APPENDIX G

WATER QUALITY INFORMATION

GETTING YOUR WATER TESTED

What to test in your well water:

- Metals, nutrients, bacteria, pathogens

What to test in your wastewater or graywater:

- Total and fecal bacteria
- E. coli or Enterococcus (human health pathogens)
- Nutrients: nitrogen, ammonia and phosphates

General notes about collecting water samples;

- Often the lab will provide collecting jars with preservatives in them.
- Clean, sterile jars will also do.
- Most samples need to be kept cold and some have limited time between when you collect and when they need to be tested.

You should call the lab to get specific instructions on how to collect the sample, how long you have to get the sample to the lab and costs.

Local testing labs include:

Montgomery Watson Laboratory, Pasadena 626-568-6449
Fruit Growers Laboratory, Santa Paula 805-659-0910

SIMPLE WAYS YOU CAN HELP CLEAN THE CREEK

Pick up the TRASH! Join us for Creek Clean Up Days each April and September!

Cover trash cans so animals can't spread trash all over and into the creek.

Wash your car at the car wash, or with biodegradable soap. Don't keep the hose running between rinses.

Dispose of oils, gasoline, paints and batteries at the local recycling center.

1 gallon of paint or motor oil can pollute 250,000 gallons of water
1 gallon of gasoline can pollute 750,000 gallons of water

Collect roof run off and rainwater in storage tanks to use for summer irrigation and on-site fire protection.

Collection systems can be really simple, like a covered trash can (keep those mosquitoes out!) to more complex cisterns.

Compost manures and corralled animal wastes.

RCDSMM manual available with ideas.

Irrigate your landscape thoughtfully. Watch those automatic systems that create runoff, spray at mid day, or come on during the rain!

Limit use of herbicides, pesticides, and fertilizers that can runoff your landscape and into the creek. They are usually not target specific. Be sure to read directions carefully and pay attention to dilutions.

Conserve water. 85% of the water you use has traveled over 300 miles to get here!

Graywater Systems can help reduce the amount of water handled by the septic system, but can also pose health risks unless they drain into the ground. No direct outflows!

Think before you Pour!

In Topanga, what goes "down the drain" or down the road/hill eventually turns up in the creek and then at Topanga Beach!

CARE AND FEEDING OF YOUR SEPTIC SYSTEM

- Limit amount of water entering the system simultaneously! Don't overload!
- Fix leaks. A leaky toilet can add 2000 gallons to your system in a day!
- Keep all toxic chemicals out of the system. They destroy the bacteria that keep a system working and can leach into the environment causing further damage.
- Limit amount of non-organic material entering the system. If you didn't eat it, then think twice before putting it into the system!
- Use non-toxic soaps and cleaners. Forget about bleach unless very dilute! It kills all the friendly bacteria that make your system work.
- Compost your veggie waste instead of grinding in garbage disposal. Meat, cheese and all fat leftovers should go to the trash.
- Pour cooking oils and grease into old cans for proper disposal in the trash.
- Keep hair and disposable diapers out of the system!
- Install a low flow toilet.
- Use toilet paper sparingly. Non-bleached are most friendly.
- Septic enzymes are not a good idea. They stimulate a short burst of bacterial activity, cause a bloom and dieback of the critters, which then creates more suspended solids that go into your drain field and clog up the works. Your gut provides sufficient bacteria to keep your system working.
- Add a low maintenance filter to the outlet of the tank. For several hundred dollars you can extend the life of your drain field for a long time.
- Pump out the tank every 6-8 years. Pump when the scum and sludge layers get too thick. Research has shown that it takes 3-5 years for a happy colony of methane decomposing bacteria to get established, and they are the most efficient decomposers.
- Be sure that nothing from the septic system "daylights" or flows directly out on the ground. If it does, you are polluting and need to fix it quick!

WEBSITES AND INFORMATION FOR SUSTAINABLE CLEANING PRODUCTS

Planet Natural
http://www.planetnatural.com/cleaningproducts1.html
On this site you can purchase online the Turbo Plus Laundry Disc, CitraSolv, Papaya Enzyme Brightener, Mildew Stain Away, ChemFree Toilet Bowl Cleaner, Earth Enzymes Drain Opener, Degreaser, Dishwashing detergent, Bathroom Cleaner and Laundry Detergent.

Heathers Naturals
http://www.heathersnaturals.com/
Window Cleaner, Oxygen Bleach Cleanser for sinks and tubs, All Purpose Cleaner, Basin, and Tub & Tile Cleaner. Formulated by an independent woman from Seattle who owned and operated a residential cleaning business.

ECOVER
http://www.ecover.com/
Washing and cleaning products from Belgium distributed worldwide.

Seventh Generation
http://www.seventhgen.com/
Environmentally friendly non-toxic household cleaners, laundry & dish products; 100% recycled, non-chlorine bleached bathroom & facial tissues, paper towels & napkins; plus recycled plastic trash bags & full-spectrum light bulbs.

Earth Friendly
http://www.ecos.com/
non-toxic and plant-based household cleaning products

Bonami Cleanser (Albertson's, Wal-Mart, Hughes, Gelson's, Pavilions, Von's, Ralph's, Lucky, Safeway)

Dr. Bronner's Sal Suds or "Magic Soaps"
http://www.drbronner.com/
Highly concentrated, effective yet mild, biodegradable cleaner

Other products that are sustainable:
Spray and Wash Stain Stick
Life Tree Products
EnviroMan (Bugs'R'Done)
BioKleen

STORES
Whole Foods
Wild Oats
PC Greens
Gaiam/Home and Garden Cleaners http://www.gaiam.com/
Real Goods/Indoor Home http://www.realgoods.com/

Reference Book: (for homemade recipes)
Clean House, Clean Planet by Karen Logan ISBN:0-671-53595-1

Household ingredients that you can make your own cleaning products with:

Baking Soda
Vinegar (white) Heinz
Liquid Soap (Castile)
Essential oils
Lemon Juice
Borax (for tough stains if lemon and baking soda won't work, use sparingly)
Club Soda or distilled water

Tub and Tile Cleaner Recipe:

Mix 1-2/3 cup baking soda with 1/2 cup of liquid soap in a bowl. Dilute with 1/2-cup water. Add 2 tbsp. vinegar last. Stir until lumps are gone. If you can pour it into a 16 oz. container easily, then you have the right consistency. If it is too thick, add more water. Shake well before using again. Use a flip top bottle for storage.

Kitchen Cleanser:

Fill a shaker half full with baking soda. Add 20 drops of pure essential oil. Stir. Fill shaker to the top with more baking soda. Put the lid on and shake it on your counter tops, kitchen sink, floors and pots (except aluminum pots). Wipe with damp sponge.

Toilet Bowl Cleaner:

Mix 1/2-cup liquid soap and 2 cups baking soda together. Dilute with 1/4-cup water and add 2 tsp. vinegar. Add one dropper full of Tea Tree oil or 50 drops. Mix and pour the final solution into a 22 oz. squirt bottle. Shake well.

DO NOT USE the following PRODUCTS:

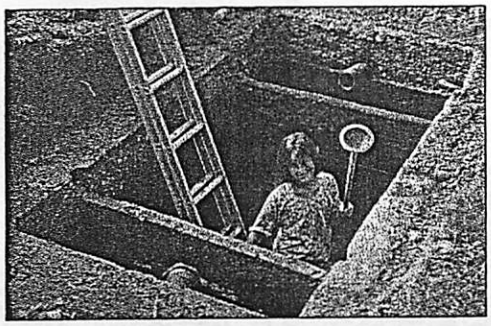
Tilex or X-14
Old English Red Furniture Polish
Comet
Lysol
Spic and Span
Commercial Air Fresheners
Aerosols
Pesticides
Bleach
Ammonia

MONEY PIT?

Abusing your septic system is like flushing money down the drain

By Blueberry Hennin

Reprinted with permission from *Handy* Magazine, March/April 2001



Some people don't to have to deal with septic systems until they grow up and move to the country or buy a vacation home. But I was only 10 when I learned firsthand that you must be careful of what you put into a septic tank.

While this experience left Associate Editor Blueberry Hennin with a healthy respect for septic systems from a young age, we don't recommend it.

My father is a contractor and teaches people how to build and understand their own homes. When the septic tank at our old farmhouse was pumped out one day, it presented an unforgettable photo opportunity for his lectures. He lowered a ladder and had me stand in the middle of the empty tank to show how big it was. (We're trained professionals. Don't try this at home.)

While I posed, plumber's helper in hand, one of my older brothers pulled out the ladder and disappeared in the direction of the house. The next thing I remember was the sound of water rushing down the main sewer line until it dribbled into the tank.

With septic systems—and brothers—out of sight should not mean out of mind. Now, when I go back to the farmhouse and take a shower, flush a toilet or pour anything down a drain, I still remember where everything goes. And I recall my personal lesson: to avoid family strife, be good to the living things down there.

Septic systems are simple, but they can cost up to $25,000 to install or replace. Basically, the sewer pipe slopes from the house toward a large holding tank. Solids settle to the bottom of the tank, where microorganisms help some of the materials decompose. Liquids, meanwhile, are piped to a leachfield, where they soak into the ground.

I read four books and interviewed several experts on septic systems to teach you how to avoid costly problems and disgusting sewage backups. (Don't worry — you don't need a ladder or a small child.) Incidentally, what's good for a septic system is great for a municipal sewage processing plant. If your home's waste line is connected to city sewers, the same practices will reduce the burden at the processing plant.

Breaking it down

Think of what you put into your septic system in three categories: water, solids and chemicals.

