My World Conference 11

SustainABILITY

Genesis Centre - Calgary
February 21, 2019

The Story of the BioSand Water Filter
'Safe Water for the World'

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www.manzwaterinfo.ca
www.cabincleanwaterfilter.com

What is a BioSand Water Filter?

A water filter that removes particulates and disease causing organisms from water.

What does the BioSand Water Filter do?

Chiapas, Mexico

Mozambique

It makes water safe to drink!

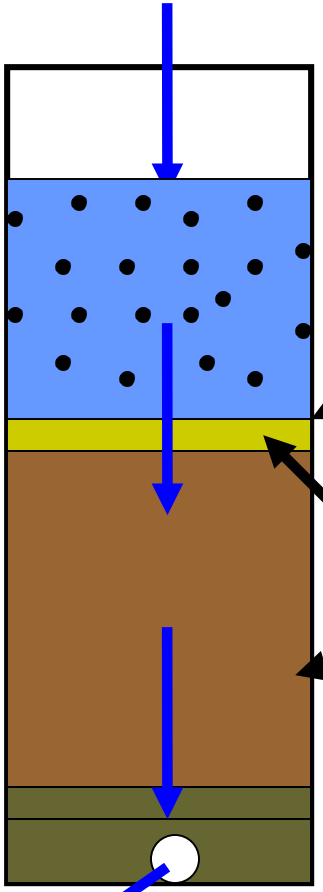
Climate change friendly: no need to boil water and use fuel and should last indefinitely (Sustainable!!!).

How does the BioSand Water Filter work?

Basic Operation

Raw water is added to filter without disturbing surface of media.

Operating water level.



Similar to traditional slow sand filtration, particulate material is captured on or near surface of the very fine filtering media.

Unlike traditional slow sand filtration, the BSF can be operated on a demand basis when removing micro-organisms.

No particulate material is captured within media because the water is not forced into the media as it is in rapid sand filtration or pressure filtration.

Filtered water exits filter.

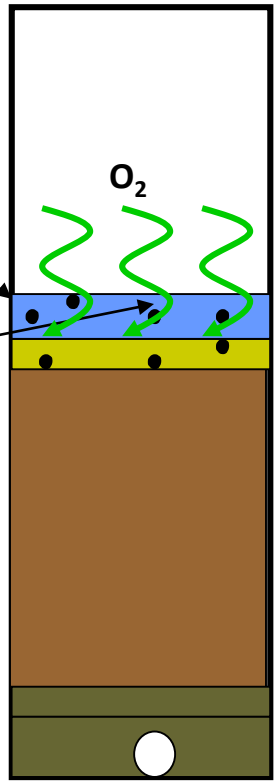
Operation of the BSF when flow is stopped and resumes.

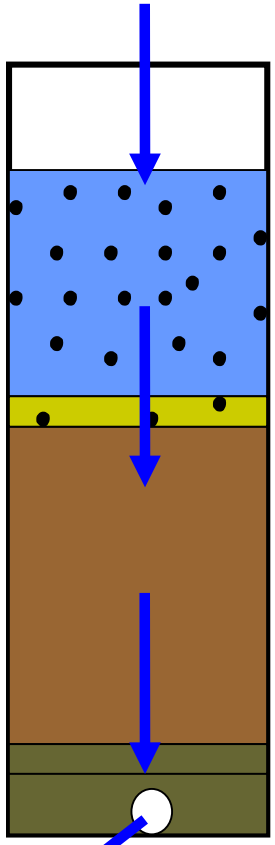
Flow to filter is stopped.

Flow to filter resumes.

Water level drains to paused or minimum depth – minimum 5cm.

Sufficient oxygen can diffuse through the shallow layer of water to keep aerobic biolayer alive.





Mature healthy biolayer still present.

Filtered water exits filter.

Note: Paused depth should NOT be less than 5 cm as the biolayer will be disturbed when water is added. Paused depths much greater than 5 cm may limit transfer of oxygen to the biolayer impairing its performance. 5 cm is considered the optimum.

- Untreated water enters filter when the lid is removed and water is poured in directly.

