Closing The Stormwater Loop by Eco- Engineering

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ABSTRACT

Our company was established on the principle that technologies should work in harmony with Nature. We believe that the Eco Engineering is the best way forward in conserving our environment. Amidst the Eco Engineering is the ecological sanitation or Ecosan concept which advocates no mixing of various wastewater streams, but to deal with it individually at source with simple proven treatment processes.

This paper describes how a river can get cleaned up without any works done to it except by closing the loops of various wastewater streams e.g rainwater, stormwater, greywater, sewage and organic matters. The closing loop also allows wastes to be recovered and converted into resources.

Based on the theory put forward by Monash University's Professor Tony Wong's team, which stated that developing cities have the best chances to leapfrog their positions from water supply / sewer city to become a water sensitive city without having gone through being a drained city, waterways city followed by the water cycle city as most developed cities have gone through.

In the light of Global Warming, the re-cycled water is best used for gardening and greening the city with landscapes, green roofs and green walls or eventually urban farming in order to conserve potable water. By selecting the right plant species, green roofs and vertical walls, can be doubled up to become an organic greywater treatment system to treat effluents from laundry and domestic discharges. Energy saving is indirectly resulted by having these green roofs and vertical gardens to cool down the building and lower the ambient temperature.

The presentation will finish with a description of the technologies promoted by Ecoclean which has been used for Leadership in Energy and Environmental Design (LEED) Green Building Rating. These technologies are CDS (Continuous Defective Separation) systems, filternator media wastewater polishing, Nano wastewater treatment plant and others.

Keywords: Ecological Sanitation , Ecosan, stormwater, greywater, CDS(Continuous Deflective Separation), Filternator.

2. INTRODUCTION OF ECO-ENGINEERING

Wikipedia defines Ecological Engineering in short Eco- Engineering as "an Emerging study of integrating Ecology and Engineering concerned with the design, monitoring and construction of ecosystems ". According to Mitsch (1990) and Jor Gensen, the design of sustainable ecosystem intends to intergrate human society with its natural environment for the benefit of both is also part of eco – engineering.

They suggested the goal of eco-engineering is 1) the restoration of ecosystem that has been disturbed by human activities such as environmental pollution, land disturbance and
2) the development of new sustainable ecosystem that have both human and ecological values.

Bergen et. al. (2001) defined eco- engineering further as:-

1) Utilising ecological science and theory.
2) applying to to all types of ecosystems,
3) adopting engineering design methods, and
4) acknowledging a guiding. value system.

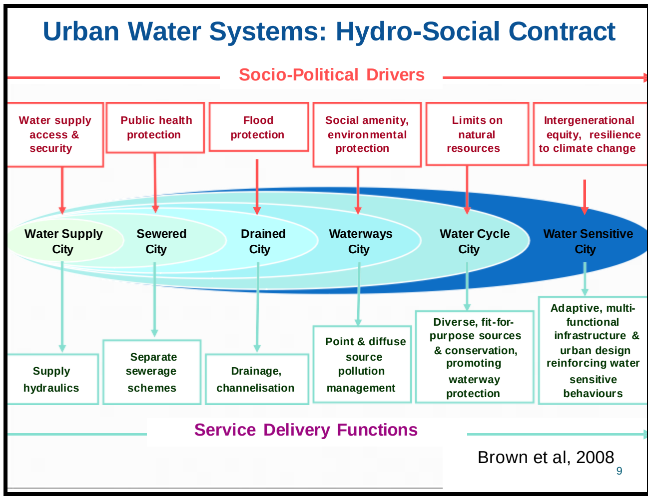
The focus of eco-engineering applicable to cities generally is in the field of landscape, architecture, urban planning and urban horticulture which can be synthesified with urban stormwater management, rain gardens, wetlands, tree planting, lately urban farming, green roofs and vertical gardens.

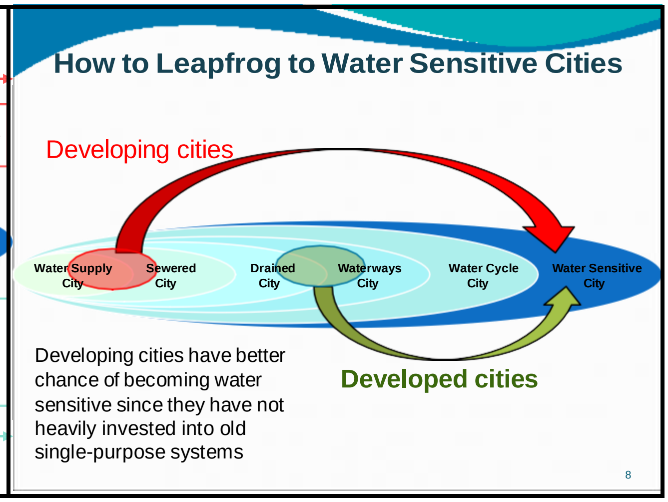
By coincidence, our company EcoClean Technology Sdn Bhd has started to promote the CDS Technology which is a self cleansing and non blocking screening technology to remove pollutants from the urban drainage system harnessed from the energy developed by flowing water. This technology was first introduced in Putrajaya development as a cheaper and better value alternative to conventional screening method of gross pollutant traps and trash screens in year 2000,

Professor Tony Wong , the former Engineer of the year 2013 voted by the Institution of Engineers Australia, helped to develop this new technology from Monash University and this technology was used on a large scale for the Olympic Park in Sydney for year 2000 Olympic Game with huge success rendering the trash screen technology becoming obsolete in Australia.

Since then Professor Tony Wong is now CEO to of catchment & Research Centre(CRC) and the follow tables are describing how cities can leapfrog into modern water sensitive cities.

