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Lake Canyon : a community's quest for satisfactory sewage disposal

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LAKE CANYON:
A COMMUNITY'S QUEST FOR SATISFACTORY SEWAGE DISPOSAL

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ABSTRACT

LAKE CANYON:

A COMMUNITY'S QUEST FOR SATISFACTORY SEWAGE DISPOSAL

by Michael C. Schott

Lake Canyon, an unsewered community of some 55 residences in the Santa Cruz Mountains of southwest Santa Clara County, sits adjacent to Beardsley creek (which flows into Lexington Reservoir) which is a part of the County aquifer recharge system. This research presents an investigation of the options available for community treatment of liquid waste, a characterization of attempts to document the problem, a questionnaire study of the residents' attitudes toward a community solution to the problem, and interviews with the twelve principal agencies and organizations involved in an ongoing attempt to resolve a long-recognized public health problem.

Due to drought conditions, documentation has been difficult; most, but not all residents favor a sewer project. All agencies interviewed agreed some form of community sewage disposal system was necessary.

Preface

Interest in the problem of Lake Canyon began with an assignment to East Los Gatos and the Santa Cruz Mountains in my employment as an Environmental Health Specialist for the County of Santa Clara. Much of the work was related to the feasibility of on-site waste disposal in the mountains, specifically in the realm of repair of failing septic systems. It became clear that repair of Lake Canyon on-site systems was for the most part a virtual impossiblility. Although there were not any obvious failures at the time, the lack of satisfactory sewage disposal had a pervasive negative impact on many aspects of life in the community.

It is gratifying that so many members of the Lake Canyon community were willing to take the time to respond to a rather involved questionnaire, particularly given my employment by an agency with some history of adversarial relationship. Particular thanks should go to Alex and Rosa Schooler and Bruce Cunningham, who helped me to overcome the mistrust of a number of residents. I also was helped considerbly in my understanding of the community's viewpoint by the several letters and comments which were returned along with the questionnaires.

Additional thanks must be awarded for the generosity and helpful candor of the representatives of the various organizations who are involved in ongoing attempts to resolve the Lake Canyon problem. All took time out of busy schedules to help me understand their views of the situation.

Particular appreciation is due the many collegues at the County of Santa Clara Environmental Health Services who gave assistance and support; notably to Rich Fuchs, for his ready help with computer problems, and to my superiors in the department, John Turner, Tony Pacheco, Trevor Hayes and Lee Esquibel for their considerable patience.

Finally, credit must go to my committee for the ultimate completion of this project. Thanks to Helen Ross for patiently accommodating my sporadic progress and varied schedules; to Glenn Hildebrand for prompt and astute reading of innumerable partial drafts; and to Henry Robinson, who gave me my start, for direction and support in muddy waters.

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INTRODUCTION

Most people in a developed society can take sewer systems for granted for the safe and efficient disposal of liquid waste from their residences. Even in unsewered areas, the septic tank with a subsurface drainfield currently provides an out-of-sight, out-of-mind solution for nearly one of every four new residences in the United States (U. S. EPA, 1980).

This study deals with that element of environmental protection as both a necessity and source of a dilemma. To the community in question, the quest for adequate disposal of bodily wastes has been fraught with obstacles, and has itself been the source of many demanding problems a typical homeowner would never experience.

The difficulties encountered in residential development in unsewered areas can be, in the presence of a history of septic system failure, compounded by a quagmire of ordinances, policies and bureaucratic red tape, all (or at least mostly) in the name of public health. Not unexpectedly, the relationship between property or home owner and public servant, intended to be one of mutual benefit, often becomes adversarial.

The story of the community of Lake Canyon must include the frustrations both sides have experienced in overcoming the residents' mistrust of the "flatland establishment" in

endeavoring to provide satisfactory sewer service for the area.

Lake Canyon has experienced a multifaceted problem, which needs a cognitive, rather than an intuitive approach. Many undercurrents are obscured by the ado surrounding a proposed major civic project. A major task could be made of selecting from the complex array of alternatives.

A useful approach to conceptualizing such a decision-making process has been offered by J. A. McMahon (1985). The most applicable among the models presented was attributed to Ralph W. Swain. The essentials of the process are as follows:

1) Recognize and define the problem;

2) determine assumptions;

3) identify tentative solutions;

4) evaluate alternative solutions, apply decision criteria;

5) select the alternative best fitting the criteria; and

6) implement the solution chosen.

Evaluation of the results (against standards based on the decision criteria) would be the logical final step.

In attempting to define the Lake Canyon problem, it is clear that there is more than one problem, or at the very least there is a rather large and multifaceted problem.

First, there is the problem of the "alleged" health hazard. If one accepts that there is, or has been and probably will be, pollution of Beardsley Creek as a result of unsatisfactory on-site waste disposal systems, Regional Water Quality Control Board requirements and County Ordinance are being violated. That in itself constitutes a "problem," whose solution could be have wide spread ramifications. The Town of Los Gatos and the Lexington Basin area are affected by there being a "health hazard"; they will also be affected by attempts at its mitigation.

Deese and Hudson (1978) described a methodology for generating and analyzing alternatives for sewage treatment for small communities. Alternatives proposed are based on the outcome of community field work after development of a community profile. Necessary factors such as population, growth rate, existing services and failures, as well as tax rates, land use and water quality will all affect the proposal. Deese and Hudson would focus on the evaluation of specific problem areas in a community. By cultivating public involvement, they were able to effectively work toward discovering the most efficient community-wide alternative.

The principal objectives of this study are:

1. To provide a representative description of the existing sewerage system in the community of Lake Canyon.

2. To clarify, by means of a questionnaire, the interplay among the various agencies as each makes its contribution toward a resolution of the problem.

3. To relate the effect of residents' actions upon the problem, and the effect of the problem and its proposed solutions on the residents.

4. To review the proposed solutions to the problem, and to discuss their relative merits.

REVIEW OF LITERATURE

History of the Problem

Lake Canyon, part of the Lexington Basin Watershed area, is in unincorporated Santa Clara County just west of Lexington reservoir. Development in Lake Canyon began with a number of small vacation homes built in the 1920's and 30's. Over the years it became a full-time community of approximately 134 persons, residing in 53 dwellings.

Originally intended for intermittent seasonal use, the on-site waste disposal systems would have been inadequate for continuous use even at that time. Today's year-round use, combined with high per capita waste discharge and more stringent standards of environmental protection, renders them even less satisfactory.

According to the Project Report for the Lexington Basin of Santa Clara County, steep slopes, tiny lots (with their concomitant high septic system density), high ground water, impervious high-clay soils, and the proximity of Beardsley Creek contribute to the high frequency of system failures reported in the area (James M. Montgomery, Consulting Engineers, Inc., 1981). Forty-five percent of systems in use in 1980 were reported to have a history of problems.

More recent studies indicate the Montgomery Report presented an oversimplified picture. Much of the soil in the Lake Canyon area, like neighboring soils in the

Lexington Basin, is actually quite porous. The history of system failure must therefore be attributed to concentrated discharge and shallow groundwater, rather than to the permeability of soils (Robert Moore, Questa Engineering, personal communication, 4-4-89).

The County Health Department had responded in the late 1960s to reports of bacterial pollution of Lexington Reservoir. The Montgomery study was undertaken in response to specific concerns expressed by the California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region that bacterial pollution demonstrated in surface waters feeding Lexington Reservoir was a result of the geographic concentration of individual septic systems in the Lexington Basin. A community leachfield project, proposed by the study and funded by the State, would have eliminated all individual systems. It was rejected by the residents; many still claim that the County had done an inadequate job of educating them about the proposed project and of explaining the consequences of their decision.

As a result, a building moratorium was imposed in the Lake Canyon area. No new construction would be permitted; life-extending construction was severely limited. The action appeased the RWQCB and the present condition would be tolerated as long as there were no new problems.

Over the years, however, the moratorium has met with frequent open violation, occasionally with political ramifications. Consequently the effectiveness of the original action to safeguard the waterways has been seriously threatened, and the enforcement abilities of both Environmental Health Services (EHS) and the Building Department have been compromised.

The uneasy status quo was disrupted by the enactment in 1986 of the Real Property Disclosure Law (California Civil Code Section 1102 et seq., effective January 1, 1987.) Owners who sought to sell or refinance their property were unable to present the necessary building permits for any of the improvements made since 1980. Moreover, most lending institutions required septic system inspections; failing or inadequate systems were so labeled by EHS.

The desire of the community to end the moratorium prompted a reexamination of the problem of sewage disposal in Lake Canyon. The issue is straightforward: the community as a whole is disposing of more waste into a small volume of soil than can be assimilated without adversely affecting ground and surface water. The intrinsic limitations of the soil are compounded by external factors such as climate and seasonally high ground water, with the result that a watercourse, Beardsley Creek, and nearby Lexington reservoir are being contaminated. However, recent weather conditions

(three drought years), have made documentation of this contamination quite difficult.

Remedy, in the form of a community waste disposal system, is expected to cost between two and three million dollars. State monies could be made available if certain qualifying requirements and State criteria for health hazard definition can be met (see Appendix A). EHS and other agencies are cooperating in an attempt to fulfill those requirements. Central to this endeavor is the necessity of gaining the confidence and cooperation of a somewhat distrustful community; without specific information about its sewage disposal problems, the criteria for funding cannot be met. It is gratifying that interactions in the course of researching this paper have helped assuage fears.

But Lake Canyon's problem cannot be addressed without considering its relationship to the Lexington Basin ordinance. This area consists of some 17,000 unsewered acres in the Santa Cruz Mountains of western Santa Clara County, to which Lake Canyon contributes less than 50 acres. In 1980 the County contracted with J. M. Montgomery, Consulting Engineers, Inc. to perform a study to develop and evaluate wastewater management alternatives for the basin (J. M. Montgomery, Inc., 1981). At that time, there was one county-wide septic system ordinance (Santa Clara County Code; Health and Sanitation. Chapter 2, Article 2. Private disposal: Sec. B11-24 through B11-34).

It was determined by the Montgomery study that conditions in most of the 11 sub-basins were such that, with appropriate constraints, suitable subsurface leaching systems could be installed. Six such design criteria were established and became the basis of a separate ordinance (Santa Clara County Code; Chapter 2, Article 3. Private Sewage Disposal within Lexington Basin: Sec. B11-35 through B11-40. 1980).

A feasible solution to the problems in Lake Canyon, on the other hand, was much more difficult to define. Although certain details have been disputed (A. Smith, unpublished letter to the Board of Supervisors, January 30, 1987), the study lists several features characteristic of waste disposal systems in Lake Canyon which are inconsistent with accepted safe waste-handling practices (Montgomery, 1980). Characteristics listed include impermeable soils, continuous high ground water, and leachfield soils continuously or seasonally so saturated that satisfactory disposal of septic tank effluent is not possible. High density of septic tank installations is the rule. There are dwellings on lots with insufficient area to even have a leachfield; one dwelling even straddles the creek! Such residents have only cesspools or seepage pits. (Accepted safe septic system practice criteria are summarized in Appendix B.)

Any of these shortcomings would render an overwhelming majority of lots undevelopable by today's County standards. Acting in combination, these physical problems present an insurmountable obstacle to anyone who would correct an inadequate or failing system. These limitations apply not only to existing installations in the area, but to Lake Canyon in general. It is widely conceded by authorities familiar with the region that the prognosis for any on-site sewage disposal scheme in Lake Canyon is poor and unlikely to be amenable to improvement by any on-site techniques currently acceptable to the RWQCB or approved for use in Santa Clara County.

One has the makings of a bona fide environmental health problem, given the refractory nature of the on-site disposal problem and the historic and logical dependence on such methods, and the legal responsibility not to allow a system to adversely affect the environment, when the problem is located in a determined, semi-rural community such as Lake Canyon, with its core of determined activists. It can become a serious dilemma.

Solution of the public health problem brings its own complications. It is perceived by Lake Canyon citizens that, despite the drawbacks of their septic systems, in living with them they gain certain protection for their chosen lifestyle.

It is unfortunate that the progression of suburbia into rural areas has, historically, been held in check by withholding development of sewers. Since there is a predictable relationship between the amount of septic tank effluent and the minimum amount of land required to assimilate that effluent. Lot sizes (and the extent of development on a lot) can, via construction codes, be tied to sewage disposal requirements; thus used successfully to curtail development of an area. Connecting to a sanitary sewer could eliminate this rationale for limiting development.