Excessive water can flood a septic tank and drain field, causing dangerous bacteria to percolate to the surface or contaminate the water table. It also can cause sewage to back up into the house.

To reduce the amount of water that enters your septic system, focus on toilets, washing machines and showers. Modern toilets require just 1.6 gallons of water to flush, compared with 5 gallons for older toilets. (And unlike early low-flow toilets, they actually work.) Older showerheads use up to 5 gallons of water per minute, while modern low-flow showerheads use 1-1/2 gallons per minute. That reduces wastewater from a 5-minute shower by more than 17 gallons.

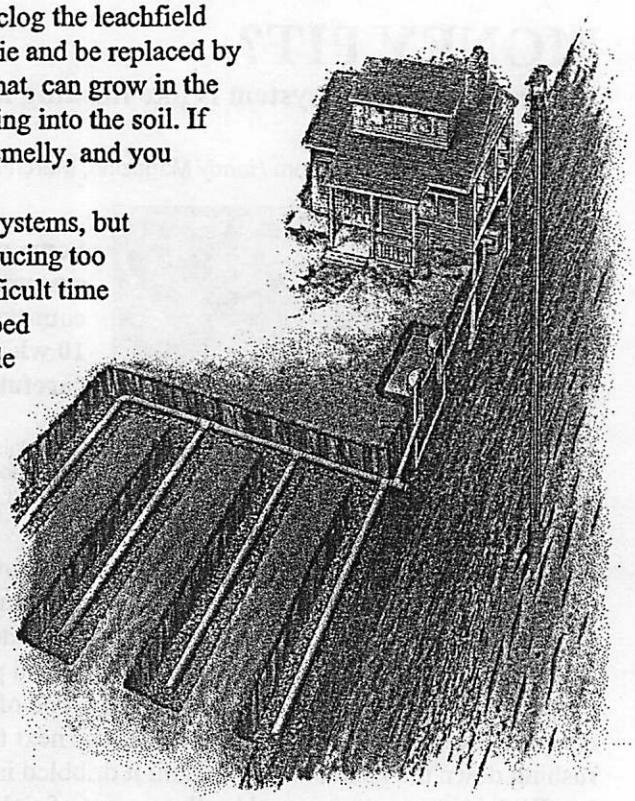
The amount of water you put into a septic system is not the only issue. Homeowners with septic systems also need to avoid creating extreme surges of wastewater, which can overwhelm the septic tank and flush solids and chemicals to the leachfield (see "Septic 101"). If everyone in your family showers in the morning, consider doing laundry in the evening or staggering loads throughout the week. That will give the solids and chemicals in the wastewater time to settle. Also, when shopping for a washing machine or dishwasher, check water usage ratings. They can vary by as much as 30 gallons among comparable models.

If you flood your septic tank, solids can clog the leachfield trenches. Aerobic (air-loving) bacteria will die and be replaced by anaerobic bacteria. Thick sludge, called biomat, can grow in the leachfield, preventing wastewater from soaking into the soil. If that happens, the leachfield will be wet and smelly, and you may have to excavate and replace it.

Excessive solids also are bad for septic systems, but again, you have a choice. If you avoid introducing too many solids or those that bacteria have a difficult time decomposing, you may need your tank pumped only once every several years. Ignore this rule and the tank may require annual cleaning.

According to Lloyd Kahn, a co-author of The Septic System Owner's Manual, a septic system should never be used for things that can be disposed of in other ways. The book says that daily use of a garbage disposer can increase the amount of solids in a septic tank by as much as 50 percent.

Anaerobic bacteria in the septic tank can digest human waste, but food scraps take much longer to decompose. Many specialists suggest the use of filters on outlet pipes. If solids (sludge or scum) are flushed from the tank, the filter will catch them before they damage the leachfield.



The three parts of a septic system are the drainage pipes from the house, the septic tank, and the leachfield.

In recent years, In-Sink-Erator introduced a disposer that injects a squirt of enzymes with each use to help food waste break down faster in the tank. HydroMaid, meanwhile, offers a water-powered disposer that chops food waste into smaller pieces that (unlike ordinary disposer waste) resist floating. The faster the particles sink, the less likely they are to be flushed out to the leachfield.

Although these garbage disposers may be an improvement over ordinary models, they still put food into the septic tank. According to Max Burns, author of Cottage Water Systems, "Things like coffee grounds and mushed-up vegetable products simply add to the sludge content in the septic tank, leaving less room for the system to treat and efficiently break down human waste."

Avoid putting grease and oils into a septic system. They can easily clog waste lines on the way to the septic tank. Once they reach the tank, they float, accumulate and eventually endanger the leachfield.

Burns says keeping your septic system healthy starts at the store. Avoid buying thick, colored or perfumed toilet tissue. It takes longer to break down in septic tanks. If in doubt, he suggests, stick a wad of your present toilet tissue in a covered jar with water and shake it. If the tissue doesn't break into small pieces, switch to a brand that does. Finally, never put paper that is thicker than tissue down a toilet.

Excessive chemicals pose another danger to septic systems. Overuse of bleach, detergent, anti-bacterial soap, chlorine, and other strong cleaning products used to kill bacteria in the home can also kill the microbes that help sewage decompose. If you can't avoid these products, at least limit their use.

Choose phosphate-free detergents to avoid causing heavy plant growth and algae over the leachfield. Phosphates act like fertilizer, causing algae and roots to grow. Roots can clog drain tile and gravel beds.

To avoid flooding your septic system with large amounts of salty water, don't let water softener backwash into the system. This increases wastewater volume, and salt can cause clay soils to harden and reduce their ability to absorb water.

Some septic system owners periodically add baker's yeast or special enzymes to help solids decompose faster. However, in 1992 Burns contacted several wastewater jurisdictions in North America, and all advised against using these products. "Although most of the products do activate bacterial growth in the tank as claimed, adding more sewage does the same thing. Any product that claims to do more — like unclog pipes, for instance — could be very toxic and would certainly shut down the activity of a tank," Burns says.

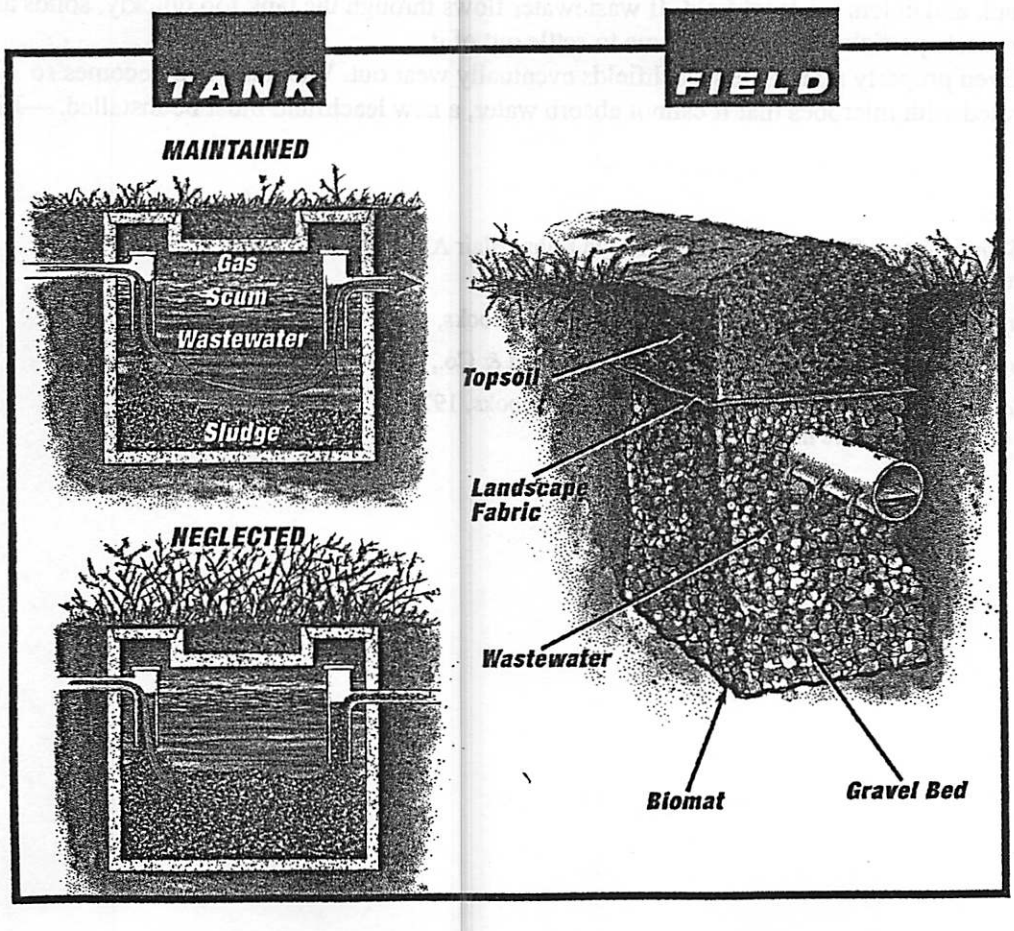
According to Burns, most homeowners turn to enzymes after the damage has been done and it is too late. If you are careful what you put down the drain, your septic system should maintain a natural balance without enzyme additives.

Septic system designs vary, but all work the same way. How much sewage your system can handle is based on the size of the tank and the drain field, the ability of the soil to absorb moisture, and the amount and types of materials you introduce. The best way to avoid a septic system failure is to be sensitive to how it works and to have the tank pumped out regularly.