BioSand Water Filter

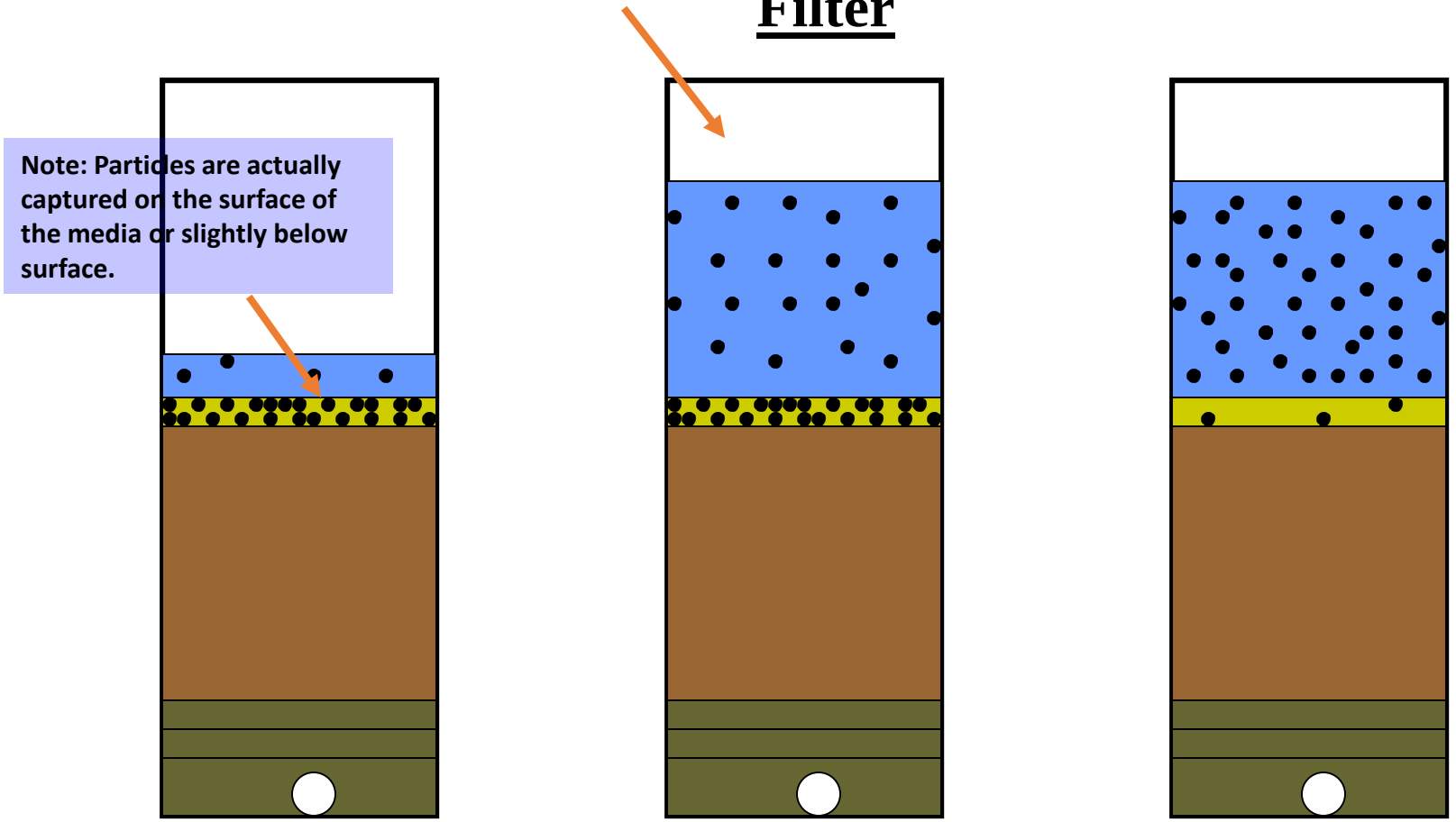
- Water passes through the sand to the underdrain, up the standpipe and out into the bucket below.

The biological layer forms naturally as the organisms in the water are captured and collect on the top of the filter sand.

The accumulation of organisms and organism parts enables the biolayer to get better and better at capturing disease causing bacteria and viruses. (Recall: Up to 99%.)

Biological layer forms here!

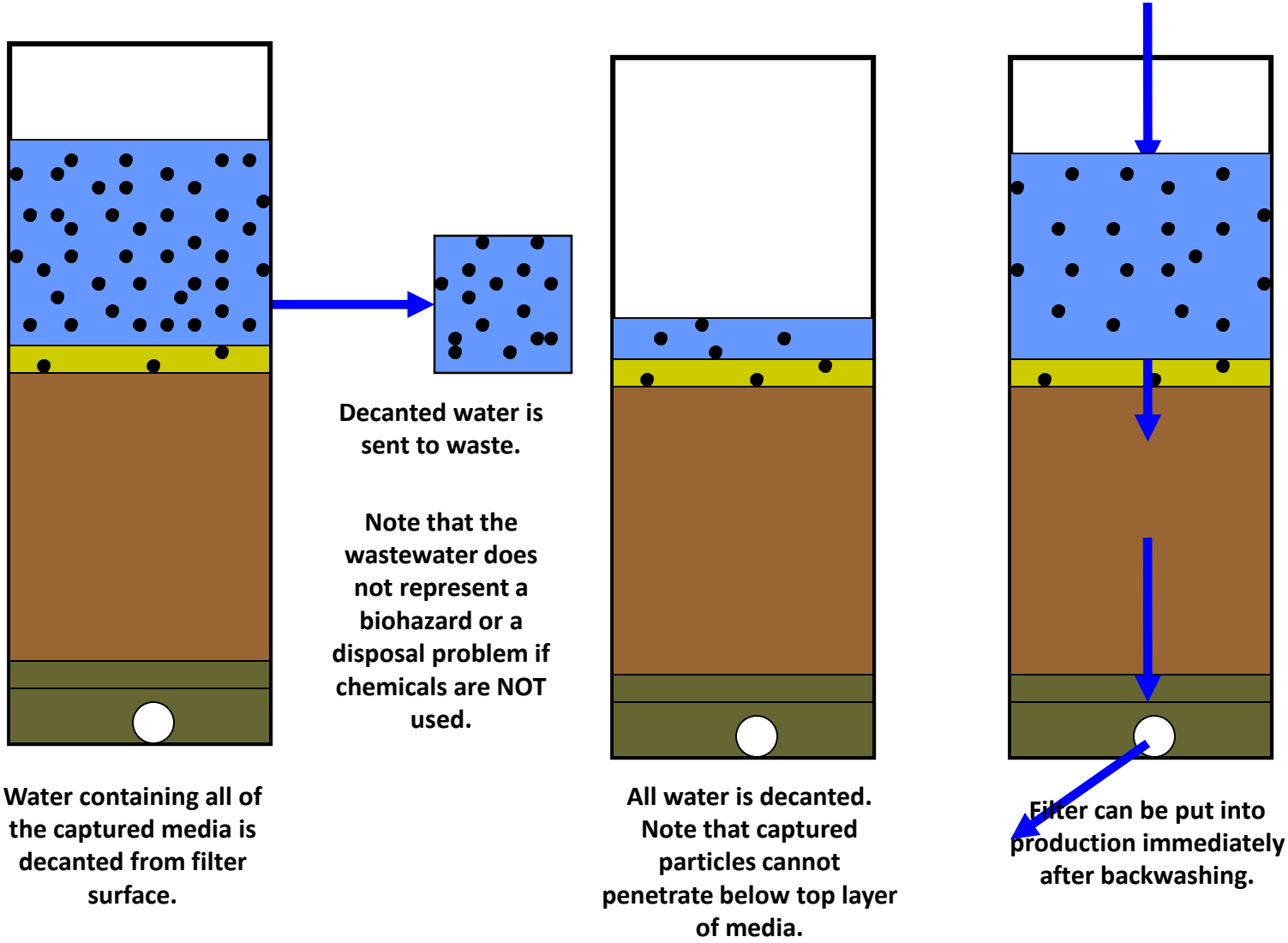
Cleaning the BSF – Raw Water Added to Top of Filter



