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EPA

# The Alternative is Conservation

## 830K80100

# A Companion Guide to "The Alternative is Conservation"

**The Alternative is Conservation,** a 20 minute, color production available in either 3/4" videotape cassette suitable for televised broadcast or in 16mm film

Many community organizations, local and state government agencies and Federal programs use this film for the following

- generating voter interest and responsiveness on major public investment decisions
- water conservation programs
- workshops on wastewater treatment and water supply construction
- adult education
- environment and civic student classroom discussions
- promoting constructive discussion among conflicting groups

Some communities have shown the video cassette version on local television programs The programs air **The Alternative is Conservation** followed by a panel discussion. Televised programs may be recorded from the telecast and used without charge for educational or public information purposes

To order this publication,
FRD-12 "The Alternative is Conservation", write to:

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**Content:**
The film provides a forum for informed and constructive discussion among viewers. The viewer visits eight communities Each community has a different understanding of their water problems and a variety of ideas for solving them

In each case, the film highlights the positive results of the community's approach to their wastewater management or water supply problems The film interviews water commissioners, sanitary district engineers, local government officials, business owners and managers, homeowners, manufacturers of water conserving products, Board of Health members and other individuals

***Some of the major ideas presented in the film are:***

- benefits of water conservation to the community
- role of conservation in helping solve specific problems such as water supply and collective wastewater management
- role of conservation in helping solve individual on-lot problems
- management requirements to make a community conservation program effective.
- devices homeowners can use to conserve water
- description of EPA's facility planning requirements and relationship to conservation program

***Comments from viewers include:***

"You made me understand the connection between wastewater and freshwater "

"Conservation makes sense for treatment and supply, I never heard that before "

"The videotape would be particularly helpful to community people who are entering into a Step I Facilities Plan At that point they are open to suggestions of alternative solutions In addition, the tape may aid consultants working on 201 projects as they describe the water conservation measures specified in the EPA regulations "

Copies of either the film or video cassette are available for loan or purchase from **USER, INC. 30 Bates Road, Watertown, MA 02172.**

# Investing In Your Water System

*Traveler, there are no paths Paths are made by walking*
*antonio machado*

We have water problems Almost every city and town in the country is faced with water shortages, excessive wastewater flows, contamination of water sources, and loss of aquifer recharge areas.

A lot of water has flowed over the dam and through the treatment plant since we outgrew the backyard well and outhouse by inventing the "limitless" (municipal) water supply and treatment system Since then we have invested billions of dollars in water supply systems, new water sources, and in treatment and disposal of wastewater

But will pouring money into *more* water supply and *more* treatment plants solve the problems facing us today?

Could we alleviate if not eliminate many of our water problems if we used the water we have more efficiently?

It is difficult for a community to stop and ask this question when faced with a water problem which demands immediate attention The easiest answer is often to increase water supply or to expand wastewater treatment However, the problem may never have been accurately identified and properly analyzed to determine if there is a more appropriate solution Too often, considerations or pressures unrelated to the immediate problem confuse the issues And seldom is there enough information on alternative courses of action

In this guide we discuss how a decision maker, a government official, or a voter, can make a deliberate, reasoned, and logical analysis of the problem before getting trapped into a solution by default. This analysis can suggest a course of action even if you lack complete information If you participate at some stage of the decision-making process, we offer

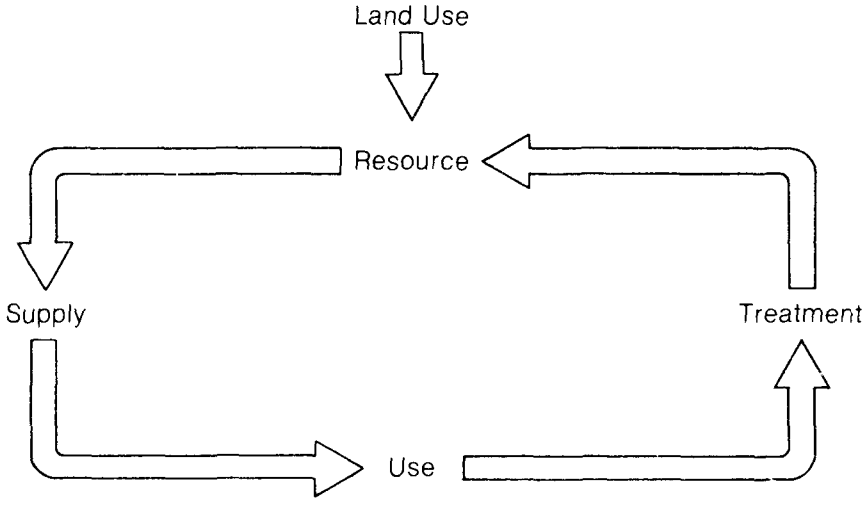
- ways of using available information to throw more light on the problem.
- suggestions for making judgments based on available information.
- an investment strategy for solving water problems, and information on conservation techniques.

We discuss conservation as a practical, cost-saving, and necessary alternative to the traditional expansion of supply and treatment for meeting our water needs

## The Water System and the Cost of Maintaining It

In the natural water system (cycle), precipitation falls on the land and drains into water sheds and river basins Some collects in surface waters such as ponds and lakes while some seeps into marshes and swamps and into the porous subsurface soils (aquifers) as groundwater Through absorption, evaporation, wind, and rain, this cycle continues through the years and makes water available to nourish life

Humans place the greatest demands on this cycle We also make major modifications in it. For example, we grow citrus fruits and lawns in the desert, transfer water from one watershed to another, and use surface waters to transport wastes away from our cities, industries, and homes




Imagine the water system as a huge liquid transportation system Fresh water is shipped in for treatment, then transported to industrial, farming, or residential users The users actually consume a minute portion of the water, throw wastes into the rest of the water, and ship it back to the starting point where the process begins all over again

Depending on how much water the various consumers want to use, we must invest in more supply And, depending on what sort of wastes the various users put into the water, we invest in wastewater treatment facilities These facilities clean the water before we use it again Just as it takes billions of dollars to build and maintain the interstate highway system, it takes billions of dollars to build and maintain the water system which supports our industrial and agricultural productivity as well as our home lives - the system provides water for swimming pools, baths and showers, water for coffee and orange juice in the morning, and water to flush toilet and sink wastes away from the home But at what cost?

Let's look at just one investment stream—tax dollars used for wastewater treatment Americans invested an estimated $20 billion between 1972 and 1977 for wastewater treatment. Another $20 billion is scheduled to be spent by 1982 for the same purpose. Experts predict another $100 billion more is needed to do the job. Almost all of this money was and will be spent on building conventional wastewater treatment plants, sewers and other facilities But is this kind of investment in treatment necessary?

