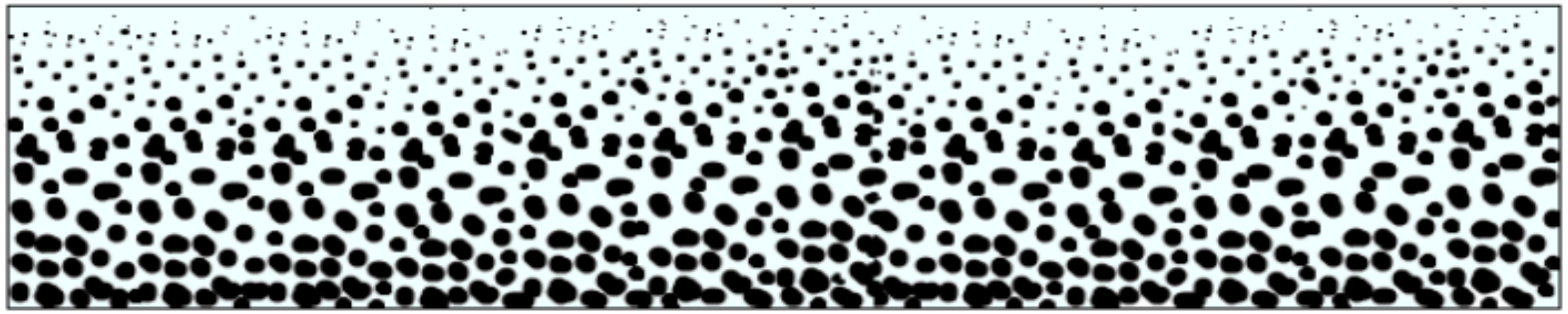
After heavy storm event, river water becomes dirty and rapidly increases.

Clear and suspended free water from spring is found in a flood plain.

Flood water is dirty. There is huge amount of soil matter from land surface.

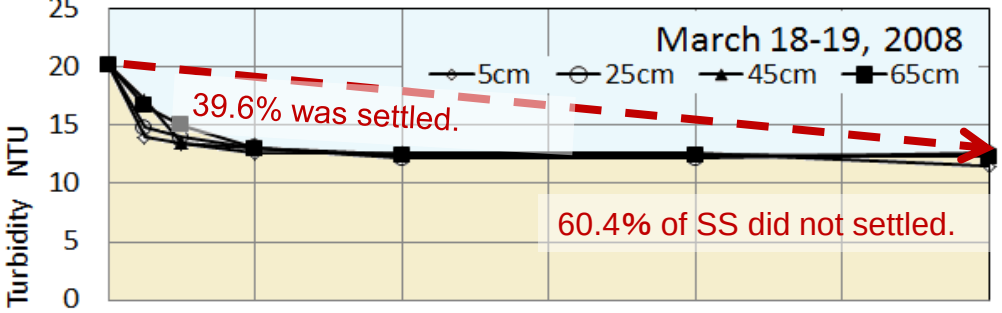
Light and small particle which is not easily settled.

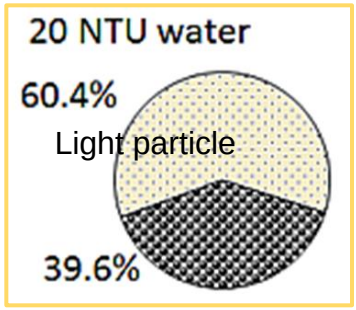
A large amount of heavy and large particles in a storm water.



*There were extremely small particles like as colloidal particles in case of small turbidity, like as less than 20 NTU. The rapid settling of turbid matters was observed **within 4 hrs**. However, a large portion of turbidity did not decrease.*

