# STATUS REPORT:

## Onsite Wastewater Treatment Systems in California

*jointly presented by:*

**California Wastewater**
**Training & Research Center**
CALIFORNIA STATE UNIVERSITY, CHICO

*and*

**EPA** Region 9
Ground Water Office

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# Status Report: Onsite Wastewater Treatment Systems in California


## Abstract

The regulation of onsite wastewater treatment systems will be undergoing significant changes in California in the coming years. Recent legislation has mandated that the State Water Resources Control Board develop and adopt statewide regulations by January 2004. These will be the first statewide regulations governing the use of onsite wastewater treatment in California.

There are approximately 1.2 million onsite wastewater treatment systems in California, serving more than 3.5 million people, or 10% of the state's population. Since 1990, ten percent of new housing starts use onsite systems and this trend should continue for the foreseeable future. Onsite/decentralized systems are an integral part of the infrastructure used to support continued growth and development in the state. In April 1997, EPA published its *Response to Congress on Use of Decentralized Wastewater Treatment Systems* which concluded that, overall, "adequately managed decentralized (onsite) wastewater treatment systems can be a cost effective and long-term option for meeting public health and water quality goals, particularly for small, suburban, and rural areas." Our dependence on onsite technologies has led to renewed interest in how they work. The performance of these systems is an important consideration in protecting the public health and water quality in the state. If onsite systems are recharging California's streams and aquifers, they can no longer simply dispose of the waste without adequate treatment.

The purpose of this report is to update information presented previously in the *STATUS REPORT: Onsite Wastewater Systems in California, June 2000 Draft* and to provide new information from additional studies. The content is general in nature and is not intended to be a technical document. Current practices and regulatory policies are presented. The intent is to offer information to promote an ongoing dialogue, to balance the best available technologies with our environmental concerns, and to protect the consumer. This report discusses general onsite system principles and the practices found in California. It is concerned with onsite wastewater treatment systems (OWTS) that generally serve individual homes with the treatment system located on the same parcel or close by. Understanding the basic concepts of OWTS is necessary so that they can be considered and applied appropriately. New wastewater technology and innovations are discussed as they promise improvements in onsite wastewater treatment performance.

The report was prepared under contract with the United States Environmental Protection Agency, Region IX, Ground Water Office, as part of their effort to address the risk to ground water posed by various practices. The content is solely the responsibility of the California Wastewater Training and Research Center and does not necessarily reflect the views or opinions of the United States Environmental Protection Agency, the California State University at Chico, the University Research Foundation or the California Wastewater Training and Research Center Advisory Board.

This report is presented in four parts:

- Part one gives a brief overview of the regulation of onsite systems and those involved.
- Part two is a general discussion of onsite system function that includes: 1) a brief review of wastewater treatment; 2) a general description of the conventional or standard system, 3) a description of alternative systems, 4) a description of system malfunction or failure, 5) a description of the pathogen reduction process, 6) a description of the nitrogen reduction process, 7) a discussion of septage (residuals) management practices.
- Part three presents the survey results and includes tables and a discussion of these as they relate to onsite practices in California. Results from this the 2001-02 survey and the 1998-99 survey, which was the basis for the Status Report: Onsite Wastewater Treatment Systems in California (CWTRC and USEPA 2000), are included. The 2001-02 survey includes some new information concerning the jurisdictions and their practices. A direct comparison of data obtained for this report with the data from the 1998-99 survey is not possible due to two factors: 1) The 2000 US Census has a changed format and no longer produces tables that separate out households with onsite systems versus those using centralized sewage treatment. The 1990 Census did separate households into these categories and this

allowed for baseline system numbers to calculate the number of onsite systems. This same comparison was not possible using the 2000 Census, and 2) fewer jurisdictions responded to this survey than to the previous survey. The results from both surveys are presented where appropriate to offer as complete a picture as possible.

- Part four presents three case studies.

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California Counties
and Regional Water Quality Control Boards (Watersheds)


*Source: State Water Resources Control Board*

# Part I: Overview

Onsite wastewater treatment is a complex issue, where environmental and public health policy must meet the limits and potential of commercially available technologies. Sewage has to be managed to protect the public from disease and to protect ground and surface water resources. Onsite sewage treatment systems must fulfill a primary function, that of treating, reducing, or eliminating constituents/contaminants of concern to levels at which they no longer pose a threat to public health or the environment. Appropriate infrastructure can be developed to manage the systems and technologies are available or can be developed that provide the necessary treatment. Regulations, training and certification programs, technology verification, and a clear environmental objective are elements of a successful onsite wastewater management program. Here is where California stands on several of these issues.

## *1.1 Regulations*

California has a tiered regulatory structure for regulation of onsite wastewater treatment systems. Federal, state and local government are all involved with actual implementation occurring at the local level. Breakdown of the specific roles follows.

### Federal Government

The federal government assumes no direct role in regulation of single-family onsite wastewater treatment systems, but it is involved based on its responsibility to protect underground sources of drinking water through provisions of the Safe Drinking Water Act, and water quality in general through the Clean Water Act. Sewage treatment systems receiving less than 2,000 gallons per day of solely sanitary waste are generally included in the "non-point source" category of potential polluting activities. The Environmental Protection Agency (EPA) and the United States Department of Agriculture work to promote best management practices by providing and funding technical assistance. The National Small Flows Clearinghouse, the National Environmental Training Center for Small Communities, and the National Decentralized Water Resources Capacity Development Project are three of the organizations funded by EPA that help carry out this function. The actual regulation of onsite systems is delegated to state and local government.

As part of their commitment, EPA recently released three important documents:

> *Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems* (2003)
>
> *Draft Handbook for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems* (2003)
>
> *Onsite Wastewater Treatment Systems Manual* (2002).

The first two documents make the case for the need to manage onsite systems. They propose a hierarchy of five management program levels based on factors such as environmental risk and system technology. Each program includes a set of management objectives, and an accompanying set of associated elements and activities targeted towards the satisfactory achievement of the objectives. The programs are benchmarks for a local unit of government to: 1) identify its management objective, 2) evaluate whether its current program is adequate, and 3) determine both an appropriate management program, and the necessary program enhancements to achieve its management objectives and public health and environmental goals. Local governments need a flexible framework and guidance to best tailor their programs to the specific needs of the community, and to the institutional capacity of the regulatory authority.

The third publication is the update of the *Onsite Wastewater Treatment and Disposal Systems Design Manual* (1980) often referred to as the 'purple book'. The 1980 manual was one of the most widely used references in the industry and it is expected that the 2002 version will continue in this vein.

## State Government

An important development in the State of California's regulatory role in onsite systems resulted from the passage of Assembly Bill 885 authored by Assemblymember Hanna-Beth Jackson. The bill was sponsored by a coalition of environmental and regulatory groups that recognized the need for statewide regulations to address water quality concerns. Assembly Bill 885 added sections 13290 to 13291.5 to the California Water Code (September 2000) that requires the State Water Resources Control Board (SWRCB) set minimum State standards for onsite sewage treatment systems by January 1, 2004. The text of the legislation can be found in the appendix I. This action will require codification of the standards as regulations in the California Administrative Code or implementation as statewide policy as well as an environmental review of the regulations as required by the California Environmental Quality Act. The SWRCB elected to develop regulations and to this end a series of stakeholder group workshops were held in 2002 to help develop the regulations. Draft regulations are to be released in 2003 followed by public comment opportunities with the goal of adopting regulations by the January 1, 2004 mandated deadline. The result will be the first set of regulations governing onsite systems applicable throughout the state.

The California State Water Resources Control Board has the statewide responsibility for protecting water quality, setting broad policies to achieve this objective. The SWRCB offers competitive opportunities for financial support of onsite sewage research, training, and infrastructure needs through several funding mechanisms, particularly the Clean Water Act State Revolving Fund and the non-point source, Clean Water Act Section 319 grant program. The SWRCB allocates water rights, adjudicates water right disputes, develops statewide water protection plans, establishes water quality standards, and guides the Regional Water Quality Control Boards located in the major watersheds of the state.

The State Water Resources Control Board convened a technical advisory committee in 1994 to identify the issues and propose a plan of action. The committee report *Management Measures and Implementation for New and Existing Onsite Sewage Disposal Systems* identified 14 issues for concern (see box, right.) If California communities make the choice not to build wastewater treatment plants, they need to be aware of these issues, particularly if they are to continue to grow.

**1994 TAC Report Concerns:**

- Degradation of water quality
- Increased number of systems
- Long-term dependence on onsite
- Inconsistent approach statewide
- Inadequate coordination between agencies
- Limited knowledge of alternative technologies
- Lack of inspection and maintenance
- Need of upgrade and repair of existing systems
- Need for education and training of personnel
- Need of funds for upgrade/repairs
- Lack of guidance for real estate transactions
- Inadequate septage disposal facilities
- Potential problems with gray water use

The state is divided into nine water quality regions, corresponding to the nine major watershed areas or basins, with each basin regulated by a Regional Water Quality Control Board (RWQCB). The boards set policy to reflect the hydrologic concerns, precipitation, topography, and population, as well as recreational, agricultural, and industrial development of that basin. The regional boards establish basin plans that include general guidelines for onsite sewage treatment systems, provide technical support to local agencies, and issue Waste Discharge Requirements for large and some specialized systems, but generally delegate direct regulatory authority for individual onsite wastewater treatment systems to local agencies. Exceptions are made when water quality impairments occur in a basin. Los Angeles Regional Water Quality Control Board, for example, issued a prohibition on the construction of new onsite systems in the Oxnard Forebay due to nitrate and coliform bacteria concerns. The pending statewide regulations will result in the basin plans having more uniform guidelines for onsite treatment systems.

## Local Government

The functional regulatory tier is at the local level, usually with a county agency such as the environmental health department, public health department or building department. It is at this level that actual regulation and oversight of onsite systems occurs. This regulation includes approval, permitting and inspection of systems. There are 58 counties and a number of other local agencies and special districts involved in this process. Each of these entities has a set of regulations and policies that govern onsite systems. With the implementation of statewide regulations it is expected that the local regulations will be more uniform. This should result in removing many of the inconsistencies that currently exist between jurisdictions for the types of systems approved, system design criteria, installation practices, maintenance, and monitoring requirements. Increased uniformity should ease the burden on the private sector that often works across jurisdictional boundaries. Uniformity should also make introduction and adoption of innovative technologies and alternative systems more feasible. Many emerging technologies offer improvements in wastewater treatment, that in turn offer better public health and environmental protection.

It is hoped that the statewide regulations will offer flexibility to accommodate the variations in soils, system density, local resources, and sensitivity of the receiving environment; California is a large state with diverse climates and topography. It is also critical that the new regulations recognize the considerable differences between jurisdictions in terms of existing resources and the ability to generate revenues to fund a more comprehensive onsite program. This concern has been expressed by several rural jurisdictions due to their limited ability to fund and carry out any new mandates.

## 1.2 Moving Forward

Many of the issues raised in the 1994 report should be addressed by the statewide regulations, specifically those dealing with inconsistent standards and agency coordination. The SWRCB, as part of the AB 885 process, also entered into three technical assistance contracts that have provided additional information about three of the concerns; alternative technologies, septage disposal facilities, and failure/malfunction of systems. The first of these: Review of Technologies for the Onsite Treatment of Wastewater in California prepared by the University of California at Davis, is a comprehensive review of the various treatment technologies. The two others report the results of two surveys; Septage, Handling, Treatment and Disposal Practices in California and Onsite Wastewater Treatment System Failure/Malfunction prepared by the California Wastewater Training and Research Center, California State University at Chico.

At least three concerns remain unresolved, but efforts continue. Notable among these are; need of funds for upgrade/repairs, lack of guidance for real estate transactions, and need for education and training of personnel. The SWRCB by virtue of adopting statewide regulations is taking a more active and coordinating role and these unresolved issues could then be addressed.

Local jurisdictions have been active in promoting uniformity and best management practices for many years. The most active group is the Land Use Sewage Advisory Committee of the California Conference Directors of Environmental Health who meet routinely to discuss and review onsite wastewater issues. Their 1998 draft publication entitled “California State Water Resources Control Board

> Training & Certification
>
> Training and certification/license requirements are considered a necessary component to the effective utilization of onsite/decentralized wastewater treatment. While these treatment systems can provide a reliable method of wastewater treatment and can fit into the overall community wastewater treatment infrastructure, their appropriate use is contingent on effective siting, design, installation, inspection, monitoring, and operation and maintenance. The proper execution of these functions requires well-trained and competent practitioners. Training and certification/licensing is a key to assuring that the practitioners know their responsibilities, are accountable, and can fulfill their assigned roles.
>
> There are training and certification requirements in most state onsite regulations. The requirements vary among the states and there are a number of approaches used to assure competency. Forty of the states do have some type of requirement in their onsite law and/or regulation. USEPA has been a strong advocate for training and certification for many years. Recently, it reinforced this position by including training and certification as a core element in its’ *Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems*.
>
> All of the interested parties and stakeholders benefit from training and certification. It is in the best interest of all to have competent practitioners so that public health and water quality are protected.
> Source: CWTRC (2003)

Guidelines for the Design, Installation, and Operation of Mound Sewage Disposal Systems" was developed to update the existing guidelines (developed in 1980) to reflect changes in mound system technology. The document is currently out for review by the nine Regional Water Quality Control Boards. These draft guidelines are the first in an expected series of guidelines that will be used to help standardize the location, design criteria, installation practices, and maintenance procedures for onsite systems.

Researchers at the University of California and at the California State University campuses have been engaged in numerous projects to investigate many aspects of wastewater treatment and effluent dispersal, including an effort for the National Onsite Demonstration Project, assessing filter media in Paradise, California.

## *1.3 Californians in the Onsite Wastewater Profession*

Altogether, there are almost 100 regulatory agencies, more than 50 equipment manufacturers, and uncounted engineers, educators, contractors and service professionals engaged in the onsite industry, serving about 3.5 million Californians.

A number of different professions are directly involved in the onsite wastewater industry. Functionally these break down into two major groups: the private sector and public sector.

The private sector includes professionals that manufacture, design, install and maintain onsite systems. Manufacturers use a wide range of professionals for research and development and in the manufacture of their products. System designers are usually registered civil engineers, engineering consultants, soil scientists, or registered environmental health specialists. Installers are typically licensed contractors. Septic tank pumpers perform much of the maintenance and repair work, and often certify systems for property transfers. Recently, the maintenance or monitoring specialist has come on the scene in response to the increasing complexity and maintenance required for the new technologies being used for onsite wastewater treatment. Builders and realtors, though not directly involved, need to understand onsite systems to effectively perform their responsibilities and serve their clients. The California Onsite Wastewater Association (COWA) represents a large number of private sector professionals, and public sector professionals as well.

The public sector professionals include state regional water quality control personnel such as environmental scientists and wastewater engineers. At the local level, registered environmental health specialists and building inspectors conduct most of the direct regulatory activities such as approving, permitting, and inspecting onsite systems. Local land use agency personnel are also involved since they review and approve development proposals that use onsite systems. In order for each professional within the onsite wastewater industry to fulfill their duties and responsibilities, it is imperative that they have a baseline level of knowledge about the various topics related to onsite sewage treatment. Both the California Environmental Health Association and the California Conference of Directors of Environmental Health represent public sector professionals.

KNOWLEDGE/SKILLS NEEDED in the Onsite Wastewater Profession

Microbiology/Public Health

Soils/Hydrogeology

Engineering

Plumbing and Wiring

Hazardous Materials Management

Marketing/Communication

Environmental, Occupational Safety, and Property Laws

**Safety Issues**: There are a number of risks managed by the onsite wastewater professional in the course of the job. Exposure to sewage exposes the worker to pathogens: viruses, bacteria, and protozoa (such as cryptosporidium.) Construction and maintenance activities involve physical labor, sometimes in confined spaces. Alternative systems may require extensive electrical installation and maintenance. Access to work sites may be obstructed by property owners and their pets. Managing these risks takes time and awareness, which in emergency situations may not be available. Inexperienced onsite staff is at most danger from these hazards.

Ideally, professionals that design, install, maintain or regulate onsite systems should be able to demonstrate a minimal level of competency and knowledge through a formal certification process before they can work in the public or private sector. Training and certification programs will protect onsite professionals, enhance the level of service provided to the public, and improve the state's ability to protect its water supply.

## *1.4 Training Programs*

Traditionally, no single educational track creates the onsite wastewater professional.

Universities in many parts of the country have recognized this gap. Particularly in the last decade, self-study courses have been offered, and state onsite wastewater training centers have opened in more than a dozen states. These training programs have formed associations, including the National Onsite Wastewater Recycling Association and the Consortium of Institutes for Decentralized Wastewater Management. The Consortium is working on a Curriculum Project funded by USEPA through the National Decentralized Water Resources Capacity Development Project. The project will develop standardized training modules for practitioners to be used at the training centers and also develop courses to be used in college and university engineering curriculum.


To complement their existing self-study courses in small water system and wastewater treatment plant operations, the California State University, Sacramento Office of Water Programs published a two-volume self-study course entitled *Small Wastewater System Operation and Maintenance* (Volume I – 1997, Volume II – 2003). The text covers onsite and small-scale wastewater treatment technologies, with an emphasis on public health and safety. Students from all over the United States have enrolled in this course. A second volume will examine treatment processes and disposal methods.

The California Environmental Health Association, whose membership includes regulatory staff, frequently sponsors professional training and workshops through its Annual Education Symposium and chapter meetings. Some regulatory staff and onsite consultants have offered courses to homeowners and others. For example the Sonoma County Permit and Resource Development Department offers workshops to homeowners on the operation and maintenance of alternative treatment systems. Many areas in Sonoma County rely on these alternative systems and the county recognized the importance of educating the community.

The California Wastewater Training & Research Center, California State University, Chico, began operation in July of 1998. The mission of the center is to: "*.… assist in improving the quality of water in the State of California by seeking, developing, and promoting effective multidisciplinary solutions to wastewater treatment and management*."