Table 1 Table 2



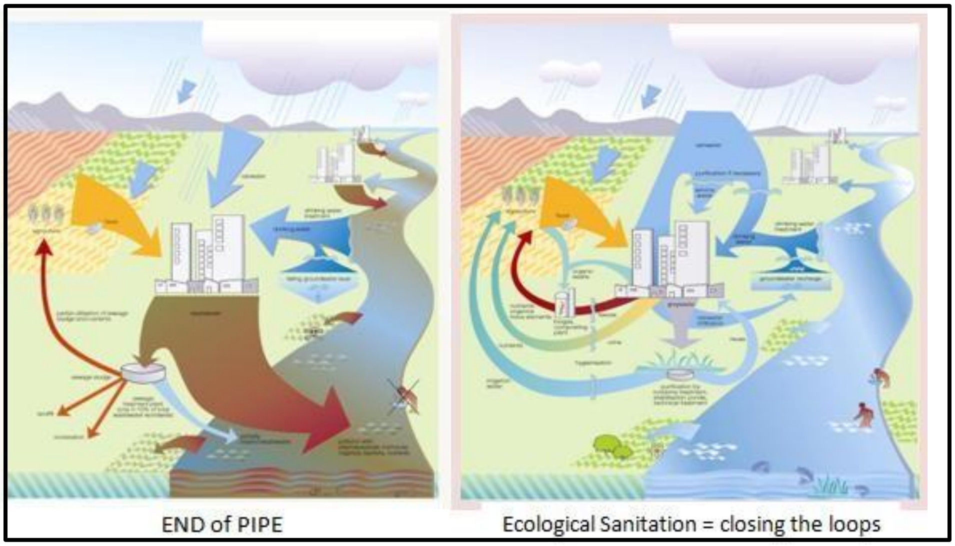


The writer who was trained in Singapore and UK as mechanical Engineer went into business by being the first person to introduce the vacuum sewer system in 1996. The writer, having worked with multinational construction groups firmly believes that engineering should be based on simple and fundamental principle mimicking nature to certain way instead of making the process complicating . In the respect of the conventional wastewater treatment of flushing sewer with potable water and transporting it to pipeline to a sewerage treatment plant which is sized to treat the mixed sewer and water their wastewater in a 'mixed' manner, may not necessary the wiser way.

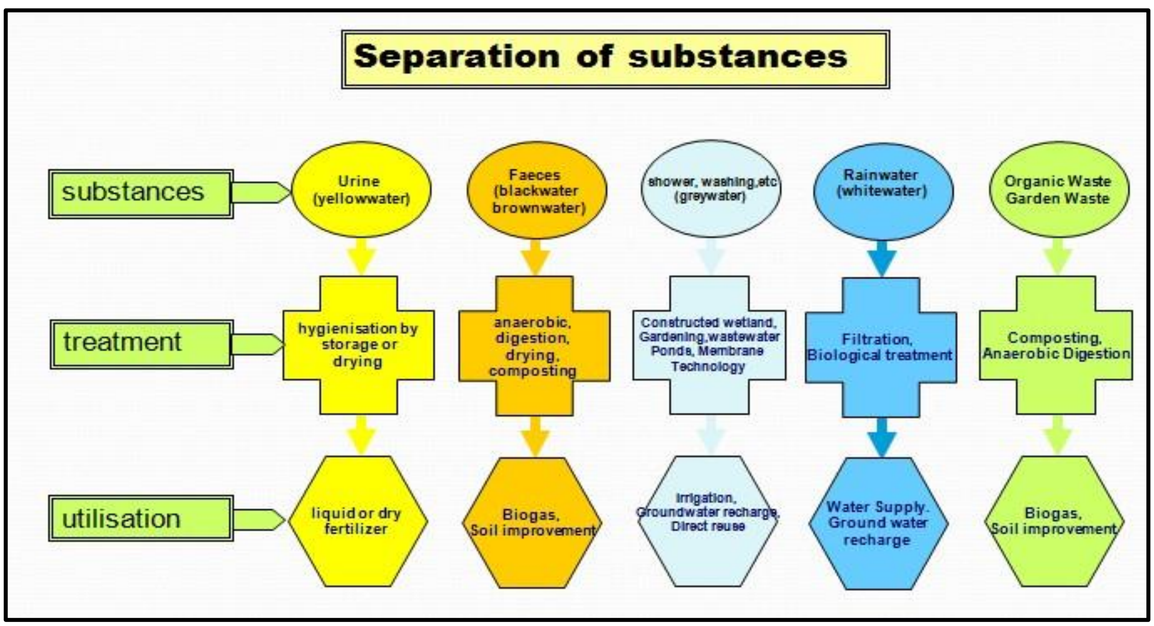
In contrary , a holistic approach of dealing what water was regarded as wastewater through a systematic implementation of material- flow-oriented recovery processes which enable recovery of nutrient from faeces, urine and greywater (Combinedly known as sewer) to the benefits of agriculture and at the same time minimizes the water pollution and ensuring water is economically and is also reused to the greatest possible extent particularly for irrigation. The term is sometime referred to Ecological Sanitation or Ecosan in short.

The table here illustrates the concept on how rivers get cleaned up(Table3) and all influents get treated and re-used (Table 4) with waste converted to resources:

Table 3

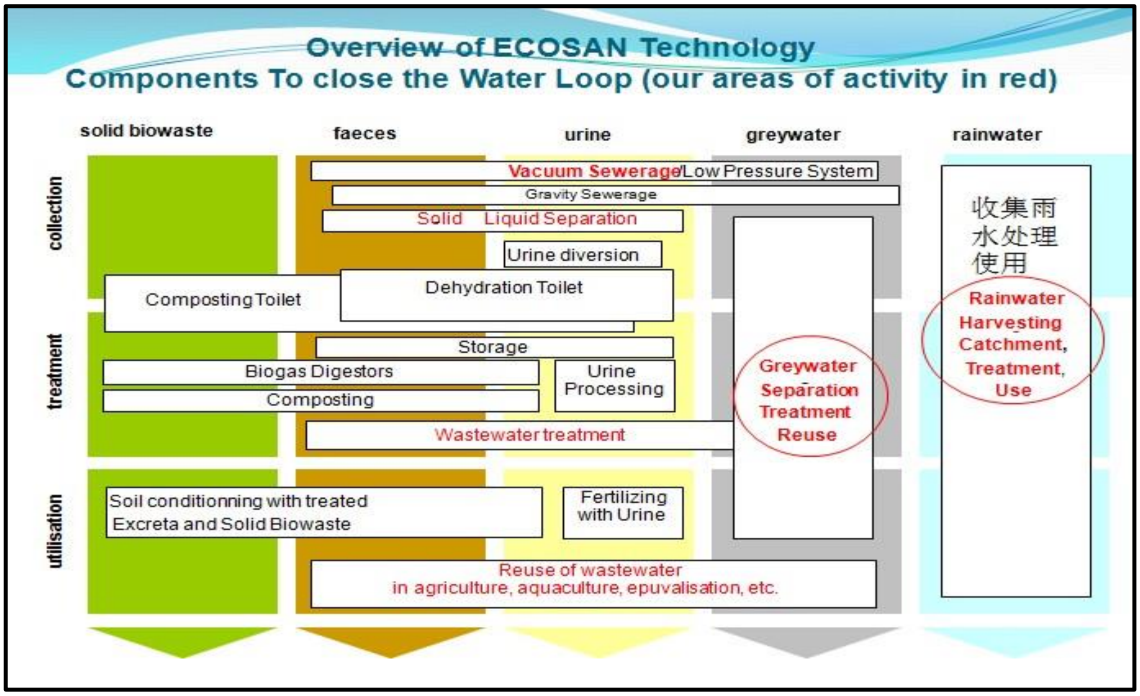


Tables 4



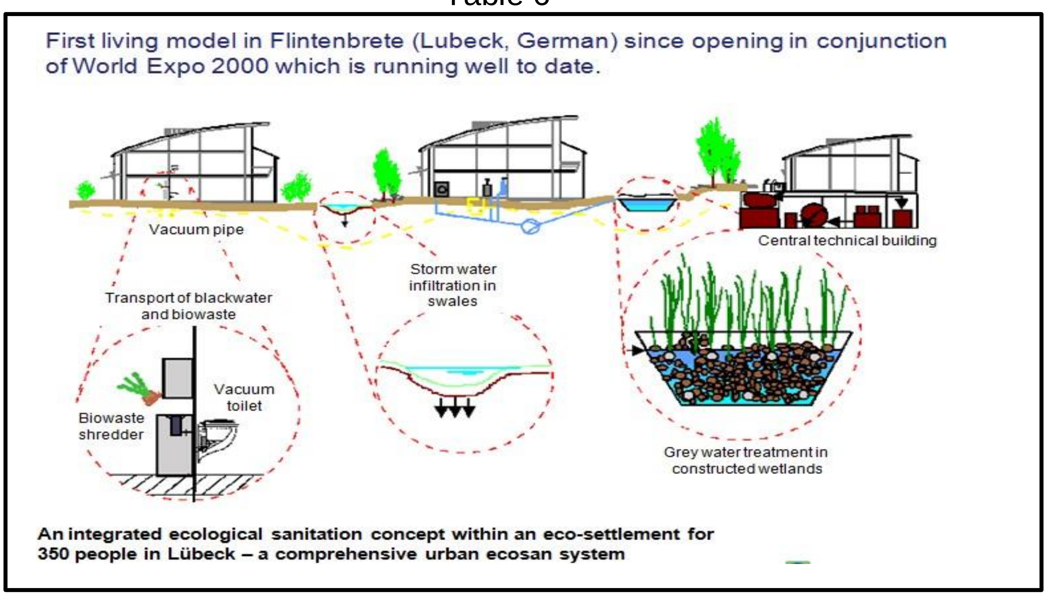
The below table 5 shows the areas of business scopes currently covered by EcoClean Technology Sdn Bhd (Show in Red)

Table 5



During World Expo 2000 in Hannover, the German has established a pilot project involving the village of Flintenbrete located in the city of Lubeck and the following table 6 was their model

Table 6

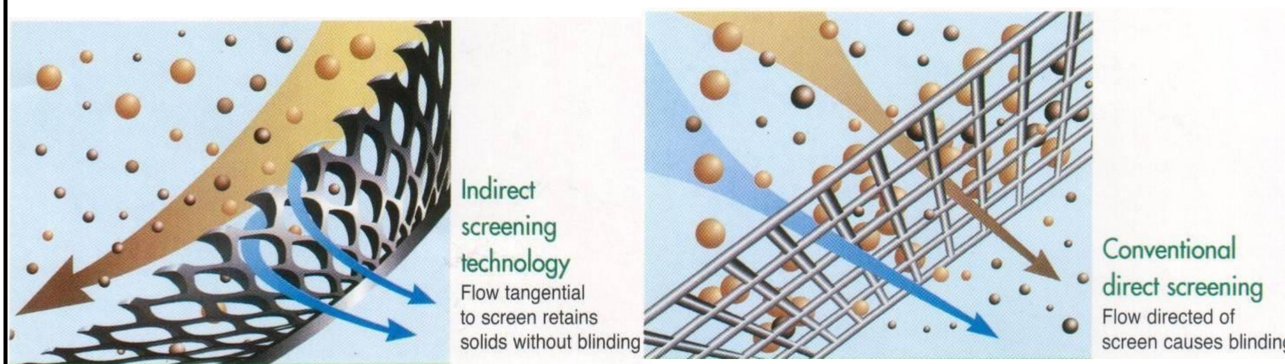


The water system of German pilot project in Flintenbrete

3. INTRODUCTION

Continuous Deflective Separation (CDS) is an innovative screening technology for the separation of solids from liquid streams. Unlike direct screening, which operates by impinging particles in the flow directly onto the screen, CDS utilizes the principle of indirect screening where the particles are carried by the flow across the face of the screen (Fig. 1). This, in conjunction with hydraulic balancing across the screen, delivers a process capable of removing solids from high flows of water and wastewater.

Figure 1 - Illustration of direct (top) and indirect (bottom) Screening



The technology utilizes a cylindrical screen with tangential inlet for the fluid above the screen and a sump below the screen. The tangentially introduced flow rotates inside the screen, keeping the screen surface free of solids while a small proportion of the fluid passes through each of the apertures in the screen. Solids are retained inside the screen on the rotating column of fluid if neutral density, sink into the sump of settleable, or float to the surface of the fluid in the unit.

Characteristics of the technology include non-blinding operation, high loading rates (up to 32 m^3/s), capture performance that is independent of flowrate, and low operation and maintenance requirements.

This technology has found use in several applications; however the most prolific use of the technology is in stormwater remediation. The technology has also been adapted to operate in raw sewage, and is currently installed for CSO/SSO abatement in the USA, UK and Australia. There are also units in use for screening of coolant, food processing, potable water intakes, coal fines separation and washdown yards; to name a few. Today, the range of product include surface and rainwater treatment device, sewer mining process for water re-use, SMART water plant to class A re-use water etc.

Malaysia is the first country in Asia to use the CDS technology when the license was acquired by EcoClean Technology Sdn Bhd a joint venture between Malaysia and Mcconnell Group from New Zealand followed by Korea and Japan before the license holder decided to stop issuing further licenses Singapore and China has recently contracted EcoClean T echnology Sdn Bhd to supply CDS technology for their Kallang River ABC projects and research respectively.

4. STORMWATER SCREENING

Over 400 CDS Gross Pollutant Traps (GPTs) are now installed in Malaysia alone for the remediation of stormwater. These units remove solids including man made litter, organic material (leaves, twigs and grass), and sediments from the influent. These units handle flows from less than 30 l/s to in excess of $5m^3/s$ and operate solely on the available head through the drainage system, which does not need to be large. For flow exceeding $5m^3/s$, multiple units of CDS units are used.

