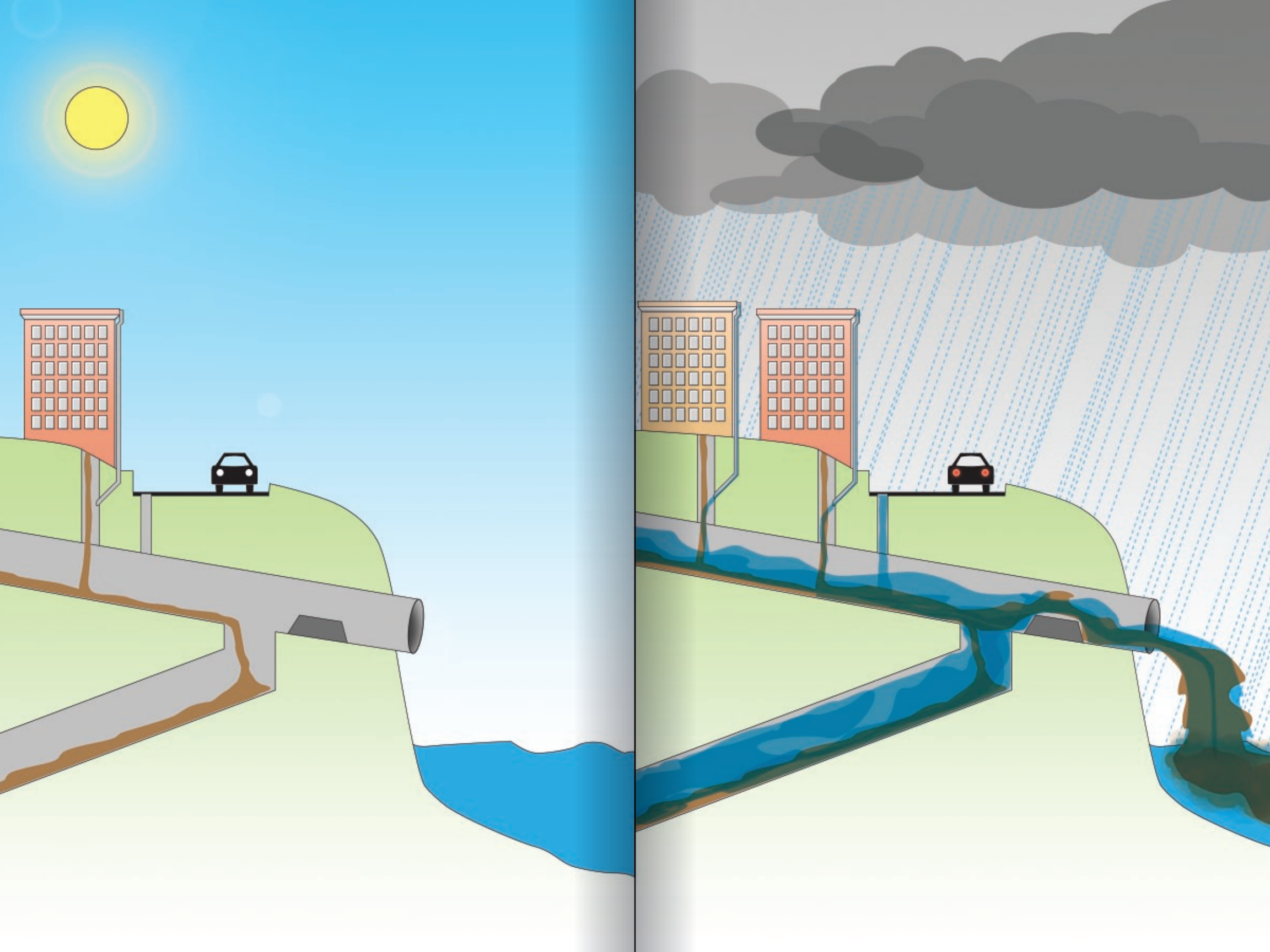


GARDEZ L'EAU



WWW.STORMPOO.COM





In the Middle Ages, from about AD 500 to about 1500, chamber pots were in standard use. When people dumped the contents out the window they often warned unsuspecting pedestrians by shouting “gardy loo!” - a term borrowed from the French *gardez l'eau*, meaning ‘watch the water’.