Since many of these circumstances apply to Lake Canyon at this time, some lots remain undeveloped, and would be undevelopable, even without the building moratorium. (Although other restraints on development of properties in this area exist, the sewage disposal-related moratorium is sufficient to create this effect.) Residents feel that the charm of their community would be threatened by a building boom close on the heels of the new sewer. Many have expressed the feeling that in allowing installation of a sewer, they are relinquishing any control they have over the future of their community (Bart Evans, LHA, personal communication, 5-23-89).

In answer to this criticism, a limited system has been proposed which could not accommodate more than the existing

load. This would meet both the aesthetic and financial goals of the residents, as well as resolve the current environmental crisis. Opponents legitimately argue that this less efficient expenditure of public funds is tantamount to public subsidization of property values in the canyon.

Whatever the solution, among the several agencies involved and the community of Lake Canyon there has emerged a consensus that a community liquid waste system is imperative. Most of the activity subsequent to that decision has been directed toward (a) funding the proposed project, (b) documenting its need and (c) ultimately alleviating a community health hazard while imposing a minimum negative impact on the community itself. The immediate public health consequences and the legal, social, and economic ramifications of the ongoing efforts at resolving this long-standing impasse are numerous and frequently controversial.

Solutions from the Literature

Over recent years, technological advances have widened the horizons of rural communities seeking solution to problems of the disposal of domestic liquid waste. Both methods of transport and on-site disposal techniques have undergone substantial recent development.

Kreissl (1984) summarized the difficult conditions which have lead to the current quest for satisfactory alternative systems. In a 1977 survey of nearly 300 facility plans developed for United States rural communities, he had demonstrated an inverse relationship between population density and the cost of sewerage; the larger the lot, the longer must be both the lateral and the length between connections (Kreissl, 1977, cited in Kreissl, 1984). However in spite of this expense, until recently, the recommended answer to failures of on-site disposal systems has "almost invariably" been the conventional gravity sewer. The EPA had begun a comprehensive program of research and development, under direction from the 92nd congress to eliminate "pollution from sewage in rural and other areas where collection of sewage in conventional, community-wide sewage collection systems is impractical, uneconomical or otherwise infeasible..." (PL 92-500, Sec. 104 (q)(1), cited in Kreissl, p. 2). Much of the literature cited here has come from that program.

Assumptions specifically pertinent to selection of alternatives are delineated in U.S.EPA, 1977. These "basic premises" are:

> If site conditions are suitable, the conventional septic tank-soil absorption system ... is the best type of on-site disposal system.

> If costs are reasonable, a conventional gravity sewage collection system is the best type of community system.
>
> A conventional gravity collection is the accepted standard for community sanitation against which all alternatives should be measured." (p. 1)

It is within this context that the proposed solutions which are currently under discussion have been evaluated.

In pursuing the best solution it is appropriate to take stock of the relative merits of two fundamentally different strategies for sewage disposal: (1), central treatment with discharge to receiving waters and (2), on-site treatment and disposal. Laak (1980) observed that the principal advantage of central treatment is the ability to treat relatively large amounts of wastewater economically in a relatively small space. In other words, it is most suited to urban areas. It has the environmental disadvantage, if only partial treatment is accomplished, of concentrating all untreated residues into one location. There is also the problem of effluent water and sludge disposal. Since it is a virtual certainty that some members of any large population are excreting pathogens, one must assume that pathogenic organisms will always be present in urban sewage.

On-site disposal costs the government less; the cost is borne by the user. Inasmuch as it will contain pathogens only when an infection is present in a member of the family or a guest, it is environmentally less hazardous. On-site systems are more energy-efficient, and produce less sludge.

The greatest disadvantage of on-site disposal is the requirement of relatively large amounts of land for absorption systems. Homeowners also may not care for the system, which could result in early failure.

Given only the two alternatives thus far mentioned would leave most communities with the difficult choice between the great capitol investment and delay in construction attendant to the sanitary sewer on the one hand, or the necessity of committing large amounts of property to leachfield use on the other. As Weston's (1986) survey of small-scale wastewater systems pointed out, there is a "growing array" of small scale alternatives, ready to be applied to problems in collection, treatment and disposal of wastes. He commended the qualities of the small scale system as a resolution to the dilemma faced by growing smaller communities with limited funds and failing on-site systems. He suggested also that, through appropriate zoning and limiting a system to designated growth areas, environmentally sensitive areas could be protected. Since small-scale systems are most frequently built to serve a specific area, "planners can encourage development when and where it is consistent with community goals, rather than inviting the undue pressure for growth inherent in the excess capacity of conventional systems" (p. 7).

Virtually all of the options which will be seriously considered for Lake Canyon, or any other residential waste project, will rely upon water carriage to remove the wastes from the home. Conceptually excluded from the discussion are several widely accepted dry toilet systems. Van der Ryn (1978) discussed thoroughly several alternatives not widely accepted or given much space in the professional literature. In his how-to, lifestyle oriented treatise, The Toilet Papers, he emphasized one of the shortcomings present in much of the current thinking regarding the problem at hand. Water-carried sewer discards large volumes of valuable water in the process of disposing of yet another commodity which also could be of agricultural value.

In his foreword to Van der Ryn, Wendel Berry pointed out "...it is possible to quit putting our so-called bodily wastes where they don't belong (in the water) and to start putting them where they do belong (on the land)" (p. 9). Although we will soon present also a number of alternatives utilizing water carriage for waste products, the emphasis on dry toilets found in this book deserves some discussion. The numerous alternatives, described in some detail, which have not received serious consideration for stated public health reasons, would probably receive wide acceptance among the local residents (Bart Evans, personal communication, 5-23-89).

Those who tout the desirability of dry toilet systems will point out two functional arguments against water carried sewage: the unnecessary use of water and the wasting of nutrients which could well be returned to the soil. Reliance on such systems also could result in a substantial savings. Nimpuno (1984) noted that the mean "Total Annual Costs per Household" (TACH) for a composting toilet are 14.8% of the TACH for septic tank, and 13.7% of that for conventional sanitary sewer. Although the principal target for this work was the developing world, the message of the cost differential is dramatic

The more-or-less standard list of non-water carriage human waste disposal can be found in Rural Wastewater Alternatives, Final Report -- Phase I (Office of Appropriate Technology, 1977), and in Van der Ryn (1978). Less "civilized" methods which offer relative health safeguards under circumstances found in third world countries, are to be found in Nimpuno (1984). Included are a two-compartment cesspool (infiltrated groundwater provides the liquid) and the "Vietnamese Toilet," in which the liquid and solid constituents are processed separately, the latter subjected to anaerobic composting.

Many methods of waterless sewage disposal are recommended based on sound environmental principals. Several designs provide reliable compost which could be

utilized agriculturally. (One would offer the caveat that root and other soil contact crops should be excepted from this technique.) The Clevis Multrum exemplifies this design (Ryn, 1978).

Laak (1980) observed that composting was sufficiently well understood to be used efficiently to stabilize biodegradable organic material. "The composting toilet is significant in pollution and energy control...excrement material needs no clean flush water for transport, no sewer pipes for transport and no treatment plant" (p. 79). Reserving compost for recycling, as opposed to landfilling of treatment plant sludge certainly has its appeal.

Some designs are less ecologically sound. One unit relied on incineration of wastes after each use, while another technique used oil to flush wastes to a holding tank for subsequent land disposal. Associated with this group is the chemical toilet, whose product is only acceptable at wastewater treatment facilities because dilution renders the chemicals less harmful to the microorganisms necessary for the plant's effective function. Intermediate on the ecological scale would be the pit privy, which lacks the drawbacks of incineration or oil flushing, but represents intensive land use.

Adequately managed and used in conjunction with suitable greywater systems, the best of these designs might

well provide an entirely satisfactory solution for a community such as Lake Canyon (assuming an operations and maintenance program could be worked out). The reduction of water use would not only relax the burden on existing soil absorption systems, but would reduce the demand on Lake Canyon's Mutual Water Company's limited capability. However, the bureaucratic complication of permitting homes for such an installation would be formidable. County Building and Plumbing Codes and the County Sewage Ordinance sanction for a residence without flush toilets would require unprecedented accommodation. Identification of possible solutions to the problem, even if limited to water carried sewers, could carry one rather far afield. Fecal matter decomposes to a degree when simply left in an aqueous environment. Cesspools represent primarily an out-of-sight, out-of-mind solution to waste disposal and are not considered as treatment, but anaerobic (and some aerobic) processes are indeed in operation. Other treatment facilities depend on settling and the bacterial action which can be encouraged in quiescent water. Laak (1980) discusses pretreatment methods used in on-site disposal systems, preceding the soil absorption system. From the public health standpoint, the efficiency of pretreatment is of secondary importance, since we depend on the soil for protection from disease organisms. However, a well

clarified effluent is highly desirable for longevity of the soil absorption system.

As an alternative in the case of Lake Canyon, a pretreatment procedure would be one method of accommodating a small diameter sewer or a community leach field. Although the most plausible would be the septic tank, several types of lagoons and oxidation ditches discussed by Laak could conceivably be used.

There are three stages in the treatment and disposal of sewage at which alternatives can be incorporated, viz., treatment, transportation, and disposal. Although they are inextricably intertwined, it is useful to consider them as separate entities for purposes of discussion.

One of the factors determining the site of ultimate disposal of treated sewage is its degree of treatment. (Untreated domestic sewage, or any treated domestic effluent may, of course, be discharged to sanitary sewer.) Primary treatment (anaerobic lagoons, settling ponds, and septic tanks) breaks down and separates solids; secondary treatment further clarifies and removes (at least bacterial, if not viral) pathogens; tertiary treatment filters and removes reactive chemicals (Hammer, 1986). Septic tank effluent, which is comfortably released into the soil, would be considered too hazardous to apply on the surface of the land, or to release to the bay. Coulter (1957) acknowledged

that one practice, innovative in this period would allow for on-site treatment with disposal into a storm drain, with expressed reservations.

Troyan (1977) listed four acceptable alternatives for the subsurface disposal of septic tank effluent. They were: the soil absorption system, the evapotranspiration system, the sand filter and the mound system. Such effluent also may be discharged to a sanitary sewer for subsequent treatment and disposal.

Successful community systems have been built utilizing each of these disposal techniques, although the sand filter is no longer acceptable for primary (septic tank) effluent. Troyan (1977) or U.S.EPA (1977) provide useful charts depicting the advantages, disadvantages, and limitations of each.

Conventional subsurface soil absorption systems receive septic tank effluent into a series of rock-filled trenches from which the effluent percolates into the soil. In order to be effective and safe, the soil must be fine enough to filter effectively, but not so fine as not to accept the additional liquid. The soil also must be deep enough not to allow inadequately treated effluent to reach groundwater or soil-free cracks in bedrock. The mound system often is used in areas where soil, hydrologic, or geologic limitations preclude use of the more conventional soil absorption

system. Evapotranspiration takes place during dry weather in either of these systems but in an area which can get considerable rainfall, should not be depended upon to guarantee liquid removal.

Any on-site disposal system installed as a community disposal field for Lake Canyon is likely to be a conventional leachfield (subsurface absorption system) or a mound system (Steven Hill, RWQCB, personal communication, June 2, 1989).

By increasing the amount of treatment, it is possible to gain more flexibility of disposal choice. Aerobic treatment, whether by individual home units (Johnson, 1978), or by oxidation ditch (carrousel) or aerobic lagoon (Laak, 1980), is reported to result in as much as a 90% reduction of BOD and suspended solids. The self-contained units operate much like an expanded septic tank, with extra (middle) compartments into which air is bubbled. Such reduction, using both individual and shared units, was sufficient for the land application of effluent in Boyd County, Kentucky (Johnson, 1978). However, Hammer was not convinced of these units' efficacy. He stated that "little evidence exists to substantiate the idea that effluent standard of 30 mg/L BOD and 30 mg/L suspended solids can be met by small compartmented aeration tanks" (1986, p. 439).

Finally, the last step in the hierarchy of sewage treatment, the discharge from facilities which fully treat domestic sewage may, with a National Pollutant Discharge Elimination System (NPDES) permit, be released directly into watercourses which are not part of potable water supplies.

If sewage is not to be treated and disposed of on-site, there must be transportation of either raw sewage or treated effluent to off-site (central) treatment facilities. Many of the alternatives discussed in the literature are variations on this transportation theme.

Any of the various forms of pretreatment presented here may be used to produce a product which can be carried by one of several methods for treatment at a central wastewater treatment facility. The two most common are Septic Tank Effluent Pumping (STEP) and Grinder Pumping (GP), often used in combination with pressure sewers. According to Kreissl (1984), "probably the best cost-effective solution would be a mixed one employing two compatible types of collection, e.g. SDG and STEP" (p. 12).

