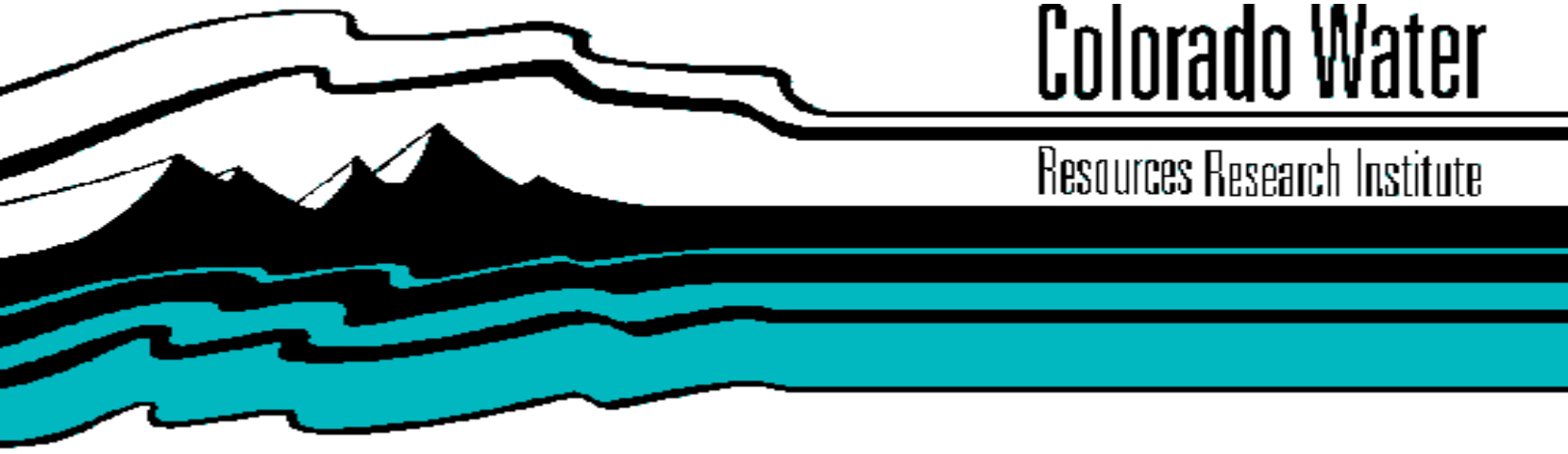
Proceedings: Fourth Workshop on Home Sewage Disposal in Colorado-State/County Cooperation in Managing Small Wastewater Flows

by

Robert C. Ward



Information Series No. 45

PROCEEDINGS

FOURTH WORKSHOP ON HOME SEWAGE DISPOSAL IN COLORADO

Emphasizing

STATE/COUNTY COOPERATION IN MANAGING SMALL WASTEWATER FLOWS

Edited by

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INTRODUCTION TO PROCEEDINGS

These proceedings record the presentations and comments made during a one-day Workshop on Home Sewage Disposal held May 6, 1981. The workshop, sponsored by the Water Resources Research Institute and the Cooperative Extension Service at Colorado State University and the Colorado Department of Health, examined the management strategy that Colorado, and other states, currently use to manage small waste flows.

The purpose of the workshop was to review the expanding definition of small wastewater management and examine alternative means by which such management could be accommodated within the current county/state management structure. There is an increasing recognition in the United States that small wastewater treatment technology does have a role to play in a total water quality management program. To be effectively utilized, however, small flows technology must be properly operated and maintained, an area often ignored within current management approaches.

The workshop noted the expanding role of small flow technology and discussed alternative means to enhance its management.

WELCOME

by

Dr. Norman A. Evans
Director: Water Resources Research Institute
Colorado State University

We are pleased to welcome you all to the Fourth Workshop on Home Sewage Disposal. I'm Norm Evans and it is my pleasure to open the meeting and preside this morning. As usual, we're delighted to have you from various parts of the state, out of the state, and from here on the CSU campus. Glad you brought along the life-giving rain with you. We have a good day to enjoy a good conference, the fourth of a series dealing with a very important subject.

This is a very important subject. I have had the pleasure and challenge of chairing a Task Force for the Colorado Water Quality Control Commission to develop groundwater quality protection strategy and regulation for Colorado. Two weeks ago we decided to survey our Task Force members, which number around 20 people, as to what they thought were the major groundwater quality problems or potential problems and pollutant sources. You would not be surprised, I'm sure, that on-site sewage disposal, often called septic tank systems, was number one on the list of potential groundwater pollution sources. I'm sure that wouldn't surprise you, but it does point out the importance of the subject, and the importance of making progress toward bringing that source of potential groundwater pollutants under some reasonable regulation and control. I do not mean to infer that it isn't under reasonable control, yet we all agree that there is progress to be made. We are here to share experiences and information on innovative and useful developments that are coming along and being tried, or that have already been demonstrated and proved.

OPENING REMARKS

by

Robert C. Ward
Agricultural and Chemical Engineering Department
Colorado State University

Thank you for attending this Fourth Workshop on Home Sewage Disposal in Colorado. These workshops have been held every three years with the purpose of bringing to the small wastewater flows "industry" in Colorado the latest technological, economic, and management information and to provide a forum for exchange of ideas between different segments of the "industry" (e.g., designers, installers, pumpers, regulators, extension personnel, sanitarians, etc.). Each workshop has been organized around a theme that reflects a major trend in the field of concern to Colorado. This year's emphasis or theme is state/county cooperation in managing small wastewater flows in Colorado.