The Drainage and irrigation Department (JPS) of Malaysia has recently commissioned a study to be carried out for their recent “River of Life Projects” by Profesor Lariyah of University Tenaga, Humid Tropic Centre and JPS themselves and the study shows CDS units are most effective in terms of Total Solid Suspention removal(TSS). Chemical Oxygen dissolved (COD) and Biological Oxygen Dissolved (BOD) removal . The histogram below (Table 5) Summarised the finding and conclusions

Table 7

Percentage of Removal Efficiency for Selected GPTs During Maintenance

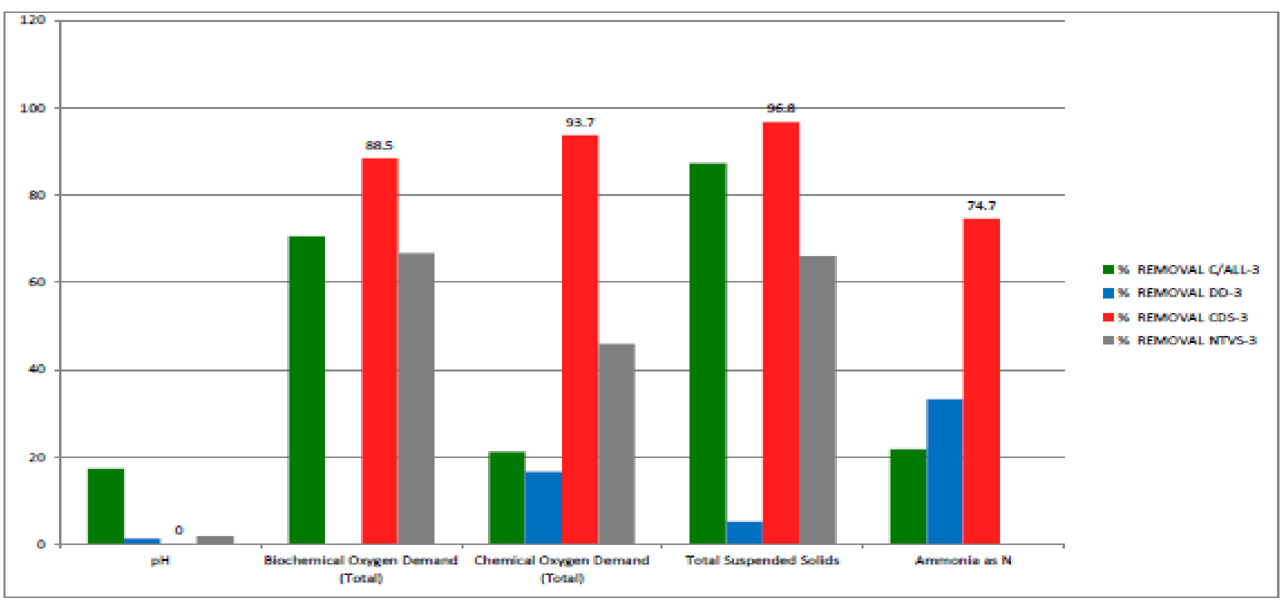
Extracted from Report 13th International Conference on Urban Drain Sarawak, Malaysia. 7 - 12 Sept 2014

" A Study on Effectiveness and Performance of Gross Pollutant Traps for Stormwater Quality Control: The River of Life (ROL) Project "

By Prrofessor Lariyah Mohd Sidek, Hidayah Basri, Mohamed Roseli , Nur Farazuien, Wesentera, Ahmad Fauzan, Md Nasir Md Noh

PARAMETER	% REMOVAL											
	C/ALL-1	C/ALL-2	C/ALL-3	DD-1	DD-2	DD-3	CDS-1	CDS-2	CDS-3	NTVS-1	NTVS-2	NTVS-3
pH	-	-	17.4	-	1.4	1.4	-	-	-	-	-	1.90
Biochemical Oxygen Demand (Total)	-	-	70.6	5.44	-	-	54.95	34.7	88.5	46.24	-	66.70
Chemical Oxygen Demand (Total)	-	-	21.2	-	-	16.7	67.08	61.1	93.7	46.52	6	45.90
Total Suspended Solids	-	-	87.3	-	4.2	5.2	19.72	78.5	96.8	16.28	29.9	66.00
Ammonia as N	-	5.9	21.9	-	18.8	33.3	-	-	74.7	-	-	-

Table 2



Histogram Comparing all 3rd cleaning result

EcoClean Technology has recently carried out a pilot project using a CDS hybrid Immobilised cell reactor sewerage treatment plant which used nano activated carbon as catalyist.