To fulfill this mission the center has adopted four major goals:

1. Provide education and training to all stakeholders concerning proper wastewater treatment and disposal methodologies, to include conventional and advanced treatment.
2. Improve installation and inspection of wastewater treatment systems by providing a standardization and certification program for wastewater professionals.
3. Increase monitoring and maintenance of existing treatment systems by providing education and training on proper operation and maintenance procedures and practices; and
4. Develop and implement a wastewater treatment research program to determine the long-term effects of wastewater treatment systems.

The Center, a partnership of the College of Agriculture, College of Engineering, Computer Science, and Technology, and College of Natural Sciences, began conducting workshops in several parts of the state in 1999. Workshop topics include onsite basics, soil science, alternative system components, and establishing operation and maintenance programs. Workshops so far have attracted more than 1,600 participants from the regulatory, technical and service sectors. The Center is developing an area where students will be able to construct and dismantle systems, or observe them in place. It can also offer space for the demonstration of newer technologies. Partnerships with industry groups and other academic institutions to expand the availability of the courses are in development. (See Resources Section, Appendix 2.)


Soils class, Chico, May 1999

This progress is encouraging, but needs to be sustained and expanded to raise the standard of practice to the level that can assure protection of public health and water quality. New wastewater technology and innovations promise improvements in onsite wastewater treatment performance. These need to be considered and applied appropriately. More effective treatment systems are a goal we must move towards.

## *1.5 Wastewater or Recharge?*

### Reconsidering Disposal vs. Treatment

Onsite/decentralized wastewater treatment systems are and will continue to be an important part of the infrastructure that serves many areas in California. These systems are reliable, economic, protective, and appropriate in many situations. These waste management systems, as with any aspect of infrastructure, must be properly operated and maintained to continue to serve the purpose intended. Our concept of this purpose has evolved from one of disposal to one of treatment. Along with this change has come the recognition that not only is treatment the goal but that the treated effluent is a water resource. At a minimum, the treated effluent recharges groundwater and in many situations eventually surface water as well. With sufficient treatment effluent can be put to beneficial use. Systems are now being designed to utilize this resource for uses such as subsurface drip dispersal that can provide landscape irrigation.

Onsite/decentralized systems should be viewed from an overall water/wastewater management perspective, not only to establish treatment goals but also to recognize the resource potential for beneficial reuse. This approach is being incorporated into the concept of integrated water resource management. Nelson and Serjak (2002), in their report of findings and conclusions of a conference of experts held on February 19-20, 2002, describe onsite/decentralized systems as part of the "soft path" approach to water resource management.

> *"Many of the most promising new approaches to water resource management are inherently distributed or decentralized systems. These systems (to varying degrees) make extensive use of the environment's own natural processes and assimilative and treatment capacity. Such regimes are often referred to as "Soft Path" approaches because they rely on managing and protecting water resources near the point of use."*

Advanced onsite treatment systems have been designed to work with the local soils and hydrology to provide treatment making the potential for reuse a viable consideration.

Soil is an important component of onsite sewage treatment and is part of the environment's own natural processes and assimilative and treatment capacity referenced above. Given the right characteristics, soil can provide very effective treatment, but generalizations are elusive because of the enormous variations in soil types, sewage flows, weather, and ground water conditions. In many parts of California, lots deemed "buildable" because their soils are suitable for conventional onsite systems are occupied, pushing new developments into the more vulnerable parts of watersheds, or into lands traditionally used for agriculture. Land use planners, regulatory agency personnel, and other officials need to understand the range of options that decentralized/onsite systems can provide in addressing some of these concerns. A study of this issue can be found in *On-site Wastewater Treatment Technology and the Preservation of Agricultural Land in California's Central Valley* (2003), California State University, Chico.

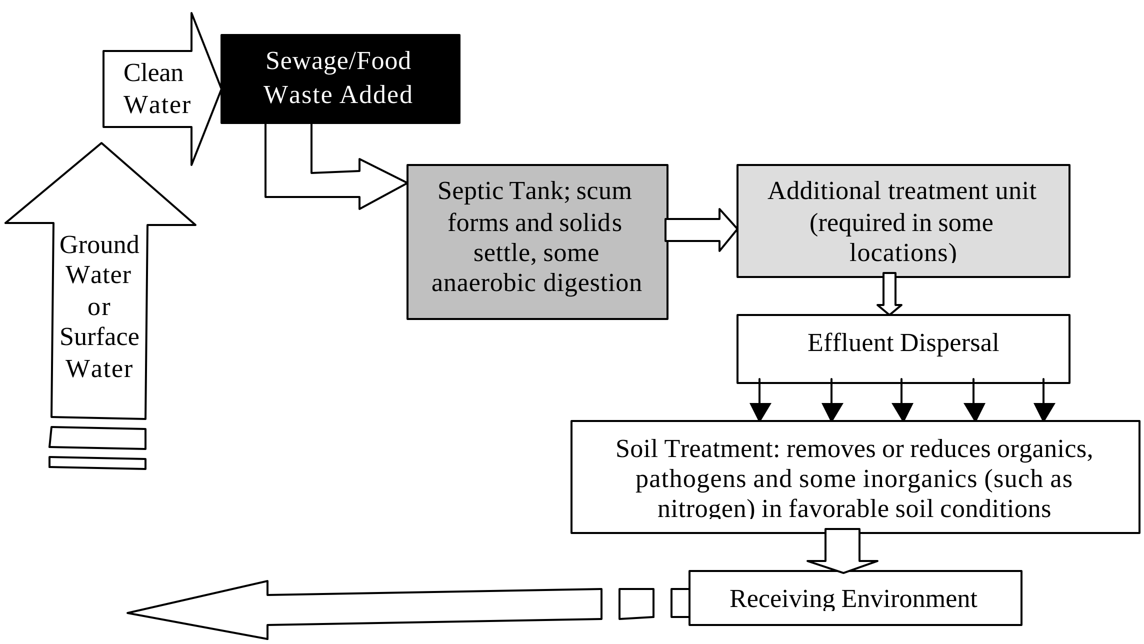
This new perspective requires changes. Regulations, and possibly the regulatory structure, need to be reshaped to become more responsive and capable. California is moving in this direction with the pending statewide regulations. It is hoped that the regulations will enable the overhaul suggested in an article in *Small Flows,* a national technical publication,

*"A regulatory overhaul from the ground up is needed to move the onsite industry into the 21st century and to raise the overall performance standard of onsite wastewater systems from the traditional septic system to a real **treatment** system that allows for adequate maintenance and performance monitoring." -Anish Janitrania* (emphasis added)

## Part II: Introduction to Onsite Wastewater Treatment

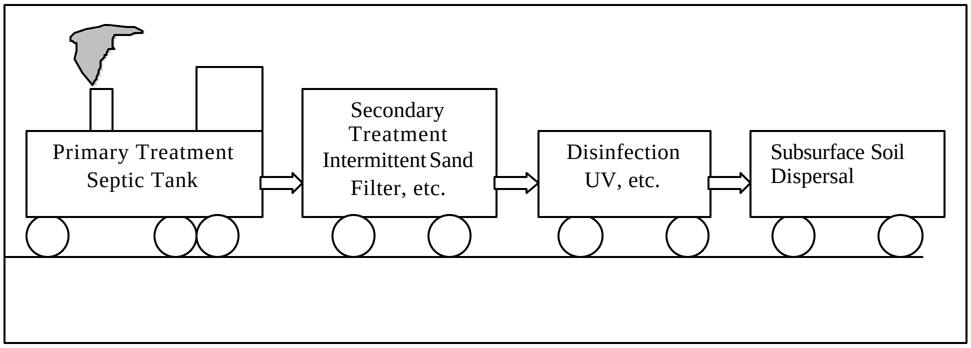
Residential sewage is composed of more than 99% water. Plumbing fixtures use clean water as the vehicle to carry the various waste products away from the home and through the treatment process. This contaminates the clean water with a variety of wastes that include organic matter (human waste material and kitchen food waste), inorganic substances, oil, fats, grease, household chemicals, and other particulate matter. The function of the treatment system is to remove or inactivate these contaminants in the wastewater to a level that does not present a public health or environmental concern.

Simply put, water derived from either a groundwater or surface water source is used to carry waste from the home, to and through the treatment system with the treated water released back into the environment where it ultimately recharges ground water and than can eventually enter surface water. The cycle is completed as illustrated below:




### *2.1 Basic Onsite Wastewater Treatment Process*

Onsite wastewater treatment systems are defined and described in a variety of ways. Current convention is to divide the entire system into treatment components, with each component a separate, identifiable part of the whole system. For example, the septic tank is the first part of the system to receive wastewater and is referred to as the primary treatment unit. A system can have any number of other components, each providing some type of treatment or other function before passing the treated wastewater on to the next component. A series of treatment components is often referred to as a treatment train (see diagram below). The simplest system is the conventional or standard system and consists of two components.




## Conventional or Standard Onsite Wastewater Treatment System (OWTS):

Fundamentally, a conventional OWTS consists of two components that provide differing environments for a series of biological, physical and chemical processes to act on the wastewater. The two treatment components are: 1) septic tank that receives the raw sewage from the home, followed by 2) a subsurface soil absorption/dispersal area that receives the primary treated wastewater from the tank and distributes it into the receiving environment.

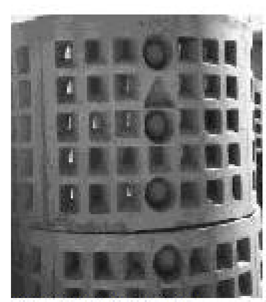
The appeal of the conventional or standard system is the simplicity of design and function, keeping material and installation costs low, and maintenance requirements at a minimum. Unfortunately, this simplicity helps to perpetuate the notion that maintenance is not required and that systems are functioning effectively. This is reinforced because the system components are below ground and out of sight.

**The Primary Treatment Component - Septic Tank**

The septic tank functions as a settling basin and provides detention time for the raw sewage and is the primary treatment component. Detention allows for 1) separation of solids from liquid, allowing solids to settle into a sludge layer with the tank providing a place for sludge storage 2) formation of a floating scum layer consisting of oil, grease, fats and other light materials that are retained in the tank 3) anaerobic digestion of organic material, and 4) production of a reasonably clarified effluent for the next treatment component. The tank typically consists of two interconnected compartments designed to help separate solids and scum from the liquid.

**The Soil Treatment Component - Effluent Dispersal**

The subsurface soil absorption/dispersal component receives the primary treated wastewater from the septic tank and distributes it, typically, through a perforated pipe into a gravel filled trench(s), also called a leach field, absorption field or drainfield. A variety of biological, chemical and physical processes act to treat the wastewater as it moves down through the gravel and into and through the soil. Soil has a large capacity to treat organic materials, inorganic substances and pathogens (bacteria, viruses and parasites). This is because the soil acts as both a filter trapping particles and a surface on which the processes can take place. The soil environment also provides a place for a variety of naturally occurring soil organisms such as bacteria, worms, and protozoa (also known as "bugs") to use the organic material in the wastewater as a source of food. Adsorption of pollutants onto soil particles and predation of pathogens by other soil organisms are two examples of processes that occur in the soil treatment component.


Precast concrete seepage pit sections

In some parts of California, seepage pits are used for the disposal of effluent from septic tanks. These are deep pits (wells/excavations) that rely almost completely on the walls of the excavation for dispersal of the effluent into the soil. According to the USEPA (2002)…" Seepage pits can be effective for wastewater dispersal, but they provide little treatment because they extend deep into the soil profile, where oxygen transfer and treatment are limited and the separation distance to ground water is reduced." Deeper soils may not provide a favorable environment for bugs to do their job. Use of seepage pits has and continues to be a subject of controversy.

Seepage pits that are not preceded by a septic tank are also known as **cesspools.** Federal ground water protection regulations banned the use of cesspools over 2,000 gallons in volume in December 1999. Cesspools have already been banned in California local jurisdictions.

The conventional system is simple in design and function but involves complex biological, physical and chemical processes and interactions. These can function to provide adequate treatment under suitable conditions by removing or reducing pollutants of concern such as pathogens, organic materials, inorganic substances, and nutrients. One notable exception is that nitrate concentration is typically not reduced significantly and can move into the groundwater. This exception is discussed later in this report. In order to continue functioning properly, loading rates (the amount of water, solids, and organic material) must be accounted for and managed. Overloading the system for any of these can cause system malfunction or failure.

## Treatment versus Disposal:

The conventional system does a good job of wastewater disposal and when properly sited, installed and maintained does a good job of treatment as well. Historically disposal was the primary consideration. As long as the system gets rid of the wastewater, without plumbing backups or surfacing of sewage, the system meets this purpose. This view is reinforced by persistent use of the terminology 'onsite sewage disposal system'. Using this terminology implies disposal is the objective. This may seem like a minor point but it does tend to frame the discussion by defining and, in essence, lowering expectations. While it is true that disposal is an important consideration (if we understand that disposal means moving the effluent away from the system – i.e., the soil must be able to accommodate the hydraulic load from the system), treatment is the primary purpose. Terminology does have consequences. For example, if we consider system failure as failure to dispose of sewage rather than failure to treat sewage, then we truly are not providing adequate public health and environmental protection.

System effectiveness should also take into consideration the system density – the cumulative contaminant contributions of all the systems in an area. While they are discrete units they must be considered in the context of the watershed into which the effluent is dispersed. Considered individually, the treatment provided by an onsite system may be considered effective, but collectively the treatment may be ineffective in protecting water quality. Setbacks may protect individual wells and surface waters, but are hedges against ambient degradation. Cumulative impact should be incorporated into decisions concerning the location, design, installation, monitoring, and maintenance of systems and should become part of the standard of practice. Onsite system management programs take these factors into consideration and these factors help determine the types of treatment systems needed and the management required to sustain system performance.

A variety of wastewater distribution devices and methods provide for better wastewater distribution into the soil component. Studies have shown that pressure-dosed distribution improves the performance and life of the soil system. Pressure distribution allows utilization of the entire soil infiltrative surface and also helps to promote unsaturated conditions resulting in more available oxygen for 'bugs' to treat the effluent. Another significant development is the recognition that the soil treatment component should be kept shallow to increase the amount of available oxygen to enhance the biological processes and improve treatment.

These are just a few examples of many improvements being proposed to enhance system performance of conventional systems.

## Alternative Onsite Wastewater Treatment Systems:

Alternative OWTS are systems that replace, add to, or modify one or more of the treatment components or add additional components to the conventional system described above. These systems are capable of providing improved treatment and a higher quality wastewater effluent. They are used primarily in situations where a conventional system cannot provide acceptable treatment due to site constraints or where a higher treatment level is necessary to protect public health or water quality.

## Onsite Sewage Treatment Systems and Private Drinking Water Wells

More than 500,000 private drinking water wells provide the domestic water supply for more than one million persons in this state. Many of these wells are located on property that also has onsite sewage treatment. A primary consideration for locating wells and onsite sewage treatment systems is to ensure that there is adequate separation between them.

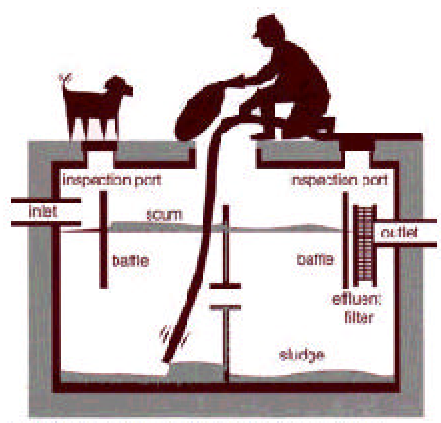
Separation helps to provide distance and therefore time for the wastewater to undergo various treatment processes. Even with proper separation, drinking water contamination can occur in the case of a system that is not adequately treating or a well that is not properly constructed. Separation distances (commonly referred to as setbacks) have been established over the years. They are generally quite conservative, that is, the established distance tries to anticipate the worst-case scenario. Travel time is a more meaningful criterion for establishing separation distances. However, this approach is not often been used since it requires a very thorough site analysis. Using travel time rather than distance requires that the site (landscape position, hydrogeology, etc.) and soil conditions (depth of soil, type of soil, etc.) be characterized to determine safe separation distances.

As noted, some wastewater constituents, such as nitrate, may not be significantly reduced as they pass through the treatment process. Depending on other factors, such as density of development and agricultural practices, this can result in contaminant levels that exceed drinking water standards. There is no requirement to test private drinking water wells for contamination. As a result, our understanding of nitrate problems is incomplete.

Alternative OWTS in many respects are variations of the conventional system because they use one or more naturally occurring biological, chemical or physical principles and processes found in the conventional system. The objective is to design a treatment method that maximizes performance of one or more of the processes by providing an enhanced environment for the process.

For example, various media filters (also referred to as packed-bed filters) using sand, peat, foam, fabric, or other materials are designed to create an environment favorable for chemical, physical and biological treatment processes. These systems are not filters in the traditional sense but rather the media provides a very large surface area for effective contact between the constituents in the wastewater and the microbes that utilize the constituents as a food source. Careful selection of the filter media and careful dosing of wastewater onto the media surface to maintain aerobic conditions accomplish this. This can result in very effective reduction in organic materials and pathogens from the applied wastewater. A listing and description of systems in use in California is provided later in this report.

Alternative systems use more complicated ways to achieve treatment and therefore involve more intensive operation and maintenance than does the standard system. Proper operation and maintenance is the key to k keeping these systems functioning properly.

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## Onsite Sewage Treatment System Malfunction:

Understanding and defining system malfunction or failure is important to our understanding of how systems should function. In some respects this definition determines performance expectations. As mentioned previously, failure can be defined in at least two ways, 1) failure to dispose and, 2) failure to treat. Failure to dispose is relatively easy to determine and is evidenced by what is termed hydraulic failure of the system. The system is backing up into the house or sewage is surfacing on the ground or entering surface water.