ABOVE IMAGE © 2006 FOTOMAS INDEX, FROM THE BOOK *TOILETS OF THE WORLD* BY MORNA E. GREGORY AND SIAN JAMES

COVER IMAGE © 2009 JOEY HAYS

Table of Contents

Why are we so secretive about poo?	6
Pittsburgh’s Dilemma.....	12
Solutions	
Living Machines	20
Greywater Systems.....	22
Stormwater Management.....	24
Composting & Urine Diversion Toilets	26
Biogas Digesters.....	28
More Info	31



Why are we so secretive about Poo?

It is surprising that something as regular as breathing that transcends all race, religion, age and class has become such a social taboo. Whether one does so in a ditch or on a jewel-encrusted throne, the result is the same. Sanitation activists suggest it is the barometer of civilization. For isn't potty training the first step in teaching a young one social norms?

Those societal norms date back to the industrial revolution when the most elite Victorians sought to differentiate themselves from the lower classes.¹ The toilet effectively concealed the disgusting reminder they created in their chamber pot each day that they were no different than anyone else. Dave Praeger, author of *Poop Culture: How America is shaped by its Grossest National Product* labels the toilet as “a tool of ideology” that provided the Victorians with “fecal invisibility”. It only gained recognition for sanitation after science linked cholera and dysentery to fecal contamination of drinking water.

Hence the toilet became one of the most lifesaving inventions in the history of man. In poorly sewered 19th century London, one child in two died early,

¹ PRAEGER, DAVE. *POOP CULTURE: HOW AMERICA IS SHAPED BY ITS GROSSEST NATIONAL PRODUCT*. NEW YORK CITY: MCGRAW-HILL HUMANITIES/SOCIAL SCIENCES/LANGUAGES, 2007.

and the toilet is credited with adding twenty years to the lifespan of an average human.² Unfortunately the spread and influence of the toilet also created the enormous - and exorbitant - engineering feat that is the modern urban sanitation system.

NASA spent \$23.4 million on a toilet that allows the astronauts to drink their own pee reducing the need to carry water on missions.³

Mushrooming populations and aging infrastructures have set the stage for a toilet revolution. In fact, figuring out how to wean the world off the flush handle took center stage at the World Toilet Summit and Expo in Macau last fall. The current 'flush and forget' attitude dumps 18 billion gallons of drinkable water in the US each year - 22 liters per person per day.⁴ In a world of increasingly finite resources, such wasteful nature needs to be reconsidered. "The world can't sustain this toilet," says Jack Sim, the founder of the World Toilet Organization.

He believes the fundamental shift in how we think about our waste disposal is to stop mixing liquids and solids. "The human body is designed to separate solid from liquid waste," and we should follow suit, he says. Separating at the source in a 'urine diversion toilet' offers a wider array of potential uses for the 'waste'.⁵

New York based Britta Riley and Rebecca Bray of Submersible Design have devised a DIY kit to convert urine into fertilizer.⁶ Composting solids for fertilizer and harvesting the methane gas is common in China where state-subsidized "digesters", a metal bin that traps the methane for reuse while the poo breaks down, power 15.4 million homes.⁷

Biodigesters are also common in India which brings up the interesting fact that the best ideas in sanitation are coming from the developing world. NASA spent \$23.4 million on a toilet that allows the astronauts to drink their own pee reducing the need to carry water on missions.⁷ Before we get to *Waterworld*, the Hollywood flick where Kevin Costner drinks his own, we have to be able to talk about it first.

In the 1966 *TIME* article *Examining the Unmentionables*, architect Alexander Kira stated, "once people got talking about bathrooms, they couldn't stop." The article primarily attacks the lack of design innovation in the modern bathroom, pointing out that kitchens have been researched to death, but the bathroom has been left alone. I share his hopes for lifting the "veil of embarrassment" and to open the dialogue for a new waste treatment mentality.

2, 3 GEORGE, ROSE. *THE BIG NECESSITY: THE UNMENTIONABLE WORLD OF HUMAN WASTE AND WHY IT MATTERS*. NEW YORK: METROPOLITAN BOOKS, 2008. PAGE 3, PAGE 225

4, 5, 7 DUNCAN, DON. "IS IT TIME TO KILL OFF THE FLUSH TOILET?" - *TIME*. 6 NOV. 2008.