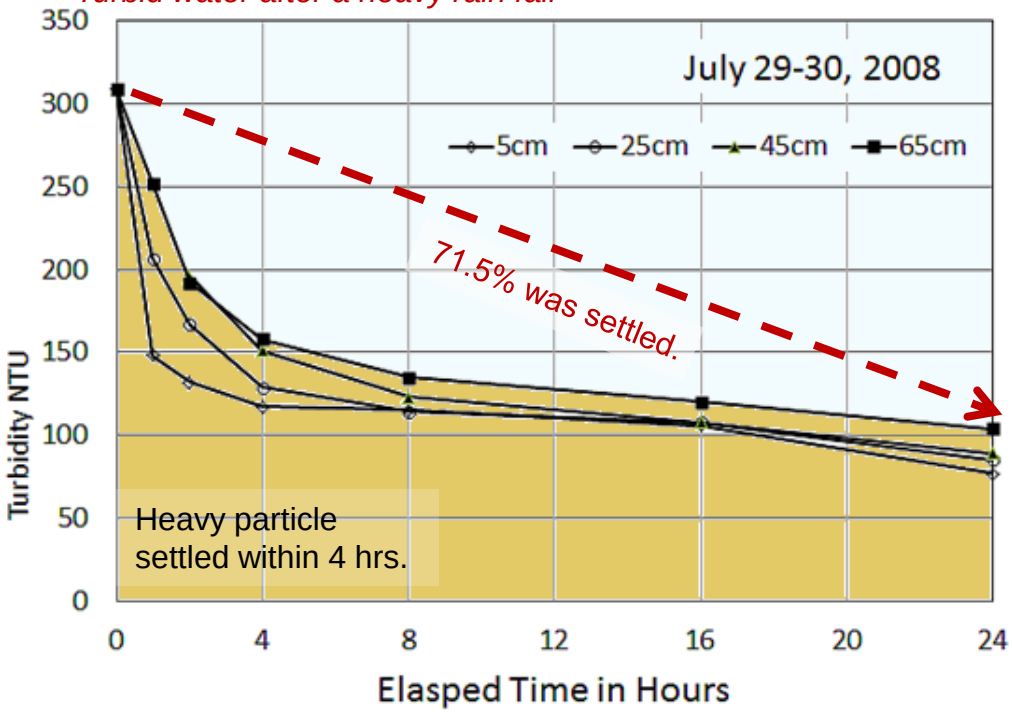
Light turbid water



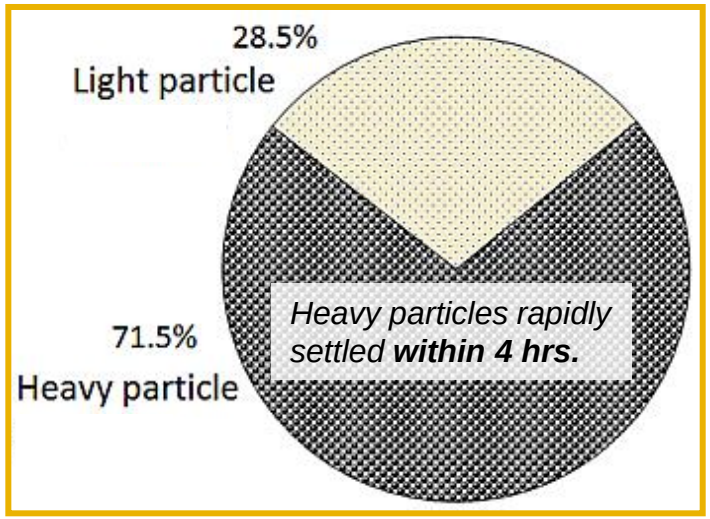


Light turbid water: small turbidity, a large portion of light particle.

Turbid water after a heavy rain fall



In case of turbid water, a large portion was heavy particles.



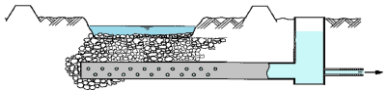
4 hrs. settling is enough.

EPS-Use of Natural Process-**Chemical Free** : **Gentle for small organisms**

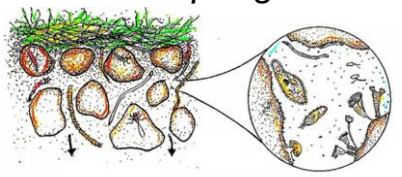
Surface stream water

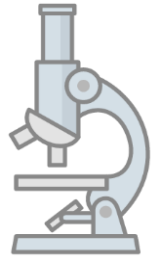
Reservoir

Clean spring water



Subsurface water





Raw water

Up-flow Roughing Filter (Gravel Filter)

Ecological Purification (Sand) Tank (natural down flow)

Storage Tank Over-flow to keep gentle flow for EPS system

Settling Tank

Drain

Drain

Public Taps

Borehole

Sediment heavy muddy matter

Aeration

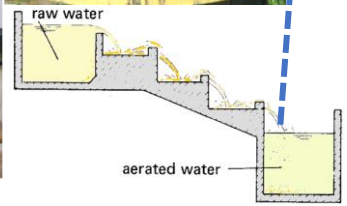
Trap & reduce colloidal matter

Complete purification

Store the germ free safe & delicious water

Project in Fiji provides 6 litters/person/day For drink & cook

Tubewell



Food chain

Smart Treatment System to make artificial spring water by Eco-friendly technique.

Using the Bucket Model in JICA training

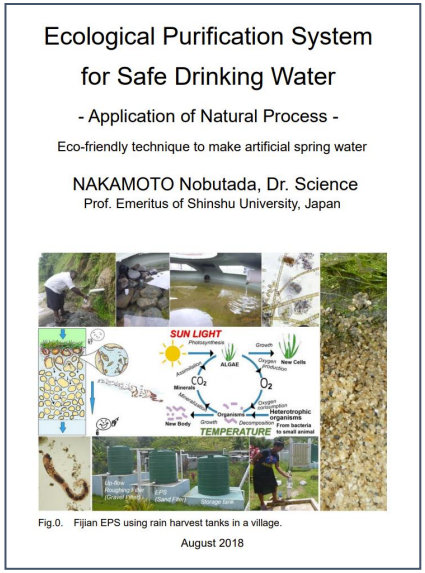
Part 4.

Water Supply Management and Ecological Purification System.

16 slides: 35-50

JICA EPS training started from Miyako-Jima

11th Pacific Water and Waste water conference, Noumena, New Caledonia, August, 2018



International EPS Workshop, Suva, Fiji in March 2019.

I studied on ecological function of Miyako-Jima wks. I made a video on EPS function of Miyako wks in March 2004 and published a book (How to make delicious water) in August 2005.

JICA training began in 2006.

Quest for Safe and Delicious Tap Water, Miyako-Jima, Island in March 2004. /15:22
With English subtitle version in Oct. 2007.
https://www.youtube.com/watch?v=r1LlPuQliu0&t=16s

JICA made Video in 2008

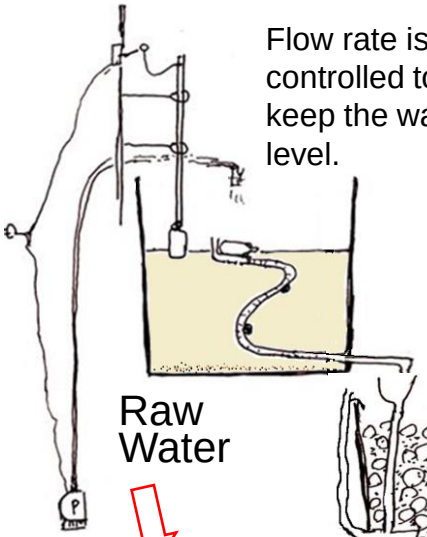
Slow sand filtration: creating clean, safe water(Full ver) in 2020

https://www.youtube.com/watch?v=V6_uDZE_l8E&t=1218s

Ecological Purification System : JICA training for SIWA, April 18, 2013 at Miyako-Jima.
https://www.youtube.com/watch?v=NCI9oeNM0aI