Small Flows Management System

Nationwide, 25-30 percent of all homes use some form of small flows technology to treat and dispose of wastewater. I have no figures for Colorado, but I would guess our figures are approximately the same. Providing effective and efficient on-site or small flows technology for wastewater treatment and disposal requires a total management system. The management of small flows involves a number of different phases or activities which roughly parallel the process by which a small flows treatment system is made operational and maintained. Figure 1 illustrates, in a flow-chart fashion, the small flows management system.

Currently, Colorado's management approach for small flows (Individual Sewage Disposal Systems Guidelines, i.e., county regulations) concentrates on the middle of the management system (site evaluation, design and installation). There are some approvals of subdivision plans required by county health departments, but not every lot is checked. Operation and maintenance are the responsibility of the homeowners.

Expanding Role of Small Flows Technology

During the past five years there has been considerable effort at the national level to upgrade management of small wastewater flows and to incorporate small flow technology into the mainstream of wastewater management in small communities. This effort has been coordinated by the U. S. Environmental Protection Agency and has recently resulted in publication of "A Strategy for Small Alternative Wastewater Systems" (SAWS). This national strategy describes a much more active state role in management of small flows than Colorado has historically provided.

Another national trend that may cause considerable reevaluation of current approaches to wastewater management is the proposed reduction in construction grant programs. With less federal support for capital construction of wastewater treatment plants, smaller communities will be forced to consider a broader range of alternatives - alternatives that provide desired levels of treatment at minimum cost.

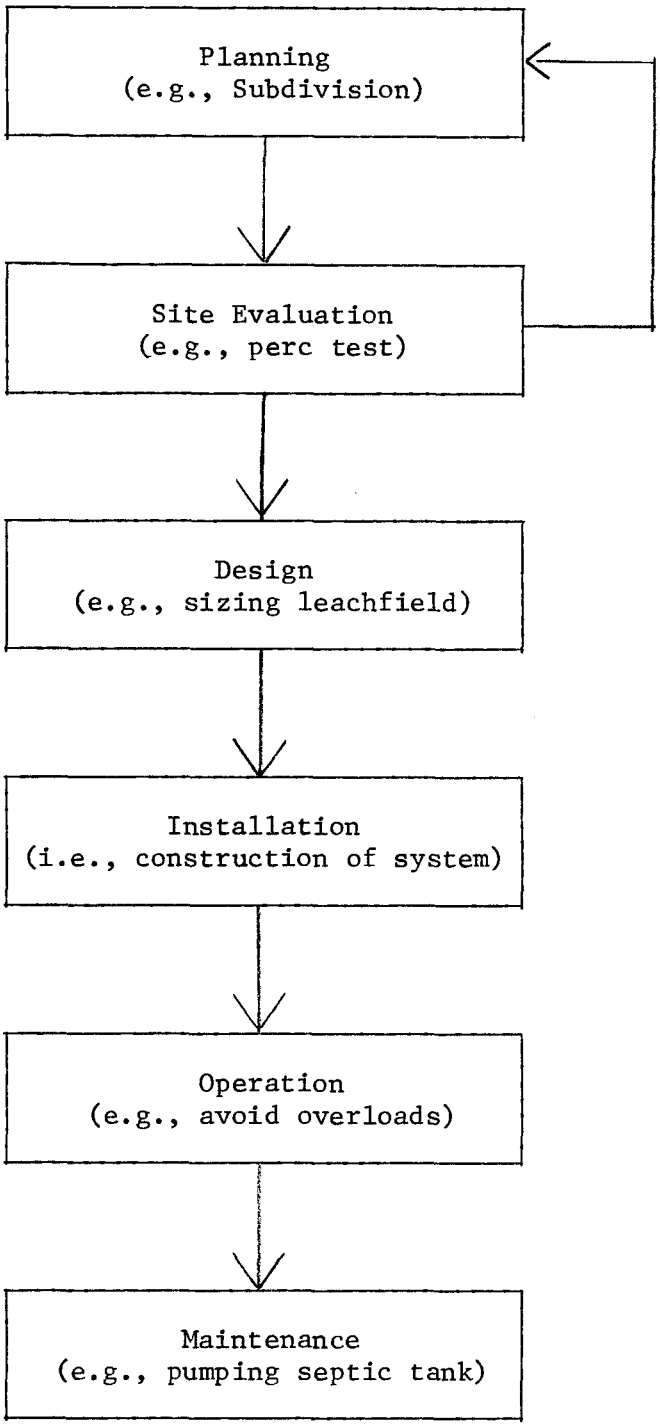

Figure 1. Small Flows Management Systems

At the county level in Colorado, some counties are attempting to update their county regulations to account for the shift to more small flow technology and its proper management. These counties are having to go beyond the current Individual Sewage Disposal Systems Guidelines issued by the Colorado Department of Health. If there is enough county interest in broadening the scope of county regulations, perhaps the state guidelines should be updated and expanded to permit inclusion of more phases of the total small flows management system by Colorado counties.

Alternative Management Systems

As the increased emphasis on small flows technology results in more applications, many communities and states are responding by modifying and updating their approach to managing small flow systems. New Hampshire has a system very similar to Colorado's except in the planning area. All subdivision applications must include sufficient information on each site to determine its acceptability for an on-site system. The prospective purchaser is, therefore, "reasonably" assured that the lot he/she buys from an approved subdivision will be suitable for an individual sewage disposal system.