6 RILEY, BRITTA , AND REBECCA BRAY. "DRINKPEEDRINKPEEDRINKPEE." SUBMERSIBLE DESIGN. WWW.SUBMERSIBLEDESIGN.COM/DRINKPEE



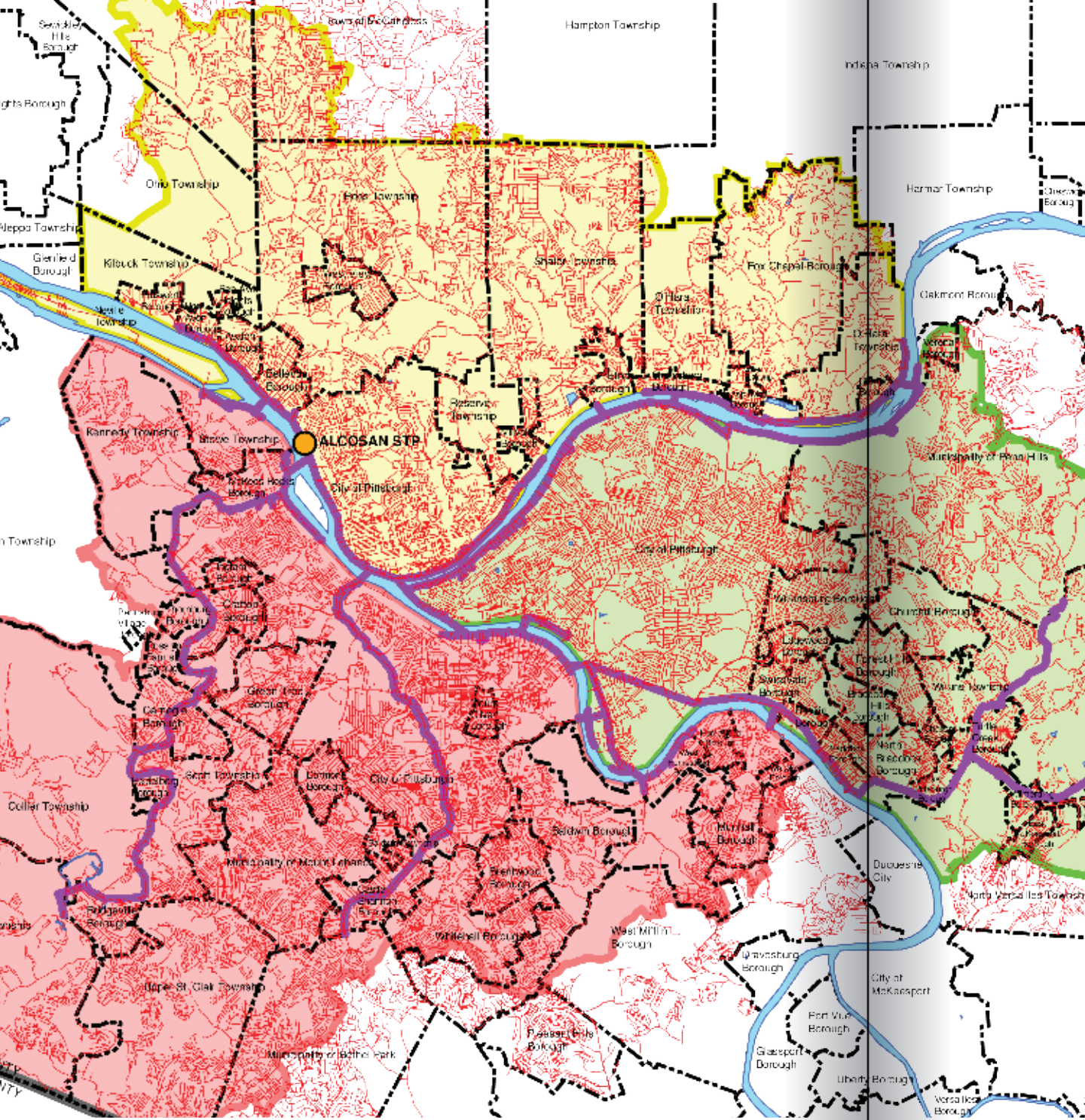
Raw sewage

is dumped into Pittsburgh's rivers every time it rains as little as one tenth of an inch

Pittsburgh's Dilemma

In the 1890's Pittsburgh city engineers decided it would be healthier and more economical to combine sewer pipes with storm water pipes in order to get the fecal matter down the river, faster. Unfortunately they did not foresee the unhealthy consequences of the combined sewer system - the accumulating raw sewage from the growing population in combination with the amount of rain in Pittsburgh - causing stagnation and extremely unsanitary conditions in and around the rivers. By the late 1940's health officials formed the Allegheny County Sanitary Authority (ALCOSAN) to formulate a sewage treatment plan for the region.

