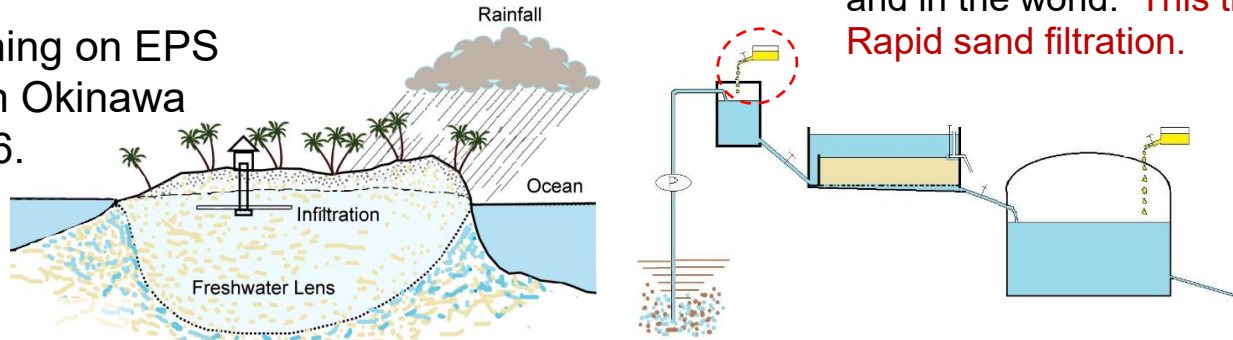


④ From Miyako Island to Samoa

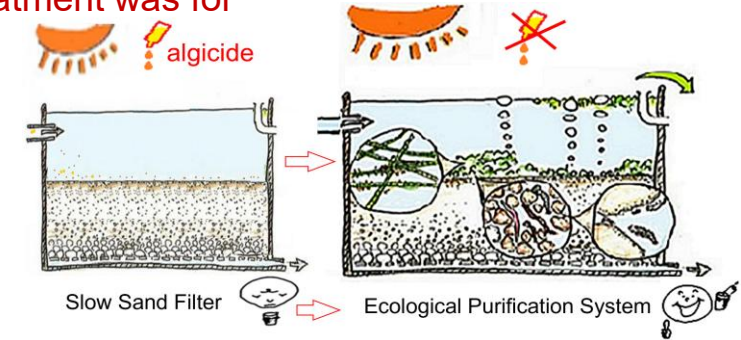
EPS 2026-OBW
Part ④:1-18 18 slides



JICA training on EPS started in Okinawa from 2006.



Pre-chlorination was a popular water treatment to kill the algae in all over Japan and in the world. This treatment was for Rapid sand filtration.



Mr. Mitsutoshi **Tomari**, managing director of Sodeyama WTP, Miyako-island, visited to Nakamoto, Shinshu Univ. in **July 8, 1997**.

He **stopped** to injection of **algicide** into receiving well in 1997. As soon as the injection stop, the **taste of tap water became delicious**. Biological communities started to work in SSF. **Ecological Purification System functionated** in this SSF.

Contents:

① Introduction : EPS

② Quest for Pure Water : Food Chain is key.

③ Chemical free URF and EPS.

④ From Miyako Island to Samoa

⑤ From Okinawa to Fiji

⑥ EPS as Social Contribution

⑦ EPS trial in Malaysia and Guyana

⑧ EPS in Sri Lanka and Pakistan

⑨ EPS: Trust Our Sense

How to make delicious water

Nakamoto published EPS text in 2005.

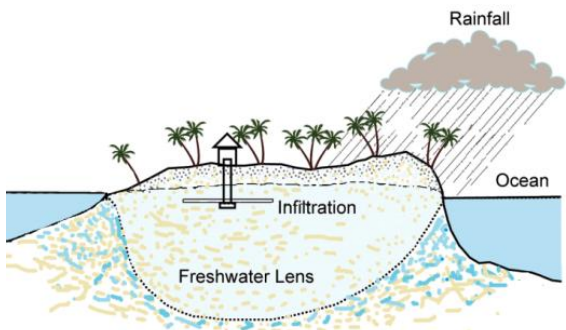


JICA EPS training started in Miyako island in 2006.

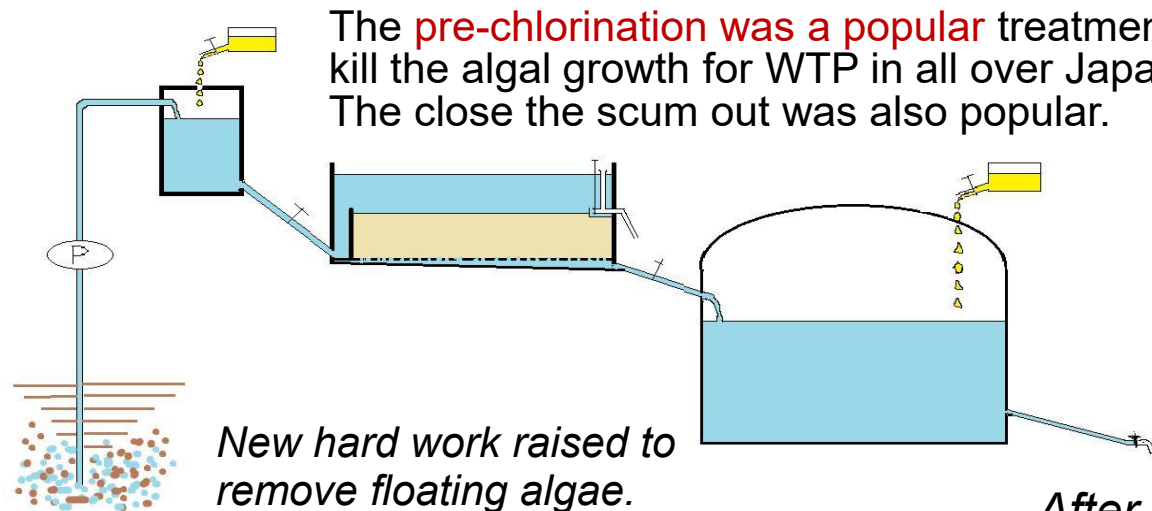


To Samoa in Nov. 2008





They pumped up the underground water as water source. They could not flow out from the scum out. In the pond, algal bloom was so severe. The pre-chlorination was introduced to kill the algal activity.