As previously pointed out, the gravity sewer is the standard against which community sewerage programs are compared. Sewer lines are sloped sufficiently to assure flow rapid enough to accomplish self cleaning, are deep enough to protect from freezing, and in areas where basements abound, to collect wastewater from basements.

Manholes are located periodically to allow for service and cleaning. Gravity sewers rely on pumping only when gravity flow would require unreasonably high cost or an excessive maintenance effort (Hammer, 1986). Conventional gravity sewers can be used in any climate, and provide centralized control of wastewater treatment at a relatively low budget for operation and maintenance. Pumping of septic tanks is not required (U.S. EPA 1977).

Methods of transportation of liquid waste other than gravity sewers are generally referred to as alternatives. In Kreissl's (1984) review of the characteristics and qualities of three principal options for transport available in the United States today, he discussed SDG, pressure sewers, and vacuum sewers.

A small diameter gravity sewer is a conveyance for sewage, using smaller pipe, clean-outs instead of manholes, and relying on gravity to move the sewage. Unlike conventional sewers, they can not accommodate solids, which must be removed by septic tanks. They are less expensive to install and can potentially result in savings in wastewater treatment due to the pretreatment of the effluent. SDG systems, conveying septic tank effluent, are susceptible to corrosion and must be constructed of non-corrosive materials.

"Pressure sewers are a viable, economic alternative to gravity sewers in rural areas where homes are scattered over a wide area or where gravity sewer construction is prohibitive because of high groundwater or difficult terrain" (Johnson, 1978, p. 90). The pressure main is fed either by septic tank effluent pumping, involving a sump from which septic tank effluent free of solids is pumped, or by a grinder pump by which waste solids are reduced to a small size before being pumped into the main. The contents of the GP pressure sewer are no different than that of a conventional sewer.

The advantage of pressure sewers relates primarily to costs on installation; they use inexpensive small diameter plastic pipe, and in hilly areas there is no need for deep excavation to provide a grade, as for gravity sewers. They demand more maintenance than gravity sewers, and require enough emergency storage to accommodate power outages; usually an existing septic tank serves this purpose.

On flat lying or gently rolling areas, a vacuum sewer with its limited lift capacity is able to move sewage from individual residences to a central collection tank, from which it is either pumped or flows by gravity to its eventual destination for treatment. After entering through a vacuum valve (along with a measured amount of air at atmospheric pressure) a bolus of sewage called a "slug"

flows downhill in vacuum mains to "transport pockets," where both ends plug with water. When the next vacuum valve opens the water plug breaks, and the sewage is abruptly "sucked" up to the next level (a matter of only a few feet) where it again flows down a gentle grade to the next transport pocket, and eventually into the collection tank. The concept was first patented in the United States in 1868 by Adrian Le Marquand (Kreissl, 1984).

The system requires expensive vacuum pumps, and energy to maintain the continuous vacuum. For homeowners, maintenance is easy and inexpensive; the vacuum valve is the only operating part on the property.

As was pointed out previously, many of the features of the facilities for dealing with liquid waste are interrelated. The obvious connection between on-site treatment and soil disposal systems, as compared to sewers and remote disposal point out the futility in carrying such an analysis too far. The pertinent facts about disposal techniques are included in the descriptions of their related treatment modalities. Other factors which must be taken into consideration, and which may affect the ultimate choice, may have relatively little to do with technological issues.

As in the Lexington Basin, non-technical elements can merge with technical factors and diplomatic compromise is

sometimes necessary. The city of Anchorage, Alaska settled on a resolution of a conflict between expansion needs and the residents' expectation of a rural lifestyle. Its Hillside Wastewater Management Plan defined areas suitable for sewer, areas suitable for conventional on-site systems, and areas unsuitable for on-site systems, but for which no sewer could be provided. In order to develop properties in this last category additional restrictions were imposed. Notable requirements were soil testing for every lot within a subdivision, and the requirement that innovative systems be utilized in order to preserve the rural atmosphere of the Hillside and Rabbit Creek-Potter Creek areas of the Anchorage Bowl (U.S.EPA, 1983).

One outcome of the increased attention on-site disposal systems received was a growing awareness that systems often fail due to owner neglect. The State Water Resources Control Board, which administers Federal Clean Water Grants for which Lake Canyon is an applicant was involved in developing and testing the feasibility of on-site waste management districts in the late seventies. Several other states echoed this solution of the problem of owner neglect, by setting up the framework for establishing such districts (Plews, 1976). The concept is expanded as alternative hybrid systems retain characteristics of on-site systems, blended with features of municipal sewers. Professional

management usually extends to the on-site component. Weston (1986) emphasized, "the most important elements in successful acceptance and management of small-scale systems are involvement of key participants...,education..., and careful review of operating and maintenance requirements" (p. 12).

The amount of maintenance required by the systems discussed thus far varies a great deal, from the high maintenance requirements of the GP system to the nearly forgettable tank and drainfield. In addition to the maintenance necessary to assure smooth operation of the public portion, it is necessary to establish a maintenance program on the homeowner-owned portions of the system. Dix and Ward (1978) advised that since "a community is composed of a variety of individuals with different backgrounds, attitudes, standards of living and life styles; ...a centralized management program must consider these differences in the design and management of individual systems" (p. 244).

These considerations must be added to the mix in selecting the type of system to install. Troyan (1986) cautioned: "For both community sewerage systems and on-site systems, the cost analysis must include all reasonable operating and maintenance costs, and where appropriate, the cost of establishing and operating public agencies to

supervise construction, and operation and management" (p. 88).

A useful index for recording and comparing maintenance demands of a system is Mean Time Between Service Calls (MTBSC). Kreissl (1984) utilized this measure in combination with other evaluative techniques (including excavation) to develop a qualitative discussion of the potential O&M requirements of pressure, vacuum, and SDG sewers.

A potential source of controversy is the odor which can be created at the termination of a line carrying septic tank effluent and the sewer (septic tank effluent contains high concentration of sulfides). Kreissl (1984) pointed out that smooth transition hydraulics were imperative in order to avoid this problem. He explained also that unless there is sufficient flow in the existing sewer to dilute the sulfide-laden effluent, concrete construction would be susceptible to destructive corrosion.

For waste discharge and treatment requirements, the Porter-Cologne Water Act , California Water Code, Division 7, Section 13241, the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB), and the State Water Resources Control Board (SWRCB) stipulate the form and quantity of discharge that is permitted into surface and ground waters.

For on-site waste disposal systems, the Santa Clara County Code, Health and Sanitation, Sec. B11-14 through B11-40., and B11-41 (pending) (1954, 1980, 1988) determine design criteria which must be met, with the intent that the above pollution discharge requirements will be met.

For the County of Santa Clara Current Planning office policy, the County Land Development Ordinance, and Life Extending Construction Policy relate the connection between permitted construction and new or existing on-site waste disposal systems. The Department of Environmental Health Services acts as field evaluators and enforcement officers for on-site waste disposal regulations.

The last decision-making step is the application of predetermined criteria to the question. Most criteria available in the literature for determining the best system for any given situation focus on obtaining optimum performance for the money spent. Based on the observed fact that the cost of collection systems constitutes the greatest single expense in sewering small communities, Troyan (1977) presented a protocol for evaluating the cost/effectiveness of eight alternatives, four on-site systems, and four community collection systems (Table 1).

Table 1. TECHNICAL SCREENING OF ALTERNATIVES

Problem conditions	Probable best response
Soils	
Impermeable	Discard ST-SAS, ST-Mound, and ST-ETA
Shallow permeable layer over impermeable layer or creviced bedrock	Discard ST-SAS and ST-ETA
Site	
Average net lot size 2 acres or more	Discard conventional gravity system
Average net lot size less than 1/2 acre	Discard ST-SAS, ST-Mound ST-ET and ST-ETA
Steep Slopes	Discard ST-SAS and ST-Mound
Irregular, hilly topography which would require deep cuts or numerous lift stations	Discard conventional gravity collection system, small-pipe gravity collection system
Geology-hydrogeology	
Shallow bedrock	Discard ST-SAS, ST-ETA, and small-pipe gravity collection systems
Unstable soils which result in high excavation costs	Discard conventional and small-pipe gravity collection systems
Seasonal high groundwater within 4 ft. of surface	Discard ST-SAS
Seasonal high groundwater within 2 ft. of surface	Discard ST-Mound and ST-ETA
Climate	
Long, cold winters	Discard ST-ETA
Low net annual evapo-transpiration	Discard ST-ETA

ST-SAT	Septic tank with conventional soil absorption system
ST-Mound	Septic tank with mounded soil absorption system
ST-ETA	Septic tank with evaporation-transpiration soil absorption system
ST-ET	Septic tank with evaporation-transpiration system

(Troyan, 1977. p. 88.)

Initially, alternatives are screened for feasibility. This consists of two independent tests: technical feasibility, and administrative feasibility. Based on his observations of the advantages, disadvantages and limitations of each system mentioned previously, Troyan derived his table for technical screening of alternatives.

To meet the administrative feasibility test, the proposed selection also must be acceptable to the regulatory agencies. For example, "a mounded soil absorption system may be the best solution to a particular problem, but if present regulations forbid its use, it is not a feasible alternative" (Troyan, 1977, p. 87).

Kreissl et al. (1978), cited in Kreissl (1984), endeavored to make a generic cost comparison between pressure sewers, small diameter gravity sewers, vacuum sewers, and conventional gravity sewers. Recognizing that cost was extremely site-specific, they assumed a community of a given population size and no topographical or geographical constraints. Relative costs, referenced to small diameter gravity, for SDG, Pressure and Vacuum sewers and conventional sewers, respectively, were 1.00, 1.05, 1.08, and 1.48. They argued that, since the figures for alternative systems were actually quite close together, under unconstrained conditions, all three alternative systems should be considered. Secondly, they observed the

obvious savings over installation of conventional sewer that their data would promise.

Finally, again be reminded of the "basic premises" included in the discussion of assumptions: (1) a conventional septic tank/absorption field is the best on-site technique; (2) if affordable, a conventional sanitary sewer is the best community system; and (3) the conventional gravity sewer is the standard.

To complete the decision-making cycle presented at the outset, one would want to take steps toward implementation of the most appropriate solution. Weston (1986) pointed out the necessity to focus on the wide variety of players on the team involved in the project. Most important of these are elected officials, community planners, regulatory and health officials, and the developers and builders. "Decisions can be made most efficiently and harmoniously if everyone understands the interrelationship of these roles" (p. 10). In the case of Lake Canyon, the residents are also key players.

METHODOLOGY

The key to the ultimate resolution of Lake Canyon's sewage disposal problem is the documentation of a condition detrimental to the public health or welfare. In the spring of 1988 State Clean Water Grant funds were made available to WVSD to contract with an outside engineering firm to provide such documentation. By Fall, Questa Engineering Corporation, a firm specializing in developing sewer systems in small rural communities had been chosen to perform the study; work was to begin in the rainy season.

The Questa Pollution Study/Sanitary Survey

One purpose of a sanitary survey is the evaluation of a community's wastewater needs and disposal capabilities. In Santa Clara County, sanitary surveys are typically performed by Environmental Health Services (EHS) for the local sewer district in anticipation of extending service to an unsewered area. Appropriately performed, such surveys will entail a well publicized, well directed, locally intensive effort requiring personal inspection of those aspects of a community's physical environment which influence its public health (Hopkins, Bingley & Schucker, 1970).

Two such sanitary surveys were undertaken in Lake Canyon over the past year. In the summer of 1988, West

Valley Sanitation District (WVSD) (then Sanitation District #4), with the participation of the community, drew up a community plot plan. (A plot plan is a scale drawing showing structures and sewage disposal facilities in relationship to property lines, water sources, streams, reservoirs and other pertinent physical and geological features.) Forty-nine of the 55 developed parcels, or 89%, participated in this community survey.

The study entailed both dye testing and water sampling. Dye testing is accomplished by flushing a small quantity of intensely colored fluorescein dye down the toilet and attempting to detect, photometrically, evidence of the dye in the stream. Water samples were tested for total coliform and fecal coliform bacteria. Presence of such bacteria gives evidence of sewage contamination. Tests for nitrate and ammonia also were performed at several test locations along the creek.

Several files of historical information were found in the course of researching Lake Canyon and the concerns all of which left two important features of the situation unclear. The first was the attitude of the residents of the community. The initial attempt at solving the sewage problem in Lake Canyon at a community level failed not because of lack of money, but because of either lack of community interest (the county's version), or poor

communication regarding the proposed project (Lake Canyon's version). It seemed appropriate to gain a more thorough understanding of the residents' positions on the matter, even though a public opinion survey performed by the West Valley Sanitation District (WVSD) in the fall of 1987 indicated a decided majority of the residents would prefer a community sewage system. There were shades of grey and various "reasons why" for either position.

