Chapter 2

ANALYSIS OF BENEFITS

WASTEWATER SYSTEM GOALS

Wastewater systems have two fundamental goals:

- Protection of public health (e.g., from waterborne disease-causing organisms such as bacteria; from high nitrate levels in ground water).
- Protection of the environment (e.g., protection of surface waters from eutrophication caused by excess phosphorus and nitrogen).

If properly sited, designed, installed and managed over their service lives, decentralized wastewater systems can, and do, meet both public health and environmental protection goals in areas where centralized treatment is impractical or not cost-effective. This section discusses why a decentralized system is often the most feasible choice for small communities.

The Clean Water Act, as amended, identifies federal requirements for wastewater treatment facilities discharging to waters of the U.S., i.e., a minimum of secondary treatment and water quality standards. Decentralized systems which discharge to a surface water must, and can, meet these requirements. Conventional onsite systems discharge effluent through the soils to the groundwater. Groundwater can be protected with properly maintained onsite systems or with additional treatment to control nutrients.

In addition, the Safe Drinking Water Act addresses the risk to groundwater quality posed by the large capacity septic systems (systems with the capacity to serve 20 or more persons per day). EPA includes large capacity septic systems as a type of Class V well which are regulated within the Underground Injection Control program to protect ground waters.

BENEFITS OF DECENTRALIZED WASTEWATER SYSTEMS

For certain communities and site conditions, managed decentralized wastewater systems are the most technically appropriate and economical means for treating wastewater when compared to centralized treatment systems. The primary benefits of using decentralized systems are:

- Protects public health and the environment
- Lower capital and maintenance costs for low density communities
- Adaptable to varying site conditions
- Additional benefits

How these factors affect the selection of wastewater systems is discussed below. For a more detailed discussion of cost-effectiveness, see the "Potential Costs and Savings" section of this document.

Protects Public Health and the Environment

Properly managed decentralized wastewater systems can provide the treatment necessary to protect public health and the environment including groundwater and surface waters, just as well as centralized systems. Decentralized systems can usually be sited, designed, installed and operated to meet all federal and state required effluent standards for biological oxygen demand (BOD), total suspended solids (TSS) and fecal coliform. Effective advanced treatment units are available for additional nutrient removal and disinfection requirements for both types of systems, as well.

Centralized systems frequently result in large watershed transfers of waters, whereas decentralized systems when used effectively promote the return of treated wastewater within the watershed of origin. Managed decentralized systems can effectively minimize the impacts of these interbasin water transfers.

Lower Capital and Maintenance Costs for Low Density Communities

In areas with low population densities (approximately one dwelling or less per acre), decentralized onsite wastewater systems often are the most cost-effective option for upgrading failing septic systems or serving new development. Constructing new centralized systems in rural areas is often economically unfeasible because of the distances between homes, the significant piping required to tie-in all the connections, and the inability to achieve economies of scale (i.e., a certain number of users to support system costs).

In urban and suburban areas with high population densities (more than three to four dwellings per acre), large-scale, centralized collection and treatment of wastewater is usually most cost-effective.

For areas with moderate population densities (one dwelling per one-half to one acre) located at moderate distances from a centralized treatment facility, the choice of a centralized or decentralized wastewater system may vary by neighborhood based on local conditions. Moderately populated areas may effectively use decentralized cluster wastewater systems that serve two or more (up to several hundred is possible) homes and are located close to the dwellings they serve. These cluster systems are cost-effective in many cases because they use smaller, less expensive collection pipes that travel relatively short distances to smaller, less maintenance intensive treatment units (often with soil disposal or reuse of effluent). As long as homes are relatively close together, cluster systems may be cost-competitive with numerous individual onsite systems.

Adaptable to Varying Site Conditions

In the past, when fewer types of decentralized wastewater systems were available, certain site conditions, such as high ground-water tables, impervious soils, shallow bedrock or limestone formations, were considered limiting factors that precluded decentralized systems. In many cases, septic tank/leach field systems were nonetheless used at many such sites, with inadequate subsequent protection of surface and ground water. Today, however, decentralized systems can usually be designed for a specific site and its hydrogeological conditions. For example, sand mounds systems are designed specifically for sites with high ground water. Decentralized wastewater systems now allow greater flexibility and are often combined into treatment trains to meet a range of treatment goals and site conditions. A treatment train might include a septic tank and recirculating sand filter (or other types of technologies) to greatly reduce BOD, TSS, nitrogen, and bacteria levels; a relatively small leach field (a larger leach field becomes unnecessary with the additional treatment provided by a sand filter or other treatment units); and multiple dosing of effluent to the leach field on sites with excessively permeable soils.

Additional Benefits

Decentralized systems can be advantageous in ecologically sensitive areas, where treatment must be specifically targeted to local environmental concerns (e.g., ground water protection and protection of off-shore shellfish beds or where construction of centralized collection systems may disrupt the ecosystem). Also, most decentralized onsite systems inherently include on-lot water reuse and ground-water recharge. The wastewater can be treated by decentralized systems to a specified level and then retained for reuse near (usually outdoors) the home or facility (e.g., outside for irrigating the landscape). Such reuse is most common in industrial settings and is beginning to occur in commercial settings (e.g., office parks, golf courses); however, certain types of industrial facilities may require pretreatment if wastes are toxic. In certain water-short states (e.g., Arizona, California, Florida, Texas), such reuse is even practiced in residential settings.

CONCLUSION

Communities Can Use Combinations of Decentralized Wastewater Systems

For communities with a diversity of locales, the best option might be to use a combination of wastewater systems. For example, in more densely populated areas, hookup to a centralized facility might be most cost-effective. Decentralized cluster systems could be chosen for less densely populated fringe areas currently under development and for use in ecologically sensitive areas. Onsite systems could be used in the more rural areas. Considering all possible options and their combinations is the best approach to managing wastewater needs to achieve the most cost-effective solution for a variety of site conditions and community goals.