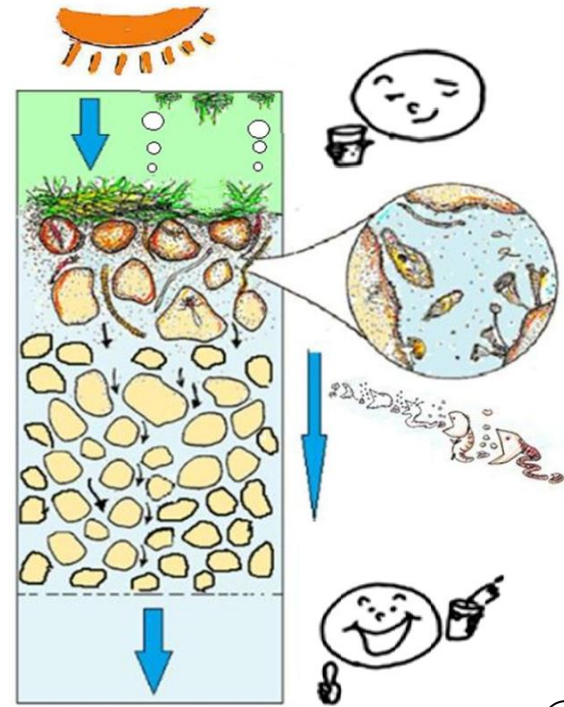
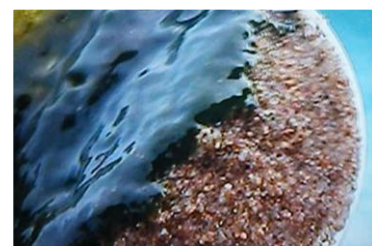
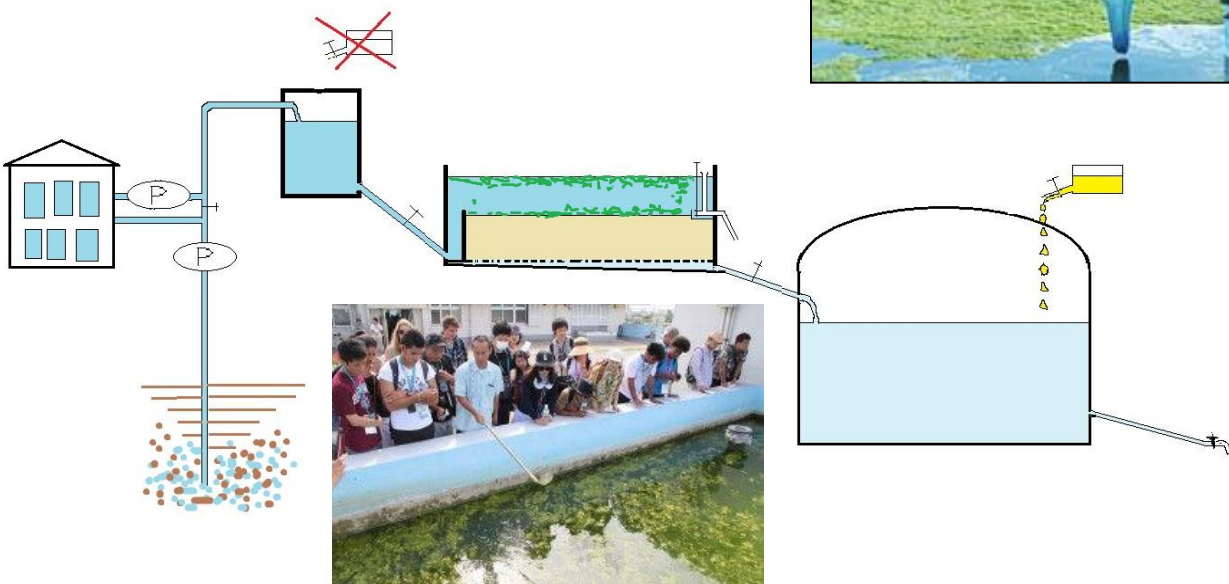
The **pre-chlorination** was a popular treatment to kill the algal growth for WTP in all over Japan. The close the scum out was also popular.



New hard work raised to remove floating algae.



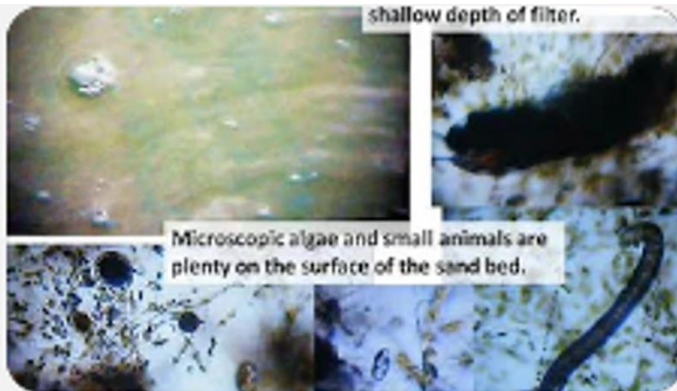
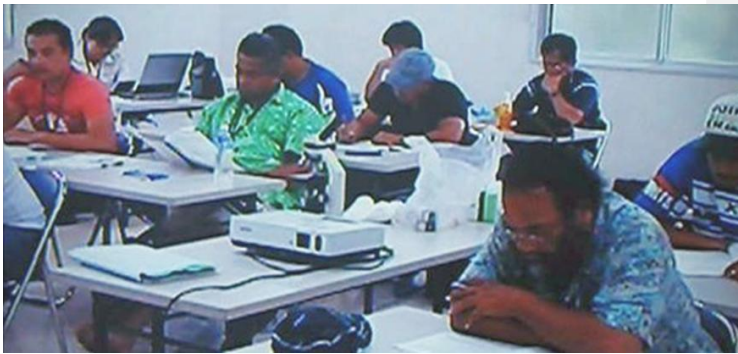
After the **injection stopped in 1997**, the **algae grew well** in filter ponds. **The taste of tap water became delicious.**



International Course on Slow Sand Filter in Okinawa, in 2010 by JICA

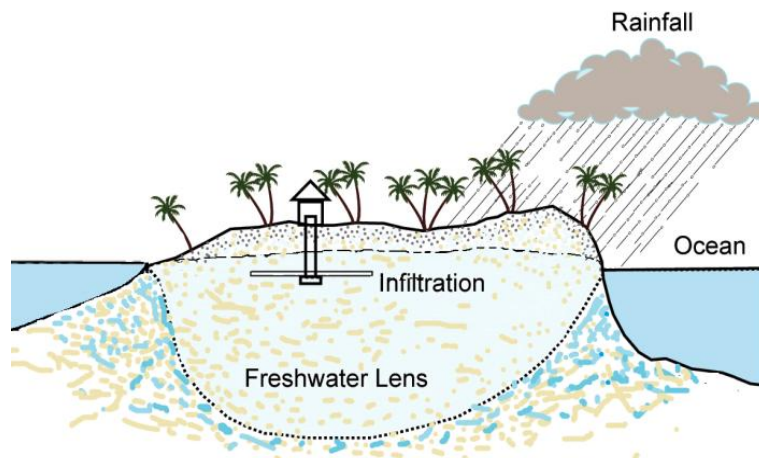
YouTube / 6:08

<https://www.youtube.com/watch?v=c3mVlbmFPqA&t=138s>



You can deepen your understanding through outdoor experience rather than classroom lectures.