In the 1950's ALCOSAN built 95 miles of large pipes along the streams and rivers to intercept the combined pipes and carry both the storm water and wastewater to a centrally located treatment facility. During dry weather the system operates as planned but when it rains (as little as one-tenth of an inch) the interceptors cannot handle the amount of water and divert the excess sewage directly into the streams and rivers via the 19th century outfalls. An average rainfall in Pittsburgh is one quarter of an inch. There are 264 combined sewer overflows (CSOs) in the Pittsburgh region that discharge on average 16 billion gallons of raw sewage into the rivers annually.



ABOVE IMAGE © 2009 THREE RIVERS WET WEATHER

The CSO flag program attempts to alert people to avoid coming in contact with the water when a storm event occurs by literally raising yellow plastic flags near the outfalls. The recreational season extends from May 15 – September 30 and on average the warnings occur for 46% of that time, cutting the season in half. More importantly 90% of Pittsburgh’s drinking water comes from the very same rivers. And who is warning the fish and the birds and the frogs?

Why has this problem persisted for so long? Partly because no one wants to think about what happens when their poo magically disappears amidst a 1-3 liter flush of drinkable water. Politically no one has elected someone interested in fixing the sewer system. If a pothole gets filled in, everyone cheers, but if a sewer pipe gets replaced, no one knows about it or cares.

ALCOSAN has estimated an engineered resolution to cost somewhere in the range of 3 BILLION DOLLARS. Recall the \$400 million Referendum from the ballot of the last election - that figure looks pretty minor in comparison. The first plan of action might be to create regional governance. There are 530 municipalities in the 10 county region and the lack of a sole regional voice causes the Ohio River Basin Commission to receive the least amount of federal money. This means more money needs to come from consumer sewer fees. ALCOSAN as a result expects sewer fees to rise over the next twenty years. Unfortunately Pittsburgh’s population is declining, so there will be fewer payers to spread the costs over. Additionally rising global temperatures means less snow and more rain, increasing the need for bigger

pipes and more treatment centers. This works out for ALCOSAN – who is paid by the amount of water treated – but not for the rivers...

ALCOSAN has estimated an engineered resolution to cost somewhere in the range of 3 BILLION DOLLARS.

Increased sewage in the rivers will breed more potent diseases, and considering the air quality in Pittsburgh is the worst in the country, maybe there is a correlation between the abundance of hospitals and the living conditions. The 10 acre 1.5 million sq ft Children’s Hospital of Pittsburgh dominating the horizon of the Bloomfield and Lawrenceville neighborhoods opens on May 2, 2009. Perhaps this hospital can serve as a research facility for studying diarrhea – the most common disease associated with poop-infected drinking water.

In Rose George’s latest book, *The Big Necessity*⁹, she offers some chilling facts about children suffering in regions with inadequate sanitation:

Diarrhea – nearly 90% of which is caused by fecally contaminated food or water – kills a child every fifteen seconds in regions with poor sanitation.

⁹ GEORGE, ROSE. *THE BIG NECESSITY: THE UNMENTIONABLE WORLD OF HUMAN WASTE AND WHY IT MATTERS*. NEW YORK: METROPOLITAN BOOKS, 2008.

The number of children who have died from diarrhea in the last decade exceeds the total number of people killed by armed conflict since the Second World War.

Evolution is 2 billion years of research and development. We don't manage nature, we at best partner with it.¹⁰

A story that levels the playing field, also found in George's book, is that of the city of Galway, on the west coast of Ireland. In the 2007 Galway Arts Parade a man in a green fuzzy costume with many arms and one eye paraded the streets but received no cheers. His name was Crypto, short for cryptosporidium, a disease-causing protozoa, that travels in poo. Crypto and friends are the reason that the city of Galway, a cultural center of Europe with a well-respected university, was forced to issue boil-water notices more familiar for inhabitants of the world's slums where children die young. Shockingly a fifth of Ireland's towns are at risk of a crypto-outbreak and half the country treats its sewage only to primary levels, which is merely screening out the lumps and discharging the rest.¹¹

Now consider again the 16 billion gallons of raw sewage that dumps into Pittsburgh's rivers each year. Consider the modern flush toilet has not been redesigned since 1596 and water is fast becoming the most important resource. I think it is time for a change. I think its time for a new waste treatment

mentality. The following pages reveal a selection of my limited research on living alternatives to conventional waste and storm water treatment.

