

ReNUWIt Seminar Series April 27, 2016



# Wastewater Microgrids for Community Development

**Rinaldo Veseliza**

**AIA, LEED AP**

**Director of Sustainability**

**Alisto Engineering Group**

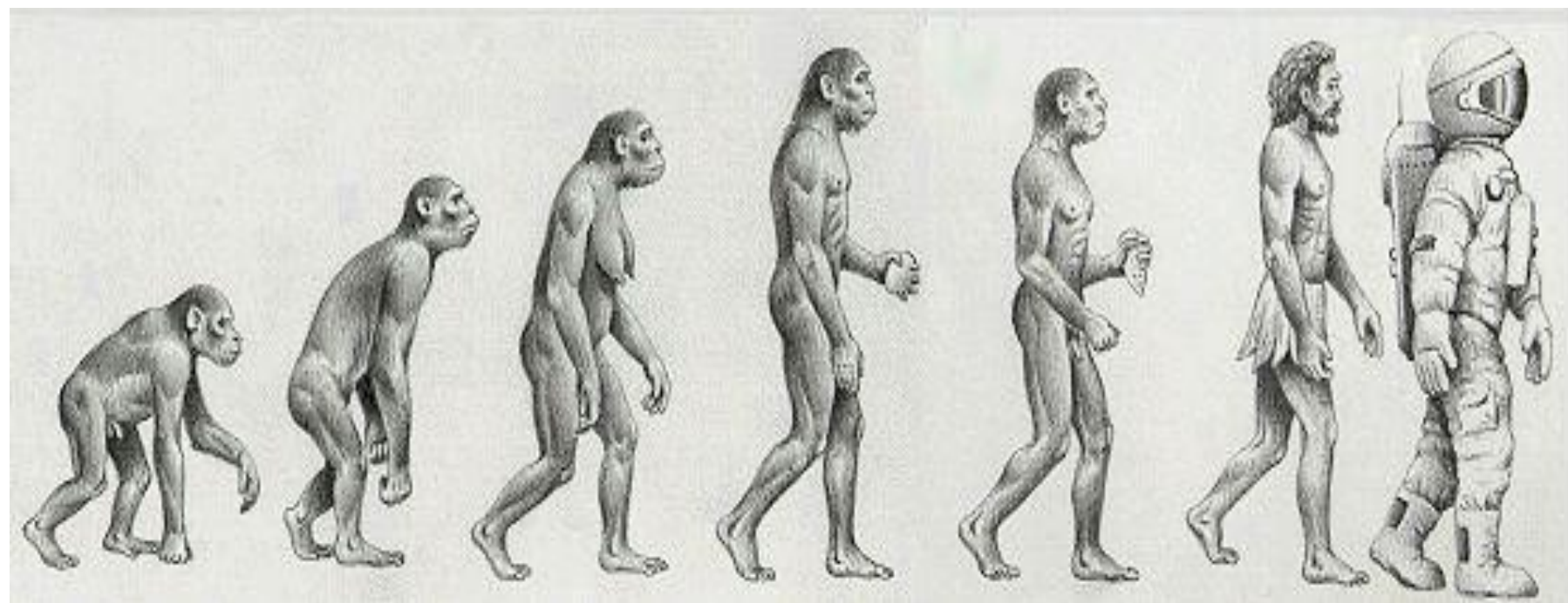
**[rveseliza@alisto.com](mailto:rveseliza@alisto.com)**

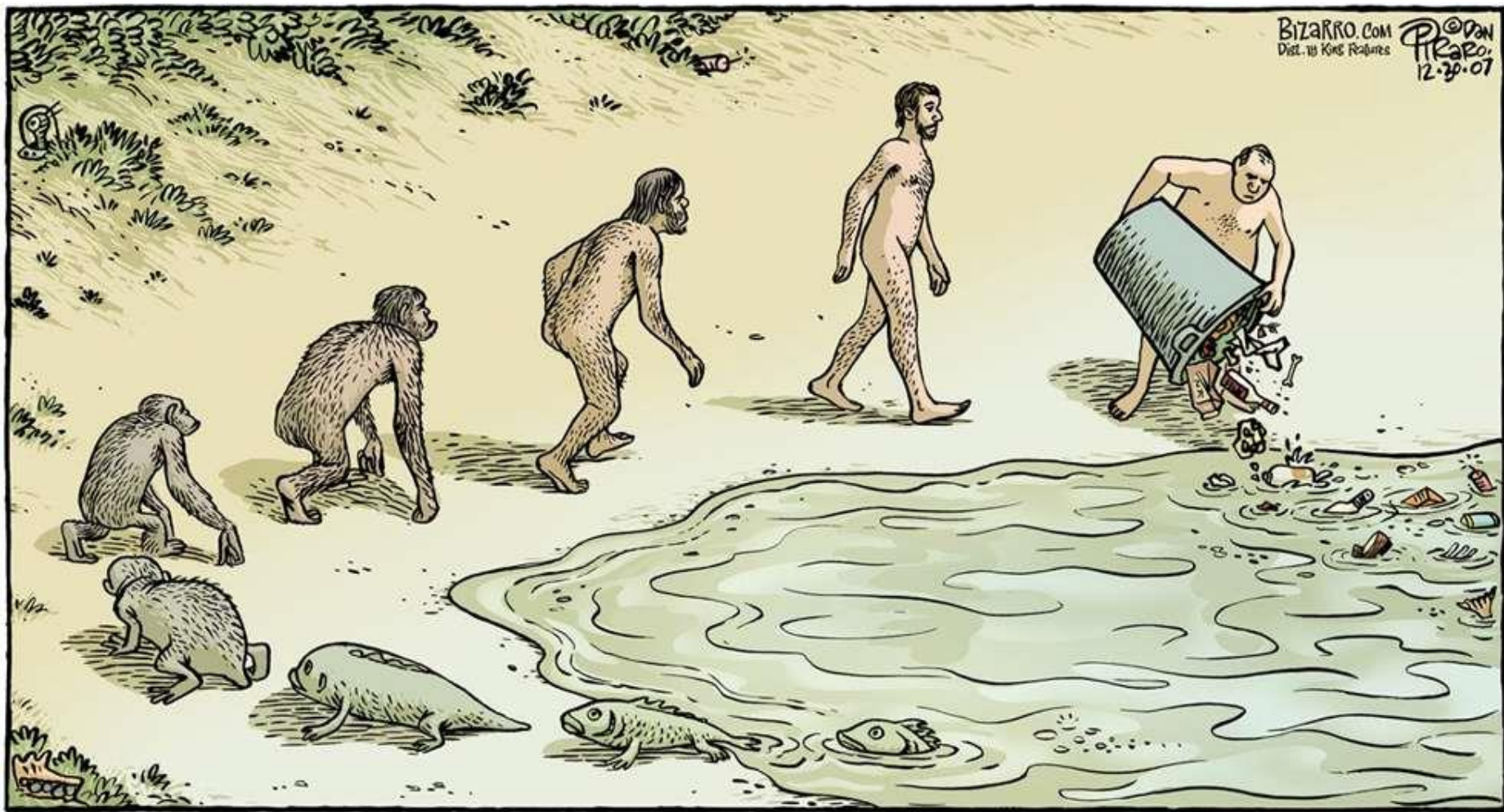
**925-202-1219**

# Presentation Agenda



- Background of Architectural Interest
- Modular water systems in the world 20-30 years
- World-wide demand for clean drinkable water
- Santa Monica Leadership in Sustainability
  - Water Garden (1990) and SMURRF (2000)
- Malibu Septic Systems and Pollution
- Scalable Modular Technology for Community Blocks
- Bay Area Wastewater Treatment Systems -Wasted
- Issues & Options- Decentralized Microgrids
- Q&A

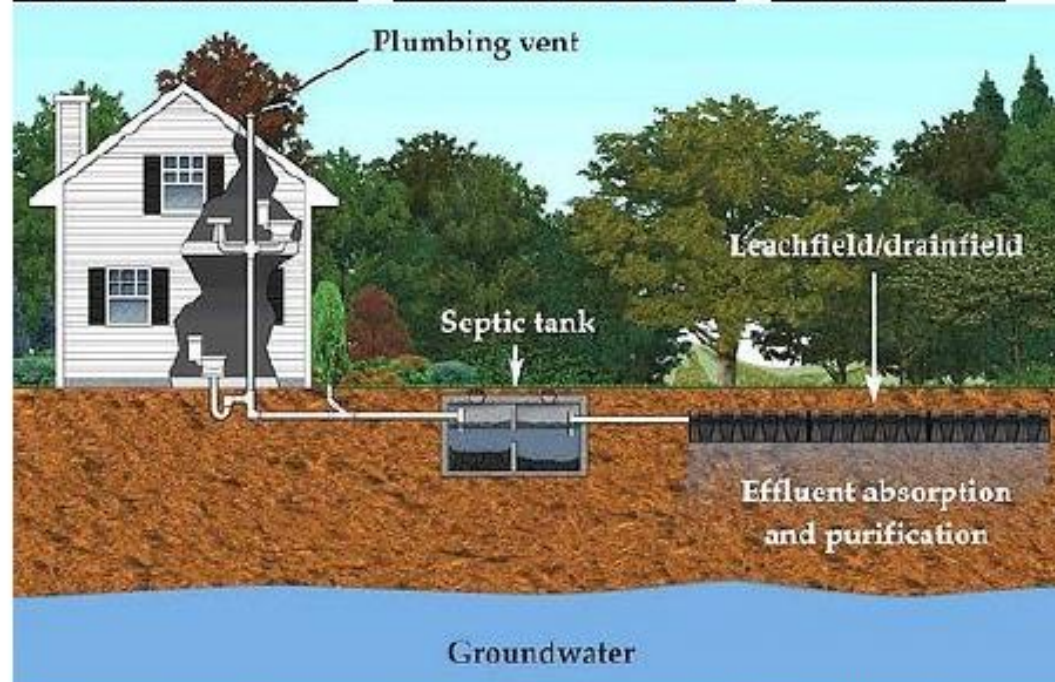






# A crash course in septic systems and how they're damaging the environment

FEBRUARY 23, 2011 | ADAM LINDQUIST | 1 COMMENT



(<http://www.flickr.com/photos/painanero/5471794815/>)

In his State of the State Address on February 3, 2011, Maryland Governor Martin O'Malley made the following statement:

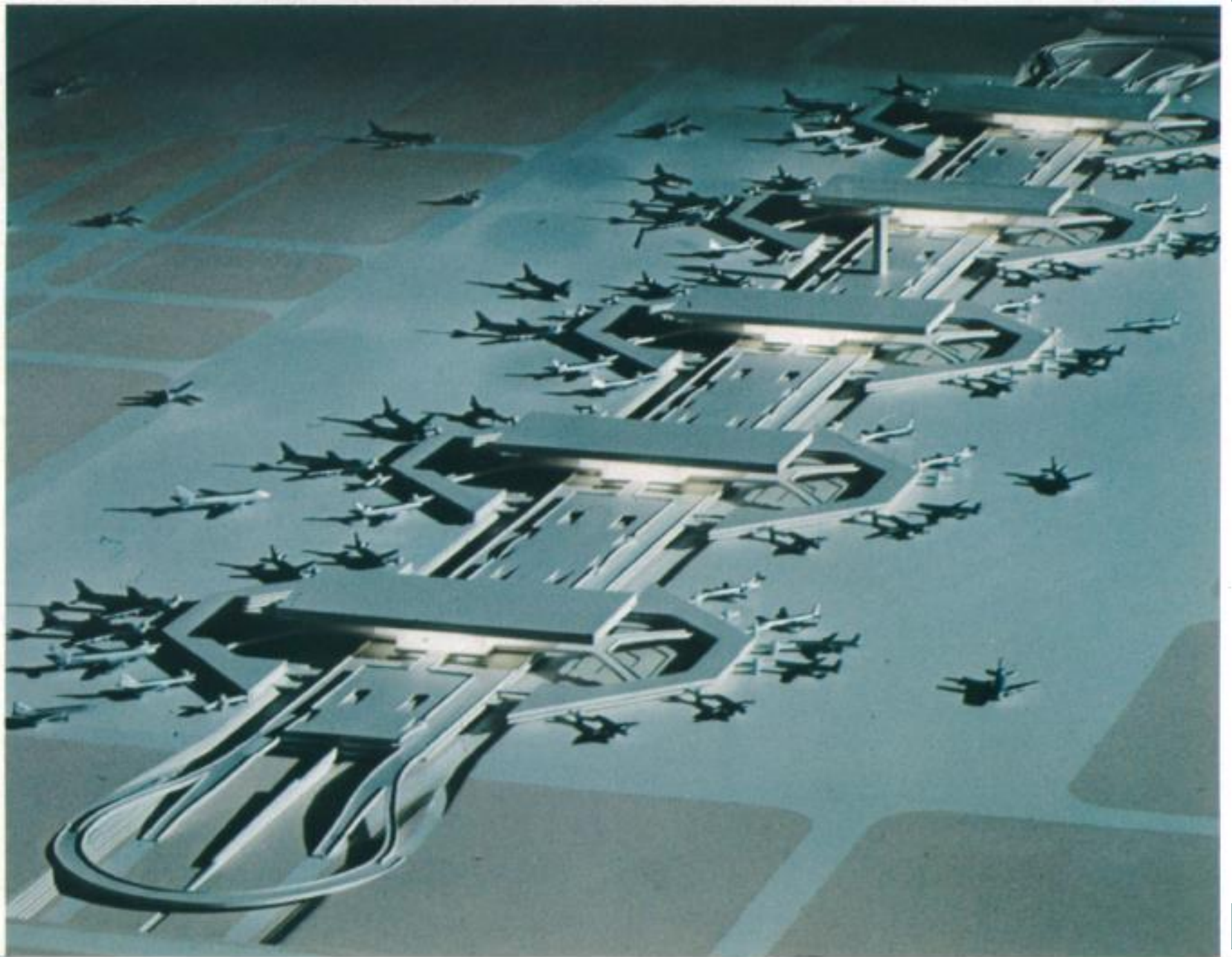
the pollution that's caused by storm-water run-off. But among the big four causes of pollution in the Bay, there is one area of reducing pollution where so far we have totally failed, and in fact it's actually gotten much worse, and that is pollution from the proliferation of septic systems throughout our State – systems which by their very design are intended to leak sewage ultimately into our Bay and into our water tables.