I started JICA training on EPS in Okinawa from 2006 and this training continues until now (2026).



At the end of the six-weeks JICA training in Okinawa (September 1, 2010), Ms. Marista from the Solomon Islands, gave a following thanks speech of the trainees.

It is also worth appreciating the Ecological Purification System which is taught by you, Dr. Nakamoto; a simple, natural and yet an effective water purification technology, we can all agree to as the most relevant technology for the Islands.

It is cheap to construct, operate and maintain which makes it even more attractive. We are grateful to your pioneering research on this technology and for generously impart this to us, so that the people of the pacific may in the very near future will have access to the high quality and delicious taste that this technology provides.



Slow sand filter problem in Samoa was solved by ecological point in 2010 – YouTube / 13:45

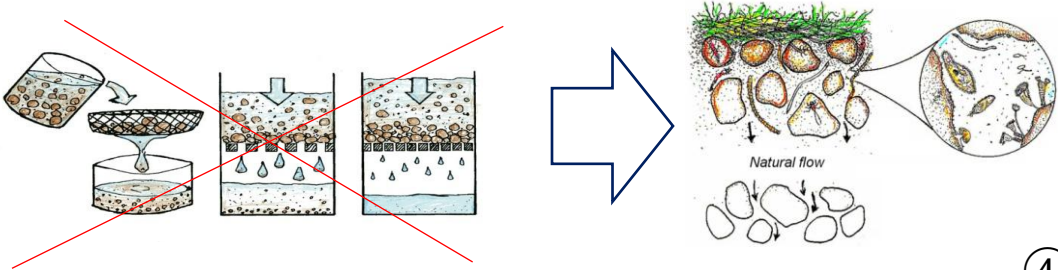


<https://www.youtube.com/watch?v=Kkk-wdIHui4>



During heavy flooding or rainy days – very high turbidity blocks sand filters

This problem was happened by the misunderstand of the real mechanism. Slow sand filter system is not simple mechanical filter. This is a real Ecological Purification System.



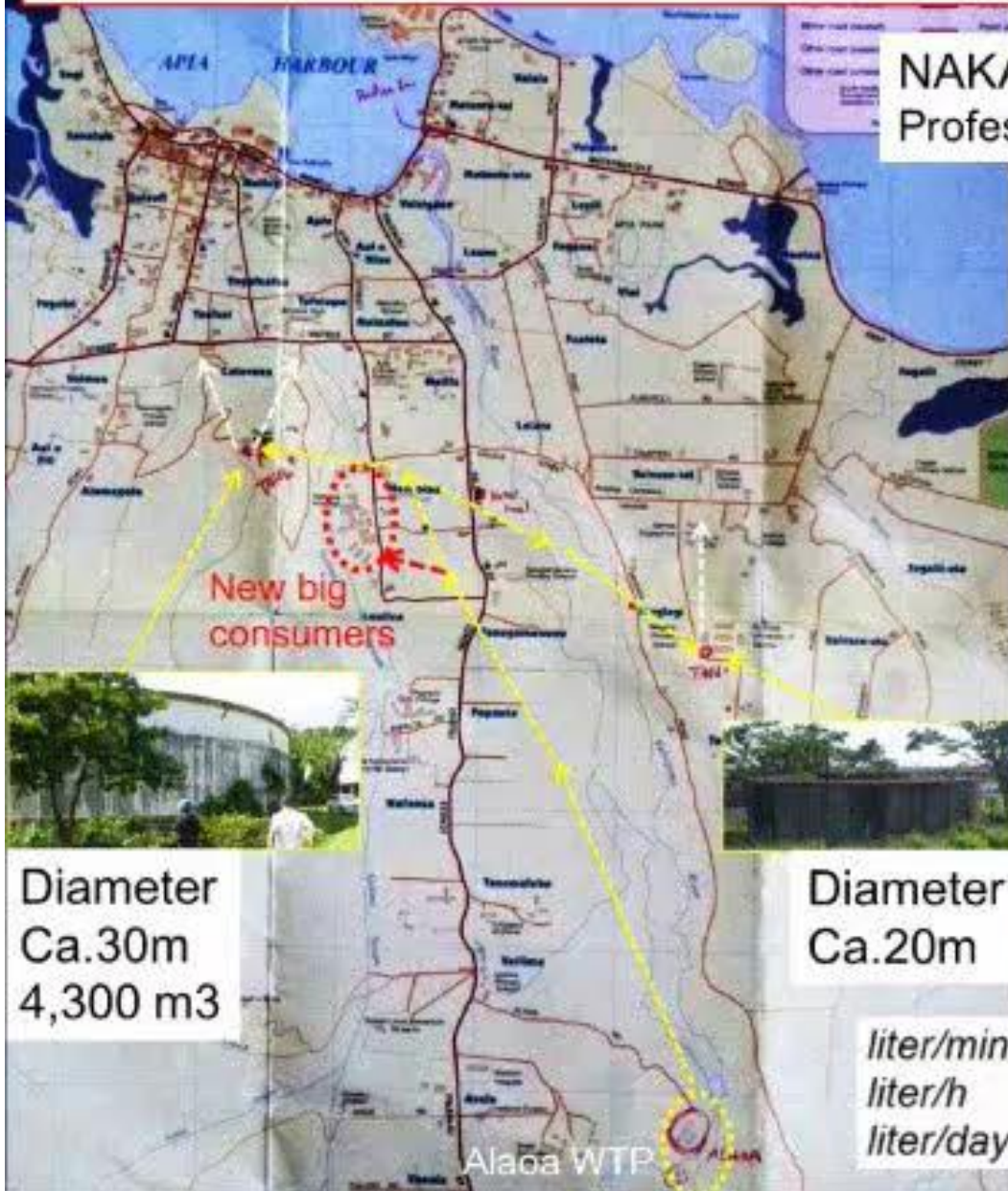
On the Alaoa Water Treatment Plant

Apia, Samoa

JICA Miyakojima Project, Feb. 2013

NAKAMOTO Nobutada, Dr. Sc.

Professor Emeritus of Shinshu University



liter/min	0.83	1.66	16.6	25
liter/h	50	100	1,000	1,500
liter/day	1,200	2,400	24,000	36,000

Close the tap:
Save the water.

Treated water is
limited amount.

<https://www.youtube.com/watch?v=dBoTf2JNdsk>

Settling tanks

Joseph River company (Germany) constructed **5 slow sand filters only during 1984-87 in Samoa.**

2000

Roughing filters (URF)

Samoan people used non-treated water (Non-purified water), before construction of Alaoa Purification plant (1984).



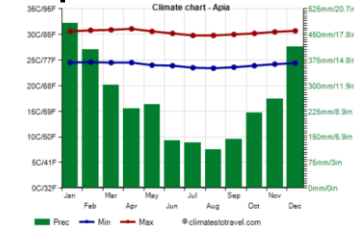
Filters were blocked with turbid matters by storm event.



