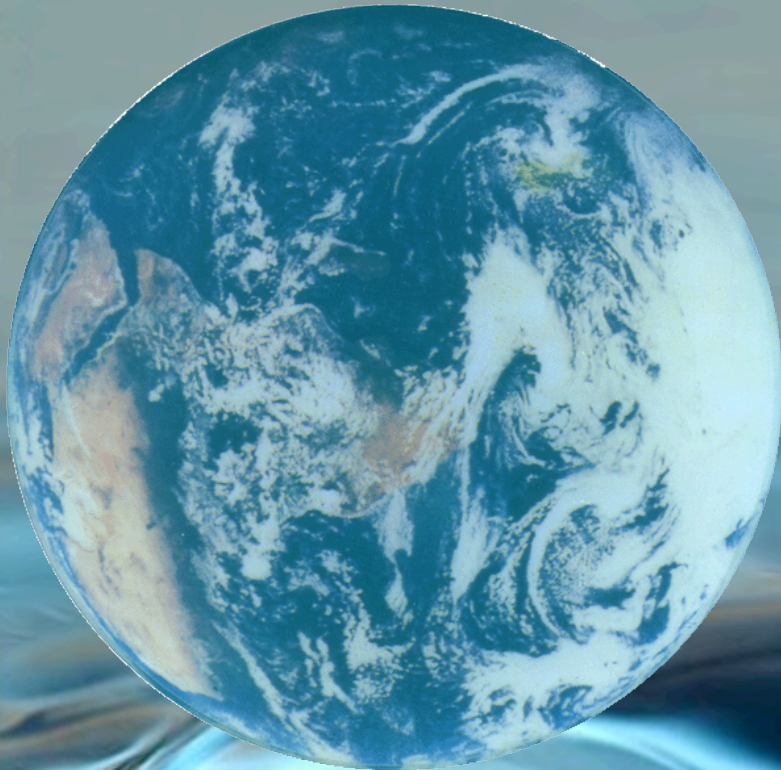


# Water Reuse

Making the Most of  
What We Have While  
Protecting Public Health

Art Ludwig  
[oasisdesign.net](http://oasisdesign.net)

October 2<sup>nd</sup>, 2015



# Acknowledging those who have helped inform my understanding of building safety and policy—



**Doug Hensel**  
Chief Deputy  
Director, CA HCD



**Bill Kelley**  
CBO, Marin  
County



**Jim MacDonald**  
CBO, Ventura County



**Brad Banner**  
Head of  
Environmental  
Health, Butte  
County



**Don Oaks**  
Fire Marshal,  
Santa Barbara  
County  
(retired)



**Gary Black**  
PE, M. Arch  
UCB Pacific  
Earthquake  
Engineering  
Research Center



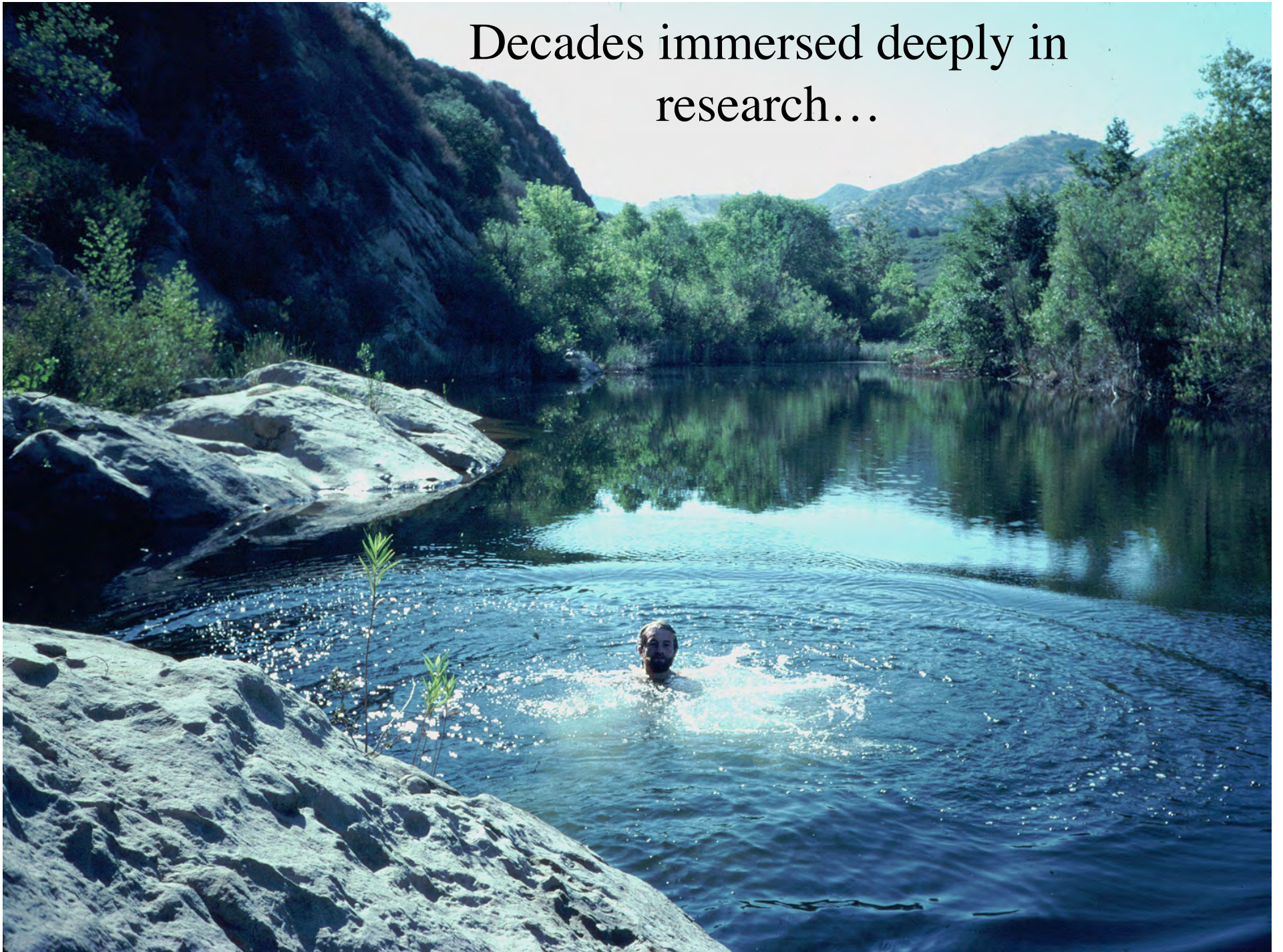
**Richard  
Jackson**  
UCLA  
Environmental  
Health  
Sciences Dept,  
CDC, CDPH



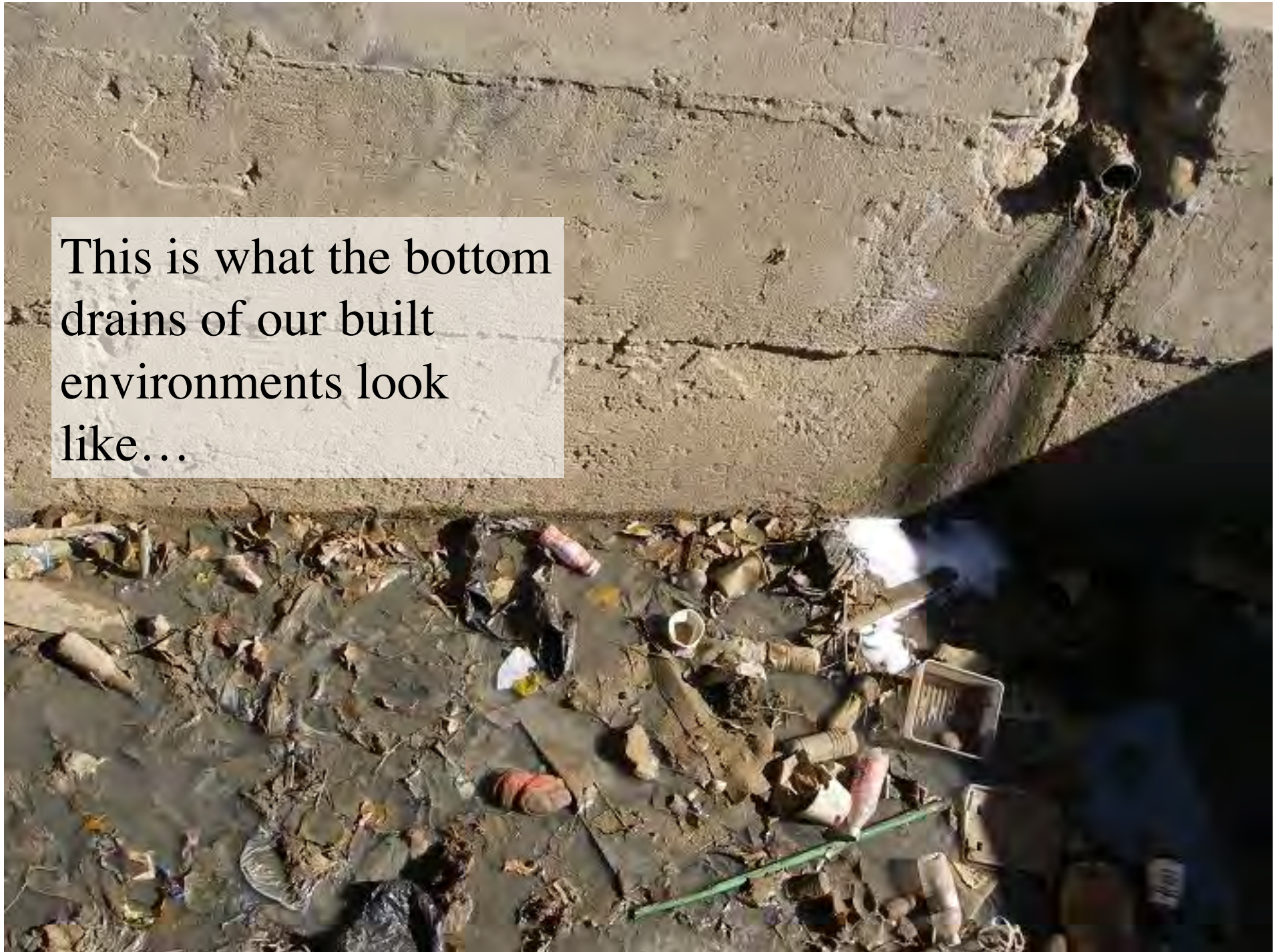
**Larry Fay**  
Head of  
Environmental  
Health, Santa  
Barbara  
County



Decades immersed deeply in  
research...



This is what the bottom drains of our built environments look like...

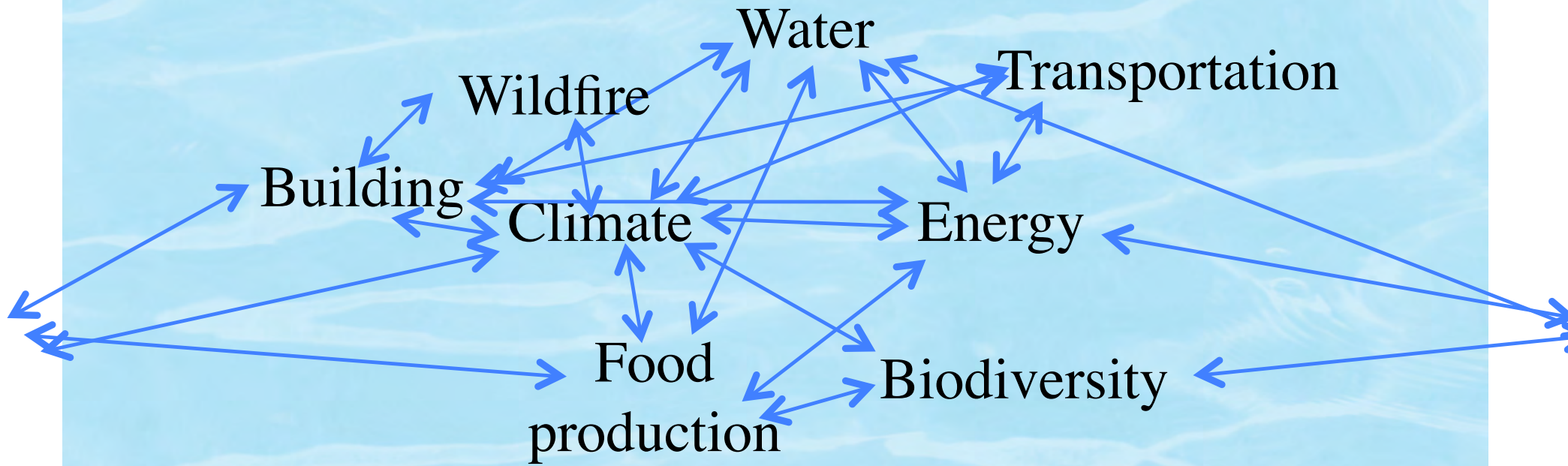


How the heck are wild  
natural surface waters  
so clean?