The Questa Engineering survey was performed by Questa Engineering environmental health specialists and community helpers, as a portion of the application for further State Clean Water Grant monies to construct a community system. It began in January 1989, interrupted by a rainy period in March, and completed in mid-May. This study, designed to evaluate the condition of existing septic systems and to demonstrate any liquid waste pollution of Beardsley Creek, required that residents make their property available for system inspection and dye testing. The results of portions of this study are presented here as a means of describing the physical circumstances contributing to the public health problem.

The second category of information not contained in these records maintained by any agency whose files were reviewed was any centralized description of the nature of working relationships between these agencies. Since Lake

Canyon has an unique position in the county scheme of things, assuming a conventional relationship among the players would surely be to overlook important nuances born of long standing controversy. Therefore two questionnaires were designed; one, to elicit public opinion information which would either confirm or cast suspicions on the WVSD poll, and another which would help describe the roles of the various agencies as solutions are sought.

Resident Questionnaire

The anonymous resident questionnaire consisted of 30 questions plus demographic data, divided into two parts. Part I dealt with the physical attributes of the residence and its waste disposal system; Part II with demographic factors of the respondents and their expectations and feelings about the proposed project.

The variables and their respective computer names (VARIABLENAME) in Part I were: street location (LOCATION), age of house (HOUSEAGE), distance from on-site waste disposal system to the creek (DISTANCE), type of sewage disposal system (SEWRTYPE), size of system (SEWRSIZE), questions regarding repair of the system (REPAIR, WHENREP, PERMIT, FAILING), and whether the occupant rented or owned the home (RENTOWN).

Demographic variables for both Respondent and Spouse/Companion included age, sex, type of employment,

education (highest level, course of study, graduation), years in Lake Canyon, years in previous residence, area of origin, status as renter or owner, and annual household income.

General philosophy of existence in the mountain community was elicited by questions on "The best way of doing things..." Variables included opinion on how best to dispose of human waste (MANWASTE), the relative practicality of sewage plants and on-site disposal systems (SEWER), the usefulness of greywater (GREYWTR), the degree of difficulty encountered when a neighbors septic system fails (TANKLEAK), the ability of bodies of fresh water to assimilate biological waste (SELFPURE), the relative safety of residential on-site waste disposal (ONSITE), and whether the County had any business exercising any control over septic systems (COMPLY).

Finally, 14 scaled-response items allowed residents to evaluate, in a range of +2, very favorably, to -2, very unfavorably, how they would be affected by changes resulting from the installation of a sanitary sewer in Lake Canyon. Variables included such issues as worry about failing septic system (WORRY), concern due to the Real Estate Disclosure Law (REPORT), release from the building moratorium (MORATORM), ability to use more water (WATERUSE), having a cleaner Beardsley Creek (CLEANCRK), enhanced property values

(VALUE), and a perceived reduction of enforcement activity by the County. Other variables related to the expense of installation (SHARE), increased traffic during construction (TRAFFIC), the effects of the construction itself (NOISE), expected overconsumption of water, resulting from relief from the need to protect touchy septic systems (OVERUSE), public interest (PUBLIC), loss of privacy (PRIVATE), and finally, whether the respondent favored the installation of a sewer (WANTIT).

Agency questionnaire

The design of the questionnaire distributed to the agencies was a compromise between the open ended interview and a structured objective questionnaire. Our reasoning was that, as with an objective format, a basic response would provide minimum standard information but leave the option for elaboration by those able to take the time.

The questionnaire was administered to twelve agencies and organizations with interest in the project. The representatives who were interviewed, from their respective agencies were: Alex Schooler and Bruce Cunningham, Co-Chairmen, Lake Canyon Mutual Water Company; Bart Evans, President of Lexington Hills Association; Bill Gissler, Managing Engineer of West Valley Sanitation District; Lee Bowman, Director of Planning, Town of Los Gatos; Trevor Hayes, Deputy Director, Environmental Health Services, County of Santa Clara; Sally Logothetti, Assistant Executive Officer, Local Agency Formation Commission; Steven Hill, Environmental Specialist, Surface Water Protection Division, Regional Water Quality Control Board; Michael Norris, Coordinator, Clean Water Grants, California State Water Resources Control Board; Robert Moore, Project Manager, and Norm Hentzsche, President, Questa Engineering Corporation; Bob Sturdivant, Senior Planner, County of Santa Clara Advanced Planning Office; Nan Vaughn, Assistant

to Supervisor Susanne Wilson, and Rob Lapsley, Aid to Assemblyman Charles Quackenbush.

To cut across the 456 cell table these interviews generated, some of the qualitative richness was sacrificed, and only objective questions have been used as points of departure for discussion of the findings. The "category questions" are listed here as a basis for organization.

Major categories of discussion included:

A. Category Question: "What is the relationship of your organization to the Lake Canyon sewerage problem?"

B. Category Question: "How did you become involved in the project?"

C. Category Question: "How will the participation of your organization affect the situation?"

D. Category Question: "How will your organization be affected by its activities in the project?"

E. Category question: "What constraints, requirements or objectives unique to your organization affect its relationship to the project?"

F. Category Question: "Have you any final observations?" Responses to this optional last question were to anticipate broader ramifications of the project.

The design of the questionnaire resulted from a necessary compromise between the desire to obtain standardized objective data and the recognition that to do

so would probably result in overlooking important relationships, or cause the misrepresenting of the ones discovered. Thus, while many standardized questions were asked, they were asked in a face-to-face interview format, giving the respondents an opportunity to describe to their satisfaction the structure as they saw it.

Treatment of Data

Data from the Resident Questionnaire were consolidated onto one-page forms and entered into the State University mainframe "Cyber" computer. Statistics performed were from SPSSx, Statistical Package for the Social Sciences. SPSS procedures utilized were FREQUENCIES, CROSSTABS, and NONPAR CORR (Spearman's rank-order correlation and Kendall's tau-b) (Norusis, 1987; SPSS, Inc., 1983). For interpretation of data, Kendall's tau was preferred to Spearman's rank order correlation due to its suitability to small samples and its ease of interpretation as a descriptive statistic (Hays, 1963).

Information from the Agency Questionnaire was summarized and plotted on an expanded chart which showed "questions X agency" for each comparison among subject responses. This tabulated information was useful in recognizing relationships not apparent at the time of the interview.

RESULTS AND ANALYSIS

Three bodies of data are presented: the community sanitary survey, the resident questionnaire, and the agency questionnaire. Each represent a look at the Lake Canyon problem from a different perspective. Different techniques were involved in acquiring each set of data; different analytical procedures were required as well.

The data are discussed very much in the order in which the problem presented itself--first the physical reality of inadequate sewage disposal facilities, then the community's response to that reality, and finally the response of the greater community at large--the Town of Los Gatos, Santa Clara county, and the state--to the pleas for assistance.

The Questa Pollution Study/Sanitary Survey

The Questa study included a survey of the properties designed to confirm or enhance the findings of the previous WVSD/resident effort. Questa Engineering reported that 44 of 55 developed properties participated, an 80% response rate (Bob Moore, Questa Engineering, personal communication, June 7, 1989).

Acknowledging a third consecutive drought year, preliminary findings from a report not available at this writing, are only suggestive of pollution of Beardsley

Creek. Transient trace levels of nitrate and coliform have been found at various sampling points on Beardsley creek. On one observation, concentrations of nitrate, measurable below all of the homes, diminish slightly as one ascends the creek, suggesting that the higher readings were the result of accumulation of effluent from the homes in Lake Canyon. One of several attempts at the dye testing of a sewage disposal system resulted in detectable but not measurable concentrations of dye in the creek. None of these positive results could be replicated.

This failure to provide substantive evidence of pollution rests the burden of conclusive argument on the demonstration of other limitations. This documentation relies on descriptions of (1) age of the system, (2) limited setback from the creek, (3) slope, and (4) limited potential for repair.

The majority of the houses are more than thirty years old, old for any method of soil absorption system. Moreover, many have cesspools, adding to their effective age. A majority of them would be expected to require repair in the near future.

Thirty-one of the 55 houses dispose of their sewage within 100 feet of the creek; many are less than 10 feet from the property line, thus violating the county setback requirement.

The slope in Lake Canyon on all but that property immediately adjacent to the creek ranges from 40% to 60%, therefore exceeding County maximum for on-site disposal systems.

Whether a large proportion of the old systems will require repair in the near future could be judged by a detailed examination of the various on-site sewage disposal systems in the community. For many of these systems, the Questa data included: year of construction, size and construction material of tanks, and extent of subsurface soil absorption system, of any. This additional data was acquired for 33 (60%) of the 55 developed properties (Questa Engineering, 1989).

Questa's data included type of tank (material), tank size (dimensions or volume measure) size of leachfield and year of construction and/or repair (Table 1). Tanks were reportedly constructed variously of redwood, steel, rock and concrete. (Only the latter is now acceptable in Santa Clara County (Santa Clara County Code Section B11-33 (c).)

Stated tank size ranged from 500 to 3840 gallons; the mean was 1564 gallons. (All sizes given in linear dimensions were converted to gallons at 7.48 gallon per cubic foot.) The median size tank was 1500 gallons. It was also the most popular size, numbering 7 in all; six more were larger. (Current minimum design criterion for installations in Lexington Basin is 1500 gallons.)

Eighteen parcels reported subsurface soil absorption systems. Five were seepage pits. One 8' by 8' by 8' rock tank called a seepage pit by Questa was shown as a cesspool by WVSD/residents. Since a separate septic tank was not shown in either study, it is listed in this paper as a cesspool. Any tanks listed in Table 1 for which no apparent septic tank or soil absorption system could be found should probably be considered to be cesspools. That is to say a tank which receives treated sewage (from a septic tank) might be considered to be a seepage pit; a tank receiving raw sewage, whose effluent is carried to a leach field might be called a septic tank, but a lone tank which directly receives sewage is a cesspool.

Table 2. LAKE CANYON WASTEWATER SYSTEM DATA

ID	Type (material)	Dimensions WxLxH (ft.)	Size (gal.)	Leach Field (ft.)	Constr/ Re-const (yr.)	Addition/ Repairs (yr.)
1	concrete		600	50	1984	
2						
3	concrete	6x8x8				
4	concrete		1200	pit	1973	
5						
6						
7	redwood					
8	concrete		1500	50	1950	
9						
10						
11						
12	concrete		1500		1970	
13	concrete			pit		1986
14						
15						
16						
17						
18	redwood			15	1965	1985,'87
19	redwood		1500			1981
20	redwood	4x4x8	500	50	1985	
21						
22						
23	concrete		500	50	1936	1987
24	concrete					1987
25	concrete	6x14x5		15	1976	
26	concrete	5x5x5				
27						
28	redwood					
29						
30	redwood	4x4x8				
31						
32						
33						
34	concrete		1500	35		
35	concrete		750	50	pre '80	
36						
37			1500		1975	
38						
39						
40						
41						
42						
43						
44						

Table 2 (cont.). LAKE CANYON WASTEWATER SYSTEM DATA

ID	Type (material)	Dimensions WxLxH (ft.)	Size (gal.)	Leach Field (ft.)	Constr/ Re-const (yr.)	Addition/ Repairs (yr.)
45						
46						
47						
48			1000	150	1977	
49						
50						
51						
52				70	1988	
53						
54						
55						
56						
57	(a)	1500	pit			
58						
59	concrete	5x9x5	1800			
60			1000			
61						
62	concrete		1200	pit	1982	
63			1000	100		
64						
65						
66	steel		1500			
67	concrete	6x12x6		25		
68						
69	rock	8x8x8		pit		
70	concrete	8x?x10				
71	concrete		1200		1974	
72	concrete		pit			
73						
74						
75						
76						
77	steel (b)					
	mean		1534	55		
	median		1500			
	mode		1500			

(a) This pit is in all probability a cesspool.
(b) This tank is also probably a cesspool. See text, p. 47.

(Questa Engineering, Inc., 1989)

Analysis, Pollution Study/Sanitary Survey

The purpose of the Questa study was to ascertain whether current ongoing wastewater disposal practices in the community of Lake Canyon constitute a health hazard according to state criteria. A positive finding would qualify the Lake Canyon community for state aid to correct the problem. (Two versions, the current state criteria, and those of only a year ago, are listed in Appendix A. New criteria are expected in July of 1989, and may be the measure against which Lake Canyon's problem is assessed.) Specifically, the study was directed at detecting pollution of Beardsley Creek, which courses down the middle of the community and runs into Lexington Reservoir, a part of the county groundwater recharge system and a recreational lake.