Dorsch consult (Germany) constructed **Settling tanks** and **Up-flow roughing filters** in order to reduce the extraordinary load of surface run off by storm event in **2000**.

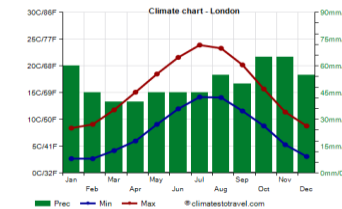


Apia, Samoa



3,100mm/year

London



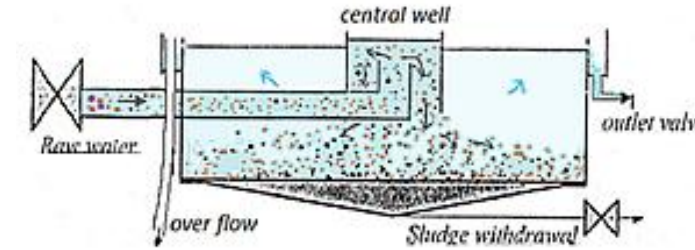
690mm/year



<https://eps.watervision.jp/wp-content/uploads/2025/04/AlaoaDurch-Manual.pdf>

Slow Sand Filter ⇒ Ecological Purification System :

Purification was done
by the function of
biological communities.
It was the food chain.



Diameter 17.8 m
Area 248.8 m²
2 tanks
Retention time: 3.3 hrs

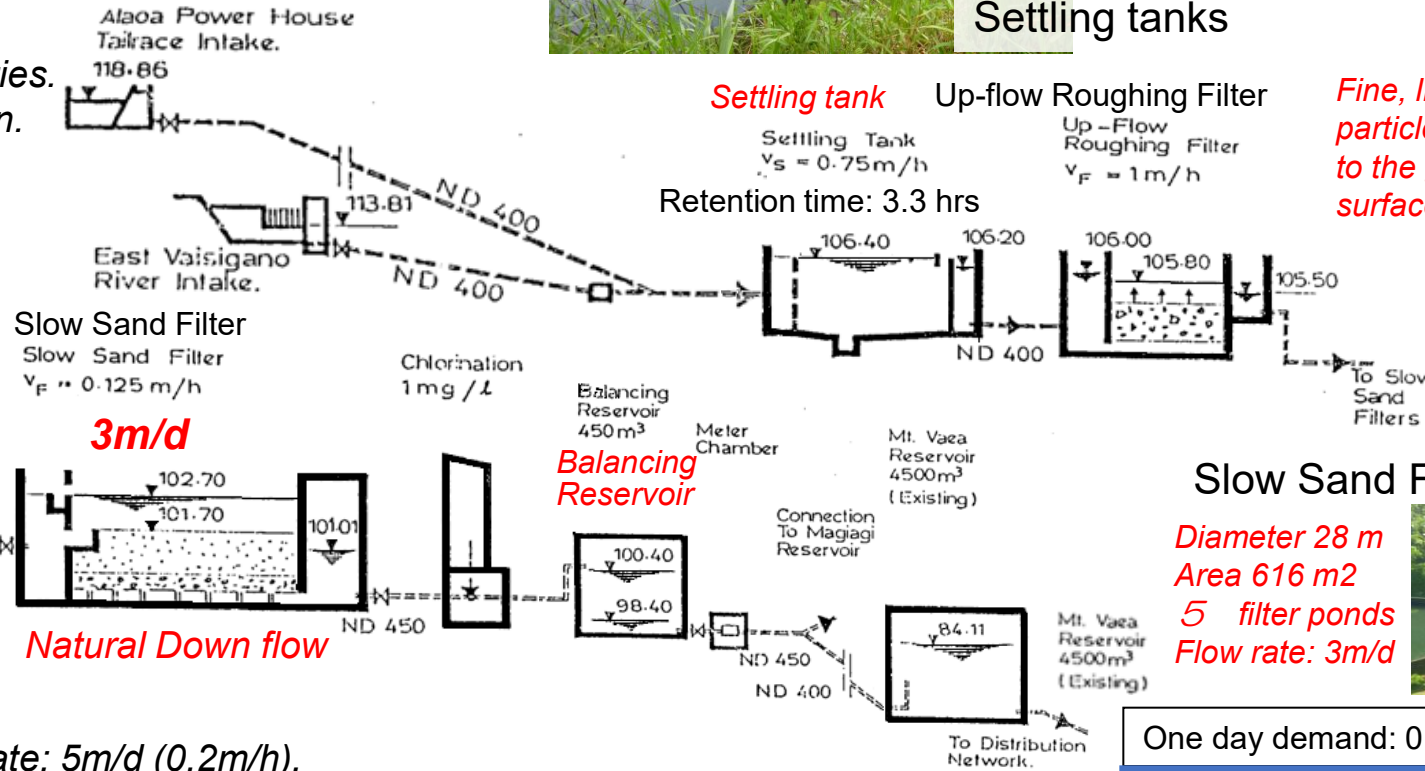
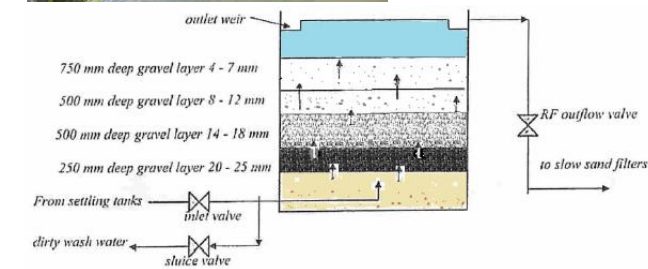
Settling tanks

Up-flow Roughing Filter:



Diameter 11.2 m
Area 98.5 m²
4 filters
Filter rate: 1m/h

Fine, light
particles cling
to the gravel
surface



Slow Sand Filter

Diameter 28 m
Area 616 m²
5 filter ponds
Flow rate: 3m/d



Slow Sand Filter:

English standard rate: 5m/d (0.2m/h).

Present Thames rater: 10m/d(0.4m/h)

Our experiment in Samoa :2013: 5m/d、10m/d、20m/d
= Any rate is good results.

Samoa is located in warm region.

Biological Activity is always good.