Two alternative investment options appear One option is investment that helps use the water currently available more efficiently The other investment option reduces the external costs of using the water supply as a waste transportation system. External costs include the tens of millions of dollars required to clean up chemical dumps like Love Canal, or the hundreds of millions of dollars needed to clean the Hudson River of PCBs Toxic chemicals left unattended by industrial water users, buried in public "sanitary" landfills, or mindlessly discarded by homeowners contaminate the water supply if left unattended This creates investment demand for new, uncontaminated water supply, and pressure for "advanced" wastewater treatment Unfortunately, neither alternative makes contaminated water safe again for human consumption

Contaminated water can be cleaned in two ways One way is to recycle wastewater at its point of use (waste-stream separation), and clean it before it goes into the water system Another method is to avoid the use of water as a waste transportation system in the first place Often productive uses can be found for what were previously considered wastes

## Creative Conservation

Creative conservation includes investments to produce more efficient water use and investments which reduce the wastes flowing to treatment plants (or septic tanks).

Although conservation is an unquestionably difficult and an often unpopular concept, its importance grows daily. Many people still believe that to conserve means to do without But a growing number of engineers, businessmen, government officials, and citizens view conservation as a creative means to solve their problems

In this new context, conservation means innovation in the productive use of water, innovation in the productive use of what was once considered waste, and the elimination of water for the transportation of wastes from one place to another

Opportunities for investment in creative conservation measures must receive equal consideration with investments in new supply and wastewater treatment facilities.

## Investment Options

Which one will you choose?

- Supply augmentation
- Wastewater treatment alternatives
- Water-use conservation measures
- Clean-up hazardous wastes
- Do nothing

This simple list suggests five major investment options for a community with water problems. No matter which one of these options is chosen, the costs and benefits of each option must be weighed.

First of all, many of you may ask, "How can doing nothing be an investment option?" A do-nothing option means that the community decides to take the money it would have spent in solving its water problem and use it in some other way. The community may decide to build more roads, to build another school, or to hire more police However, the costs and benefits of the do-nothing approach must be weighed against the costs and benefits of solving the problem

Waiting to solve the town's wastewater problem until the board of health puts a two-year building moratorium on future growth is expensive Finding a new public water supply after the "sanitary" landfill or a toxic waste dump has polluted the town's ground water supply is even more expensive Often a do-nothing approach proves vastly more expensive to taxpayers and to the health of the community Devastating long-term costs may be avoided with a relatively small expenditure today

A choice of one option, such as wastewater treatment, does not foreclose creative conservation measures A balanced investment approach is best. Each option can complement the others

For example, if someone proposes a $1 million wastewater treatment plant, we must ask a few questions· How much extra wastewater treatment do we need? Can we obtain the same amount of treatment for less cost in an alternative manner? If we put some money into cleaning up wastes at the source, does this open up new, less expensive wastewater treatment alternatives? Does water conservation reduce the scope of the problem This type of analysis must be done before any decision is made As the analysis proceeds, the list of options might look like this

## Wastewater Treatment Options

for a hypothetical community* (all numbers are in thousands)

| Type Of Treatment | Initial Cost | Yearly Operating & Maintenance Costs | Present Value Of All Future Costs Over Next 20 Years |
|---|---|---|---|
| ***CENTRALIZED*** | | | |
| Conventional treatment | **$1000** | **50** | **1425** |
| Land application | **650** | **20** | **820** |
| Holding Ponds prior to Land application | **500** | **10** | **585** |
| Aquaculture Systems | **600** | **20** | **770** |
| Silvaculture Systems | **600** | **15** | **730** |
| Re-use for Industrial Processes | **400** | **25** | **615** |
| Sludge Composting | **500** | **10** | **585** |
| Anaerobic Digestion to Produce methane gas | **500** | **—** | **500** |
| ***DECENTRALIZED*** | | | |
| Rennovation of existing systems in problem areas | **200** | **20** | **370** |
| Composting Toilets | **300** | **10** | **385** |
| Low Flow toilets & devices | **200** | **—** | **200** |
| Conventional Package treatment | **250** | **15** | **380** |
| Pricing and land use controls | **100** | **—** | **100** |
| Sand Filtering | **250** | **5** | **295** |
| Mounds, alternating fields and evapotranspiration systems | **250** | **5** | **295** |
| Greywater segregation & re-use | **150** | **10** | **235** |

***This table is for illustrative purposes only.***

It is neither exhaustive nor is it intended to indicate that one method is better or less expensive than another For each particular case, the relative and absolute costs will vary. However, the decision maker should request this type of comparative data for the alternative solutions proposed in his or her community.

The assumptions for these calculations are a 10% discount rate and zero inflation effects on future cash flows. Since the choice of assumptions is an important determinant for the final present value, a large margin of absolute error is always to be expected However, the calculation will highlight if one option is approximately 2X or 3X as expensive over twenty years as another option

Consideration should also be given to alternative packages of options which produce an optimal solution

# Protect The Resource

*The frog does not drink up the pond in which he lives*
*american indian proverb*

## Water Management Principles

Protect the watershed

Protect aquifer recharge areas from being built upon or polluted

Use the water you have more efficiently rather than go after greater supply

Take the wastes out of the water stream. Water is becoming too expensive for use as a waste transportation system

Combine water supply and wastewater management districts, they are part of the same system.

Conservation must be rewarded Businesses and households that conserve should pay less for water and sewer than more wasteful users

It is less costly to clean up toxic waste dumps before they pollute the water supply. It's much less costly to properly dispose of toxic wastes in the first place

Price water at the marginal cost of new supply Water users should pay the real cost associated with producing fresh water supply and cleaning wastewater for others consumption

Before investing in wastewater treatment facilities look at the long term costs for operating and maintaining the facility

***It is essential to protect the resource.*** There are five major ways to do this.

- land use controls
- keeping wastes from the water system
- solid waste disposal controls
- hazardous chemical use and disposal controls
- minimizing water consumption waste

## Land Use Controls

Land use controls offer the greatest opportunity for protecting valuable aquifer recharge areas and surface waters Zoning is the major technique Zoning can protect resources directly through protection districts for watersheds, wetlands, and aquifer recharge areas Indirect means include preformance zoning, cluster zoning, and other techniques

Although located less than twenty miles from the heart of Boston, Lincoln, Massachusetts has thousands of acres of open land, miles of ski and bicycle trails, and a rural atmosphere Lincoln wants to continue growing while maintaining its own water supply and aquifer recharge areas Officials and citizens are working together to this end

The town's conservation commission mapped out all of the land containing major resources and compiled a list of the properties and the owners As these properties come up for sale, the commission works with the owners to preserve the resource value of the property, at the same time providing the owner with the financial benefits he or she would have derived from developing the property to the density allowed by law They do this using a combination of techniques:

- Direct purchase of property (or part of it) by the town
- Gifts of property to the town by the owner
- Use of a cluster zoning allowance together with a dedication or gift of a portion of property to the town This allows for more intense development on a portion of the property while protecting the part of it that is valued for aquifer protection, farmlands, and so forth

The town has been able to continue growing, and that growth has not cost the community important resources The town has at least 1400 acres of land that it protects in order to conserve water and farm resources, a large portion of this land was acquired at no cost to the town. Lincoln is one of the few towns that is not hooking up to the Metropolitan (Boston) District Commission water system which gets its water from western Massachusetts It is "living within its capacity" while accommodating more growth

## Waste Stream Separation

Separating industrial wastes from household wastes at the source keeps poisons out of the wastewater The wastewater can then be reused for irrigation The sludge can be used for fertilizer without fear of contamination from toxic industrial wastes

There are now 12,000 potentially toxic chemicals now in industrial use. Approximately 500 new chemicals are produced each year and introduced into manufacturing processes No form of treatment totally cleanses the water of these chemicals.