Suitable on-site waste disposal usually is prescribed by local health codes (Laak 1980, and elsewhere). In California, the requirements of the local ordinance must meet standards set by the Regional Water Quality Control Board. In Santa Clara county, a conventional on-site system consists of a septic tank, which receives all sewage (including greywater), which must be large enough to allow several days retention, and a soil absorption system of sufficient size to allow all of the effluent to dissipate into the soil. A dual leach field is required by county

ordinance (Santa Clara County Code, Sec. B11-34, B11-38), although by policy, leaching or seepage pits which are functioning satisfactorily are not treated as violative. Cesspools, which accept untreated sewage (combining the functions of septic tank and seepage pit), are expressly prohibited in Santa Clara County (Santa Clara County Code Sec. B11-26) but if functioning, are not sufficient cause for enforcement action. Many of the systems present in Lake Canyon are in the latter two categories--existing, nonconforming--and if failure ensued, would not be amenable to repair. Since the consequences of having an unacceptable system might seem potentially unpleasant, the reliability of some of the following data, as undocumented reports of property owners or residents, is open to question.

From those several systems for which there were data available, it as apparent that although there is a preponderance of cesspools, there is also a substantial number of conventional subsurface absorption systems. Moreover, although several are in close proximity with the creek, many are distant enough to meet county standards.

From these examples, it can be seen that not every system in Lake Canyon is an immediate health hazard, but most sites which could make repairs, have already done so. The most convincing arguments against attempting to solve the problem with innovative on-site repairs are slope and

density. If one neighbor is able to affect a repair, it is more than likely that the next will not; most properties will not be amenable to repair. It is out of a need to come to a permanent solution that a community sewerage system has been proposed.

In evaluating the community's existing sewage disposal system against current County policy in the Lexington Basin, about one third would be acceptable if viewed as repairs upon existing systems, and two thirds (the cesspools) would be unacceptable as soon as there was evidence of failure. If assessed as new construction, none would pass. Lot size, slope, and County Ordinance are criteria listed in the current State Guidelines for determining public health hazard from on-site sewage disposal.

This failure to meet County design criteria will help establish the case for funding with the SWRCB.

Results, Resident Questionnaire

Responses to the Resident Questionnaire are shown in **boldface** on a copy of that document on pages 53 through 60, immediately following this section. Selected Kendall tau-b Correlations, Crosstabulations with Chi-Square tests for significance and the Lambda test for statistical dependence are summarized on pages 61 and 62 (Tables 3 and 4).

The best eight variables were selected because of the positive relationship they demonstrated, or, in the case of the variables from Part I of the Questionnaire, due to an expectation that there might be a relationship between the physical condition of a property and the owner's position regarding the proposed sewer. The asymmetric statistic Lambda was selected due to interest in determining whether a respondent's position regarding the project (WANTIT) might be a function of the first ten questionnaire items. "WANTIT" was therefore made to be the dependent variable.

LAKE CANYON STUDY

Resident Questionnaire Score Summary

1. On what street is your house located?

a._12__ Beardsley.

b.__6__ Laurel.

c.__1__ Madrone.

d.__4__ Manzanita.

e.__2__ Oak.

2. Year house was built:

a.__8__ before 1930,

b._13__ 1931 to 1950,

c.__4__ 1951 to 1970,

d.__0__ 1971 or after.

3. Distance from septic system to creek:

a.__2__ less than 10 feet,

b.__5__ between 10 and 50 feet,

c.__6__ between 50 and 100 feet,

d._12__ greater than 100 feet.

4. Type of sewage disposal system.

a.__5__ cesspool.

b.__1__ septic tank.

c.__4__ septic tank and seepage pit.

d._11__ septic tank and drainfield.

e.__4__ other/don't know.

5. If you checked "d", how large is the drainfield (total lineal feet of leach line)?

a.__1__ less than 30 ft.

b.__3__ betweem 30 and 100 ft.

c.__3__ greater than 100 ft.

d._10__other/don't know. (DATA MISSING)

6. Is the system...

a.__3__as old as the house? or,

b._16__has it been repaired? or,

c.__6__don't know.

7. If you checked "b", when was it repaired?

a.__2__within the last year.

b.__5__more than a year ago but since 1980.

c._10__before 1980.

d.__2__don't know. (DATA MISSING)

8. If repaired, was a health department septic tank repair permit issued?

_2_(yes), 11_(no), _8_(don't know). (DATA MISSING)

9. If repaired, was system failing (leaking)?

_5_(yes), _3_(no), 13_(don't know). (DATA MISSING)

10. Are you a renter _5_, or owner_20?

Part II

A. Describe your household. (Check the best answer.)

	You				Spouse/Companion		
	(mean)	(range)	(s.d.)		(s.d.)	(range)	(mean)
1. AGE:	**46.0**	**29-74**	**13.8**		**13.3**	**24-76**	**42.8**
							(DATA MISSING)
2. SEX:	m	f					m f
	17	**5**					**3 13**
							(DATA MISSING)

3. EMPLOYMENT:
(type of work)

8	blue-collar	**3**
2	clerical	**3**
6	professional	**5**
1	not employed	**3**
5	self-employed	**4**
2	retired	**0**
		(DATA MISSING)

4. EDUCATION

(highest level)

7	elementary thru high school	**10**
12	trade school or college	**6**
5	graduate work or professional school	**2**

y n		y n
12 4	did you graduate?	**12 2**

(course of study)

5	natural/physical sciences	**1**
3	humanities	**1**
4	social/behavioral sciences	**3**
4	other/not applicable	**6**
		(DATA MISSING)

5. HOW MANY YEARS IN:

			Lake Canyon?		
12.3	2-42	11.6	11.0	1-42	10.3
(mean)	(range)	(s.d.)	(s.d.)	(range)	(mean)
8.5	1-30	7.9	4.3	1-15	5.8

Previous Residence?

6. PREVIOUS RESIDENCE:

4	Santa Cruz Mts.	1
8	Santa Clara/Santa Cruz Co.	8
5	Bay Area	5
3	California	2
1	Western US	1
2	USA	1
1	other	0
		(DATA MISSING)

7. NATIVE OF:

0	Santa Cruz Mts.	0
3	Santa Clara/Santa Cruz Co.	2
3	Bay Area	3
8	California	3
1	Western US	1
8	USA	7
1	other	2
		(DATA MISSING

Do you rent _5_, or own_20? (You did tell us this before but this (anonymous) questionnaire is separate from the other.)

9. Is your annual household income...

a.0_less than $10,000, b.2_$10,000 to $20,000, c.5_$20,000 to $30,000, d.7_$30,000 to $40,000, e.10_greater than $40,000.

(DATA MISSING)

B. "The best way of doing things."
1. Human waste should be... (choose one)
a. _10__ returned to the earth.
b. __1__ sterilized.
c. __8__ purified.
d. __3__ reduced to non-living form.
e. __2__ other.

2. Sewage plants are ecologically more sound than individual on-site disposal systems (septic systems).

agree __16_ disagree ___3_ no opinion _6_

3. Greywater (wastewater not containing bodily wastes) is a valuable resource and must not be wasted.

agree __18_ disagree ___1_ no opinion ___6_

4. My neighbor's leaking septic tank is... (choose one)
a. __3__ a smelly nuisance.
b. _18__ a potential threat to my health and my neighbor's health.
c. __4__ none of my business (decline to answer).

5. Creeks and freshwater lakes are self-purifying and, as such, can naturally assimilate biological waste.

agree __4__ disagree _21__ no opinion __0__

6. Individual residential septic systems... (choose one)

a. __2__ are safer than community waste disposal systems because
there is less to go wrong.

b. __7__ are not as safe in a community such as Lake Canyon because there are so many in such a small space.

c. __9__ cannot be compared in safety to a community disposal
system because they rely upon different principals.

d. __6__ no opinion.

7. The county's preoccupation with septic tanks should have no bearing on whether we can build, or get a loan, or sell our house!

agree __18_ disagree __3__ no opinion __3__

C. "How would **you** be affected..."

Installation of a sanitary sewer would undoubtedly result in some major changes; some of the possibilities are listed below. Please respond by marking a number on the scale which best describes how you would expect to be affected by each of the changes.

How would **you** be affected...

favorably...			unfavorably...	
very	mildly		mildly	very
+2	+1	0	-1	-2
FREQ	**FREQ**	**FREQ**	**FREQ**	**FREQ**

1. ...by not having to worry about a failing septic system?

+2	+1	0	-1	-2
19	**3**	**3**	**0**	**0**

2. ...by not having to report your septic system under Real Estate Disclosure Law?

+2	+1	0	-1	-2
15	**3**	**5**	**1**	**0**

3. ...by release from the building moratorium?

+2	+1	0	-1	-2
19	**3**	**3**	**0**	**0**

4. ...by freedom from limiting water use to accommodate your septic system.

+2	+1	0	-1	-2
11	**1**	**11**	**1**	**0**

5. ...by the improved quality of Beardsley Creek?

+2	+1	0	-1	-2
15	**8**	**2**	**0**	**0**

C. How would **you** be affected...

favorably...			unfavorably...	
very	mildly		mildly	very
+2	+1	0	-1	-2
FREQ	**FREQ**	**FREQ**	**FREQ**	**FREQ**

- -

6. ...by changes in property values following installation of the sewer?

+2	+1	0	-1	-2
18	**5**	**1**	**1**	**0**

7. ...by the expense of your share of installation cost?

+2	+1	0	-1	-2
3	**3**	**3**	**10**	**6**

8. ...by increased traffic during construction?

+2	+1	0	-1	-2
3	**2**	**5**	**6**	**10**

9. ... by negative effects of the construction itself (dust, erosion, noise, excavation on your property, etc.)?

+2	+1	0	-1	-2
1	**1**	**10**	**6**	**7**

10. ...by an end to the hassles with the County Building and Health Departments?

+2	+1	0	-1	-2
20	**1**	**2**	**1**	**0**

C. How would **you** be affected...

favorably...			unfavorably...	
very	mildly		mildly	very
+2	+1	0	-1	-2
FREQ	**FREQ**	**FREQ**	**FREQ**	**FREQ**

- -

11. ...by potential overconsumption of water from Lake Canyon's limited supply?

+2	+1	0	-1	-2
1	**2**	**11**	**2**	**8**

12. ...by the notoriety due to public interest in the project?

+2	+1	0	-1	-2
3	**1**	**15**	**2**	**3**

13. ...by loss of privacy, solitude or serenity of the area if development follows?

+2	+1	0	-1	-2
2	**2**	**4**	**5**	**11**

14. How do you feel about the installation of a community sewage disposal system in Lake Canyon?

in favor...			opposed...	
	very much	somewhat		somewhat strongly
+2	+1	0	-1	-2
16	**3**	**1**	**0**	**4**

Table 3. CONDITION OF INDIVIDUAL SYSTEM X "WANTIT"

	LOCATION	HOUSEAGE	DISTANCE	SEWRTYPE
tau x WANTIT	.05	-.07	-.15	-.11
Sig.	.38	.36	.20	.29
Chi Square	5.75	3.90	15.3	3.26
D.F.	12	6	9	6
Sig.	.93	.69	.08	.77
Lambda	.00	.00	.00	.00
N	24	24	24	20

	SEWRSIZE	REPAIR	WHENREP
tau x WANTIT	-.60	-.06	.04
Sig.	.07	.38	.42
Chi Square	3.00	2.40	5.83
D.F.	4	3	6
Sig.	.55	.38	.44
Lambda	.00	.00	.00
N	6	18	16

	PERMIT	FAILING	OWNRENT
tau x WANTIT	-.45	-.55	-.10
Sig.	.05	.06	.30
Chi Square	16.55	4.59	1.26
D.F.	6	3	3
Sig.	.01	.20	.74
Lambda	.40	.00	.00
N	13	8	24

Association between desire for sewer and condition of individual on-site disposal system in Lake Canyon.

Table 4. ASSOCIATIONS AMONG OTHER SEWER-RELATED FACTORS

tau-b
Sig.
N

	COMPLY	TRAFFIC	NOISE	PUBLIC
NOISE		.73 <.001 25		.46 .006 24
PUBLIC		.45 .006 24		
GREYWATR	.62 .001 24			
VALUE				.44 .01 24
SHARE		.70 <.001 25	.60 <.001 25	.48 .004 24

Some associations found between factors relating to respondents' desire to install a sewer in Lake Canyon.