Water level in filter is at the paused depth – could be at any depth.

Untreated water is added until there is at least 0.2 to 0.3 m of depth above top layer of media.

Surface of top layer of media is agitated. This action suspends most of the captured particles.


Water containing all of the captured media is decanted from filter surface.
Decanted water is sent to waste.
Note that the wastewater does not represent a biohazard or a disposal problem if chemicals are NOT used.
All water is decanted. Note that captured particles cannot penetrate below top layer of media.
Filter can be put into production immediately after backwashing.

Where is the BioSand Water Filter used?

More than 2,000,000 all over the world!

Thousands built every day.

Saves 10's of millions of lives!

Epidemiological studies (impact on human health) have demonstrated up to 45% reduction in diarrheal diseases.

Subsequent studies indicate up to 70% reduction in diarrheal diseases with very good sustainability.

Filtered water also used for:

- **Bathing (elimination of fungal infections and skin penetrating parasites)**
- **Food preparation**
- **Kitchen hygiene and more.**

You can search on the internet with the words:
'BioSand Water Filter' or 'Manz BioSand Water Filter'
and the name of almost any country you are interested in and you will find projects.

So how did this happen?

I was very interested in using my knowledge of water and environmental engineering to help disadvantaged communities world wide.

So, I began to work with the Division of International Development at the University of Calgary, learned about development and the opportunities appeared.

The development of the BioSand Water Filter was inspired by visits to disadvantaged communities in Africa and Asia (1988 and 1989).

Visit to Kwazulu, Natal, South Africa – help with water problems on behalf of the Division of International Development at the U of C.

Island of Mindanao Philippines to help solve water problems on behalf of the Division of International Development of the U of C.

Outhouse and well behind store in Heritage Park, Calgary.
(typical situation in early prairie years if you don't know better)

It was evident that people needed a point-of-use treatment system.

The treatment technology of choice is known as

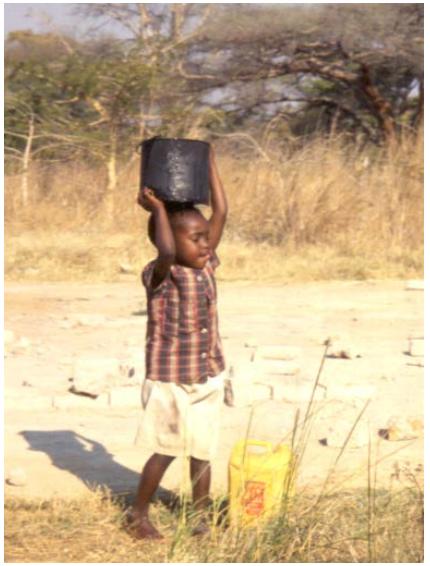
‘Slow Sand Filtration’.

Slow sand filtration has been used around the world, for over 180 years to treat water for drinking purposes.

Household filters that use sand have been in use for several thousand years. (Such as the one in China shown above.)

Alone Slow Sand Filters remove:

- Parasites - typically 100%
- Bacteria - 90 – 99%
- Viruses - 90 – 99%
- Sand, silt and other particles
- Organic and inorganic toxins (substantially reduced)



Objective: Develop a version of slow sand filtration that could be used in a household.

For this treatment technology to be successful it had to be:

- **Effective (it has to work)**
- **Affordable (within consumer budget)**
- **Sustainable (integrated into the local culture and economy AND long lasting)**
- **Simple to build and use**
- **Easy to teach others to build and use**

Brief History

Original testing of my ideas: 1991 – 4th year Civil Engineering student project (David Lee).

Budget: $75.00 and some free water testing from the Province of Alberta.