# Drought is a major issue

*but it is just one of many interconnected crises—*



*This perfect storm of crises is in part the symptom of an **epidemic of specialization**.*

*Optimizing elements in isolation tends to “pessimize” the whole system.*

*What we need is more **systems thinking**, and environmental health professionals may be the best poised to facilitate this.*

- ❖ Climate change
- ❖ Biodiversity loss
- ❖ Groundwater depletion
- ❖ Water contamination
- ❖ Food contamination
- ❖ Emerging contaminants
- ❖ Environmental injustice
- ❖ Habitat loss
- ❖ Peak oil
- ❖ Peak fish
- ❖ Etc.
- ❖ Etc.
- ❖ Etc.



# Design for all relevant factors at once



- ❖ Drought
- ❖ Flood
- ❖ Fire
- ❖ Climate
- ❖ Food production
- ❖ Transportation
- ❖ Economy
- ❖ = Health



# Optimal, Integrated Design

- ❖ Take every relevant factor into account
  - ❖ Adapt the design to the context
  - ❖ Optimize connections between systems
  - ❖ Plan for all probable future conditions
- = Achieve highest overall, life cycle performance  
—ecological, economic, social, etc.
- = **Achieve greatest overall safety and health**

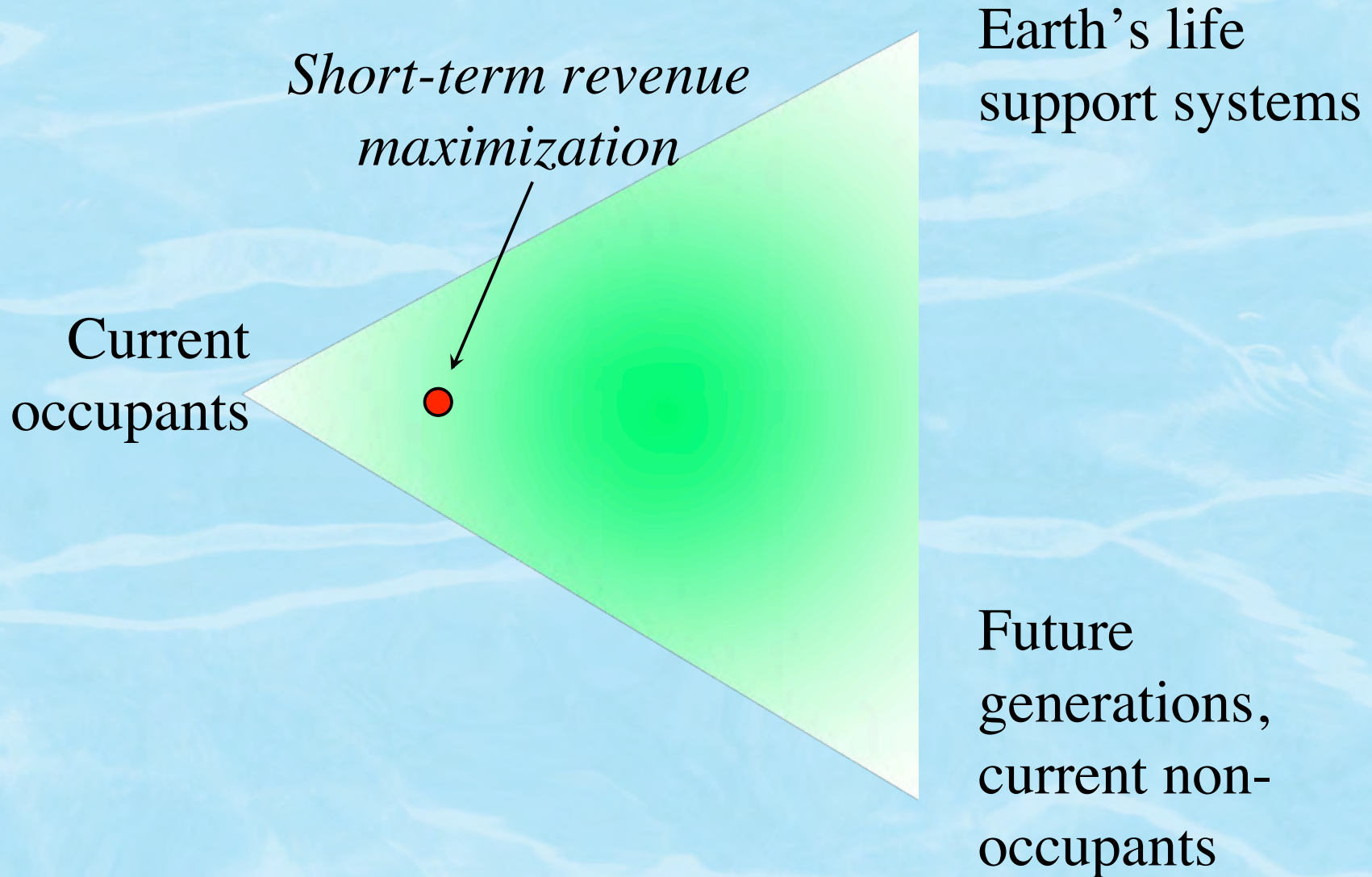


# Take every relevant factor into account

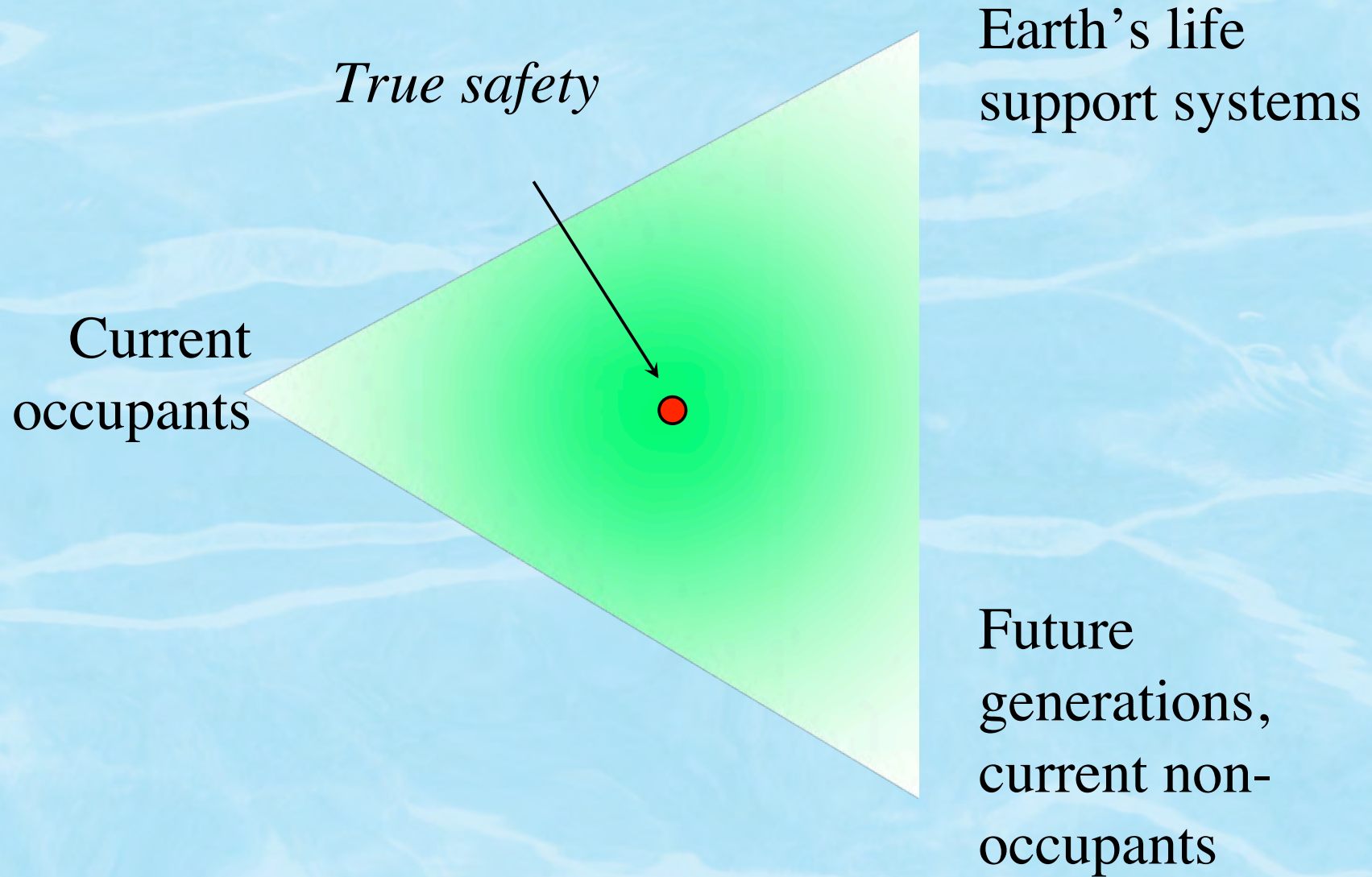
- Current occupant safety / Minimum safety standards
- ❖ Fire safety
  - ❖ Structural safety
  - ❖ Sanitation
  - ❖ Toxin exposure
  - ❖ Cardiac health
  - ❖ Financial well-being
  - ❖ Off-site impacts
  - ❖ CO<sup>2</sup> emissions
  - ❖ Manufacturing-related toxins
  - ❖ Extraction-related impacts
  - ❖ Transportation impacts
  - ❖ Future impacts
  - ❖ Disposal or reuse of building materials
  - ❖ Resiliency
- Optimal health



# Survival Tradeoffs



# Survival Tradeoffs



# Systems thinking exercise: list the factors and outcomes

Issue	Response	Result
❖ Not enough water	<ul style="list-style-type: none"><li>❖ Borrow \$ for desalination</li><li>❖ Burn more cheap fossil fuel</li></ul>	<ul style="list-style-type: none"><li>+ More water</li><li>- Waste promoted (e.g., subsidizing lawn watering at ±\$500/year per lawn with base rate funds from conserving households)</li><li>- Conservation and alternate supply starved of funds</li><li>- Water too expensive to grow food</li><li>- Worse droughts (almost 1 gal CO<sup>2</sup> per gallon water)</li></ul>
<i>EH director joint proclamation against desalination?</i>		

# Systems thinking exercise: list the factors and outcomes

## Issues

- ❖ Bill for centuries of carbon dumping coming due now
- ❖ Climate damage increasing exponentially
- ❖ Water budgets getting harder to balance
- ❖ Groundwater running out, less recharge
- ❖ Insufficient storm drain capacity for “water bombs”
- ❖ Central valley food production likely to decline

## Response

- ❖ Account for all water
- ❖ Eliminate most remaining waste
- ❖ Relandscape California to capture and infiltrate stormwater (e.g., convert lawns to stormwater harvesting basins and fruit trees)

## Result

- + Less demand
- + More water
- + Less flood damage
- + Less climate disruption
- + More local food production

# Greywater Systems

- ❖ Residential systems thinking gateway
- ❖ Most interconnected, more context sensitive
- ❖ **Low stakes**
- ❖ One universal rule that applies to all greywater systems installations:

*No universally applicable rules*

- ❖ General law of greywater regulation:

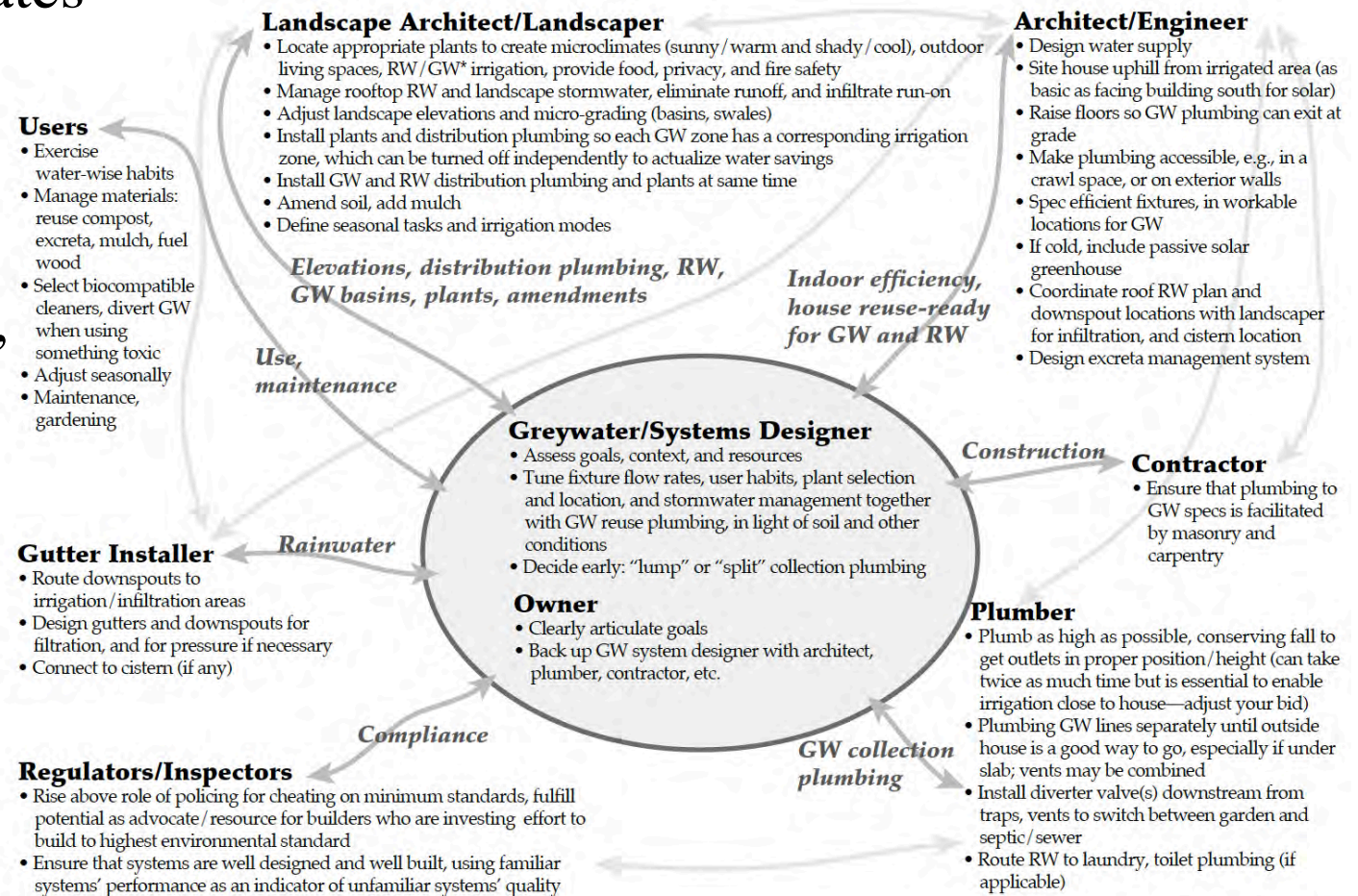
*The opposite of the obvious is what will happen*



# Gateway for systems thinking at the residential scale

## Most interconnected, more context sensitive

- ❖ Tune together—
- ❖ Fixture flow rates
- ❖ User habits
- ❖ Rainwater
- ❖ Stormwater
- ❖ Green “waste”
- ❖ Plant selection, location
- ❖ For soil and site conditions

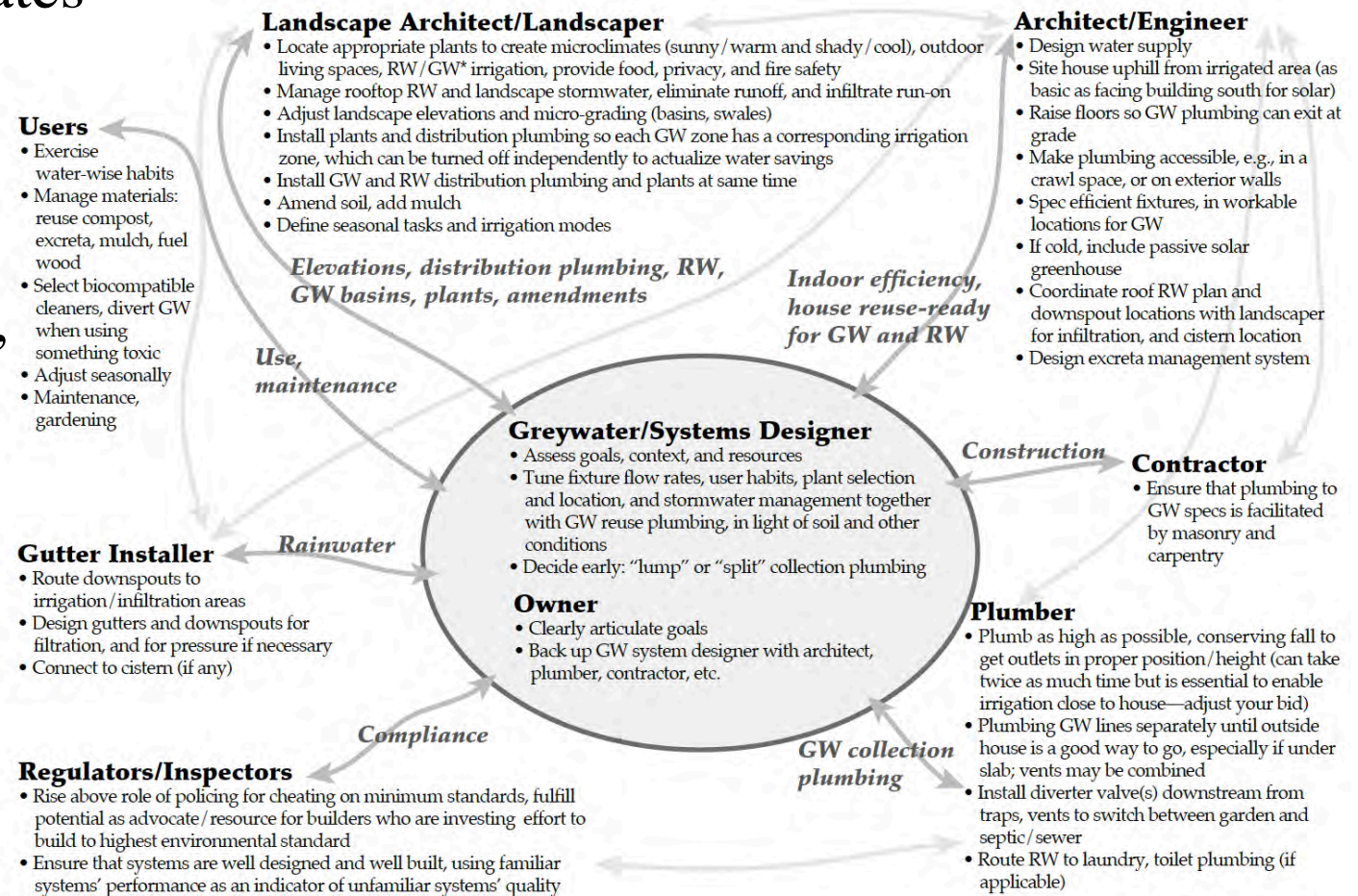




**Low stakes—** big upside (save water, foster systems thinking) and little downside (even if someone fails at every one of these things, it's more missed opportunity than actual damage)

Tune together—

- ❖ Fixture flow rates
- ❖ User habits
- ❖ Rainwater
- ❖ Stormwater
- ❖ Green “waste”
- ❖ Plant selection, location
- ❖ For soil and site conditions



# California Greywater Policy Data and Calculations

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Datum	What	Date	Source	URL
<b>Greywater system exposure in CA</b>				
36,553,215	Population of CA	2007	US Census Bureau	quic
13.9%	Households with greywater systems	1999	Soap and Detergent Manufacturer's Association Graywater	sdas
5,080,897	Greywater users	2009	Calculation: population * percent greywater users	Ext
2.87	People per household	2000	US Census Bureau	quic
1,770,347	Greywater systems	2009	Calculation: greywater users / people per household	(This
<b>System use-years-CA</b>				
5,080,897	Greywater users	2009	From above	Using
10.0%	Households with greywater systems	2009	Calculation: this is a "back of the envelope" type calculation; the point is still valid	still valid
10,586,223	Population of CA	1950	US Census Bureau	cen
1,058,622	Greywater users	1949-2009	Average of 2009 and 1950 greywater users	
3,069,760	Average number of greywater users			
60	Years from 1949-2009			
184,185,576	System user-years of greywater exposure		Calculation: average greywater users * years (not counting neig	
<b>Greywater system exposure in US</b>				
303,824,640	Population of US	2008	CIA estimate	cia.
7.0%	Households with greywater systems	1999	Soap and Detergent Manufacturer's Association Graywater	sdas
21,267,725	Greywater users	2009	Calculation: population * percent greywater users	Ext
2.59	People per household	2000	US Census Bureau	quic
8,211,477	Greywater systems	2009	Calculation: greywater users / people per household	Ext
<b>System use- years-US</b>				
21,267,725	Greywater users	2009	From above	
10.0%	Households with greywater systems	1950	Estimate: in general, older infrastructure has more greywater us	
152,271,417	Population of US	1950	NPG historical data	npg
15,227,142	Historic greywater users	1950	Calculation: population * percent greywater users	
18,247,433	Average number of greywater users	1949-2009	Average of 2009 and 1950 greywater users	
60	Years from 1949-2009		Calculation	
1,094,845,995	System user-years of greywater exposure		Calculation: average greywater users * years (not counting neig	

**Low stakes —**  
 appears to be almost impossible  
 to get yourself sick with  
 greywater in practice, no matter  
 how stupid the system

## California Greywater Policy Data and Calculations

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Datum	What	Date	Source	URL
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<b>13.9%</b>	Households with greywater systems
5,080,897	Greywater users
<b>2.87</b>	People per household
<b>1,770,347</b>	Greywater systems

### System use-years-CA

5,080,897	Greywater users
<b>10.0%</b>	Households with greywater systems
<b>10,586,223</b>	Population of CA
1,058,622	Greywater users
3,069,760	Average number of greywater users
<b>60</b>	Years from 1949-2009
<b>184,185,576</b>	System user-years of greywater exposure

### Greywater system exposure in US

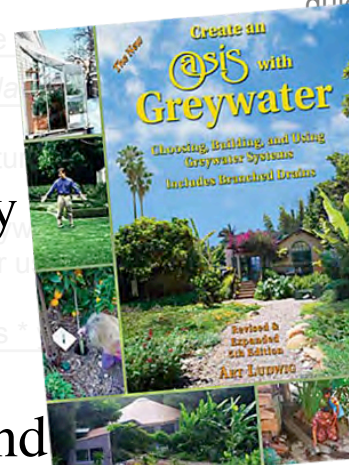
<b>303,824,640</b>	Population of US
<b>7.0%</b>	Households with greywater systems
21,267,725	Greywater users
<b>2.59</b>	People per household
<b>8,211,477</b>	Greywater systems

### System use- years-US

21,267,725	Greywater users
<b>10.0%</b>	Households with greywater systems
<b>152,271,417</b>	Population of US
15,227,142	Historic greywater users
18,247,433	Average number of greywater users
<b>60</b>	Years from 1949-2009
<b>1,094,845,995</b>	System user-years of greywater exposure

Greywater prohibition has created the most extreme possible manifestation of the situation it was intended to avoid:

- ❖ 8 million unpermitted systems
- ❖ Almost none of them conform to the CA code
- ❖ Less than 0.01% inspected
- ❖ Almost none professionally installed
- ❖ Many built with almost no outside guidance of any kind