Maine has tightened its administration of the middle section of the management system (particularly, site evaluation) to ensure that all systems are properly matched to site characteristics. This has been done by eliminating the perc test, using a soil classification site evaluation procedure, and licensing site evaluators.

Pennsylvania has established a strong state program for small flows management that includes a state staff of several professionals responsible for developing statewide regulations and training county sewage enforcement officers to implement the state regulations.

California and Illinois recognize the inability of current regulatory programs to effectively manage the entire small flows systems and are, consequently, actively encouraging small communities to establish management programs, funded by a monthly fee from each homeowner, to provide the needed services. In particular, these local management programs are to deal with continuing maintenance.

Workshop Emphasis

Given the increasing interest in, and application of, small flows technology, is Colorado's current management approach of this "new" technology adequate? Can we be assured that, as more small Colorado towns and communities turn to alternative wastewater management technology (non-sewer systems), the citizens of Colorado are receiving the most effective wastewater treatment at least cost? Will the public health and environmental aesthetics be adequately protected as this "new" technology plays a larger role in wastewater management in Colorado?

The answers to these questions are not readily apparent, nor is it obvious how the answers will be obtained. Hopefully, the workshop today will initiate a dialogue from which some answers can ultimately be formulated.

In addressing the above questions, there are several factors that must be kept in mind. Small flows technology is not necessarily new, but our

historical low priority view of it has resulted in very few trained people in the field. This has great ramifications to all sectors of the small flows "industry," if the industry is to respond to the increasing demand for this technology. How will the state and local health departments and community management organizations hire trained personnel in this field with their budgets getting tighter and the demand for the trained professionals increasing?

The consulting engineering profession which provides a large amount of direction to small towns and communities regarding wastewater management is not adequately prepared, in general, to deal with alternative methods for treating wastewater. Part of the problem is a fee structure that lends itself to capital construction, not nonstructural oriented approaches of small flows technology. How can the fee structure be modified to encourage consulting engineers to effectively integrate small flows technology into their wastewater management evaluations?

Again, thank you for coming. We have an excellent program, so let's get started.

INDIVIDUAL SEWAGE DISPOSAL SYSTEMS - PROBLEMS, OPPORTUNITIES AND THE STATE'S ROLE

by

Gary Broetzman
Director: Water Quality Control Division
Colorado Department of Health

I appreciate the opportunity to participate in the workshop this morning. As mentioned, we've had the pleasure of assisting the University in the organization and sponsorship of this workshop.

There has been an oscillating attitude towards individual sewage disposal systems over the years. Such systems have been promoted and utilized extensively as successful means of treating and disposing of wastewater. There have also been problems. These problems, resulting in system failures, can generally be attributed to a design inadequate for the particular lot size, soils, geology, etc. or a lack of proper maintenance. These failures have, at times, led to public health problems and generated negative attitudes toward use of such systems.

The engineering profession has, for the most part, not been a wholehearted supporter of septic systems. This is unfortunate. With proper design, proper construction and proper management, there is no reason why individual systems cannot provide effective wastewater treatment. The fee structure of the engineering profession is oriented toward the more capital intensive projects. This has been a factor in the profession's failure to afford the individual sewage disposal system the same opportunity that central collection and treatment systems have had.

It is time to put these attitudes behind us. We can no longer afford to dwell on the problems we have had in the past, but must look at small alternative wastewater systems in a more positive way. Certainly the need and the opportunity exist. We are seeing more and more scattered development: "ranchettes;" second homes and recreational developments. The demand is there for a more efficient means of providing wastewater service to these people. In many of these developments, central systems are not economically feasible. This is especially true where construction and treatment costs must be spread among relatively few residents.

Geologic conditions in some of our mountainous areas result in extremely high costs of constructing sewer lines. This leaves little choice but to place greater emphasis on individual systems. The grant program, as has been mentioned, is also encouraging the use of small and alternative wastewater systems. But again, their success really depends on the proper design and management of the system. They cannot be placed in the ground with an out-of-sight, out-of-mind attitude.

Technological changes are also taking place. More emphasis is being placed on cluster systems, wherein a single septic system serves more than one home. This, we believe, is adding some efficiency where homes are

clustered and leach field sites are at a premium. More radical technological changes are demonstrated by such concepts as complete recycle, as in the Pure Cycle system. In Colorado, the state's role in individual sewage disposal systems is somewhat limited. Primary responsibility for regulation of these systems is at the county level. The Water Quality Control Division reviews county regulations for compliance with ISDS guidelines. We also review those subdivisions submitted under provisions of S.B. 35. The comments are provided to the county for consideration in their decision-making process.

The Water Quality Control Act currently contains a provision whereby local government can identify areas of severe limitation to septic tank use. Areas so designated require state review of proposed facilities. That provision has seldom been used and has been deleted from the proposed water quality legislation (S.B. 10). This is not a significant loss as the provision was seldom used.

In addition to the preparation of ISDS guidelines and the review of county regulations, the Division provides technical assistance to the extent possible through the field engineers who serve the various areas of the state. The ability to provide this assistance is limited by time and staff capabilities.

One final item of support is through the 208 program. A few demonstration projects have been carried out around the state. One in particular, in the Pueblo area, will be the topic of a presentation later in today's program.

In summary, the state's role has been somewhat limited and I don't believe that we will see a marked increase, if any at all, in the state's direct responsibilities. The primary responsibility is, I believe, very adequately covered at the local level through county regulations.