The IBM plant in Tucson is a positive example of an industry taking responsibility for its waste streams. There are two water systems in the plant: one for sanitary purposes and the other for industrial purposes. Both are treated and recycled. The community is not burdened with the cost of treating industrial wastes produced by the plant. The plant is designed to provide for its own needs.

## Solid Waste Disposal Controls

Wastes pose the most dangerous threat to public water supplies. In 1979 the Metropolitan Boston area thirteen communities lost their water supplies because of toxic solid wastes seeping into the ground and surface waters All urban areas are faced with the same situation Waste dumps are ticking time bombs that have only just begun to go off. Even if the production of all toxic solid wastes were to stop today, we would still have a legacy from the past to clean up These dumps must be cleaned up before they do irreparable damage to the ground water

## Hazardous Wastes Controls

Hazardous wastes enter water supplies not only through improper dumping, but also through presently legal activities

For example, common practice in the Pacific Northwest is to spray petro-chemical defoliants on forests This eliminates underbrush and makes it easier for lumber companies to harvest the trees However, these chemicals enter surface water and seep through the ground into the ground water Traces of these chemicals can be found in all the drinking water in the region Local communities are attempting to control or eliminate the use of chemicals which enter the water cycle and end up in everyone's drinking water.

## Minimizing Waste In Water Consumption

Waste can be minimized through leak detection and repair, conservation, greywater reuse, building and plumbing codes, and water pricing

## Leak Detection and Repair

A leak detection survey can be a cost-effective means for a community to conserve water Particularly in older towns and cities, water lost through leaks in the public water supply pipes often represents a significant percentage of total water use. In communities that think they need more water supply, this should be an early step in the search for more water

Water leaks in home plumbing can be costly, especially if the leaks are in the hot water system Such leaks are easy to find and repair.

# How To Choose A Strategy That Solves Your Community's Water Problems

*The greatest of all gifts is the power to estimate things at their true worth.*
*la rochefoucauld, reflexions*

## Set Your Priorities and Plan Ahead

The water commissioners for two major metropolitan regions in the United States expect the water supply for their cities will be totally inadequate in less than eight years. However, no major investments in solving the problem are planned because, in each case, city government is so preoccupied with day-to-day problems that its priorities reflect only urgent short-term problems The more important question of water supply is being neglected until it too becomes urgent

## Accurately Identify the Problem

Too often, expensive facility-plan studies have been done without actually determining the nature of the problem and its origin Often a user-need survey is an appropriate first step for a facilities plan

When the septic tanks in the center of Bolinas, California started overflowing, the consultant engineers, with government support, proposed a $12 million sewer system This community of less than a thousand people then began to wonder if the proposed sewer system wasn't more of a problem than the problem it was designed to correct. For one thing, the sewer engineers wanted to run a pipe through a coastal bird sanctuary over the San Andreas fault The taxpayers in the town would also have had to pay large maintenance and operating costs each year to run the elaborate and expensive treatment plant.

Citizens in the town responded by requesting an Environmental Impact Study (EIS) on the proposed sewer Part of the EIS was to accurately identify the problem, septic system by septic system To do this, they went door-to-door, assessing each system and educating homeowners on proper septic tank practices

Using the results of the study, the town built a small central collection system for the center of the town only Treatment is a natural biological system of four settling ponds. Wastewater works its way through each of these ponds and, by the time it reaches the fourth pond, it can be sprayed on forage crops. The town also permits and encourages the use of composting toilets and the recycling of greywater for watering lawns

The user-needs survey saved the town $10 million in construction costs. By choosing a non-mechanical biological treatment process the town also saves each year on maintenance and operating costs. Eighty acres of crop land are irrigated by the town's wastewater at no additional cost The bay ecology is spared disruption from construction of the proposed pipeline And no additional residences in the town must hook up to the system in order either to have enough water for the system to function properly or to pay operating and maintenance costs of the treatment system

## Shop Around for the Best Technical Advice

Not all experts are equally knowledgeable or competent to solve the particular problems which are identified

Just as it is inappropriate to ask a surgeon to cure a cold, it makes no sense to ask a sewer engineer to design a conservation program for your community Often, the choice of a consulting engineer will determine what solutions are investigated and what recommendations are made A community may benefit by choosing more than one consultant and asking each to recommend alternative solutions and outline the costs, advantages, and disadvantages of each so that a balanced, rational investment program will be considered

What happens when a community does not receive more than one opinion in the beginning of a facility planning process is illustrated in the case of Tisbury, Massachusetts Tisbury has been stalled for over five years in the facility planning stage Septage from malfunctioning and overused septic tanks in the town was deposited in the town dump only five hundred feet from the town well. First the consulting engineers recommended a $12 million treatment plant and sewer to solve the problem However, the town voters refused to pay for this expensive system The sewer engineers then proposed a scaled down $8 million version to service seven hundred homes and businesses

Dissatisfied with this proposal, the town's citizens requested an Environmental Impact Study Another set of consulting engineers recommended a $2 million treatment plant for 120 homes

In evaluating these recommendations, members of the board of health realized that a user-needs study was never performed to determine exactly where problems were in this town of two thousand people This study, finally performed by members of the community themselves, identified seven septic systems which were the cause of the problem

Since then, citizens have invested in devices to reduce the volume of wastewater, such as two-quart toilets (replacing five gallon flush toilets) and low-flow showerheads Many of the problems for which the $8 million treatment plant was proposed may be eliminated by private efforts at less expense to the town

## Identify Your Overall Objective

Too many communities skip this step by glibly stating that their objective is to solve their town's water problem. With such a limited perspective, it is far too easy to generate more problems than you "solve."

In Phoenix, Arizona, water is in short supply, but at the same time wastewater flows in the treatment plants are in excess of capacity. In the southeastern part of town, the U.S. Water Conservation Laboratory is experimenting with a technique which could solve both problems simultaneously. They are treating wastewater by land application in order to recycle it back for irrigation of farmlands. However, on the opposite side of town, the city has decided to solve the excess wastewater problem by selling it to the local utility to cool its nuclear power plant. The problem with this solution is that it ignores the other major problem: water supply. The wastewater sold to the power plant will be completely consumed and no longer available for irrigating crops, for reclamation, or for anything else.

The communities' overall objectives must determine what solutions are finally chosen.