# AEROPORTO PER TEHRAN

linear modular airport terminal  
*aérogare linéaire modulaire*

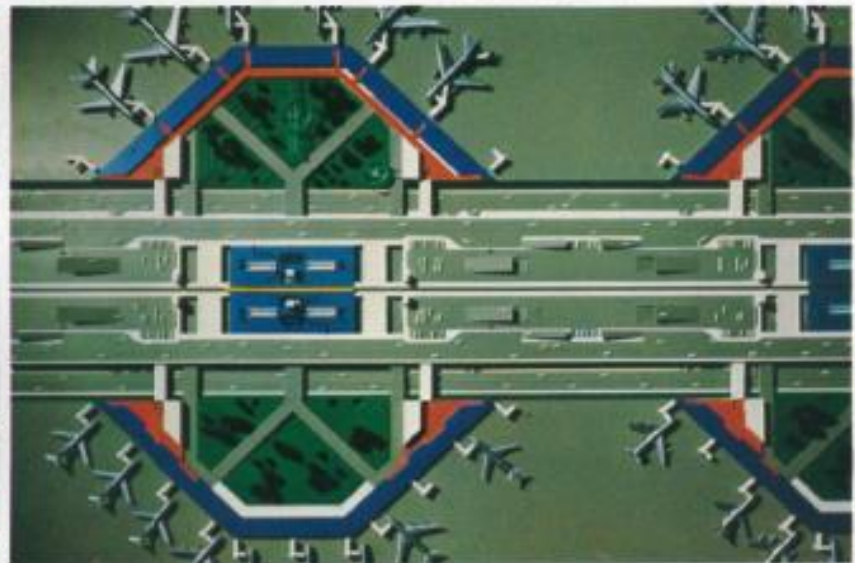
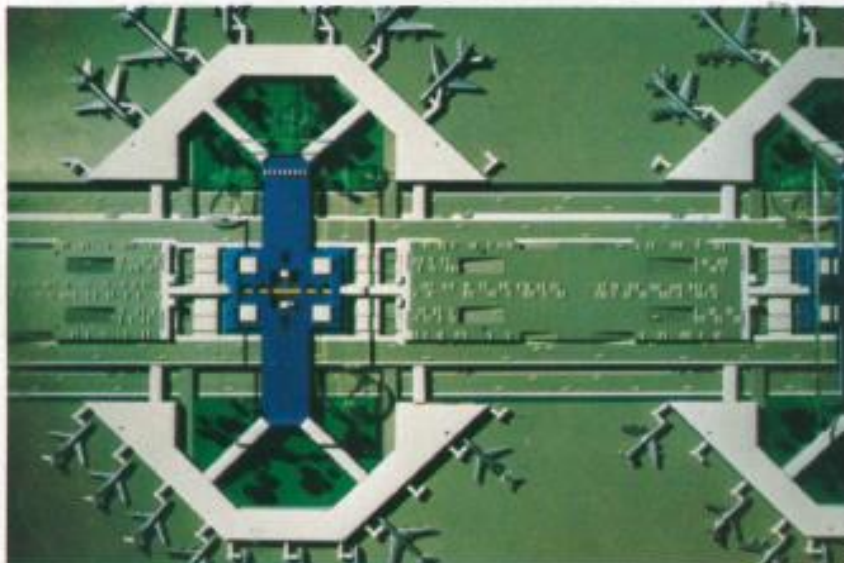
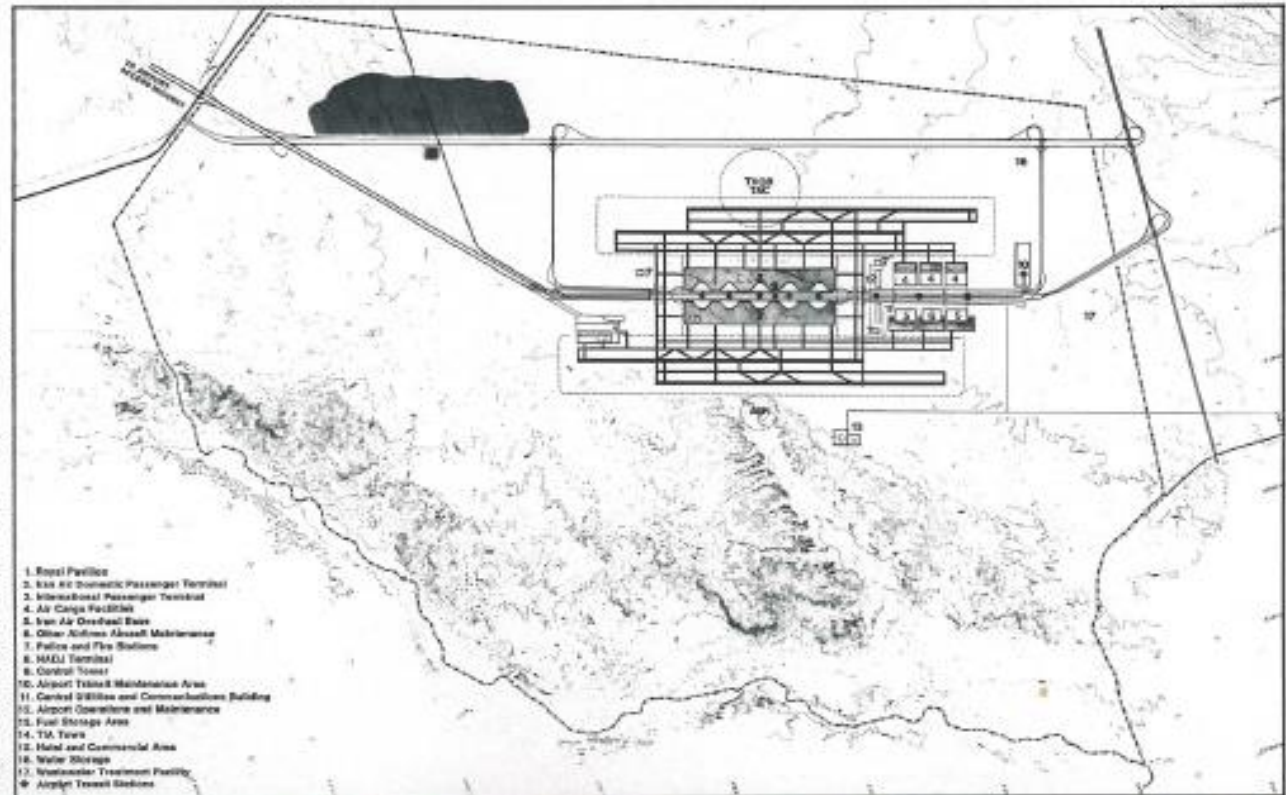




AEROPORTO DI TEHRAN  
 ARCHITETTI:  
 TIPPETTS-ABBETT-  
 MCCARTHY-STRATTON  
 ARCHITETTI ASSOCIATI:  
 W. PROKOSCH, R. J. HODGE,  
 D. R. PEIRCE,  
 A. FARMANFARMAIAN  
 1975-...

The architects Tippetts-Abbett-McCarthy-Stratton of New York have asked Domus to publish a preview of their design for the new Tehran airport.

This *modular* and *linear* design is the most recent instrumental form for an airport. An airport, this one, that will connect almost in a straight line the USA and the Far East (in addition to branch flights) and which represent, also formally, a new dimension. Air links bring peoples closer. It is a mistake, in my opinion, to say that this makes the living world smaller. To my mind, it broadens the scope for relations among populations, leading consequently to that civilised coexistence which our final geographical knowledge of this has made ineluctable. *Glo Ponti*