SEPTIC 101

Residential septic tanks are watertight containers, usually made of precast concrete, fiberglass or plastic. The interior may be a single open chamber or several compartments created by internal walls with openings for waste to flow through. Local plumbing codes determine the minimum tank and leachfield sizes based on the number of bathrooms and bedrooms in the house. Other factors include soil conditions and nearby environmental resources such as lakes, reservoirs, streams and rivers.

When sewage enters the tank, it separates. The denser, heavier materials sink to the bottom, while the lighter materials collect toward the top. This produces three distinct layers: scum, wastewater and sludge. As the waste decomposes, it produces methane gas, which is released into the air through the home's main plumbing vent stack.



The oil, grease, fat and fecal matter form scum. Sludge is the solid waste and silt that sink, and wastewater is composed of the various liquids in the tank. Anaerobic bacteria (which don't need air) digest organic waste. These bacteria are slow compared with aerobic bacteria (which need air) found in the leachfield.

Because decomposition is slower underwater, solid waste accumulates in the tank and eventually must be professionally removed. The Septic System Owner's Manual says tanks should be inspected every three to five years and pumped out as needed. Ken Cotton, a specialist in septic system maintenance, uses a stick to measure the layers of sludge and scum in the tank. If the sludge layer exceeds 10 in. or the scum layer exceeds 6 in., the tank needs to be emptied. Make sure the person who pumps the tank inspects the baffle or filter to ensure that it is intact and functioning properly. If possible, he also should inspect the tank for cracks.

When fresh waste enters the tank, the level of waste rises so that the same volume of wastewater is pushed into the outlet pipe, where gravity carries it to the leachfield. Although a gallon in equals a gallon out, Cotton says an individual drop of water typically takes several days to move through the tank.

The leachfield (soil absorption system) is composed of either a series of underground perforated drainage pipes, plastic or concrete chambers, fabric-wrapped pipe or other proprietary devices set in gravel.

Clarified wastewater leaving the tank should be free of scum and sludge, but it still contains harmful germs, parasites, bacteria and viruses. As wastewater is dispersed into the leachfield, the gravel beds and aerobic bacteria continue to filter it. The wastewater deposits organic material in the trenches and creates biomat. This black, jelly-like material grows between the pieces of gravel along the sidewalls and bottoms of the healthy drainage beds. It feeds on organic material in the water and thickens if the water is not effectively clarified by the septic tank. If biomat becomes too thick, it can prevent wastewater from being absorbed into the soil. The water can surface, making the leachfield soil wet and smelly.

The key to a problem-free septic system is to make sure that only clarified wastewater leaves the tank and enters the leachfield. If wastewater flows through the tank too quickly, solids and other waste particles do not have time to settle out of it.

Even properly maintained leachfields eventually wear out. When the soil becomes so saturated with microbes that it cannot absorb water, a new leachfield must be installed. —BH

Sources

The Septic System Owner's Manual by Lloyd Kahn, Blair Allen and Julie Jones, Shelter Publications, 2000

Cottage Water Systems by Max Burns, Cottage Life Books, 1999

Country Plumbing by Gerry Hartigan, Alan C. Hood & Co., 1984

Septic Tank Practices by Peter Warshall, Anchor Books, 1979
(Out of print, available in public libraries.)

Locations	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00
Weekly sites												
1. End of Paradise Lane	Excellent	no water	no water	no water	Good*	Good*	Good	Good*	Excellent	Excellent	Excellent	Good
2. Below Cheyney bridge- not sampled												
3. Old Topanga, Backbone Trail	Excellent	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Excellent	Excellent	Good
4. Behind Topanga Market	Good*	Good *	Good *	Good *	Problem	Good*	Good*	Good*	Good*	Good*	Problem	Problem
5. Falls Drive, above culvert	Excellent	Excellent	Excellent	Good*	Problem	Good*	Excellent	Problem	Good*	Good*	Good*	Problem
Monthly sites												
6. Topanga Cyn. Blvd. MM2.2	Excellent	Excellent	Excellent	Excellent	Good*	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
7. Fernwood Pacific Rd, Dix Creek	no water	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Excellent	no water
8. Old Topanga Cyn. MM 3.41	no water	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Good*	Good*	Excellent
9. Greenleaf Rd, MM 0.97	no water	no water	no water	no water	Good*	no water	no water	no water	Good*	Excellent	Excellent	Excellent
10. Highvale Rd. culvert pool	Excellent	Excellent	Excellent	Excellent	Good*	Good*	Excellent	Excellent	Excellent	Excellent	Excellent	Good
11. 815 TC Blvd. below maintenance site	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
12. Santa Maria Rd, near oak at 2980	no water	no water	no water	no water	no water	no water	no water	Excellent	Excellent	Excellent	Good*	Good
13. Santa Maria Rd. and TC Blvd.	no water	no water	no water	no water	Good*	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
14. Entrado Rd below culvert 0.14	Problem	Excellent	Problem	Good*	Problem	Problem	Good*	Problem	Good*	no data	Problem	Problem
15. Summit Valley Park	no water	no water	no water	no water	no water	no water	no water	Good*	Excellent	no data	no water	no water
16. Topanga Lagoon												
Criteria: Excellent - no problems												
Good - recurrent readings above limits for 1 parameter, other than total coliform												
Problematic - consistently exceeds limits for more than 1 parameter, or for fecal coliform/E. coli												
Topanga State Beach												
Heal the Bay Report Card Grade - dry	A+	A+	A+	A	A-F	D-F	A+	C	A+	B	A-F	A-B
Heal the Bay Report Card Grade -wet	ns	ns	ns	ns	C-A	ns	A+	F	F	F	F	ns
data collected by Hyperion weekly												
Control sites in bold												
* denotes bacteria counts above standards												
Potable drinking water= 0/100mL water												
Primary contact water= <200, <1000												
Secondary contact water= <1000, <5000												
AB411 standards used for beach closure												
Total coliform limit 10,000												
Fecal coliform limit 400												
E.coli limit 400												
Enterococcus limit 106												
Water considered unsafe if exceeds these limits or, the total:fecal ratio is less than 10 with a Total over 10,000												

							2001				
Locations	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00	1-Jan	1-Feb	1-Mar	1-Apr	1-May
Weekly sites											
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2. Below Cheyney bridge- not sampled				Good	Excellent	Good*	Good	Problem	Good	Excellent	Problem
3. Old Topanga, Backbone Trail	Excellent	no water	no water	Excellent	Excellent	Excellent	Excellent	Problem	Good	Problem	Good*
4. Behind Topanga Market	Good*	Good*	Good*	Good*	Good	Good	Good	Problem	Problem	Excellent	Problem
5. Falls Drive, above culvert	Good*	Good*	Excellent	Good	Good*	Problem	Problem	Problem	Good	Good*	Problem
Monthly sites											
6. Topanga Cyn. Blvd. MM2.2	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Problem	Good	Excellent	Good*
7. Fernwood Pacific Rd, Dix Creek	no water	no water	no water	no water	no water	no water	no water	Problem	Good	no water	Good*
8. Old Topanga Cyn. MM 3.41	no water	no water	no water	no water	no water	no water	Good*	Problem	Good	Excellent	Excellent
9. Greenleaf Rd, MM 0.97	no water	no water	no water	no water	Excellent	Good	Good	Problem	Excellent	Good*	Problem
10. Highvale Rd. culvert pool	Good	Good	Problem	Problem	Good	Excellent	Excellent	Problem	Problem	Problem	Good*
11. 815 TC Blvd. below maintenance site	no water	no water	no water	no water	Excellent	no water	Good	Problem	Excellent	Problem	Excellent
12. Santa Maria Rd, near oak at 2980	no water	no water	no water	no water	no water	no water	no water	Problem	Problem	Problem	Good*
13. Santa Maria Rd. and TC Blvd.	no water	no water	no water	no water	Excellent	Excellent	Problem	Problem	Excellent	Good*	Good*
14. Entrado Rd below culvert 0.14	Good*	Good*	Good*	Good*	Problem	Problem	Problem	Problem	Problem	Good*	Problem
15. Summit Valley Park	no water	no water	no water	no water	no water	no water	no water	Problem	Good	Excellent	no water
16. Topanga Lagoon					Problem	Problem	no data	Problem	Problem	Excellent	Good*
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Topanga State Beach											
Heal the Bay Report Card Grade - dry	A+	A+	A+	A	A-F	D-F	A-F	B-C	A-C	C	A+
Heal the Bay Report Card Grade -wet	ns	ns	ns	F	C	C	F	F	F	F	ns
data collected by Hyperion weekly											
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Enterococcus limit 106											
Water considered unsafe if exceeds these limits or, the total:fecal ratio is less than 10 with a Total over 10,000											

DETERGENT COMPOSITION AND GREYWATER

Office of Arid Lands Studies in cooperation with the
Soil, Water and Plant Analysis Laboratory, University of Arizona
Reprinted with permission by Oasis Biocompatible Products (805) 967-3222
—Includes footnotes from Oasis—

This study was prepared for conservation-minded people who would like to use washing machine water (greywater) to irrigate their landscape plants. The list of wash-day products that follows this introduction is presented alphabetically by brand name with no endorsement of any product implied. The numbers cited should be used *only* as a basis of comparison among the products. It is left to the reader to choose the product(s) best suited to his/her needs. The reuse of greywater may be regulated in your area—check with your local government.

Purpose

Before greywater is used to irrigate plants, amounts of constituents potentially harmful to plants and/or soils should be known. Since labeling on detergent and other clothes-washing products often is incomplete, this study was conducted to evaluate certain product characteristics which, when introduced through greywater irrigation, may adversely affect the landscape. The specific characteristics selected for study were alkalinity, boron, conductivity, phosphate, and sodium.