## Identify Your Options

Water demand for the greater Boston area grows each year. Over the last one hundred years Boston has tapped water further and further from the city. Today water is piped in through a series of reservoirs from one hundred miles away in the western part of the state. Boston officials now want to divert the Connecticut River to augment supply. However, citizens of the Connecticut River Valley fear this $100 million project may produce expensive environmental damage and prevent growth in the western part of the state. They suggest that investment in conservation measures such as fixing leaking public water supply pipes may augment supply for less cost. Engineering studies indicate that the water lost each year due to leaking municipal waterpipes is almost equal to the extra water that would be available from the diversion.

## Match Your Choices with Your Objectives

Elmhurst, Illinois is located twenty miles from Lake Michigan, the second largest body of fresh water in the world. However, competition for this water among Chicago and its suburbs left no choice for Elmhurst—it either had to build a new town deep well for $400,000 or use its present supply more wisely.

The town's objectives were to secure needed water supply at minimum expense to the town while protecting the resource. Elmhurst decided to promote a door-to-door campaign teaching homeowners about their own water systems, and how to conserve. The campaign cost approximately $50,000, or $1 per person. The town distributed low-flow showerheads, toilet dams, and information on how to install them. The result was a

13% reduction in water consumption, an added benefit was less demand on wastewater treatment facilities Elmhurst can now add an extra four thousand housing units to the waste treatment plant because less wastewater is generated In this case water conservation allows for growth without construction of water supply or treatment facilities

## Don't Forget About Inflation Protection

Inflation means that if the choice the community makes today isn't a good one, it will cost much more in the future to do it right Cleaning up an aquifer or building a new water supply after the town's supply is polluted by toxic wastes almost invariably costs many times more than eliminating or containing wastes in the first place Eventually the community will have to pay one of these two costs In the past, communities often chose to defer these costs, reasoning that their children will be better off than their parents and better able to afford these costs Today however, the concern is that our deferred costs are rising at a much faster rate than the deferred benefits we will leave to our children In other words, unless we change our strategy our children may not be better off than we are today, and may be even less so

# Wastewater Treatment Options — Clean Water Act of 1977

*The city of Amastris, sir, which is handsome and tastefully built, possesses among its finest constructions a very beautiful and at the same time very long boulevard, all along one side of which runs what indeed is called a river, but is in reality a very foul sewer, hideous with its filthy aspect, and equally pestilent from its disgusting odour. For this reason it is a concern of salubrity no less than of appearance that it should be covered up. This shall be done, with your permission, on our undertaking that money too shall not be wanting for the execution of a work as important as it is necessary.*

*letter from pliny to trajan, circa 61 - 113*

In 1977, Congress passed the *Clean Water Act* which amended the Federal Water Pollution Control Act of 1972, to encourage innovative and alternative wastewater treatment solutions. The *goals* of the act are the following:

- eliminate discharge of pollutants
- reduce costs
- increase *energy conservation* or recovery
- *recycle and conserve water* resources (including preventing the mixing of pollutants with water)
- *reclaim or reuse effluents* to increase land productivity
- improve the efficiency and reliability of water systems
- *use sludge or effluent beneficially*
- manage toxic wastes for increased environmental benefits

## Innovative and Alternative Technologies

Under the new Act, grant recipients are required to analyze innovative and alternative treatment processes and techniques for use in wastewater treatment works.

The Clean Water Act and its legislative history make it clear that the provisions pertaining to innovative and alternative technologies are intended to achieve greater use of systems which reclaim and reuse water, productively recycle wastewater constituents or otherwise eliminate the discharge of pollutants, or recover energy.

The principal difference between alternative and innovative wastewater treatment technologies, as viewed by the 1977 Act, is the degree to which they have been developed and implemented. Alternative wastewater treatment processes and techniques are those which have been proven and used in actual practice, innovative processes and techniques are developed methods which have not been fully proven under the circumstances of their contemplated use. The goal of achieving greater recycling and reclamation, however, is clearly indicated as

being an objective common to both innovative and alternative technologies Any risk associated wih using innovative technology is balanced by the very real potential for public benefits including energy and cost savings

*States are authorized to give higher priority* to treatment work utilizing innovative and alternative technologies

**Funding:**
The Act provides for Federal *grants* for *85% of allowable construction costs* for treatment works or significant portions of treatment works that utilize innovative and alternative treatment processes and techniques

The Act provides 100% Federal grants for *replacement or modification* of malfunctioning treatment works constructed under an 85% grant

The cost effectiveness guidelines permit a *15% cost preference* for treatment works that utilize innovative or alternative processes or techniques

**Grant Eligible Methods:**
*For effluent treatment*
- land treatment
- aquifer recharge
- aquaculture
- silvaculture
- reuse for industrial processes and other non-potable purposes
- horticulture
- revegetation of disturbed lands
- holding ponds
- holding ponds prior to land treatment
- total containment ponds

*For sludge treatment*
Land application
- *horticulture, silvaculture, agriculture*
- composting for beneficial reuse
- revegetation of disturbed lands

Energy recovery
- anaerobic digestion to produce and recover over 90% methane gas
- self-sustaining incineration

*Individual* treatment systems and other *on-site treatment* systems and facilities that are constructed for septage treatment are eligible for funding This includes compositing toilets and septic tank renovation and replacement as part of an overall local plan.

## Flow Reduction

*Any facilities plan submitted to EPA must include an evaluation of costs, cost savings, and the effects of flow reduction measures over a 20-year period,* unless average daily base flows from the area are less than 70 gallons/day/capita, or the current population of the applicant is under 10,000

Flow reduction measures may include:

- a public information program
- pricing and regulatory approaches
- installation of water meters, and retrofit of toilet dams and low-flow showerheads for existing homes and other habitations
- specific changes in local ordinances, building codes or plumbing codes requiring installations of water saving devices such as meters, water conserving toilets, showerheads, lavatory faucets, and appliances in new homes, motels, hotels, institutions, and other establishments

## Public Participation

Each agency (EPA, state, interstate, substate) responsible for development of the facilities plan must conduct a continuing program for public information and participation including the following:

- the timely provision of information to insure meaningful and active participation
- continual updating of the public on policy, programs and technical information, highlighting significant issues

### Advisory Groups

The facilities grants program may require the creation and participation of an advisory group. Its role is to provide advice and recommendations to elected decision-makers and to encourage discussion among the interests represented in the group. The group should be representative of

- private citizens
- public interest groups
- public officials
- citizens or organizations with a substantial economic interest in the plan

Their main duty is to monitor the progress of the facility plan and to become familiar with the relevant issues The group may also take on responsibility for conducting public participation activities to involve and inform more people and groups EPA has the responsibility of training and providing assistance to the advisory group.