One day demand: 0.1 to 0.3 m³/day person (Japan)

IF: One day demand: 0.2 m³/day person (Samoa)

616 m² x 3m/d = 1,848 m³/d x 5 filters = 9,240 m³/d
5m/d : 3,080 m³/d x 5 filters = 15,400 m³/d
10m/d : 6,160 m³/d x 5 filters = 30,800 m³/d

⇒ 0.2 m³/d = 46,200 persons
⇒ 0.2 m³/d = 77,000 persons
⇒ 0.2 m³/d = 154,000 persons

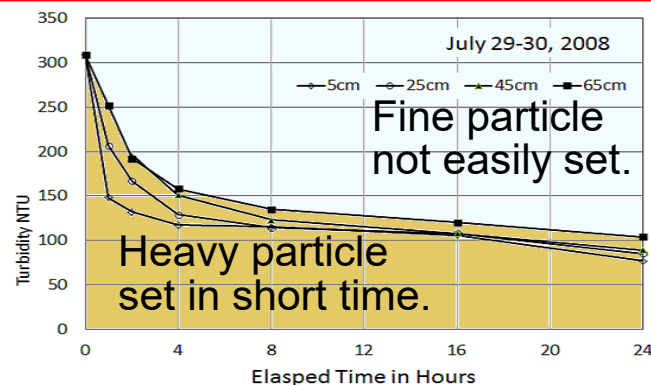
Samoa 217,000 persons (2023)
Apia 36,000 persons (2021)

Heavy rains during the rainy season cause filter blocks, which are a major problem. Water leakage from water supply pipes is also a problem.

We advised: Reduce inflow water for set turbid matter.

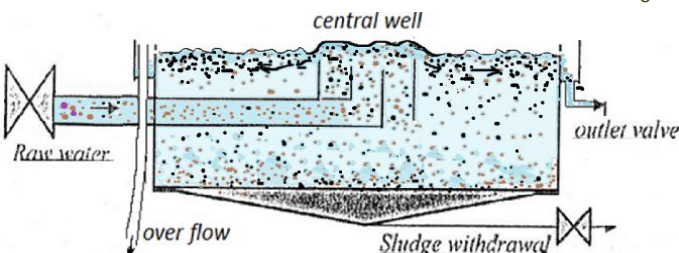
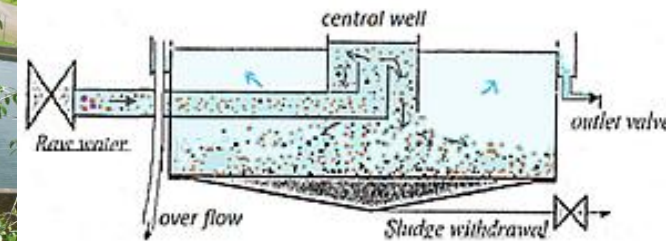


Too much inflow.
Short retention time.

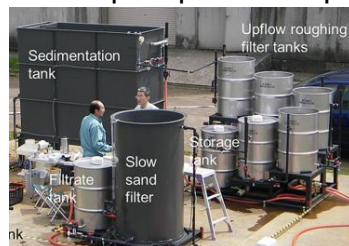


Retention time: 3.3 hrs (design)

The ideal is a calm surface.



Result of pilot plant in Japan.



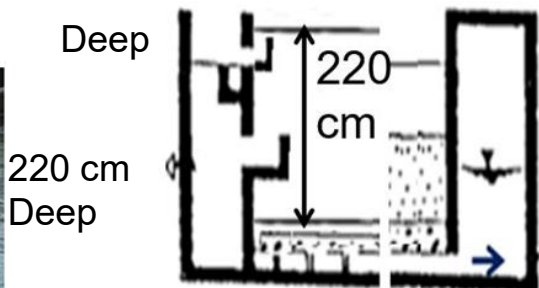
We reduced the inflow rate.



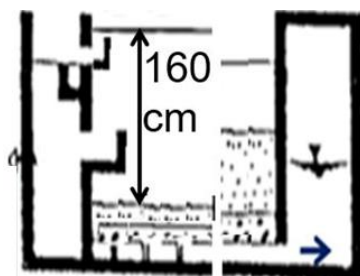
We advised: Put more sand to make shallow depth.



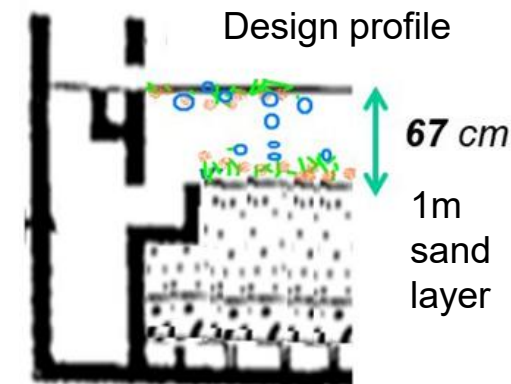
Large mud on the bottom



Almost no sand layer.



Shallower depth
Lifted algal mat with mud.



Shallow depth: Active photosynthesis: much oxygen bubble formation.

Shallow Water Depth is the Key for Ecological Purification System of a Filter Pond.

In shallower pond, algal mat lifts up by photosynthetic bubbles.



No floating algal mat.



Thick mud layer was seen on the bottom at Alaoa No.1 deep filter on 26th Nov. 2010.



Present depth:
220 cm

High pressure and low radiation on the bottom.

Hardly growth of algae at the bottom due to low radiation. **Easily block.**



Role of algal mat in slow sand filter, shallow depth is key: experience in Samoa - YouTube/ 5:05

<https://www.youtube.com/watch?v=ot-KAm6TuaY>

Hardly growth of algae on the deep bottom.

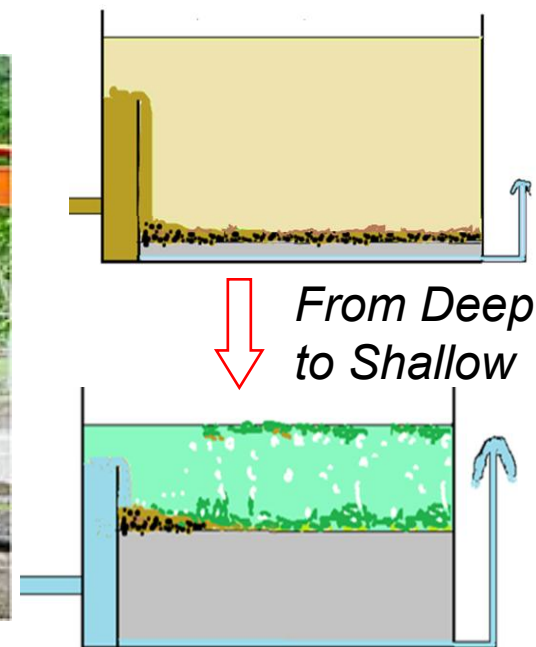
I advised to use beach sand and easy way to wash.



Beach sand near a river mouth was washed to make a shallow depth of slow sand filter pond.