Alkalinity refers to the relative amounts of alkaline chemicals in a solution. Sodium, potassium, and calcium are alkaline chemicals; they often are combined with carbonates, sulfates, or chlorides. Plants do not tolerate high concentrations of alkali salts. In soils, a buildup of alkali salts can severely reduce plant productivity.[1] In soils with high alkali concentrations, sulphur may need to be added to the soil to increase productivity.

Boron is considered a plant micronutrient, which means it is required by plants only in very, very small amounts; these usually are available in most soils. Caution: concentrations only slightly higher than those considered beneficial can cause severe injury or death to plants! The addition of boron to irrigation water should be kept at a minimum.

Conductivity is a simple measure of the amount of dissolved chemicals in a solution. These chemicals can be beneficial or harmful. The higher the conductivity, the more dissolved salts and minerals are present. In general, the higher the concentration of salts and minerals in the water, the greater the potential for adverse impacts on the environment and plant health.[2]

Phosphate is a plant food and is added to soil as a fertilizer to enhance productivity. Soils in the Tucson area typically are low in phosphate; thus, there may be some benefit to plants from the presence of this ingredient in greywater. Since phosphate has various chemical configurations, its form in detergent greywater may not be in a readily usable form to the plants and soil. This source of phosphate, therefore, should not be relied upon to assist in fertilization of plants.[3]

Sodium can act as a plant poison by changing the osmotic concentration relationship between the plant and the surrounding soil. This will reduce the plant's ability to take up water and thus will adversely impact the health of the plant. Too much sodium also destroys the structure of clay soils, making them slick and greasy by removing air spaces and thus preventing good drainage. Once a clay soil is impregnated with sodium, it is difficult to restore it to a viable condition. If soils are damaged, they may require the addition of gypsum and repeated leaching with fresh water to remove the sodium.

Although chlorine in bleach and detergents generally is expended in the washing of clothes and vaporized by the heat of hot water, some may be left in the greywater that reaches plants. If you smell chlorine during the washing process, this means that the chemical is leaving the wash water as vapor. Chlorine is considered a plant and animal poison and should not be used in the garden because it may substitute for similar nutrients, blocking normal metabolic processes. The addition of chlorine to water used for irrigation should be kept to a minimum.

Method of Analysis

All the detergents and related clothes washing products in the list below (e.g., fabric softeners) were purchased during May 1992 from various supermarkets, specialty stores, and other vendors in the Tucson, Arizona, metropolitan area.

The amount of product used in this study was based on the manufacturer's instructions for a cool-to warm-water wash in a top loading machine. The average volume of a top loading machine is 19 gallons, based on data published by Consumer Reports. Each product was dissolved in distilled/deionized water, the "cleanest" water possible, "clean" water having none or only very small amounts of dissolved salts and minerals (see table below). Tap water can contain salts and minerals in widely-varying amounts depending on its source. Using distilled/deionized water avoided addition of salts from tap water.

Discussion

Choose your detergent and clothes-washing products keeping in mind that it is better for your plants and soils to have a low alkalinity, boron, conductivity, and sodium content in the wash water. You may prefer product(s) with a higher level of one or more of these items because your clothes come out of the wash cleaner or because of personal preference.

Sandy soils are less vulnerable to damage than are clay soils because they drain better. In very low rainfall areas, apply fresh water occasionally, instead of greywater, to leach out accumulated salts.[4] Use greywater on salt-

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Oasis Additions:
(these comments are not part of the original paper)
[1] Potassium is a nutrient which is removed by plants, and is thus unlikely to build up.
[2] The majority of the conductivity and alkalinity measured for Oasis is due to Potassium.
[3] According to our plant tests, phosphate in the form used in most detergents is readily available. The amount in Oasis is, however, only a minor supplement.
[4] Rainwater is comparable in quality to deionized water [before it hits the ground] and is ideally suited for leaching.

leach out accumulated salts.[4] Use greywater on salt-tolerant plants such as oleander, Bermuda grass, date palms, and native desert plants. Avoid using greywater on plants that prefer acid conditions, such as:[5]

Ash	Rhododendron
Foxglove	Bleeding Heart
Philodendron	(Dicentra)
Azalea	Hydrangea
Gardenia	Violet
Primrose	Camellia
Begonia	Impatiens
Hibiscus	Xylosma
	Fern
	Oxalis (Wood Sorrel)

The word *biodegradable* means that a complex chemical is broken down into simpler components through biological action. Do not be confused by the word biodegradable which often is used to imply good things. Harmful chemicals as well as beneficial ones may be biodegradable.[6]

Be aware that harmful effects are not always visible immediately and may take one to two years to appear. In any case, you should always pay attention to the health of the plants being irrigated and discontinue irrigation with greywater if signs of stress are observed.

If you choose to use greywater, we strongly recommend that you become aware of the appropriate methods to operate a greywater system and the local regulations regarding its use.

This study was prepared by the Office of Arid Lands Studies in cooperation with the Soil, Water and Plant Analysis Laboratory, University of Arizona, and is based in part on materials previously published by Pima County Cooperative Extension, University of Arizona. The study was sponsored by Tucson Water.

Oasis Additions (these comments are not part of the original paper):

[5]From our chemical analysis, our plant studies and our customer's experience, it appears that the cautions below about specific plants are not a concern if you are using Oasis.

[6]Biocompatible, (a word used in Oasis literature) means that the biodegradation products are beneficial or non-harmful to a particular environment. Biocompatibility varies with the environment. For example, salt doesn't harm the ocean but is harmful for soil, phosphate is harmful for freshwater aquatic ecosystems but beneficial for soil. Most attention to date has been given to biocompatibility of cleaners with freshwater aquatic ecosystems. This study and Oasis's studies are among the first on the biocompatibility of cleaners with soil.

Product Name	Product type	P/L	Conductivity at 25°C (umho/cm)	Alkalinity as CaCO3 (mg/l)	Sodium (mg/l)	Boron (mg/l)	Phosphate (mg/l)
Ajax Ultra	Laundry Det.	P	1130.0	219.0	292.00	0.04	11.20
Alfa Klean		L	25.6	16.8	3.71	<<	<<<
All		P	2030.0	659.0	492.80	0.10	NT
All Regular		L	116.0	29.8	39.30	<<	<<<
Amway		P	939.0	310.0	227.80	<<	4.00
Ariel Ultra		P	1020.0	247.0	280.80	0.03	10.80
Arm and Hammer		P	2450.0	1160.0	572.80	<<	<<<
Bold		L	46.7	68.6	9.74	<<	<<<
Bonnie Hubbard Ultra		P	1560.0	617.8	377.80	0.04	<<<
Cheer Free		L	307.0	80.3	94.70	<<	<<<
Cheer Ultra		P	718.0	149.0	171.80	0.08	<<<
Dash		P	1060.0	482.0	238.80	2.14	<<<
Draft Ultra		P	757.0	328.0	189.80	9.75	<<<
Ecocover		L	132.0	63.7	24.30	<<	<<<
ERS Plus		L	102.0	15.3	26.30	<<	<<<
Fab Ultra		P	1148.0	199.5	443.80	<<	21.70
Fab 1-Shot		Pkt	581.0	108.0	109.80	<<	5.26
Fresh Start		P	510.0	106.0	132.80	0.83	8.28
Gain Ultra		P	792.0	300.0	180.80	8.06	<<<
Greenmark		P	1690.0	568.0	395.80	<<	1.67
Ivory Snow		P	258.0	219.0	70.80	<<	NT
Oasis		L	89.6	16.2	<	<<	<<<
Oxydol Ultra		P	1030.0	501.0	272.80	11.30	<<<
Per All		P	2350.0	431.0	529.80	0.05	2.67
Temperature							
Purex Ultra		P	1010.0	278.0	231.80	<<	<<<
Sears Plus		P	2500.0	1200.0	635.80	<<	<<<
Shaklee		L	19.8	12.1	6.48	<<	<<<
Shaklee Basic L		P	1038.0	285.0	230.80	<<	<<<
Sun Ultra		P	1490.0	653.0	335.80	<<	1.58
Surf Ultra		P	989.0	302.0	249.80	<<	13.70
Tide with Bleach		L	329.0	58.3	95.80	2.30	<<<
Tide Regular		L	291.0	61.2	93.80	0.83	<<<
Tide Ultra		P	959.0	256.0	245.80	0.10	10.70
Total Time		P	1650.0	460.0	371.80	0.83	1.79
White King		P	266.0	165.0	74.80	1.83	NT
White Magic Ultra		P	1140.0	194.0	273.80	0.04	18.50
Wisk Advanced Action		L	221.0	72.4	56.80	7.41	<<<
Wisk Power Scoop		P	1160.0	360.0	319.80	<<	9.77
Woolite		P	1040.0	22.3	259.80	0.17	<<<
Yes		L	42.5	10.3	6.40	<<	<<<
Detergent Average			871.6	281.8	221.14	1.87	8.69
Tap Water	Control	n/a	317.0	118.0	42.70	0.84	<<<
Bi-Mod/Deionized Water	Control	n/a	2.0	3.8	<	<<	<<<
Snuggle Fabric Softener	Fabric Softl.	L	2.6	NT	<	<<	<<<
Downy Fabric Softener	Fabric Softl.	L	6.4	NT	<	<<	<<<
Chlorox 2	Bleach	P	2880.0	1430.0	672.80	11.20	<<<
Calgon Water Softener	Water Softl.	P	1290.0	345.0	359.80	<<	22.90

P: Powder; L: Liquid.
<: Less than the sodium detection limit of 1.0 mg/L
<<: Less than the boron detection limit of 0.025 mg/L
<<<: Less than the phosphate detection limit of 1.2 mg/L
NT: Testing of sample not possible.