With respect to funding, the Federal Clean Water Act included a provision in 1972, when the law was passed, to earmark a portion of the Construction Grants Program funds for small facilities. This program is aimed primarily at large communities and those facilities which have major water quality impacts. However, for those states defined as rural, a set-aside of four percent of the state's grant money was required. This program, the Small Alternative Wastewater System (SAWS), was designed for communities of less than 3,500 residents. Colorado has a state grant program designed to serve communities of under 5,000 in population. There is nothing in this state grant program which would prohibit funding of small alternative wastewater systems or septic tank management programs. No applications have been submitted for funding such a project through the state program. The opportunity exists for funding the establishment of a management program and acquisition of hardware for such a program.

Because of the state grant program, Colorado has chosen not to participate in the federal four percent set-aside program. We have also been reluctant to participate due to the inability to reapply any unused, set-aside funds in the normal construction grant program. This could prevent the state from participating in the reallocation of funds not used by other states during the funding period. Those states not utilizing their allocated funds, including that set aside for SAWS programs, lose the uncommitted monies and do not participate in their reallocation. This would be particularly critical in view of the lack of requests for funding such projects under the state grant program. We believe the state program, then, is adequate for our needs.

I would conclude my remarks by saying that we encourage further use of individual sewage disposal systems. We feel they provide a practical solution to wastewater problems for many areas of the state. Although we do not see a great deal of expansion of the state's role, we are hopeful that the role of local government will be maintained or strengthened, as needed. I, personally, hope to see a proposal submitted for grant assistance utilizing the septic tank management district concept.

Thank you very much.

ACTIVITIES OF THE ADVISORY COMMITTEE FOR INDIVIDUAL SEWAGE DISPOSAL SYSTEMS

by

Elwood Bell
Bell Geotechnical Services
Westminster, Colorado

In the role of an historian this morning, I want to explain what happens when a sanitarian says no and describe all the trouble that is generated by saying no. Back in 1972 when I was a sanitarian for Larimer County, I had an engineering firm approach me for clearance on obtaining a permit for an aeration unit with an absorption field. I had no regulations regarding aeration units. Since the field sizing dimensions didn't fit what was in our regulations at the time, I denied the permit. The farmer asked if they could appeal this to the State Health Department and I said, "Man, you're quite welcome to go right ahead." It was appealed to the Water Pollution Control Board which had jurisdiction at that time, and the appeal was turned down. About a month later, I found a unit installed and functioning. I immediately went to the State Health Department and said, "Hey, since you guys are higher than I am, and you denied the permit, it is really your jurisdiction to go ahead and file a suit." They promptly did, and we ended up in the district court here. We really didn't have a trial - we met with the two attorneys, the state's and the defense attorney, and they finally said, "Well, we looked through all the material that you have and according to the state law, an aeration treatment system is a septic tank." Quite obviously this is not true, and he said, "All I want from the State Health Department is to come up with a new set of regulations which will spell out what an aeration unit is and whatever regulations may apply. I don't really care what regulations you come up with, but you have to do it."

Well, this left the State Health Department in a real spot because they said, "Gee, that's in a law; that means we have to go back to the State Legislature and change the law." So they diddled around about this for quite a while and Don Marmondy, who was the Environmental Health Director of Boulder County, was not a person to take anything slowly. He got very upset about all this and said, "If nobody is going to do anything, I'm going to do it." So he quickly got his lawyer, their board representative and the House Representatives from Boulder County and they drafted a set of regulations to cover the specific problems, and he sent it to me for comment.

I made my second mistake. The first time was saying no; and the second time was saying, "I don't think this thing is really quite comprehensive enough. Could you really blow it up and do something with it." The next time he sent it back to me, we had virtually what exists today. He said, "I'll go along with you and we will meet down at the House of Representatives before the hearing board. The thing pretty well got going and at that time we said, "Hey, if this thing goes through, the new law will be approved sometime in July, and it specifies that we must have the state provide guidance on what will be done around the state. Also, the local rules and regulations have to be submitted to the State Health Department by the first of October." This was in 1973.

The state, in its wisdom, appointed what really was the first advisory committee. On the committee was Gene Facetti, who was an engineer in the engineering section of the State Health Department; Don Marmondy; and myself. I'll never quite figure out why I got included on that, but that's what happens when you open your mouth.

We started meeting to form the guidelines that were required for the State Health Department, and we split some of the work up. The first real confrontation we had was over the format that the whole thing would take. This took us three days just arguing about format and finally I was outvoted. I wanted the format to relate to the upcoming rules and regulations, and Don and Gene thought it would be better if it related to the law so it could be easily referenced. From then on, we moved rather quickly.

We split up the work among the three of us. Don handled primarily the administrative end; Gene Facetti and I split up the technical work. I've found a few errors in there which I'll have to confess today.

We researched as much of the existing material as possible (other state laws at that time, primarily Michigan and Indiana as I recall), taking whatever seemed appropriate and greatly expanding the information that we had. Now, up to that time, other than a few articles from the University of California (Dr. Winnerbarger's work) there wasn't very much information available. I can remember one time looking through all the material to determine the well distances from a septic field. We found one reference which said that the farthest in good soils (what we ended up calling suitable soils) was 75 feet from a privy. And so, with our wisdom of public health, we added a little safety factor and came up with 100 feet. At that time a study was underway in Jefferson County by the USGS and the Colorado Geological Survey. Their findings (preliminary findings at that time) said if the field is located 250 feet from an absorption field, they rarely found any contamination. We concluded, if it is 250, we'll make it 300. Well, what we hadn't considered is what 300 feet meant in the way of total area. We were apprised of that at the next open meeting that we had. Some of the developers said, "Hey, you're talking about five-acre lots; what am I going to do with my one acre?" So we promptly backed off that. In Larimer County we came back to 100 feet. There were many areas in which we entered into compromise. The four-foot depth soil requirement came from the old literature. That was the best we could come up with at that time - not highly scientifically based.