Analysis, Resident Questionnaire

The expectation that there would be some relationship between residents' desire for a sewer and the degree of compromise existing in their current condition appears not to have been justified. By far the most significant finding is this virtually complete lack of relationship. (The moderate correlation between SEWRSIZE and WANTIT which might hint that those who had larger individual systems felt less need for a sewer represented an N of only 6.) A brief examination of the correlation and crosstabs values shows remarkably little association between any of the physical variables and WANTIT, the measure of desire for the sewer. (Table 3). The small but significant correlation between REPAIR and WANTIT would indicate that, for those who knew ("Don't know" was recoded as "missing"), a history of repair predisposed toward voting against the sewer.

On the other hand, some of the variables from the second half of the questionnaire showed a rather strong interaction. Lambda for NATIVEZ (spouse/companion) with WORRY as the dependent variable was .75, (N=15) indicating that the further away the person who accepted the secondary role in the questionnaire called "home," the more was the concern over the existing septic system. (These variables showed a Kendall tau correlation of .70, $P<.001$.)

The high correlation between GREYWATR and COMPLY (tau=.63, significance <.001) might be explained by a different phenomenon. The County (both EHS and CPO/Building Dept.) and many of the residents of the mountain communities fail to agree on many principles relating to such issues as safe use of greywater. Those who would differ with these agencies would probably be most anxious to see less of them.

Probably the most enlightening relationship found among the measures related to NOISE, TRAFFIC, PUBLIC and SHARE. The high general correlation among these measures seems to indicate a segment of the population which is concerned about the consequences (expense and inconvenience) of the project.

Finally, it has been a source of personal insight to recognize that, at least in this case, mountain residents truly do see things through eyes different from those of the Environmental Health Specialist. The factors which this writer had expected to be of major consideration (distance to creek, repair of system, age of system) which one would consider when evaluating the status of one's sewage facility were not among those which related at all to the expression of need for a sewer.

What is clear is that, of those who responded to the questionnaire, a large majority wanted a sewer. The 25 questionnaires returned represented 44 residents. That

question was answered on all 25 questionnaires returned. Four were strongly opposed, one neutral, three somewhat in favor, and 16 very much in favor of building a sewer.

Significant also were the several comments and letters from the respondents. These additional communications underscore the diversity and intensity of this community. It is remarkable that nine, or more than one third of the returned questionnaires contained substantial comment.

Some comments clarified description of their property, some pointed out shortcomings in some of the questions to accurately address the issues. Others gave insight into the values of the respondent (the Real Estate Disclosure Law was seen to be a fair requirement). Others merely pointed to the fact that no matter how complex and flexible a questionnaire could be constructed, there would always be exceptions.

Several comments provided some insight into the basis for some of the antagonism between "the county" and the mountain community as a whole. It is interesting that "the county" was blamed both for meddling and for not being active enough!

Results, Agency Questionnaire

As previously explained, the reason for using a questionnaire format for a series of interviews was to

achieve uniform coverage of the topics of concern. This was generally accomplished, albeit with some disservice to some of the participants' stories.

Responses to the objective questions from this questionnaire are shown on a copy of that form. Multiple entries indicate that a respondent felt that more than one choice was applicable. Responses to the more subjective questions have been summarized and are also included.

LAKE CANYON STUDY

Organization Questionnaire

The purpose of this questionnaire is to explore the activities of your organization as they relate to the proposed project of sanitary sewer line construction in Lake Canyon. From your responses and those of the other contributors I hope to derive a model which describes the interaction of these groups as their joint efforts influence developments in this mountain community.

The following is a list of organizations involved in the Lake Canyon sewerage question to whom this questionnaire is addressed:

- Lake Canyon Mutual Water Co./Community Improvement Committee
- Lexington Hills Association
- West Valley Sanitation District of Santa Clara County
- Town of Los Gatos
- Environmental Health Services, Santa Clara County Health Dept.
- Local Agency Formation Commission
- California Regional Water Quality Control Board, SF Bay Region
- State Water Resources Control Board
- Questa Engineering.

If, in your understanding of the situation, you feel that it is necessary to include any additional participants, please make a note here:

Added were:
County Advance Planning Office (APO)
Assemblyman Charles Quackenbush
Supervisor Susanne Wilson

Please include a brief explanation of their significance:

Principal Coordinator with Los Gatos,
Representative in Sacramento, and
Representative in County Government, respectively.

In describing the interaction of the various organizations involved in the project of sewering Lake Canyon, several questions must be addressed. An organization's involvement in the project may be molded by a number of factors, eg. nature of involvement, type of activity pursued, legal constraints, or financial considerations. A series of questions attempting to clarify the relationship between the agency and the project itself will begin this questionnaire / interview. Each series will be preceded by a summary topic question.

A. Category Question: "What is the relationship of your organization to the Lake Canyon sewerage problem?"

1. Is your organization or agency

   a. a consumer of the services (sewerage) in question?

   LCMW/CIC

   b. a controller or provider of services (line function)?

   WVSD, LG, EHS, LAFCo, RWQCB, SWRCB, APO

   c. an ancillary provider to the project (staff function)?

   EHS, QUESTA

   d. a third party affected by the outcome?

   LHA, LG

   e. other? _____

   LAFCo (boundaries), Q'BUSH, WILSON (political representation)

2. What is your agency's primary contribution?

   a. Onetime and technical in nature? (eg. consultative)

   LG, EHS, LAFCo, QUESTA, APO

   b. Ongoing and technical? (eg. construction and maintenance)

   WVSD, Q'BUSH

c. Regulating the outcome of the project?

LHA, RWQCB, SWRCB, APO (writes EIR)

d. Granting of permission for the project to proceed?

LG, LHA, LAFCo, WILSON (as member of LAFCo)

e. Other? _____

LCMW/CIC (recipient)

3. If your agency makes a secondary contribution, is it:

a. Onetime and technical in nature? (eg. consultative)

b. Ongoing and technical? (eg. construction and maintenance)

c. Regulating the outcome of the project?

APO (will write the Environmental Impact Report)

d. Granting of permission for the project to proceed?

LG, LAFCo, LHA (expressed readiness to go to court)

e. Other? _____

A history of the project as each agency became involved also is important. This second series of questions asks you to describe the history of your agency's involvement in the project.

B. Category Question: "How did you become involved in the project?"

4. Describe briefly the history of your involvement.

Dissatisfied with the County's handling of septic system problems and the moratorium, LCMW/CIC approached other organizations in an effort to initiate action.

5. How/why was involvement initiated?

Most agencies felt that it had been consistent with their mission and responsibilities to become involved.

6. Is your activity in the project the result of statutory mandate? (or other legal obligations)

yes WVSD, LG, EHS, RWQCB SWRCB, WILSON

no LCMW/CIC, LHA, LAFCo, QUESTA, APO, Q'BUSH

7. Describe the nature of your interest in the project.

Each organization fills a niche in the mosaic made up of environmental protection, public health, and public service which make up this story.

8. What do you perceive to be the underlying problem?

Two issues fuel the fires; the need for permanent sewage disposal and the community's need to be free of the encumbrances of the building moratorium.

9. What alternative solutions do you recognize?

Responses ranged from suggesting a change in the rules whose enforcement create the conflict (moratorium, septic system regulations, etc.) through the suggestion that individual on-site repairs were the solution, to the recommendation of a community sewage system.

10. What is your perception of the technical solution? (How does it fit with what you do?)

Most saw the technical solution in terms of their role. Thus WVSD expects to install a sewer, EHS is involved in enforcement of regulations; LAFCo approves boundaries.

The agency's or organization's role in the project in terms of its contribution must be explored. This series of questions will ask how the agency's contribution is expected to affect the outcome of the project.

C. Category Question: "How will the participation of your organization affect the situation?"

11. What will be the nature of your agency's involvement (from the viewpoint of the project)?

I. Scope:

a. central: LCMW/CIC, LHA, LG, WVSD, EHS, LAFCo, SWRCB, QUESTA, WILSON

b. peripheral: LHA RWQCB, Q'BUSH, APO

II. Function:

a. instrumental (doing it): WVSD, LAFCo

b. facilitative (getting it done): LG, EHS, RWQCB, SWRCB, QUESTA, Q'BUSH, WILSON, APO

c. other: LCMW/CIC (recipient), LHA (political) LAFCo (prerequisite)

12. What role does your agency play as the activities proceed?

a. directive: LG, WILSON

b. consultative: LHA, WVSD, LG, RWQCB, QUESTA, APO, Q'BUSH, WILSON

c. provider of services: WVSD, SWRCB, (funding)

d. regulative: EHS, LAFCo, WILSON (on LAFCo)

e. other: LCMW/CIC (recipient), (LHA (political), APO (EIR)

13. How do you foresee cooperation with other agencies? (What will be the consequences of your involvement?)

All but LHA agreed that cooperation among participants had been excellent to date.

14. How will your agency be enhanced by its participation?

None saw the agency profiting from participation; many saw opportrunities for professional growth and accomplishment.

In addition, it is necessary to determine the effect participation in the project will have upon each agency. Questions investigating this relationship both from a qualitative and quantitative standpoint are presented here:

D. Category Question: "How will your organization be affected by its activities in the project?"

15. To what extent is your agency involved?

a. insignificant proportion of your budget.

LG, WVSD, RWQCB, APO

b. measurable but small proportion of your budget.

LHA, EHS, LAFCo, SWRCB, APO, Q'BUSH, WILSON

c. large segment of your budget.

LCMW/CIC, WVSD (during construction) QUESTA

16. Approximate % of budget allocated to project:0 TO 25%.

17. What are the limitations of your organization relative to the performance requirements of the project?

Most public agencies saw no limitations. The activities were part of their routine responsibilities. Unforeseen problems could, however tax overburdened staff. LHA pledged as much effort as necessary to achieve their desired ends. LCMW/CIC has limited funds.

18. What will be the impact of the adequacy of funding upon the activity of your organization.

Funding more or less paralleled question 17. LCMW/CIC is dependent on outside sources; Quackenbush and Wilson would find funds elsewhere if necessary to complete the project.

19. What will be the impact experienced by your agency because of the agency's involvement in the project? (enlarged sphere of influence, greater tax base/service burden, etc.)

This question had local relevance only. Major impact on LCMW/CIC and EHS, whose responsibilities would be reduced, and LG and WVSD, whose responsibilities would increase.

20. How do legally established relationships (between yours and the other agencies) affect your agency's performance in the context of this project?

Three interactions were found. A water/health/sewage matrix included WVSD, EHS, RWQCB, and SWRCB. A zoning/planning matrix included LG, LAFCo, APO and WVSD. Contractual obligations exist among LCMW/CIC, WVSD, AND QUESTA. LCMW/CIC is responsible for carrying out the "will of the people" in the canyon.

Finally, among the several agencies involved, some may be more eager to pursue their prescribed activity than others. Each agency has a unique manner of participating in the project. Many may have specialized interests or be uniquely constrained. The following series of questions is directed at discerning these features.

E. Category question: "What constraints, requirements or objectives unique to your organization affect its relationship to the project?"

21. Is its stance generally in favor of or against the proposed project(s)?

a. in favor: LCMW/CIC, LG, WVSD, EHS, RWQCB, SWRCB, APO, Q'BUSH, WILSON

b. against: LHA

c. no position: QUESTA, LAFCo

22. How does your agency come to have its position?

Responses varied according to their answer to the previous question. Public agencies tended to cite mission, mandate, and responsibility. Other organizations cited surveys, political position or in the case of APO, "..it's the right thing to do" (Bob Sturdivant, APO, personal communication, June 6, 1989).

23. How does answerability to a political constituency constrain your (agency's) activities regarding the project?

Political constituency was important to Q'BUSH, WILSON, LHA, not for public agencies. LCMW/CIC found themselves to agree that they <u>were</u> the constituency.

24. Is your agency's activity seeking to increase or to limit public sector involvement in Lake Canyon? i.e. Is your stance "pro-improvement" or "protective of the status quo"?

a. pro-improvement: LCMW/CIC, LG, EHS, RWQCB, QUESTA, APO Q'BUSH, WILSON

b. status quo: LHA, LG

c. no position: WVSD, LAFCo, SWRCB

25. To what degree is your performance in the project directed or motivated by considerations other than your agency's primary mission? (Such considerations might be political or jurisdictional, relate to land use or density, etc.)

No one had any extraneous motives they chose to share.

We have come to the end of this questionnaire. The following topics are intended to suggest some of the many possibilities not covered. We would like to know your general thoughts on these or other matters. (Please consider response to this question to be optional.

F. Category Question: "Have you any final observations?"

26. What other ramifications do you foresee as a result of your organization's current activities? (Effects need not necessarily be related to the issue of sewage disposal.)

Topics might include:

a. constraints upon activities of other agencies, communities, etc.;

No observations offered.

b. any changes the community of Lake Canyon might see due to forces placed in motion by this constellation of activities we are experiencing now;

The issue of inescapable development was raised by LHA, LCMW/CIC, APO and LG.

c. contributions your agency expects to make outside the realm of the stated goal of the project;

No observations offered.

d. any others that might occur to you.