APPENDIX G-A [For DWR]

GRAYWATER SYSTEMS FOR SINGLE-FAMILY DWELLINGS

G 1 Graywater Systems (General)

(a) The provisions of this Appendix shall apply to the construction, installation, alteration and repair of graywater systems for subsurface landscape irrigation. The graywater system shall not be connected to any potable water system without an air gap and shall not result in any surfacing of the graywater. Except as otherwise provided for in this Appendix, the provisions of the Uniform Plumbing Code (U.P.C.) shall be applicable to graywater installations.

(b) The type of system shall be determined on the basis of location, soil type and ground water level and shall be designed to accept all graywater connected to the system from the building. The system shall discharge into subsurface irrigation fields and may include surge tank(s) and appurtenances, as required by the Administrative Authority.

(c) No graywater system, or part thereof, shall be located on any lot other than the lot which is the site of the building or structure which discharges the graywater, nor shall any graywater system or part thereof be located at any point having less than the minimum distances indicated in Table G-1.

(d) No permit for any graywater system shall be issued until a plot plan with appropriate data satisfactory to the Administrative Authority has been submitted and approved. When there is insufficient lot area or inappropriate soil conditions for adequate absorption of the graywater, as determined by the Administrative Authority, no graywater system shall be permitted. The Administrative Authority is a city or county.

(e) No permit shall be issued for a graywater system which would adversely impact a geologically sensitive area, as determined by the Administrative Authority.

(f) Private sewage disposal systems existing or to be constructed on the premises shall comply with Appendix I of this Code or applicable local ordinance. When abandoning underground tanks, Section 722.0 of the U.P.C. shall apply. Also, appropriate clearances from graywater systems shall be maintained as provided in Table G-1. The capacity of the private sewage disposal system, including required future areas, shall not be decreased by the existence or proposed installation of a graywater system servicing the premises.

(g) Installers of graywater systems shall provide an operation and maintenance manual, acceptable to the Administrative Authority, to the owner of each system. Graywater systems require regular or periodic maintenance.

(h) The Administrative Authority shall provide the applicant a copy of this Appendix.

G 2 Definitions

Graywater is untreated waste water which has not come into contact with toilet waste. Graywater includes used water from bathtubs, showers, bathroom wash basins, clothes washing machines and laundry tubs or an equivalent discharge as approved by the Administrative Authority. It does not include waste water from kitchen sinks, photo lab sinks, dishwashers or laundry water from soiled diapers.

Surfacing of graywater means the ponding, running off or other release of graywater from the land surface.

G 3 Permit

It shall be unlawful for any person to construct, install or alter, or cause to be constructed, installed or altered, any graywater system in a building or on a premises without first obtaining a permit to do such work from the Administrative Authority.

G 4 Drawings and Specifications

The Administrative Authority may require any or all of the following information to be included with or in the plot plan before a permit is issued for a graywater system:

(a) Plot plan drawn to scale completely dimensioned, showing lot lines and structures, direction and approximate slope of surface, location of all present or proposed retaining walls, drainage channels, water supply lines, wells, paved areas and structures on the plot, number of bedrooms and plumbing fixtures in each structure, location of private sewage disposal system and 100 percent expansion area or building sewer connecting to public sewer, and location of the proposed graywater system.

(b) Details of construction necessary to ensure compliance with the requirements of this Appendix together with a full description of the complete installation, including installation methods, construction and materials as required by the Administrative Authority.

(c) A log of soil formations and ground water level as determined by test holes dug in close proximity to any proposed irrigation area, together with a statement of water absorption characteristics of the soil at the proposed site as determined by approved percolation tests. In lieu of percolation tests, the Administrative Authority may allow the use of Table G-2, an infiltration rate designated by the Administrative Authority, or an infiltration rate determined by a test approved by the Administrative Authority.

(d) A characterization of the graywater for commercial, industrial or institutional systems, based on existing records or testing.

G 5 Inspection and Testing

(a) Inspection

(1) All applicable provisions of this Appendix and of Section 103.5 of the U.P.C. shall be complied with.

(2) System components shall be properly identified as to manufacturer.

(3) Surge tanks shall be installed on dry, level, well-compacted soil if in a drywell, or on a level, 3-inch (76 mm) concrete slab or equivalent, if above ground.

(4) Surge tanks shall be anchored against overturning.

(5) If the irrigation design is predicated on soil tests, the irrigation field shall be installed at the same location and depth as the tested area.

(6) Installation shall conform with the equipment and installation methods identified in the approved plans.

(7) Graywater stub-out plumbing may be allowed for future connection prior to the installation of irrigation lines and landscaping. Stub-out shall be permanently marked GRAYWATER STUB-OUT, DANGER—UNSAFE WATER.

(b) Testing

(1) Surge tanks shall be filled with water to the overflow line prior to and during inspection. All seams and joints shall be left exposed and the tank shall remain watertight.

(2) A flow test shall be performed through the system to the point of graywater irrigation. All lines and components shall be watertight.

G 6 Procedure for Estimating Graywater Discharge

(a) Single Family Dwellings and Multifamily Dwellings

The Administrative Authority may utilize the graywater discharge procedure listed below, water use records, or calculations of local daily per person interior water use:

1. The number of occupants of each dwelling unit shall be calculated as follows:

First bedroom	2 occupants
Each additional bedroom	1 occupant

2. The estimated graywater flows for each occupant shall be calculated as follows:

Showers, bathtubs and wash basins	25 GPD/ occupant
Laundry	15 GPD/ occupant

3. The total number of occupants shall be multiplied by the applicable estimated graywater discharge as provided above and the type of fixtures connected to the graywater system.

(b) Commercial, Industrial and Institutional Projects

The Administrative Authority may utilize the graywater discharge procedure listed below, water use records or other documentation to estimate graywater discharge:

1. The square footage of the building divided by the occupant load factor from U.B.C. Table 10-A equals the number of occupants.

2. The number of occupants times the flow rate per person (minus toilet water and other disallowed sources) from U.P.C. Table I-2 equals the estimated graywater discharge per day.

The graywater system shall be designed to distribute the total amount of estimated graywater discharged daily.

G 7 Required Area of Subsurface Irrigation

Each irrigation zone shall have a minimum effective irrigation area for the type of soil and infiltration rate to distribute all graywater produced daily, pursuant to Section G-6, without surfacing. The required irrigation area shall be based on the estimated graywater discharge, pursuant to Section G-6 of this Appendix, size of surge tank, or a method determined by the Administrative Authority.

If the mini-leachfield irrigation system is used, the required square footage shall be determined from Table G-2, or equivalent, for the type of soil found in the excavation. The area of the irrigation field shall be equal to the aggregate length of the perforated pipe sections within the irrigation zone times the width of the proposed mini-leachfield trench.

No irrigation point shall be within 5 vertical feet (1524 mm) of highest known seasonal groundwater nor where graywater may contaminate the ground water or ocean water. The applicant shall supply evidence of ground water depth to the satisfaction of the Administrative Authority.

G 8 Determination of Irrigation Capacity

(a) In order to determine the absorption quantities of questionable soils other than those listed in Table G-2, the proposed site may be subjected to percolation tests acceptable to the Administrative Authority or determined by the Administrative Authority.

(b) When a percolation test is required, no mini-leachfield system or subsurface drip irrigation system shall be permitted if the test shows the absorption capacity of the soil is less than 60 minutes/inch or more rapid than five minutes/inch, unless otherwise permitted by the Administrative Authority.

(c) The irrigation field size may be computed from Table G-2, or determined by the Administrative Authority or a designee of the Administrative Authority.

G 9 Surge Tank Construction (Figure 1)

(a) Plans for surge tanks shall be submitted to the Administrative Authority for approval. The plans shall show the data required by the Administrative Authority and may include dimensions, structural calculations, and bracing details.

(b) Surge tanks shall be constructed of solid, durable materials, not subject to excessive corrosion or decay, and shall be watertight.

(c) Surge tanks shall be vented as required by Chapter 5 of this Code and shall have a locking, gasketed access opening, or approved equivalent, to allow for inspection and cleaning.

(d) Surge tanks shall have the rated capacity permanently marked on the unit. In addition, GRAYWATER IRRIGATION SYSTEM, DANGER—UNSAFE WATER shall be permanently marked on the surge tank.

(e) Surge tanks installed above ground shall have an overflow, separate from the line connecting the tank with the irrigation fields. The overflow shall have a permanent connection to a sewer or to a septic tank, and shall be protected against sewer line backflow by a backwater valve. The overflow shall not be equipped with a shut-off valve.

(f) The overflow and drain pipes shall not be less in diameter than the inlet pipe. The vent size shall be based on the total graywater fixture units, as outlined in U.P.C. Table 7-5 or local equivalent. Unions or equally effective fittings shall be provided for all piping connected to the surge tank.

(g) Surge tanks shall be structurally designed to withstand anticipated loads. Surge tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (14.4 kN/m²) when the tank is designed for underground installation.

(h) Surge tanks may be installed below ground in a dry well on compacted soil, or buried if the tank design is approved by the Administrative Authority. The system shall be designed so that the tank overflow will gravity drain to a sanitary sewer line or septic tank. The tank must be protected against sewer line backflow by a backwater valve.