Slow sand filtration: (Digest ver) in 2021/3:26

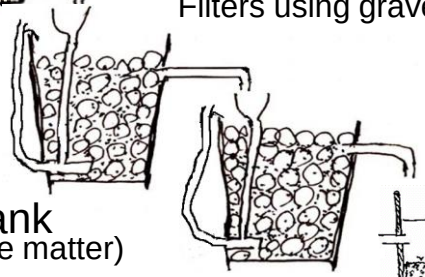
https://www.youtube.com/watch?v=QAH1SoAgfL0&t=37s



Flow rate is controlled to keep the water level.

JICA training of Ecological Purification System using a simple model in Miyako-Jima, Okinawa, Japan, Nov. 7th. 2007.

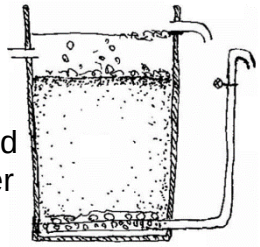
Raw Water



Up-flow Roughing Filters using gravel.

Sedimentation tank
(Reduce heavy particle matter)

(Settle Heavy matter)



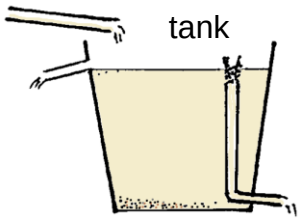
Sand Filter

Up-flow Roughing Filter
(Reduce fine particles)

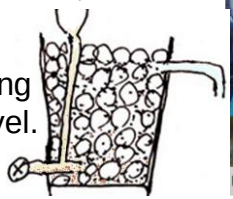
(Trap Colloid matter)

Sand Filter (Complete elimination of impurities by Ecological Purification System)

Sedimentation tank

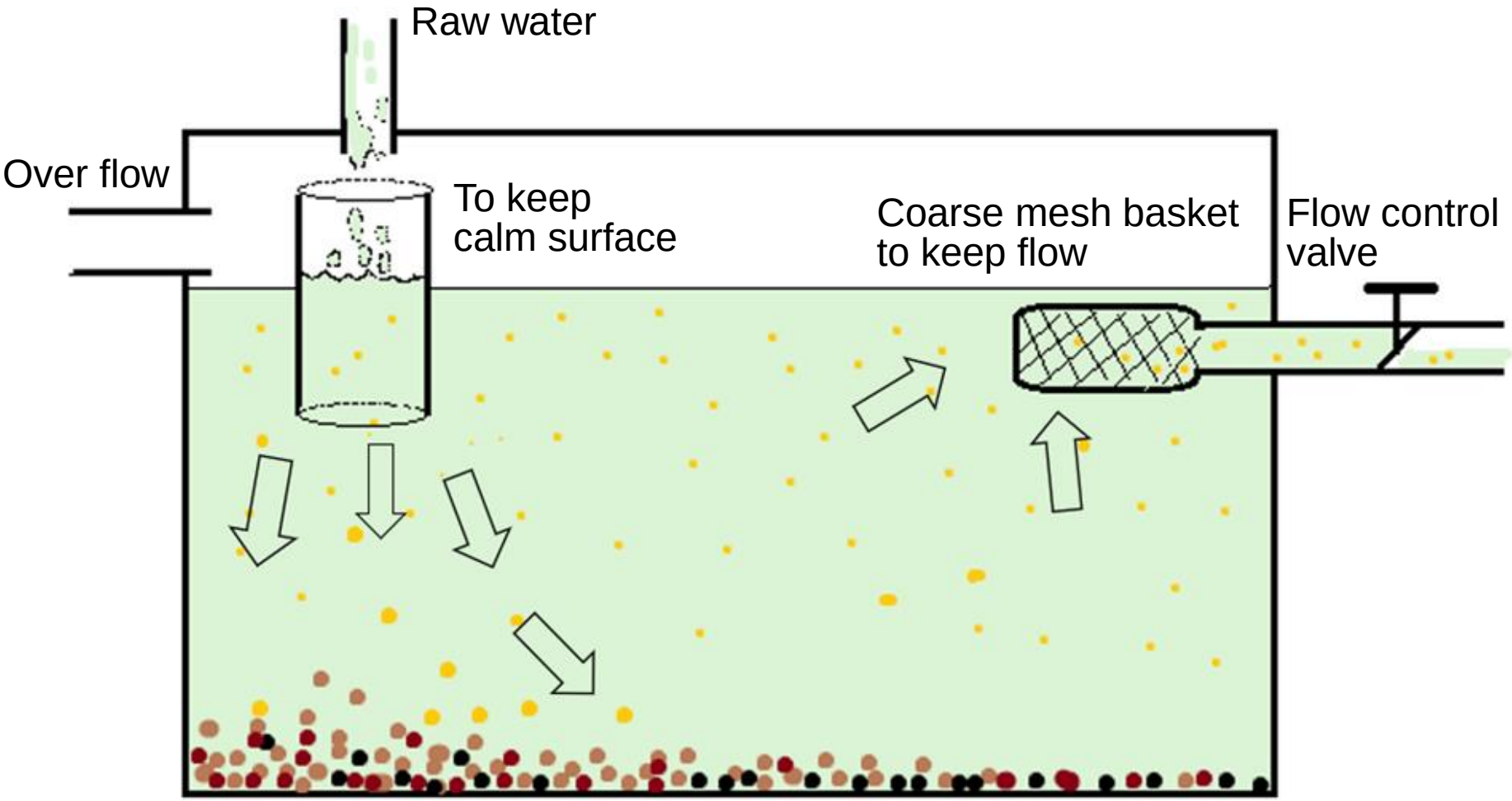


Up-flow Roughing Filter using gravel.