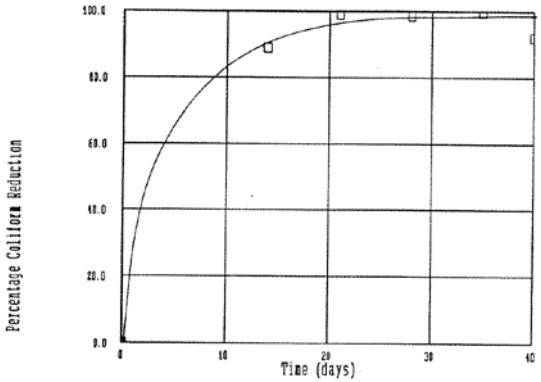


Figure 4.1 Reduction in Total Coliforms

First BioSand Filter Ever!

The theories behind the BSF innovation were demonstrated to be true!

I realized that the results of our little study were very important.

A variation of slow sand filtration suitable for household (small scale) use had been demonstrated.

I decided to do whatever was necessary to bring the 'new slow sand filtration technology' to practical use. I decided to be the 'champion' of the new filter idea.

Important questions:

1. **Must make sure the technology works.**
   (Mustn't experiment on trusting people.)
2. **Would people use a filter like this to treat their water?**
   (Underlying this question was the doubt that people really knew that the water would make them sick – well they did but had no choice but to use unsafe water.)
3. **How should the filter be designed?**
   (Concept to commerce idea.)

Confirming study results and developing practical designs before going to actual projects.

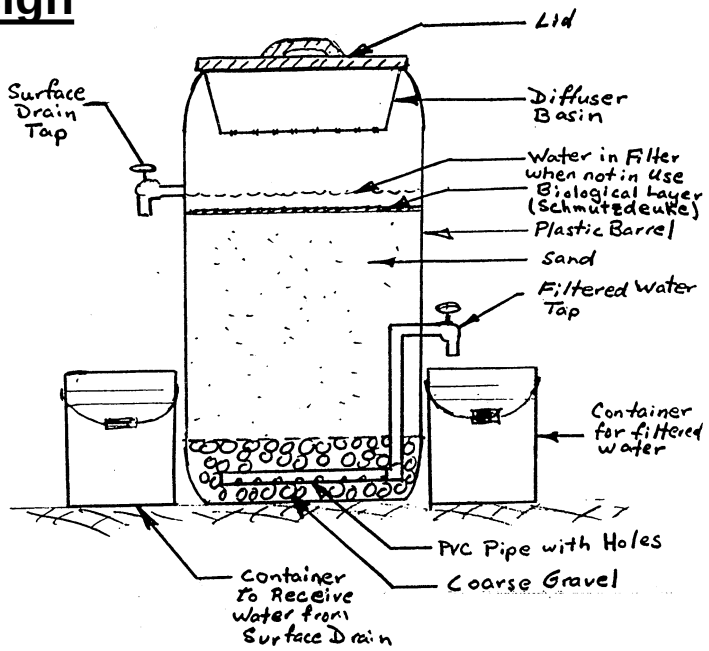
First filter used in initial lab work at the University of Calgary

First prototype of the modern BioSand Filter

Would people want to use the BioSand Filter?

Our first project (4 plastic filters) was in Nicaragua in 1993 – south of the city of Managua.

Design

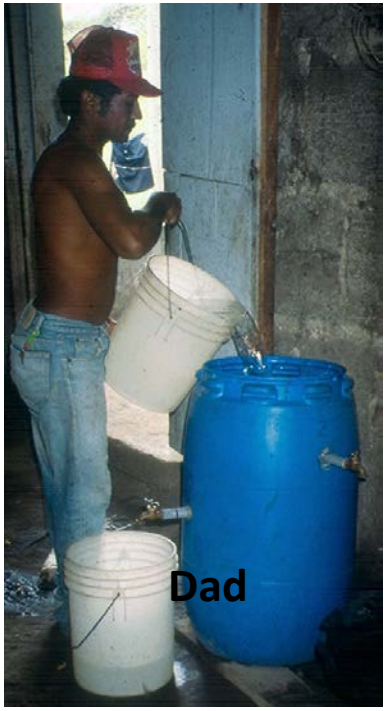


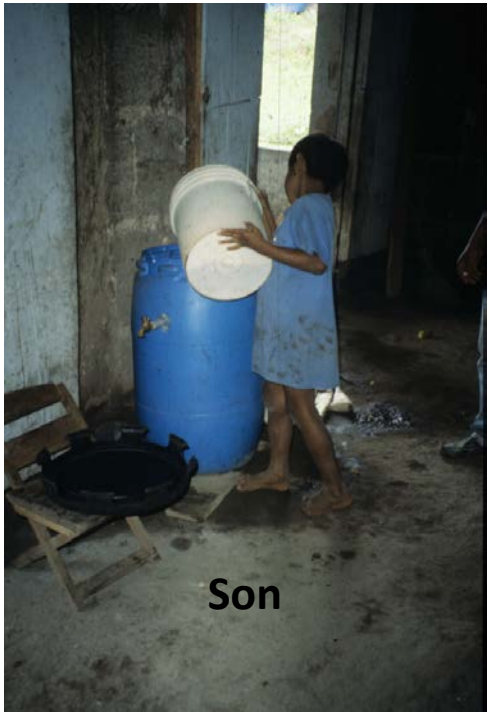
Sketch of:
Nicaragua Household
Slow Sand Filter.
(Plastic barrel version)

Implementation Team

Funded by the Pan American Health Organization through a project managed by the University of Calgary.

Typical filter installation and use in Nicaragua.