The design and use of alternative water systems carries legal, public health, and ecological consequences. I encourage people to follow common sense and local regulations when considering these alternatives.

¹⁰ DR. JOHN TODD, FOUNDER TODD ECOLOGICAL DESIGN

¹¹ GEORGE, ROSE. *THE BIG NECESSITY: THE UNMENTIONABLE WORLD OF HUMAN WASTE AND WHY IT MATTERS*. NEW YORK: METROPOLITAN BOOKS, 2008.

BELOW IMAGE IS HUMAN GUT INFECTED WITH CRYPTOSPORIDIUM

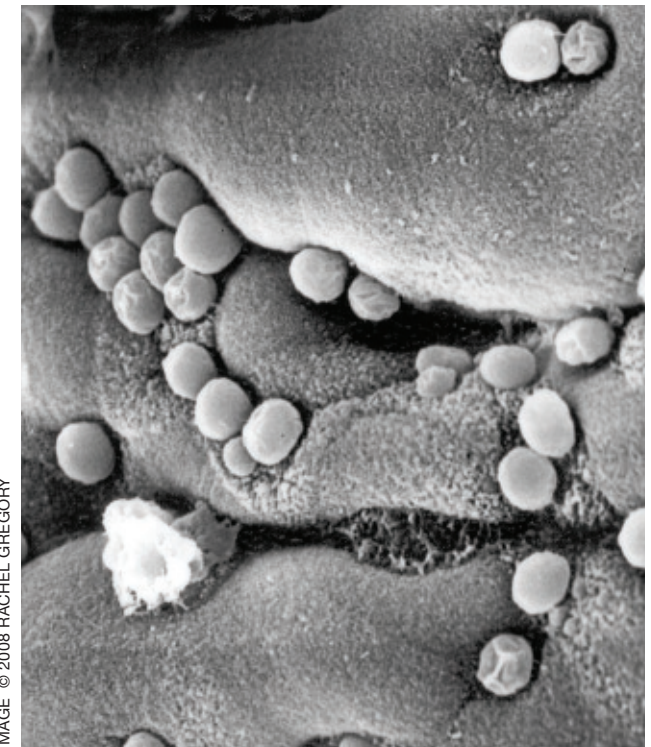
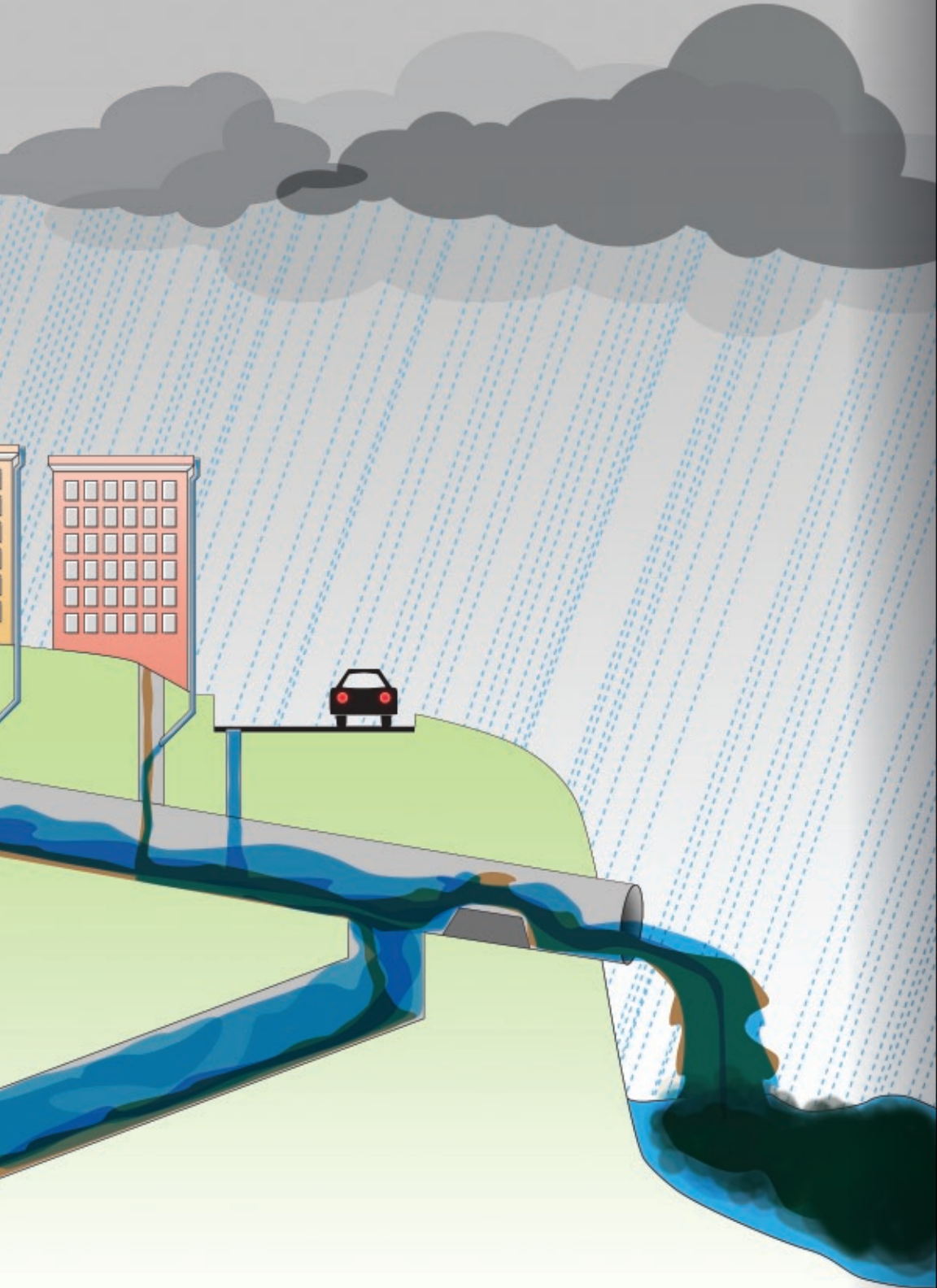