Settling tank
沈殿槽
Up-flow Roughing Filter
上向き粗ろ過槽
Up-flow Roughing Filter
上向き粗ろ過槽
Sand Filter
砂ろ過槽
Storage tank 貯水槽
2016/ 8/24 9:01

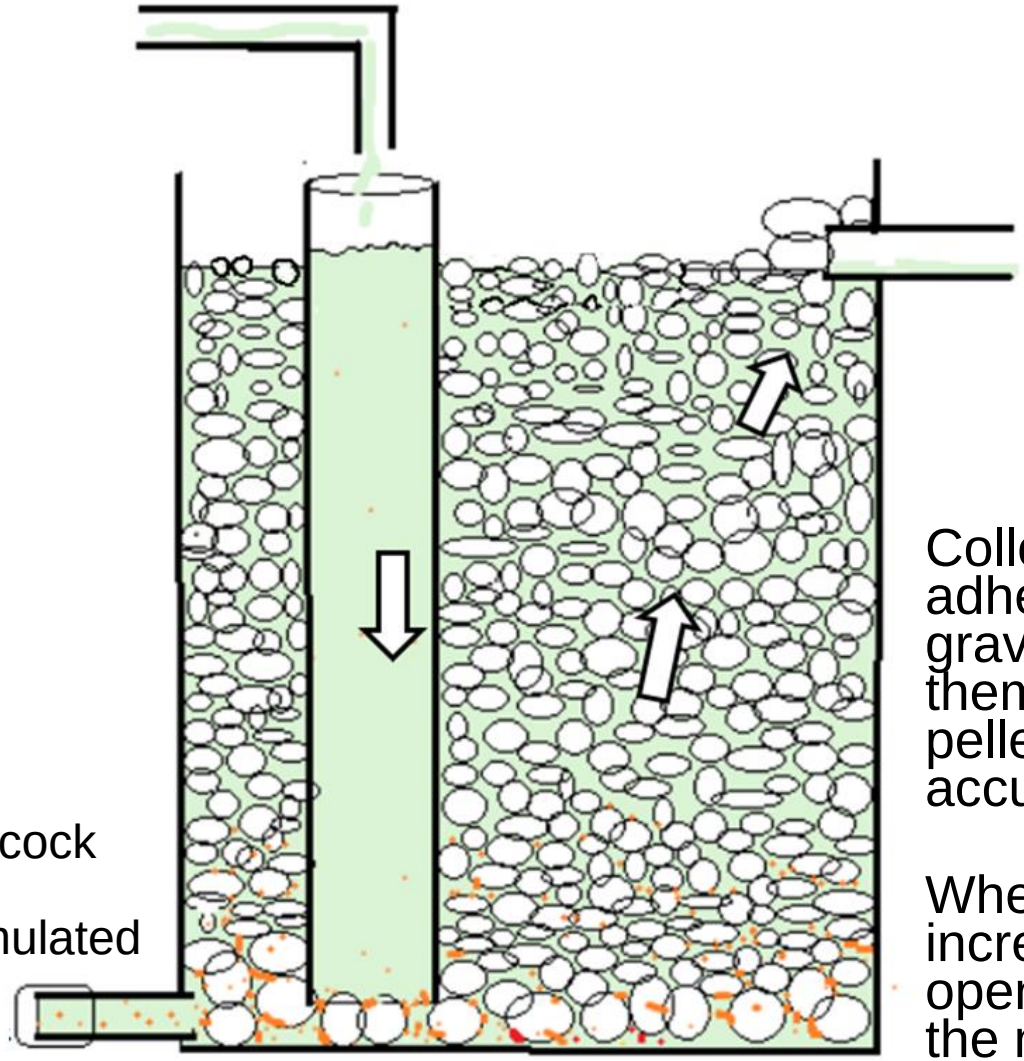
Receiving Tank (Settling Tank)



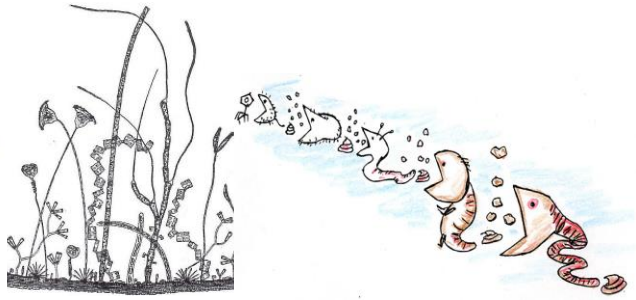
Heavy particulate matters are easily settled. However, colloidal light particles like silt material are not settled in this settling tank.

Up-Flow Roughing Filter (URF): Gravel Filter

Additional URF if necessary.



Drain cock for accumulated mud.