Results of this massive experiment:  
 proof that greywater is a relatively insignificant transmission route  
 (apparently, if someone in the house is infectious, you are more likely to catch what they have through some other means/pathway)

lightnings  
 nsc.org/n  
 (This assume  
 Using the 199  
 vig, 2±...rest are

**Reports of greywater-transmitted illness in US**

0	Reports of greywater-transmitted illness
400	People struck by lightning in the US, per year
344	People drowned in bathtubs

**Greywater system permit compliance rate in CA**

1,770,347	Greywater systems
200	Permitted greywater systems
8,852	Ratio of unpermitted to permitted systems
0.011%	Percent of permitted systems

Calculation  
 Calculation

**Reportable GW Diseases, Potential & Reported**

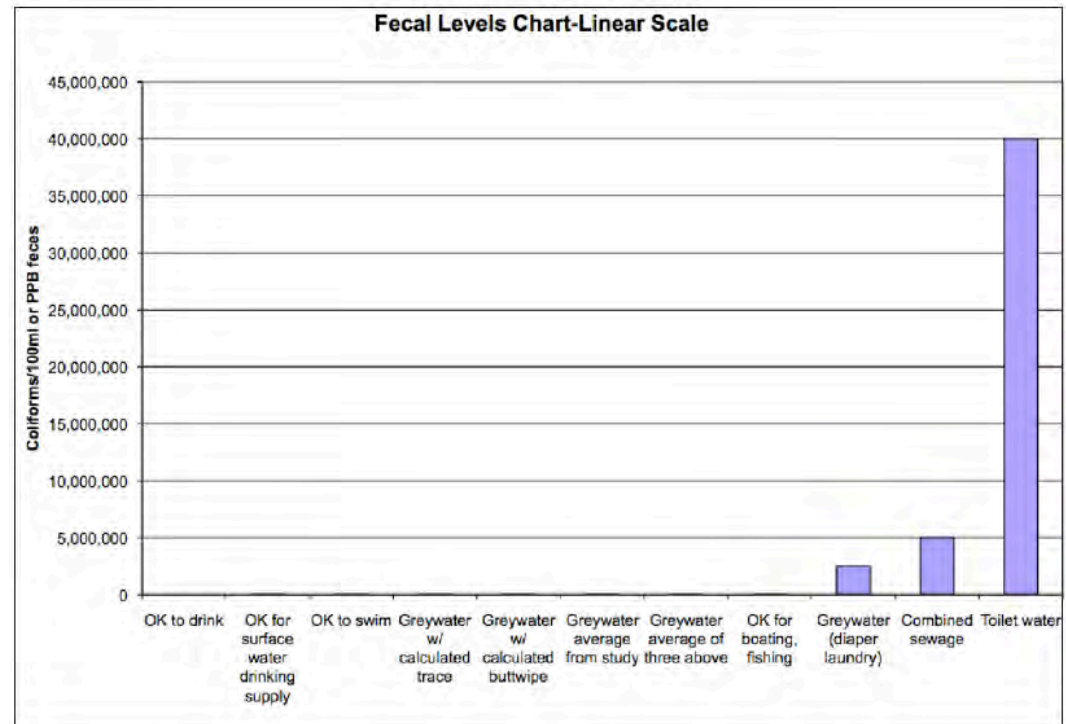
Disease	Total Cases in 2007	Est. 60 Years Cumulative Cases
Cholera	7	288
Cryptosporidiosis	11,170	502,650
E. coli, Shiga toxin-producing (STEC)	4,847	218,115
Giardiasis	19,417	873,765
Hepatitis A	2,979	134,055
Legionellosis	2,716	122,220
Salmonellosis	47,995	2,159,775
Shigellosis	19,758	889,110
Vibriosis (non-cholera Vibrio species infections) §	447	20,115
<b>Totals</b>	<b>123,713</b>	<b>4,920,093</b>

Cases Linked to Greywater

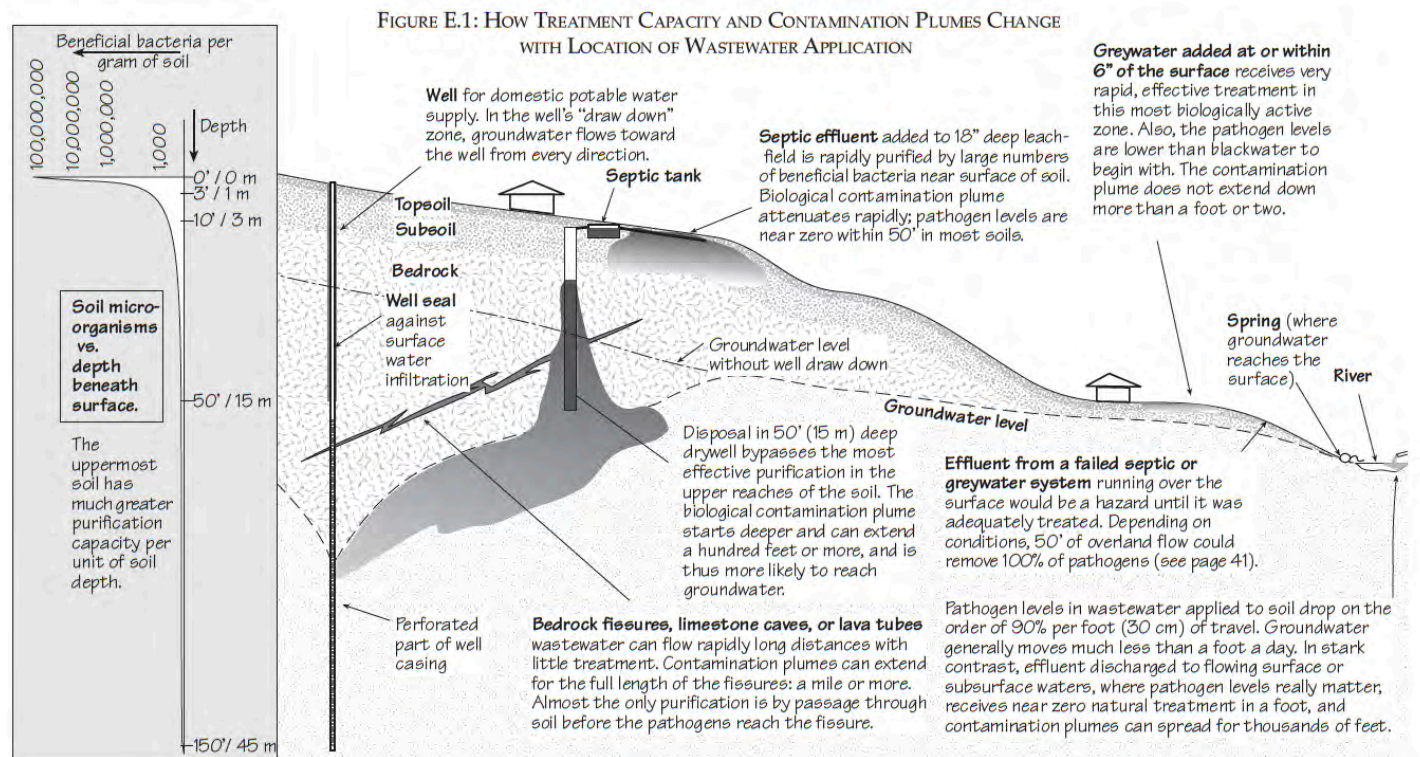
- ❖ 1,000,000,000 system user-years of exposure
- ❖ No recorded instances of disease transmission at CDC, NM health, AZ health, SB health...

0  
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**Greywater  
appears to be  
relatively  
innocuous in  
reality...**



# And...purification at the surface is incredibly potent



... and purification at the surface is incredibly potent

TABLE E.1: TREATMENT RATES FOR HIGH VOLUME SURFACE FLOW

From Green Land—Clean Streams: The Beneficial Use of Waste Water through Land Treatment.<sup>23</sup> Reprinted with permission from Temple University, Philadelphia, PA. This table summarizes removal rates for several facilities. A typical system distributes combined waste from a soap factory through sprinklers, after primary treatment. Loading rates in some cases are up to 6" per day. Overland flow facilities intentionally allow the water to run off, with treatment by bacteria living on the surface of the soil and plants. This presumably would be indicative of the treatment level greywater would receive if it ran off over the surface from a failed system: 90%+. Most facilities operate year-round. In cases where frozen wastewater accumulates on the surface, good treatment is apparently achieved when it thaws. It is reasonable to expect that these levels would represent absolute minimums for the treatment that water would receive in improperly constructed residential greywater systems that had greywater running over the surface.

Pollutant	Facility												
	Muskegon County, Michigan	Flushing Meadows, Arizona	Penn State University (Woodland)	Penn State University (cropland)	Penn State University (overall)	Paris, Texas (overland flow)	Santee, California	Whittier Narrows, California	Seabrook Farms, New Jersey	Riegel Paper Co., New Jersey	Beardmore & Co., Ltd., Toronto	Shoemakers Dairies, New Jersey	Green Valley Farms, Pennsylvania
BOD	98%+	98%				99.1%		93%	99.3–99.7%	95%*	95%		
COD		100%					100%						
Total Organic Content						98.2%	75%						
Suspended Solids		100%				98.2%							
Phosphorous	98%+	87%	97%+	99%		90.0%	100%						
Nitrogen total		40–80%		100%		91.5%	100%						
Nitrogen organic	75–87%	100%	57–82%										
Nitrogen ammonia	97%	98.2%					100%						
Fluoride		50%											
Chloride					****								
Salt		Slight increase			****								
Potassium			82.8%	118%									
Magnesium			66.7%	11%									
Sodium				0.4%									
Calcium			51.9%	19%									
Boron			67.6%										
ABS (detergent)			(MBAS) 81%	98%	****	100%	97%						
Coliform total	100%					99%+	100%						
Coliform fecal		100%											
Virus pathogenic	100%					100%							

That's how natural  
surface waters are so  
clean!





## Natural purification specs

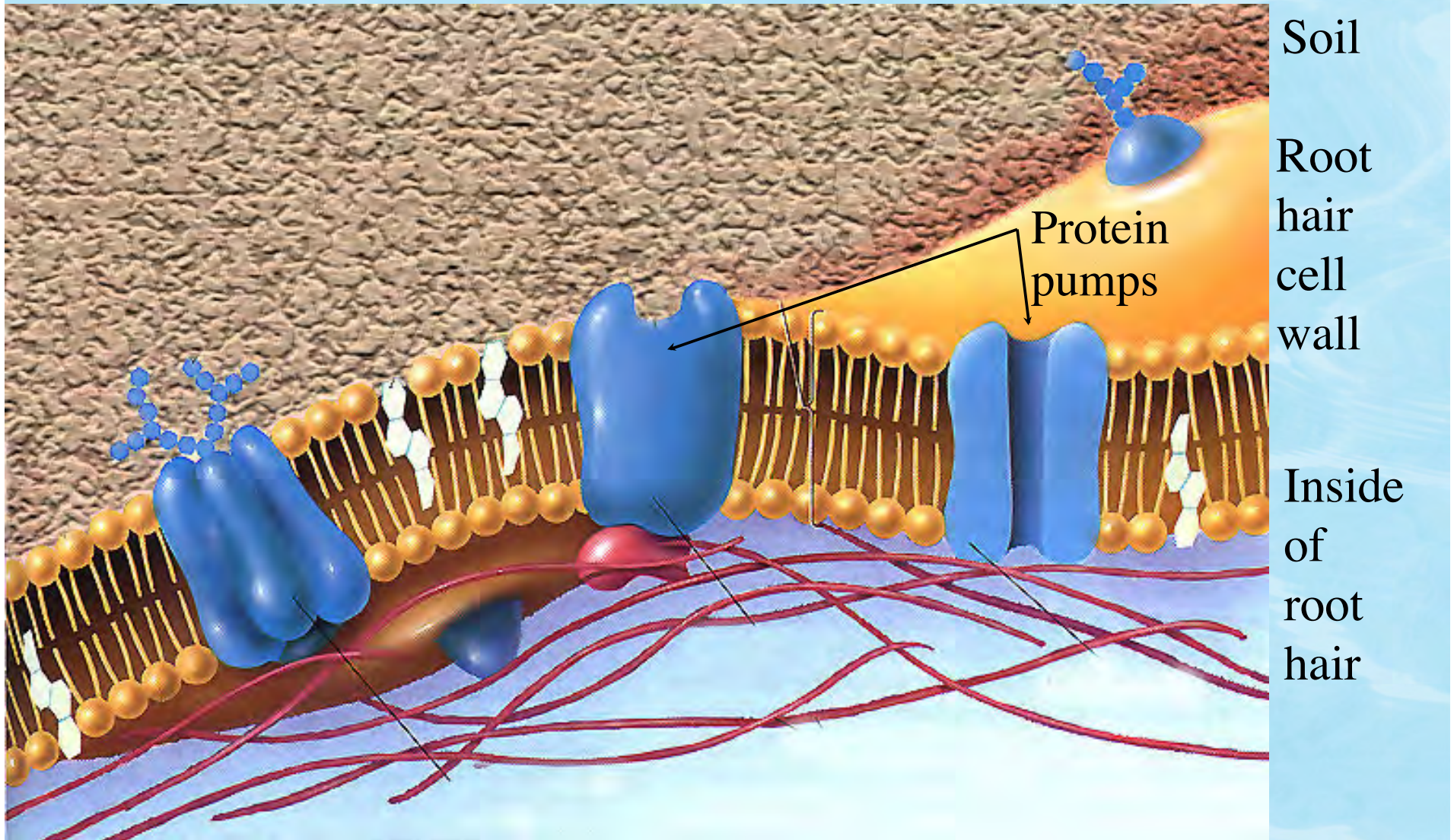
- ❖ It takes wastewater a few hours to a few weeks to pass through a foot of soil.
- ❖ Slow passage through *one foot* of healthy topsoil removes about 90% of the pathogens.