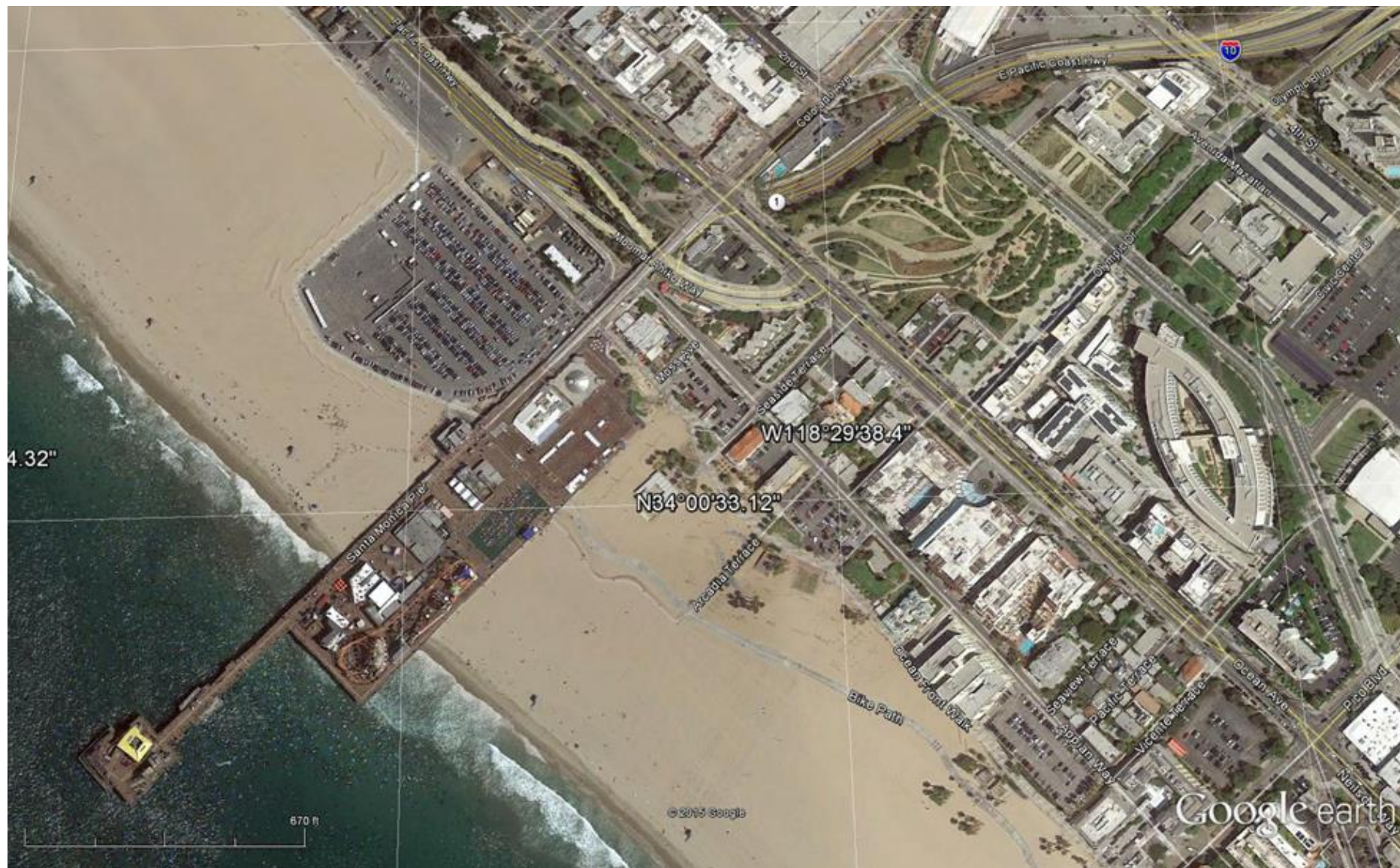


IAMNOTASTALKER.COM

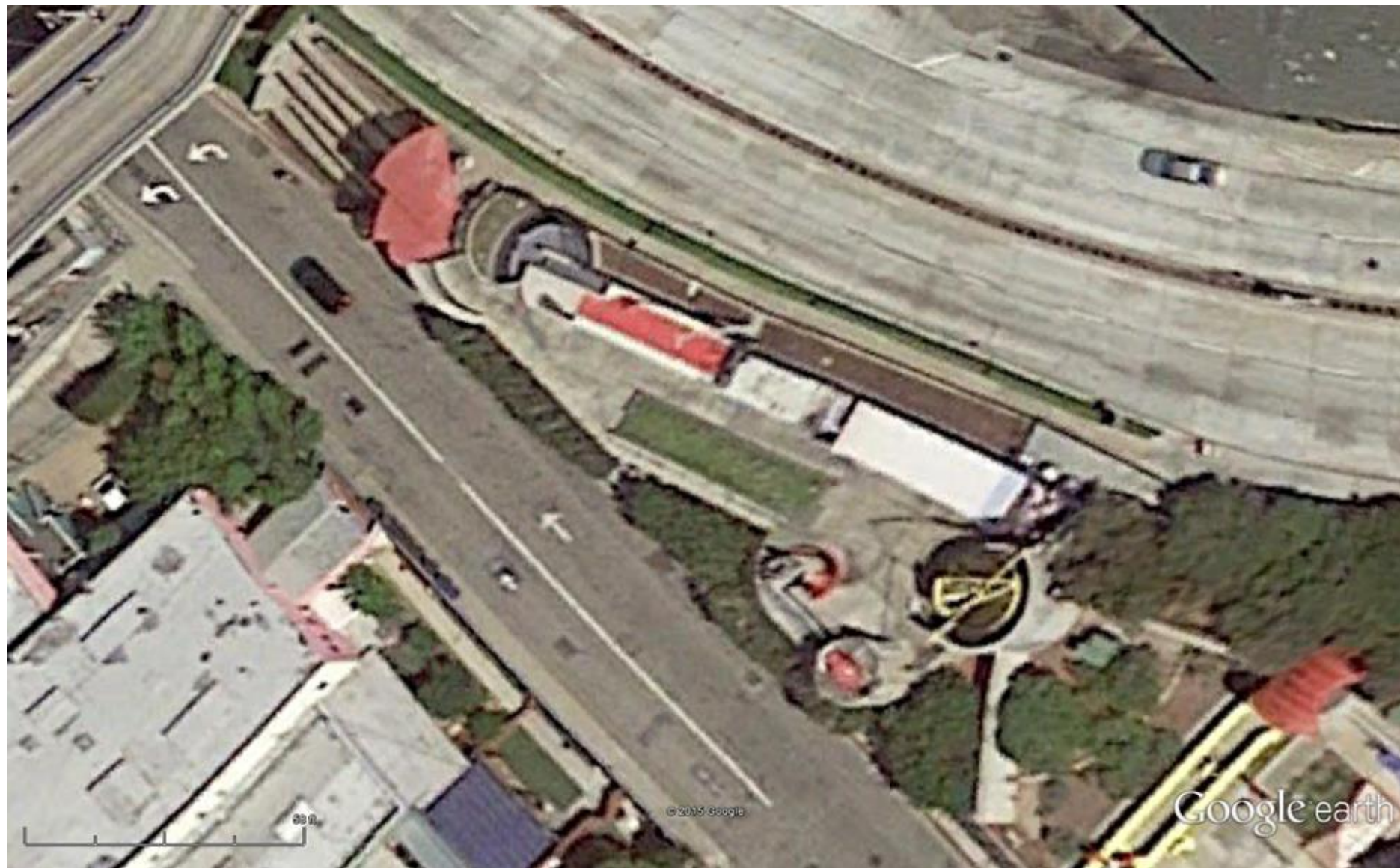




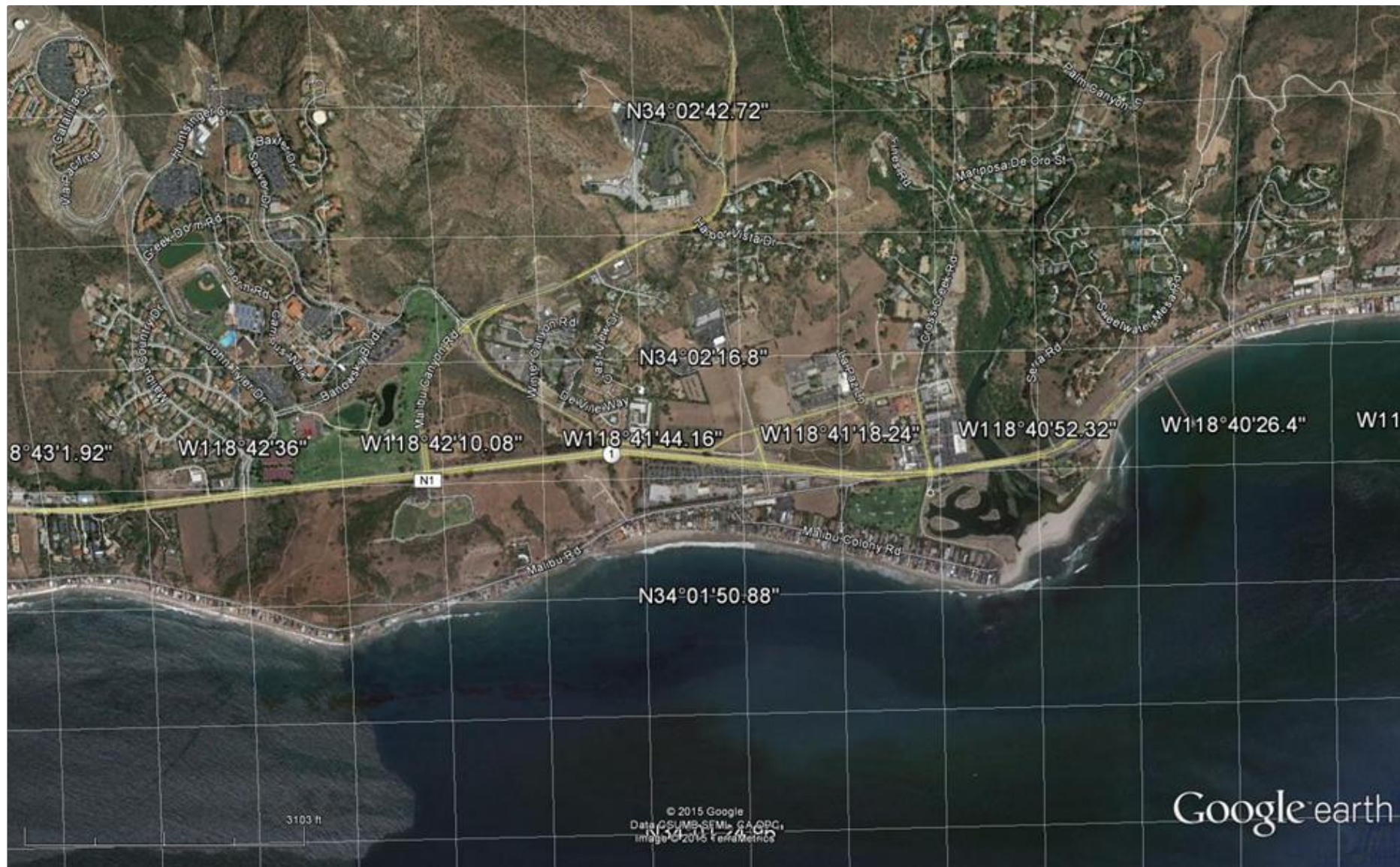








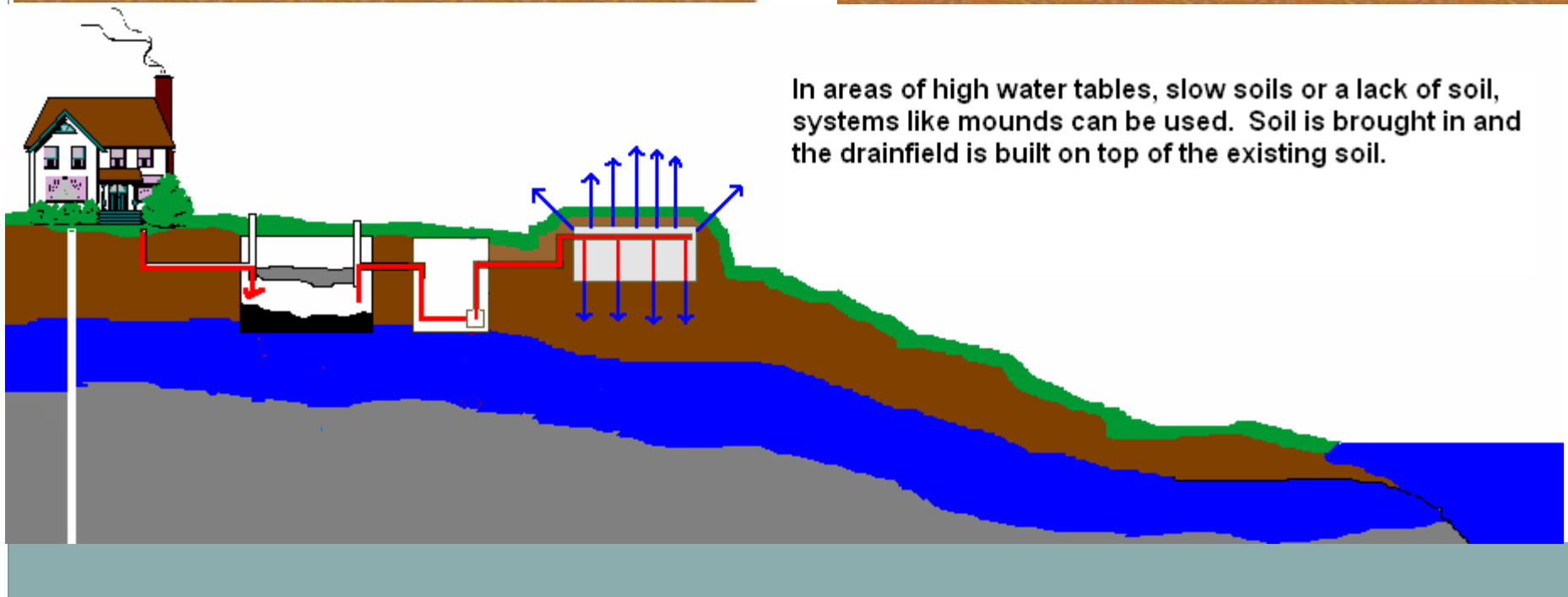
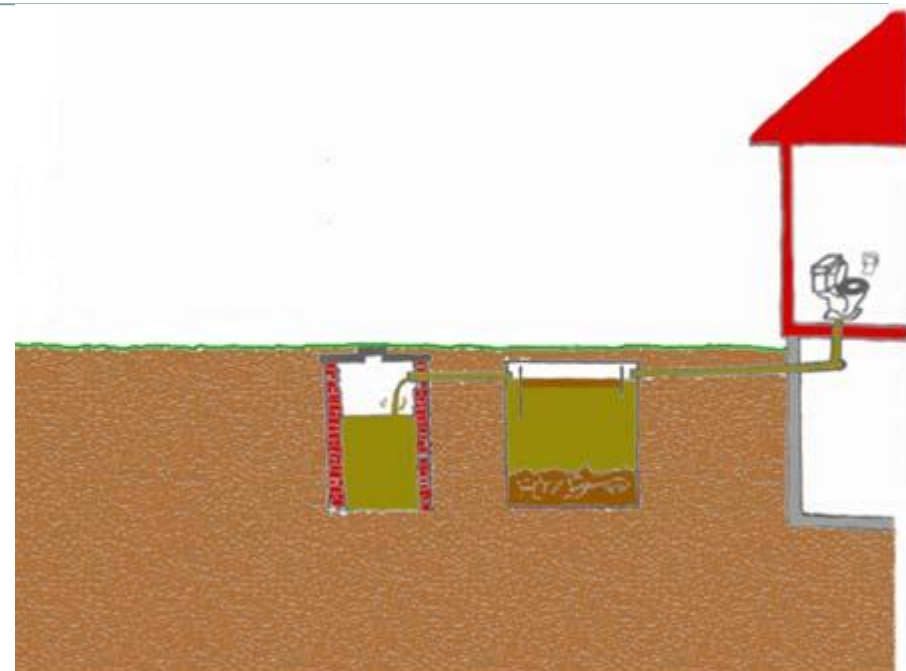
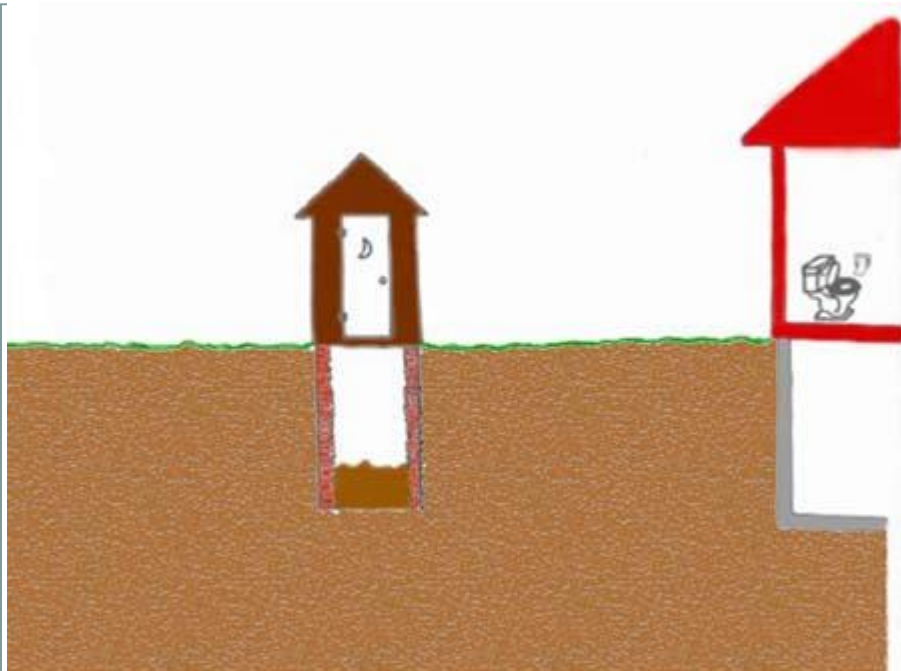