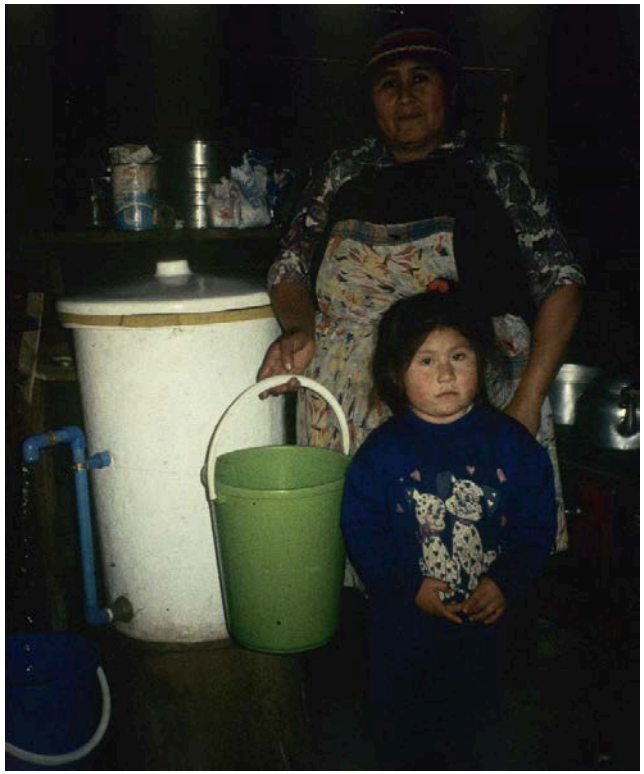




Honduras - 1994

Filters worked, were accepted but needed a better design.

Chile - 1994



Development of the concrete version of the BioSand Water Filter (BSF). Lots of 4th year engineering projects.

Second cast concrete BSF at U of C.

Ferro-cement construction of BioSand Water Filter at University of Calgary.

First cast concrete BSF at U of C.

Byron Buzunis – my Grad Student evaluating performance of prototype of first cast concrete BSF to be used in Nicaragua.

Another grad student from Germany, Ole Mrklas, who did his masters degree assessing the use of the filter in warm and very cold environments. Here discussing the method we used to produce contaminated water with a visitor from El Salvador.

Terry Nail, Senior Technologist from the University of Calgary – with First Concrete Filter made in Nicaragua.

First Concrete Filter Factory in Nicaragua.

Concrete BSF Factory in Nicaragua in 1994.

First concrete filters manufactured using a wood mold.

Nicaragua 1994: 60 homes. Eliminated diarrheal diseases - including cholera!

Despite the apparent success of the Nicaragua water filter project, the Government of Canada and the University of Calgary discontinued support.

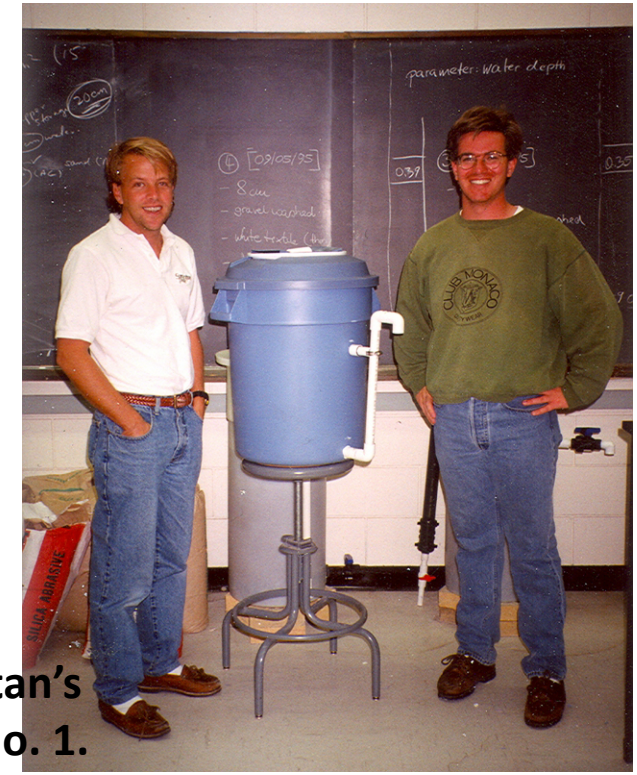
There was no contact with the community in Nicaragua for two years.

This turned out to be a blessing as the people of the community continued to use and maintain their filters without any outside assistance. They 'loved' their filters as they later explained.

Their health was greatly improved and their neighbors also wanted filters – none were to be had.

The water filter project was discovered by Samaritan's Purse Canada. They were impressed and wanted to use the technology – which I had continued to develop independently.

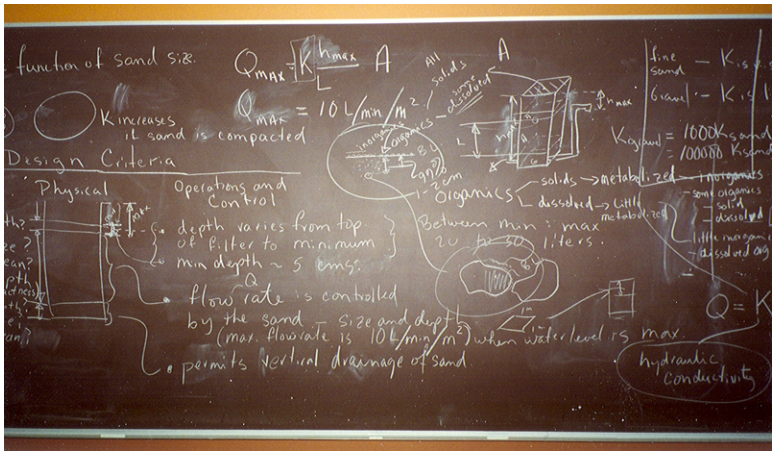
News of the successful Nicaraguan filter project spread and instruction was demanded.