Failure to dispose also represents a failure to treat. These situations are generally recognizable and lead to system repair or replacement. Failure to treat is a much more difficult situation to identify. Adequate disposal may be taking place, no surfacing or backup, but poor location, design, installation or maintenance may allow inadequately treated wastewater to contaminate ground or surface water. In order to define what constitutes failure to treat, treatment goals must be set in order to measure performance. First, these goals must be clearly defined and based on public health and environmental concerns. This is complicated because there is no clear consensus or total understanding of what happens to all of the wastewater constituents of concern, how to measure them, and where to measure for them. Second, treatment goals must be realistic and achievable. This means that there need to be reliable and affordable systems available that can reach these goals. Third, the goals should incorporate risk-based assessment tools that provide for flexibility in order to take into account important factors such as density of development, and specific site conditions such as depth to ground water, and depth and type of soil. Lastly, the goals must be measurable in some practical way. This said, failure to treat to some agreed to level, while considering the site variables, should be the criteria for defining system malfunction.

**Common Onsite System Failures**

| Type of Failure | Evidence of failure |
|---|---|
| Hydraulic failure | Untreated or partially treated sewage pooling on ground surface, sewage backup in plumbing fixtures, sewage breakouts on hill slopes |
| Pollutant contamination of ground water | High nitrate levels in drinking water wells; tastes or odor problems (e.g., sulfur, household cleaners) in well water caused by untreated, poorly treated, or partially treated wastewater; presence of toxics (e.g., solvents, cleaners) in well water. |
| Microbial contamination of ground and surface water | Shellfish bed bacterial contamination, recreational beach closures due to high bacterial levels, contamination of drinking water wells with fecal bacteria or other fecal indicators. |
| Nutrient contamination of surface water | Algae blooms, high aquatic plant productivity, low dissolved oxygen concentrations. |

Adapted from: U.S. Environmental Protection Agency (2002) Onsite Wastewater Treatment Systems Manual

A recent survey (CWTRC 2003) conducted for the State Water Resources Control Board examined what indicator local agencies use to identify failure/malfunction. The survey demonstrates most agencies rely on the traditional symptoms of surfacing effluent (96%) or sewage backup (84%). Encouraging is that almost 25% of the jurisdictions are now also using monitoring reports to identify failures, an indication that system performance is becoming a tool to identify failure/malfunction. This is an important trend as it indicates that jurisdictions are looking at treatment and treatment goals as a measure of system performance.

The survey asked which of the following methods the agency uses to identify a failure/malfunction. The table summarizes the responses (out of a total of 45 agency responses).

**Failure/malfunction indicators used by jurisdictions**

| | | |
|---|---|---|
| Effluent surfacing | 43 | 96% |
| Sewage backup | 38 | 84% |
| Monitoring/monitoring report | 11 | 24% |
| Other | 4 | 9% |

Source: Onsite Wastewater Treatment System Repair of Failure/Malfunction Survey (CWTRC 2003)

## Oversight and Ongoing Maintenance:

Few California jurisdictions require ongoing maintenance after a system has been installed. The service life of any type of system can be significantly extended with routine inspections and maintenance. The maintenance required for an onsite system is dependent on the complexity of the system. Generally, the more parts and mechanical components used, the more critical adhering to maintenance schedules becomes. For example, the standard onsite system is a passive system without mechanical parts and consists of the septic tank and soil dispersal system. Maintenance typically consists of pumping the septic tank when the solids and scum level reaches a point where the effective tank volume is reduced enough so that retention time through the tank is inadequate. On the other hand, advanced treatment units may have pumps, floats, control panels and other components that need to be maintained at some prescribed frequency. These systems must be maintained for them to continue to function properly and to attain performance expectations.

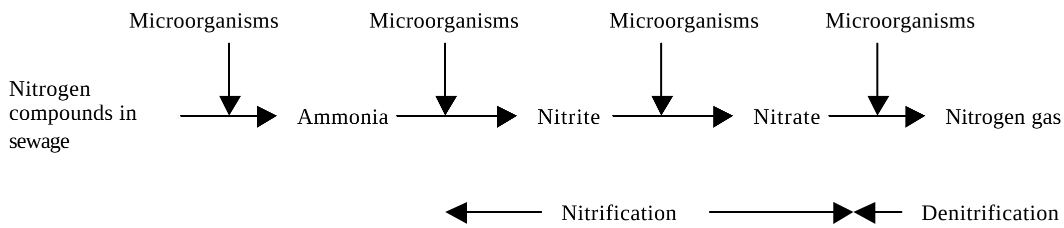
## *2.2 Public Health and Environmental Considerations*

Pathogen Reduction: A principal purpose of any sewage treatment system is to reduce or eliminate the pathogenic (disease causing) organisms in wastewater to protect public health. These pathogenic organisms include bacteria, viruses and parasites. Diseases attributed to contamination by wastewater include typhoid, cholera, bacterial and viral gastroenteritis, Hepatitis A, giardiasis and cryptosporidiosis. Inadequately treated wastewater can carry the organisms from the treatment system and contaminate ground or surface water and lead to disease outbreaks.

> *"As a health hazard, sewage may contain parasitic worms' eggs and larvae, and also microbial pathogens and parasites. Some of these may attack directly through the skin, or after transmission by a vector (usually rodent or insect), or after man ingests sewage-contaminated food or water. Of the "top five" human parasitic diseases, each with about half a million to a million cases per year worldwide (ascariasis hookworm, malaria, trichuriasis, and amoebiasis) only one (malaria) is not directly spread in sewage."*
>
> O.B. Kaplan, Septic Systems Handbook.

A properly functioning onsite sewage treatment system can remove very high levels of these organisms by a combination of biological, chemical and physical processes. In the conventional system, this combination occurs primarily in the soil treatment component. The effectiveness of the soil treatment component depends on a number of factors such as soil particle size, the size of the pores between soil particles, and the amount of water saturation of the soil. Given the right conditions, organisms are filtered by entrapment in the soil pores or adsorbed onto soil particles. The organisms are then subject to predation by other soil organisms or are subject to conditions unfavorable for their survival. These processes can effectively reduce or eliminate bacteria and parasites. While viruses are subject to the same processes, their removal is more problematic. This is due primarily to their small size and hence greater chance of being transported by water away from the active soil treatment area. Alternative treatment systems offer a variety of treatment mechanisms that improve pathogen removal from the wastewater. These units accomplish this by optimizing or enhancing the biological, chemical and physical processes that contribute to pathogen removal. Alternative systems can help attain the pathogen reduction necessary to provide adequate groundwater or surface water protection to meet public health concerns.

**Nitrogen Reduction** is one of the treatment goals for sewage treatment systems. Nitrogen in certain forms and at high enough concentrations can present a public health and environmental concern. Available onsite system components vary in their ability to reduce nitrogen in the wastewater. Nitrogen containing compounds are present in wastewater in various forms. A series of microorganisms utilize and transform the nitrogen compounds as the wastewater moves through the treatment processes. A complete cycle converts these nitrogen compounds back into nitrogen gas that is then released back into the environment with no adverse consequences. In simplified schematic form the nitrogen transformations are as follows:




Each of these transformations is performed by a different group of microorganisms. Each group needs fairly specific environmental conditions to perform effectively. A potential problem arises with onsite systems that use subsurface soil absorption as the final treatment component. The conditions necessary to support sufficient numbers of the microorganisms responsible for some of the transformations may not be present. This is most often the case with the last step known as denitrification. When this denitrification does not take place, nitrate is the prevalent final nitrogen product of the treatment process. Nitrate is a soluble (and thus mobile) compound, which flows with water out of the treatment area to the water table. Once reaching groundwater, the nitrogen remains in the nitrate form and contributes to the total nitrate concentration.

Onsite systems are a source of nitrogen, but not the major contributor in every area of the state. Other major sources (depending on location) include livestock waste and fertilizer application. The density of one or more sources, the type of treatment systems used, certain soil conditions, and the other factors can cause nitrate concentrations to reach levels of concern.

The California Department of Health Services Drinking Water Source Assessment Program (DWSAP) identifies limits of recharge areas to public water supplies. One of the "potentially contaminating activities" to be identified with each area is the prevalence of onsite sewage systems. For more information about the Source Water Program, see *www.dhs.ca.gov*.

Nitrogen in the form of nitrate is a public health concern because at sufficient concentration, nitrate in drinking water can cause methemoglobinemia (blue baby syndrome) in infants under six months old. As a result, the United States Environmental Protection Agency has established a maximum contaminant level of 10-mg/l-nitrate nitrogen in drinking water. There are a number of documented areas in California where nitrate levels in the ground water exceed the maximum contaminant level and wells have been taken out of service as unsuitable for drinking water. Nitrate is an environmental concern since it is a nutrient that can contribute to unwanted plant and algae growth (eutrophication) of surface water. Excessive plant and algae growth can deplete oxygen in the water causing fish and other organisms to die.

**Department of Health Services Warning Language required in Consumer Confidence Reports (from Public Water Systems to Customers)**

**(A)** **Nitrate:** For systems which detect nitrates at levels above 23 mg/l, but below the MCL, the following language is REQUIRED:

*Nitrate in drinking water at levels above 45 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can interfere with the capacity of the infant's blood to carry oxygen, resulting in serious illness; symptoms include shortness of breath and blueness of the skin. High nitrate levels may also affect the ability of the blood to carry oxygen in other individuals, such as pregnant women and those with specific enzyme deficiencies. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider or choose to use bottled water for mixing formula and juice for your baby. If you are pregnant, you should drink bottled water.*

The California Regional Water Quality Control Boards have identified a number of areas in California that have high concentrations of nitrate due to large concentrations of onsite systems. These include the Baywood – Los Osos area in San Luis Obispo County, the Oxnard Plain in Ventura County, Yucca Valley in San Bernardino County, the Livermore Valley in Alameda County, and the Chico Urban Area in Butte County. Recently the Department of Water Resources identified the Antelope area in Tehama County with elevated nitrate levels. Approximately 200 homes in the area are on onsite systems with domestic water provided by individual wells.

A number of alternative systems, further described in Part III, offer more complete treatment and nitrate reduction. These systems attempt to maximize the environmental conditions necessary to support the microorganisms responsible for the various nitrogen transformations. As discussed above, denitrification is the most difficult to monitor and control in the subsurface. This is also generally true for alternative systems. Nitrates can be reduced but total removal is difficult and expensive. Public water systems generally seek an alternative source of drinking water before investing in nitrate removal.

## *2.3 Septage (Residual) Management*

Onsite wastewater treatment systems require maintenance and one of the required maintenance items is to remove the scum and solids that accumulate in the primary treatment component (septic tank). This material is referred to as domestic septage and is defined as " …liquid, solid or semisolid material removed from septic tanks, cesspools, marine sanitation devices, portable toilets and similar devices that receive domestic waste only (household, non-commercial, non-industrial sewage)." (USEPA, 1993).

The November 1994, State Water Resources Control Board Report of the Technical Advisory Committee For Onsite Sewage Disposal Systems identified septage disposal as one of the issues of concern facing California. The report stated, "With ever increasing dependence on OSDS, there is a corresponding demand for adequate septage disposal facilities. More and more publicly owned treatment works (POTWS) are refusing to accept septage, and it is becoming increasingly difficult to locate and obtain environmental and public approvals for new land disposal septage sites." This finding has not changed significantly since this report.

The following discussion on residual management is adapted from the report: *Survey of Septage Treatment, Handling and Disposal Practices in California* prepared for the California State Water Resources Control Board by the California Wastewater Training and Research Center.

Residual management is the term used to describe the handling, treatment, and disposal of the solids that are removed from septic tanks and other treatment units. In the broadest sense septage is material that has been removed, typically pumped, from a treatment tank or waste holding tank and hauled to another location for final disposition or additional treatment. The composition and source of the material generally dictates how the material must be handled and the treatment and disposal options that are available. The United States Protection Agency classifies septage into two broad categories that determines how it can be handled: 1) domestic septage, and 2) commercial and industrial septage.

Domestic septage contains mostly water, sewage, inorganic materials like grit, and organic fecal matter. Small quantities of polluting substances that are normal to household activity can also be present. Laboratory analysis of domestic septage typically shows low levels of heavy metals and other pollutants.

There are five primary methods for treatment and disposal of septage practiced in California. The methods are: 1) land application; 2) co-treatment at a sewage/wastewater treatment plant; 3) independent septage treatment facilities; 4) septage ponds with subsequent solids disposal; and 5) disposal at a sanitary landfill. There are some processes that may combine several of these treatment methods.

Survey results indicate that more than 230 million gallons of septage are being treated and disposed annually in California by one of the methods listed above. The quantity of septage received by the type of facility is distributed as follows; 84% wastewater treatment plants (sewage treatment plants), 2% land application, 2% independent treatment facilities (proprietary systems), and 11% septage ponds (see table below).

The survey results demonstrate that most of the septage is treated at publicly owned sewage/wastewater treatment plants. Also, the facilities accepting septage are generally the larger municipal, sanitary district or county facilities with large waste flows. This is expected as these facilities can assimilate the additional organic load by virtue of dilution without disrupting their treatment processes. The survey also found that some smaller communities and rural areas do not have treatment facilities in close proximity, requiring longer hauling distances and increased cost to the consumer. This can be a disincentive to the proper maintenance of onsite systems as system owners may put off needed maintenance due to the cost.

**Table 2-1 Septage Treatment and Disposal Facilities - California**

| Septage Treatment and Disposal Facilities - California | | |
|---|---|---|
| Type of Facility | Number of Facilities | Septage Received (gallons/year) |
| Sewage Treatment Plant | 78 | 199,691,181 |
| Landfill | 1 | not available |
| Land application | 5 | 830,000 |
| Independent Treatment System | 2 | 4,300,000 |
| Pond | 10 | 26,277,864 |

Residual (septage) disposal costs vary from less than three (3) cents to more than twenty-five (25) cents per gallon. The lowest costs are generally at the larger capacity public owned wastewater treatment facilities. This is demonstrated by the finding that the average cost is lowest in the Los Angeles Region where the large publicly owned sewage treatment facilities accept and treat the waste.

**Table 2-2 Average Disposal Costs - Septage Treatment and Disposal**

| Average Disposal Costs - Septage Treatment and Disposal Facilities by Regional Board Jurisdiction - California | | | | | | | |
|---|---|---|---|---|---|---|---|
| Regional Board | Wastewater Treatment Plant | Landfill | Land Application | Proprietary treatment | Pond | Quantity Gallons | Average Fee per gallon |
| North Coast | 8 | 1 | 1 | 1 | 3 | 10,022,990 | $0.091 |
| San Francisco | 12 | | | | 1 | 18,195,396 | $0.049 |
| Central Coast | 6 | | | | | 38,767,567 | $0.076 |
| Los Angeles | 7 | | | | | 46,531,000 | $0.036 |
| Central Valley | 29 | 2 | 4 | 1 | 3 | 71,644,923 | $0.079 |
| Lohanton | 5 | | | | | 9,987,500 | $0.044 |
| Colorado River | 1 | | | | 1 | 1,287,250 | $0.100 |
| Santa Ana | 9 | 2 | 1 | | 2 | 37,875,444 | $0.055 |
| San Diego | 1 | | | | | 599,475 | $0.054 |
| Totals | 78 | 6 | 6 | 2 | 10 | 234,911,545 | $0.066 |

The report recommends that California should consider developing a comprehensive septage management plan. A number of states, for example North Carolina, have developed a program that insures facilities are available and that these wastes are managed in a manner that protects public health and the environment. Local government, the Regional Water Quality Control Boards and the State Water Resources Control Board need to develop strategies to ensure that the septage treatment and disposal facilities are adequate to meet the demand. This was also pointed out in the previously referenced Report of the Technical Advisory Committee for Onsite Sewage Disposal Systems, SWRCB, November 1994.

# Part III Onsite Wastewater Practices in California

## *Survey of Onsite Wastewater Practices in California*

In 1998-99 and again in 2001-2002 the California Onsite Wastewater Training and Research Center surveyed public agencies that have jurisdiction for approving and inspecting onsite sewage treatment systems in California. The surveys requested information concerning population, number and types of onsite systems, monitoring requirements, regulatory requirements, and population dependent on private drinking water wells.

The information concerning the number of private drinking water wells and any documented drinking water contamination problems attributed to onsite systems was gathered from a number of sources. These include: local environmental health agencies, the California Department of Health Services Division of Drinking Water and Environmental Management, California Department of Water Resources, California State Water Resources Control Board, and the Regional Water Quality Control Boards.

## *3.1 1998-99 Survey Summary*

Two summary tables, Table A and Table B, from the 1998-99 survey are used here as they present the most complete data available. The statistical information is based on that survey, statistical information from the 1990 United States Census, and the 1999 California Department of Finance Housing Estimates. The 2000 United States Census did not separate out housing units by the method of sewage treatment (i.e., sewage treatment plant versus individual treatment system) as it had in previous censuses. This information would have been helpful in validating the information obtained from the jurisdictions as well as the projections made in the 1998-99 survey. Complete tables for these summaries can be found in appendix III.

### *Survey Summary*

There are more than 1.2 million housing units, or 10% of the state, that rely on individual onsite sewage treatment systems. This represents more than 3.5 million persons with the systems handling an estimated **420** million gallons of wastewater per day. The proper treatment of this sewage is important as the major portion of the resulting wastewater migrates through the soil and recharges groundwater and eventually surface water in many cases.

In 28 counties onsite sewage treatment systems provide the method of sewage treatment for at least 25 percent of the housing units. In thirteen counties onsite systems provide the sewage treatment for more than fifty percent of the housing units. These include Amador, Butte, Calaveras, Lassen, Mariposa, Mendocino, Modoc, Nevada, Plumas, Sierra, Tehama, Trinity and Tuolumne. As expected these are rural counties, and it is important to note that these counties include significant watershed areas for several of California's major rivers.

Table A summarizes the number of onsite systems, systems installed per year, systems repaired per year, and private drinking water wells, and the population served. None of the jurisdictions or agencies surveyed has complete and accurate records of total systems and private wells. This is due to several reasons: 1) many systems and wells were installed prior to any record keeping or permitting requirements; 2) jurisdiction for permitting has changed and there is no continuity of records; and 3) permits for building and onsite systems are combined in one building permit, and there is no practical way to separate them out. As a rule, jurisdictions could provide reasonably accurate information concerning onsite systems installed over the past 10 years. Local environmental health jurisdictions were given statutory responsibility for well permitting and well construction oversight in 1990 and were able to provide current data.