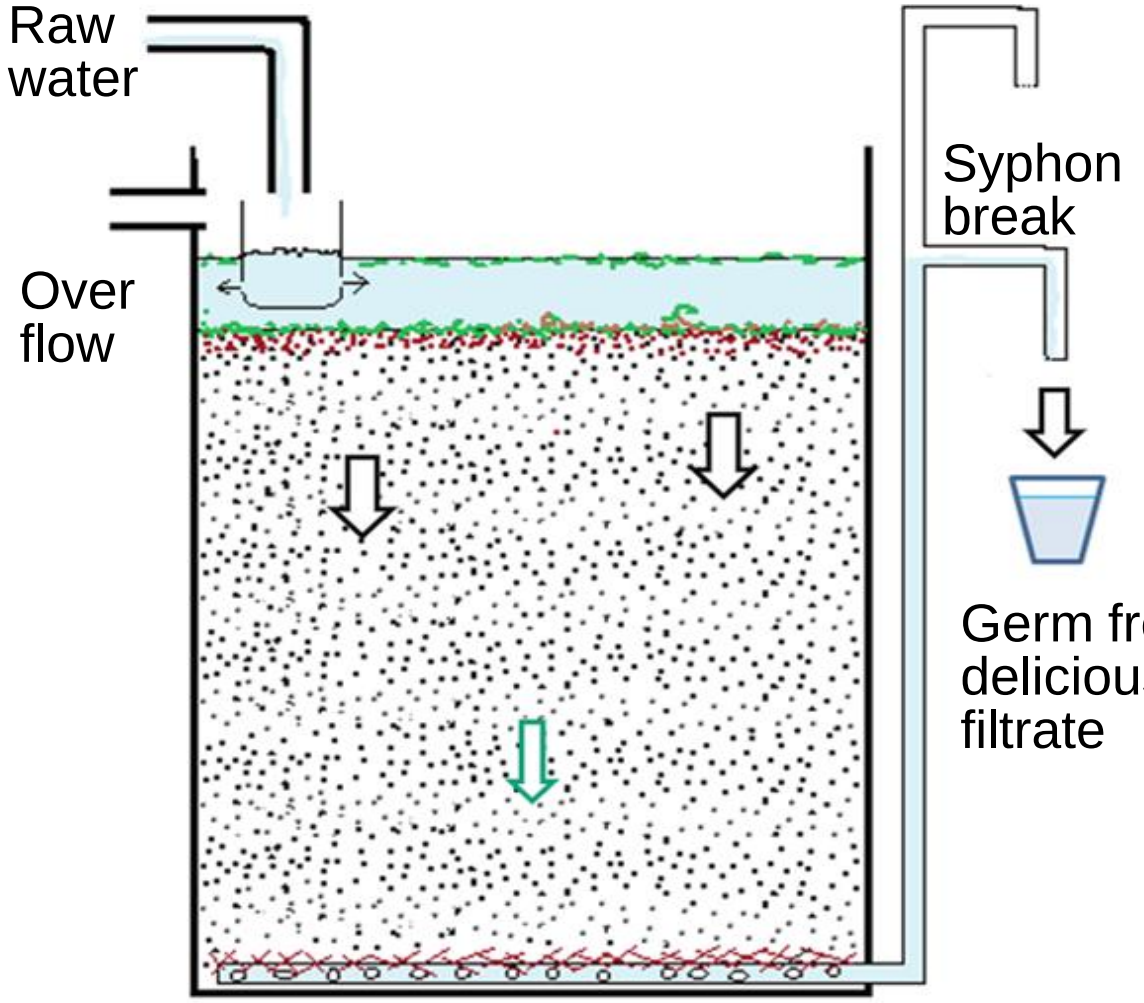


Colloidal fine particles adhesive to the surface of gravels. Small animals scrape them and produces fecal pellets. Fecal pellets accumulated to the bottom.

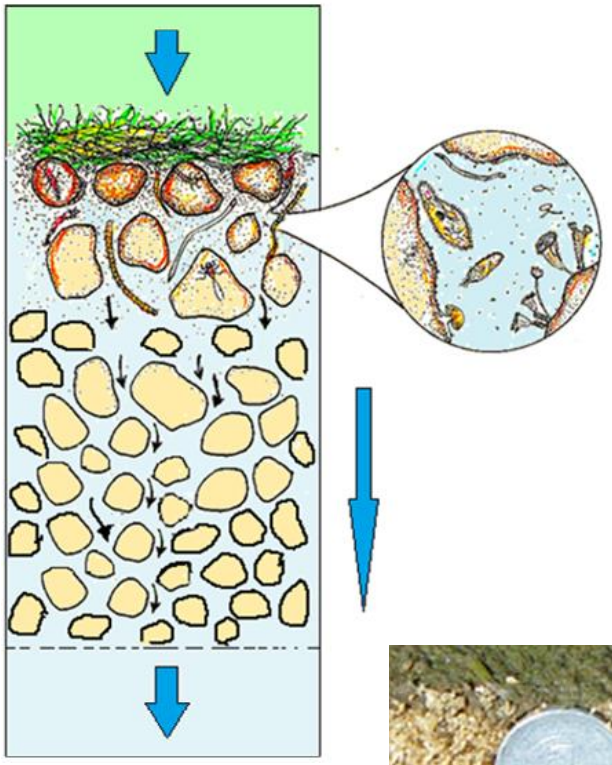
When the filter resistance increase, the drain cock is opened in short time to drain the mud (accumulated fecal pellets.)