# Household Devices To Conserve Water

*The consumer now presides over the most vital, productive, and rapidly growing portion of the economy (his or her household)*
*scott burns the household economy*

## Regulator Valve

Regulator valves reduce home water pressure to 50 lbs This conserves water and reduces wear on washing machines. They come with automatic control, and they cost less than $50 plus installation, they can conserve more than 30,000 gallons of water per year

## Devices for Faucet and Shower

### Spray Taps

These are actually mini-showers designed for use in sinks and wash basins Water is sprayed from the tap rather than issuing a single stream as in conventional faucets The spray allows for faster washing and rinsing with less water used as a result When these devices are combined with thermostatic mixing valves, water savings of up to 90% are claimed by the manufacturer. The saving of hot water is especially significant since it results in a savings of electricity or gas in the water heater

### Faucet Aerators

This device mixes water with air, reducing the amount of water flowing from a faucet so that less water is used for washing and rinsing

### Flow Control Devices

Flow control devices limit the rate of flow from showerheads and faucets These devices are usually nothing more than valves that fit into the supply lines for faucets or showers Flow is usually limited to 2 5 gallons per minute Water savings of 50 to 70 percent are claimed for flow-limiting showerheads and up to 50% for faucets

### Thermostatic Mixing Valves

These valves mix hot and cold water to preset temperatures. Water issues from the tap at this temperature. Thus, water is not wasted while its temperature is being adjusted by manipulating the hot and cold water faucets

### Flow-Reducing Showerheads

These showerheads replace any regular showerheads. They reduce shower water consumption by as much as 75% They will pay for themselves in no time from the energy savings reflected in the hot water

bills. Two types are available: plastic inserts or plastic showerheads and metal showerheads The metal showerheads seem to give a better shower and save more water Retail prices are less than $15.

## Devices for the Toilet

The conventional gravity operated toilet uses 5-8 gallons per flush Only 2-2½ gallons is really needed to carry away the water, the remaining 3-5 gallons are required to build up enough head pressure to flush the bowl

### Toilet Dams or Plastic Bottles

Toilet dams or plastic bottles (with rocks in the bottom to weigh them down) placed in the tank will save 1-2 gallons per flush by forming a reservoir in the tank while maintaining the necessary head pressure The cost ranges $ 0-8

### Shallow-Trap Toilets

Shallow-trap toilets have a smaller water reservoir than the conventional toilet and use only 3½ gallons/flush It operates the same way and is no different in appearance than a conventional toilet It costs less than $80.

### Pressure Toilets

Pressure toilets store water under pressure so that when the toilet is flushed, the air pressure provides the velocity required to clean the bowl Such systems use only 2½ gallons/flush Cost less than $60

### Other Pressure Toilets

These systems use compressed air from an air compressor to flush the toilet The advantage is that only two quarts of water are needed per flush This toilet requires no modification to existing plumbing Cost less than $600

### Dual-Flush Devices

This device has two flush volumes By pushing up on the handle a smaller amount of water is flushed for liquids, by pushing down, a normal flush for solids It .its most toilets

### Dry-Composting Toilets

Composting toilets collect urine, feces, and kitchen wastes in an impervious container, and compost these wastes to produce a high quality soil fertilizer The toilet uses no water, creates no odor, and is approved for use in 30 states Two basic types are available electric models which easily replace conventional toilets and large box models requiring more plumbing modification The systems work on gravity and thus are vertical Electric models cost less than $1,000 Commercially produced large box models are available which accommodate a family of six Larger models are also available for public and commercial uses These cost less than $2,000

### Note:

Chemical and oil-flush toilets are purposely deleted from this list as options only where low flow and composting toilets are inadequate

## Cost Estimate for Four-Member Family

(using a combination of devices to conserve water)

***Costs***

| | |
|---|---|
| **Material Cost:** | |
| • 1 shallow trap res | **$ 70.20** |
| • 1 flow control shower | **15.00** |
| • 2 aerators | **3.00** |
| | **$ 88.20** |
| **Labor Cost:** | |
| • 6 hrs. at $10/hr | **60.00** |
| | **$148.60** |
| **Expected Life:** | |
| • 20 years | |
| **Depreciated equipment cost/year:** | **7.40** |
| **Extra maintenance and energy cost/year:** | **0** |
| ***Savings*** | |
| **Cost of water saved/year** (Louisville rates) | **$ 13.70** |
| **Cost of energy saved/year** (Cincinnati rates) | **22.32** |
| **Cost of sewage treatment saved/year** (Louisville rates) | **14.00** |
| **Total savings/year** | **$50.02** |
| **Net savings/year** | **$42.62** |

| | |
|---|---|
| **Water saved:** | **56 gals/day**<br>**20,400 gals/yr** |
| ***Return on Investment*** | **24%** |

**How much water do you use?**
Each household consumes and wastes water Before you can save water and money, you should understand how you use and waste water. The chart below will help you to calculate your daily consumption of water

## Household Water Consumption

| hot water | fixture | use in gallons | x users | x uses | = gallons/day |
|---|---|---|---|---|---|
| — | flush toilet | 5 | _____ | _____ | _____ |
| — | composting toilet | 0 | _____ | _____ | _____ |
| — | low flush toilet | 3 | _____ | _____ | _____ |
| + | bathroom sink | 2 | _____ | _____ | _____ |
| + | normal shower | 20-30 | _____ | _____ | _____ |
| + | low flow shower | 8-12 | _____ | _____ | _____ |
| + | bathtub | 30-40 | _____ | _____ | _____ |
| ± | cooking & drinking | 3 | _____ | _____ | _____ |
| + | dish washing (hand) | 5 | _____ | _____ | _____ |
| + | dishwashing (machine) | 6-19 | _____ | _____ | _____ |
| + | laundry top load | 20-33 | _____ | _____ | _____ |
| + | laundry front load | 10-15 | _____ | _____ | _____ |
| — | lawn watering | 30/hr/ 100 sq ft | _____ | _____ | _____ |
| — | car washing (hose) | 5/min | _____ | _____ | _____ |

Your total water budget will be in the range of 20 gallons/person/day for a water conserving household to 80 gallons/person/day for a non-conserving household.

# Resources

*There is gold and a multitude of rubies but more precious are the lips of knowledge*
*proverbs 20:15*

## Educational Materials

**A Consumer Handbook on Water Saving and Wastewater Reduction** (19 pp., 1976) is available from the *Washington Suburban Sanitary Commission, 4017 Hamilton Street, Hyattsville, MD 20781* This is the first customer handbook of its kind produced and distributed by a water and sewer utility It offers practical suggestions for changing family and individual behavior to prevent water waste Changing water-use behavior alone can halve the amount of water households use

**Conservation Tips from PG & E**
*Energy Conservation and Services Department, 77 Beale Street, San Francisco, CA 94106* This public utility publishes pamphlets to help its customers reduce energy utility bills. A few of these are helpful for water conservation as well They are

- "Cooling Your Home More Efficiently"
- "Saving Energy with Your Swimming Pool"
- "Shoppers Guide. Refrigerators, Freezers, Air Conditioners"

**EPA Journal**
*"Protecting Water",July/August 1978 (40 pp) Office of Public Awareness (a-107), Washington D C. 20460* This issue has articles on treatment for small communities and on sludge. The Clean Water Act and the Municipal Construction Grants Programs are also discussed

**Readings in Water Conservation**
is edited by Ronnie McGhee, Mary Reardon, and Arleen Shulman, and published by the National Association of Counties Research, Inc. (338 pages, 1978) It is excellent source material for planners and officials and includes chapters on

- regulation (63 pp)
- leaks and infiltration technology (14 pp)

- water conserving devices—showerheads, clothes washers, dishwashers, toilet dams, flush adapters, and faucet controls (76 pp)
- education (20 pp)
- land use planning (34 pp)
- pricing policies (44 pp)
- water reuse (52 pp)

**1979 Directory of Federal Programs Related to Water Conservation** is published by the *Clean Water Fund, 1341 G Street, N.W , Washington D.C., 20005, (202) 638-2013,* and available from the Office of Water Program Operations, EPA, Washington, D C.