The number of onsite systems and wells was determined by taking the survey responses from the jurisdictions for the number installed since 1990 and adding that number to the 1990 Census information. The current estimates for the population served by onsite systems and private drinking water wells were determined by using the 1999 California Department of Finance Housing and Population Estimates for persons per household in unincorporated areas. The calculation for population served is based on full-time residence.

**Summary Table A  Onsite Sewage Treatment Systems – 1998/99 Survey**

| Onsite Sewage Treatment Systems – 1998/99 Survey | |
|---|---|
| Housing units with individual sewage systems | 1,202,266 |
| Total housing units* | 23,605,549 |
| Percent housing units on individual systems | 10% |
| Population served | 3,507,829 |
| State population* | 33,733,399 |
| Percent population on individual systems | 10% |
| Systems installed per year (5 year average) | 14,012 |
| System repairs per year (5 year average) | 7,866 |
| Percent systems repaired per year | 0.7% |
| Persons* per household | 2.8 |
| | |
| **Domestic Individual Water Wells** | |
| Individual domestic water wells | 483,546 |
| Population served | 1,372,373 |
| Wells with nitrate last 5 yrs. | 1,017** |

*State of California, Department of Finance, City/County Population and Housing Estimates, 1991-1999, with 1990 census counts. Sacramento, California, May 1999.
** 1,100 of these were reported by the Los Angeles County Public Department (Environmental Health)

Table 3B compares the number of housing units using onsite sewage treatment systems in 1999 with the number of systems derived from the 1990 Census. Table B shows that the percent of housing units using onsite systems in 1999 compared to 1990 remains the same at 10 percent. This finding demonstrates that the rate of reliance on onsite systems remains consistent. This holds for urban counties as well, where development continues in the more rural areas not served by centralized sewers.

**Summary Table B  Onsite Sewage Treatment System Comparison - 1999 with 1990**

| Onsite Sewage Treatment System Comparison - 1999 with 1990 | |
|---|---|
| 1999 Housing units with individual sewage systems | 1,202,266 |
| 1999 Total housing units* | 12,199,822 |
| Percent housing units on individual systems | 10% |
| 1990 Housing units with individual sewage systems** | 1,092,174 |
| 1990 Total housing units** | 11,182,822 |
| Percent housing units on individual systems | 10% |

*State of California, Department of Finance, City/County Population and Housing Estimates, 1991-1999, with 1990 census counts. Sacramento, California, May 1999.
** 1990 Census

## *3.2 2001-02 Survey Results*

A survey was again conducted in 2001-02 to update and gather additional information from local jurisdictions.  The response rate to this survey was not as complete as the previous survey (70% versus 95%) but provides information to augment our understanding of onsite systems and practices in California. The survey looked at:  1) Local Program Administration, 2) Septic Tank and Treatment Units, 3) Leachline/absorption Area Design Practices, 4) Effluent Distribution Methods, 5) Effluent Dispersal Methods, 6) Advanced/alternative Treatment Systems, 7) Post-installation Oversight, and 8) Individual Domestic Water Wells.  The summary tables from the 1998-99 survey are presented in the appendix for comparison purposes.

## *Local Program Administration*

This portion of the survey focused on obtaining additional information on local programs and local practices. Table 3-1 provides a summary of the administrative practices and staffing of the local programs with pertinent information summarized in the text below.

**System Tracking and Record Keeping**

Sixty four percent of jurisdictions are using computerized tracking and record keeping for the onsite program. Ten jurisdictions rely on this method exclusively while fifteen have a dual manual and computer-based system. Fourteen jurisdictions report the capability of plotting systems using GIS. Three jurisdictions have an online permit application process.

**Staffing**

A majority of the jurisdictions are part of environmental health/public health departments with staff typically environmental health specialists with district assignments. In addition to onsite systems, a staff person will perform all the environmental health duties such as food safety, recreational health, and housing, etc. within a geographical district. Most programs do not have staff solely dedicated to the onsite program. For example, in Amador County 1.5 person years are allocated to the onsite program with five individuals sharing the responsibilities.

**New Systems and System Repairs**

The surveyed jurisdictions reported 7,602 new system installations and 4,490 system repairs in 2000. The repair rate based on the total number of systems (818,750) in these jurisdictions is less than one percent (0.56%). This is considerably lower than national failure rate estimates of 10% (USEPA), but is consistent with the rate reported in two previous surveys: Status Report: Onsite Wastewater Treatment Systems in California (CWTRC and USEPA 2000) and Onsite Wastewater Treatment System Repair of Failure/Malfunction Survey (CWTRC 2003). Part of the explanation for this discrepancy between the national and state failure rate may be that a large number of systems in California are relatively new and were typically installed in site and soil conditions suitable for a standard system. These systems are passive and the operation and maintenance requirements minimal, so even with minimum care they can function. Age-related deterioration described as a potential cause of failure might not yet be occurring at any appreciable rate.

**Summary Table 3-1 Local Program Information**

| Local Program Information – 39 Jurisdictions | | |
|---|---|---|
| **Onsite Systems Based on 2001-2002 Survey** | Number of systems | 881,750 |
| | New systems installed | 7,602 |
| | Systems repaired | 4,490 |
| **System Tracking and Record Keeping by # of Jurisdictions** | Computerized | 25 |
| | Manual | 27 |
| | GIS capability | 14 |
| | Online permit application | 3 |
| **Program Information** | Person years allocated – all jurisdictions | 110 |
| | Staff working in program – all jurisdictions | 239 |
| | Jurisdictions with MOU with RWQCB | 17 |
| | Jurisdictions with Moratorium/prohibition areas | 11 |

## *A Closer Look at Onsite Sewage Treatment Options - Design Practices*

Onsite wastewater treatment systems provide sewage treatment for 10% of households in California. The proper location, design, installation, and maintenance of these are important factors in protecting public health and water quality in the state. This protection is a function of the practices that are allowed and the policies used to ensure that the practices are followed. There are broad water quality guidelines that counties must adhere to, but there is no statewide standard that details approved practices. One purpose of this survey is to determine what the general practices are in the counties. A variety of treatment units, wastewater distribution and soil dispersal methods are currently being used.

The survey requested information on the design practices used in the jurisdictions with the results presented in the following summary tables. The complete tables are located in the appendix.

**Septic Tank and Treatment Units**

Table 3-2 Septic Tank and Treatment Units lists the different types of septic tanks and alternative treatment units commonly in use. Septic tanks function to provide primary treatment of the raw sewage. They must be watertight to perform properly. Septic tanks can be constructed out of a variety of materials, the most common being concrete, fiberglass, and plastic. The other treatment units listed in the table provide more advanced wastewater treatment and are considered alternative treatment methods in California. These units typically receive effluent from a septic tank and provide additional wastewater treatment. Aerobic treatment units, recirculating sand filters, intermittent sand filters, peat filters, and recirculating gravel filters, absorption mounds, etc. are called alternative treatment units. The treated wastewater from these systems is typically discharged into a soil absorption/ dispersal component for final treatment.

**Summary Table 3-2 Septic Tank and Treatment Units**

*of 39 counties responding*

| Component | Type of Unit | YES | NO |
|---|---|---|---|
| Septic Tank Requirements – What is approved or required | Two compartment septic tank | 39 | 0 |
| | One compartment septic tank | 2 | 37 |
| | Plastic septic tank | 27 | 12 |
| | Fiberglass septic tank | 33 | 6 |
| | Pump vault in tank | 19 | 20 |
| | Separate pump chamber required | 34 | 4 |
| | Effluent filter | 11 | 28 |
| | Tank access riser | 18 | 20 |
| | Watertight tank | 34 | 4 |
| | Watertight tank test required | 11 | 28 |
| Alternative/Secondary Treatment Units – What is approved | Aerobic Treatment Unit | 25 | 13 |
| | Recirculating sand/gravel filter | 25 | 13 |
| | Intermittent sand filter | 28 | 11 |
| | Peat filter | 8 | 31 |
| | Absorption/sand mound | 28 | 11 |
| | Textile/media filter | 17 | 22 |
| | Evapotranspiration system | 22 | 17 |
| | Constructed wetland | 9 | 30 |
| | Composting Toilet | 6 | 33 |
| | Lagoon | 8 | 31 |

A majority of jurisdictions require watertight septic tanks with nearly one-third requiring field-testing for water tightness. Watertight tanks are essential for proper system performance and this is critical for proper performance of advanced treatment units.

Septic tank effluent filters and tank access risers are not treatment units but are innovations that are of value for improving system performance. They add very little cost to a system compared to the benefit derived.

Effluent filters improve septic tank effluent quality by limiting the amount of solids leaving the septic tank. Tank access risers provide ease of access for maintenance and also mark the tank location. They are included in this survey to gain some insight on how jurisdictions are adopting these innovations.


Assorted effluent filters.

All of the jurisdictions now require a two-compartment septic tank for standard installations (one-compartment tanks are allowed in two jurisdictions under experimental/special use permits). A majority of counties allow alternative treatment units, with aerobic treatment units, recirculating sand filters, intermittent sand filters, adsorption mounds and evapotranspiration allowed in at least 50% of the counties.

A brief description of the major alternative treatment systems follows. Note that absorption mounds, evapotranspiration, and constructed wetlands are included in both the treatment and dispersal component categories.

**Aerobic Treatment Unit (ATU):** Aerobic systems are similar to septic systems in that they both use natural processes to treat wastewater. But unlike septic (anaerobic) treatment, the aerobic treatment process requires oxygen. These units use mechanisms to inject and circulate air inside the treatment tank. This allows certain bacteria that need an oxygen rich environment to thrive and work to break down and digest wastewater constituents inside the tank.

**Media Filters** (also known as Packed-Bed Filters, recirculating sand filters, intermittent sand filters, peat filters, textile media filters, and recirculating gravel filters) are alternative treatment units that use media to enhance naturally occurring biological, chemical, and physical processes to treat wastewater. They usually consist of a container to hold the filter media and a wastewater distribution system that doses the wastewater onto the filter media. The objective of the media filter is to mimic or create the ideal treatment environment.

**Absorption Mound Systems** are designed to provide treatment and dispersal in situations where there is not adequate soil depth or separation to groundwater. These conditions do not allow the installation of a standard gravity onsite system. Mounds function as both the secondary treatment unit and the dispersal component. A "mound" of specific sand is placed above properly prepared original soil. A pressure distribution network is placed at the top of the sand and distributes wastewater from the primary treatment unit onto the mound where it receives a high-level of treatment as it flows downward through the sand and into the underlying soil.

**Evapotranspiration Systems** discharge wastewater to large sand beds with an impervious liner. Wastewater from a primary treatment unit is distributed into the bed and is removed by evaporation. Specific plants can also be used in the beds to enhance transpiration of wastewater. These systems are used in areas where conditions prohibit wastewater discharge into the ground and where climatic conditions provide enough evaporation potential.

**Constructed Wetlands** are artificially constructed systems that copy features of naturally occurring wetlands. They rely on plants and naturally occurring biological, chemical, and physical processes to treat wastewater constituents and reduce the volume of wastewater by evapotranspiration. Wastewater is applied to 'cells' that are carefully designed to support and enhance the processes.

### Leachline/absorption Area Design Practices

Table 3-3 Leachline/absorption Area Design Practices examines general site testing requirements and soil absorption area sizing practices. Twenty-five jurisdictions require both a soil profile and a percolation test as part of site evaluation. Nine require only a soil profile while five require only a percolation test.

Absorption area sizing requirements are based on what part of the trench is to be used (credited) in calculating the surface area needed to accept and absorb the effluent. Three absorption area sizing practices are used: 1) seven jurisdictions use trench bottom area only, 2) twelve jurisdictions use trench sidewall area only, and 3) twenty-three jurisdictions use both trench bottom and sidewall area.

**Summary Table 3-3 Leachline/absorption Area Design Practices**

| *of 39 counties responding* | | YES | NO |
|---|---|---|---|
| **Absorption Area/Leach Area Sizing Practices** | 100% Expansion area | 36 | 3 |
| | Sizing trench bottom only | 8 | 31 |
| | Sizing trench sidewall only | 12 | 27 |
| | Sizing both trench bottom and sidewall | 23 | 16 |
| | Reduction for chambers | 14 | 25 |
| **Site testing – Evaluation Required** | Percolation test required | 30 | 9 |
| | Soil Profile required | 34 | 5 |
| **Design Manual – Guidelines Used** | Manual of Septic Tank Practice | 22 | 17 |
| | Uniform Plumbing Code | 28 | 11 |
| | EPA Design Manual | 21 | 18 |
| | RWQCB Basin Plan Guidelines | 26 | 13 |
| | Local Ordinance/guidelines | 35 | 4 |

### Effluent Distribution Methods

Table 3-4 **Effluent Distribution Methods** lists the common methods used to distribute the wastewater from the primary treatment unit into the soil dispersal/absorption component. Distribution methods are different ways to apply wastewater to the soil absorption area. Proper distribution can provide a suitable environment for the biological, chemical and physical processes that need to take place for effective wastewater treatment. The terms equal distribution and serial distribution describe the way in which the wastewater is distributed onto the absorption area. Equal distribution attempts to distribute the wastewater equally to the absorption area, thereby dosing the entire absorption surface. Serial distribution doses one part of the absorption area until it reaches saturation and fills up, forcing wastewater to flow to the next part of the absorption area.

Pop-overs, drop-boxes, dosing siphons, distribution boxes, and hydrosplitters are devices used to distribute the wastewater. Pressure distribution uses either pressure from a pump or gravity to equally dose the absorption area.

**Summary Table 3-4 Effluent Distribution Methods**

| *of 39 counties responding* | | YES | NO |
|---|---|---|---|
| **Effluent Distribution Methods - What is approved or required** | Serial Distribution | 25 | 14 |
| | Equal Distribution | 37 | 12 |
| | Pop-overs | 16 | 13 |
| | Drop-boxes | 24 | 15 |
| | Pressure Distribution | 33 | 6 |
| | Dosing Siphons | 28 | 11 |
| | Hydrosplitter | 21 | 18 |

### Wastewater Dispersal and Absorption Methods

Table 3-5 **Effluent Dispersal Methods** lists the manner in which the wastewater from the primary treatment component is discharged and is a critical element to ensure effective treatment. Dispersal systems should be designed to take advantage of the naturally occurring treatment processes in the soil. The system should optimize the biological, chemical and physical processes to provide the most effective treatment. Note that absorption mounds, evapotranspiration, and constructed wetlands are included in both the treatment unit and dispersal component categories.

**Summary Table 3-5 Dispersal and Absorption Methods**

| *of 39 counties responding* | YES | NO |
|---|---|---|
| Standard Drainfield 2'-6' | 39 | 0 |
| Shallow Trenches <2' | 30 | 9 |
| Deep Trenches>6' | 27 | 12 |
| Absorption/leach Beds | 24 | 15 |
| At-grade | 25 | 14 |
| Imported Fill | 23 | 16 |
| Sand-lined Trenches | 16 | 23 |
| Alternating Drainfields | 32 | 7 |
| Gravelless (Chambers) | 37 | 2 |
| Gravelless (foam/chips) | 1 | 38 |
| Gravelless (half-pipe) | 6 | 33 |
| Seepage Pits | 19 | 20 |
| Constructed Wetland | 8 | 31 |
| Evapotranspiration | 22 | 17 |
| Subsurface Drip Dispersal | 20 | 19 |
| Absorption/sand Mound | 32 | 7 |

Shallow trenches, deep trenches, at-grade, imported fill, sand-lined, and gravel-less are variations of the standard drainfield. Gravel-less systems are now considered standard trench designs in several counties. Shallow trenches and absorption mounds are allowed in more than two-thirds of the counties. Only eight counties would consider allowing constructed wetlands. A brief discussion of the major types of dispersal methods follows.

**Standard Trenches**: Standard trenches (leachlines, leach field or drainfield) are constructed with the trench bottom level. Their depth is 2-6 feet, with a width of between 2 and 3 feet. The trenches typically contain 18 inches of gravel with the distribution pipe placed in the center of the trench with 12 inches of gravel under the pipe. Wastewater is generally gravity fed into the perforated distribution pipe where it leaches out into the soil. The gravel and soil provide further wastewater treatment.

**Shallow Trenches:** a variation on the standard drainfield. They are designed to use the upper soil to receive the effluent from the treatment unit. These shallow systems enhance wastewater treatment since there is more biological activity at these shallow depths. These systems are also used to provide for greater separation from underlying groundwater.

**Deep trenches** are typically used to get below poor soil conditions or an impervious layer that restricts the downward movement of the wastewater. They can, therefore, provide effective wastewater dispersal but not necessarily effective treatment, as there is limited biological activity at this depth. Deep trenches can also be used to provide wastewater storage in slowly permeable soils.

**At-grade** systems are designed to use the upper soil to receive the effluent from the treatment unit. The distribution pipe is laid at the ground surface and is covered with soil. Their function is similar to the shallow trenches. These systems also provide for greater separation from groundwater or to maximize separation to restrictive soil layers.

**Imported fill** systems are used to either replace excavated soil or place additional soil at a site in which to place the soil dispersal area.

**Sand-lined Trenches** use carefully selected sand to line the trench excavation. The sand acts as a media filter for the applied wastewater. These systems are often used in improve treatment in areas of shallow soils over fractured rock or soils that are too permeable, that is, leach too quickly. They can be either gravity or pressure dosed.

**Gravel-less Trenches:** as the name implies, these systems replace the gravel in the trench system. Replacement materials include with preformed structures called chambers, half-pipe, and foam or other synthetic material. These structures provide a void space for passage and storage of wastewater from the treatment component and an interface with the exposed soil surface. The gravel-less option has the same function performed by the layer of gravel that is traditionally used in drainfields.