(i) Materials

(1) Surge tanks shall meet nationally recognized standards for nonpotable water and shall be approved by the Administrative Authority.

(2) Steel surge tanks shall be protected from corrosion, both externally and internally, by an approved coating or by other acceptable means.

G 10 Valves and Piping (Figure 1)

Graywater piping discharging into a surge tank or having a direct connection to a sanitary drain or sewer piping shall be downstream of an approved waterseal-type trap(s). If no such trap(s) exists, an approved vented running trap shall be installed upstream of the connection to protect the building from any possible waste or sewer gases. Vents and venting shall meet the requirements in Chapter 9 of the U.P.C.

All graywater piping shall be marked or shall have a continuous tape marked with the words DANGER—UNSAFE WATER. All valves, including the three-way valve, shall be readily accessible and shall be approved by the Administrative Authority. A backwater valve, installed pursuant to this Appendix, shall be provided on all surge tank drain connections to the sanitary drain or sewer piping.

G 11 Irrigation Field Construction

The Administrative Authority may permit subsurface drip irrigation, mini-leachfield or other equivalent irrigation methods which discharge graywater in a manner which ensures that the graywater does not surface. Design standards for subsurface drip irrigation systems and mini-leachfield irrigation systems follow:

(a) Standards for a subsurface drip irrigation system are:

(1) Minimum 140 mesh (115 micron) filter with a capacity of 25 gallons (94.6 L) per minute, or equivalent, filtration, sized approximately to maintain the filtration rate, shall be used. The filter backwash and flush discharge shall be caught, contained and disposed of to the sewer system, septic tank or, with approval of the Administrative Authority, a separate mini-leachfield sized to accept all the backwash and flush discharge water. Filter backwash water and flush water shall not be used for any purpose. Sanitary procedures shall be followed when handling filter backwash and flush discharge or graywater.

(2) Emitters shall have a minimum flow path of 1,200 microns and shall have a coefficient of manufacturing variation (Cv) of no more than 7 percent. Irrigation system design shall be such that emitter flow variation shall not exceed ± 10 percent. Emitters shall be recommended by the manufacturer for subsurface use and graywater use, and shall have demonstrated resistance root intrusion. For emitter ratings, refer to Irrigation Equipment Performance Report, Drip Emitters and Micro-Sprinklers, Center for Irrigation Technology, California State University, 5730 N. Chestnut Avenue, Fresno, California 93740-0018.

(3) Each irrigation zone shall be designed to include no less than the number of emitters specified in Table G-3, or through a procedure designated by the Administrative Authority. Minimum spacing between emitters is 14 inches (356 mm) in any direction.

(4) The system design shall provide user controls, such as valves, switches, timers and other controllers, as appropriate, to rotate the distribution of graywater between irrigation zones.

(5) All drip irrigation supply lines shall be polyethylene tubing or PVC Class 200 pipe or better and Schedule 40 fittings. All joints shall be properly solvent-cemented, inspected and pressure tested at 40 psi (276 kPa), and shown to be drip tight for five minutes, before burial. All supply lines will be buried at least 8 inches (203 mm) deep. Drip feeder lines can be poly or flexible PVC tubing and shall be covered to a minimum depth of 9 inches (229 mm).

(6) Where pressure at the discharge side of the pump exceeds 20 psi (138 kPa), a pressure-reducing valve able to maintain downstream pressure no greater than 20 psi (138 kPa) shall be installed downstream from the pump and before any emission device.

(7) Each irrigation zone shall include a flush valve/antisiphon valve to prevent back siphonage of water and soil.

(b) Standards for the mini-leachfield system are:

(1) Perforated sections shall be a minimum 1 inch (76 mm) diameter and shall be constructed of perforated high-density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, or other approved materials, provided that sufficient openings are available for distribution of the graywater into the trench area. Material, construction and perforation of the piping shall be in compliance with the appropriate absorption field drainage piping standards and shall be approved by the Administrative Authority.

(2) Clean stone, gravel or similar filter material acceptable to the Administrative Authority, and varying in size between 3/4 inch (19 mm) to 2 1/2 inches (64 mm) shall be placed in the trench to the depth and grade required by this section. Perforated sections shall be laid on the filter material in an approved manner. The perforated sections shall then be covered with filter material to the minimum depth required by this section. The filter material shall then be covered with landscape filter fabric or similar porous material to prevent closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspections and acceptance.

(3) Irrigation fields shall be constructed as follows:

	Minimum	Maximum
Number of drain lines per valved zone	3	—
Length of each perforated line	—	100 ft (30480 m m)
Bottom width of trench	6 in. (152 mm)	18 in. (457 m m)
Total depth of trench	17 in. (432 mm)	18 in. (457 mm)
Spacing of lines, center-to-center	4 ft (1219 mm)	—
Depth of earth cover of lines	9 in. (229 mm)	—
Depth of filter material cover of lines	2 in. (51 mm)	—
Depth of filter material beneath lines	3 in. (76 mm)	—
Grade of perforated lines	level	3 in./100 ft. (76 mm/30 480 mm)

G 12 Special Provisions

(a) Other collection and distribution systems may be approved by the Administrative Authority as allowed by Section 310.0 of the U.P.C.

(b) Nothing contained in this Appendix shall be construed to prevent the Administrative Authority from requiring compliance with stricter requirements than those contained herein, where such stricter requirements are essential in maintaining safe and sanitary conditions or from prohibiting graywater systems. The prohibition of graywater systems or more restrictive standards may be adopted by the Administrative Authority by ordinance after a public hearing.

G 13 Health and Safety

(a) Graywater may contain fecal matter as a result of bathing and/or washing of diapers and undergarments. Water containing fecal matter, if swallowed, can cause illness in a susceptible person.

(b) Graywater shall not include laundry water from soiled diapers.

(c) Graywater shall not be applied above the land surface or allowed to surface and shall not be discharged directly into or reach any storm sewer system or any water of the United States.

(d) Graywater shall be not be contacted by humans, except as required to maintain the graywater treatment and distribution system.

(e) Graywater shall not be used for vegetable gardens.

Table G-1 Location of Graywater System

Minimum Horizontal Distance From	Surge Tank (feet) x 304.8 for mm	Irrigation Field (feet) x 304.8 for mm
Buildings or structures[1]	5[2]	8[3]
Property line adjoining private property	5	5
Water supply wells[4]	50	100
Streams and lakes[4]	50	50
Seepage pits or cesspools	5	5
Disposal field and 100 percent expansion area	5	4[5]
Septic tank	0	5[6]
On-site domestic water service line	5	5[7]
Pressure public water main	10	10[8]
Water ditches	50	50

Notes: When mini-leach fields are installed in sloping ground, the minimum horizontal distance between any part of the distribution system and ground surface shall be 15 feet (4572 mm).

[1]Including porches and steps, whether covered or uncovered, but does not include carports, covered walks, driveways and similar structures.

[2]The distance may be reduced to 0 feet for aboveground tanks if approved by the Administrative Authority.

[3]The distance may be reduced to 2 feet (610 mm).

[4]For subsurface drip irrigation systems, 2 feet (610 mm) from property line.

[5]Where special hazards are involved, the distance may be increased by the Administrative Authority.

[6]Applies to the mini-leachfield type system only. Plus 2 feet (610 mm) for each additional foot of depth in excess of 1 foot (305 mm) below the bottom of the drain line.

[7]Applies to mini-leachfield-type system only.

[8]A 2-foot (610 mm) separation is required for subsurface drip systems.

[9]For parallel construction or for crossings, approval by the Administrative Authority shall be required.

Table G-2 Mini-Leachfield Design Criteria of Six Typical Soils

Type of Soil	Minimum sq. ft. of irrigation area per 100 gallons of estimated graywater discharge per day	Maximum absorption capacity, minutes per inch, of irrigation area for a 24-hour period
1. Coarse sand or gravel	20	5
2. Fine sand	25	12
3. Sandy loam	40	18
4. Sandy clay	60	24
5. Clay with considerable sand or gravel	90	48
6. Clay with small amount of sand or gravel	120	60

Table G-3 Subsurface Drip Design Criteria of Six Typical Soils

Type of Soil	Maximum emitter discharge (gal/day)	Minimum number of emitters per gpd of graywater production
1. Sand	1.8	0.6
2. Sandy loam	1.4	0.7
3. Loam	1.2	0.9
4. Clay loam	0.9	1.1
5. Silty clay	0.8	1.6
6. Clay	0.5	2.0

Use the daily graywater flow calculated in Section G-6 to determine the number of emitters per line.