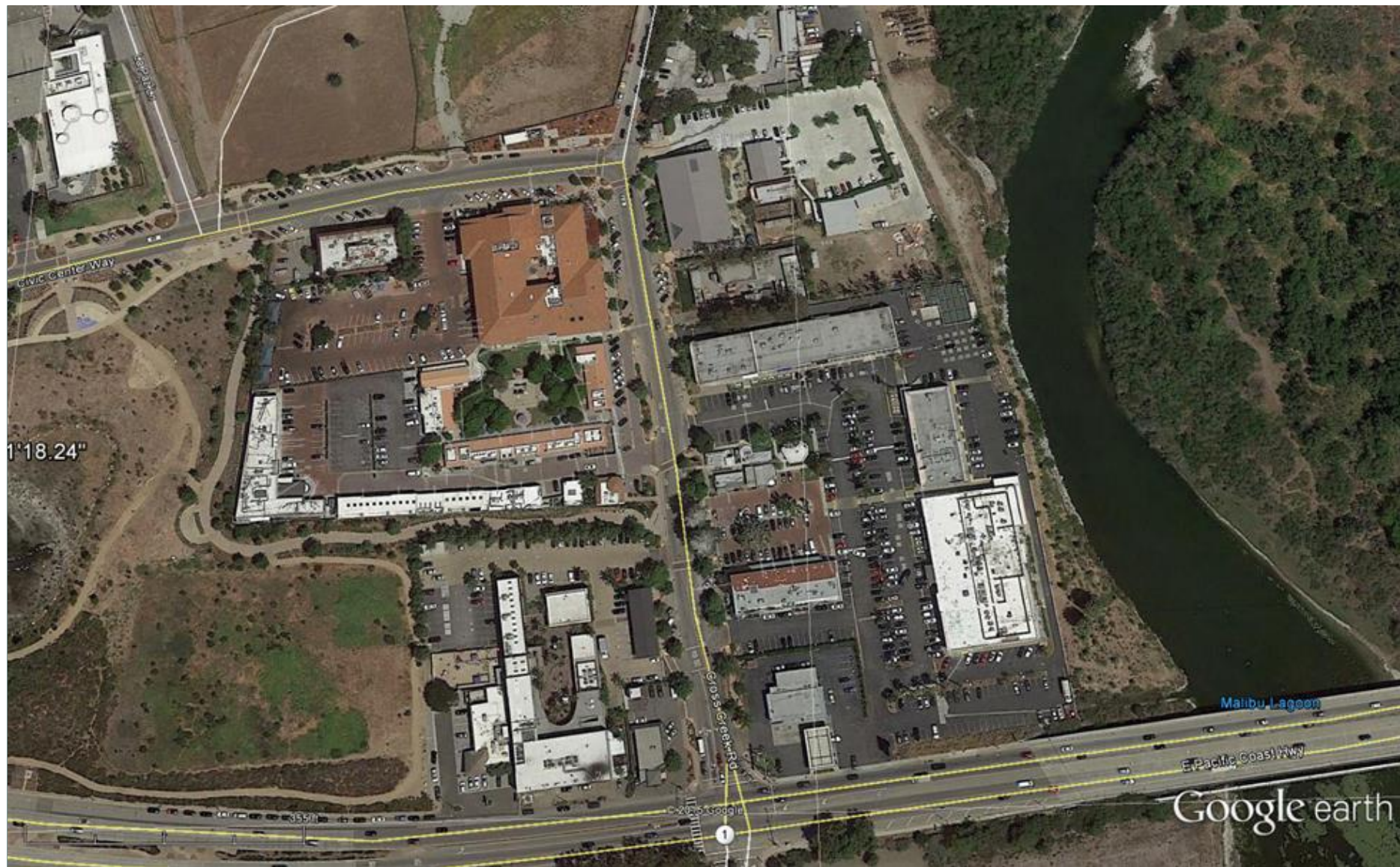








In areas of high water tables, slow soils or a lack of soil, systems like mounds can be used. Soil is brought in and the drainfield is built on top of the existing soil.









# Water board, city struggle over septic permitting issues

Posted: Wednesday, June 24, 2009 12:00 am

[2 comments](#)

Malibu city officials say the city is not entirely responsible for the poor water quality of its local ocean and lagoon waters, and should not have to front the full cost to mitigate pollution problems.

By Olivia Damavandi / Staff Writer

A palpable tension existed last week when Malibu city officials and Los Angeles Regional Water Quality Control Board members met at City Hall to renegotiate their memorandum of understanding for the management of onsite wastewater treatment systems, commonly known as septic systems, within the city. The tension is the result of continuing problems over water quality in Malibu's ocean and lagoon waters, and who is responsible for the pollution.

That, however, did not sit well with a member of the Malibu Surfing Association, which issued the statement, "The bottom line is the toilet is full and it's overflowing and the City of Malibu wants to do another study to see if they should call a plumber."

# **\$2,495,000 - 11948 Beach Club Way, Malibu**

MLS® #SR15233144

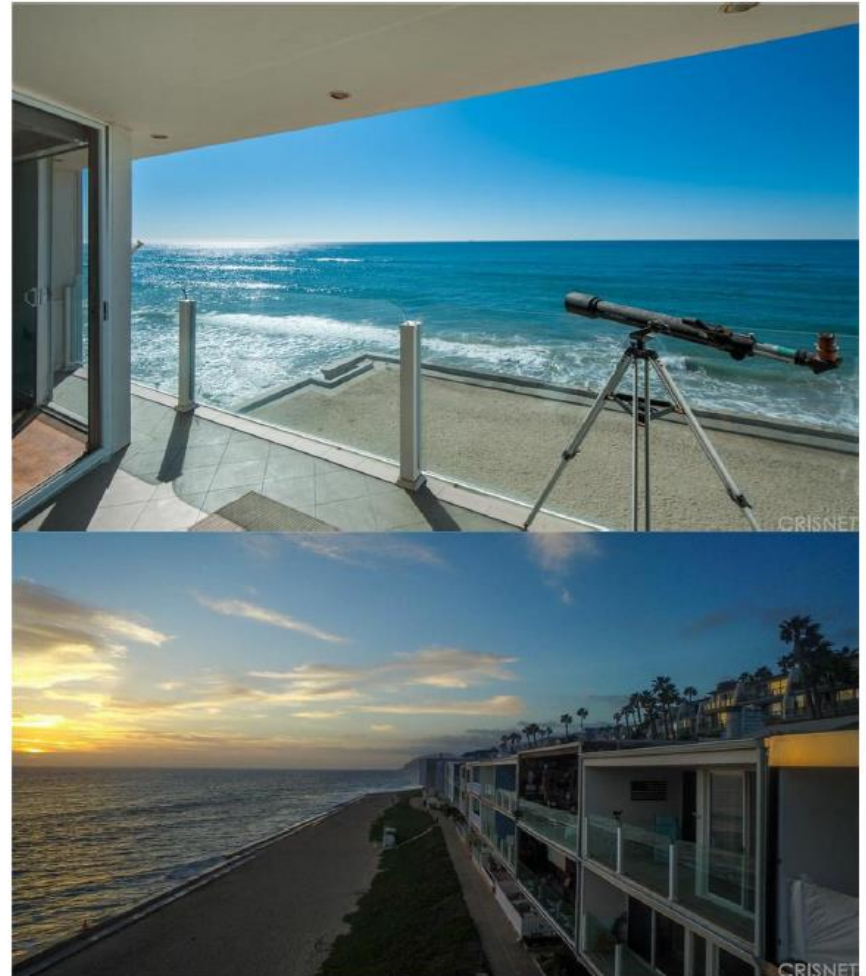
**\$2,495,000**

2 Bedroom, 3.00 Bathroom, 1,924 sqft  
Residential on 0 Acres

N/A, Malibu, CA

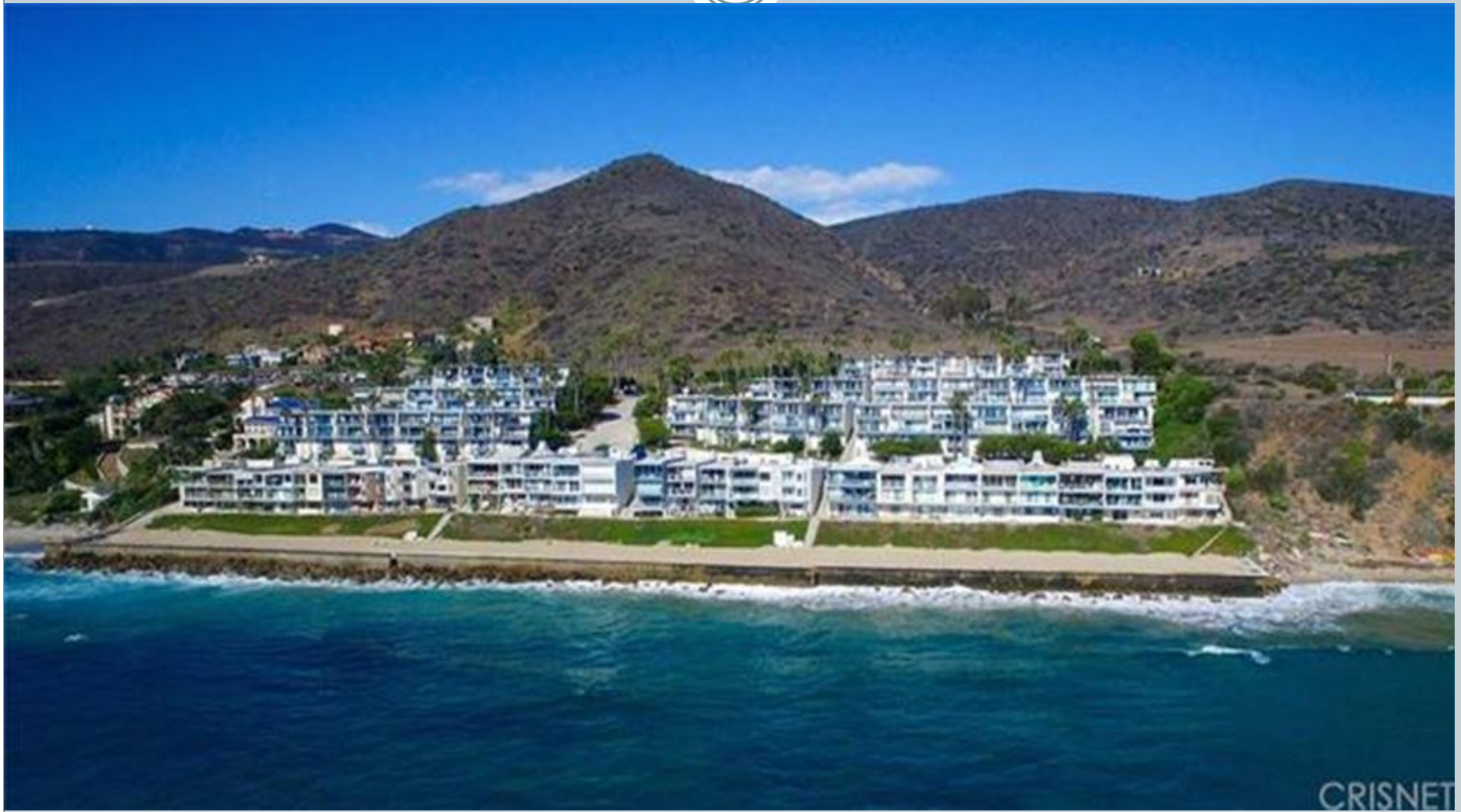
Spectacular FRONT ROW Malibu Bay Club Townhome! Explosive unobstructed ocean views from everywhere! Recently updated with wood floors, granite counters, and more! Truly turn key with a premier front row location! Steps to the sand! Open floor plan with skylights and a gourmet center island kitchen. Family room with built ins and a fireplace. Second level, over-sized master suite with large walk in closet and killer ocean views, even from the master bath! Gated community with pool. Hurry, this will not last!