## In one cubic foot of topsoil there are:

- ❖ 1.5 million square feet of treatment area
- ❖ 3 trillion beneficial bacteria
- ❖ Enough root hairs to wrap around the perimeter of the US
- ❖ Countless specialized proteins which pump specific nutrient molecules through root hair cell walls



***Zoom...* Root hair cell walls contain specialized pumps that remove plant nutrients from soil:**

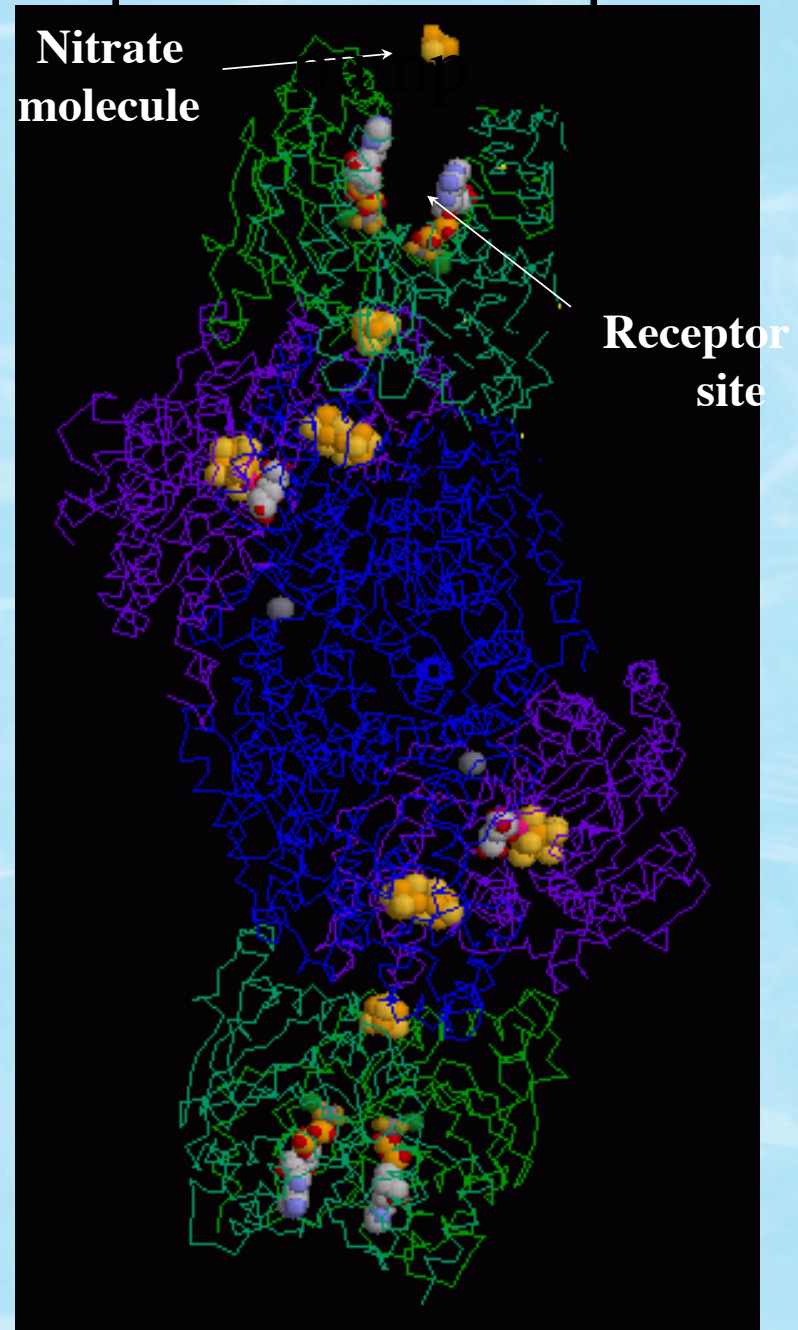


*Zoom...*

## Protein pumps:

large, powerful,  
complex molecules  
constructed identically  
from tens of thousands  
of atoms;  
fantastically elegant,  
precise function

Computer model of protein



Compared to the elegance of a protein pump, an activated sludge treatment plant looks like a very blunt instrument.



## Greywater systems have every factor for effective purification:

- ✓ Lots of soil particle surface area for amount of flow
- ✓ Long contact time percolating through soil
- ✓ Higher temperature (water still warm)
- ✓ Lots of plant roots
- ✓ Good balance of nutrients
- ✓ Few non-biodegradable toxins
- ✓ Mix of aerobic and anaerobic decomposition
- ✓ A way to get nutrients out of the soil (fruit)

Bottom line: Pure drinking water in 3–30 feet





Even the humblest  
greywater system  
features extremely  
sophisticated  
systems  
engineering...  
because nature  
does most of the  
work

# Proportional Response

In EH dual function (safety and promotion), greywater is an area where you can relax more than you'd think on safety.

The 85th percentile speed limit method **reflects the collective judgment of the vast majority of drivers as to a reasonable speed for given traffic and roadway conditions.**

This is also aligned with the general policy sentiment that **laws should not make people acting reasonably into law-breakers.**

# How proportional and successful is our current way of regulating greywater?

- ❖ CA compliance rate < 2009, approximately 0.01% (one in 10,000)
- ❖ CA compliance rate for new systems > 2009, perhaps 1%.
- ❖ If you discount two unrealistic laundry-only provisions, probably 50%.

**Intent**

The provisions of this chapter are intended to:

1. Conserve water by facilitating greater reuse of laundry, shower, lavatory and similar sources of discharge for irrigation and/or indoor use.
2. Reduce the number of non-compliant gray water systems by making legal compliance easily achievable.
3. Provide guidance for avoiding potentially unhealthful conditions.
4. Provide an alternative way to relieve stress on a private sewage disposal system by diverting the graywater.

**1601.0 General.**

**1601.1 Applicability.** [HCD 1] Except as otherwise provided for in this chapter, the provisions of this code shall be applicable to alternate water source system installation. [BSC & HCD 1] The provisions of this chapter shall apply to the construction, alteration, discharge, use and repair of alternate water source systems for nonpotable applications.

**1601.1.1 Allowable Use of Alternate Water.** Where approved or required by the Authority Having Jurisdiction, alternate water sources [reclaimed (recycled) water, rainwater, gray water and on-site treated nonpotable gray water] shall be permitted to be used in lieu of potable water for the applications identified in this chapter.

**1601.2 System Design.** Alternate water source systems complying with this chapter shall be designed by a person who demonstrates competency to design the alternate water source system as required by the Enforcing Agency. The Enforcing Agency may also require plans and specifications to be prepared by a licensed design professional for Complex Systems. Components, piping, and fittings used in any alternate water source system shall be listed.

**1601.3 Permit.** It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered an alternate water source system in a building or on a premise without first obtaining a permit to do such work. Prior to commencing the issuance of permits for indoor gray water systems pursuant to state requirements relating to gray water, a city, county, city and county or other local agency shall seek consultation with the local public health department to ensure that local public health concerns are addressed in local standards or ordinances, or in issuing permits. See California Water Code Section 14877.3.

**Exception:** [HCD 1] A construction permit shall not be required for a clothes washer system meeting the requirements of Section 1602.1.1.

**1601.4 Component Identification.** shall be properly identified as to th

**1601.5 Maintenance and Inspection.** source systems and components maintained in accordance with the mndations and/or as required b [BSC] Where no manufacturers additional recommendations are li

**1601.5.1 Maintenance Responsibility.** maintenance and inspection systems shall be the respon owner, unless otherwise rec Having Jurisdiction.

**1601.6 Operation and Maintenance.** and maintenance manual for gray site treated water systems required dance with Section 1601.3 shall b owner by the system designer or in maintenance manual shall include t

- (1) Diagram(s) of the entire system components.
- (2) Instructions on operating and
- (3) Instructions on maintaining th for on-site treated nonpotable
- (4) Details on startup, shutdown system for maintenance, repair
- (5) Applicable testing, inspec frequencies in accordance with
- (6) A method of contacting the i turer(s).
- (7) Directions to the owner or o shall remain with the building of the structure.

**1601.7 Minimum Water Quality**

**1601.7.1 [BSC]** The minimum alternate water source systems s water quality requirements for as determined by the Authority the absence of water quality nonpotable treated gray wat ments of NSF 350 shall apply.

**Exception:** Water treatment water used for subsurface/ disposal field.

**1601.7.2 [HCD 1]** The minimum alternate water source system cable water quality require application as determined Authority Having Jurisdiction quality requirements for on-gray water systems, the fo requirements shall apply:



Mulch basins have up to 100 times the long-term acceptance rate (LTAR) of leachfields. Unlike septic systems, greywater systems are required to have a 100% backup system.

So...why are the loading rates just copied from the septic code?

Greywater has at least a thousand times less pathogens than septic effluent and is applied to a part of the soil column that has 10–100 times more purification capacity. So...why are the setbacks virtually identical?