See below Table 8 the process and pilot plant photo

Table 8

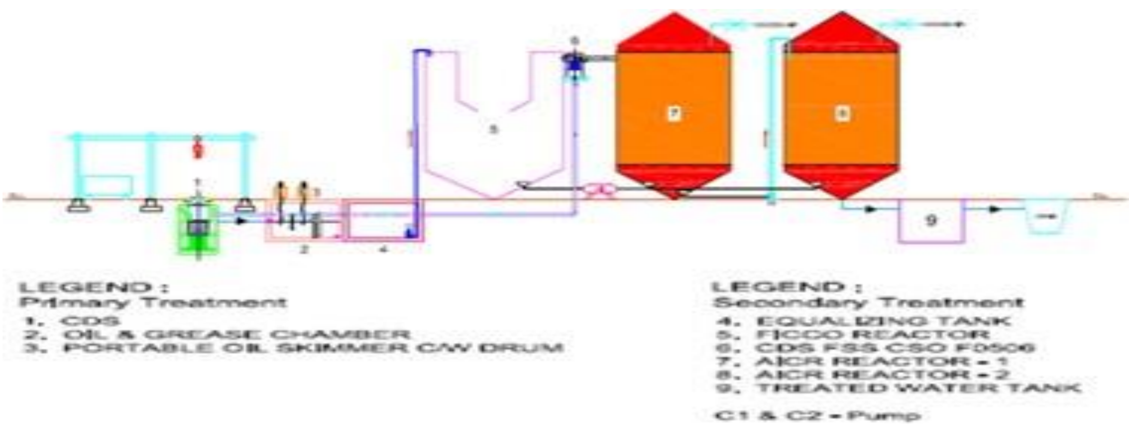


Diagram of the Pilot Plant Process Layout

Image of the Pilot Plant Setup

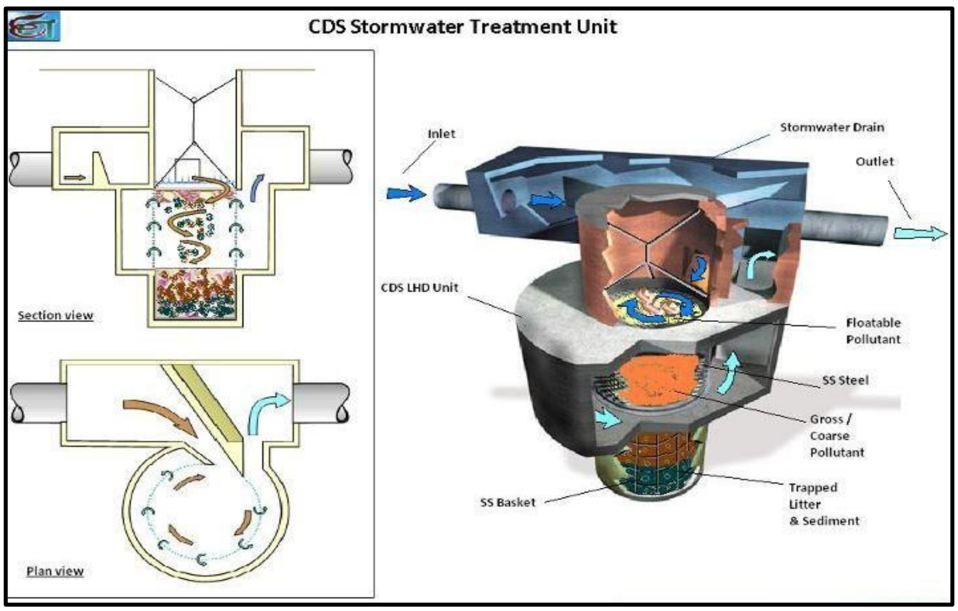
4.1. Design and Construction

Units are designed to treat to maximum flow specified by the client, or may be based on pipe size. However, best outcomes in terms of cost and treatment are achieved by carrying out a hydraulic assessment of the catchment area. Typically a unit i s sized to treat a ‘ one in three month’ event would be recommended to the client. Expected litter loading rates and preferred frequency of unit clean-out may also be taken into consideration.

A diversion weir is sized to divert the maximum flow to be treated. Consideration is taken that this diversion weir does not cause up stream flooding, even under the most severe storm events. A special “collapsible” weir has been developed for shallow and tidal drains that allows a maximum flow to be passed through a unit but has the ability to collapse, reducing the cross section presented to the flow to let high flows pass without causing upstream flooding.

Product development has led to most components being made in fiberglass or precast concrete. Units are installed below ground alongside the existing stormwater line. This stormwater line is cut to allow a diversion chamber to be built in the line. This chamber contains the diversion weir to divert the flow into the unit for treatment (Fig. 2).

Figure 2



Baskets are manufactured out of polypropylene material with nylon lifting strap. If required for life span usage, stainless steel basket can be supplied. Ongoing development has allowed cheaper precast concrete units to be built and caisson style construction to be used when difficult site conditions are encountered. We have recently completed several nos. of CDS model P3000 series in Johor using this method. The Senai River Cleaning Project involved CDS Units (Model F0908 to P2028) treating stormwater with ARI 3 month first flush conveyed via interceptor pipe to a stormwater treatment plant downstream before discharge into the Senai River this is project built beyond the normal stormwater management practice.

Screens are manufactured from stainless steel 316 material. This expanded metal mesh has proven to be the preferred form for the screen material. The aperture size used in the CDS unit has a short-ways opening of either 4.7 or 2.4mm for stormwater treatment and
1.2mm for sewage treatment.

4.2. Operation and Maintenance

CDS units have no moving parts and require no regular maintenance other than regular removal of the captured solids. In operation the units need no power and are driven entirely by the flow of the stormwater. Importantly the screens are non-blocking and this means that during operation, the headloss across the unit remains constant. This is important as it allows the unit to continuously treat the maximum flow. Direct screening devices normally will have an increasing headloss across the unit as the screen blocks. This will lead to less flow being treated by the unit, and more flow bypassing the unit (or possible up-stream flooding if the unit or bypass system is not properly designed).

As mentioned, the only maintenance required is regular cleaning, typically once every 3 months. A major advantage of the CDS Stormwater Treatment Device is that there is a choice of three methods for cleaning. The design of the unit allows access for a clamshell grab, vacuum eduction or removal of a specially designed basket that contains the trapped solids. For site not accessible by vehicle , we have developed a method of scaffolding and hand hoist to clean CDS units up to model P1015.

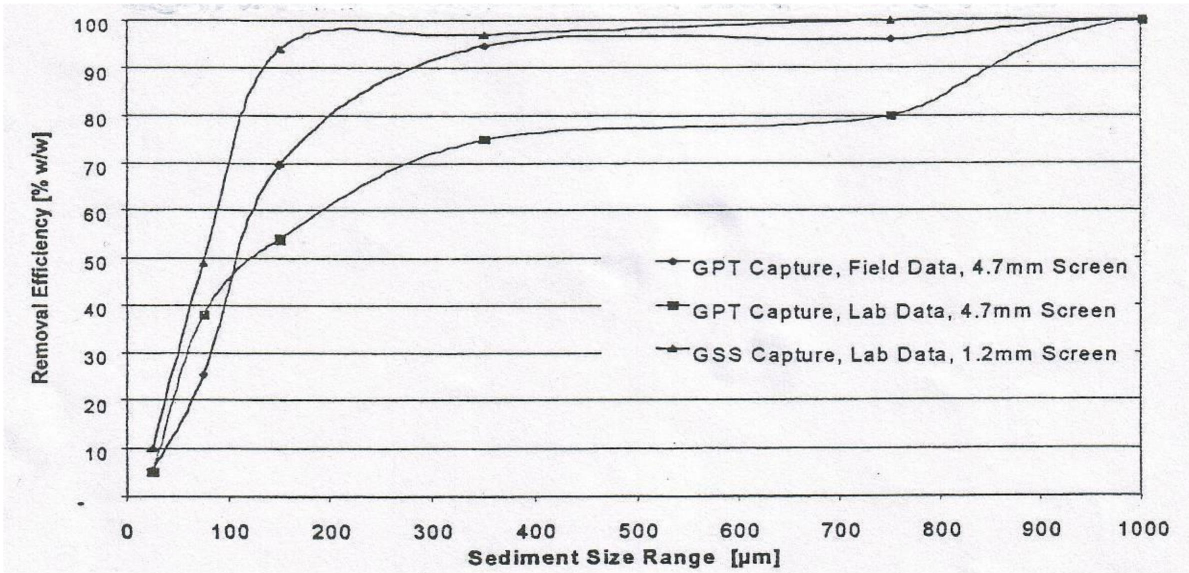
4.3. Monitoring and performance

Over the years, monitoring of a number of installed stormwater units has been carried out by independent research groups and users. Despite varying size and catchment conditions, this work has shown a general consistency with regard to the treatment efficiency of the units. Capture of gross pollutants is reported to be 100% for the flow treated by the unit (Walker et. Al.1988).

As the screen is non-blocking, the unit will always treat 100% of its design flow. This means, even allowing for periodic bypass of the unit in extreme events, overall gross pollutants capture from a stormwater line is in excess of 95% when the unit is sized to treat a one in 3 months storm event.