IMAGE © 2008 RACHEL GREGORY



Big Problem

Pittsburgh's sewage and stormwater infrastructure was designed as a combined system. During dry weather, sewage flows to the treatment plant. However, when it rains as little as one tenth of an inch, the pipes cannot process the excess water. As a result, raw sewage is dumped directly into the rivers.

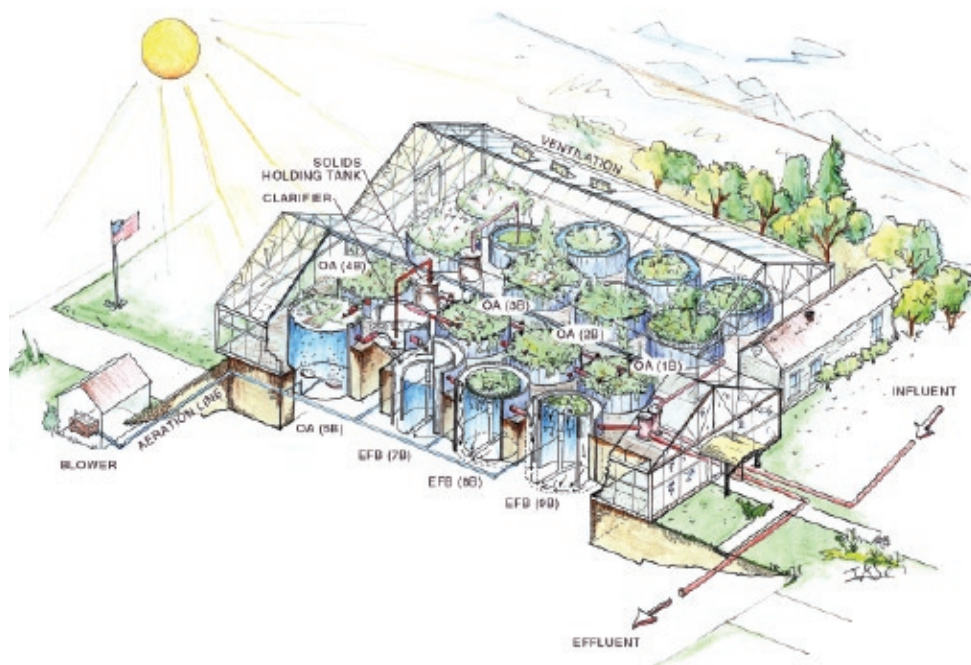
Solutions

The following pages contain a selection of my limited research on living alternatives to conventional waste and storm water treatment.