Built in 1972

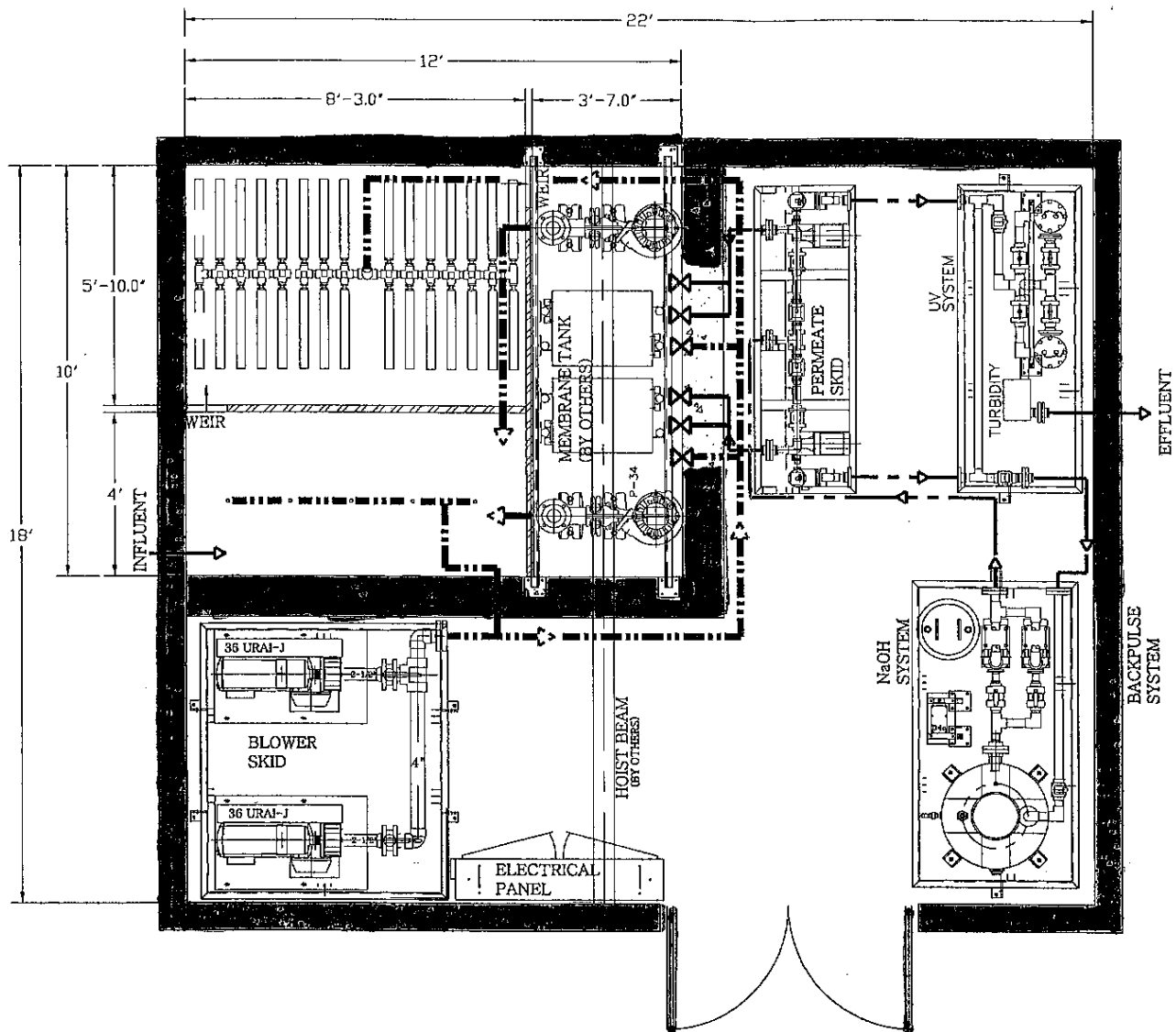




# Malibu Bay Condos





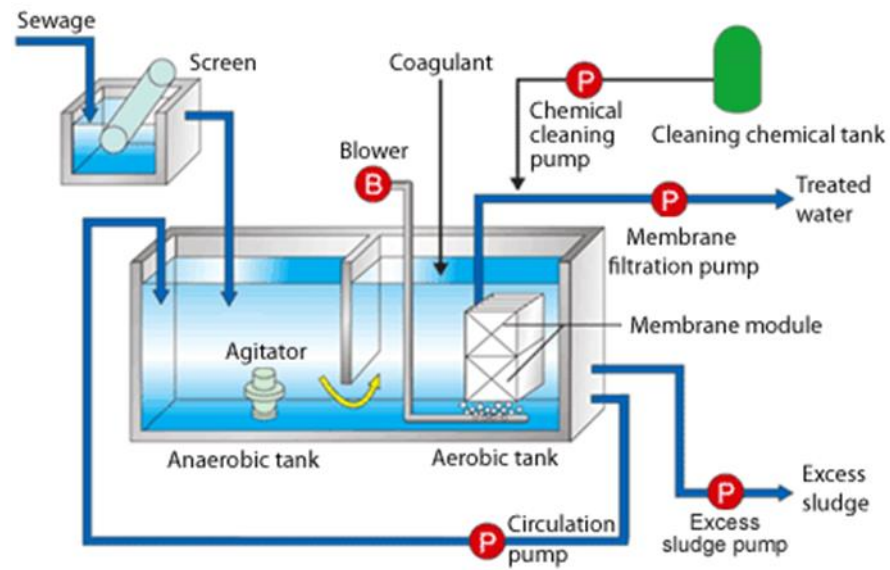
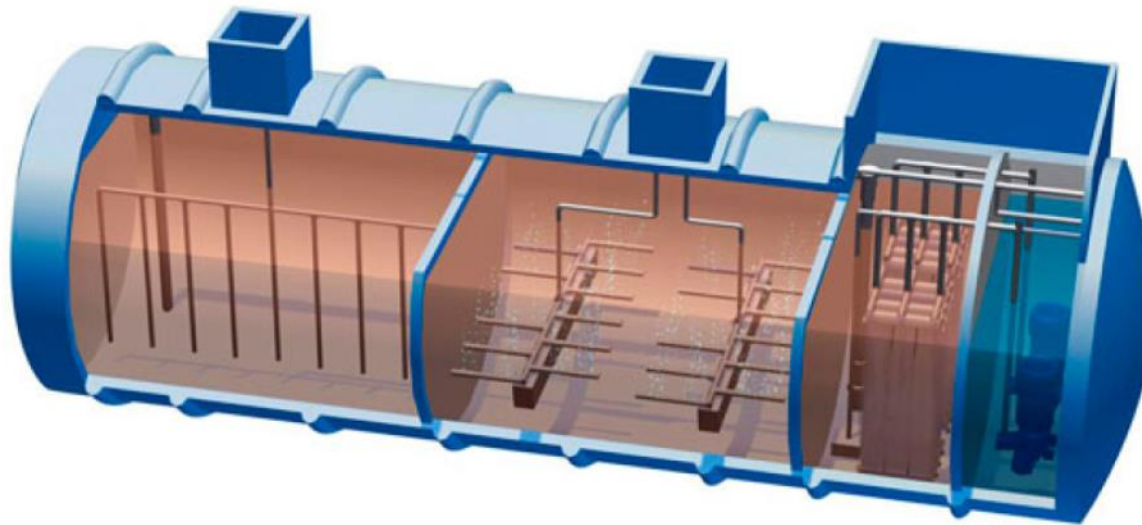




*Image courtesy of Lorcan O'Herlihy Architects*

This architectural rendering shows a neighborhood of the future linked by a variety of home storm-water capture systems that feed community wells and regional storage facilities and aquifers.



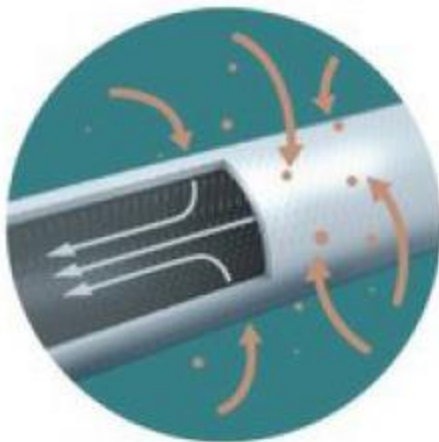


# Advanced water purification

Advanced water purification is a three-step process that cleans water to a level similar to that of distilled water.

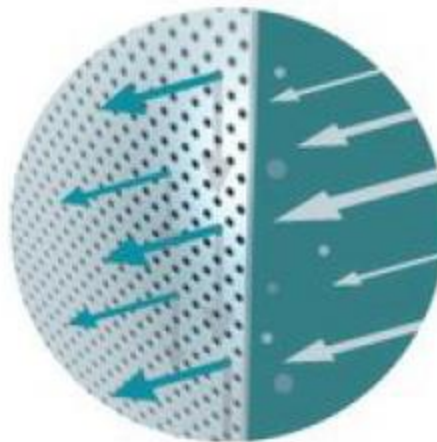
## Microfiltration

Water is sucked through thousands of tiny straws — each no wider than three hundredths the thickness of a human hair — that filter out bacteria, protozoa and suspended particles.



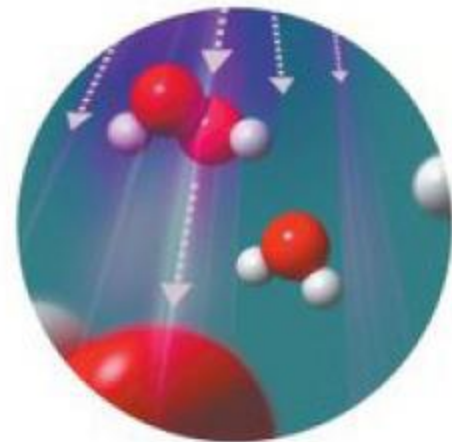
## Reverse osmosis

Water, under great pressure, is then forced through a semipermeable membrane with holes small enough to let only water molecules pass through.



## Ultraviolet light

Intense ultraviolet light breaks up remaining organic molecules. Hydrogen peroxide then oxidizes the remnants of broken molecules, disinfecting the water.





# Existing Modular Technology



## **ZENON WASTEWATER TREATMENT SYSTEM**



From commercial projects in the United States to upscale resort developments in the Caribbean with strict water conservation guidelines, ZENON's membrane technology offers cost-effective development opportunities that are in harmony with the environment.

ZENON has the best wastewater purifying systems to meet or exceed the world's toughest discharge requirements. This is why land developers have consistently chosen our membrane systems for schools, shopping malls, golf courses and resorts.

The modular membrane systems can be installed in virtually any location. In fact, with their small footprints, ZENON systems are a key part of many award-winning designs because they blend easily into the surroundings and are free of unpleasant odors.

If a wastewater treatment plant already exists, membrane technology is able to immediately upgrade the quality of the effluent and the capacity of the plant by up to three times, with no additional tank construction. These units are simple to operate and can even be controlled remotely by computer.

The effluent quality produced by the membrane system is so high that it can be immediately reused for landscape irrigation or for toilet flush water. The reuse of treated wastewater reduces the amount of fresh water drawn from the environment by up to 85%, greatly reducing operating costs.