None offered. Most felt that they had already satisfactorily covered their organization's position.

Thank you for your participation. I will be calling your office shortly to arrange for a very brief interview to discuss or clarify any questions or responses which require further explanation.

Analysis, Agency Questionnaire

While the information sought for this study was qualitative and highly diverse, throughout the questionnaire there were questions which could discriminate respondents into categories (multiple choice questions 1, 2, 3, 11, 12, 15, 21, and 24). Of those, 1 and 2, describing the agency itself and its expected principal contributions; 12, agency's role in proceeding activities; and 21, position on public sector involvement demonstrate the greatest diversity of response. Question 21, in favor or against a sewer project also deserves comment.

A. Category Question: "What is the relationship of your organization to the Lake Canyon sewerage problem?"

The descriptions in Question 1 from which respondents could choose were (a) consumer, (b) controller or provider of services (line function), (c) ancillary provider of services (staff function), (d) third party affected by the outcome, or (e) other. Most of the responses were as expected.

Lake Canyon is a consumer, Lexington Hills Association (LHA) and the Town of Los Gatos are third parties affected by the outcome. Assemblyman Quackenbush and Supervisor Wilson are "other." We coined "third parties trying to affect the outcome" for them.

West Valley Sanitation District (WVSD) is a primary provider, whereas Questa Engineering, who performed the pollution study, is an ancillary provider. All the remaining respondents--the various state and local government agencies--are controllers.

Los Gatos, in its role as planner has some controller function; County Environmental Health Services (EHS) in its involvement with the pollution study, acts as an ancillary provider of services.

Responses to question 2, however, held some surprises. Question 2 was: "What is your agency's primary contribution?" Choices were:

"a. Onetime and technical in nature? (e.g., consultative)

b. Ongoing and technical? (e.g., construction/maintenance)

c. Regulating the outcome of the project?

d. Granting of permission for the project to proceed?

e. Other? _____" (Agency Questionnaire, p. 3).

The more obvious technical contributions of WVSD, Questa, and EHS relating to the pollutions study, were joined by Local Agency Formation Commission (LAFCo.), and by County and Los Gatos Planning offices who claimed principal technical contributions. The obvious regulators, the State water agencies, were joined by the county Advanced Planning

Office (APO), whose regulatory activity will be the review of Environmental Impact Reports for the project.

It is generally accepted that the town of Los Gatos holds a trump card in granting permission for the project to proceed, and would join LAFCo. in that responsibility. (LAFCo. would control boundaries of WVSD, which must be changed to include Lake Canyon if a sewer is to be constructed.)

Assemblyman Quackenbush would pursue State funding well into the project and would view himself as an ongoing technical contributor; Supervisor Wilson would be influential, through LAFCo., in the granting permission to proceed; Bart Evans, President of the Lexington Hills Association insists that they will "regulate" the scope of the project, and will, unless the project is limited to a small diameter sewer capable of serving only Lake Canyon, affect the ability of the project to proceed via court action.

C. Category Question: "How will the participation of your organization affect the situation?"

Question 12 asked: "What role does your agency play as the activities proceed?" Responses were chosen from: "(a) directive, (b) consultative, (c) provider of services, (d) regulative, and (e) other." (Agency Questionnaire, p. 5.)

Responses to question 12 were expected to be highly confounded with question 1 and 2. An organization's role in a project cannot easily be separated from that organization's inherent nature or its proposed contributions. However, several of those who characterized themselves as "regulators" at the outset (County APO, The State Water Resources Control Board--SWRCB--the Regional Water Quality Control Board--RWQCB--and LHA), would revert to a consultative role as construction of a community sewer system proceeded. (RWQCB would remain regulative if a community leach field were involved.) The Town of Los Gatos, County APO, LAFCo., and their member, Supervisor Wilson, would retain a regulatory role; the only remaining providers of services would be WVSD, who would do the work, and SWRCB, who has the money.

It should be mentioned that it is quite possible that this "grouping" around the less controversial consultant role, when the choice is offered has no significance, but simply represents a weakness in questionnaire design.

E. Category question: "What constraints, requirements or objectives unique to your organization affect its relationship to the project?"

The general stance regarding public sector involvement (Question 24) in Lake Canyon, as well as position on the proposed sewer (Question 21) can be grouped against each respondent's reply to questions 1 and 2. The relationship

Table 5. PUBLIC SECTOR INVOLVEMENT AND SEWER PROJECT

Question #:	24 (Public Sector)			21 (Sewer Project)		
1 and 2	Pro	Con	No position	Pro	Con	No position
Consumer/ recipient		L.C.		L.C.		
3rd Pty/ regulator		LHA	L.G.	L.G.	LHA	
Provider/1 technical	Questa		WVSD	WVSD	Questa	
Controller/ technical	EHS APO		LAFCo.	EHS APO		LAFCo.
Controller/ regulator	RWQCB		SWRCB	RWQCB SWRCB		
Constituency-bound rep-resentatives	Q'bush Wilson			Q'bush Wilson		

Respondent positions on issues of public sector involvement and installation of a sewer system, as related to their relationship to the problem.

of the respondents' positions on questions 24 and 25 to the six response categories from questions 1 and 2 are shown in Table 5.

Three observations come easily to mind: (1) that most people want to do something; (2) more people are in favor of the sewer project per se, than favor general involvement in Lake Canyon; and (3) that there must be some factors, perhaps characteristics of the organizations themselves, which determine how they can relate to certain aspects of the problem.

Lake Canyon's position on the proposed project, as a consumer/recipient, was expected. The community in general is not pro-improvement, but to a degree such a posture is necessarily associated with getting the sewer.

The provider/controller-regulator/technical group's general position in favor of both improvement and the specific project appears to be modified somewhat, in certain circumstances, by the respondent's awareness of his/her organization's primary mission. SWRCB has been approached for help solving this particular problem (Lake Canyon's sewer issue), and has a specific application pending. WVSD is in a quite similar circumstance, as is the Town of Los Gatos. With a specific solution to a specific problem under submission, their position on the general issue of involvement is irrelevant to their mission, and has not been considered.

Finally, Questa Engineering generally favors such projects in the general sense, and sees public sector solutions most appropriate to communities like Lake Canyon. As a firm contracted for the purpose of making an independent evaluation, they, of necessity, have no position on the particular project.

Other questions revealed features unique to each respondent. Those questions in **Category B., "How did you become involved in the project,"** elicited a generally

historical tale from many of those interviewed. The involvement of many of the agencies was initiated by direct request for service. Six organizations were asked to help resolve a problem which had been exacerbated by alienation from local (county) government. One office (APO) first become involved as others (EHS and the Town of Los Gatos) were grappling with the problem. The Board of Supervisors, EHS, and Central Permit Office (CPO) had been involved since earlier times in an attempt to mitigate via moratorium (see Introduction, Montgomery Study). Involvement of the county APO and the Town of Los Gatos planning office, through the Hillside Special Plan (Town of Los Gatos, 1978) appears to have the best chance of providing a legally enforceable resolution (Bob Sturdivant, APO, personal communication, 6-6-89).

Responses to **Category Question C. How will participation of your organization affect the situation** drew some interesting responses. Interest in the project generally followed in line with organizational specialties. Environmental Health Services, RWQCB and SWRCB perceived primarily a health problem; those who were related to community concerns (LHA, Supervisor Wilson and Assemblyman Quackenbush focused on problems with the moratorium. LHA and the planning offices (APO and Town of Los Gatos) expressed concern about the growth-inducing effects.

Similar parallels were found regarding alternative technical solutions to the problem (question 9). Most agencies favor sewer construction. LHA proposed "alternative on-site systems"; LAFCo. pointed out that the county had been successfully sued over that very issue. However, Supervisor Wilson's and Assemblyman Quackenbush's office had diametrically opposed positions: Wilson sees sewer as the only solution--Quackenbush wants releases from moratorium and special septic system rules.

Category D. How will your organization be affected? was not generally a very fruitful category, except for a few insightful comments. On organization budget (question 15), LHA stated that it can (and will) dedicate as much as is needed to get its own way.

On funding of the project, (question 18), RWQCB perceived it as a local problem which, if not solved, will present them with more enforcement headaches. SWRCB is even now withdrawing from direct funding. Both Quackenbush and Wilson will redouble efforts for funding if state monies are not forthcoming. APO expects to complete its activities whether funding comes through or not.

Question 14, "How will your agency be enhanced by its participation," which really belonged in category C., elicited an interesting range of responses: "It's a no-win situation," Bart Evans, LHA; "It would be a coup to sewer

Lake Canyon," Trevor Hayes, EHS; "Our office has experienced growth, a broadened perspective, and we are getting to know staff and the community better," Nan Vaughn, Supervisor Wilson's office.

Finally a general impression of the interviews is that everyone involved believes strongly that there is a problem of significance in Lake Canyon. No one denies that solution will have multiple ramifications; all agree that no solution will please everyone.

A key comment was made by Michael Norris, SWRCB, in answering question 21 (public sector involvement). What they could do hinged on the determination of a health hazard. (The new criteria have yet to be published by the State.) If the data from the Questa pollution study show conclusively that there is indeed a health hazard, money probably will be made available. The next step is cost/effective analysis and the choice of the best alternative.

If, on the other hand, the drought years have succeeded in masking the problem, and a successful case cannot be made for the funds, it's a "whole new ball game."

CONCLUSION

What are the limitations in existence today which result in waste disposal system requirements that differ from those requirements of more than fifty years ago? They include lot size limitations, changes in land use, the need for more adequate disposal (more demanding performance standards), simultaneous and continuous use (as compared with the asynchronous and discontinuous use resulting from vacation usage).

As these limitations evolved, the forgiving nature of the surrounding environment was gradually exhausted. Further, society, in its concern with the proper use of the land, imposed its own restrictions. Science and experience both made their contributions to the practical and legal aspects, in most instances resulting ultimately in a workable and coherent septic system policy, capable of protecting the environment while serving the needs of the community.

Let us observe, however, how Lake Canyon was affected by such an accumulation of policy.

Section B11-40 of the Santa Clara County Code was written in response to the findings of the Montgomery Report. It states that "...subdivision or development on previously undeveloped parcels utilizing on-site individual

sewage disposal systems shall be prohibited." This section also leaves the way open for a community leachfield, should that solution become the most favorable.

Along with the development prohibition, the building department has enacted a moratorium on building onto existing structures. As a result the residents of Lake Canyon have been unable to legally improve their homes since 1980. Even with release from the moratorium, the Policy Regarding Life Extending Construction (1988), developed by EHS and the Department of Planning and Development to standardize approval of health and safety repairs, would result in severe limitations.

Following the reasoning that further utilization of soils in the Lexington Basin for subsurface soil absorption must be curtailed, building site approval is required for any addition of more than 500 square feet which, in the judgement of Environmental Health Services, will result in an intensification of use of the land for on-site waste disposal. Since site approval in Lexington Basin presupposes a lot size of at least an acre, this has been interpreted as meaning that houses which are not now habitable may not be improved. These factors conspire to frustrate Lake Canyon residents' efforts to achieve a conventional lifestyle.

In the introduction, a decision model was presented as a basis for discussion of the wide range of options available to small unsewered communities for their sewage disposal. Close at hand for Lake Canyon is the stage of evaluating alternative solutions and applying decision criteria. Based on previous discussion, one would expect several options. Suggested have been both conventional and septic tank effluent sewer lines, a package treatment plant and a community leach field. Repair to existing on-site systems utilizing pumping of effluent to leachfields on higher ground has also been considered.

There are, however, characteristics unique to Lake Canyon which limit the choices. Limited lot size, steep slopes and proximity to the creek have been considerations kept in mind throughout this paper and they appear, again, to make reliance on septic tanks for an septic tank effluent sewer difficult from standpoint of installation. Due to small lot size, many properties could not successfully repair their systems, even if pumping were allowed. (Maintaining 55 individual pumping systems would itself be a formidable task.)

The requirements for a NPDES discharge permit for a package treatment plant to discharge into a lake such as Lexington Reservoir are far more stringent than could be met. Even the once-approved community leachfield has the

drawback of continuing to dispose of effluent within the Lexington Basin.

Not that a conventional sewer is the only possible solution, but it does appear that there is sound reasoning behind the front-runner status of such a system. It remains now only to find a political means of furthering the effort.