TABLE K-4  
DESIGN CRITERIA OF FIVE TYPICAL SOILS

TYPE OF SOIL	REQUIRED sq. ft. OF LEACHING AREA/100 gal. (m <sup>2</sup> /L)	MAXIMUM ABSORPTION CAPACITY IN gals./sq. ft. OF LEACHING AREA FOR A 24 HR. PERIOD (L/m <sup>2</sup> )
Coarse sand or gravel	20 (0.005)	5.0 (203.7)
Fine sand	25 (0.006)	4.0 (162.9)
Sandy loam or sandy clay	40 (0.010)	2.5 (101.8)
Clay with considerable sand or gravel	90 (0.022)	1.1 (44.8)
Clay with small amount of sand or gravel	120 (0.030)	0.8 (32.6)

TABLE 1602.10  
DESIGN OF SIX TYPICAL SOILS

TYPE OF SOIL	MINIMUM SQUARE FEET OF IRRIGATION/LEACHING AREA PER 100 GALLONS OF ESTIMATED GRAY WATER DISCHARGE PER DAY	MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FOOT OF IRRIGATION/LEACHING AREA FOR A 24-HOUR PERIOD
Coarse sand or gravel	20	5.0
Fine sand	25	4.0
Sandy loam	40	2.5
Sandy clay	60	1.7
Clay with considerable sand or gravel	90	1.1
Clay with small amounts of sand or gravel	120	0.8

TABLE K-1  
LOCATION OF SEWAGE DISPOSAL SYSTEM

MINIMUM HORIZONTAL DISTANCE IN CLEAR REQUIRED FROM	BUILDING SEWER	SEPTIC TANK	DISPOSAL FIELD	SEEPAGE PIT OR CESSPOOL
Building or structures <sup>1</sup>	2 feet (610 mm)	5 feet (1,524 mm)	8 feet (2,438 mm)	8 feet (2,438 mm)
Property line adjoining private property	Clear <sup>2</sup>	5 feet (1,524 mm)	5 feet (1,524 mm)	8 feet (2,438 mm)
Water supply wells	50 feet <sup>3</sup> (15,240 mm)	50 feet (15,240 mm)	100 feet (30.5 m)	150 feet (45.7 m)
Streams and other bodies of water	50 feet (15,240 mm)	50 feet (15,240 mm)	100 <sup>7</sup> feet (30.5 m)	150 feet <sup>7</sup> (45.7 m)
Trees	–	10 feet (3,048 mm)	–	10 feet (3,048 mm)
Seepage pits or cesspools	–	5 feet (1,524 mm)	5 feet (1,524 mm)	12 feet (3,658 mm)
Disposal field	–	5 feet (1,524 mm)	4 feet <sup>4</sup> (1,219 mm)	5 feet (1,524 mm)
On-site domestic water service line	1 foot <sup>5</sup> (305 mm)	5 feet (1,524 mm)	5 feet (1,524 mm)	5 feet (1,524 mm)
Distribution box	–	–	5 feet (1,524 mm)	5 feet (1,524 mm)
Pressure public water main	10 feet <sup>6</sup> (3,048 mm)	10 feet (3,048 mm)	10 feet (3,048 mm)	10 feet (3,048 mm)

TABLE 1602.4  
LOCATION OF GRAY WATER SYSTEM

MINIMUM HORIZONTAL DISTANCE IN CLEAR REQUIRED FROM	SURGE TANK (feet)	SUBSURFACE AND SUBSOIL IRRIGATION FIELD AND MULCH BASIN (feet)	DISPOSAL FIELD
Building structures <sup>1</sup>	5 <sup>2, 5-9</sup>	2 <sup>3, 8</sup>	5
Property line adjoining private property	5	5 <sup>8</sup>	5
Water supply wells <sup>4</sup>	50	100	100
Streams and lakes <sup>5</sup>	50	100 <sup>5, 10</sup>	100 <sup>5</sup>
Sewage pits or cesspools	5	5	5
Sewage disposal field <sup>10</sup>	5	4 <sup>6</sup>	4 <sup>6</sup>
Septic tank	0	5	5
On-site domestic water service line	5	0	0
Pressurized public water main <sup>7</sup>	10	10	10 <sup>7</sup>

## Mostly B.S.

- ❖ Industry has an outsized influence on regulations, wrapping themselves in the cloak of public safety while mandating profits and externalizing costs (e.g., fracking).
- ❖ Regulators and policy makers are key operators in this war.
- ❖ What do you want to support?
- ❖ A few more years of pillaging the commons at this critical time will have enormous consequences for the future.

## CHAPTER 16

### ALTERNATE WATER SOURCES FOR NONPOTABLE APPLICATIONS

on-site treated gray water that it is connected to the system.

(9) The drain on the system shall be checked for flow at the time of the test.

(10) Where there is a drain on the system which would be used for potable water, the drain shall be checked for flow at the time of the test.

1604.12.2.3 In the event that the Authority Having Jurisdiction requires immediate action, the Authority Having Jurisdiction shall require the installer to provide a permit for the installation of the system.

(1) On-site treated gray water shall be permitted for use in lieu of potable water for the applications identified in this chapter.

(2) Potable water shall not be used in lieu of alternate water source systems for nonpotable applications.

(3) .

(4) .

#### Intent

The provisions of this chapter are intended to:

1. Conserve water by facilitating greater reuse of laundry, shower, lavatory and similar sources of discharge for irrigation and/or indoor use.
2. Reduce the number of non-compliant gray water systems by making legal compliance easily achievable.
3. Provide guidance for avoiding potentially unhealthful conditions.
4. Provide an alternative way to relieve stress on a private sewage disposal system by diverting the graywater.

#### 1601.0 General.

**1601.1 Applicability.** [HCD 1] Except as otherwise provided for in this chapter, the provisions of this code shall be applicable to alternate water source system installation. [BSC & HCD 1] The provisions of this chapter shall apply to the construction, alteration, discharge, use and repair of alternate water source systems for nonpotable applications.

**1601.1.1 Allowable Use of Alternate Water.** Where approved or required by the Authority Having Jurisdiction, alternate water sources [reclaimed (recycled) water, rainwater, gray water and on-site treated nonpotable gray water] shall be permitted to be used in lieu of potable water for the applications identified in this chapter.

**1601.2 System Design.** Alternate water source systems complying with this chapter shall be designed by a person who demonstrates competency to design the alternate water source system as required by the Enforcing Agency. The Enforcing Agency may also require plans and specifications to be prepared by a licensed design professional for Complex Systems. Components, piping, and fittings used in any alternate water source system shall be listed.

**1601.3 Permit.** It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered an alternate water source system in a building or on a premise without first obtaining a permit to do such work. Prior to commencing the issuance of permits for indoor gray water systems pursuant to state requirements relating to gray water, a city, county, city and county or other local agency shall seek consultation with the local public health department to ensure that local public health concerns are addressed in local standards or ordinances, or in issuing permits. See California Water Code Section 14877.3.

**Exception:** [HCD 1] A construction permit shall not be required for a clothes washer system meeting the requirements of Section 1602.1.1.

**1601.4 Component Identification.** Systems shall be properly identified as to the manufacturer and model.

**1601.5 Maintenance and Inspection.** Alternate water source systems and components shall be maintained in accordance with the manufacturer's recommendations and/or as required by the Enforcing Agency. [BSC] Where no manufacturer's recommendations or additional recommendations are listed in Table 1601.5.1, the following shall apply:

**1601.5.1 Maintenance Responsibility.** The responsibility for the maintenance and inspection of alternate water source systems shall be the responsibility of the owner, unless otherwise required by the Authority Having Jurisdiction.

**1601.6 Operation and Maintenance Manual.** The manufacturer shall provide a manual for gray water, rainwater, and on-site treated water systems required to have a permit. The manual shall be supplied to the owner by the system designer or installer. The manual shall include the following:

- (1) Diagram(s) of the entire system and its components.
- (2) Instructions on operating and maintaining the system.
- (3) Instructions on maintaining the requirements for on-site treated nonpotable water systems.
- (4) Details on startup, shutdown, and disposal of the system for maintenance, repair, or other purposes.
- (5) Applicable testing, inspection, and frequency in accordance with Section 1601.5.1.
- (6) A method of contacting the installer and manufacturer(s).
- (7) Directions to the owner or occupant to ensure that the system shall remain with the building throughout the life of the structure.

#### 1601.7 Minimum Water Quality Requirements

**1601.7.1 [BSC]** The minimum water quality requirements for alternate water source systems shall meet the minimum water quality requirements for the intended use as determined by the Authority Having Jurisdiction. In the absence of water quality requirements for nonpotable treated gray water systems, the minimum requirements of NSF 350 shall apply.

**Exception:** Water treatment is not required for water used for subsurface/subsoil disposal in a disposal field.

**1601.7.2 [HCD 1]** The minimum water quality requirements for alternate water source systems shall meet the minimum water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements for on-site treated gray water systems, the following requirements shall apply:

Mostly B.S.  
Years of crying wolf on greywater has a major hazard: reduced credence for regulations.

*Credibility and reliable guidance is needed now more than ever for massive reorganization of our systems in response to climate change.*

The horse is out of the barn; promoting best practices can only make things better.

on-site treated g that it is conr system.

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(10) Where ther which wor potable w

1604.12.2.3 I the event tha following Authority ) immediate

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(2) Pr s

(3)

(4)

160 pip th

## CHAPTER 16

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**1601.3 Permit.** It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered an alternate water source system in a building or on a premise without first obtaining a permit to do such work. Prior to commencing the issuance of permits for indoor gray water systems pursuant to state requirements relating to gray water, a city, county, city and county or other local agency shall seek consultation with the local public health department to ensure that local public health concerns are addressed in local standards or ordinances, or in issuing permits. See California Water Code Section 14877.3.

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**1601.6 Operation and Maintenance Manual.** The manufacturer shall provide an operation and maintenance manual for gray water, rainwater, and on-site treated water systems required to have a permit. The manual shall be provided to the owner in accordance with Section 1601.3 and shall be supplied to the owner by the system designer or installer. The manual shall include the following:

- (1) Diagram(s) of the entire system and its major system components.
- (2) Instructions on operating and maintaining the system.
- (3) Instructions on maintaining the required water quality for on-site treated nonpotable water systems.
- (4) Details on startup, shutdown, and disposal of the system for maintenance, repair, or other purposes.
- (5) Applicable testing, inspection, and maintenance frequencies in accordance with Section 1601.6.1.
- (6) A method of contacting the installer or manufacturer(s).
- (7) Directions to the owner or occupant to be followed should the system fail to remain with the building throughout the life of the structure.

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The *intent* of CPC chapter 16 is spot on...

the body of the chapter just fails to achieve this intent.

## CHAPTER

### ALTERNATE WATER SOURCES FOR

#### ***Intent***

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- 1. Conserve water by facilitating greater reuse of laundry, shower, lavatory and similar sources of discharge for irrigation and/or indoor use.*
- 2. Reduce the number of non-compliant gray water systems by making legal compliance easily achievable.*
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**1601.1 Applicability.** *[HCD 1] Except as otherwise provided for in this chapter, the provisions of this code shall be applicable to alternate water source system instal-*

# Is there a better way?

*This is the whole code for  
99% of greywater systems!*



- ❖ AZ compliance rate before 2001: approximately 0.003% (one in 30,000)
- ❖ AZ compliance rate now: perhaps 70%
- ❖ That's 23,000 x better compliance....
- ❖ ...with almost zero expenditure of regulatory resources.

## **R18-9-711. Type 1 Reclaimed Water General Permit for Gray Water**

**A.** A Type 1 Reclaimed Water General Permit allows private residential direct reuse of gray water for a flow of less than 400 gallons per day if all the following conditions are met:

1. Human contact with gray water and soil irrigated by gray water is avoided;
2. Gray water originating from the residence is used and contained within the property boundary for household gardening, composting, lawn watering, or landscape irrigation;
3. Surface application of gray water is not used for irrigation of food plants, except for citrus and nut trees;
4. The gray water does not contain hazardous chemicals derived from activities such as cleaning car parts, washing greasy or oily rags, or disposing of waste solutions from home photo labs or similar hobbyist or home occupational activities;
5. The application of gray water is managed to minimize standing water on the surface;
6. The gray water system is constructed so that if blockage, plugging, or backup of the system occurs, gray water can be directed into the sewage collection system or onsite wastewater treatment and disposal system, as applicable. The gray water system may include a means of filtration to reduce plugging and extend system lifetime;
7. Any gray water storage tank is covered to restrict access and to eliminate habitat for mosquitoes or other vectors;
8. The gray water system is sited outside of a floodway;
9. The gray water system is operated to maintain a minimum vertical separation distance of at least five feet from the point of gray water application to the top of the seasonally high groundwater table;
10. For residences using an onsite wastewater treatment facility for black water treatment and disposal, the use of a gray water system does not change the design, capacity, or reserve area requirements for the onsite wastewater treatment facility at the residence, and ensures that the facility can handle the combined black water and gray water flow if the gray water system fails or is not fully used;
11. Any pressure piping used in a gray water system that may be susceptible to cross connection with a potable water system clearly indicates that the piping does not carry potable water;
12. Gray water applied by surface irrigation does not contain water used to wash diapers or similarly soiled or infectious garments unless the gray water is disinfected before irrigation; and
13. Surface irrigation by gray water is only by flood or drip irrigation.

**B.** Prohibitions. The following are prohibited:

1. Gray water use for purposes other than irrigation, and
2. Spray irrigation.

**C.** Towns, cities, or counties may further limit the use of gray water described in this Section by rule or ordinance.