## Water Treatment & Tertiary Systems

### Z-BOX S

up to 400,000 gpd (1,514 m<sup>3</sup>/d)

- Fully integrated process and control components
- Less than 6-foot (1.8-meter) tall system readily fits into any building
- Side-loading membrane door for easy access



### Z-BOX M

up to 350,000 gpd (1,325 m<sup>3</sup>/d)

- Equipped with rugged reinforced membranes to withstand the harshest environments and the most difficult-to-treat water sources
- Fully integrated, skid-mounted system



### Z-BOX L

up to 3.25 MGD (12,300 m<sup>3</sup>/d)

- Easily fits beneath a 9-foot (2.7-meter) ceiling
- Side loading membrane door for easy access



## Wastewater Treatment Systems

### Z-MOD S

up to 80,000 gpd (303 m<sup>3</sup>/d)

- Fully integrated wastewater treatment plant
- Can be buried or installed above ground (smaller flows available for below ground systems)
- Complete plug-and-play design with all components in a single tank
- Can operate at MLSS concentrations between 3,000 and 15,000 mg/L



### Z-MOD M

up to 110,000 gpd (416 m<sup>3</sup>/d)

- Fully integrated skid-mounted system
- Can operate at MLSS concentrations between 3,000 and 15,000 mg/L



### Z-MOD L

up to 1 MGD (3,785 m<sup>3</sup>/d)

- Containerized or skid-mounted components
- Dual-train systems
- Can operate at MLSS concentrations between 3,000 and 15,000 mg/L





# Modular Building Size Systems



Packaged plants for water  
and wastewater treatment







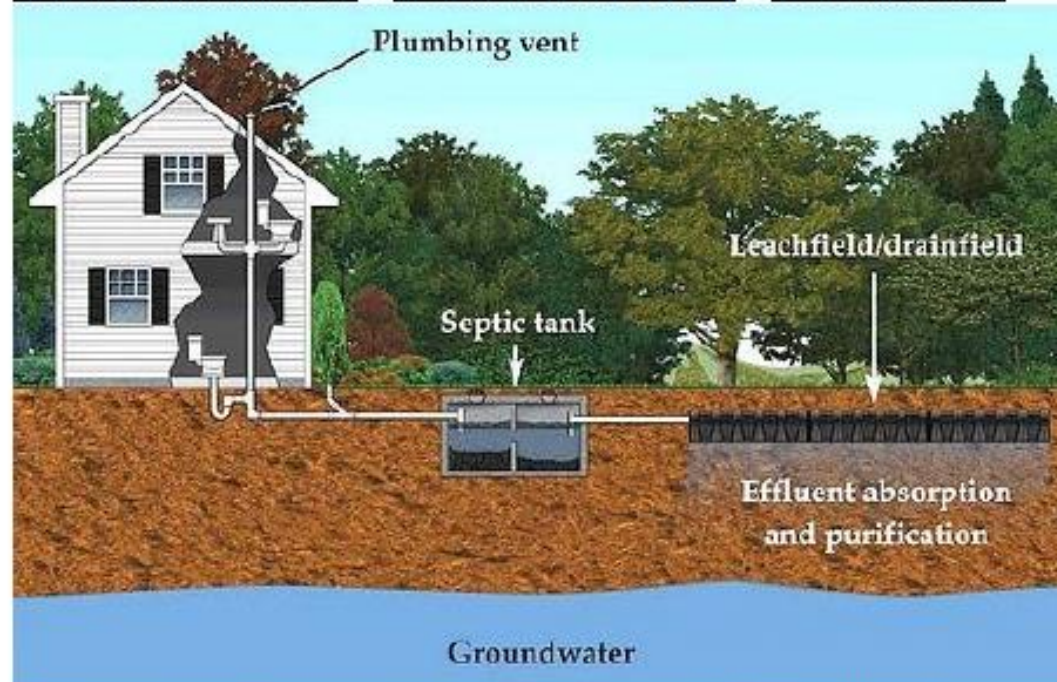
# Graywater Do's and Don'ts



- While different definitions of graywater exist, the California Plumbing Code includes wastewater from bathtubs, showers, bathroom sinks, clothes washing machines, and laundry tubs as being sources of graywater.
- Wastewater from toilets, utility sinks, kitchen sinks, or dishwashers is considered blackwater and cannot be used for graywater systems.
- A common method of using graywater is by diverting laundry wash water to an irrigation system that is below a covering like mulch
- Most building departments do not require a permit to install this type of simple graywater system, and a laundry-to-landscape system can be relatively low cost to install.

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(<http://www.flickr.com/photos/painanero/5471794815/>)

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# Did We Solve the Problem?



## DECENTRALIZED WASTEWATER TREATMENT CAN BE GREEN AND SUSTAINABLE

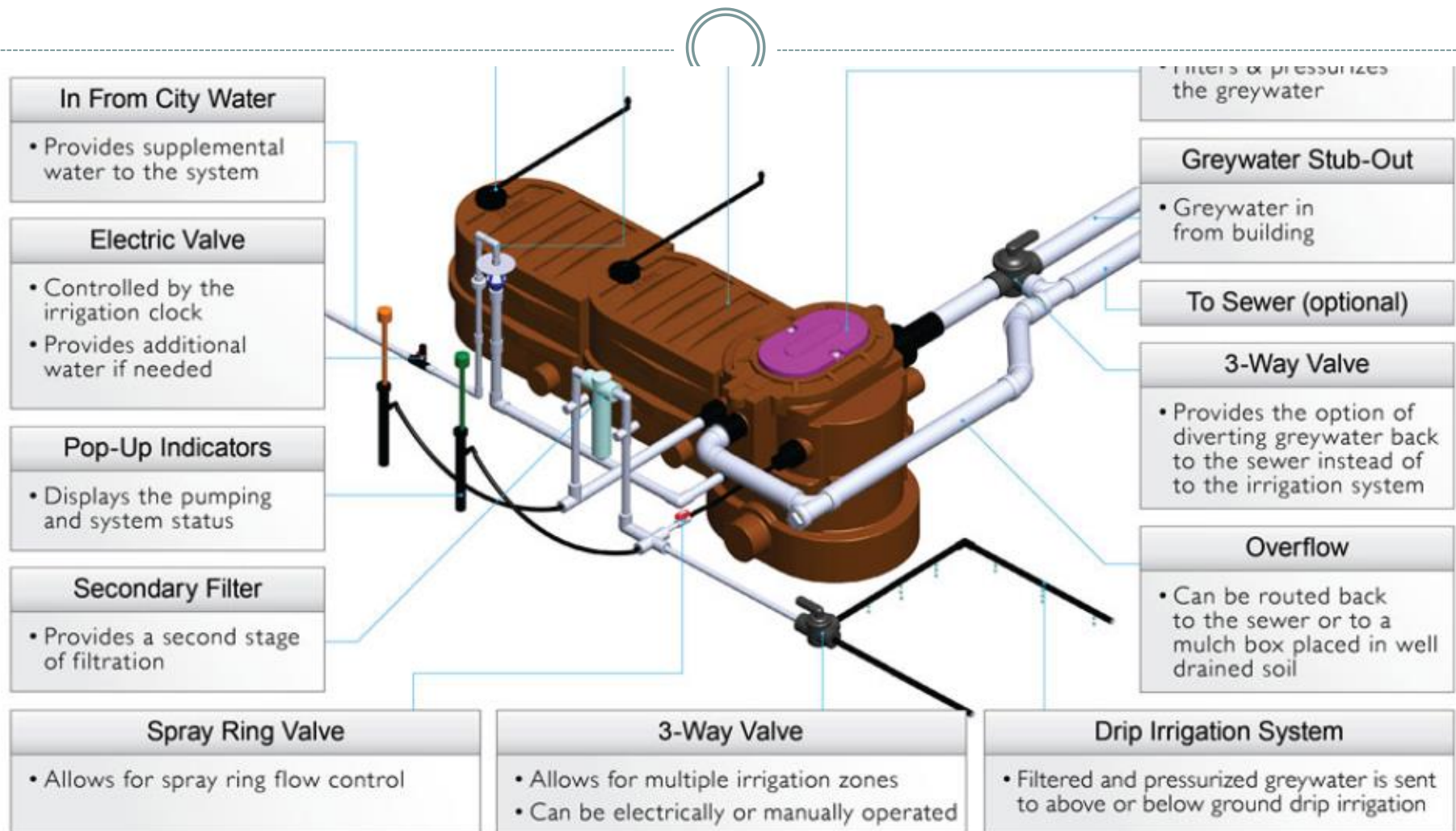


*Decentralized wastewater treatment can meet the triple bottom line of protecting the environment, being efficient, and contributing to community well-being by:*

- increasing water quality and availability,*
- using energy and land wisely,*
- responding to growth while preserving green space, and*
- using the natural treatment properties of the soil.*

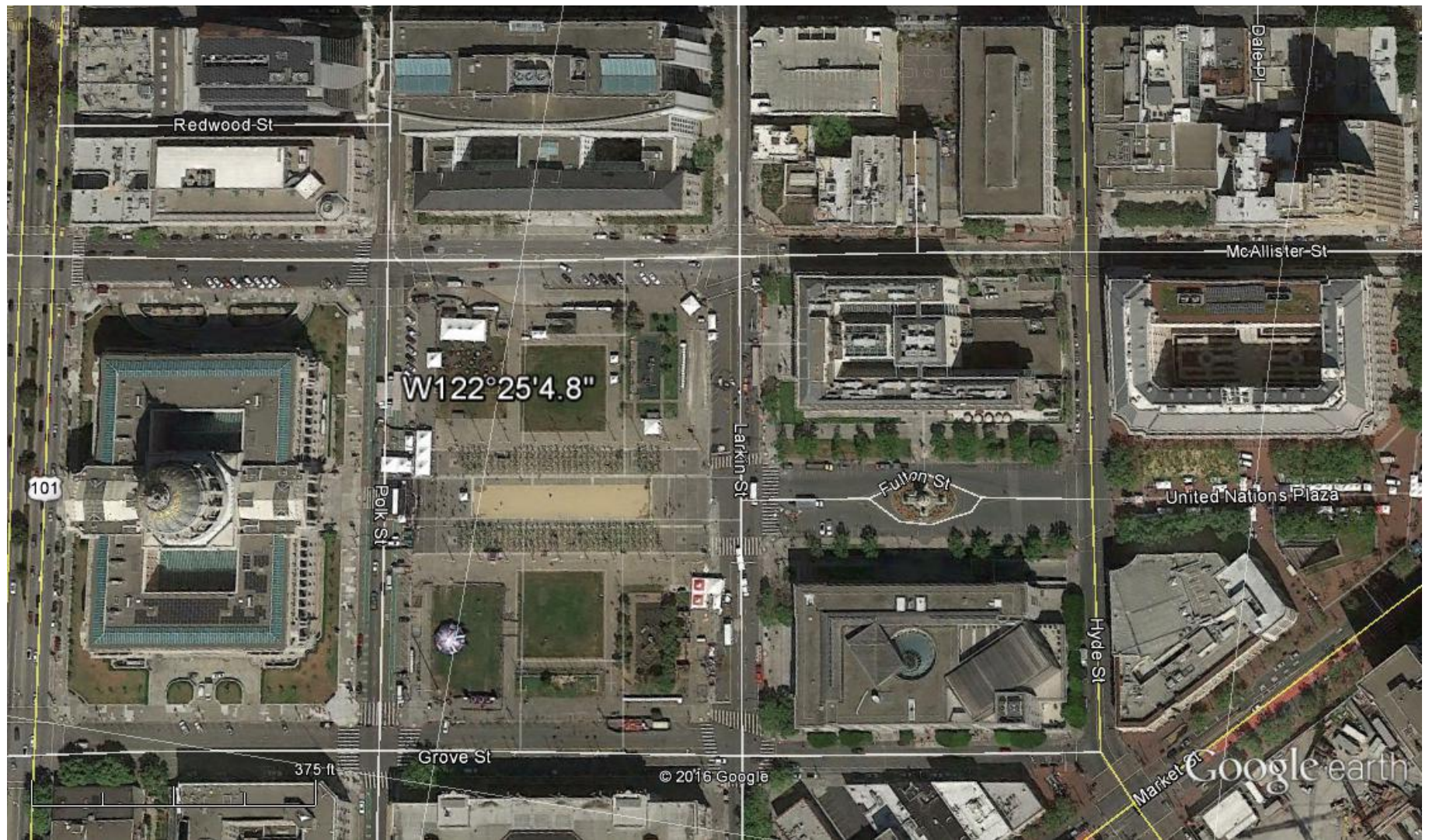
### HOW CAN DECENTRALIZED WASTEWATER TREATMENT BE GREEN?