*The "Watershed" section of* **The Co-Evolution Quarterly** *(Winter 1976/77, pp 7-50, Box 248, Sausalito, CA 94965,* introduces the Watershed Quiz

- When you turn on the faucet, where does your water come from?
- When you flush your toilet, where does the water go?
- When rainwater flows past your home, what creek, lake, or river is it flowing toward?

*Peter Warshall is completing a book on* **Watersheds.** It treats the topic from the viewpoint of an anthropologist, botanist, and well-known watershed expert Contact *Sierra Club, Scribners, New York*

**Rural Sewage Treatment in Vermont: Book I, A Guide to the Alternatives,** *and* **Book II, A Planning Manual.** Book I is a source book of generic descriptions of the various types of wastewater treatment systems Book II is a water resource management workbook These are available from *Vermont 208 Water Quality Program, Agency of Environmental Conservation, Montpelier, VT 05602*

**Water Wasteland**
Ralph Nader's Study Group Report on Water Pollution by David Zwick and Marcy Benstock is a Bantam book published jointly with Grossman Publishers, Inc (1972)

**Project Water**
*The East Bay Municipal Utility District, P O Box 24055, Oakland, CA 94623* has created an entire school education curriculum around water conservation The most famous feature of this curriculum is **Captain Hydro,** a four-color comic book that is highly regarded in education circles The workbook is also available in Spanish

**The Story of Water Supply**
is a discussion in comic-book format aimed at schoolchildren It is available from the *American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235 (15 pp).*

**Environmental Conservation**
*by Raymond F Dasman John Wiley & Sons, Inc., New York (427 pp, 1976).* If the goals of environmental conservation and the well-being of humanity are to be attained, a change must take place in the attitudes of people toward nature and toward themselves This change must take place in the individual and the local community This book contains chapters on civilization and water, the aquatic environment, and the urban-industrial-technological trap.

## Films

**The Alternative is Conservation**
A 20-minute, 16mm, color documentary on water conservation. The film provides a forum for informed and constructive discussion among viewers The viewer visits eight communities Each community has a different understanding of their water problems and a variety of ideas for solving them *U S. Environmental Protection Agency, U.S.E R , Inc., 30 Bates Road, Watertown, MA 02172*

**Water Follies (A Soap Opera)**
A 16mm, color, animated presentation of the ways individuals can conserve water Sponsored by the Denver Water Department Available from *Stan Phillips Associates, Box 5286, Terminal Annex Street, Denver, CO 80217.*

## Bumper Stickers

*"Use Water Wisely"*
Illinois Interagency Water Committee,
303 E Monroe, Springfield, IL 62706

*"Dirty Cars Save Water"*
East Bay Municipal Utility District,
P O Box 24055,
Oakland, CA 94623

*"Save Water - Soap Together"*
East Bay Municipal Utility District,
P.O. Box 24055,
Oakland, CA 94623

*"1 Acre of Jojoba=30 Sperm Whales"*
ESP Jojoba, P O. Box 2749
Tucson, AZ 85702

## Conservation Techniques

**Codes**
Dick Church
Plumbing Manufactures Institute (PMI)
P O. Box 484
Glen Ellwyn, IL 60137

PMI has information and conducts workshops on plumbing codes and *residential water conserving devices*

## Drought-Resistant Agriculture

Two-thirds of the land surface of the earth is arid or semi-arid. As modern agriculture has extended into dry lands to meet the world's food needs, the set of crop species cultivated has become more limited to the high water-using types which require irrigation For example, in the Southwest where such water intensive crops as melons, citrus trees, and cotton are grown, the cost of pumping the water is growing so prohibitive (because the water is being mined from deep below the surface) that farms are being abandoned

Drought-resistant agriculture is not new, the American Indians of the Southwest cultivated many species These species are being reintroduced into the area with great success Coupled with the use of microcatchment basins, these species can be grown in the desert with less cost and produce crops suitable for commercial use. Since 30,000 species of edible seed plants (many of which are drought resistant) exist worldwide, it seems very probable that econo-mix crops may be grown in arid lands which require little irrigation.

For information on new crops economical to arid lands and those providing ground cover to protect against soil erosion, contact

- Kenneth Foster
  Office of Arid Lands Studies
  University of Arizona
  Tucson, AZ 85719

- Dwayne Fink
  U.S Water Conservation Laboratory
  4331 E Broadway Road
  Phoenix, AZ 85040

- Gary Nabhan
  Meals for Millions
  715 N Park Ave
  Tucson, AZ 85719

**More Water for Arid Lands** is a book that discusses promising technologies for conserving scarce water supplies in arid areas It is available from *The National Academy of Sciences, Washington, D.C., 154 pages, 1974*

**Social and Technological Management in Dry Lands,** *AAAS Symposium #10, edited by Nancy L Gonzales,* gives an anthropologist's views of the peoples and cultures of arid lands and their diverse farming practices It is published by Westview Press, 5500 Central Avenue, Boulder, CO

## Low Flow / No Flow Devices

**Low Flow Devices**
ECOS
Damon Mill Square
W Concord, MA 01742

**Composting Toilets**
ECOS
Damon Mill Square
W Concord, MA 01742

Clivus Multrum
14a Eliot Street
Cambridge, MA

**Low Flow Toilets**
Microphor, Inc
452 East Hill Road
P O Box 490
Willits, CA 95470
Producer of the 2 quart toilet

## Land Use

**Creative Development, Bridge to the Future,**
*by Robert Lemire Houghton Mifflin (1979)* Discusses creative development and financing techniques which protect natural resources.

## Landscaping

Peak water usage determines the size of waterpipes and treatment facilities In the arid Southwest, water systems are often three times larger than they would normally have to be just to meet the summer water demand caused by watering lawns. Tax dollars and water can be saved by using appropriate landscaping for the climate and by catching rain runoff for watering purposes.