SOLUTIONS

Living Machines

Developed officially by John Todd in the early 1980's, Living Machines (now Eco Machines) are a series of tanks teeming with live plants, algae, snails, and a diversity of microorganisms and bacteria that naturally filter waste water. They function similarly to a facultative pond and often are used in combination with an outdoor constructed wetland. Because the 'machine' is alive, it adapts to sudden and extreme changes in the system, increasing its cleaning capacity and durability over time. Living machines underline the basic principles used in most natural filtration processes.



Benefits

- **Ultimate in Water Conservation** - no matter how much you use its all being recycled back to you.
- **EcoConscious** - encourages users to be more conscious of what they put down the drain
- **Adaptability** - because the working parts of the 'machine' are alive, they adapt to sudden changes in the system, increasing its cleaning capacity and durability over time
- **Scaling** - On a large scale, and in the right climate, the process can prove much more economically efficient than a conventional system

Drawbacks

- **Costly and Complicated Setup** - pumps, tanks, plumbing, climate controls, aeration systems all need to be catered specifically to waste input
- **Climate Specific** - in colder climates the tropical wetland plants that filter need to have tropical climates year round i.e. climate controlled greenhouse
- **Use** - needs regular usage in order for plants to receive enough nutrients to survive
- **Energy Intensive** - most systems continually run pumps and climate controls in cold climates making small scale systems less economically and environmentally feasible

MORE INFO: WWW.TODDECOLOGICAL.COM

SOLUTIONS

Greywater Systems

A subsidiary of Living Machines, greywater systems use wetland plants to filter **greywater** - any water that has been used in the home, except toilet water.



GREYWATER CONCEPT DESIGN BY JOEY HAYS

Benefits

- **Nutrients** - safe and nutrient-rich water source for non-edible gardening
- **Conservation** - saves water (and money on your bill)
- **Reduce Sewer Strain** - reduces chances of polluting nearby water bodies
- **EcoConscious** - encourages users to be more conscious of what they put down the drain
- **Cost Effective** - in new construction the water can be sent directly to a planted basin decreasing plumbing needs

Drawbacks

- **Climate Specific** - in colder climates the tropical wetland plants that filter need to have tropical climates year round i.e. climate controlled greenhouse
- **Storage** - storing greywater turns it rather quickly (<24hrs) into more toxic blackwater
- **Plumbing** - most houses already have plumbing that runs into the basement making it difficult to divert into a planter

MORE INFO: WWW.GRAYWATER.NET
WWW.GREYWATERGUERRILLAS.COM
WWW.FUTUREFARMERS.COM



SOLUTIONS

Stormwater Management

The main cause of sewer overflows is storm events that flood the system. Rain gardens, roadside planters to filter and absorb runoff, gutter planters, rain barrels, green roofs or simply planting trees are all examples of green stormwater management.

Benefits

- **Water Quality** - reduces strain on sewer system during storm events reducing overflows
- **Biodiversity** - brings beneficial insects and microorganisms that form the base of the food chain
- **Air Quality** - sequesters carbon dioxide and filters pollutants

Drawbacks

- **History** - this department has historically been handled by concrete-minded engineers