# Greywater systems



Above: Flotender Residential Greywater System. [Click image to learn more.](#)

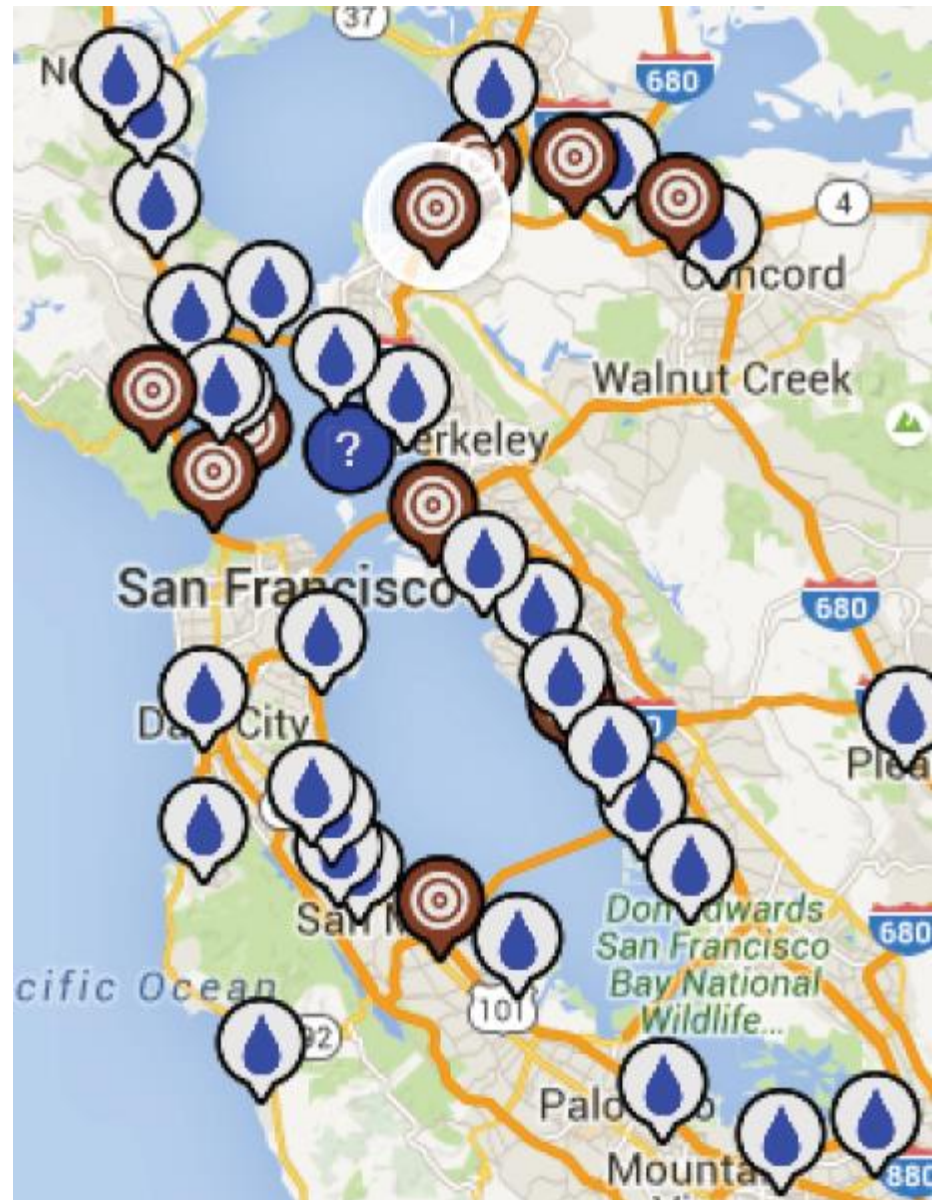






## Bay Area Sewage Treatment Plants

- Designed for Gravity Flow
- 1955 Primary Treatment
- Upgraded 1972 for Secondary Treatment
- Upgraded 1985 to handle increased flow
- Processes and removes activated sludge waste to 97%
- Water disinfected with Hypochlorite
- Hypochlorite removed
- **Water Dumped into Bay**





## 2.7 million-gallon sewage spill in Richardson Bay

By Peter Fimrite, Marisa Lagos and Jill Tucker Published 4:00 am, Saturday, February 2, 2008

ADVERTISEMENT



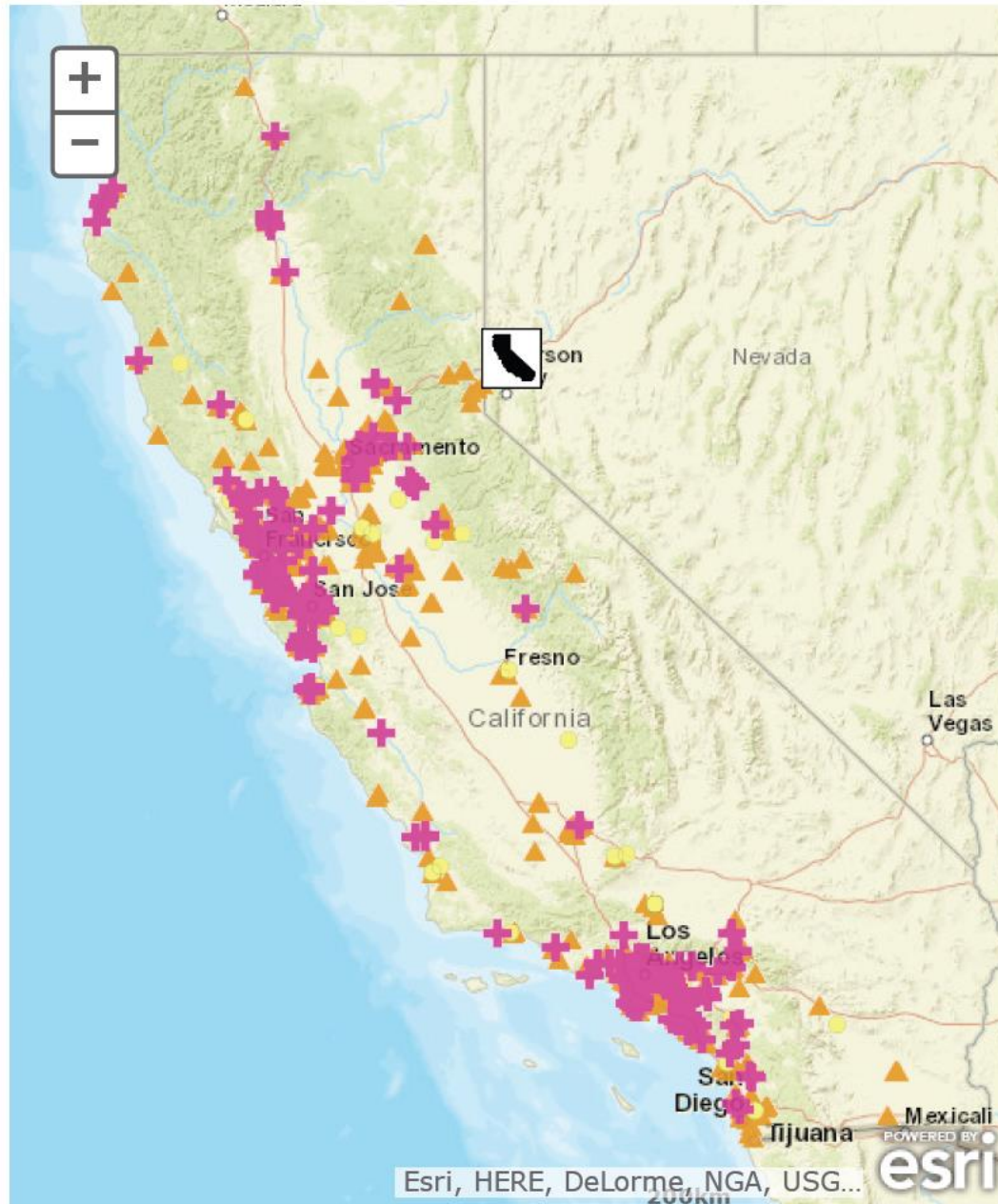
Special to the Chronicle / Liz Mangelsdorf

Residents and officials throughout Marin County were upset Friday that they were not notified for almost a day that 2.7 million gallons of treated and raw sewage had spilled into Richardson Bay.

## SANITARY SEWER OVERFLOWS: 12/24/2015 - 04/24/2016

Spill type:  [Category 1](#)  [Category 2](#)  [Category 3](#)

Click on a map icon for incident information.



Note: Map does not include spills from sewage treatment plants.

☐ Show all incidents  
☒ Show on [More Info](#) with valid GPS coordinates

Filter by [Change basemap](#) ▼  
0 - 1,000,000+ gal.

Minimum:

0 ▼

Maximum:

1,000,000+ ▼

[Set Volume](#)

Filter by date:

12/24/2015 - 04/24/2016

Start:

Dec ▼

24 ▼

2015 ▼

End:

Apr ▼

24 ▼

2016 ▼

[Set Dates](#)

Filter by Agency:

(All)

▼

[Set Agency](#)

[Show All](#)



# Current Plans



*Eastward view of secondary treatment tanks*

**A**long the shore of the southern San Francisco Bay, the San José-Santa Clara Regional Wastewater Facility (RWF) stands as the largest tertiary-level treatment facility in the western U.S. Two key purposes:

- Protect the health, environment, and economy of the South Bay by cleaning wastewater to near-drinking water standards before discharging it into the Bay

## San José-Santa Clara Regional Wastewater Facility

700 Los Esteros Road, San José, CA 95134



San José-Santa Clara  
Regional Wastewater Facility

*mgd = million gallons per day*

### Capital Improvement Program

- To continue reliable service, the aging facility is being rebuilt under publicly-approved Plant Master Plan
- \$2 billion rebuild over 30 years is among Bay Area's largest infrastructure projects, similar to building the San José Mineta International Airport
- Construction projects are prioritized through rolling 5-year

# Facts and Figures



- 1956: City of San José built the original wastewater facility and continues to administer and operate the facility
- Annual operations budget: ~ \$80 million annually
- Funded by rate revenue from contracting agencies, which in turn set rates that include their respective sanitary sewer system costs
- Employs ~ 200 staff

## Water Recycling

- RWF treats an average 110 mgd of wastewater, ~ 13% goes to adjacent South Bay Water Recycling (SBWR) pump station
- SBWR distributes annual average of 14 mgd to ~ 750 customers in San José, Santa Clara, and Milpitas



# Infrastructure



- 60 year old pipes, stations, pumps need replacement
- Long distances, One-way to Plant. No returns
- Difficult & Expensive to retrofit, upgrade, expand
- Meeting the needs of growing communities
- Recycling at 13-15%
- Sewage spills pollute environment, aquifers
- Storm water runoff most difficult to handle.
- Cannot see leaks, spills, breaks and pollution

# Sewage System Failures



- Out of Sight, Out of Mind
- Seismic Impact
- Corrosion Controls
- Valve Automation
- Designed for Overflows
- Lack of Detection
- Toxic Substances
- Septic Systems Failures
- Methane Gases

- LEAKS
- LEAKS
- SPILLS
- SPILLS
- LEAKS
- CONTAMINATION
- POLLUTION
- POLLUTION
- GLOBAL WARMING



*Northward view of Regional Wastewater Facility with sludge lagoons to right and community of Alviso to left*





San Francisco  
**Water Power Sewer**  
Services of the San Francisco Public Utilities Commission

SEWER SYSTEM IMPROVEMENT PROGRAM | Grey. Green. Clean.

## San Francisco's Wastewater Treatment Facilities

Serving over 800,000 customers, the San Francisco Public Utilities Commission (SFPUC) owns and operates San Francisco's combined sewer system, which collects and treats both sewage and stormwater runoff.

On a typical day, a vast network of pipes creates a "city under the City" that transports and delivers San Francisco's wastewater to one of our two local treatment plants: the Southeast Treatment Plant or the Oceanside Treatment Plant. During a storm North Point Wet-Weather Facility is activated to treat additional flow. Each treatment facility plays an integral role in handling and treating the City's flows before being discharged into the San Francisco Bay or the Pacific Ocean.

Stormwater enters the combined sewer system through the thousands of catch basins along the street. Since most of San Francisco is paved over, the rainwater that falls from the skies usually ends up in our sewers. Each non-rainy day an average of 80 million gallons of wastewater is collected and transported to one of the two treatment plants. When it rains, our wastewater system can collect and treat up to 575 million gallons a day (MGD).