# Local Greywater Exemption

## Unified Policy Framework for Permit Exempt Graywater Systems in Santa Barbara County

*Santa Barbara County Building Departments  
in consultation with Environmental Health, Water Purveyors, and local experts*

DRAFT 9/30/2015 Larry Fay and Art Ludwig

**WHEREAS** On May 5, 2015, the Santa Barbara City Council declared a Stage Three Drought Condition in response to the driest consecutive four years on record; and

**WHEREAS** in each year of the current drought, water income has been significantly below the amount needed to fill Santa Barbara's reservoir system and groundwater; and

**WHEREAS** the water deficits in each year of the current drought have put Santa Barbara County further and further behind in meeting its essential water needs; and

**WHEREAS** there is no way to know when the drought will end, further urgent action is needed to address the water shortage and protect the people and property in Santa Barbara County; and

**WHEREAS** the Governor of California has issued multiple successive Executive Orders proclaiming a statewide drought, and ordering water districts to take action to meet deep conservation goals, specifically including accelerated use of technologies such as onsite reuse systems; and

**WHEREAS** as of September, 2015, storage in Lake Cachuma, the County's main water reservoir, is at 17% of capacity, and groundwater levels are falling; and

**WHEREAS** State Water Project water allocations have been reduced to between 0 and 15 percent of requested deliveries, matching 1991 as the lowest water allocation year in State Water Project history, and Central Valley Project water allocations for agricultural users have now been reduced to zero; and

**WHEREAS** the lack of water has forced local communities to draw water from their emergency water reserves, putting communities at risk of further catastrophe if emergency reserves are depleted or cut off; and

**WHEREAS** it has been observed that the effect of California’s exemption of laundry only systems since 2009 has been to create jobs for professional installers, and increase the percentage of professionally installed systems and elevate the quality of the installed systems base; and

**WHEREAS** Governor’s executive orders require, to the extent allowed by applicable law, state agencies within the administration to prioritize and streamline permitting and regulatory compliance actions for water conservation and recycling projects that provide drought relief; and

**WHEREAS** section 1602.1.2 (2) of the California Plumbing Code allows exemption of simple (<250 gpd) graywater systems from permit by the Building Official, in consultation with the water provider; and

**WHEREAS** it is in the public’s interest to promote the use of graywater systems by reducing regulatory barriers that do not provide significant improvement in public health or environmental protection; and

**WHEREAS** the following authorities have endorsed this exemption: Santa Barbara County Environmental Health, Santa Barbara City Water Resources, Santa Barbara City Building and Safety, Santa Barbara County Building and Safety—

**It is resolved that** the following unified policy shall govern the exemption of graywater systems of under 250 gpd in all participating jurisdictions:

**Definitions for the purposes of this policy:**

Graywater: wastewater that originates from residential clothes washers, bathtubs, showers, and sinks, but does not include wastewater from kitchen sinks, dishwashers and toilets.

Tier I system: all laundry only systems, irrespective of the number of bedrooms

Tier II system: system for a house with 5 bedrooms or less that relies on gravity only

Tier III system: system for a 6 or more bedroom house, or system that utilizes a pump

- A. All tier II and III graywater systems must be designed by a person who demonstrates competency to design gray water systems**
- B. Tier I and Tier II systems do not require a construction permit**
- C. All gray water systems regardless of whether permitted or permit exempt shall conform to the standards specified in the currently adopted uniform plumbing code.**

**Applies to:**

Santa Barbara City Water Customers in Santa Barbara City and County

1 Greywater: the same meaning as defined in Section 17922.12 of the California Health and Safety Code. ¶

2 Tier I: the same meaning as “Clothes Washer System”, as described in Section 1602.1.1 of the 2013 California Plumbing Code ¶

3 Tier II: a subset of “Simple System”, as described in Section 1602.1.2 of the 2013 California Plumbing Code, except that tier II excludes pumped systems, and excludes systems for houses of 5-9 bedrooms that have separate laundry only systems. ¶

4 Tier III: The same meaning as “Complex System”, as described in Section 1602.1.3 of the 2013 California Plumbing Code, with the addition of those “Simple Systems” excluded from Tier II for reason of having a pump or 5-9 bedrooms. ¶

Residential GPD to Bedrooms Conversion Chart per CPC 1602.8.1 ¶

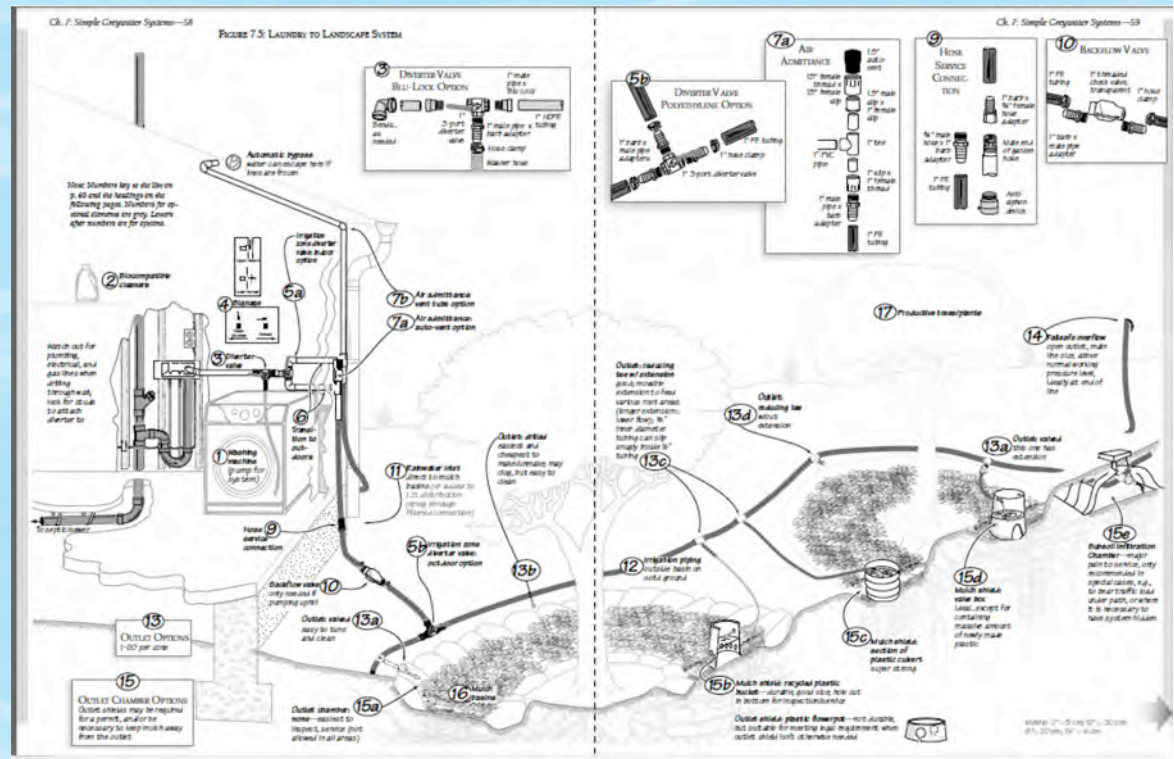
Bedrooms	laundry (gal)	Shower, etc. (gal)	total (gal)
1st	30	50	80
additional	15	25	40
1	30	50	80
2	45	75	120
3	60	100	160
4	75	125	200
5	90	150	240
6	105	175	280
7	120	200	320
8	135	225	360
9	150	250	400



# Guidelines

14. **Good plumbing practice and all other provisions of the California Plumbing Code are complied with.** For example, in the graywater collection plumbing in the house, the diverter valves are downstream from traps and vents so venting functions properly and sewer gas does not enter the house; the pipe slope and materials are correct; the proper fittings are correctly oriented and cleanouts are properly situated to ensure that the drainage system is not susceptible to blockage and can be easily serviced in case of blockage (the recommended way to ensure good collection plumbing practice is to hire a professional plumber) ;

15. **The design of the system meets generally accepted graywater system design criteria (the easiest way to ensure this is to hire an experienced graywater installer)**

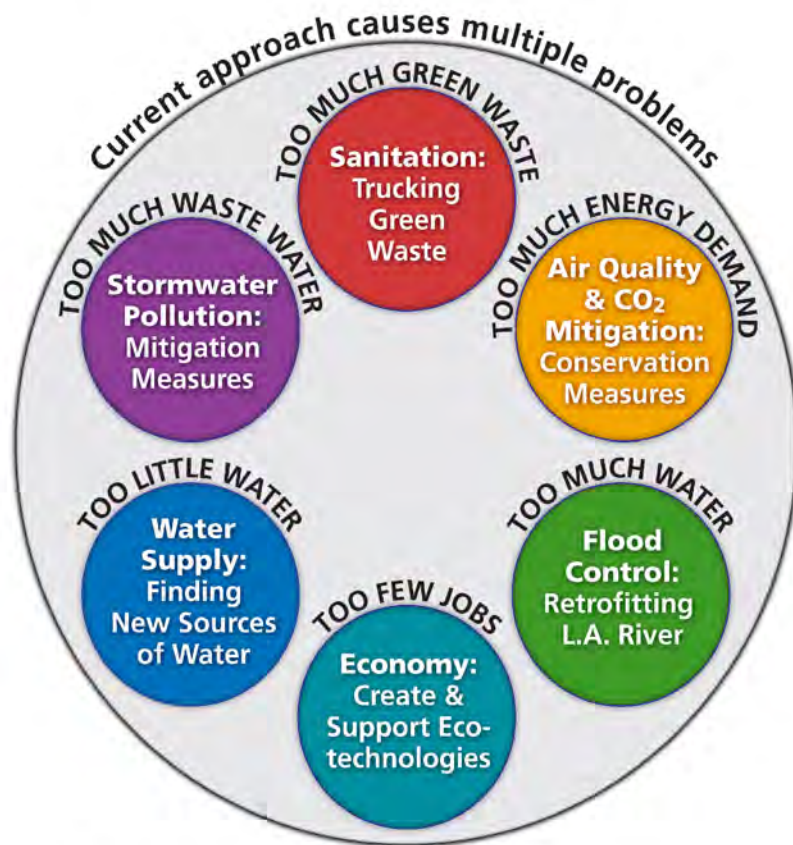


# Advantages

- ❖ Better use of regulatory resources
- ❖ Rebuilds relationship with citizenry
- ❖ Rebuilds credibility for codes as a useful source of guidance, which can then be used for reducing significant hazards
- ❖ Allows the only people stopped by greywater codes — professionals — into the field, where they can gain experience and perfect best practices
- ❖ Improves the stock of greywater systems directly via professional installations and indirectly through workshops and exposure to better practice
- ❖ Adds community resiliency
- ❖ Prepares citizens for a more active role in managing resources that is going to be essential going forward, with an educationally rich, safe activity

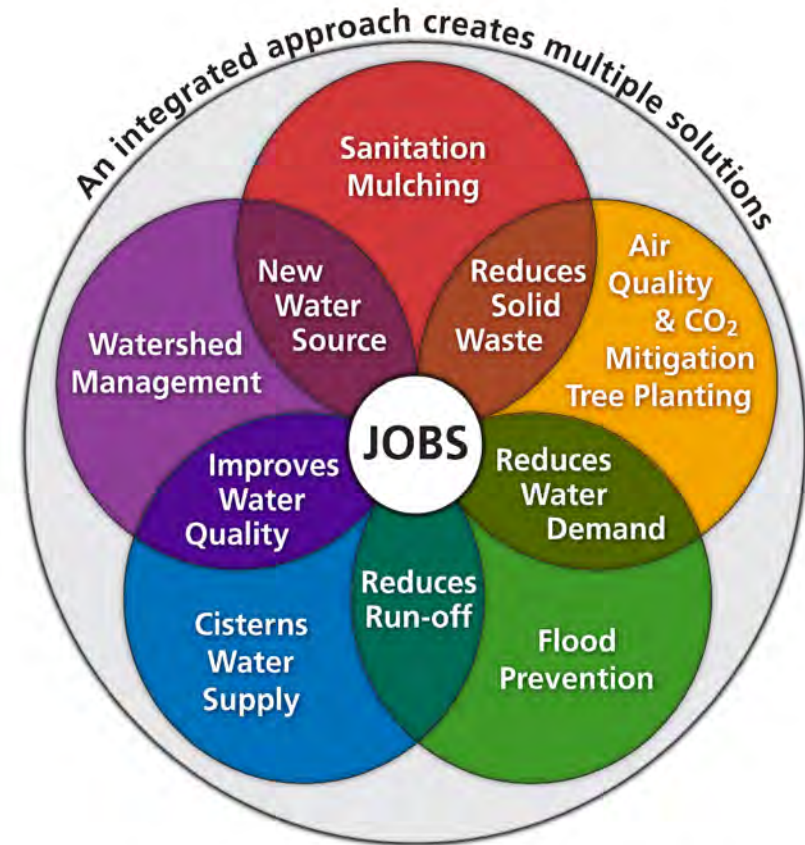
# Stormwater = *Municipal* systems thinking gateway

## LOS ANGELES TODAY



Dis-integrated approach wastes resources, duplicates efforts and imposes unsustainable practices.