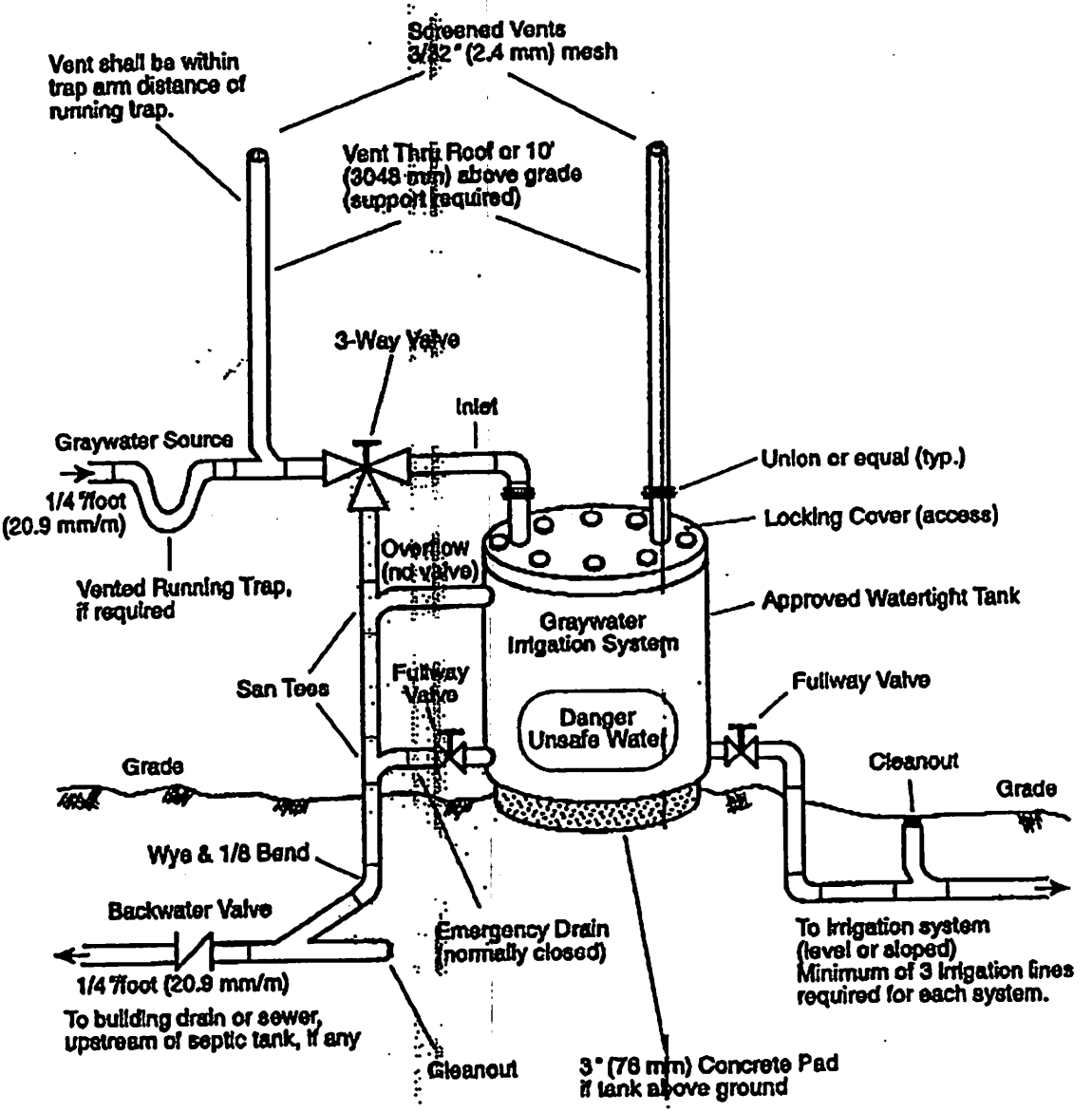


Figure G-1
Graywater system Tank – Gravity (conceptual

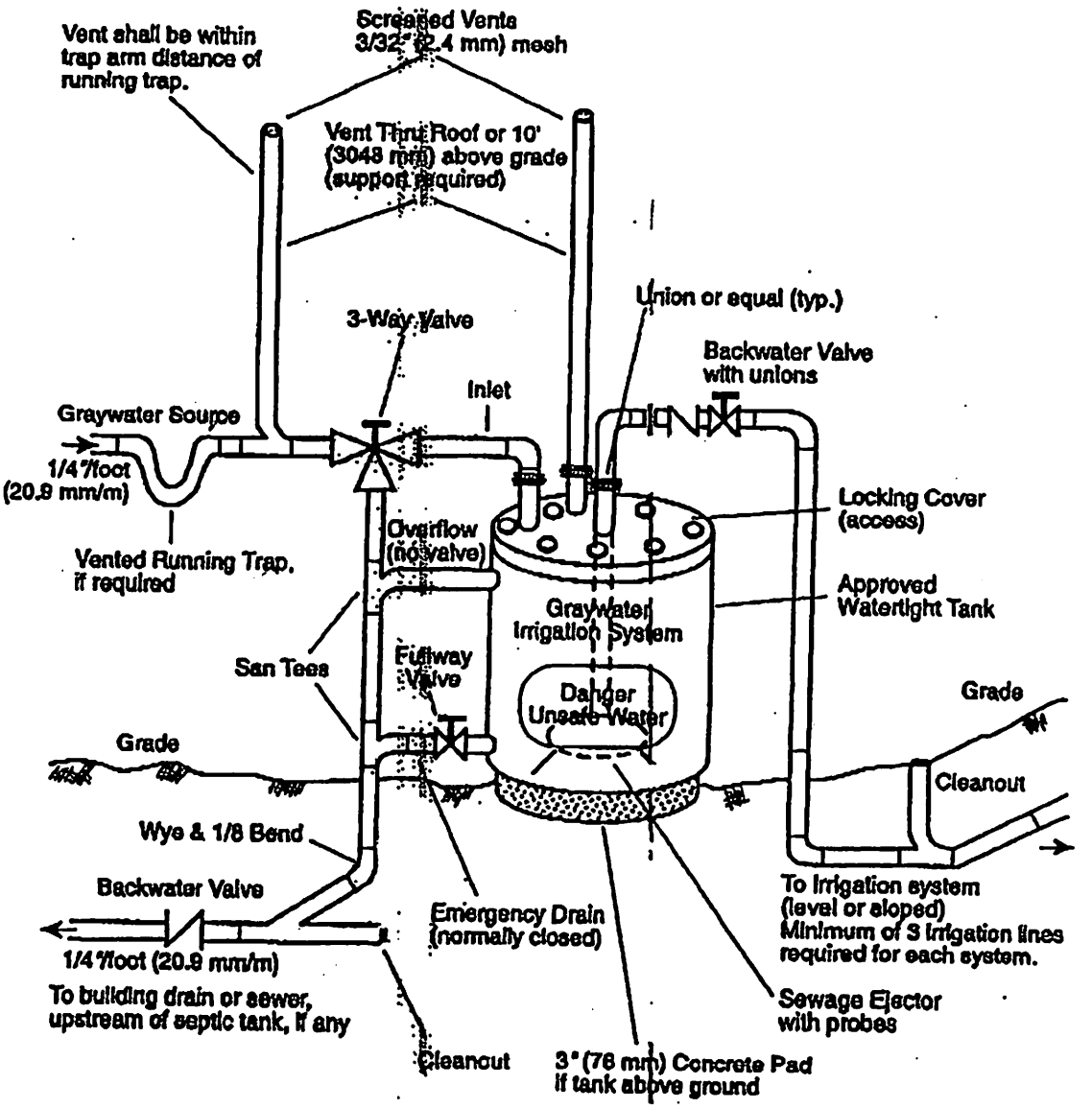


Figure G-2
Graywater System Tank – Pumped (conceptual)

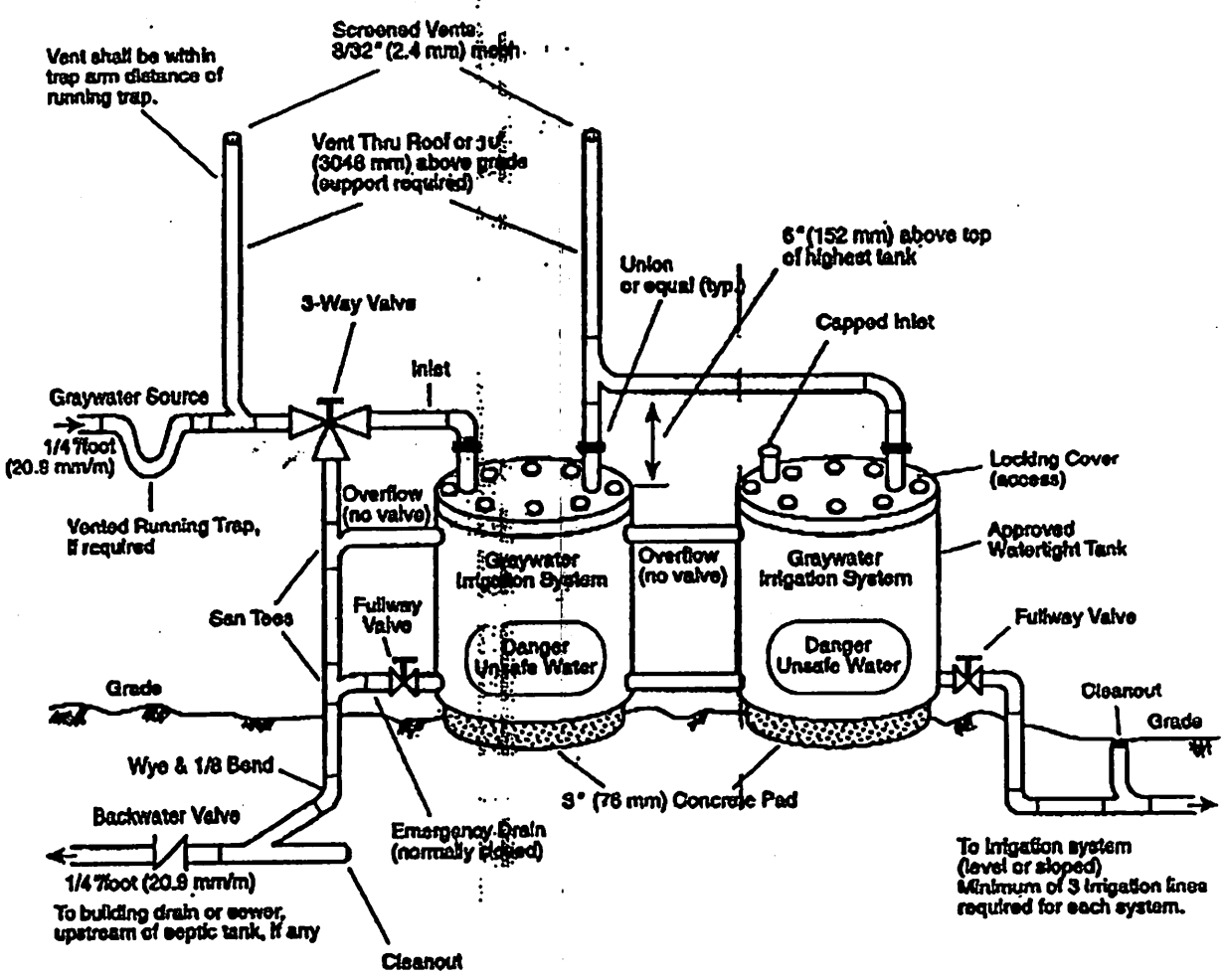


Figure G-3
Graywater System Multiple Tank Installation (conceptual)