Samaritan's Purse No. 1.

First courses on filter construction offered at the University of Calgary in 1996.

El Salvador - CESTA



The first order of business was to replace the wood mold with a steel mold – better quality control and longer lasting.

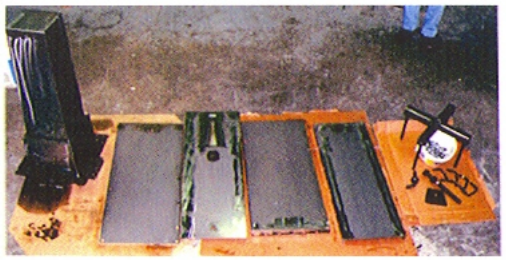
Several prototypes were developed before achieving a satisfactory design.

One of several training manuals used in the water filter training course.

Concrete
BioSand Water Filter
Construction Manual

Book 3: Construction of the Concrete Filter Body

Dr. David H. Manz, P. Eng.



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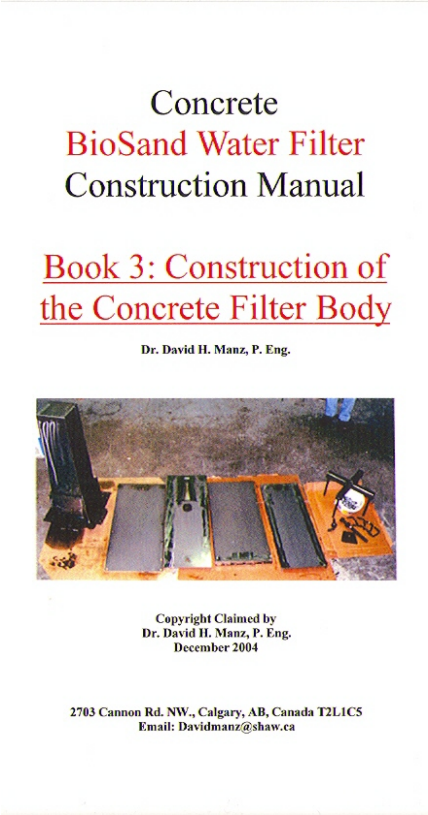
Email: Davidmanz@shaw.ca

With the development of an adequate steel mold design a training program with good manuals could be developed and the 'sharing of the BSF technology with interested individuals and organizations could begin.

Designs and training program continued to evolve as more experience was gained.

The objective was to share the technology as widely as possible – for free.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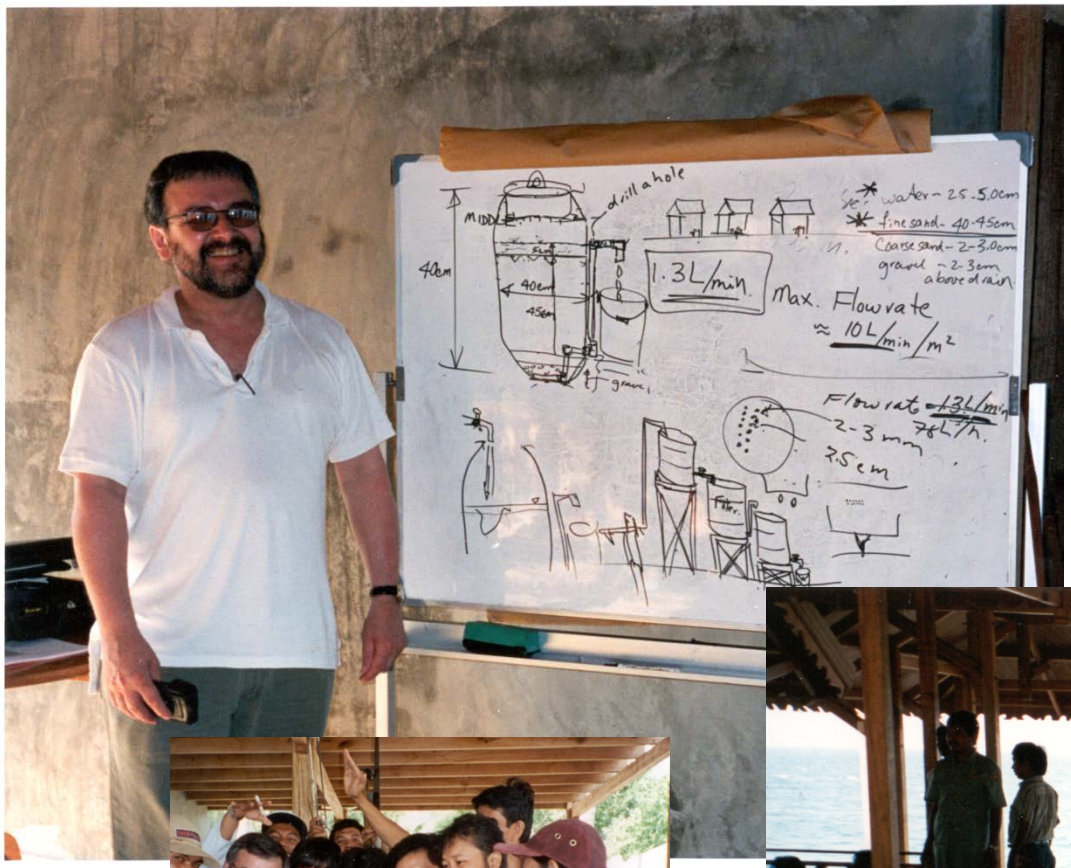
Samaritan's Purse received funding from the Rotary Club of Calgary South for their first concrete filter project in Ethiopia in 1997.