It is important to note that due to the nature of indirect screening, the aperture size is not critical in determining the minimum particle size that may be captured. It has been shown in both the field and the laboratory that close to 100% capture of particles at 500 µm may be achieved with a 4.7mm and 98% of 200µm using 1.2mm screen and majority to 100µm aperture screen along with significant capture of particles below this size (Fig. 3). Such results may be improved with finer screens and better hydraulic design in some circumstances.

Figure 3 – Sediment Capture Date for CDS GPT and GSS units



Other important results include a reported overall TSS removal of 70% and Phosphorus removal of 30% during storm events (Wong et. Al.,1999). As a large proportion of the solids removed from the unit is typically organic, the unit also effectively reduces the BOD and Phosphorus, regular cleaning of the units is recommended as studies have also suggested the potential for leaching of these pollutants into the downstream system over longer period of time.

CDS units can be made to remove 80% or more TSS by having the flow detained a longer time in the CDS unit in order to satisfy the requirement of LEED Green Building score. The first Gold LEED building in Malaysia for SHELL 3 Building in Cyberjaya utilizes CDS units to achieve the targetted stormwater management requirement.

The principal of CDS in Australia has performed cleaning of installed units and has collected considerable data over a 3-year period. The data shows that the amount of trash and debris collected by units installed in urban catchments ranges from 0.64 – 1.36 m^3/ha/yr, depending on rainfall and catchment type. This is much higher than previously reported (0.23 – 0.4m^3/ha/yr) and is probably due to the increased sediment capture efficiency of these units. The proportion of man-made; organic, and sediment removed by the units varies widely for different catchments but typically sediments comprise around 35% of the load, with man-made materials totaling only about 15%.

Our experience in maintain some CDS units for over a year show that we have doubling amounting of floatables as well as sediment load probably amounting to 2 to 3m^3/ha/year in Malaysia urban area.

5. SEWAGE SCREENING

The same technology has been applied to produce a fine screening device (the Gross Solids Separator or GSS) with enhanced features for the management of sewage and stormwater containing sewage, also at high flow rates. This device splits the influent into a foul stream, which is returned to sewer lines, and a screened discharge free of all visible solids. The foul stream is removed periodically at an average rate of just 1% of the influent flow rate.

Initially, two test units, one in the USA and one in Australia, were installed in the inlet headworks of sewage treatment plants and evaluated over a two year period, screening raw sewage down to 1mm. Operational histories exceeding 2 years are now available for units installed in several places in Australia and the USA to manage the discharge and remove the gross solids from overflowing sewers. Two of these have a design capacity of $1m^3/s$ and have operated successfully without blinding of the screen, even under conditions exceeding design capacity.

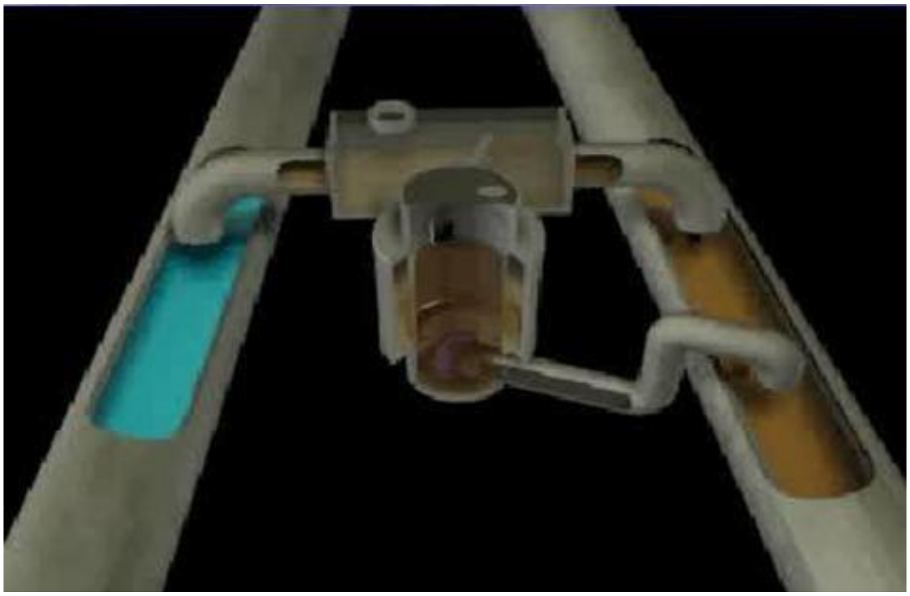
5.1. Design and Construction

The main problems encountered in the adaptation of this technology were due to the fibrous nature of sewage leading to “stapling” of the screens. Solids’ handling for sewage is also much more complex than it is for stormwater as the solids accumulate rapidly and cannot be stored for any length of time. Many subtle design modifications were made to the GPT design to overcome these problems.

Central to these is the selection of the screen type. The 4.7 and 2.4mm screen used for stormwater in the GPT are not satisfactory. For a combination of mechanical robustness and performance a 1.2mm expanded metal mesh screen (316 SS) is used in the GSS. This is plastic coated to minimize attachment of oil and grease.

The installation of the unit is similar to that of the GPT however the diversion chamber is built into the connection between the sewer and the stormwater line (for an SSO as per Fig.4 which shows the sewer on the right and the stormwater line on the left) or into the overflow discharge line (for a CSO). The screened flow is discharged to stormwater, or receiving water, and the purge stream (containing all the solids) to the sewer or storage.

Figure 4 – Configuration of the GSS for SSO Screening



5.2. Operation and Maintenance

As for the GPT the screening operation of the GSS has no moving parts. However, solids handling involves periodically purging the unit while it continues to operate. This is usually achieved with a sump pump as the solids need to be returned to the sewer lines, which is under pressure. Due to the variable nature of solids encountered in CSO/SSOs the purge has to be based through a large diameter underflow pipe, and at a fairly high velocity (>1m/s). However this is only done once every hour or so and the total amount of fluid containing all the solids purged from the unit is less than 1% of the flow treated. Commonly a PLC is used and the entire operation is automated. As such, units require no regular maintenance, cleaning or inspection.

Another feature of the GSS is the use of washdown facility to clean the screen following an event to remove any contaminated material from the unit. As with the purge this operation is entirely automated.

5.3. Monitoring and performance

Pilot plant results and field observations have shown the GSS removes all particles down to 1mm and the majority of grits and settleable solids down to 100 µm. Units require no mechanical cleaning and the screens do not block.

Independent monitoring of overflow events for the large ($0.9m^3/s$) CSO unit in Louisville, Kentucky, has returned results for TSS removal from 22-53%. Significant but variable removal rates were also demonstrated for TS (10-37%), TP (8-22%) and BOD (6-36%) (O'Brien & Gere, 2000).