**Seepage pits or dry wells** are deep excavations used for subsurface dispersal of wastewater from a primary treatment unit. These pits are designed to provide storage and dispersal of the wastewater into formations that are permeable. No appreciable wastewater treatment occurs in the pits with their primary function being dispersal of the wastewater. When seepage pits are not preceded by a septic tank and are the sole means of treatment and dispersal, they are also called **cesspool**s.

**Evapotranspiration Systems** dispose of wastewater to the atmosphere by using large sand beds lined with an impervious liner. Wastewater from a primary treatment unit is distributed into the bed and is removed by evaporation. Specific plants can also be used in the beds to enhance transpiration of wastewater. These systems are used in areas where conditions prohibit wastewater discharge into the ground and where climatic conditions provide enough evaporation potential.

**Constructed wetlands** are artificially constructed systems that copy features of naturally occurring wetlands. They rely on plants and naturally occurring biological, chemical, and physical processes to treat wastewater constituents and reduce the volume of wastewater by evapotranspiration. Wastewater is applied to 'cells' that are carefully designed to support and enhance the processes. Only six jurisdictions would consider allowing these systems.

**Absorption Mound Systems** are designed to provide treatment and dispersal where there is not sufficient soil depth to install conventional gravity or pressure distribution systems. A "mound" of specific sand is placed above properly prepared original soil. A pressure distribution network is placed at the top of the sand. Wastewater from the primary treatment unit is distributed into the mound where it receives a high level of treatment as it flows downward through the sand and into the underlying soil.

**Subsurface Drip Dispersal Systems** use small diameter pipes and drip emitters for subsurface dispersal of the wastewater into the soil. They are designed to discharge very small doses of effluent over a large surface area and at shallow depths and utilize the biological, physical and chemical processes in the shallow soil for wastewater treatment. These systems typically require effective pretreatment and filtering to keep the emitters from clogging. These systems are being designed to provide subsurface irrigation for landscaping.

### Advanced/alternative Treatment Systems in Operation

Table 3-6 Advanced/alternative Treatment Systems lists the number and type of alternative treatment units in operation. Less than one-percent of the systems in the state fall into these categories. This is a limited sample with 25 jurisdictions providing information. It does however provide an overview of the types of systems actually in operation. A breakdown by jurisdiction is in the appendix.

**Summary Table 3-6 Advanced/alternative Treatment Units**

| Advanced/alternative Treatment Units – 25 Jurisdictions | |
|---|---|
| **Treatment Unit** | **Number** |
| Aerobic Treatment Unit | 1,502 |
| Recirculating Sand/gravel Filter | 113 |
| Intermittent Sand Filter | 884 |
| Peat Filter | 1 |
| Absorption/sand Mound | 2,137 |
| Textile/media Filter | 15 |
| Evapotranspiration | 208 |
| Constructed Wetland | 6 |
| Composting Toilet | 65 |
| Lagoon | 42 |
| | |
| Total Number Alternative Systems in the 25 Jurisdictions Responding | 4,973 |
| | |
| Total Number Onsite Systems in the 25 Jurisdictions Responding | 625,288 |

## *Post-installation Oversight*

Post-installation oversight includes those activities performed or required by the regulatory jurisdictions after a system is installed. These activities are more critical with alternative systems since these typically require some frequency of checking system operation and performing maintenance to ensure proper system functioning. Monitoring can involve quantitative checking of system function including wastewater influent and effluent sampling and analysis. This sampling is used to determine system treatment efficiency in removing contaminants and comparing the obtained results to the expected performance. These tests can be useful in indicating a problem with the system.

Real estate transaction inspections refer to activities conducted to ensure that an onsite system serving a home is functioning properly at the time of sale. These inspections are often referred to as 'point of sale' inspections. This inspection can provide the opportunity to evaluate systems and perform necessary maintenance. Lenders often require this type of inspection prior to issuing a loan on the property.

Table 3-7Post-installation Oversight examines the activities required by jurisdictions after systems have been installed. Approximately 50 percent of the counties require system monitoring and ongoing operation and maintenance activities. In contrast, more than 75 percent of the counties allow some type of alternative system. This is a concern since alternative systems require some form of routine maintenance to ensure proper function. ALL onsite systems require some form of routine maintenance to ensure proper function, however maintenance for a traditional system is typically less frequent, consisting mainly of tank pumping. Local agency personnel in 40 percent of the counties conduct real estate transaction inspections. The thoroughness of these inspections varies, but they typically require at least inspection of the tank with tank pumping required if it had not been done for some set period of time (anywhere from 3 to 5 years). Several jurisdictions indicated that they had recently stopped performing these inspections. These inspections can provide a window of opportunity to make assessments. A thorough inspection can reveal if the system is functioning properly and to some extent if adequate treatment is occurring. Twenty jurisdictions require on going system operation and maintenance. Typically this is a requirement for the alternative systems. Conventional system monitoring is rarely performed.

**Summary Table 3-7 Post-Installation Oversight**

| **Post-Installation Oversight – Number of Jurisdictions Requiring** | |
|---|---|
| Monitoring/sampling required | 11 |
| Agency conducts monitoring | 11 |
| Operation and maintenance required – Standard Systems | 3 |
| Operation and Maintenance Required – Alternative Systems | 20 |
| Agency Performs Real Estate Transaction Inspections | 16 |

If the use of onsite continues to expand to areas with unfavorable soils, alternative systems will be more commonly used to compensate for those conditions. Operations, maintenance and oversight responsibilities will have to increase to protect these investments. This change will also require a more effective educational program targeting all the stakeholders, including local elected officials, homeowners and the professionals involved in the onsite wastewater industry. Informed stakeholders will determine the policies and practices needed to better protect public health and water quality.

## *Individual Domestic Water Wells*

Information was received from thirty-five jurisdictions about the number of new water wells installed for the period 1998 to 2000. 21,869 wells were installed for this three-year period. This information is accurate as these jurisdictions are responsible for the permitting of new wells. The survey also requested information on documented nitrate contamination or waterborne diseases attributed to onsite systems for individual domestic wells. No waterborne disease problems were reported but there were 24 nitrate contamination problems attributed to onsite systems. Survey results are presented in summary table 3-8 below. The complete table is in appendix II.

**Summary Table 3-8 Individual domestic water wells**

| Individual domestic water well information – 35 jurisdictions | |
|---|---|
| Wells installed – 1998 to 2000 | 21,869 |
| Wells with documented nitrate contamination from onsite systems | 24 |
| Wells with documented waterborne disease contamination from onsite systems | 0 |
| Number of individual wells in California - estimated | 330,150 |

The number of individual wells was estimated by adding the numbers reported for 1998-2000 to the totals determined from the 1998-99 survey.

## Part IV: Case Studies

### *Case Study 4.1: Effects on Ground Water Chico, Butte County*

Nitrate contamination was detected in Chico's shallow ground water in 1979. Sampling conducted in the early 1990's determined that the primary origin of nitrate contamination was septic systems. Nitrate values ranged from less than 10 milligrams per liter to over 100 milligrams per liter (the Maximum Contaminant Level is 45.) The California Regional Water Quality Control Board in Redding adopted a prohibition restricting the use of septic systems in the Chico Urban Area until some remedy could be identified. Where septic system density in some of the current problem areas exceeds four systems per acre, new septic systems would only be allowed on parcels of one acre or more. County and city officials began to work together to evaluate their options, identify funding sources and seek input from the affected public.

On May 16, 2000 the Butte County Board of Supervisors authorized that the Chico Urban Area Nitrate Compliance Plan as the County's formal response to Prohibition Order No. 90-126. This Plan sets the foundation for the County to prepare engineering, financing, and environmental plans that will support a State Revolving Fund (SRF) loan application and relevant grants. Approximately 7,800 units are proposed to be sewered. The County anticipates submitting its SRF loan application by early 2001. Engineering design, bid preparation, and construction activities would follow thereafter. The County anticipates securing project financing by late 2001 or 2002 to support construction efforts. Approximately 4,200 units are proposed to remain on septic systems. These units are located on larger properties that exceed the sewer density requirements identified in the Nitrate Compliance Plan. As part of an oversight monitoring program, the County will conduct water quality monitoring of the shallow aquifer for nitrate and coliform; enhance public education and outreach on septic system operations & maintenance; develop a reporting program for system complaints and repairs; and codify the oversight monitoring program into the County Code to ensure its implementation.

For more information, see www.buttecounty.net/cob (see "Nitrate Plan") or call (530) 538-7631.

### *Case Study 4.2: Effects on Surface Waters Malibu, Los Angeles County*

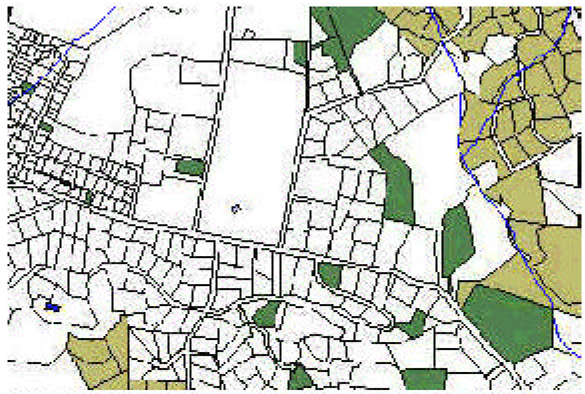
Whenever the Malibu Lagoon breaches and flows into the ocean, Surfrider Beach is closed to protect public health. Both Malibu Creek and Lagoon are listed on the federal Clean Water Act Section 303(d) list of impaired water bodies, where the parameters of concern include nutrients (nitrogen), coliform, and viruses. From August through November 1999, the Regional Water Quality Control Board, Los Angeles Region (Regional Board), conducted a joint study with the City of Malibu to assess whether septic systems along Malibu Creek were contributing to water quality problems. During the summer months, when discharge from Malibu Creek to the Lagoon is low, a sandbar forms at the mouth of the lagoon, causing water levels in the Lagoon and the nearest parts of the creek to rise. It has been reported to the Regional Board that leachfields near the Lagoon become submerged due to the rise in ground water. In November 1999, the Lagoon breached as it does every year, draining the impounded water to the ocean. This decrease in Lagoon levels also allowed septic system effluent, containing ammonia, coliform, and other wastewater constituents, to discharge to the creek and lagoon. A concurrent study undertaken by University of California as part of the Santa Monica Bay National Estuary Project evaluated the health effects of recreational contact with contaminated marine water. The results of the study showed that swimmers who swim in front of a flowing storm drain could experience an increased risk for fever, chills, ear discharge, vomiting, coughing with phlegm in comparison to those who swam over 400 yards away. Although it is not yet known what specific pathogens cause illness, the study confirms that the bacterial indicators that are being monitored do help to predict risk. Septic systems, illegal connections to sewer, and the swimmers themselves are cited as potential sources of pathogen contamination.

The Regional Board is now requiring commercial septic system users to install monitoring wells and meet discharge limits for nutrients and bacteria. For additional information about the Santa Monica Bay epidemiological study, see http://www.epa.gov/owow/estuaries/coastlines/coastlines6.3/monicbay.html.

### *Case Study 4.3: Pollution Prevention with Geographic Information Systems Santa Barbara County, California*

The Environmental Health Division in the Santa Barbara County Public Health Department recognizes the value of its shoreline, and the vulnerability of its many watersheds. With help from GeoDigital Mapping Inc., the Department has begun working with parcel maps of the county to project where water quality impairments might occur as a result of failing or densely sited septic systems. Using maps of existing sewer lines and other records, they have identified all of the areas dependent on septic systems and their proximity to water bodies.

Data from pumpers reports, inspections, and historic records are being integrated with links to the maps so that staff can access or update records on a site by clicking on the map. Not only does this make the Division more efficient at site-specific review, the mapping function will enable the County to make informed decisions for sustainable, environmentally sound growth.



*Mapped neighborhoods. Shaded sections represent areas on septic system; darker shaded areas indicate that sewer is available. (From Santa Barbara County Environmental Health.)*

The Division has also partnered with the County Water Agency and Heal the Ocean to investigate human and animal sources of bacteria to near coastal waters in the Lower Rincon Creek Watershed. To see that report, go to their website at http://www.sbcphd.org/ehs/.

## Conclusions

Onsite systems serve **10%** of the housing units in the state. The survey results demonstrate that this 10% rate has been maintained for new housing units since the 1990 Census. All indications are that this trend will continue in the future. Onsite sewage treatment systems are a necessary and practical method to handle sewage treatment needs for many locations in California. These systems can be sited, designed, installed, monitored, and maintained to provide effective sewage treatment to protect public health and water quality. New innovations and technology that provide improved treatment are now available and will continue to be developed. These systems need to be evaluated and used appropriately. The challenge is to change attitudes and practices to reflect the new reality that the function of systems is treatment and that the systems are permanent.

The survey results demonstrate a significant variation in allowable practices and policies among state and local regulatory agencies. This inconsistency has perpetuated an atmosphere of uncertainty and confusion among all the stakeholders, wastewater treatment professionals and the general public alike. The pending statewide regulations should remedy this situation by establishing baseline standards for all jurisdictions that have responsibility for onsite systems. Strong leadership is needed in areas where there are shared objectives, for example, professional certification. Collection and distribution of treatment results, from various components in different hydrogeologic settings, is needed so that technology can be used appropriately to address treatment objectives. Any necessary changes can then be based on informed decisions.

A key to further developing the onsite/decentralized concept to met infrastructure needs is educating and informing all of the stakeholders. This includes not only the practitioners but also the policy and decision makers and the general public. California's growth and development needs require effective utilization of onsite/decentralized wastewater treatment systems as part of an integrated water management program. Using onsite/decentralized systems is in many situations the appropriate and cost effective method of sewage treatment.

Several issues remain to be addressed. Notably: 1) California needs to develop a comprehensive septage management strategy to meet future needs. Local government, the Regional Water Quality Control Boards and the State Water Resources Control Board need to develop strategies to ensure that the septage treatment and disposal facilities are adequate to meet the demand. 2) California needs to develop an effective training and certification program to ensure that systems are sited, designed, installed, inspected, operated, and maintained properly. Training and certification/licensing is a key to assuring that practitioners know their responsibilities, are accountable, and can fulfill their assigned roles. 3) California needs to develop a technology certification program to ensure that the technology functions as needed and thereby protects the consumer, property values, public health, and the environment.

This survey found that obtaining accurate statistical information remains a problem. There is no data collection requirement or central data collection for this information. The pending regulations will require establishing management programs that include a minimum data collection element and this should enable more accurate and complete information in the future. The survey information presented should, however, provide reasonably accurate statistical information. This information can be used to gain a clearer picture of onsite sewage treatment system practices in California.

## Appendices

**Appendix I – Chapter 781, California Water Code (AB 885 Text)**

**Appendix II – Complete Tables from the 2001-2002 Survey**

**Appendix III – Selected Tables from the 1998-1999 Survey - Status Report: Onsite Wastewater Treatment Systems in California (June 200 Draft)**

**Appendix IV - Resources - For more Information Resources**

**Appendix V - Bibliography**

## *Appendix I – Chapter 781, California Water Code (AB 885 Text)*

BILL NUMBER: AB 885 CHAPTERED
BILL TEXT

CHAPTER 781
FILED WITH SECRETARY OF STATE SEPTEMBER 27, 2000
APPROVED BY GOVERNOR SEPTEMBER 27, 2000
PASSED THE ASSEMBLY AUGUST 29, 2000
PASSED THE SENATE AUGUST 28, 2000
AMENDED IN SENATE AUGUST 25, 2000
AMENDED IN SENATE AUGUST 18, 2000
AMENDED IN SENATE AUGUST 8, 2000
AMENDED IN SENATE JUNE 29, 2000
AMENDED IN SENATE APRIL 24, 2000
AMENDED IN ASSEMBLY MAY 13, 1999
AMENDED IN ASSEMBLY APRIL 8, 1999

INTRODUCED BY Assembly Member Jackson

FEBRUARY 25, 1999

An act to add Chapter 4.5 (commencing with Section 13290) to Division 7 of the Water Code, relating to water.

LEGISLATIVE COUNSEL'S DIGEST

AB 885, Jackson. Onsite sewage treatment systems. Existing law authorizes a California regional water quality control board to prohibit, under specified circumstances, the discharge of waste from individual disposal systems or community collection and disposal systems that use subsurface disposal. This bill would require the State Water Resources Control Board, on or before January 1, 2004, and in consultation with the State Department of Health Services, the California Coastal Commission, the California Conference of Directors of Environmental Health, counties, cities, and other interested parties, to adopt, specified regulations or standards for the permitting and operation of prescribed onsite sewage treatment systems that meet certain requirements.

The bill would require each regional board to incorporate the state board's regulations or standards into the appropriate regional water quality control plans.

The bill would make a statement of legislative intent relating to assistance to private property owners with onsite sewage treatment systems.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. Chapter 4.5 (commencing with Section 13290) is added to Division 7 of the Water Code, to read:

CHAPTER 4.5. ONSITE SEWAGE TREATMENT SYSTEMS

13290. For the purposes of this chapter:

(a) "Local agency" means any of the following entities:

(1) A city, county, or city and county.

(2) A special district formed pursuant to general law or special act for the local performance of functions regarding onsite sewage treatment systems within limited boundaries.

(b) "Onsite sewage treatment systems" includes individual disposal systems, community collection and disposal systems, and alternative collection and disposal systems that use subsurface disposal.

13291. (a) On or before January 1, 2004, the state board, in consultation with the State Department of Health Services, the California Coastal Commission, the California Conference of Directors of Environmental Health, counties, cities, and other interested parties, shall adopt regulations or standards for the permitting and operation of all of the following onsite sewage treatment systems in the state and shall apply those regulations or standards commencing six months after their adoptions:

(1) Any system that is constructed or replaced.