READ SUCCESS STORIES IN PORTLAND, OREGON HERE:
WWW.WERF.ORG/LIVABLECOMMUNITIES/STUDIES_PORT_OR.HTM

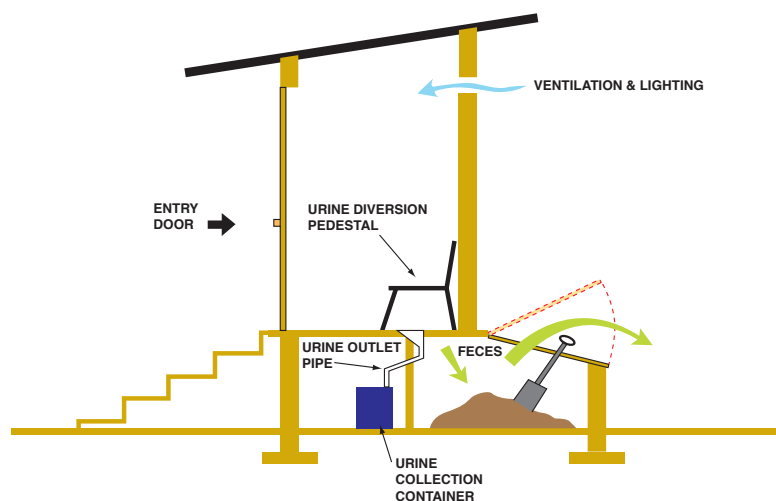
IMAGE COURTESY OF CLAIRE HOCH

SOLUTIONS

Composting & Urine Diversion Toilets

Composting toilets have traditionally been used in rural situations. The solids and liquid waste can be applied as pathogen free and 'locally grown' fertilizer, after a decent period of storage.

Separating solids from liquids has proven valuable to Swedish farmers and the local sanitation crew. There are currently at least 135,000 urine diversion toilets in use. The collected urine, which contains 80% of the nutrients, is a cheap and environmentally friendly fertilizer. The waste sludge contains less nitrogen and phosphate which creates richer sludge producing more methane, a potentially valuable energy source.¹²



Benefits

- **Free Fertilizer** - heavy in nitrogen and phosphorus, urine contains 80% of the nutrients in wastewater
- **Cost Effective** - In some parts of the world, the price of phosphorus fertilizers rose 50 percent in the past year
- **Water Saver** - as water becomes the next most important resource, it doesn't make much sense to flush 1-3 liters every time you answer nature's call
- **Energy** - by dealing with your own poo, the sewer system will be less burdened

Drawbacks

- **Mental Block** - Americans have the most difficulty facing that which comes from them everyday
- **Labor Intensive** -requires emptying the contents into a compost heap
- **Smell** - As long as there is enough cover material, there are no smells
- **Space** - A compost heap does not fit the bill for a highrise apartment building in an urban context

¹² GEORGE, ROSE. "OP-ED CONTRIBUTOR - YELLOW IS THE NEW GREEN." *THE NEW YORK TIMES*. 28 FEB. 2009

¹³ WWW.WEBLIFE.ORG/HUMANURE/DEFAULT.HTML

MORE INFO: WWW.SUBMERSIBLEDESIGN.COM/DRINKPEE

SOLUTIONS

Biogas Digesters

Food compost, when properly blended and diluted can produce methane (as cows do) through the anaerobic (oxygen-free) digestion process. Biodigesters are common in developing countries where a fuel infrastructure is not already in place. However, in Lille France there are a fleet of buses running on methane created from the city's poo.¹⁴

Benefits

- **Emission Free Fuel** - methane burns without producing smoke or soot preventing 300-600kg of CO₂ from entering the atmosphere
- **Reuse** - keeps food waste from being bagged and landfilled or amounting heaps that attract rodents and flies
- **Fertilizer** - the effluent makes a good fertilizer

Drawbacks

- **Complex Setup** - need knowledge of plumbing gas lines, tanks, and gas storage
- **Labor Intensive** - requires daily input of 1kg mashed up food waste and 15 Liters of water



Dr. Anand Karve, president of the Appropriate Rural Technology Institute, has built 3,000 rooftop biodigesters that provides cooking fuel from kitchen waste in the city of Pune, India.

¹⁴ DUNCAN, DON. "IS IT TIME TO KILL OFF THE FLUSH TOILET?" - *TIME*. 6 NOV. 2008.

MORE INFO

- DR. ANAND KARVE YOUTUBE VIDEO:
[HTTP://WWW.YOUTUBE.COM/WATCH?V=BGSL72XZHNK](http://www.youtube.com/watch?v=BGSL72XZHNK)
- APPROPRIATE RURAL TECHNOLOGY INSTITUTE WEBSITE:
WWW.ARTI-INDIA.ORG



More Info

ALCOSAN
WWW.ALCOSAN.ORG

3 RIVERS WET WEATHER DEMONSTRATION PROGRAM
WWW.3RIVERSWETWEATHER.ORG

3 RIVERS 2ND NATURE
HTTP://3R2N.CFA.CMU.EDU

ACT FOR HEALTHY RIVERS
WWW.HEALTHYRIVERS.ORG

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