The Los Gatos Hillside Specific Plan is an agreement between the Town of Los Gatos and the County of Santa Clara regarding policy in County areas outside the town but within the Los Gatos sphere of influence. Issues dealt with are land use, facilities and services, circulation (traffic), open space, and safety (Town of Los Gatos, 1987). In the Hillside Plan, which at this time does not include Lake Canyon, the Town of Los Gatos and the County have already agreed that satisfactory disposal of sewage has to be included in the list of key services necessary for the development of any rural hillside area. Thus, the use of such an agreement between the County and the Town, if there were otherwise justification for the Town's involvement, would seem to be a sensible way to approach the sewer issue. Although the topic is dealt with only briefly, both the county and town planning offices agree that there are sufficient agreements in place to warrant the plan's use as a framework for the development of a new sewer. (Bob Sturdivant and Lee Bowman, County and Town planners,

personal communication, June 6 and 20, 1989).

LCMW/CIC has worked diligently to achieve a unity of purpose out of a diverse community. WVSD stands ready to take on construction of whatever alternative is eventually chosen. Since the resurgence of interest in a community solution to the problem, EHS has endeavored to do its part to promote that solution which will accomplish the greatest gain for the greatest number of citizens. There is emphatic consensus around this conclusion: "Lake Canyon needs a community sewer system."

It is the professional position of Questa Engineering, Inc. that, even in the absence of conclusive bacteriological and chemical evidence, existing methods for sewage disposal in Lake Canyon have considerable potential for health hazard (Robert Moore, Questa Engineering, personal copmmunication, July 10, 1989). This is evidenced by inadequate setback, steep slopes, and substandard systems.

Some of the SWRCB criteria are sensitive to such factors. It is apparent from the multiplicity of criteria that SWRCB wants to be able to respond to any legitimate claims. Therefore, all involved parties must join forces in urging in the strongest possible way that SWRCB liberally interpret the guidelines in favor of funding a sewer project for Lake Canyon.

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APPENDIX A

State guidelines for documentation of public health hazard.

I. Guidelines for "Substantial Evidence" Determination Regarding Failure of Individual Disposal Systems. (Draft; used with permission.)

Sanitary Survey

Minimum community-wide response rate of 35% of which 50% of the respondents report "problems" with their on-site systems. These problems would include odor, backed-up plumbing, surfacing effluent, and pumpout rate exceeding once every two years.

Greywater

Twenty (20) percent of the houses surveyed have uncontrolled greywater discharges.

Well Pollution

Twenty-five percent of the on-site wells tested exhibit bacterial and chemical concentrations exceeding state drinking water standards.

Bacterial Sampling

Any bacterial analysis indicating positive for total and fecal coliform organisms should be rechecked within 24, 48, and 96 hours after the initial results. A positive verification after this follow-up sampling is completed should be considered as a significant indicator of

pollution, demanding more intense sampling and evaluation of the suspected well.

Chemical Sampling

1. Any Sample for chlorides which is greater than 250 mg/l should be rechecked within 24, 48, and 96 hours after the initial result.
2. Any sample for nitrate nitrogen which is greater than 10 mg/l should be rechecked within 24, 48, and 96 hours after the initial result.
3. Background levels of chemical concentrations should also be determined on non-suspected wells in order to compare them with levels measured in suspected wells.

Depth to Groundwater

During a normal rainfall year, a minimum separation of five (5) feet between groundwater and the bottom of the leachfield is not maintained for 50% of the systems.

Surface Water Contamination

Based on a representative sampling of the area, 30% of the samples are identified to have either:

a. Fecal coliform exceeding a log mean of 200/100 ml (at least five samples for the same sampling location taken over a 30-day period, or
b. Of samples taken for nitrate nitrogen, at least 20% are over background levels, or

c. Of samples taken for chlorides, at least 20% are over background levels.

Lot Size

Thirty (30) percent of the lots do not meet set-back and separation requirements as determined by current county code, Regional Board guidelines or the Uniform Plumbing Code.

Slope

One-third of the area exceeds ground slopes of 30%.

County Ordinance

On-site systems do not conform to current county code on thirty (30) percent of the lots and Regional Board has waived requirements pursuant to Water Code Section 13269.

Drainage

One-third of the study area is flooded two out of every five years. (SWRCB Division of Clean Water Grants, December 1987.)

II. Criteria for Class A priority ranking for a wastewater project (1988).

The following criteria are offered by the State Water Resources Control Board (SWRCB) as guidelines for providing acceptable documentation of a public health hazard. To qualify for first level priority at least three of the following conditions must be demonstrated:

"a. Over 50 percent of the individual sewage systems in the study area have uncontrolled grey water discharges. Documentation must be presented from a house-to-house survey for grey water discharges.

"b. The County Health Officer is on record that a public health hazard exists as a result of septic tank discharges and is able to provide documentation to support this position. Documentation may be in the form of inspection reports, monitoring data, or evidence of postings, condemnations, etc.

"c. Over 50 percent of the existing systems are shown to have surface outbreaks of effluent during the past year. This information must be developed from an inspection survey of septic systems in the study area.

"d. The individual septic system pumpout rate for the area averages greater that one pumpout every two years. Documentation of pumpouts from septic tank pumping forms must be submitted to support the pumpout rates.

"e. Ground water levels in each of the past five years have reached a height, or expected to reach a height that causes the loss of the minimum separation (leachfield to ground water) for at least 50 percent of the on-site systems in the area. This information must be supported by ground water elevation monitoring data.

"f. Condemnation of wells, prohibition on swimming and fishing, and/or local building moratoriums have been imposed by the local health agency due to public health concerns.

"g. The concentration of nitrates, sulfides, TDS, coliforms, BOD, etc., in the effluent, ground waters, or surface waters due to on-site systems is such that it is hazardous or is expected to be hazardous to public health. Monitoring data must be presented to document this condition.

"Furthermore, in order to receive ... (a priority)... classification, the Regional Board and local health agency must adopt a prohibition with a time schedule for eliminating discharge or the County must adopt a moratorium for the affected area. Finally, Federal Regulations 40 CFR 35.2116(b) pertaining to the funding of new collection systems require the bulk (generally two-thirds) of the expected flow (flow from existing plus future residential uses) will be from the resident population existing on October 18, 1972" (SWRCB, Division of Clear Water Grants, January 13, 1988).

APPENDIX B

Accepted safe septic system practice criteria

REFERENCE	BULLETIN A[1]	USPHS[2]	LAAK[3]
MINIMUM SIZE	1200 gallon	750 gallon	575-735 gallon*
COMPARTMENTS	two minimum	one acceptable	no standard (one OK)
MATERIAL	concrete or masonry	steel acceptable	"structurally sound & corrosion-
INSPECTION	no standard	yearly	once/3 years
COVER	< 12 inches	8 inches	no standard
MINIMUM DEPTH	4 ft.	2.5 ft.	3 ft.
LENGTH/WIDTH	2.5:1	"unimportant"	>3:1

* MDF, maximum daily flow is calculated as follows, using a range of 50 to 75 gallons per person per day: (Minimum peak factor and maximum safety factor were used with the maximum usage estimate; maximum peak factor and minimum safety factor were used with the minimum usage estimate.

75 gal/capita day x 1.5 peak factor x 3.0 safety factor x 135/62 capita/houses = 735 gal.

50 gal/capita day x 3.5 peak factor x 1.5 safety factor x 135/62 capita/houses = 575 gal.

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[1] County of Santa Clara (1986) Septic Tank Sewage Disposal System: Bulletin "A"

[2] U S Public Health Service (1967) Manual of Septic Tank Practice

[3] Laak (1980), Wastewater Engineering

APPENDIX C

Letters of Introduction

May 8, 1989

TITLE FNAME LNAME
AGENCY
ADDRESS
CITY STATE ZIP

Dear TITLE LNAME:

As a portion of the requirements for a Master of Public Health degree for San Jose State University, I am studying the sewage disposal problem in Lake Canyon (focusing on the proposal of sewering that community) in which your agency is currently or may soon become involved. I became involved with the problem while I was assigned to Los Gatos and the Santa Cruz Mountain area as an Environmental Health Specialist for the County of Santa Clara.

One aspect of my study has entailed a questionnaire addressed to residents and property owners attempting to discern their opinions and attitudes regarding the proposed project.

I need also to understand the interactions of the several agencies and organizations which are or will be involved in planning and implementing this project. Toward that end I have developed the attached questionnaire; I ask now that you but briefly review it and reflect on any items which strike you as requiring some contemplation, and respond to those which represent simple statement of fact.

Soon I will be calling your office to arrange for a brief "interview" during which we can complete the actual questionnaire together.

Where possible, I have chosen a multiple choice format in order to save you time. I am aware of the limitations of such a format and welcome any elaborations you would like to offer to better describe the role, contribution or activity of your agency or organization as they relate to this project.

I am looking forward to meeting with you; thank you for your time and attention.

Sincerely

Michael Schott, R.E.H.S.
(408) 299-6930

August 11, 1988

Dear Lake Canyon Resident:

My name is Mike Schott. I am a graduate student in the Department of Health Science at San Jose State University, working toward a Master of Public Health degree with a specialty in Environmental Health. I am also a Sanitarian for the County of Santa Clara and since February 1988 have been assigned to a part of Los Gatos and the Santa Cruz Mountains. In my work for the Health Department I heard about Lake Canyon, its history, and its need for improved sewage disposal; I became interested in studying Beardsley Creek, Lexington Reservoir, and septic systems as they related to the sewage disposal problem in the canyon.

In reading county files and previous studies (including the Montgomery Report) it became clear to me that there was a great deal more to the Lake Canyon problem than failing septic systems and pollution in the creek. For many years it had been clear that much of the sewage disposal in the mountains was unsatisfactory. However, little could be done that would not be unfair to many and punitively costly to some. Failure to resolve several issues surrounding the Montgomery study and poor communication regarding the community leachfield for Lake Canyon had left many dissatisfied. The mood of distrust and suspicion that developed in the minds of nearly everyone involved in mountain life--home-owners, contractors, developers, realtors, public servants--was only made worse by the building moratorium.

The Lake Canyon Community has joined forces with several agencies in a project requiring an unprecedented spirit of cooperation. The eventual success of these attempts to provide a permanent solution to what, for many, has already become an impossible problem, depends upon the interaction of these diverse agencies, many unaccustomed to working together and lacking experience trusting in one another. I want to document the progress of your community and the other players as we work toward the goal of a healthier and safer Lake Canyon.

Missing from all the files, and, if no one preserves it, missing permanently from history are the opinions and feelings of the very members of the community who will ultimately have to live with the outcome. With your help, I would like to record your position.

I also want to try to relate people and their feelings; not by name, but by characteristics such as years of residence or sex or where you were born or grew up, just to see if it matters. Perhaps the answers can help another small community in dealing with a similar problem.

The attached questionnaire will help me do so.

INSTRUCTIONS:

The questionnaire is in two parts. Part I, although no names are asked, cannot <u>really</u> be considered anonymous because you are asked to give your address (in order to map trends). It is intended only to document the generally inadequate conditions of sewage disposal in Lake Canyon <u>at a community level</u>. In no way is this paper going to explore the shortcomings of any <u>individual</u> waste disposal system. Information provided becomes property of San Jose State University, not of the County. Part I is provided with its own separate envelope.

In Part II, which is truly anonymous, I am attempting to relate a few easily obtained descriptive characteristics to various opinions about the proposed sewer project and its consequences. I want to know what <u>you</u> think. In a limited space, I have tried to cover major issues. If, when you have finished, you feel I've left out something important (and you want to take the time) go ahead and write it down on the back.

Finally, please try to do this all at once. It should only take a few minutes. Just answer "off the top of your head." Your first impression will be your best answer.

Thank you very much for your time and effort!

Michael Schott, R.E.H.S.

REGISTERED ENVIRONMENTAL HEALTH SPECIALIST

APPENDIX D

Table of Acronyms

LCMW/CIC.....Lake Canyon Mutual Water Company/Community Improvement Committee

LHA.....Lexington Hills Association

WVSD.....West Valley Sanitation District of Santa Clara County

LG.....Town of Los Gatos

EHS.....Santa Clara County Environmental Health Services

LAFCo.....Local Agency Formation Commission

RWQCB.....Regional Water Quality Control Board, San Francisco Bay Region

SWRCB.....State Water Resources Control Board

QUESTA.....Questa Engineering, Inc.

APO.....County of Santa Clara Advance Planning Office

Q'BUSH.....State Assemblyman Charles Quackenbush

WILSON.....Supervisor Susanne Wilson

NPDES.....National Pollution Discharge Elimination System

MTBSC.....Mean Time Between Service Calls

SPSS.....Statistical Package for the Social Sciences

CPO.....Current Planning Office (Central Permit Counter)

USPHS.....United States Public Health Service

Table 6. DATA LIST

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