### GET INVOLVED!

We offer free bike and walking tours of our wastewater treatment plants and green infrastructure projects. Visit our website for upcoming tours and more info about the SSIP upgrades. [sfwater.org/ssip](http://sfwater.org/ssip)

North Point Wet Weather Facility



- Built in 1951
- Only active during wet weather
- Treats up to 150 MGD during rain storms
- Located at Bay Street and The Embarcadero

### OUR COMBINED SEWER SYSTEM

**3**

Treatment Facilities

**1,000+**

Miles of Pipes

**80**

Million Gallons  
Treated Non-Rainy Day

**575**

Million Gallons  
Treated Rainy Day

**40**

Billion Gallons  
Treated Annually

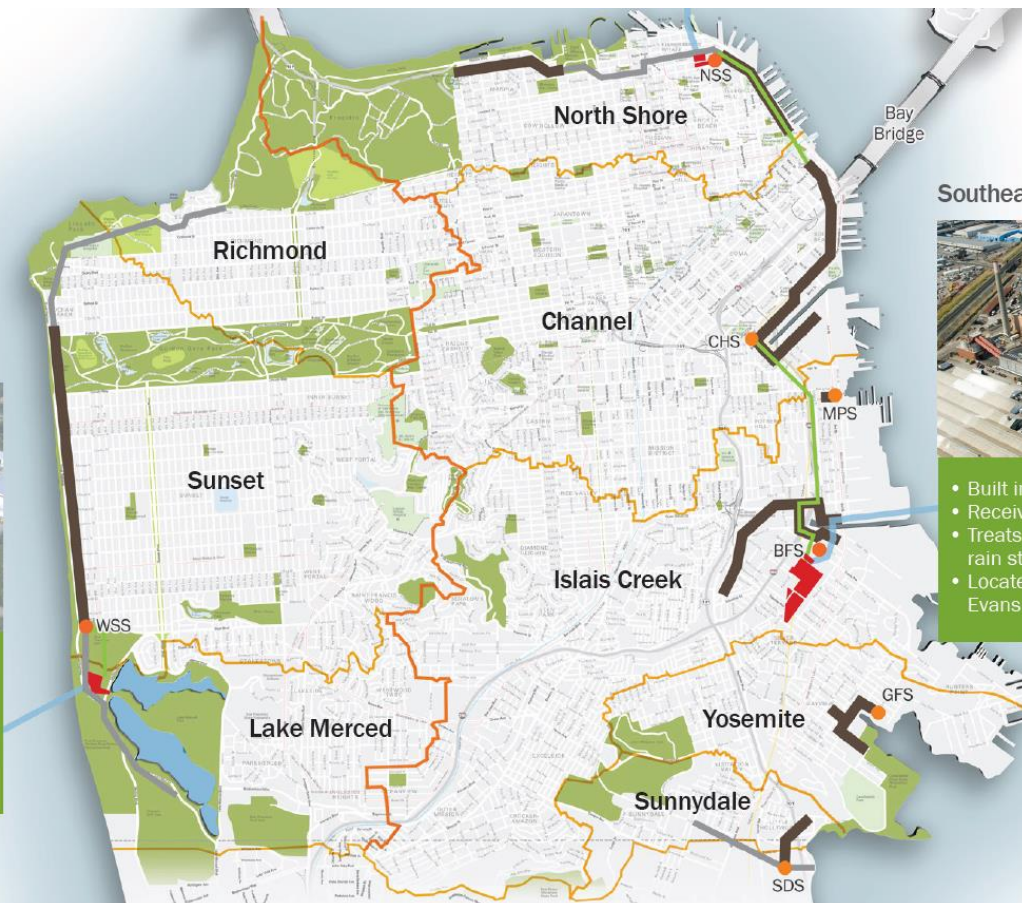




Oceanside Treatment Plant



- Built in 1993
- Receives 20% of the City's flows
- Treats 15 MGD and up to 175 MGD during rain storms
- Located off the Great Highway between Lake Merced and San Francisco Zoo



Southeast Treatment Plant



- Built in 1952
- Receives 80% of the City's flows
- Treats 60 MGD and up to 250 MGD during rain storms
- Located on Phelps Street near Third and Evans streets in the Bayview District

**ABOUT THE SSIP:** The SSIP is a 20-year citywide investment to upgrade our aging sewer system and provide a more reliable, sustainable, and seismically safe sewer system now and for future generations. The Commission authorized \$2.7 billion of Phase I Improvement in August 2012.

[OUR WORK](#)[NEWS](#)[TAKE ACTION](#)[ABOUT](#)[DONATE](#)

# Controlling Urban Storm Water Pollution

## A Low-Profile But High-Impact Source of Pollution to the Bay

Storm water is the largest source of pollution to San Francisco Bay. When it rains, pollution like trash, oil, pesticides, fertilizers, household chemicals, and legacy toxic pollutants are washed into the Bay without being treated or filtered. Paved concrete and asphalt surfaces on roofs, driveways, streets, buildings, and parking lots send rainwater rushing into gutters and storm drains. This storm water – carrying all the pollution it collects along the way – then gets emptied into creeks and sloughs that flow into the Bay, or into the Bay itself.

Each pollutant can have impacts on the plants, animals, and people that depend on the Bay:





## Facility Map



Water Pollution Control Plant: flow routing and influent and effluent sampling stations.

The wastewater treatment process consists of screening, grit removal, primary sedimentation, secondary (biological nutrient removal) treatment, secondary clarification, filtration, disinfection, and dechlorination.







## Capital Improvement Program

- To continue reliable service, the aging facility is being rebuilt under publicly-approved Plant Master Plan
- \$2 billion rebuild over 30 years is among Bay Area's largest infrastructure projects, similar to building the San José Mineta International Airport
- Construction projects are prioritized through rolling 3-year Capital Improvement Plan (CIP); learn more about the CIP at [www.sjenvironment.org](http://www.sjenvironment.org), Regional Wastewater Facility tab.

## Budget, Funding & Staffing

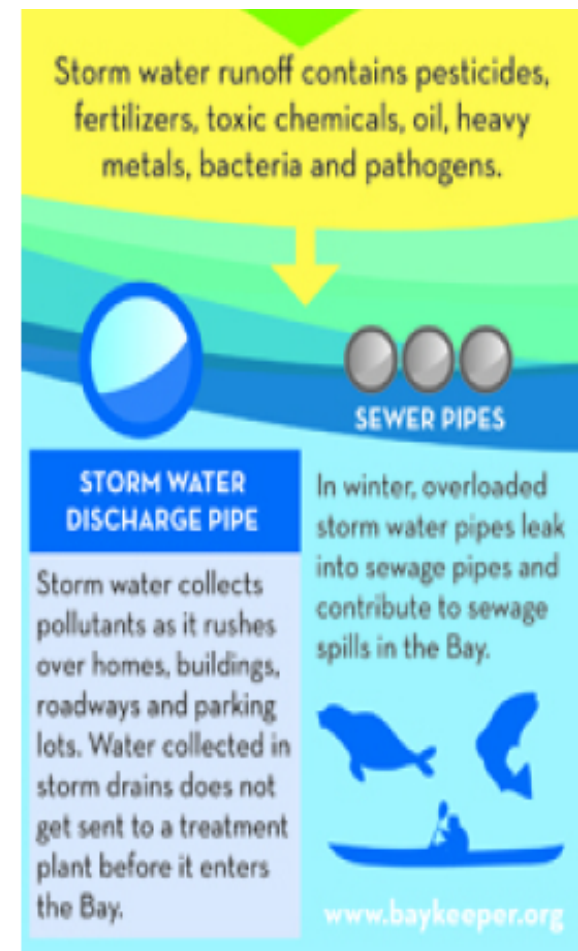
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## Water Recycling

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- SBWR distributes annual average of 14 mgd to ~ 750 customers in San José, Santa Clara, and Milpitas
- Beginning March 2014, RWF supplied secondary wastewater to Silicon Valley Advanced Water Purification Center which in turn purifies the water with advanced technologies; this water blends with SBWR water to create a high quality recycled water for SBWR customers



- Many Bay Area creeks cannot support healthy fish populations because of pesticide contamination.
  - Fertilizers contribute to growth of algae and reduced oxygen in the Bay.
  - Bay fish are unsafe to eat because of high PCBs and mercury concentrations.
  - Copper causes salmon to lose their ability to find their spawning streams.
  - Nickel is lethal to shorebirds.
  - Oil and grease are toxic to the hearts of fish.
  - Bacteria and other pathogens make waterways unsafe for recreational activities like boating and swimming.
  - Dirt from construction zones and eroded creeks clouds the water, destroying habitat and impeding healthy plant growth.
  - Trash such as plastic bags and bottles clogs waterways and can suffocate and disable wildlife.
- Cigarette butt filters release toxic chemicals and become lodged in the digestive tracts of seals, birds, and many sea creatures.



# Recycling water and energy

EBMUD's wastewater treatment plant is more than a treatment plant –it's a green factory. Biodegradable wastes in sewage, food scraps and grease from local restaurants, plus waste streams from wineries and poultry farms are mixed together in large tanks and "digested" by microorganisms. The biogas emitted by the microorganisms is captured







# City of Pinole







# Sausalito-Marin City Sanitary District

*Wastewater Collection, Treatment and Safe Disposal to Protect Our Community's Health and the Bay*

Wednesday April 20, 2016 | [Odor Control Status](#) | [Site Map](#)

## Capital Improvement Projects

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### Projects that are under construction or in final design

During the next five years, the District will carry out over \$30 million in critically needed improvements to our community's sewer pipelines, pumps, manholes and treatment facilities. The goal: to upgrade the sanitary systems so that it will continue to reliably protect public health and the environment, while achieving regulatory requirements.

Below are links with updates on current construction projects.

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### Secondary Sediment Tanks Rehabilitation Project

# Conclusion



- Technology is there, people are not !!!!!!!
- Clean Water Act has been dormant in many cases
- Educate, Motivate, Activate and Litigate
- Great opportunity to save water for multiple purposes by going local and modular
- Reduce costs to Cities for infrastructure
- Reduce inefficiencies in transport
- Recapture the Aquifers, Rivers and Bays
- Purify runoff and waste streams locally
- HEAL THE BAY



## EDITOR'S LETTER

By Kevin Westerling

Chief Editor, [editor@wateronline.com](mailto:editor@wateronline.com)

### **When Bill Gates Drank Poop Water**

You may have seen it on *The Tonight Show Starring Jimmy Fallon* or learned about it from *Forbes*, CNN, *Wired*, NPR, or *Popular Mechanics*.

When Bill Gates drank water purified from sewage, promoting a new technology funded by the Gates Foundation, it blew people's minds. The general public, however, is a different story, and squeamishness surrounding "toilet to tap" (a term advocates avoid) has been a major hurdle in getting this needed resource implemented.

- Direct and indirect potable reuse will need to be increasingly utilized as the stresses of population growth and drought converge,
- Gates normalized the idea for millions overnight, creating waves of mainstream influence that continue to resonate and turn the tide toward widespread public acceptance.

# Future for CA Wastewater Re-use



- In 2014 WaterReuse estimated that by 2020 over 2,300 MGD treated wastewater will be discharged to surface waters or the ocean.
- Over 1,000 MGD could be used for indirect potable re-use which would meet the residential, commercial and industrial water needs for 8,000,000 people, or 20% of projected population of CA in 2020
- A number of communities throughout the country are evaluating the use for direct potable re-use to supplement their current .water supply



# Recommendations



- Discontinue expansion of existing Wastewater Treatment Plants except to maintain and purify (Tertiary Treatment for existing flows
- Start construction of retention and underwater storage facilities along the coastline, creating platforms/ foundations for waterfront parks & housing
- Mandate Wastewater microgrids with tertiary treatment at the local community level.
- Ban the use of Septic systems and require tertiary treatment at the residential level.
- Invent small modular units, combining existing proven technologies with mass production techniques

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UC Berkeley Professor of Civil and Environmental Engineering



SAN FRANCISCO CHRONICLE AND SFGATE.COM/BOOKS | Sunday, February 23, 2014 | Section F

## Books

**NONFICTION**

### Drying up

By Kate Galbraith

With the turn of a tap, clean water flows out. With the flush of a toilet, waste travels to a plant for treatment. It all seems so simple and obvious. And yet, as UC Berkeley Professor David Sedlak explains in his fact-packed new book, "Water 4.0," such conveniences are really a marvel of engineering, built on centuries of trial and (often) error. More improvements are urgently needed as new challenges like climate change loom. So Sedlak's effort to engage the public on this oft-neglected subject is welcome.

**Water 4.0**  
The Past, Present, and Future of the World's Most Vital Resource  
By David Sedlak  
(Yale University Press; 332 pages; \$28.50)

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# ReNUWIt Seminar Series, April 27, 2016



## Q & A

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