During this process, we soon concluded that the new law would definitely go through, and with a short time requirement for the submission of the local rules and regulations. I started to draft the guidelines. Don Marmondy and I met, together with Gene Facetti, and we talked about what the local rules and regulations were. We had the guidelines completed by about the middle of August, as I recall, and I was almost through the local rules and regulations for Larimer County at that time. We met with the State Health Department and a number of local health departments and talked about the guidelines and also about the local rules and regulations. And we submitted to them both what we had drafted and they decided that the local rules and regulations looked pretty good to them. In general, those were adopted; however, I had to guarantee the local health departments that by the first of September a copy of the final local rules and regulations would be available to them. All we had was four weeks to get the state board

approval and get these things in by October 1. We did meet the deadline.

In the development of the local rules and regulations, I really must bring in one gentleman's name who was not on the advisory committee, but who had a very definite influence on what we did - that was the legal advisor to the Larimer Board of Health, Ron Strahle. He was, and still is, in the House of Representatives of the State Legislature. He would take my rough draft, the first rough draft, and then we would sit down and go over it. He told me one time, "Elwood, my business is dealing with words. Now, what in the world do you mean by this sentence?" So, we would go back and restructure the sentence as I tried to tell him what I meant. He did an excellent job.

From the final draft, which he had gone over, I have noticed that the other local health departments' legal advisors didn't change any of the wording - that's really something! So, he did an excellent job and really made me look good in developing the local rules and regulations.

Everything was approved. We met at Steamboat Springs, as I recall, with the Board of Health at their public meeting and accepted the rules and regulations. There was one aspect which we really had trouble with. At the time, I was using the NSF standard number 40 as the basis for drawing up the requirements for aeration units. I ended up, in our local rules and regulations for Larimer County, just about quoting per se, particularly the problem of testing. When we got to the state board the testing feature was not included, but they did include a phrase that the aeration unit would have to meet the standards of the State Health Department to their satisfaction. This really didn't give you much of a leg to stand on and at times, I felt later, was rather unfair to some manufacturers. Be that as it may, we did manage to con the State Health Department into being the representative to the local health department on review of any new types of units which weren't covered in the guidelines or local rules and regulations. About three months later they formed the second advisory committee. This committee had two charges. One was to review the guidelines every two or three years; two years the first time since they were so new and needed to be checked to see if everything was working well. They were also to review all current literature to see if modifications were needed to keep current with the state-of-the-art. They also had a second charge which became equally as prominent in the work of the advisory committee. They were to review all of the new equipment and any new device, any magic black box which came in. They were to review this and then, from their review, make recommendations to the State Health Department which would then issue a certificate of acceptance. The advisory board in itself has no authority. It was merely an advisory group, but since a couple of the members of the State Health Department sat on it, we pretty well had a board that decided on the acceptance or denial of the certificates. The board at that time was headed up by Dan Tipton. Don Marmondy elected not to belong to the board because of a press of duties that he had and, as I recall, sent a representative. We did have about seven or eight that were represented on the board. The advisory board at that time did not have an industrial representative (and so it remains today). I think this is a weakness.

The board again, in 1974, started a review of the guidelines. We had a lot of recommendations based on some of the newer scientific information

coming out of the various universities on their research. The research today is greatly expanded from what it was at that time, and I think there is a much more solid basis to take into consideration the scientific information that has been approved. I left the board about late fall of 1977 and I seem to be the only original member that still is around. Mr. Marmondy passed away and Mr. Facetti retired.

Thank you very much.

COUNTY REGULATIONS EXCEEDING STATE GUIDELINES - PITKIN COUNTY -

by

Robert F. Nelson
Assistant Environmental Health Officer
Aspen/Pitkin Environmental Health Department
Aspen, Colorado

It is a pleasure to come down from out of the mountains once in a while and get a dose of the real world. It is a heavy experience when you have John Denver showing your back yard and the surrounding country on T.V.; his special was excellent. It is interesting working in a community like Aspen and Pitkin County because while John Denver is doing T.V. specials, we are out there trying to figure out how to design and work out a septic system for his new addition on his house and solve the problems with the failed system that we encountered on his property.

Elwood did an excellent job of presenting the historical perspective as far as what has happened in Colorado. Basically, the local counties have been handed the ball and given a chance to run. The state law and both drafts of the state guidelines appropriately give the primary responsibility for enforcement of on-site sewage regulations to the county and offer the opportunity and latitude to develop different regulations which match local conditions.

Pitkin County, for instance, has unique problems in soils, terrain, and slopes. Working in the mountains is a chance to work with a wide variety of soils and most types of engineering solutions that have been developed in the last ten to twelve years. We started out with an on-site sewage regulation in 1968. It was two pages and basically adopted the U.S. Public Health Manual 526 as the regulations and guidelines. We continued with that until 1974, then basically implemented the first set of state guidelines. That particular regulation ran about 45 pages. The new one that was just adopted, and which went into effect in March, is about 80 pages plus four appendices. Obviously we are either getting smarter or we are putting a lot more down on paper. I'm not sure which. The most recent regulation is a sincere effort to adapt regulations to local conditions.