EPS (Sand) Filter (Natural Down Flow)

Ecological Purification System

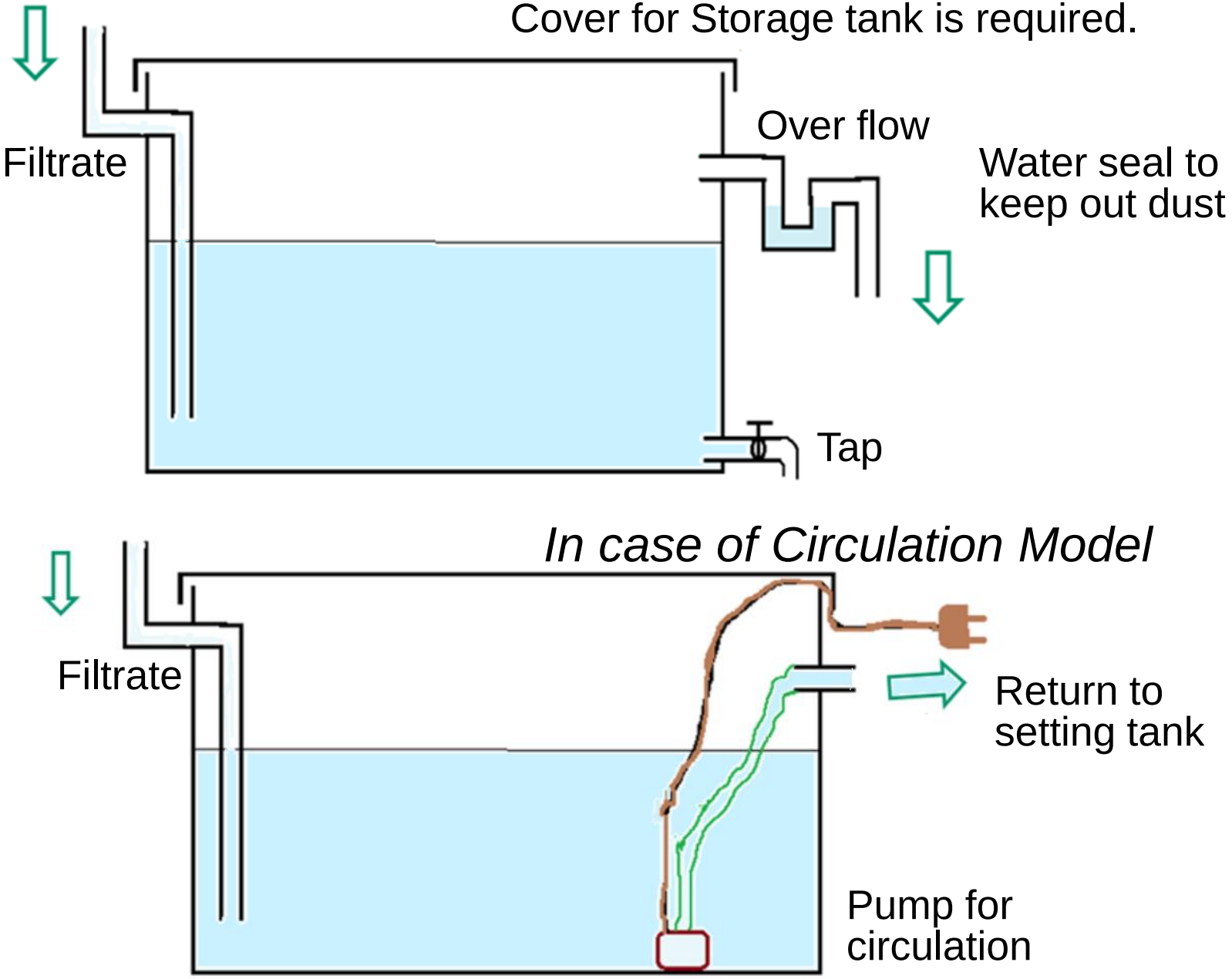


Biological active layer is only surface and thin layer beneath the surface.

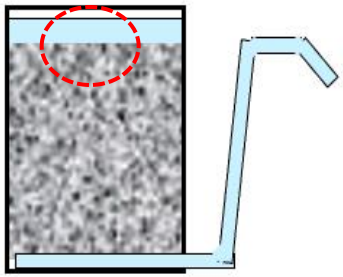


Algae and animals grow well on the sand surface.
Deep sand layer is a guarantee layer for emergency.

Storage (Filtrate) Tank

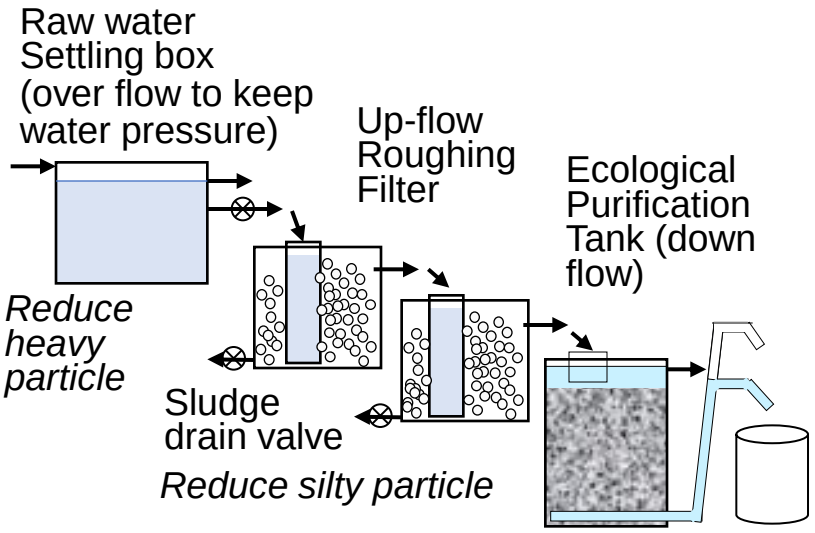


Filter rate can be measured using a cup and is regulated by a cock.



Shallow water depth over sand is important to keep aerobic condition.

Passing time of water is shorter in shallower depth.
And higher flow rate is also better to keep aerobic condition.