(2) Any system that is subject to a major repair.
(3) Any system that pools or discharges to the surface.
(4) Any system that, in the judgment of a regional board or authorized local agency, discharges waste that has the reasonable potential to cause a violation of water quality objectives, or to impair present or future beneficial uses of water, to cause pollution, nuisance, or contamination of the waters of the state.
(b) Regulations or standards adopted pursuant to subdivision (a), shall include, but shall not be limited to, all of the following:
(1) Minimum operating requirements that may include siting, construction, and performance requirements.
(2) Requirements for onsite sewage treatment systems adjacent to impaired waters identified pursuant to subdivision (d) of Section 303 of the Clean Water Act (33 U.S.C. Sec. 1313(d)).
(3) Requirements authorizing a qualified local agency to implement those requirements adopted under this chapter within its jurisdiction if that local agency requests that authorization.
(4) Requirements for corrective action when onsite sewage treatment systems fail to meet the requirements or standards.
(5) Minimum requirements for monitoring used to determine system or systems performance, if applicable.
(6) Exemption criteria to be established by regional boards.
(7) Requirements for determining a system that is subject to a major repair, as provided in paragraph (2) of subdivision (a).
(c) This chapter does not diminish or otherwise affect the authority of a local agency to carry out laws, other than this chapter, that relate to onsite sewage treatment systems.
(d) This chapter does not preempt any regional board or local agency from adopting or retaining standards for onsite sewage treatment systems that are more protective of the public health or the environment than this chapter.
(e) Each regional board shall incorporate the regulations or standards adopted pursuant to subdivisions (a) and (b) into the appropriate regional water quality control plans.

13291.5 It is the intent of the Legislature to assist private property owners with existing systems who incur costs as a result of the implementation of the regulations established under this section by encouraging the state board to make loans under Chapter 6.5 (commencing with Section 13475) to local agencies to assist private property owners whose cost of compliance with these regulations exceeds one-half of one percent of the current assessed value of the property on which the onsite sewage system is located. 13291.7. Nothing in this chapter shall be construed to limit the land use authority of any city, county, or city and county.

## *Appendix II – Complete Tables from the 2001-2002 Survey*

# Table 3-1 LocalProgram Administration

| | Onsite Systems Based on 2001/02 Survey | System Tracking & Recordkeeping | | | | Program information | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Computerized | Manual | GIS capability | Online permit application | Staffing - Person years | Staff working in the onsite program | MOU with RWQCB | Moratoriums - prohibition areas | Systems installed - 2000 | Systems repaired - 2000 |
| **Alpine** | 636 | N | Y | Y | N | 0.1 | 1 | N | N | 30 | 10 |
| **Amador** | 10,020 | N | Y | N | N | 1.5 | 5 | Y | Y | 155 | 55 |
| **Calaveras** | 16,128 | N | Y | N | N | 4 | 4 | N | N | 250 | 50 |
| **Colusa** | 2,613 | Y | Y | N | N | 0.3 | 3 | N | N | 45 | 18 |
| **El Dorado** | 33,754 | Y | N | N | N | 2 | 7 | N | N | 419 | 82 |
| **Fresno** | 44,126 | Y | Y | Y | N | 1 | 9 | N | N | 515 | |
| **Glenn** | 4,830 | N | Y | N | N | 0.4 | 3 | N | N | 55 | 31 |
| **Humboldt** | 16,541 | Y | Y | N | N | 3.5 | 4 | Y | N | 85 | 47 |
| **Imperial** | 6,783 | N | N | N | N | 0.1 | 5 | Y | N | 36 | 1 |
| **Inyo** | 2,258 | N | Y | N | N | 0.4 | 4 | Y | N | 29 | 10 |
| **Lassen** | 6,154 | N | Y | N | N | 0.1 | 3 | Y | Y | 100 | 13 |
| **Los Angeles** | 81,110 | Y | Y | Y | N | 8 | 14 | N | Y | 333 | 141 |
| **Madera** | 18,526 | Y | Y | Y | N | 2 | 3 | N | N | 321 | 208 |
| **Marin** | 9,446 | Y | Y | Y | Y | 5 | 5 | Y | Y | 77 | 38 |
| **Mariposa** | 6,754 | Y | Y | N | N | 1.2 | 2.5 | N | Y | 167 | 20 |
| **Napa** | 9,860 | Y | Y | Y | N | 2.2 | 6.5 | N | N | 139 | 52 |
| **Plumas** | 9,724 | Y | N | N | N | 1.2 | 4 | N | N | 156 | 117 |
| **Riverside** | 115,285 | N | Y | N | N | 4.2 | 6 | Y | Y | 544 | 207 |
| **Sacramento** | 19,349 | Y | Y | N | N | 1.1 | 4 | N | N | 191 | 199 |
| **San Diego** | 74,837 | N | Y | Y | N | 18 | 26 | N | Y | 1003 | 510 |
| **San Joaquin** | 28,800 | Y | N | Y | N | 2.2 | 3 | | | 260 | 325 |
| **San Luis Obispo** | 27,773 | Y | N | N | N | 1.2 | 15 | Y | Y | 400 | 200 |
| **San Mateo** | 6,460 | Y | N | Y | N | 4 | 5 | Y | Y | 26 | 91 |
| **Santa Barbara** | 11,848 | Y | N | Y | N | 2.5 | 9 | Y | N | 127 | 211 |
| **Santa Clara** | 19,320 | N | Y | N | N | 3.6 | 12 | Y | N | 98 | 78 |
| **Santa Cruz** | 26,922 | Y | N | Y | N | 7.5 | 16 | Y | N | 72 | 445 |
| **Shasta** | 29,116 | Y | Y | N | N | 1 | 9 | N | N | 200 | 100 |
| **Sierra** | 1,632 | N | N | N | N | 0.2 | 1 | N | N | 39 | 9 |
| **Siskiyou** | 10,433 | Y | N | Y | Y | 1.5 | 3 | Y | N | 218 | 62 |
| **Solano** | 6,069 | Y | N | N | N | 2 | 4 | Y | N | 70 | 12 |
| **Sonoma** | 44,461 | N | Y | N | N | 14 | 14 | Y | Y | 387 | 390 |
| **Stanislaus** | 26,585 | Y | Y | Y | | 3 | 9 | Y | N | 75 | 243 |
| **Sutter** | 11,971 | Y | N | N | N | 3 | 3 | N | N | 100 | 75 |
| **Tehama** | 14,319 | N | Y | N | N | 1 | 3 | N | N | 215 | 43 |
| **Tulare** | 34,981 | N | Y | N | N | 1 | 1 | N | N | 361 | 92 |
| **Ventura** | 17,076 | Y | Y | N | Y | 2.5 | 6 | | | 145 | 268 |
| **Yolo** | 5,384 | Y | Y | N | N | 1 | 3 | N | N | 80 | 15 |
| **Yuba** | 6,866 | Y | Y | N | N | 1.5 | 3 | N | N | 79 | 22 |
| | **818,750** | **24** | **26** | **13** | **3** | **109** | **238** | **16** | **10** | **7602** | **4490** |

**Blank cells indicate no response**

**** MOU - Memorandum of Understanding between jurisdiction and RWQCB in place**

# Table 3-2 Septic Tank & Treatment Units

| | Two compartment septic tank | One compartment septic tank | Plastic septic tank | Fiberglass septic tank | Pump vault in tank | Septic tank with separate pump chamber | Effluent filter required | Tank access riser required | Water tight tank required | Water tight tank test required | Aerobic treatment unit | Recirculating sand/gravel filter | Intermittent sand filter | Peat filter | Absorption/sand mound | Textile/media filter | Evapotranspiration system | Constructed wetland | Composting toilet | Lagoon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Alpine** | Y | N | N | N | Y | Y | N | Y | Y | Y | Y | Y | Y | N | N | N | N | N | N | N |
| **Amador** | Y | N | Y | Y | Y | Y | N | N | Y | N | N | N | Y | N | N | Y | Y | N | N | N |
| **Calaveras** | Y | N | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | N | Y | N | Y | Y | N | Y |
| **Colusa** | Y | N | N | N | Y | Y | | | | | N | Y | Y | N | Y | Y | Y | N | N | N |
| **El Dorado** | Y | N | Y | Y | N | Y | Y | Y | Y | N | Y | Y | Y | N | Y | N | Y | N | N | N |
| **Fresno** | Y | N | Y | Y | N | Y | N | N | Y | N | N | N | N | N | N | N | Y | N | Y | N |
| **Glenn** | Y | N | Y | Y | N | Y | N | N | Y | N | Y | Y | Y | N | Y | Y | Y | N | N | N |
| **Humboldt** | Y | N | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | | Y | | | Y | | |
| **Imperial** | Y | N | N | Y | Y | Y | N | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Inyo** | Y | Y | Y | Y | Y | Y | N | N | Y | N | N | N | Y | N | Y | N | N | Y | N | Y |
| **Lassen** | Y | N | Y | Y | Y | Y | N | N | Y | N | N | Y | Y | N | N | N | N | N | N | Y |
| **Los Angeles** | Y | N | Y | Y | N | Y | N | N | Y | N | Y | N | N | Y | N | Y | Y | N | N | N |
| **Madera** | Y | N | Y | Y | N | Y | N | N | N | N | Y | N | N | N | Y | N | Y | N | N | N |
| **Marin** | Y | N | N | Y | N | Y | Y | Y | Y | Y | N | Y | Y | N | Y | Y | N | N | N | N |
| **Mariposa** | Y | N | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | N | Y | N | N | N | N | N |
| **Napa** | Y | N | Y | Y | N | Y | Y | Y | Y | Y | N | N | N | N | Y | N | Y | N | N | N |
| **Plumas** | Y | N | Y | Y | Y | Y | N | Y | Y | N | N | Y | Y | N | Y | Y | N | N | N | N |
| **Riverside** | Y | N | | Y | N | N | N | N | N | | N | N | N | N | N | N | N | N | N | N |
| **Sacramento** | Y | N | | | | | N | N | Y | N | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| **San Bernardino** | Y | N | Y | N | Y | Y | N | N | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y |
| **San Diego** | Y | | Y | Y | | Y | Y | Y | Y | Y | Y | | | | | | Y | | | |
| **San Francisco** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **San Joaquin** | Y | N | | Y | | | Y | Y | Y | N | Y | | | | Y | | Y | | | |
| **San Luis Obispo** | Y | N | Y | Y | N | Y | N | N | N | | Y | Y | Y | Y | Y | Y | Y | Y | N | Y |
| **San Mateo** | Y | N | Y | Y | N | Y | N | Y | Y | N | Y | Y | Y | Y | Y | Y | N | N | N | N |
| **Santa Barbara** | Y | N | Y | Y | Y | Y | N | Y | Y | N | Y | Y | Y | N | Y | N | Y | N | N | N |
| **Santa Clara** | Y | N | Y | Y | N | Y | Y | Y | Y | N | N | N | N | N | N | N | N | N | N | N |
| **Santa Cruz** | Y | N | Y | Y | N | Y | N | Y | N | N | Y | Y | Y | N | Y | Y | N | N | N | N |
| **Shasta** | Y | N | Y | Y | N | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| **Sierra** | Y | N | Y | Y | Y | Y | N | Y | Y | N | Y | Y | Y | N | N | N | Y | N | N | N |
| **Siskiyou** | Y | N | Y | Y | Y | Y | N | N | Y | N | Y | Y | Y | N | Y | N | Y | N | Y | N |
| **Solano** | Y | N | Y | Y | Y | | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N |
| **Sonoma** | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N |
| **Stanislaus** | Y | Y | Y | Y | Y | Y | N | N | Y | N | Y | N | N | N | Y | | Y | N | N | N |
| **Sutter** | Y | N | N | Y | N | Y | N | N | Y | N | N | N | Y | N | Y | N | N | N | N | N |
| **Tehama** | Y | N | N | Y | Y | Y | N | N | Y | N | N | Y | Y | N | Y | N | N | N | N | |
| **Tulare** | Y | N | N | Y | Y | N | N | N | Y | N | N | N | N | N | N | N | N | N | N | N |
| **Ventura** | Y | N | Y | Y | N | Y | N | N | Y | Y | N | N | N | N | Y | N | N | N | N | N |
| **Yolo** | Y | N | N | N | Y | Y | N | N | Y | N | Y | Y | Y | N | Y | Y | Y | Y | Y | Y |
| **Yuba** | Y | N | N | N | N | Y | N | N | Y | N | Y | Y | Y | N | N | Y | N | N | N | N |
| **Yes responses** | **39** | **2** | **27** | **33** | **19** | **34** | **11** | **18** | **34** | **11** | **25** | **25** | **28** | **8** | **28** | **17** | **22** | **9** | **6** | **8** |

**Blank cells indicate that the question was left blank on the survey form.**

# Table 3-3 Leachline Design Practices

| | Absorption/leach area | | | | | | | | Site Testing - Evaluation Requirements | | Design manual/guidance used | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100% expansion area required | Sizing trench bottom only | Sizing sidewall only | Sizing both bottom and sidewall | Percent sidewall allowed | Percent bottom allowed | Reduction for chambers | % reduction for chambers | Percolation test required | Soil profile required | Manual of Septic Tank Practice | Uniform Plumbing Code | EPA Design manual (1980) | RWQCB Basin Plan Guidelines | Local Ordinance/guidelines |
| **Alpine** | Y | N | N | Y | 50% | 50% | Y | 30% | N | Y | Y | Y | N | Y | Y |
| **Amador** | Y | N | N | Y | 100% | 100% | N | | N | Y | Y | Y | Y | Y | Y |
| **Calaveras** | Y | N | N | Y | | | N | | N | Y | Y | Y | N | N | Y |
| **Colusa** | Y | N | N | Y | 20% | 100% | N | | N | Y | Y | Y | Y | Y | |
| **El Dorado** | Y | N | Y | N | | | Y | | Y | Y | Y | Y | | Y | Y |
| **Fresno** | Y | N | N | Y | 75% | 100% | N | | Y | Y | Y | Y | N | Y | Y |
| **Glenn** | Y | N | N | Y | 100% | 100% | Y | MR | N | Y | N | N | N | N | Y |
| **Humboldt** | Y | N | Y | N | | | N | | Y | Y | Y | Y | Y | Y | Y |
| **Imperial** | Y | Y | N | N | | | Y | 20% | Y | N | N | Y | N | Y | Y |
| **Inyo** | N | N | N | Y | 100% | 100% | Y | MR | Y | Y | N | Y | Y | Y | Y |
| **Lassen** | Y | N | N | Y | 33% | 66% | N | | Y | Y | Y | Y | Y | Y | |
| **Los Angeles** | Y | Y | N | Y | 100%* | 100% | Y | 30% | Y | Y | N | Y | N | N | Y |
| **Madera** | Y | N | N | Y | 50% | 100% | N | | N | Y | Y | Y | Y | N | Y |
| **Marin** | Y | N | Y | N | | | N | | Y | Y | | | Y | | Y |
| **Mariposa** | N | N | Y | N | | | N | | Y | Y | N | N | Y | Y | Y |
| **Napa** | Y | N | Y | N | | | N | | N | Y | N | N | N | N | Y |
| **Plumas** | Y | N | Y | N | | | N | | Y | Y | Y | Y | Y | Y | Y |
| **Riverside** | Y | N | N | Y | 30% | 100% | Y | 20% | Y | Y | Y | Y | N | Y | Y |
| **Sacramento** | Y | N | Y | N | | | N | | Y | N | N | N | N | N | Y |
| **San Bernardino** | Y | N | N | Y | 50% | 50% | N | | Y | Y | N | Y | Y | Y | Y |
| **San Diego** | Y | Y | N | | | | N | | Y | Y | | | | | Y |
| **San Francisco** | NA | NA | NA | NA | | | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **San Joaquin** | Y | N | Y | N | | | | | Y | Y | Y | N | Y | Y | Y |
| **San Luis Obispo** | Y | N | N | Y | 50% | 100% | Y | | Y | N | | Y | Y | Y | Y |
| **San Mateo** | Y | N | Y | N | | | N | | Y | Y | N | N | Y | Y | Y |
| **Santa Barbara** | Y | N | N | Y | 50% | 100% | N | | Y | N | N | Y | N | Y | Y |
| **Santa Clara** | Y | N | N | N | | | N | | Y | Y | Y | N | Y | Y | Y |
| **Santa Cruz** | N | N | N | Y | 100% | 100% | Y | MR | Y | Y | N | N | N | Y | Y |
| **Shasta** | Y | N | N | Y | 20% | 100% | N | | Y | Y | Y | Y | N | Y | Y |
| **Sierra** | Y | N | N | Y | 33% | 66% | Y | | Y | Y | | Y | | Y | |
| **Siskiyou** | Y | Y | N | N | | | Y | 25% | Y | Y | Y | Y | Y | Y | Y |
| **Solano** | Y | Y | Y | N | | | N | | Y | Y | N | N | N | N | Y |
| **Sonoma** | Y | N | Y | N | | | N | | Y | Y | Y | Y | Y | Y | |
| **Stanislaus** | Y | N | Y | Y | 30-44% | 40-60%** | Y | 30% | Y | Y | Y | Y | Y | Y | Y |
| **Sutter** | Y | N | N | Y | 20% | 80% | Y | 30% | N | Y | Y | Y | Y | N | Y |
| **Tehama** | Y | N | N | Y | 25% | 75% | Y | 30% | N | Y | Y | Y | Y | Y | Y |
| **Tulare** | Y | N | N | Y | 33% | 66% | | | Y | N | Y | Y | N | N | Y |
| **Ventura** | Y | Y | N | N | | | N | | Y | Y | N | Y | N | N | Y |
| **Yolo** | Y | N | N | Y | 30% | 30% | | | Y | Y | Y | Y | Y | Y | Y |
| **Yuba** | Y | Y | N | Y | MSTP | 100%*** | N | | Y | Y | Y | Y | Y | N | Y |
| **Yes responses** | **36** | **7** | **12** | **23** | | | **14** | | **30** | **34** | **22** | **28** | **21** | **26** | **35** |