The state guidelines offer a lot of pluses, as far as local health departments are concerned. The administrative procedures, the enforcement procedures, and the requirements to get the registered professional engineers involved in the design and planning on particular problem lots, all give the local sanitarian an opportunity to work within the guidelines of the laws and the authority of not only the Board of Commissioners, but also the State Health Department. The state guidelines smooth over the rough spots: legal notices; inspections, requests for entry; that sort of thing. I don't think anyone in the State of Colorado has really encountered a lot of problems with those particular aspects. Certainly not like it was in the late sixties, early seventies.

The new guidelines which were adopted by the state in 1978 offered all the local counties a chance again to update and change regulations. Unfortunately, the guidelines came out perhaps a year ahead of the publication of a lot of new developments in the field, particularly the E.P.A.-funded studies. The new on-site E.P.A. design manual, the Small Flows Clearing House information, and the research done at the University of Wisconsin and here in Fort Collins, all added technical data and design practices that we felt needed to be included in our regulations for mountain terrain, and probably should be included as part of the most recent state guidelines. There were also a few problems with the guidelines as far as the clarity of some of the design calculations and formulas were concerned, and in the fact that the guidelines continued to emphasize aerated treatment more than emphasizing hydraulics, loading rates of absorption fields, water conservation, and reduction of household wastewater flows. The guidelines also left the local counties several options, although we had to be at least as stringent as the guidelines, regarding minimum distances and separations from property lines, wells, streams, rivers, and other physical components which influence the design and construction of on-site sewage systems. It left the county open to adopt or not adopt requirements regarding the minimum lot sizes suitable for on-site systems and the licensing of contractors and pumpers. Again, I think this is probably a wise decision. Often times, the need for licensing depends on the rapport the local sanitarian has with contractors, and the number of contractors in the area. It depends on the problems he has had with small lot sizes on platted, existing lots which are not yet built on, and the implications of the development for on-site sewage system on each of these lots as to whether a particular county would or would not wish to develop a minimum lot size requirement. In Pitkin County, there has been a number of downzoning amendments to the Land Use Code causing the few existing small lots under the same ownership and contiguous property lines to accumulate into a single lot. These zoning laws have eliminated the small lot problem for on-site sewage systems on existing lots. Our comments and review policies on new subdivisions have eliminated any new small lots (one acre or less) from being created. As a result, the sewage regulations do not contain a minimum lot size.

In the development of our current Pitkin County regulations, we looked at failures. We observed a number of failures on systems eight to ten years old, which consisted of metal septic tanks with corroding lids and baffles, and which basically used small seepage pits of cinder block construction for the absorption area. This led us to outlaw metal tanks and discourage seepage pit construction as a general practice. We also tried, at the same time, to develop these regulations so contractor abuses and other difficulties in construction details found during inspections over a period of years were eliminated. We try to encourage the owner to do more than the minimum recommended requirements for septic tank size and absorption area. We also tried to address some of the problems we encountered with aerated treatment plants. The fact was that we were encountering the second, third, and fourth owners who did not know what happens when they flush their toilet. Obviously they didn't know that they have an aerated treatment plant, the kind of wiring provided, or what to do to maintain the aerated devices. The aerated units presented severe maintenance problems, and pointed toward the need for professional maintenance and periodic inspection. The state guidelines put the burden for maintenance on aerated treatment plant dealers by requiring service contracts with optional renewals. Most dealers are no longer in business or do not push service. I don't know of more than three or four contracts

renewed for periodic inspection and maintenance out of perhaps 175 aerated treatment plants in Pitkin County. People just don't seem to care to pay for that kind of thing.

We also tried in our Pitkin County Regulations to develop a set of guidelines that would enable an on-site sewage system to last a long time. I think basically the attitude in the late sixties was that a septic system was eventually bound to fail, perhaps in ten to fifteen years, and that all we were doing with regulations was buying a little more time before we could run a sewer line out to lots, get them hooked up to a central collection system, treat the sewage at the sanitation district plant, and put it back into the river. Our county commissioners have, since 1972, advocated strong growth control; limiting growth to a specific percentage of existing population and a specific annual increase in the number of units. As a result, they have taken the attitude over the last five to six years that the sewer line itself is perhaps a growth generator and had the potential of producing development; even strip development where central collection systems are available. The Pitkin County Board of Commissioners has made recommendations to the State Health Department and the Water Quality Control Division that certain sewer lines not be built. As a result, they also indirectly put more emphasis on individual sewage disposal systems, simply because that was the only alternative.

We had problems developing regulations to deal with recreational nature, attitudes, and wealth of the community. We have a unique set of problems as far as house usage goes. For instance, houses that sell for two to three million dollars may actually be, in fact, vacation homes occupied by a housekeeper or caretaker for nine to ten months out of the year. Then the owners come out, their friends join them, and all of a sudden the occupancy will jump to twenty or more; parties of 150 are common. It becomes very difficult to design an on-site sewage system for that type of house and water usage pattern. As a result of water usage, limited lot area, and the policies of the commissioners mentioned, we basically decided, in developing our regulations, to use a different approach than the state guidelines. Our approach is intended to require sizing and construction techniques that prevent the major causes of absorption system failure. It is very similar to the on-lot system design that E.P.A. used in their handbook published in October, i.e., using loading rates for a range of percolation rates to develop the minimum required square footage of absorption fields, rather than trying to tie it down to the standard formula where the area is equal to the sewage flow multiplied by the square root of the percolation rate over five ($A = \frac{Q\sqrt{t}}{5}$).