ROTARY CLUB OF CALGARY SOUTH

SERVICE ABOVE SELF - HE PROFITS MOST WHO SERVES BEST

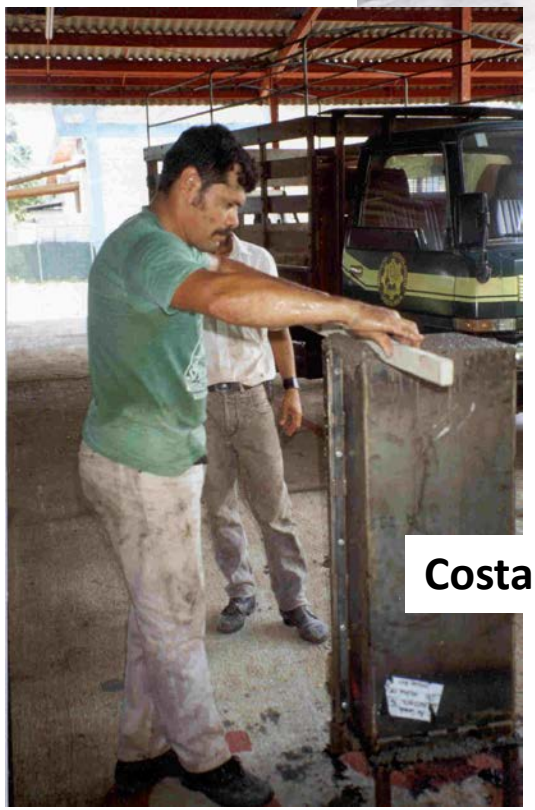
This project has been very successful.

This project received considerable additional funding from the Canadian International Development Agency to construct and install thousands more of the concrete filters in the remotest parts of the country. Filters are still operating 21 years later!



CARE International Indonesia Project – in Indonesia - 1997.

Students at the University of Calgary.



Costa Rica


Rotary – Aquinas College
Concrete Filter Workshop
Michigan Feb 2006













Dominican Republic

Media Workshop

August 2006

Concrete Filter Project in Chiapas, Mexico – another Samaritan's Purse Canada Project.

Viet Nam

Mozambique

Kenya

Cambodia

Some other Samaritan's Purse Projects around the world.

Map of Republic of Haiti

Haiti

ROTARY CLUB OF CALGARY SOUTH

SERVICE ABOVE SELF - HE PROFITS MOST WHO SERVES BEST

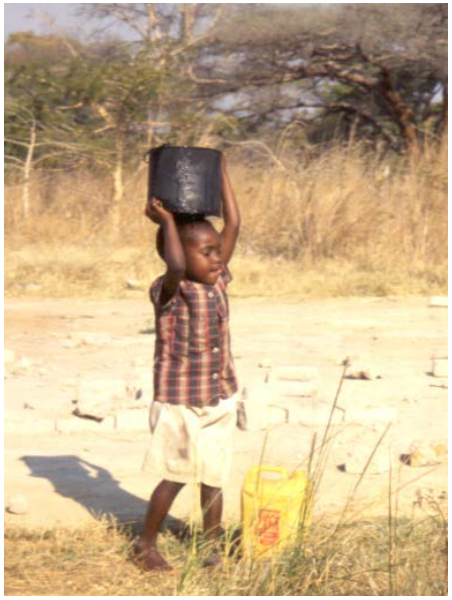
Training in Haiti – no electricity – no audio visual! Round table, picture books and a translator!