Filter area = 30.5 cm x 44 cm = 1,342 cm2

In case of Present Thames filter rate (40cm/h =9.6m/d)

Filtrate/min = 1,342 cm2 x 40 cm/h/ 60 (min) =895 cm3(ml)/min

Filtrate/h = 1,342 cm2 x 40 cm/h = 53,680 cm3/h =53.7 liter/h

Filtrate/d = 53.7 liter x 24 hrs = 1.29 m3/d

	unit	Simpson 1829	English Filter	Present Thames Filter	Experiment in Samoa
Flow rate	m/d	2	4.8	9.6	20
	cm/h	8.3	20	40	83
Flow rate in sand layer (50% porosity)	cm/h	16.7	40	80	167
Passing time of 1 m sand layer	hr	6	2.5	1.25	0.6
Passing time of upper active 1 cm	min	3.6	1.5	0.75	0.36

JICA Training on Ecological Purification System (EPS) in Okinawa, Japan in 2022

DIY EPS bucket model making 2022 - YouTube / 38:01

https://www.youtube.com/watch?v=jz94KFkLL3E

NGO Okinawa Blue Water

Un sistema ecológico, económico y replicable que puede ser utilizado por pequeñas, medianas y grandes comunidades. Este sistema fue desarrollado por el Doctor Nobutada Nakamoto

Ecological Purification System

Daniel Castro
2017/07/20 に公開

https://www.youtube.com/watch?v=Ye-POV6qBU0&t=39s

Ecological Purification System for Safe Drinking Water

- Application of Natural Process -

Eco-friendly technique to make artificial spring water

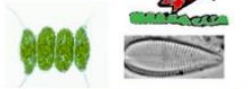
NAKAMOTO Nobutada, Dr. Science
Prof. Emeritus of Shinshu University, Japan

Fijian EPS using rain harvest tanks in a village.

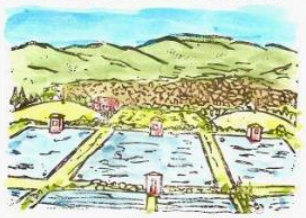
August 2018

Ecological Purification System for Safe Drinking Water

Contents

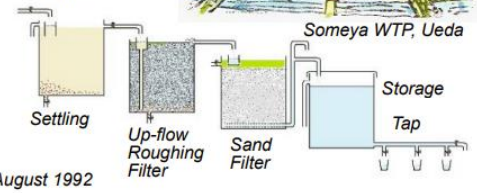


Cast off skins of midge larvae



Someya WTP, Ueda

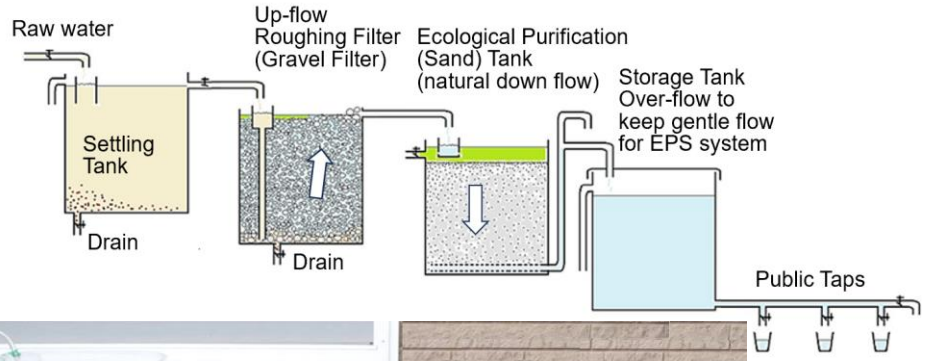
August 1992



http://www.cwsc.or.jp/files/pdf/EPStext-NC-2019.pdf

11th Pacific Water and Waste water conference, Noumea, New Caledonia, August, 2018

JICA-Hiroshima, July, 2018
Microscopic organisms



EPS model

11th Pacific Water and Waste water conference, Noumena, New Caledonia, August, 2018

JICA EPS training in Miyako-Jima, in Aug. 2011.

For rural people from 2013 in Fiji.

To make artificial spring water from surface water.