In Tucson and Phoenix desert landscaping is very practical and is becoming very popular. It is replacing lawns in the older neighborhoods and is common in many new developments Desert landscaping requires little or no care and no watering In this way these communities are saving water for drinking purposes that otherwise would be used for irrigating lawns

**Water Conserving Gardening,** *Katherine Cuneo, Botanist, Madrone Associates, Box 2970, San Rafael, CA 94902.*
Produced for the Marin Municipal Water District, the book highlights species of landscaping plants and garden planning techniques that will ensure a green garden with little water

*For Summer—Dry—California—Water Saving Planting,* **Sunset Magazine,** October 1976.

Dwayne Fink, U S Water Conservation Laboratory, 4331 E Broadway Road, Phoenix, AZ 85040. For information on microcatchment basins which collect rainwater for use in agriculture or gardening

## Wastewater Treatment

### Aquaculture

This process is similar to conventional wastewater lagoons except that the ponds are covered. Solar heating keeps biological activity at a maximum. Plastic strips provide surface area on which bacteria grow Organisms such as snails feed on the bacteria. Other organisms in turn eat the snails, and so forth On the surface float hyacinths and duckweeds which absorb nutrients and consume suspended particles and heavy metals This is considered innovative technology

Chris Alsten
Solar Aquasystems, Inc
P O Box 88
Encinitas, CA 92024

### Conventional Wastewater Treatment

*Proceedings: National Conference on Water Conservation and Municipal Wastewater Flow Reduction.* A compilation of 28 papers presented at the 1978 EPA Water Conservation Conference. The papers are divided into six areas: federal legislative background, regulation of the water resource, water conservation technology, education and public participation, water and wastewater management issues, and case studies of water resource management Individual papers range from economic analysis to discussions of household water conservation devices. Available from ERIC, 26 West St Clair, Cincinnati, OH 45268.

*A Primer on Wastewater Treatment* is an informative survey of wastewater treatment technology and terminology. Conventional treatment of wastewater by primary and secondary filtering processes is explained along with the role of trickling filters, aeration tanks, and storage lagoons in water purification More advanced methods of treating wastewater including land application and innovative and alternative methods are also described in the booklet. Available from EPA, Office of Public Affairs (A107), Washington, D.C 20460

*Small Wastewater Systems* folder describes 21 different alternative systems for small communities and rural areas Illustrations and diagrams are used throughout. Available from EPA, Office of Water Program Perations, Washington, D.C. 20460.

**Greywater Reuse**
Clivus Multrum
14a Elliot Street
Cambridge, MA 02138
(gravel filters)

**Land Application**
*Wastewater Bonanza*, a 40 minute 16mm film on land application techniques and case studies. Available for rental *Sheafer and Roland, Inc., 130 N. Franklin, Chicago, IL 60606.*

**Land Treatment**
The U S Water Conservation Laboratory is experimenting with the use of the natural ability of the soils in the area to purify the wastewater in order that the wastewater may be used again to irrigate crops including those for human consumption Contact.

Clarence Lance
U.S Water Conservation Laboratory
4331 E Broadway Road
Phoenix, AZ 85040

**User Needs Survey**
Many communities spend thousands of dollars on facilities plans before their needs have been fully evaluated *Septic Tank Practices in Bolinas, California* is a need survey submitted to the Public Utilities District It contains information necessary for regulating septic tank practices Management improves sewage disposition practices and prolongs the life span of septic systems Individual waste disposal systems provide reliable low cost, nonmechanical septic treatment This form of treatment also offers sub-surface irrigation, low pollution potential, and promotes water conservation The book is available from *Warshall and Farnsworth, Watershed Consultants, P O. Box 251, Bolinas, CA 94924.* (90 pp 1973)

**Wastestream Separation**
Keith Burton
Manager, Site Services
IBM General Products Division
Tucson, AZ 85744

**Pressure Sewers**
Pressure sewers are used to collect septic tank effluent for centralized treatment They prevent ground water infiltration, accept new hookups and reasonable expansions, and easily accommodate small flow travelling from considerable distances

Priest Lake, Idaho in 1973 built a pressure sewer The cost of 500 hookups, two separate aerobic treatment lagoons, pumper truck, and all necessary legal and engineering fees, totaled $900,000 (or $1,800 per hookup) Two sanitary districts were set up to handle operation and maintenance of the publicly owned on-site sewerage facility Homeowners were assessed $50 00 at the time of installation and have paid a $10.50 monthly fee The community pays a total of $63,000 operating and maintenance costs per year

**Rural Wastewater Disposal Alternatives,** March 1977 *Office of Appropriate Technology, P.O Box 1677, Sacramento, CA 95808* (160 pp.) Contains excellent review of alternatives and 80 references for more detailed reading

**The Status of Pressure Sewer Technology,** James F Kressil, P.E , 1977. *Wastewater Research Division, Municipal Environmental Research Laboratory, EPA, Cincinnati, OH 45268*

# Glossary

*The way that can be walked on is not the perfect way. The word that can be said is not the perfect word.*

*lao tzu, 3rd century b c*

**Advanced Waste Treatment**
Wastewater treatment beyond the secondary or biological stage which includes removal of nutrients such as phosphorus and nitrogen and a high percentage of suspended solids Advanced waste treatment, also known as tertiary treatment, is the "polishing stage" of wastewater treatment and produces a high quality of effluent.

**Aerobic**
Refers to life or processes that occur only in the presence of oxygen

**Alternative Technology**
Alternative waste treatment processes and techniques are proven methods which provide for the reclaiming and reuse of water, productively recycle waste water constituents or otherwise eliminate the discharge of pollutants, or recover energy Alternative technologies may not be variants of conventional biological or physical/chemical treatment.

**Anaerobic**
Refers to life or processes that occur in the absence of oxygen

**Aquatic Plants**
Plants that grow in water, either floating on the surface, or rooted emergent or submergent

**Aquifer**
A geologic stratum or unit that contains water and will allow it to pass through. The water may reside in and travel through innumerable spaces between rock grains in a sand or gravel aquifer, small or cavernous openings formed by solution in a limestone aquifer, or fissures, cracks, and rubble in such harder rocks as shale

**Artesian Aquifer**
A water-filled layer that is sufficiently compressed between less permeable layers to cause the water to rise above the top of the aquifer. If the water pressure is great, water will flow freely from artesian wells

**Bacteria**
Any of a large group of microscopic plants living in soil, water or organic matter, important to man because of their chemical effects as in nitrogen fixation, putrefaction or fermentation, or as pathogens

**Bedrock**
The solid rock beneath the soil and subsoil

**Biochemical Oxygen Demand (BOD)**
A measure of the amount of oxygen consumed in the biological processes that decompose organic matter in water Large amounts of organic waste use up large amounts of dissolved oxygen; thus, the greater the degree of pollution, the greater the BOD.