For our loading rates we relied on the research at the University of Wisconsin, and used, for instance, in soils that are percolating from an inch in five minutes to an inch in ten minutes, 1.3 gallons per square foot per day; at an inch in twenty minutes we would be using .72 gallons per square foot per day; and at an inch in sixty minutes, .3 gallons per square foot per day (See Chart 1). The application rate then led us to three basic formulas to calculate minimum absorption areas, using the sewage flows that the state requires and a peak loading factor of 1.5 average daily sewage flow, and using a different formula for absorption trenches, seepage beds, and seepage pits. With trench construction we calculated the minimum required area as 1.5 times the sewage flow over the loading rate minus a

small evaporation factor calculated out to the pan rate evaporation of the area (see Chart 2). It gave us a very large absorption area compared to state guidelines, but it also offered the possibility that those beds will continue to work for a longer time.

We also prohibited construction of seepage beds and seepage pits in soils with percolation rates over 30 minutes per inch and tried to emphasize the construction of absorption trenches. Most of the literature encourages the use of trenches whenever possible due to the increased side wall area, the better opportunities for reduction of area for additional gravel depth, less soil saturation and puddling, and basically more square feet of area for absorption using the same amount of material and excavating a similar amount of earth in system construction. There is usually less soil damage by equipment during construction in trench systems. We require trenches in all cases of slopes over 15 percent and we require serial distribution to the trenches, as well, in slopes over 20 percent. These particular things, we think, over the long run, will lead to increased sewage system life. At the same time, we designed the regulations to encourage homeowners and contractors to weigh the economic considerations of on-site sewage system construction. For instance, wastewater flow reduction and management reduces the size and cost of the absorption area required, and under this regulation should be cost-effective. We also require rather specific construction techniques regarding pumps and pumping chambers, again using mostly recommendations from the on-site design manual of E.P.A. We are, by regulation, requiring, or at least encouraging, dosing systems wherever practical and have made them mandatory any time the sewage flows exceed over 2,000 gallons per day. The Pitkin County Regulations require the addition of vent pipes at the end of all trenches and beds. I think this is very important to emphasize. The research now indicates that perhaps an absorption field can be rehabilitated by the introduction of hydrogen peroxide. The vent pipe offers an injection port where you can add the peroxide, and by having this available, we hope to encourage air flow and oxygen exchange in the gravel and further the breakdown of sewage in the absorption field itself. Vent pipes offer an inspection port, where you can determine during a periodic maintenance inspection what the water level is, how well this particular system might be working, and if there are any unusual characteristics in the absorption system signaled by abnormal liquid levels.

We also developed something of a maintenance scheme very similar to what was developed by Gary Plews and the people at the Washington State Health Department. We require the periodic inspection and maintenance of cluster systems; and on any system where a homeowner must cross property lines and must obtain an easement from an adjacent property. Also, any time that the flow exceeds 1500 gallons per day, we require these maintenance guidelines to be implemented as a county permit condition. It was difficult to incorporate the guidelines for the formation and operation of any on-site waste management plan into our regulations, because there is no enabling State legislation. Finally added was an appendix trying to set up a minimum framework for the legal management entity which could establish maintenance functions, collect the fees for the maintenance, and periodically provide records to the local health department to show that the maintenance has actually been accomplished. The requirements were not specifically written into the regulations, but were left for permit conditions

where applicable. As a home-rule County, we believe we can legally use this technique. There have been four or five systems installed recently with the cluster development concept: using a single absorption area for three or four houses where there was a flat site and where well-developed, reasonable deep soils were available. These cluster systems need routine periodic maintenance, and if it is not performed, the problems are going to haunt the Health Department. I am hoping that the maintenance is periodically performed; but I am worried that if there is, in the future, a proliferation of these sort of shared systems, with the staff we have, we may be adding an enforcement problem which could get out of control due to lack of time. That is the same problem which leads to no routine maintenance and operation inspections that you find throughout the state. Each local Health Department has written regulations and guidelines to control the design and the construction of septic systems and absorption areas, but once they are put in the ground and receive a final inspection, we probably will never go back to see them until there is a problem or a complaint.

The adoption and implementation of our most recent county regulations were very little problem, probably because of the environmental awareness of most of the community, and the fact that increased costs do not impact most of the homeowners in Pitkin County as perhaps they would in some of the eastern plain counties. The on-site sewage system remains a very small percentage of construction costs. The adoption of strict on-site sewage regulations enabled our planning office to use Health Department regulations for land use development control, building permit reviews, special review requirements, and to write our basic regulations into the County Land Use Code. That allows the Health Department to scrutinize each and every development that comes through, and make comments on the wastewater system design and placement, offer engineering alternatives, and determine if on-site sewage disposal is an appropriate alternative for a proposed building site. Also at the time of the review, we can, if necessary, write in maintenance and routine inspection requirements which condition the subdivision review approval. With lots selling for up to $300,000.00 or $500,000.00, the developers are anxious for approval and are willing to make and keep those commitments. In our particular case, I think we may have had some success in using the planning process as an effective tool to insure proper maintenance and operation of on-site systems. We also had an additional requirement in our county regulations that requires a use permit whenever a bank or the V.A. or F.H.A. requests a loan inspection in a particular on-site sewage system. We were able to add a few for the inspection with this use permit and this fee may be changed by the Board of County Commissioners. Therefore, we have avoided going to the State Health Department for approval of fees and avoided the risk of relying on state guidelines as a legal basis to charge the inspection fee. Loan inspections are a spot maintenance and operations check which enable us to detect perhaps three to five malfunctioning systems a year. Once the people are involved in a real estate sale, the money generally is easily escrowed and repairs are quickly done, because usually the sale is contingent upon approval from our department. We have also worked out a cooperative agreement with the building department where any houses that are being expanded go through an inspection and maintenance review of the on-site system to determine the adequacy of the system to handle increased flows. This again is a local requirement where the circumstances in Pitkin County enable the Health Department to get