*After 12" gravel
**18" gravel standard
***Sidewall after 12" gravel

# Table 3-4 Effluent Distribution Methods

| | Serial distribution | Equal distribution | Pop-overs | Drop-boxes | Pressure distribution | Dosing siphons | Hydrosplitter |
|---|---|---|---|---|---|---|---|
| Alpine | Y | Y | N | Y | Y | Y | N |
| Amador | N | Y | N | N | Y | Y | Y |
| Calaveras | Y | Y | Y | Y | Y | Y | Y |
| Colusa | Y | Y | N | N | Y | Y | Y |
| El Dorado | Y | Y | Y | Y | Y | Y | ? |
| Fresno | Y | Y | Y | N | Y | Y | N |
| Glenn | N | Y | N | Y | Y | Y | Y |
| Humboldt | Y | Y | N | Y | Y | N | |
| Imperial | N | Y | N | Y | N | Y | N |
| Inyo | N | Y | N | Y | Y | Y | Y |
| Lassen | N | Y | N | Y | Y | Y | Y |
| Los Angeles | Y | Y | Y | N | Y | N | Y |
| Madera | N | N | N | N | Y | N | N |
| Marin | Y | Y | N | N | Y | Y | Y |
| Mariposa | N | Y | N | Y | Y | Y | Y |
| Napa | Y | Y | Y | Y | Y | Y | Y |
| Plumas | Y | Y | | Y | Y | Y | Y |
| Riverside | N | Y | N | N | Y | Y | N |
| Sacramento | N | Y | | | | | |
| San Bernardino | Y | Y | Y | Y | Y | Y | N |
| San Diego | Y | | | | | | |
| San Francisco | NA | NA | NA | NA | NA | NA | NA |
| San Joaquin | N | Y | | | | | |
| San Luis Obispo | Y | Y | | | Y | Y | |
| San Mateo | Y | Y | Y | N | Y | Y | N |
| Santa Barbara | Y | Y | Y | Y | Y | Y | Y |
| Santa Clara | Y | Y | Y | Y | N | N | Y |
| Santa Cruz | N | Y | Y | Y | Y | Y | Y |
| Shasta | Y | Y | Y | Y | Y | Y | Y |
| Sierra | Y | Y | Y | Y | Y | Y | Y |
| Siskiyou | N | Y | N | N | Y | Y | Y |
| Solano | Y | Y | Y | Y | Y | N | Y |
| Sonoma | Y | Y | Y | Y | Y | Y | Y |
| Stanislaus | Y | Y | N | Y | Y | N | N |
| Sutter | N | Y | N | N | Y | Y | Y |
| Tehama | Y | Y | Y | Y | Y | N | N |
| Tulare | Y | Y | N | N | Y | Y | N |
| Ventura | N | Y | N | Y | N | N | N |
| Yolo | Y | Y | Y | Y | Y | Y | N |
| Yuba | Y | Y | N | Y | Y | Y | Y |
| Yes Responses | 25 | 37 | 16 | 24 | 33 | 28 | 21 |

# Table 3-5 Effluent Dispersal Methods

| | Standard drainfield 2'-6' | Shallow trenches <2' | Deep trenches >6' | Absorption/leach Beds | At-grade | Imported fill | Sand-lined trenches | Alternating drainfields | Gravelless (chambers) | Gravelless (foam/chips) | Gravelless (half-pipe) | Seepage pits | Constructed wetland | Evapotranspiration system | Subsurface drip dispersal | Absorption mound |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Alpine** | Y | Y | Y | Y | Y | Y | Y | N | Y | N | N | Y | N | N | N | N |
| **Amador** | Y | Y | N | N | Y | Y | Y | Y | Y | N | N | N | N | Y | N | Y |
| **Calaveras** | Y | Y | N | Y | Y | Y | Y | Y | Y | N | N | N | N | Y | Y | Y |
| **Colusa** | Y | N | Y | Y | Y | Y | N | Y | Y | N | N | N | N | Y | Y | Y |
| **El Dorado** | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N | Y | Y | Y |
| **Fresno** | Y | Y | Y | Y | N | Y | N | Y | Y | N | N | Y | N | Y | Y | Y |
| **Glenn** | Y | Y | Y | N | Y | Y | Y | Y | Y | N | N | N | N | Y | N | Y |
| **Humboldt** | Y | Y | N | N | Y | N | N | Y | Y | N | Y | N | Y | NR | N | Y |
| **Imperial** | Y | N | N | Y | NR | Y | N | Y | Y | N | N | Y | Y | Y | Y | Y |
| **Inyo** | Y | Y | Y | N | N | N | N | N | Y | N | N | N | Y | N | N | Y |
| **Lassen** | Y | Y | Y | Y | Y | Y | N | N | Y | N | N | Y | N | N | N | N |
| **Los Angeles** | Y | Y | Y | Y | N | Y | N | Y | Y | N | N | Y | N | Y | Y | Y |
| **Madera** | Y | Y | Y | N | Y | Y | Y | Y | Y | N | N | Y | N | Y | N | Y |
| **Marin** | Y | Y | Y | N | N | N | Y | Y | Y | N | N | Y | N | N | Y | Y |
| **Mariposa** | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | Y | N | N | N | Y |
| **Napa** | Y | Y | N | N | N | N | N | N | N | N | N | N | N | Y | N | Y |
| **Plumas** | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N | N | Y | Y |
| **Riverside** | Y | Y | Y | Y | Y | Y | N | Y | Y | N | N | Y | N | N | N | N |
| **Sacramento** | Y | Y | Y | N | Y | N | Y | Y | Y | N | Y | Y | N | Y | Y | Y |
| **San Bernardino** | Y | Y | Y | Y | Y | Y | N | Y | Y | N | N | Y | Y | Y | N | Y |
| **San Diego** | Y | | | | Y | | | | Y | | | Y | | Y | Y | |
| **San Francisco** | NA | NA | NA | | NA | NA | NA | | NA | | | NA | NA | NA | NA | NA |
| **San Joaquin** | Y | N | Y | Y | N | N | N | Y | | | | Y | | Y | | Y |
| **San Luis Obispo** | Y | Y | Y | Y | N | Y | Y | Y | Y | | | Y | Y | Y | | Y |
| **San Mateo*** | Y | N | Y | Y | N | N | | Y | Y | N | N | N | N | N | Y | Y |
| **Santa Barbara*** | Y | Y | Y | Y | Y | N | N | Y | Y | N | Y | N | N | Y | Y | Y |
| **Santa Clara** | Y | N | Y | N | N | N | N | N | Y | N | N | N | N | N | N | N |
| **Santa Cruz*** | Y | Y | Y | N | Y | Y | N | Y | Y | N | Y | N | N | N | Y | Y |
| **Shasta*** | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | Y |
| **Sierra** | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N | Y | Y | Y |
| **Siskiyou** | Y | Y | Y | Y | Y | N | Y | Y | Y | N | N | N | N | Y | N | Y |
| **Solano** | Y | Y | N | N | Y | N | N | Y | Y | N | Y | N | Y | Y | Y | Y |
| **Sonoma*** | Y | N | Y | N | Y | N | N | Y | Y | N | N | N | N | N | Y | Y |
| **Stanislaus** | Y | Y | N | Y | Y | Y | N | N | Y | N | N | Y | N | Y | Y | Y |
| **Sutter** | Y | Y | N | N | N | N | N | Y | Y | N | N | N | N | N | Y | Y |
| **Tehama** | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | Y | N | N | | Y |
| **Tulare** | Y | N | N | Y | N | Y | N | Y | Y | N | N | Y | N | N | N | N |
| **Ventura** | Y | Y | N | Y | Y | N | N | Y | Y | N | N | Y | N | N | N | Y |
| **Yolo** | Y | N | N | Y | N | Y | Y | Y | Y | N | N | N | Y | Y | N | Y |
| **Yuba** | Y | Y | Y | N | N | N | N | Y | Y | N | N | Y | N | N | Y | N |
| **Yes responses** | 39 | 30 | 27 | 24 | 25 | 23 | 16 | 32 | 37 | 1 | 6 | 19 | 8 | 22 | 20 | 32 |

***Seepage pits for repairs**
**NR = No response**
**NA = Not applicable**

# Table 3-6 Alternative Systems Reported by County

| County | Total number onsite systems | Aerobic treatment unit | Recirculating sand/gravel filter | Intermittent sand filter | Peat filter | Absorption/sand mound | Textile/media filter | Evapotranspiration system | Constructed wetland | Composting toilet | Lagoon | Total alternative systems in county | Alternatives as percentage of onsite systems |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alpine | 636 | | | 3 | | | | | | | | 3 | 0.5% |
| Amador | 10,020 | 3 | 1 | 300 | 0 | 200 | 0 | 30 | 0 | 3 | 0 | 537 | 5.4% |
| El Dorado | 33,754 | 0 | 0 | 0 | | 10 | | 3 | | 10 | | 23 | 0.1% |
| Glenn | 4,830 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | | | | 3 | 0.1% |
| Humboldt | 16,541 | 1 | 4 | 10 | | 122 | | | 2 | | | 139 | 0.8% |
| Imperial | 6,783 | 0 | 0 | 0 | 0 | 0 | ? | ? | 2 | 2 | ? | 4 | 0.1% |
| Inyo | 2,258 | | | 30 | | 1 | | | 1 | 2 | 5 | 39 | 1.7% |
| Lassen | 6,154 | | 1 | 1 | | | | | | | 1 | 3 | 0.0% |
| Los Angeles | 81,110 | 0 | | | 0 | | 1 | 7 | | | | 8 | 0.0% |
| Madera | 18,526 | 1320 | | | | 0 | | 0 | | | | 1320 | 7.1% |
| Marin | 9,446 | | 30 | 250 | | 600 | 5 | | | | | 885 | 9.4% |
| San Bernardino | 132,000 | 1 | 0 | 1 | | 2 | 1 | 2 | 0 | 1 | 5 | 13 | 0.0% |
| San Diego | 74,837 | 50 | | | | | | 50 | | | | 100 | 0.1% |
| San Joaquin | 28,800 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0.0% |
| San Mateo | 6,460 | 0 | 5 | 10 | 0 | 0 | 0 | | | | | 15 | 0.2% |
| Santa Cruz | 26,922 | 110 | 10 | 10 | | 51 | 4 | | | | | 185 | 0.7% |
| Shasta | 29,116 | 2 | 30 | 15 | 0 | 20 | 0 | 5 | 0 | 20 | 1 | 93 | 0.3% |
| Siskiyou | 10,433 | 3 | 1 | 18 | | 9 | | 2 | | 2 | | 35 | 0.3% |
| Sonoma | 44,461 | 11 | 26 | 12 | 1 | 754 | 2 | 5 | | 1 | | 812 | 1.8% |
| Stanislaus | 26,585 | 0 | | | | 4 | | 4 | | | | 8 | 0.0% |
| Sutter | 11,971 | | | 5 | | 10 | | | | | | 15 | 0.1% |
| Tehama | 14,319 | | 4 | 10 | | 1 | | | | | | 15 | 0.1% |
| Ventura | 17,076 | | | | | 300 | | | | | | 300 | 1.8% |
| Yolo | 5,384 | 0 | 0 | 0 | | 50 | 0 | 100 | 1 | 24 | 30 | 205 | 3.8% |
| Yuba | 6,866 | 1 | 1 | 209 | | | 2 | | | | | 213 | 3.1% |
| State Total | 625,288 | 1502 | 113 | 884 | 1 | 2137 | 15 | 208 | 6 | 65 | 42 | 4973 | 0.8% |

These results are from those counties responding that provided the number of alternatives.
The shaded cells indicate that particular type of alternative was not permitted by the jurisdiction at the time the survey was conducted.
This response represents 25 counties with approximately one-half of the all onsite systems in the state.

# Post-installation Oversight

| | Monitoring/sampling required | Agency conducts monitoring | Operation & maintenance required standard systems | Operation & maintenance required alternative systems | Real estate transaction inspections |
|---|---|---|---|---|---|
| **Alpine** | N | N | N | N | Y |
| **Amador** | N | Y | N | N | N |
| **Calaveras** | N | Y | N | N | N |
| **Colusa** | N | N | N | N | Y |
| **El Dorado*** | N | N | N | N | Y |
| **Fresno** | N | N | N | N | Y |
| **Glenn** | N | N | N | N | Y |
| **Humboldt** | | | N | Y | Y |
| **Imperial** | N | N | Y | Y | N |
| **Inyo** | N | N | N | Y | Y |
| **Lassen** | N | N | N | N | Y |
| **Los Angeles** | Y | Y | N | Y | N |
| **Madera** | N | N | N | Y | Y |
| **Marin*** | Y | N | N | Y | N |
| **Mariposa** | N | N | N | N | N |
| **Napa*** | Y | Y | N | Y | N |
| **Plumas** | N | N | N | Y | N |
| **Riverside** | N | N | N | Y | N |
| **Sacramento** | N | N | N | N | N |
| **San Bernardino** | N | N | N | Y | N |
| **San Diego** | N | N | N | Y | N |
| **San Francisco** | NA | NA | NA | NA | NA |
| **San Joaquin** | Y | Y | N | Y | N |
| **San Luis Obispo** | N | N | N | Y | N |
| **San Mateo** | Y | Y | N | Y | Y |
| **Santa Barbara** | N | N | N | N | N |
| **Santa Clara** | N | N | Y | N | N |
| **Santa Cruz*** | Y | Y | N | Y | Y |
| **Shasta** | Y | Y | N | Y | Y |
| **Sierra** | N | N | N | N | Y |
| **Siskiyou** | N | N | N | N | N |
| **Solano** | Y | Y | N | Y | N |
| **Sonoma*** | Y | Y | N | Y | Y |
| **Stanislaus**** | Y | Y | N | Y | N |
| **Sutter** | N | N | N | N | N |
| **Tehama** | Y | N | N | Y | N |
| **Tulare** | N | N | N | N | Y |
| **Ventura** | N | N | N | N | N |
| **Yolo** | N | N | Y | N | Y |
| **Yuba** | N | N | N | N | N |
| **Yes responses** | 11 | 11 | 3 | 20 | 16 |

***Monitor alternative sytems**
****Monitor aerobic treatment units**

## Table 3-8 Individual Domestic Water Wells

| Well information for three year period 1998-2000 | Wells installed - 1998 to 2000 | Nitrate contamination | Bacterial contamination | Estimate of individual wells in jurisdiction |
|---|---|---|---|---|
| **Amador** | 391 | 0 | 0 | 5,454 |
| **Calaveras** | 366 | 0 | 0 | 15,332 |
| **Colusa** | 256 | 0 | 0 | 2,151 |
| **El Dorado** | 1,067 | 0 | 0 | 12,726 |
| **Fresno** | 1,019 | 0 | 0 | 12,103 |
| **Glenn** | 146 | 0 | 0 | 4,146 |
| **Humboldt** | 144 | 0 | 0 | 4,459 |
| **Inyo** | 86 | 0 | 0 | 2,108 |
| **Lassen** | 300 | 0 | 0 | 5,598 |
| **Los Angeles** | 806 | 0 | 0 | 11,818 |
| **Madera** | 950 | 0 | 0 | 12,155 |
| **Marin** | 122 | 0 | 0 | 1,728 |
| **Mariposa** | 320 | 0 | 0 | 5,733 |
| **Napa** | 1,180 | 0 | 0 | 7,779 |
| **Plumas** | 325 | 0 | 0 | 4,202 |
| **Riverside** | 789 | 0 | 0 | 18,603 |
| **Sacramento** | 483 | 0 | 0 | 15,087 |
| **San Bernardino** | 2,779 | 0 | 0 | 20,779 |
| **San Diego** | 1,562 | 1 | 0 | 17,326 |
| **San Joaquin** | 855 | 0 | 0 | 24,094 |
| **San Mateo** | 300 | 0 | 0 | 1,979 |
| **Santa Barbara** | 283 | 0 | 0 | 3,800 |
| **Santa Clara** | 522 | 0 | 0 | 7,448 |
| **Santa Cruz** | 347 | 0 | 0 | 8,435 |
| **Shasta** | 900 | 0 | 0 | 12,809 |
| **Sierra** | 60 | 0 | 0 | 277 |
| **Siskiyou** | 588 | 10 | 0 | 7,212 |
| **Solano** | 180 | 0 | 0 | 4,739 |
| **Sonoma** | 1,601 | 0 | 0 | 35,478 |
| **Stanislaus** | 735 | 0 | 0 | 17,630 |
| **Sutter** | 159 | 0 | 0 | 8,470 |
| **Tehama** | 839 | 0 | 0 | 8,316 |
| **Tulare** | 949 | 0 | 0 | 20,956 |
| **Yolo** | 173 | 13 | 0 | 4,739 |
| **Yuba** | 287 | 0 | 0 | 6,350 |
| **Totals** | 21,869 | 24 | 0 | 352,019 |

## ***Appendix III – Selected Tables from the 1998-1999 Survey - <u>Status Report: Onsite Wastewater Treatment Systems in California (June 2000 Draft)</u>***

Table A - Onsite Sewage Treatment Systems – 1998/99 Survey

Table B - Onsite Sewage Treatment System Comparison - 1999 with 1990

Summary tables from 1998-1999 Survey:

Summary Table 1 - Septic Tanks and Treatment Units

Summary Table 2 Effluent Dispersal

Summary Table 3 Effluent Distribution

# TABLE A

| | ONSITE SEWAGE TREATMENT SYSTEMS | | | | | | WATER WELLS | | |
|---|---|---|---|---|---|---|---|---|---|
| | Housing units with individual sewage systems | Population served | County population* | Systems installed per year (5 year average) | System repairs per year (5 year average) | Persons* per household | Individual domestic water wells | Population served | Wells with nitrate last 5 yrs. |
| **Alameda** | 4,489 | 12,388 | 1,433,309 | 225 | 60 | 2.8 | 2,106 | 5,812 | 0 |
| **Alpine** | 551 | 1,316 | 1,193 | 10 | 5 | 2.4 | 200 | 478 | 4 |
| **Amador** | 9,600 | 23,491 | 33,924 | 175 | 35 | 2.4 | 5,063 | 12,389 | 1 |
| **Butte** | 44,314 | 110,573 | 201,935 | 335 | 245 | 2.5 | 20,000 | 49,905 | see note 1 |
| **Calaveras** | 15,378 | 38,645 | 38,144 | 300 | 50 | 2.5 | 14,966 | 37,610 | 0 |
| **Colusa** | 2,507 | 7,215 | 18,537 | 38 | 14 | 2.9 | 1,895 | 5,454 | 0 |
| **Contra Costa** | 11,222 | 32,063 | 916,403 | 250 | 100 | 2.9 | 7,267 | 20,763 | 2 |
| **Del Norte** | 5,230 | 13,587 | 28,096 | 75 | 6 | 2.6 | 2,435 | 6,326 | 0 |
| **El Dorado** | 32,609 | 89,917 | 150,824 | 1,000 | 150 | 2.8 | 11,659 | 32,149 | 0 |
| **Fresno** | 42,861 | 134,156 | 793,766 | 600 | 200 | 3.1 | 11,084 | 34,693 | 6 |
| **Glenn** | 4,686 | 13,196 | 26,943 | 47 | 22 | 2.8 | 4,000 | 11,264 | 0 |
| **Humboldt** | 16,265 | 41,277 | 128,086 | 115 | 49 | 2.5 | 4,315 | 10,950 | 0 |
| **Imperial** | 6,651 | 20,400 | 142,737 | 90 | 15 | 3.1 | 1,105 | 3,389 | 0 |
| **Inyo** | 2,191 | 5,126 | 18,204 | 30 | 5 | 2.3 | 2,022 | 4,730 | 0 |
| **Kern** | 46,939 | 136,442 | 648,398 | | | 2.9 | 11,790 | 34,271 | 0 |
| **Kings** | 5,533 | 19,119 | 128,323 | 54 | 12 | 3.5 | 5,106 | 17,644 | 0 |
| **Lake** | 13,452 | 32,591 | 55,294 | 100 | 55 | 2.4 | 5,476 | 13,267 | 0 |
| **Lassen** | 5,854 | 15,814 | 34,059 | 101 | 10 | 2.7 | 5,298 | 14,312 | 0 |
| **Los Angeles** | 80,135 | 288,797 | 9,757,542 | 287 | 265 | 3.6 | 11,012 | 39,686 | 1,000 |
| **Madera** | 17,526 | 51,985 | 115,846 | 273 | 185 | 3.0 | 11,205 | 33,236 | 0 |
| **Marin** | 9,276 | 23,558 | 247,934 | 200 | 100 | 2.5 | 1,606 | 4,079 | 0 |
| **Mariposa** | 6,347 | 14,687 | 16,124 | 98 | 15 | 2.3 | 5,413 | 12,526 | 1 |
| **Mendocino** | 20,520 | 53,077 | 87,143 | 446 | 140 | 2.6 | 10,590 | 27,392 | 0 |
| **Merced** | 15,000 | 49,795 | 206,887 | 125 | 40 | 3.3 | 15,000 | 49,795 | 0 |
| **Modoc** | 3,275 | 7,717 | 9,934 | 90 | 45 | 2.4 | 2,250 | 5,302 | 0 |
| **Mono** | 2,400 | 5,704 | 10,812 | 60 | 4 | 2.4 | 1,500 | 3,565 | 0 |
| **Monterey** | 21,154 | 66,664 | 391,322 | 225 | 380 | 3.2 | 12,000 | 37,816 | 0 |
| **Napa** | 9,450 | 26,019 | 124,588 | 110 | 50 | 2.8 | 6,599 | 18,169 | 0 |
| **Nevada** | 22,988 | 58,004 | 89,644 | 300 | 90 | 2.5 | 15,956 | 40,260 | 1 |
| **Orange** | 6,708 | 17,310 | 2,775,619 | | | 2.6 | 866 | 2,235 | |
| **Placer** | 23,315 | 61,259 | 225,873 | 240 | 36 | 2.6 | 13,882 | 36,474 | 0 |
| **Plumas** | 9,286 | 20,062 | 20,452 | 425 | 50 | 2.2 | 3,877 | 8,376 | 0 |
| **Riverside** | 113,238 | 336,986 | 1,473,307 | 2,100 | 2,500 | 3.0 | 17,814 | 53,013 | 0 |
| **Sacramento** | 18,887 | 50,393 | 1,177,835 | 250 | 38 | 2.7 | 14,604 | 38,966 | 0 |
| **San Benito** | 4,993 | 15,652 | 47,873 | 100 | 100 | 3.1 | 2,666 | 8,357 | 0 |
| **San Bernardino** | 132,000 | 415,189 | 1,654,007 | | | 3.1 | 18,000 | 56,617 | 0 |
| **San Diego** | 71,930 | 223,759 | 2,853,258 | 1,250 | 205 | 3.1 | 15,764 | 49,039 | 0 |
| **San Francisco** | 0 | 0 | 790,498 | 0 | 0 | 2.5 | 0 | 0 | |
| **San Joaquin** | 28,033 | 81,758 | 554,438 | 267 | 278 | 2.9 | 23,239 | 67,776 | 0 |
| **San Luis Obispo** | 26,700 | 72,552 | 241,598 | 462 | 90 | 2.7 | 12,686 | 34,472 | 0 |
| **San Mateo** | 6,360 | 19,680 | 722,762 | 35 | 100 | 3.1 | 1,679 | 5,195 | 0 |
| **Santa Barbara** | 11,434 | 33,424 | 409,048 | 140 | 145 | 2.9 | 3,517 | 10,281 | 0 |
| **Santa Clara** | 19,000 | 56,547 | 1,715,374 | 100 | 100 | 3.0 | 6,926 | 20,613 | 0 |
| **Santa Cruz** | 26,693 | 73,699 | 252,806 | 84 | 416 | 2.8 | 8,088 | 22,331 | 0 |
| **Shasta** | 28,516 | 73,046 | 165,438 | 215 | 200 | 2.6 | 11,909 | 30,506 | 0 |
| **Sierra** | 1,521 | 3,388 | 3,216 | 20 | 19 | 2.2 | 217 | 483 | 0 |
| **Siskiyou** | 9,760 | 22,973 | 44,335 | 131 | 84 | 2.4 | 6,624 | 15,591 | 0 |
| **Solano** | 5,938 | 18,222 | 390,112 | 40 | 30 | 3.1 | 4,559 | 13,990 | 0 |
| **Sonoma** | 43,360 | 115,739 | 443,669 | 300 | 300 | 2.7 | 33,877 | 90,426 | 2 |
| **Stanislaus** | 26,360 | 82,987 | 432,990 | 85 | 263 | 3.1 | 16,895 | 53,189 | 0 |
| **Sutter** | 11,671 | 33,522 | 76,694 | 100 | | 2.9 | 8,311 | 23,871 | 0 |
| **Tehama** | 13,669 | 34,630 | 55,671 | 232 | 59 | 2.5 | 7,477 | 18,943 | 0 |
| **Trinity** | 5,790 | 13,537 | 13,180 | 75 | 25 | 2.3 | 1,565 | 3,659 | 0 |
| **Tulare** | 34,238 | 114,743 | 363,305 | 280 | 84 | 3.4 | 20,007 | 67,050 | 0 |
| **Tuolumne** | 16,013 | 39,449 | 52,876 | 163 | 111 | 2.5 | 6,549 | 16,134 | 0 |
| **Ventura** | 16,701 | 50,513 | 742,008 | 300 | 191 | 3.0 | 2,401 | 7,262 | 0 |
| **Yolo** | 5,164 | 14,802 | 158,797 | 75 | 75 | 2.9 | 4,566 | 13,088 | 0 |
| **Yuba** | 6,585 | 18,685 | 60,409 | 59 | 26 | 2.8 | 6,063 | 17,204 | 0 |
| **TOTAL** | 1,202,266 | 3,507,829 | 33,773,399 | 13,287 | 7,872 | | 483,546 | 1,372,373 | 1,017 |

*State of California, Department of Finance, City/County Population and Housing Estimates, 1991-1999, with 1990 census counts. Sacramento, California, May 1999.

## TABLE B

### ONSITE SEWAGE TREATMENT SYSTEM COMPARISON 1999 WITH 1990

| | 1999 Housing units with individual sewage systems | 1999 Total housing units* | Percent housing units on individual systems | 1990 Housing units with individual sewage systems** | 1990 Total housing units** | Percent housing units on individual systems |
|---|---|---|---|---|---|---|
| **Alameda** | 4,489 | 531,166 | 1% | 4,264 | 504,109 | 1% |
| **Alpine** | 551 | 1,461 | 38% | 451 | 1,319 | 34% |
| **Amador** | 9,600 | 14,905 | 64% | 7,642 | 12,814 | 60% |
| **Butte** | 44,314 | 86,563 | 51% | 41,142 | 76,115 | 54% |
| **Calaveras** | 15,378 | 22,937 | 67% | 12,978 | 19,153 | 68% |
| **Colusa** | 2,507 | 7,085 | 35% | 2,213 | 6,295 | 35% |
| **Contra Costa** | 11,222 | 349,912 | 3% | 9,422 | 316,170 | 3% |
| **Del Norte** | 5,230 | 10,688 | 49% | 4,582 | 9,091 | 50% |
| **El Dorado** | 32,609 | 71,974 | 45% | 25,859 | 61,451 | 42% |
| **Fresno** | 42,861 | 270,782 | 16% | 38,361 | 235,563 | 16% |
| **Glenn** | 4,686 | 10,174 | 46% | 4,310 | 9,329 | 46% |
| **Humboldt** | 16,265 | 56,576 | 29% | 15,365 | 51,134 | 30% |
| **Imperial** | 6,651 | 43,067 | 15% | 6,431 | 36,559 | 18% |
| **Inyo** | 2,191 | 9,078 | 24% | 1,951 | 8,712 | 22% |
| **Kern** | 46,939 | 231,629 | 20% | 46,939 | 198,636 | 24% |
| **Kings** | 5,533 | 36,176 | 15% | 5,074 | 30,843 | 16% |
| **Lake** | 13,452 | 31,910 | 42% | 12,452 | 28,822 | 43% |
| **Lassen** | 5,854 | 11,635 | 50% | 4,943 | 10,358 | 48% |
| **Los Angeles** | 80,135 | 3,261,750 | 2% | 77,839 | 3,163,343 | 2% |
| **Madera** | 17,526 | 39,018 | 45% | 15,342 | 30,831 | 50% |
| **Marin** | 9,276 | 104,420 | 9% | 7,476 | 99,757 | 7% |
| **Mariposa** | 6,347 | 9,146 | 69% | 5,617 | 7,700 | 73% |
| **Mendocino** | 20,520 | 37,112 | 55% | 16,949 | 33,649 | 50% |
| **Merced** | 15,000 | 68,542 | 22% | 13,975 | 58,410 | 24% |
| **Modoc** | 3,275 | 5,183 | 63% | 2,773 | 4,672 | 59% |
| **Mono** | 2,400 | 11,651 | 21% | 1,882 | 10,664 | 18% |
| **Monterey** | 21,154 | 130,924 | 16% | 19,230 | 121,224 | 16% |
| **Napa** | 9,450 | 48,373 | 20% | 8,566 | 44,199 | 19% |
| **Nevada** | 22,988 | 44,605 | 52% | 19,588 | 37,352 | 52% |
| **Orange** | 6,708 | 954,882 | 1% | 6,708 | 875,072 | 1% |
| **Placer** | 23,315 | 102,344 | 23% | 21,395 | 77,879 | 27% |
| **Plumas** | 9,286 | 13,812 | 67% | 7,416 | 11,942 | 62% |
| **Riverside** | 113,238 | 569,287 | 20% | 96,738 | 483,847 | 20% |
| **Sacramento** | 18,887 | 464,470 | 4% | 16,637 | 417,574 | 4% |
| **San Benito** | 4,993 | 15,954 | 31% | 4,193 | 12,230 | 34% |
| **San Bernardino** | 132,000 | 604,060 | 22% | 124,684 | 542,332 | 23% |
| **San Diego** | 71,930 | 1,026,142 | 7% | 61,603 | 946,240 | 7% |
| **San Francisco** | 0 | 337,983 | 0% | 624 | 328,471 | 0% |
| **San Joaquin** | 28,033 | 186,718 | 15% | 25,897 | 166,274 | 16% |
| **San Luis Obispo** | 26,700 | 99,905 | 27% | 24,677 | 90,200 | 27% |
| **San Mateo** | 6,360 | 261,434 | 2% | 6,080 | 251,782 | 2% |
| **Santa Barbara** | 11,434 | 145,135 | 8% | 9,814 | 138,149 | 7% |
| **Santa Clara** | 19,000 | 581,532 | 3% | 18,132 | 540,240 | 3% |
| **Santa Cruz** | 26,693 | 96,679 | 28% | 25,563 | 91,878 | 28% |
| **Shasta** | 28,516 | 71,042 | 40% | 26,596 | 60,552 | 44% |
| **Sierra** | 1,521 | 2,295 | 66% | 1,396 | 2,166 | 64% |
| **Siskiyou** | 9,760 | 21,989 | 44% | 8,712 | 20,141 | 43% |
| **Solano** | 5,938 | 134,294 | 4% | 5,618 | 119,533 | 5% |
| **Sonoma** | 43,360 | 180,415 | 24% | 40,980 | 161,062 | 25% |
| **Stanislaus** | 26,360 | 149,966 | 18% | 25,714 | 132,027 | 19% |
| **Sutter** | 11,671 | 29,080 | 40% | 10,671 | 24,163 | 44% |
| **Tehama** | 13,669 | 23,784 | 57% | 11,813 | 20,403 | 58% |
| **Trinity** | 5,790 | 8,074 | 72% | 5,364 | 7,540 | 71% |
| **Tulare** | 34,238 | 120,211 | 28% | 31,338 | 105,013 | 30% |
| **Tuolumne** | 16,013 | 28,252 | 57% | 14,709 | 25,175 | 58% |
| **Ventura** | 16,701 | 248,500 | 7% | 14,809 | 228,478 | 6% |
| **Yolo** | 5,164 | 59,911 | 9% | 4,564 | 53,000 | 9% |
| **Yuba** | 6,585 | 23,230 | 28% | 6,113 | 21,245 | 29% |
| **TOTAL** | 1,202,266 | 12,119,822 | 10% | 1,092,174 | 11,182,882 | 10% |

*State of California, Department of Finance, City/County Population and Housing Estimates, 1991-1999, with 1990 census counts. Sacramento, California, May 1999.

** 1990 Census

## Summary tables from 1998-1999 Survey

| Summary Table 1 - Septic Tanks and Treatment Units of 55 counties responding | YES | NO |
|---|---|---|
| Two compartment septic tank allowed | 55 | 0 |
| One compartment septic tank allowed | 3 | 50 |
| Plastic septic tank allowed | 36 | 19 |
| Fiberglass septic tank allowed | 44 | 11 |
| Septic tank with pump vault allowed | 35 | 20 |
| Septic tank with separate pump chamber allowed | 52 | 3 |
| Effluent filter required | 16 | 36 |
| Water tight tank required | 49 | 4 |
| Tank access riser required | 38 | 16 |
| Aerobic treatment unit allowed* | 28 | 26 |
| Recirculating sand filter allowed* ** | 33 | 22 |
| Peat filter allowed* ** | 37 | 18 |
| Intermittent sand filter allowed* ** | 10 | 42 |
| Recirculating gravel filter allowed* ** | 15 | 38 |
| Composting toilet allowed* | 11 | 42 |

| Summary Table 3 Effluent Distribution of 55 counties responding | Yes | No |
|---|---|---|
| Serial distribution | 41 | 14 |
| Equal distribution | 52 | 3 |
| Pop-overs | 25 | 25 |
| Drop-boxes | 25 | 25 |
| Pressure distribution | 48 | 7 |
| Dosing siphons | 36 | 17 |
| Hydrosplitter | 31 | 20 |

| Summary Table 3 Effluent Dispersal Methods of 55 counties responding | Yes | No |
|---|---|---|
| Standard drainfield 2'-6' | 55 | 0 |
| Shallow trenches <2' | 44 | 11 |
| Deep trenches >6' | 37 | 18 |
| At-grade | 38 | 16 |
| Imported fill | 28 | 27 |
| Sand-lined trenches | 22 | 33 |
| Gravel-less (chambers) | 48 | 7 |
| Seepage pits | 28 | 25 |
| Constructed wetland | 2 | 51 |
| Evapotranspiration | 25 | 28 |
| Pressure drip irrigation | 17 | 36 |
| Absorption mound | 42 | 11 |

## *Appendix IV Resources - For more Information Resources*

California Conference Directors of Environmental Health
3700 Chaney Court, Carmichael, CA 95608
Phone (916) 944-7315 Fax: 944-2256

California Environmental Health Association
CEHA Support Services
2211 Westchester Drive, San Jose, CA 95124
Voice: (408) 356-7574 Fax: (408) 358-1712 http://www.ceha.org/

California Groundwater Association
P.O. Box 14369, Santa Rosa, CA 95402
Phone: (707) 578-4408 Fax: (707) 546-4906

California Onsite Wastewater Association
Cliff Trammel, Executive Director
Box 6146, Santa Rosa, CA 95406
707/579-4882 Fax 707/579-0117

California Rural Water Association
8300 Fair Oaks Blvd., Suite 302, Carmichael, CA 95608
toll-free: (800) 833-0322 phone: (916) 944-0236 fax:(916) 944-0128 or www.cowa.org

Office of Water Programs
CSUS Foundation, California State University at Sacramento
6000 J Street, CA 95819-6025
(916) 278-6142

California Wastewater Training & Research Center
California State University, Chico
Chico, CA 95929-0930
(530) 898-6027 fax: (530) 898-4576 or www.csuchico.edu/cwtrc

Rural Community Assistance Corporation
2125 19th Street, Suite 203
Sacramento, CA 95818
(916) 447-2854, fax: (916) 447-2878

Small Flows Clearinghouse/National
Environmental Training Center for Small Communities
(800) 624-8301, EST or www.nsfc.wvu.edu, www.netc.wvu.edu

State Water Resources Control Board
(Links to Regional Water Quality Control Board information) www.swrcb.ca.gov

United States Environmental Protection Agency
Office of Water and Wastewater, Municipal Assistance Branch
www.epa.gov/owm/decent/decent.htm.Onsite

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