**Capital Costs**
All costs associated with installation (as opposed to operation) of a project.

**Coliform Bacteria**
Members of a large group of bacteria that flourish in the feces and/or intestines of warm-blooded animals, including man. Fecal coliform bacteria, particularly *Escherichia coli (E. coli)*, enter water mostly in fecal matter, such as sewage or feed-lot runoff. Coliform bacteria apparently do not cause serious human diseases, but these organisms are abundant in polluted waters and they are fairly easy to detect The abundance of coliform bacteria in water, therefore, is used as an index to the probability of the occurrence of such disease-producing bodies (pathogens) as *Salmonella, Shigella,* and enteric viruses These pathogens are relatively difficult to detect

**Drainage Basin**
(1) An area from which surface runoff is carried away by a single drainage system Also called catchment area, watershed, drainage area. (2) The largest natural drainage area subdivision of a continent The United States has been divided at one time or another, for various administrative purposes, into some 12 to 18 drainage basins

**Effluent**
Wastewater or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial plant, or part thereof

**Elevated Mound**
A mound, generally constructed of sand, to which settled wastewater is applied. Usually used in areas where conventional on-site treatment is inadequate

**Gravity System**
A system of conduits (open or closed) in which no liquid pumping is required.

**Groundwater**
Water that is below the water table.

**Groundwater Runoff**
Groundwater that is discharged into a stream channel as spring or seepage water.

**Holding Tank**
Enclosed tank, usually of fiberglass or concrete, for the storage of wastewater prior to removal or disposal at another location.

**Infiltration**
The flow of a fluid into a substance through pores or small openings. Commonly used in hydrology to denote the flow of water into soil material

**Infiltration/Inflow**
Total quantity of water entering a sewer system. Infiltration means entry through such sources as defective pipes, pipe joints, connections, or manhole walls Inflow signifies discharge into the sewer system through service connections from such sources as area or foundation drainage, springs and swamps, storm waters, street wash waters, or sewers.

**Innovative Technologies**
Technologies whose use has not been widely documented by experience They may be variants of conventional biological or physical/chemical treatment and offer promise as methods for conservation of energy or wastewater constituents, or reduce cost of treatment, or contribute to the elimination of discharge of pollutants

**Interceptor Sewers**
Sewers used to collect the flows from main and trunk sewers and carry them to a central point for treatment and discharge In a combined sewer system, where street runoff from rains is allowed to enter the system along with the sewage, interceptor sewers allow some of the sewage to flow untreated directly into the receiving stream to prevent the treatment plant from being overloaded.

**Lagoon**
In wastewater treatment, a shallow pond, usually man-made, in which sunlight, algal and bacterial action and oxygen interact to restore the wastewater to a reasonable state of purity

**Land Treatment**
A method of treatment in which soil, air, vegetation, bacteria, and/or fungi are employed to remove pollutants from wastewater. In its simplest form, the method includes three steps: (1) pretreatment to screen out large solids; (2) secondary treatment and chlorination, and (3) application to cropland, pasture, or natural vegetation to allow plants and soil microorganisms to remove additional pollutants Some of the applied wastewater evaporates, and the remainder may be allowed to percolate to the water table, discharged through drain tiles, or reclaimed by wells.

**Leachate**
Solution formed when water percolates through solid wastes, soil, or other materials, and extract soluble or suspendable substances from the materials.

**Non Point Source**
A general source of pollution. Surface water runoff is an example as it does not originate from a single source and is not easily controlled.

**Point Source**
A stationary source of a large individual emission This is a general definition; point source is legally and precisely defined in Federal regulations.

**Pressure Sewer System**
A wastewater collection system in which household wastes are collected in the building drain and conveyed therein to the pretreatment and/or pressurization facility. The system consists of two major elements, the on-site or pressurization facility, and the primary conductor pressurized sewer main

**Primary Treatment**
The first stage in wastewater treatment in which nearly all solids are mechanically removed by screening and sedimentation.

**Rapid Infiltration**
A form of land treatment where wastewater is placed into spreading basins and applied to the land to percolate into the soil

**Recharge**
The process by which water is added to an aquifer. Used also to indicate the water that is added. Natural recharge occurs when water from rainfall or a stream enters the ground and percolates to the water table. Artificial recharge by spreading water on absorbtive ground over an aquifer or by injection through wells.

**Runoff**
Surface runoff is the water from rainfall, melted snow, or irrigation water that flows over the surface of the land Groundwater runoff, or seepage flow from groundwater, is the water that enters the ground and re-appears as surface water Hydraulic runoff is groundwater runoff plus the surface runoff that flows to stream channels, and represents that part of the precipitation on a drainage basin that is discharged from the basin as streamflow Runoff can pick up pollutants from the air or the land and carry them to the receiving waters

**Secondary Treatment**
The second stage in the treatment of wastewater in which bacteria are utilized to decompose the organic matter in sewage This step is accomplished by using such processes as a trickling filter or activated sludge Effective secondary treatment processes remove virtually all solids as well as 90% of BOD and suspended solids Disinfection of the effluent by chlorination customarily is the last step in this process

**Septic Snooper**
Trademark for the ENDECO (Environmental Devices Corporation) Type 2100 Septic Leachate Detector This instrument consists of an under-water probe, a water intake system, an anaylzer control unit and a graphic recorder Water drawn through the instrument is continuously analyzed for specific fluorescence and conductivity When calibrated against typical effluents, the instrument can detect and profile effluent-like substances and thereby locate septic tank leachate or other sources of domestic sewage entering lakes and streams

**Septic Tank**
An underground tank used for the collection of domestic wastes Bacteria in the wastes decompose the organic matter, and the sludge settles to the bottom The effluent flows through drains into the ground Sludge is pumped out at regular intervals

**Sewer, Combined**
A sewer, or system of sewers, that collects and conducts both sanitary sewage and storm-water runoff During rainless periods, most or all of the flow in a combined sewer is composed of sanitary sewage During a storm, runoff increases the rate of flow and may overload the sewage treatment plant to which the sewer connects At such times, it is common to divert some of the flow, without treatment, into the receiving water

**Sewer, Lateral**
A sewer designed and installed to collect sewage from a limited number of individual properties and conduct it to a trunk sewer. Also known as a street sewer or collecting sewer

**Sewer, Storm**
A sewer designed and installed to collect sewage from a number of lateral sewers and conduct it to an interceptor sewer or, in some cases, to a sewage treatment plant

**Water Table**
The upper level of groundwater that is not confined by an upper impermeable layer and is under atmospheric pressure. The upper surface of the substrate that is wholly saturated with groundwater This level varies seasonally with the amount of percolation Where it intersects the ground surface, springs, seepages, marshes or lakes may occur. Also known as the groundwater level

**Watershed**
The land area drained by a stream, or by an entire river system.

**The Alternative is Conservation** film and video documentary is made possible by grants from the Office of Water Program Operations, U S Environmental Protection Agency (EPA), and Urban Scientific and Educational Research, Inc (USER, INC )

This guide was prepared by Laura Brecht, an urban planner and graduate from the Harvard Graduate School of Design and Lyle Brecht, applied ecologist and degree candidate at the Harvard Business School

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