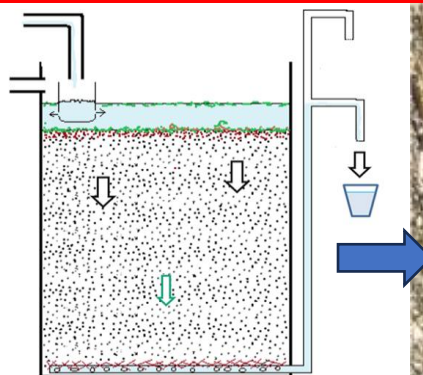
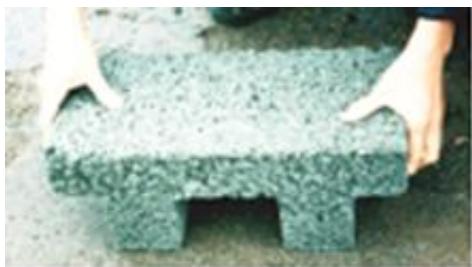


Put sand to make shallow depth.



I advised easy way to put the sand using a cloth seat.

I knew there was only sand layer on bottom porous brick in slow sand filter pond in UK.

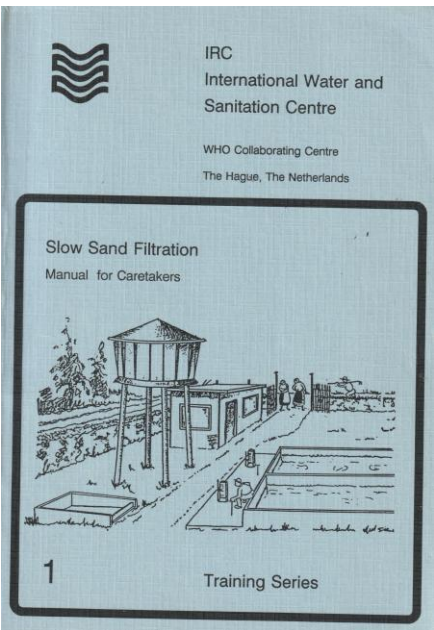


Mesh cover on a porous pipe

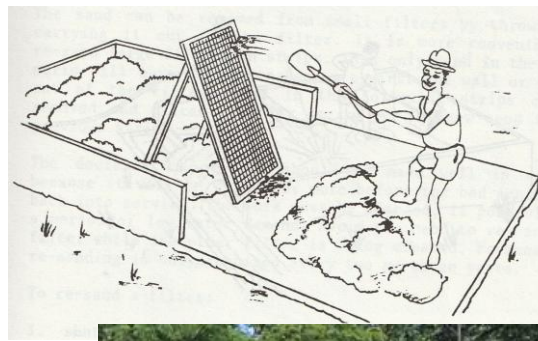
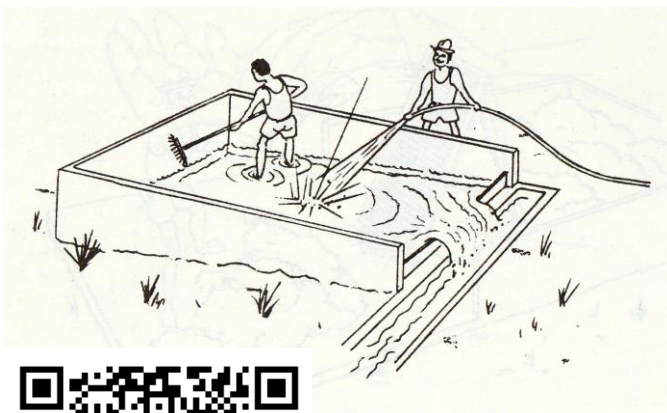
*Only the sand was put on the gravel layer **using a cloth to separate them.***



Over-flow from the balance tank for filtrate water.



IRC Slow Sand Filtration Manual for caretakers



From the video photo of friend of
Samoa Water Authority.



<https://www.ircwash.org/sites/default/files/255.1-85SL-1994.pdf>



Cloth covered gravel layer.



How to wash the sand.
How to set the gravel layer
and sand layer.

<https://youtu.be/lfoI8D3tAAc>

4 min:12"



June, 2025

Stuffs of Samoa Water Authority presented their activity at the 5th Conference at Nagoya, Japan in 2014.

They made shallow water depth of 0.5 - 1m.



CONCLUSION

- **Shallower water depth improves SSF Performance**
 - Increased uplift of algae
 - Increased sediment removal
 - Self cleaning process reducing scraping frequency
 - Reduction in SSF scraping – Reallocation of manpower





名古屋市上下水道100周年

The 100th Anniversary of
Waterworks & Sewerage of Nagoya



The 100th Anniversary of
Waterworks & Sewerage of Nagoya

5SSABC

第5回 緩速・生物ろ過国際会議 19th(Thu) June - 21st(Sat) June 2014

The 5th International Slow Sand and Alternative Biological Filtration Conference



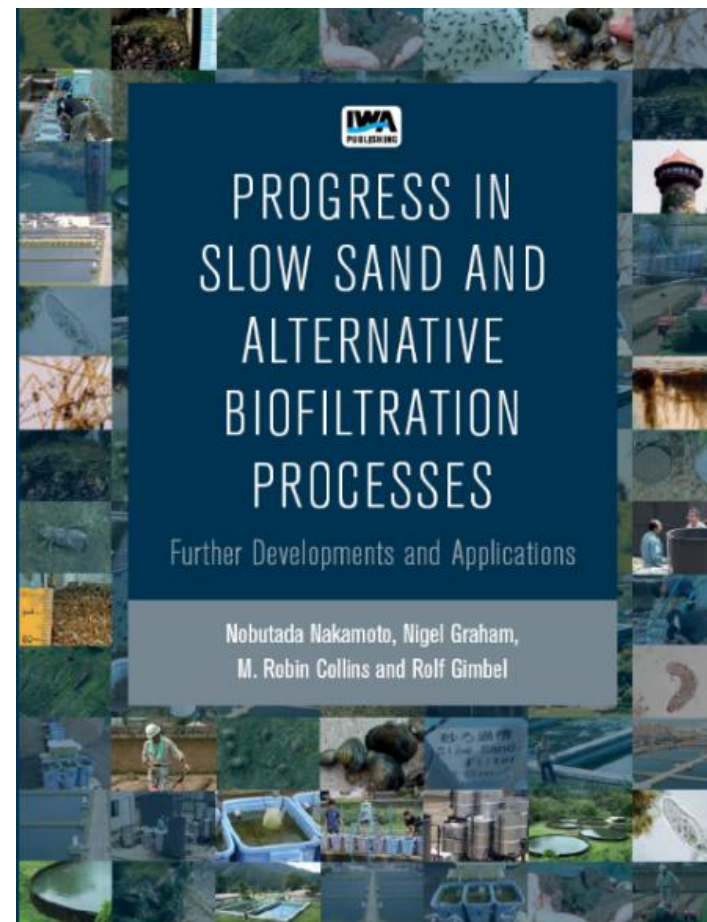
Professor
Nigel J.D. Graham
Imperial College London, UK
Chairman,
Program Committee