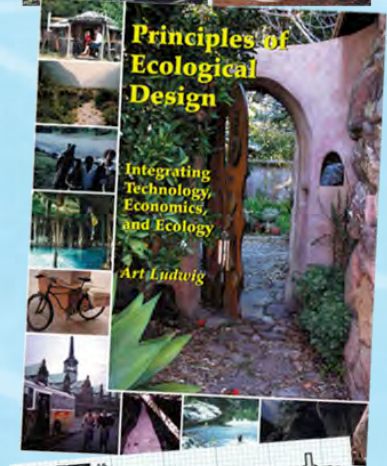
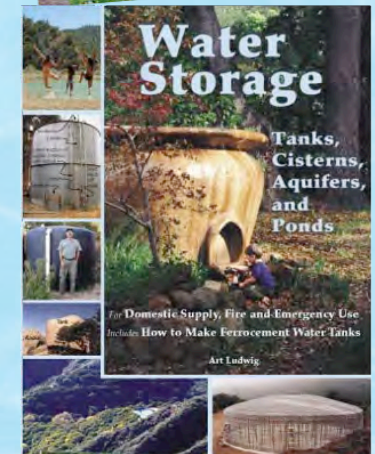
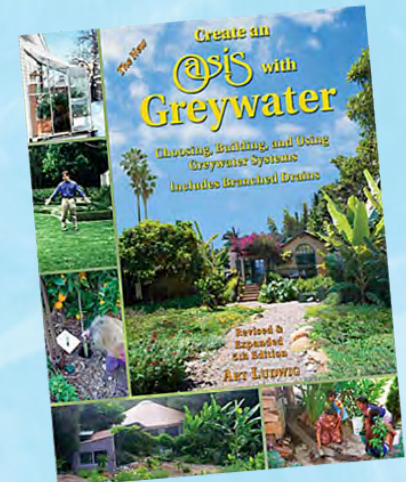
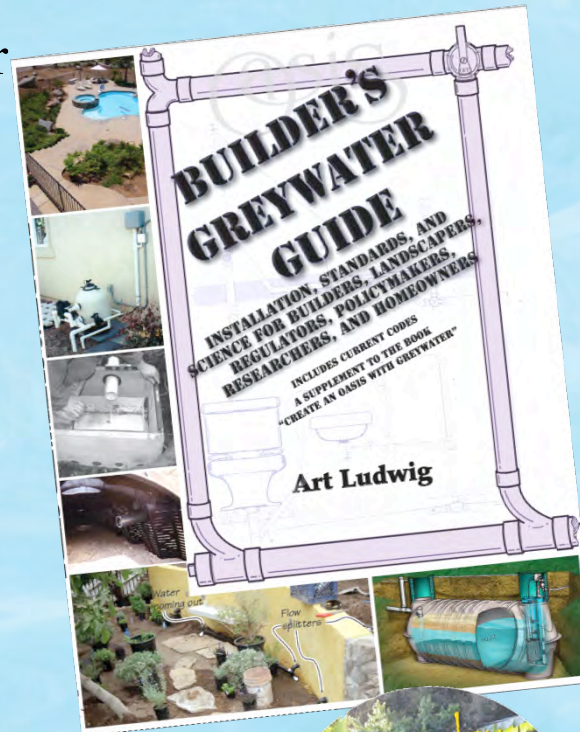
## LOS ANGELES POTENTIAL



Integrated approach also creates jobs and liberates funds for emerging green technologies.

# Take-homes and more info

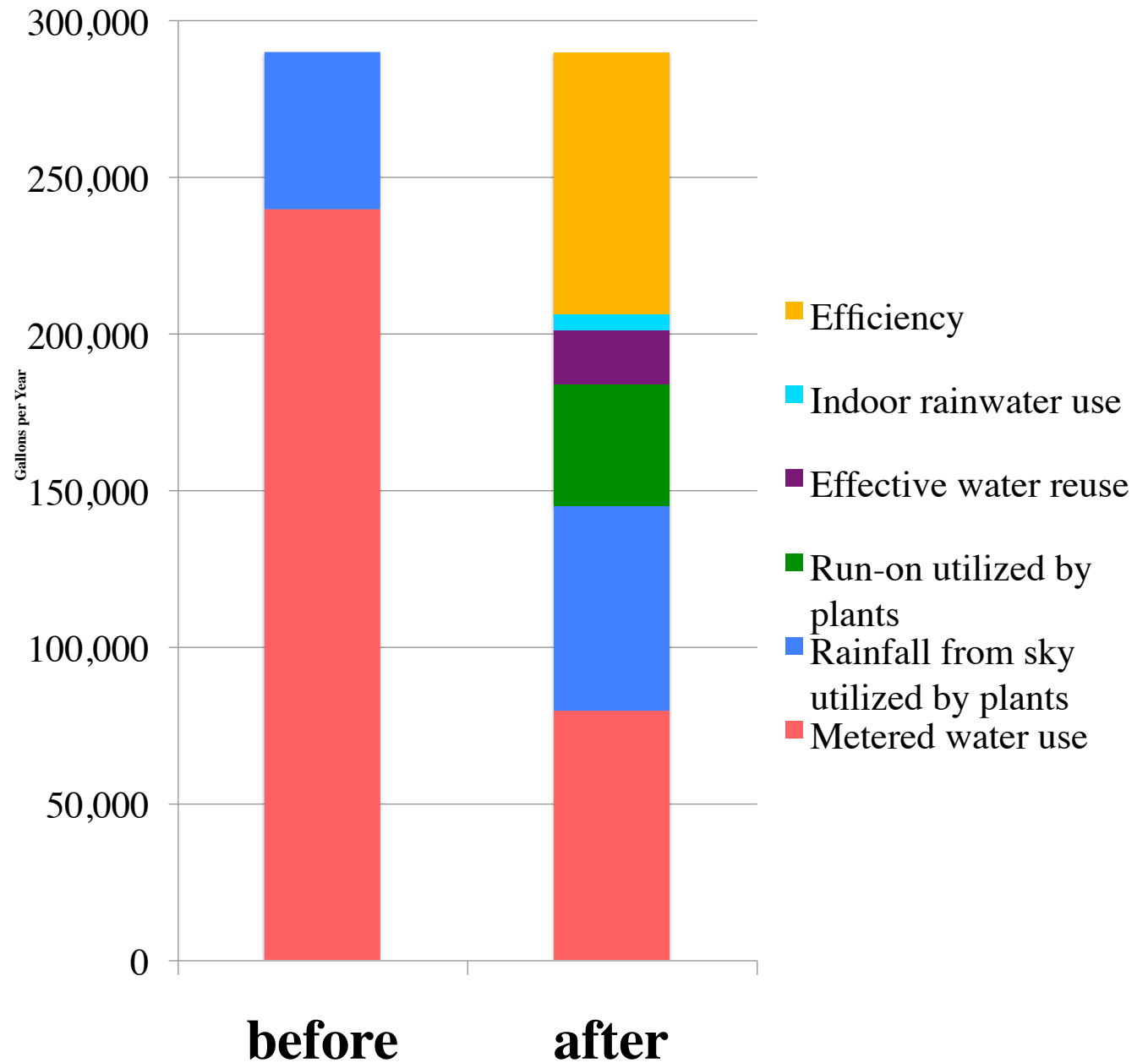
- ❖ **Practice systems thinking:** consider all relevant factors
- ❖ **Teach systems thinking:** help others consider more factors, adjust for context
- ❖ **Facilitate adoption of policy exempting simple greywater systems from permit in your jurisdiction...and statewide**
- ❖ **Facilitate adaptation in a rapidly changing climate** likely to present unprecedented challenges and opportunities
- ❖ **Create joint EH resolutions** against worst practices: desalination, Clean Water Act- exempt fracking, etc.



500 pages more info:  
[oasisdesign.net](http://oasisdesign.net)

**Online  
Water  
Wizard**  
Optimize all  
water  
management  
parcel by  
parcel

**Home Water Budget Before and After  
Water Makeover**



*...Achieve Global Impact  
on Water Commons*

**water  
commons  
effects**

↑  
**Good**  
Impacts  
**Bad**  
↓

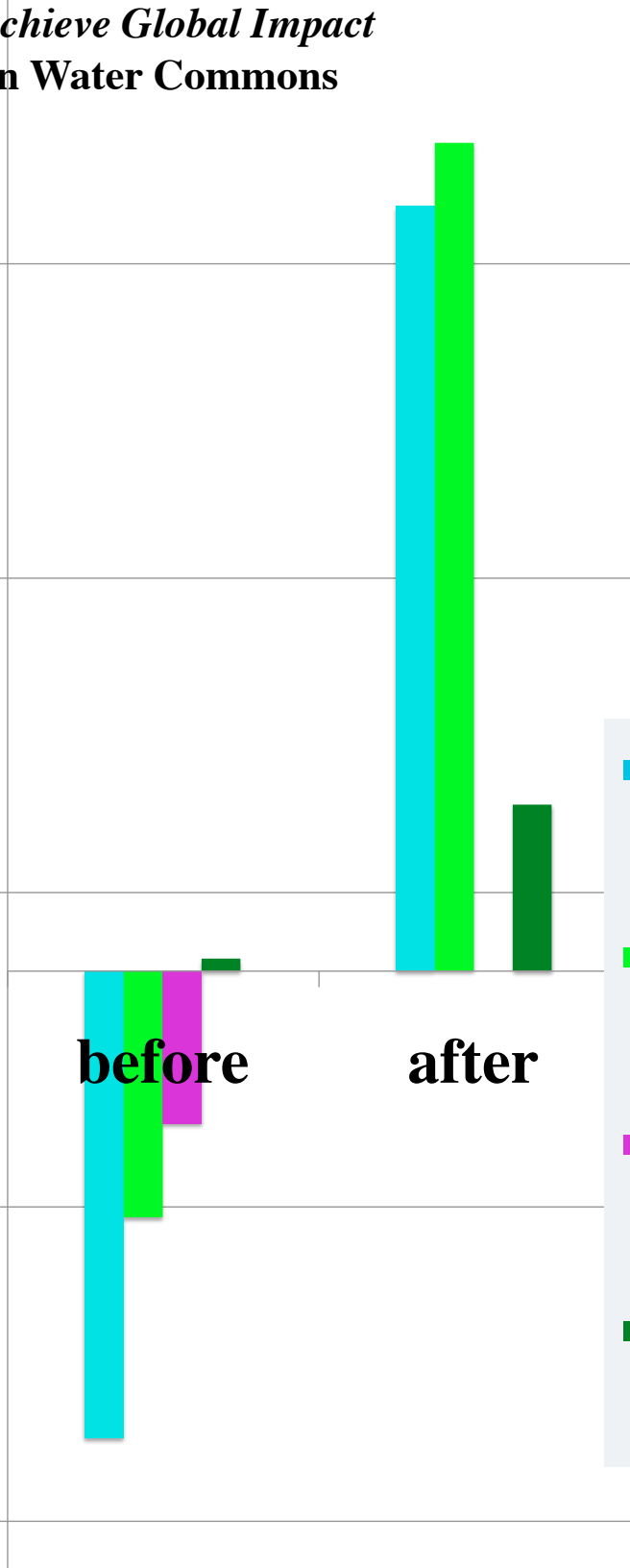
Gallons per year

450,000  
250,000  
50,000  
-150,000  
-350,000

**before**

**after**

- Net community water use (recharge-metered use)
- Runoff net absorption (runon-runoff)
- Sewer flow avoided
- Irrigation saved off site due on site food production



# Climate commons effects

## ...and on Global Climate Commons