EPS for Fiji village

EPS Nagano Japan → Miyako-Jima Okinawa → Fiji Samoa → Pacific islands

SPREP
Secretariat of the Pacific Regional Environment Programme

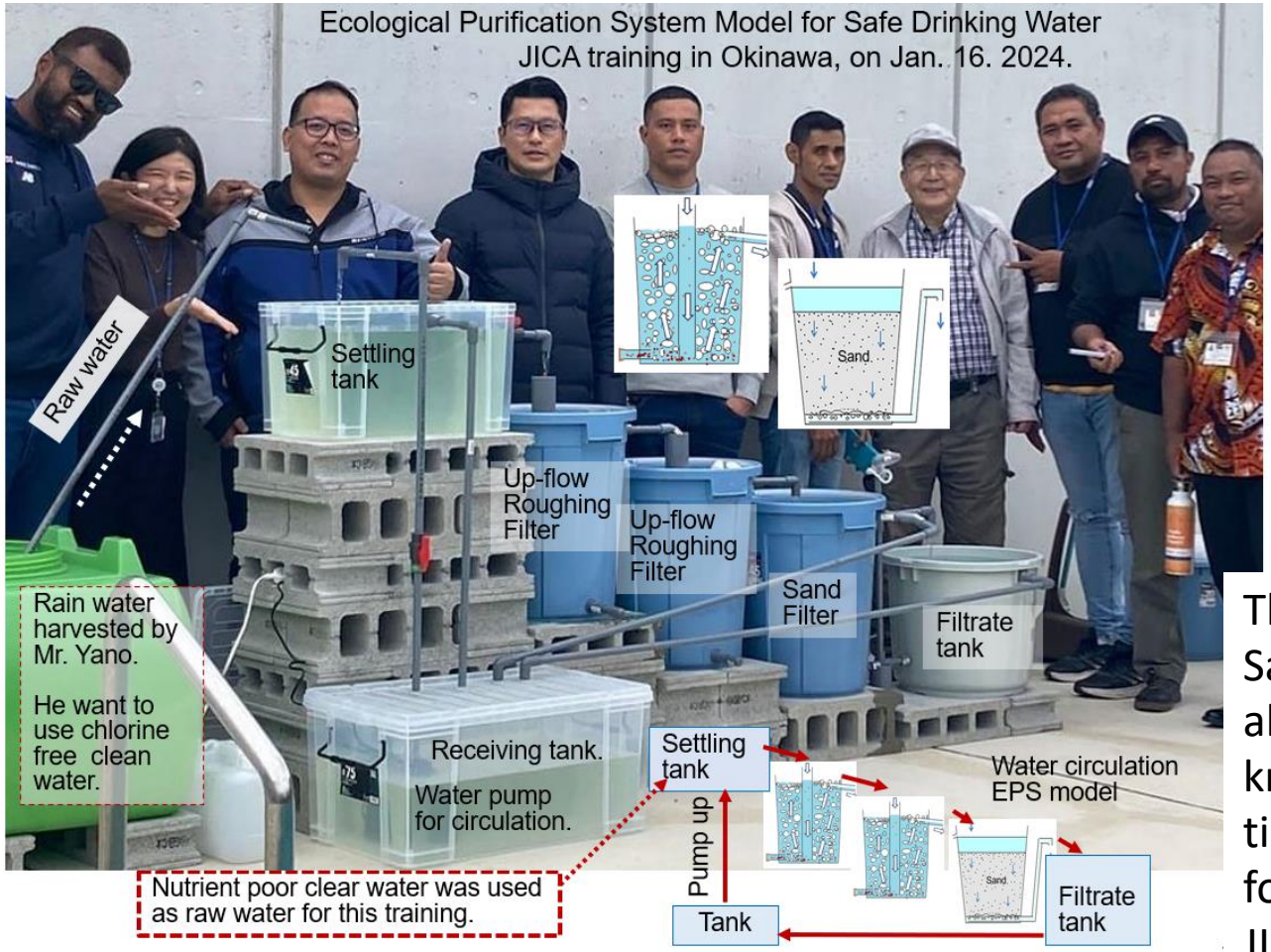
Pacific Regional Environment Programme

太平洋地域環境計画事務局

https://www.sprep.org/

Safe water access in rural areas to build climate resilience in Fiji, Papua New Guinea and Solomon Islands

https://www.sprep.org/news/safe-water-access-in-rural-areas-to-build-climate-resilience-in-fiji-papua-new-guinea-and-solomon-islands



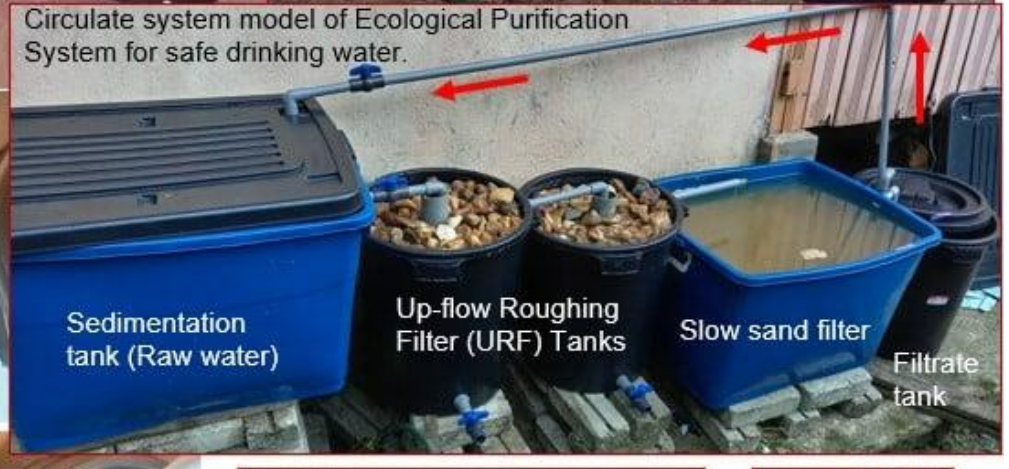
2024/09/15

Thanks to Dr. Nakamoto, Yano San, Maho San, Mariko San and all EPS member for the knowledge & support all this time. I feel proud & thank full for the knowledge I gain from JICA KCCP Program. In addition, I want to share to all of you, up-flow filtration method is super, value for money, maintenance & stress free as to compare to normal down-flow filtration. From Mr. Mohamed Zairi, a trainee from Malaysia.

After 5months, still crystal-clear water produce


Sedimentation tank
Up-flow Roughing Tanks
Slow sand filter
Filtrate tank

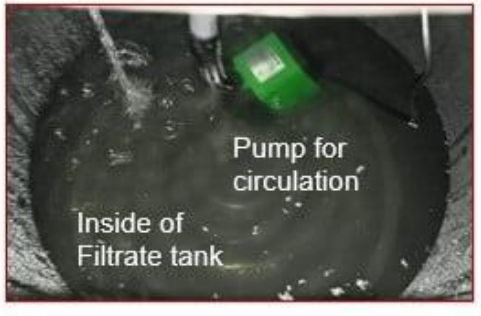

Circulate water from filtrate tank
Raw water
Slow sand filter
Filtrate tank


Circulate system model of Ecological Purification System for safe drinking water.
Sedimentation tank (Raw water)
Up-flow Roughing Filter (URF) Tanks
Slow sand filter
Filtrate tank


Up-flow Roughing Filter (URF) Tanks


Washing the sand


Bottom drainage pipe of the slow sand filter


Pump for circulation
Inside of Filtrate tank


filtrate