Professor
M. Robin Collins, Ph.D., P.E.
University of New Hampshire
Vice-chairman,
Program Committee



Professor (Emeritus)
Nobutada Nakamoto
Shinshu University, Japan
Vice-chairman,
Program Committee



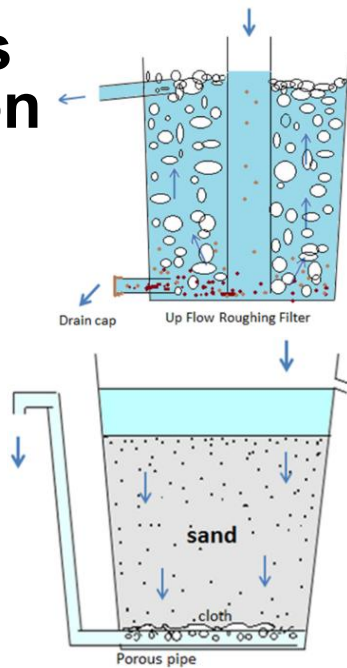
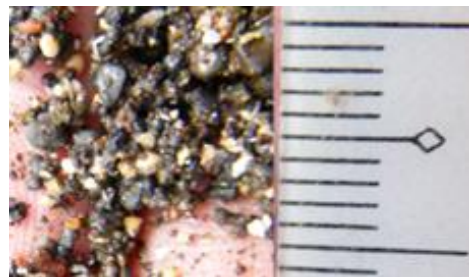
<https://www.youtube.com/watch?v=Wv1FxTkDfsM&t=2s>

5SSABC -
YouTube /
14:15

Biological activity is related with radiation and temperature.



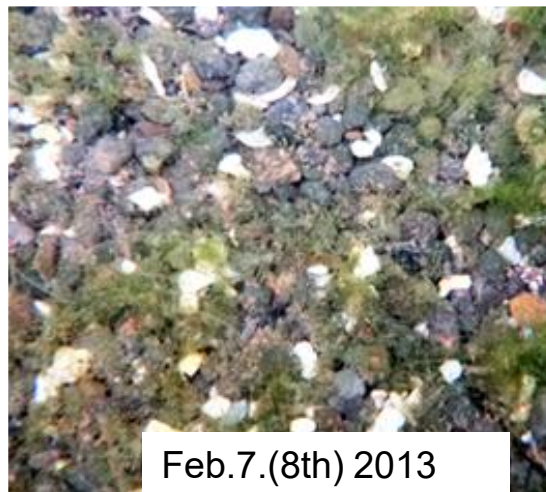
Sand washed with mosquito mesh (1-2 mm)



Sand separated with mosquito mesh (1-2 mm)



Two Up-flow Roughing Filters



Feb.7.(8th) 2013



Feb.14.(15th)

Shallow depth: Algae grow well

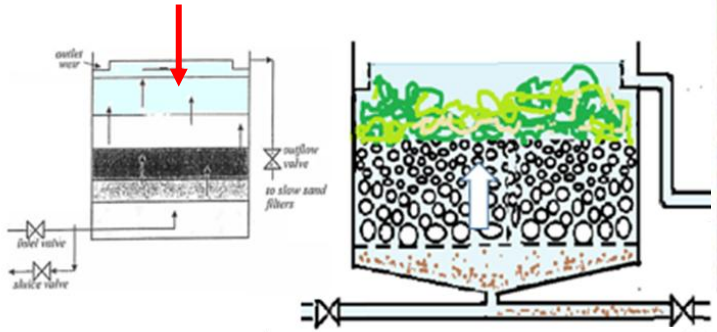
High flow rate experiment for the performance of slow sand filter was done in Samoa (tropical region) from Dec. 2012 to Feb. 2013.



Different flow rate of sand filters (5m/d, 10m/d, 20m/d)
All good quality of filtrates.

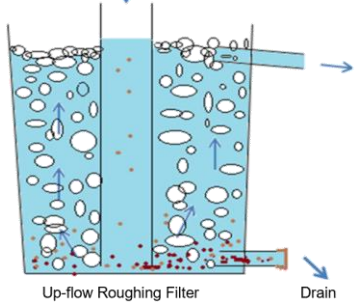
Points:
shallow depth, enough radiation on the bottom, rapid growth, large size of sand.

URF in German Manual
Water 1 m depth above gravel layer

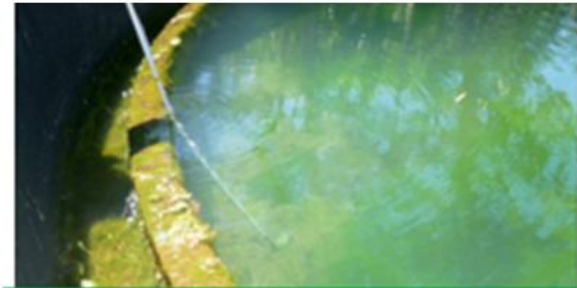


Clear water in river bed in enough area of gravel surface.

Large area of gravel surface is important to adhere suspended matter in URF.

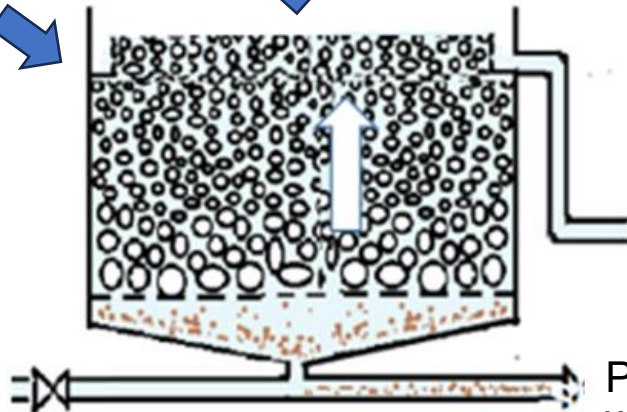


We have to expand more capacity of settling tank and **additional several steps of URF.**



Active growth in URF

SWA Facebook (2026/5/5)



In order to **expand adhesive area** of stone surface for suspended matter in raw water.



Put full gravel with small crushed stones.



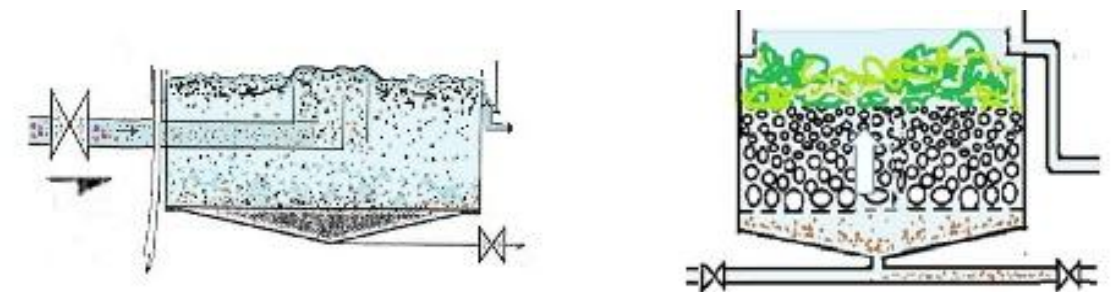
Putting the gravel to URF was continued in March, 2026.