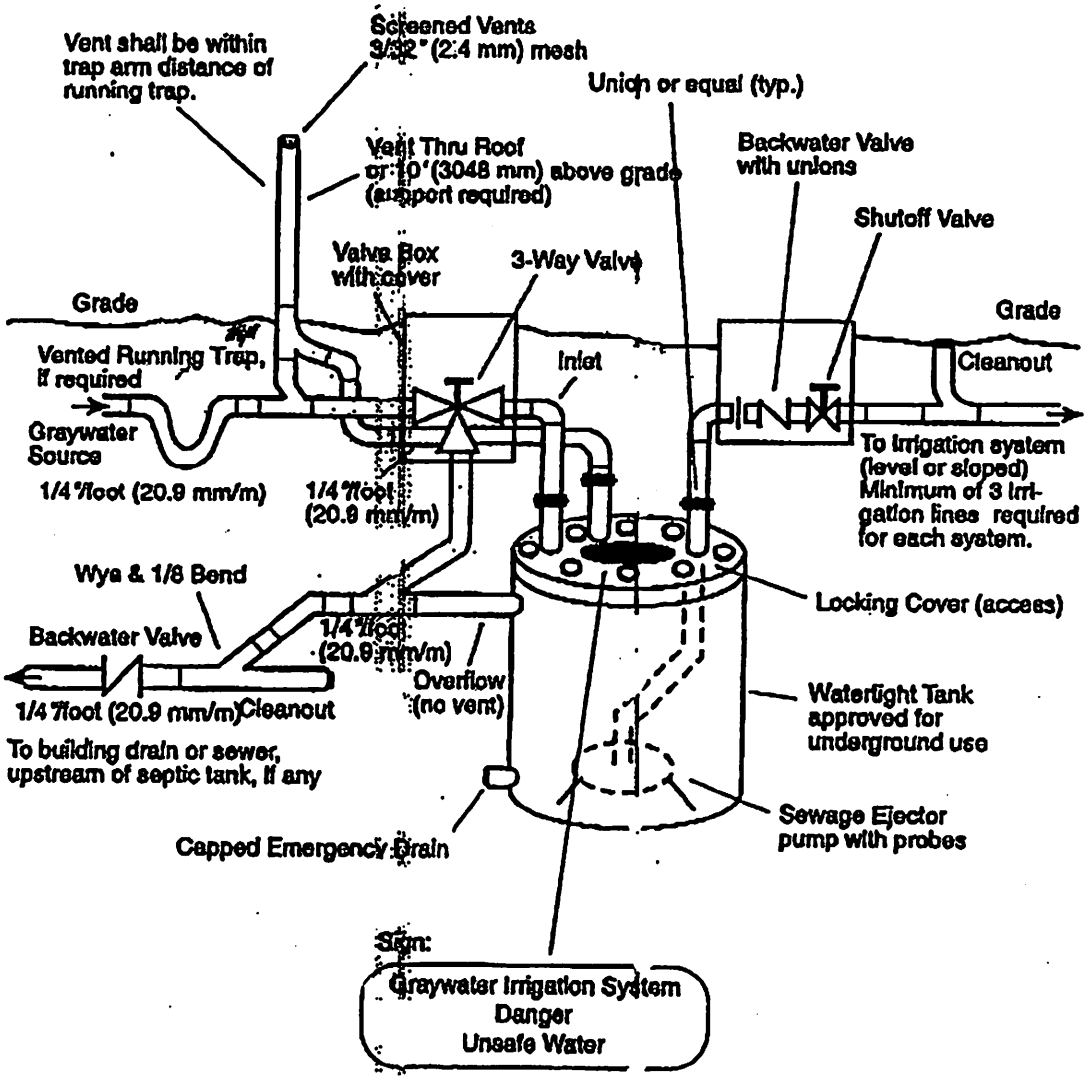
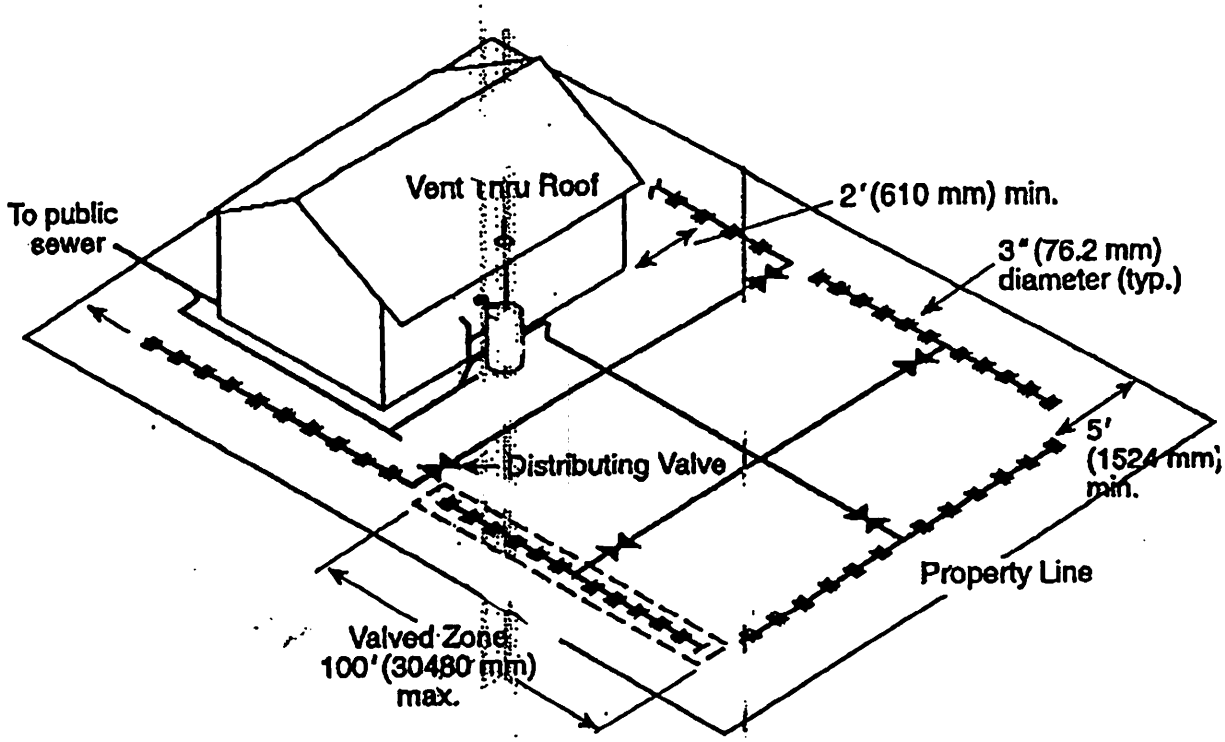


Figure G-4
Graywater System Underground Tank – Pumped (conceptual)



Note: Each valved zone shall have a minimum effective absorption/irrigation area in square feet predicated on the estimated graywater discharge in gallons per day and on the type of soil found in the area. The area of the field shall be equal to the aggregate length of perforated pipe sections within the valved zone times the width of the proposed field.

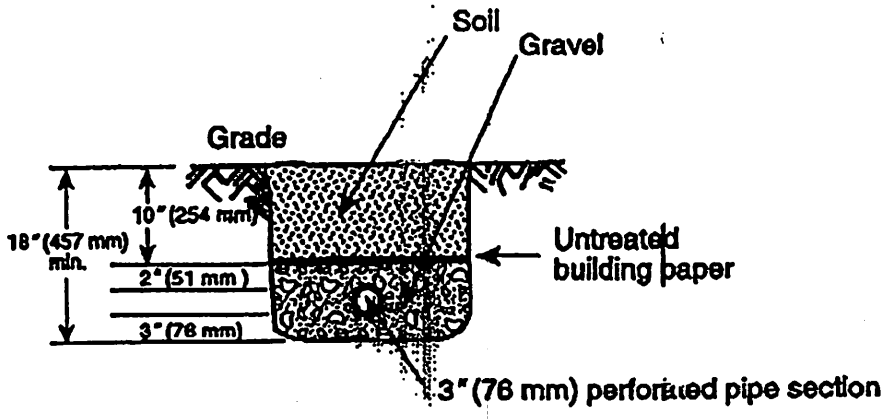


Figure G-5
Graywater System Typical Irrigation Layout (conceptual)