6. HIGH RATE SEWAGE CLARIFICATION

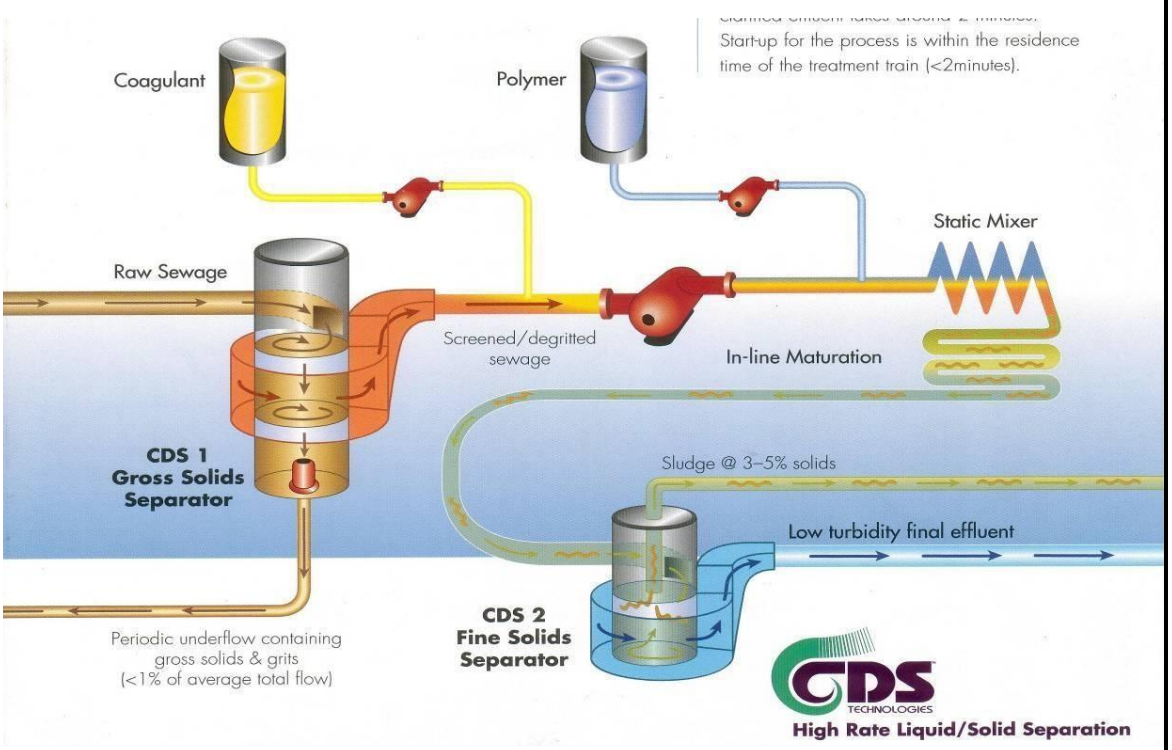
Work over the past year has targeted a high rate separation of sewage fines using flocculation for applications where a clear and/or disinfected discharge is required. Conventional coagulant and flocculants are dosed into screened raw sewage and the flocs formed are separated from the stream using a specially adapted separator. This process, referred to as Fine Solids Separation (FSS), will be ideal for the remediation of CSO/SSO's where disinfection prior to discharge is required.

6.1. Process Description and Design

Raw sewage is screened to remove all solids greater than 1mm and grits down to about 150 µm in a continuous screening operation (A GSS unit). A coagulant is then mixed into this screened sewage stream followed by a polymer to increase floccs strength. A small amount of air is added and the stream is mixed in line, firstly through a static mixer, and then in a gentle hydrodynamic flocculator to achieve maturation of the floccs. The resultant floccs are then screened out through a second screening unit (Fig. 5).

The entire process from raw sewage inlet to final effluent outlet takes approximately 2 minutes at the systems design flow. The process starts up and reaches steady state within the residence time of the treatment train (i.e. approximately 2 minutes).

Figure 5 – The CDS FSS Process



6.2. Results

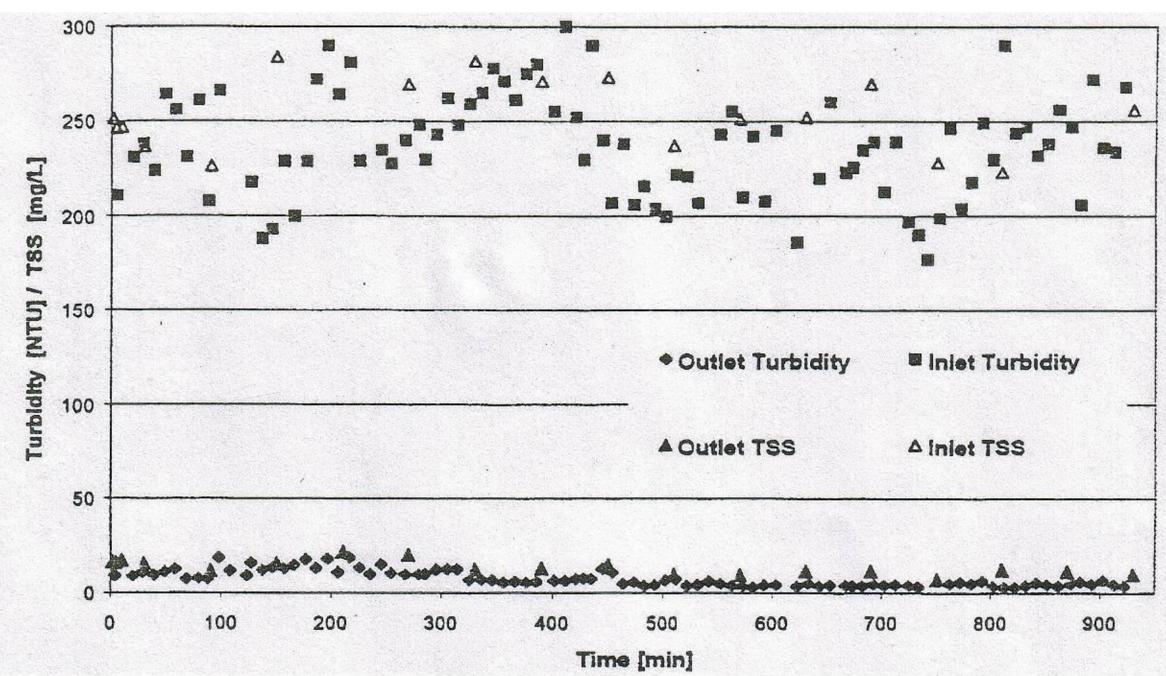
The results shown below (Table 9) are from a 2.5MLD pilot plant at the Mornington Sewage Treatment Plant, Victoria, operating on raw sewage. During the course of the work turbidity was used as a process control parameter and was measured continuously (Fig. 6). The results for both turbidity and TSS reduction show consistent solids removal is achieved despite significant variations in influent conditions. Other results are from several grab samples taken periodically over the course of a run.