<https://youtube.com/shorts/1nna1brMkyY>



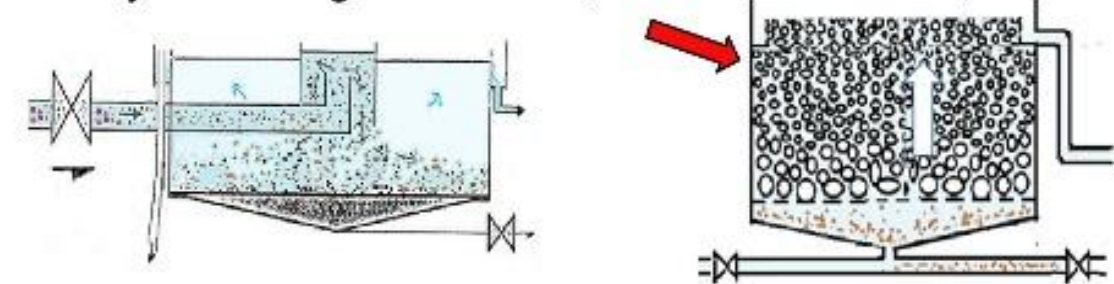
1min 58sec.

Advise for a better plant system to Samoa



Reduce inflow
⇒ Easy to settling

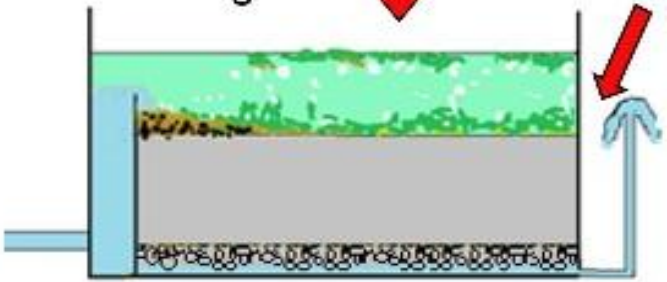
Thicker gravel media
⇒ Expand active area



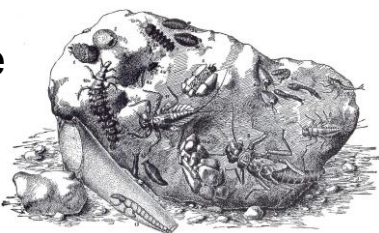
Improvements to the Purification Function.



Make shallow depth
⇒ Activate algae

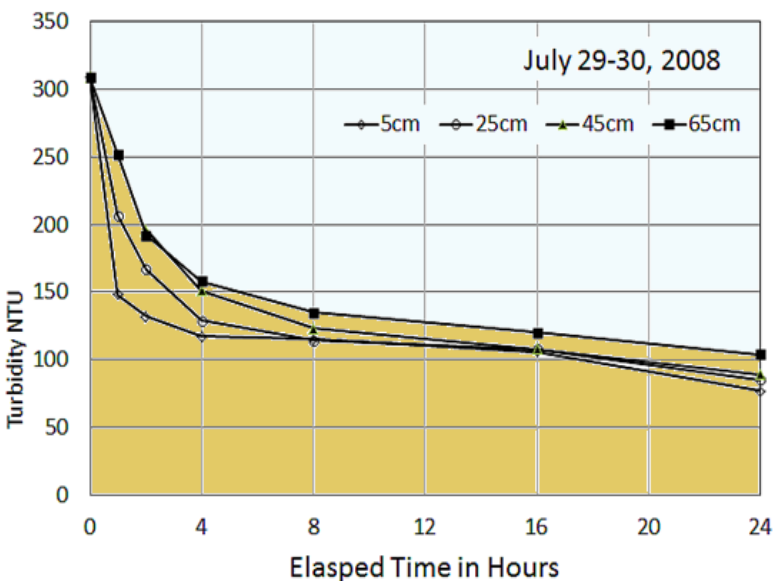
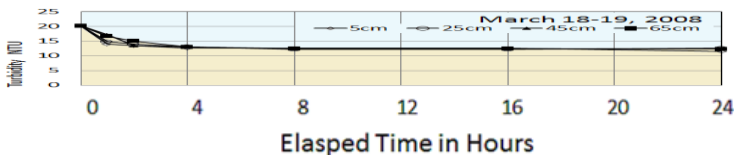


Small organisms active on the stone surface.



Suitable residence time for settling

Clear water



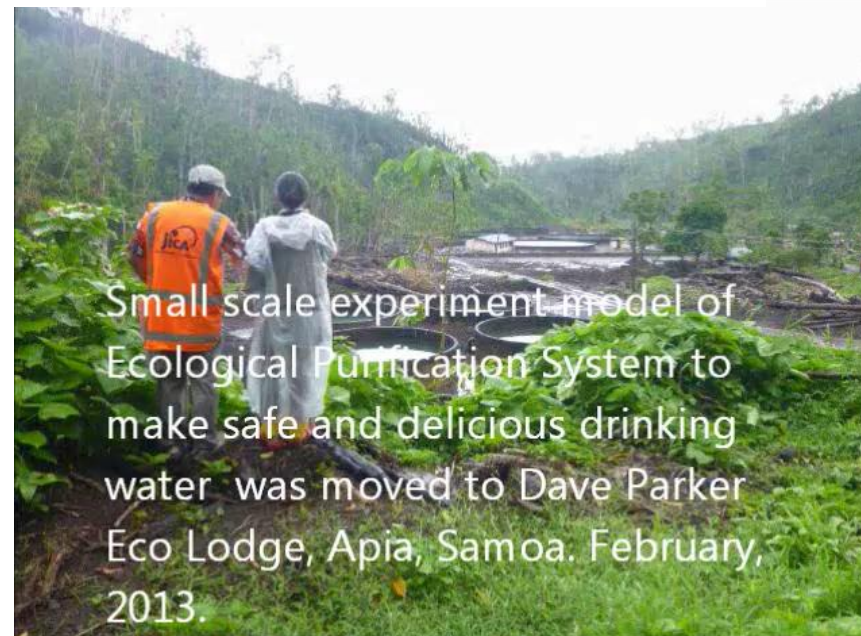
Shallow depth is better for algal activity.

Turbid matter in storm event, easily settles within short time.





Small scale experiment model of Ecological Purification System to make safe and delicious drinking water was moved to Dave Parker Eco-Lodge, Apia, Samoa. February, 2013.



<https://www.youtube.com/watch?v=YslTuNHXxZg&t=112s>

4 min 24 sec