Dominican Republic - 2000

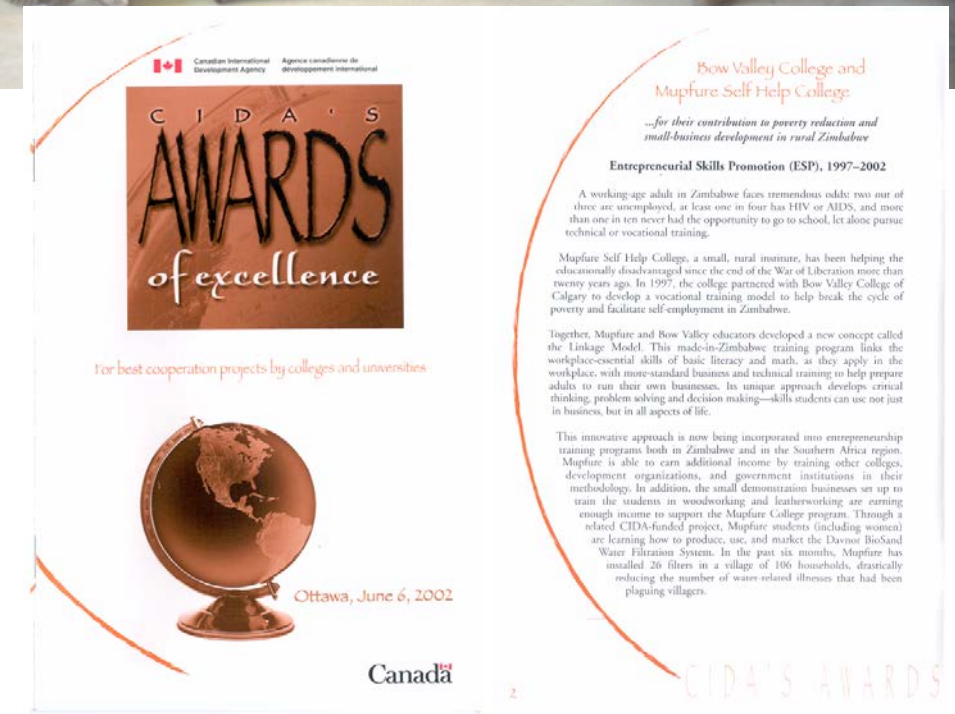
Jan Tollefson

and the BioSand Water Filter Projects she developed and raised funds for.

A Project in Zimbabwe supported by a committed individual, Gerry Simon, and Bow Valley College, Calgary – 2001 to 2002.




Clean Water
Healthy People


Canadian International Development Agency
Agence canadienne de développement international
CIDA'S
AWARDS
of excellence
For best cooperation projects by colleges and universities
Ottawa, June 6, 2002
Canada
Bow Valley College and
Mupfure Self Help College
...for their contribution to poverty reduction and small-business development in rural Zimbabwe
Entrepreneurial Skills Promotion (ESP), 1997–2002
A working-age adult in Zimbabwe faces tremendous odds: two out of three are unemployed, at least one in four has HIV or AIDS, and more than one in ten never had the opportunity to go to school, let alone pursue technical or vocational training.
Mupfure Self Help College, a small, rural institute, has been helping the educationally disadvantaged since the end of the War of Liberation more than twenty years ago. In 1997, the college partnered with Bow Valley College of Calgary to develop a vocational training model to help break the cycle of poverty and facilitate self-employment in Zimbabwe.
Together, Mupfure and Bow Valley educators developed a new concept called the Linkage Model. This made-in-Zimbabwe training program links the workplace-essential skills of basic literacy and math, as they apply in the workplace, with more-standard business and technical training to help prepare adults to run their own businesses. Its unique approach develops critical thinking, problem solving and decision making—skills students can use not just in business, but in all aspects of life.
This innovative approach is now being incorporated into entrepreneurship training programs both in Zimbabwe and in the Southern Africa region. Mupfure is able to earn additional income by training other colleges, development organizations, and government institutions in their methodology. In addition, the small demonstration businesses set up to train the students in woodworking and leatherworking are earning enough income to support the Mupfure College program. Through a related CIDA-funded project, Mupfure students (including women) are learning how to produce, use, and market the Davnor BioSand Water Filtration System. In the past six months, Mupfure has installed 26 filters in a village of 106 households, drastically reducing the number of water-related illnesses that had been plaguing villagers.
2
CIDA'S AWARDS

Introduction of the BioSand Water Filter

Eastern Cape Province, South Africa

Summer 2007 (Lethbridge Community College Project)


CHOLERA

More than 90% of the BSF's are the small household concrete version that are locally constructed.

Calgary not-for-profit organizations:

Samaritan's Purse and

The Centre for Affordable Water and Sanitation Technology (CAWST)

and many, many others in Canada and around the world

support NGO managed BioSand Water Filter programs globally.

Calgarians believed in the good the BSF's would have in the developing world.

Calgarians have provided millions of dollars to support to BSF projects worldwide.

The world has followed.

The World Health Organization and even the World Bank have noted the impact of the introduction of the BSF on community health.

The BSF technology is now recognized as the best available point-of-use water treatment in the world.

Today it is estimated that more than 2 million filters are in operation with several hundreds (thousands) more concrete BSF's being built and installed every day.

CAWST is born!

CAWST was founded in 2001 as a result of conflict-of-interest between interests of a publically traded for-profit company, Davnor Water Treatment Technologies Ltd., and not-for-profit initiatives.

Decided to co-found Centre for Affordable Water and Sanitation Technology with Camille Dow-Baker who would be the CEO. Intention was that CAWST would carry on with my vision for the BSF, and a broader non-commercial agenda that included sanitation.

Under Camille's leadership CAWST became very effective at disseminating the concrete BSF technology and becoming a knowledge centre on provision of safe water and sanitation for disadvantaged communities worldwide.

For the development of the BioSand Water Filter, making it freely available to the world and co-founding CAWST I was awarded Alberta Order of Excellence in 2018.

With Lieutenant Governor, Lois Mitchell

With other AOL recipients and Premier, Rachel Notley

Today the emphasis is getting the technology more widely available to people who need it – like the urban and peri-urban (slum) communities as well as the rural poor.

After learning many manufacturing techniques, marketing methods, how to run a business, etc., etc. and not doing too good – maybe, finally after twenty-five years of trying the following two products will take off:

Actively marketing in Canada, Africa, Cambodia, India and China – soon the whole world!
Still empowering! Billions of filters! Safe water for the world!

Lots more to tell.

The adventure continues. Not done yet!

Global warming and climate change, increased global population and demand on resources!

Room for all of you to contribute.

Thankyou!

Dance in praise of the BSF project in Zimbabwe.

For more information see the following two web sites:

www.manzwaterinfo.ca

and

www.cabincleanwaterfilter.com