Table 9 – CDS FSS results from a 25 MLD pilot plant

Parameter	Unit	Raw Sewage	Treated Sewage	Removal Efficiency
Turbidity	[NTU]	240 (177-369)	7.6 (3.4-15.2)	97%
TSS	[mg/L]	259 (184-564)	13.5 (4-22)	95%
BOD_5 *	[mg/L]	302 (190-420)	38 (25-46)	87%*
COD *	[mg/L]	531 (454-643)	82 (76-85)	80%*
Faecal Coliforms	[CFU/mL]	$12.5x10^6$ ($5.4-17x10^6$)	$58.6x10^3$ ($30-110 \times 10^3$)	99.5%
Total Phosphorus	[mg/L P]	12 (9.7-17.2)	0.6 (0.4-0.7)	95%
Total Nitrogen	[mg/L N]	71 (60-85)	55 (49-59)	16%
Ammonia	[mg/L NH_4-N]	40 (28-45)	37 (34-39)	8%

*these results are specific for the sewage tested. The sewage entering Mornington STP is domestic and is from a short sewer. As such, virtually all the BOD_5 and COD are expected to be particulate and this high removal efficiencies are achieved through effective particulate solids removal.

Figure 6 – Turbidity and TSS results over a 15 hour run of the FSS process



7. LOCAL DEVELOPMENT OF COMBINED STORMWATER / SEWAGE / SULLAGE WATER TREAMENET

EcoClean Technology Sdn Bhd has utilised a non-chemical based flocculant powder which has proven to be equivalent to chemical coagulant and polymer in Malaysia. We have conducted test in our CDS model and the test proved that our GSS could trap these floccs with simulated condition of wastewater with water from our drains as well as liquid from kitchen oil and grease interceptor.

We have approached Dr. Wong from Taliworks Technology Sdn Bhd subsidiary of, of a major water treatment company in Malaysia and together we have jointly arrived at a solution as per in sketch attached which could shed the lights of a next generation of treatment plant working on eco-engineering principle without electricity i.e green.

The process is similar to the Mornington plant except that we have substituted the coagulant and polymer with this Eco flocculant in powder form. As a result, the sludge collected will not be considered as scheduled waste which is expensive to dispose. On the other hand, there is a potential use of this sludge as fertilizer especially the affluent has no industrial waste water contamination. The treated water pass through a wetland or artificial wetland will certainly complete the “treatment train” process for water.

We believe this development could push us beyond the current level of managing and treating stormwater flows to the next level of eco-engineering especially our recent acquisition of Empire Green Industries Sdn Bhd which has the right of a soilless Vertical Garden and Green Roof technology . We are now carrying out further research in Malaysia to use Vertical Green Wall to treat greywater and utilize it’s clean affluent to flush toilets and for irrigation.

8. CONCLUSIONS

Eco Engineering is certacaly the way to go forward especially for nation who wants to leapfrog into a modern water sensitive city . See table . Amist the green technology for stormwater management and re use. Continuous Deflective Separation (CDS) is a screening technology capable of removing solids from liquid streams at high flows. It utilizes indirect screening, and is therefore non- blocking giving it superior performance to other screening technologies. Its utilization in the remediation of wet weather flows, in particular stormwater, has been extensively monitored and it has been shown to be highly effective. In the field the units achieve 100% capture of gross pollutants and significant capture of TSS and associated pollutants. Current work, directed at the removal of flocculated sewage in a CDS separator, is showing promising results at the pilot plant stage with high removals of TSS, turbidity, BOD, and other pollutants from raw sewage. Based on the success of this process, we have researched and developed a non-chemical flocculation using eco- friendly flocculation agent and power dosing machine to arrive at a stormwater / sewage / sullage treatment plant which will treat up to the required first flush hence , taking most of the harmful pollutants from the waterways.

To complete the “ Closing the Stormwater Loop”, EcoClean Technology Sdn Bhd has also diversified into rain water and stormwater harvesting using CDS technology for first flush clean water treatment bypass stored underground using recycled plastic modules.

9. BIOGRAPHY OF AUTHOR

Mr. Wong founded EcoClean Technology Sdn Bhd and Sistem Vakuum Sdn Bhd to represent CDS Technology as Malaysia licensee and Bilfinger Water Technologies GmbH as sole licensee /distributor respectively for Malaysia and Brunei since year 2000. Both technologies are now world leading in their own respective fields of stormwater treatment and waste water collection. Sistem Vakuum Sdn Bhd has completed few projects in Peninsula Malaysia, Brunei and Maldives in areas of vacuum sewerage system and currently undertaking the decay plant for the Brunei Cancer Centre.

Mr. Wong has completed Mechanical Engineering Diploma & Post Diploma courses in Singapore Polytechnic and was registered with Engineering Council in UK as Incorporated Engineer. He has also completed an MBA from Henley Management College and conferred a Master Degree from Brunel University, UK

Mr. Wong has close to 40 years experience in which more than 20 years were working abroad. During his 11 years services with McConnell Dowell International (NZ) and 8 years John Laing International Ltd.(UK), he has undertaken major projects like Master Planning of Mersing Camp for Special Forces ,Nucleus Hospitals for 12 Districts in joint venture with YTL Group,Terebu Layang Layang Naval Outpost, Pasir Gudang Power Station Jetty etc.
He set up Y. Wong & Partners in 1996. As a consultant, he has advised several international companies, Leighton International like Bilfinger Berger (Germany), UDL Ltd (HK) and China Fujian Engineering (China) etc.

The company EcoClean Technology Sdn Bhd was set up as a JV company with McConnell Group, which is privately owned by the McConnell family, the very family who used to own McConnell Dowell . EcoClean Technology Sdn Bhd is currently the market leader in Stormwater Treatment work in Malaysia and has undertaken projects in the Iskandar Region, River of Life for Sg.Klang and Melaka River clean up works it is now.

EcoClean Technology Sdn Bhd exporting the technology to Singapore and China has recently

acquired Empire Green Industries Sdn Bhd as a subsidiary company to provide Green Roof and Green all in the region and this system which is ‘soilless’ has a potential to be used as grey water treatment system.

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(Report 13th International Conference on Urban Drain Sarawak, Malaysia 7-12 Sept 2014)

Project Profile for Pilot Plant at Ijok, Selangor, Malaysia

Treating Raw Water Quality from
Class 4 to Class 2B without any Electrical Power