systems upgraded, repaired, or replaced easily because the construction costs, lack of available land, and the money market, actually make an addition an easier alternative than buying or constructing a new house. Any additional cost incurred as a result of upgrading the system can be off-set to some extent by water conservation, or as an alternative, by adding water conservation fixtures, which often can result in no expansion or repair of the on-site system. We have tried to encourage by county regulation the construction of trenches, the addition of extra gravel under the distribution lines, and the use of larger septic tanks wherever possible. We emphasize through engineering design, local regulation, and consultation that the whole pattern of household water usage of a particular residence can be planned and that on-site systems should be built with a water usage plan in mind. Many alternative and innovative solutions from gray water growing beds, sluffing filters, split flows for part of the water used, water recycling back for toilet flushing, etc., have all been encouraged. I think all of these things will lead to better operation of on-site sewage systems in Pitkin County. I can make a copy of our regulations available to anyone, if you care to contact me later on. Thank you.

CHART I

MAXIMUM LOADING RATES OF EFFLUENT VOLUME
FOR SOIL ABSORPTION SYSTEMS

Percolation Rate (Minutes/Inch)	Soil Class	Typical Soil Textures (Appendix 2)	Maximum Loading Rate (gal/sq.ft./day)
0-10	I	Sand	1.30
11-20	II	Sandy Loam to Loam	.72
21-30	III	Loam	.50
31-40	IV	Loam to Silty Loam	.40
41-60	V	Clay Loam	.30
Over 60	VI	Clay	.20

5. A minimum absorption system may be approved by the Health Officer as prescribed in Table VII for one and two family residences based on the soil class as determined by the percolation rate (includes provisions for garbage disposal and washer).

CHART 2

REQUIRED SQUARE FOOTAGE OF SOIL ABSORPTION SYSTEMS FOR ONE- AND TWO-FAMILY RESIDENCES

Soil Class	Required Bottom Absorption Area in Sq. Ft. Per Bedroom(c) for Standard Trenches	Required Bottom Absorption Area in Sq. Ft. Per Bedroom(c) For Seepage Beds	Required Sidewall Area (a) in Sq. Ft. Per Bedroom(c) For Seepage Pits
I	165	215	185
II	300	400	335
III	440	575	480
IV	550	(e)	(b)
V	740	(e)	(b)
VI	(d)	(d)	(d)

(a) Absorption area for seepage pits is figured as effective side wall area beneath the inlet.

(b) Unsuitable for seepage pits if percolation rate is over thirty (30) minutes per inch.

(c) Minimum number of bedrooms is two (2).

(d) Unsuitable for conventional absorption systems.

(e) Unsuitable for seepage beds if percolation rate is over one (1) inch in thirty (30) minutes.

COUNTY REGULATIONS EXCEEDING STATE GUIDELINES - LARIMER COUNTY -

by

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INTRODUCTION

Determining the size of an on-site wastewater leachfield is critical to the continued operation of the system. The following paper describes a new leachfield sizing equation developed by the Larimer County Health Department. It includes a definition of information utilized, a description of how the equation was developed, and how it may be applied. The paper also comments on why the equation was developed by a local health department.

LEACHFIELD SIZING

Background

Experience in sizing on-site wastewater systems has been passed down through various public regulatory agencies. The basic equation upon which most of these agencies formulated their regulations is the equation developed by the U. S. Public Health Service[1] in the 1950s. Application of this equation in Colorado by local health departments resulted in the gradual addition of wastewater generation safety factors. Each time the regulations were revised the leachfield area requirements increased.

While the public sector continued to modify sizing requirements, academic institutions initiated research in wastewater flow through porous media. Some soil scientists concentrated on the variation of flow into and through soil under different moisture tension[2], while others considered the variation in hydraulic conductivity over time and with varying strengths of wastewater[3]. The researchers recognized that a biological mat which developed on the surface of the soil matrix was the major control of wastewater infiltration.

At the University of Wisconsin it was known that the biological mat affected the moisture tension of the subsoil below the leachfield, and the relationship between moisture tension and hydraulic conductivity was defined for various textured soils[2,4]. Although moisture tension for a biological mat was not specifically defined, it did show that in soils under a moisture tension of 80 to 100 milibars the soils exhibited a hydraulic conductivity of 1.0 to 10 mm/day (.0245 to .245 gallons per square foot per day). At the University of Connecticut other experiments[5] determined that a "long-term

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acceptance rate" of between 10 to 20 mm/day (0.245 to 0.49 gallons per square foot per day) defined the hydrologic limits imposed by the biological mat.

Current Colorado Regulations

Colorado Department of Health regulations[6] which govern the leachfield area requirements are given below. Table I gives wastewater generation requirements.

Table I

QUANTITIES OF SEWAGE

RESIDENTIAL ESTABLISHMENTS	GALLONS/PERSON/DAY (Average) (Unless Otherwise Stated)
Hotels and motels without private baths	50
Hotels and motels with private baths	60
Multiple family dwellings or apartments	75
Rooming houses	50
Single family dwellings	75

"Maximum flow shall be considered as 150 percent of average flow and shall be the basis for design purposes unless otherwise established by evidence satisfactory to the health officer.

"Absorption Area: The minimum absorption area in square feet (A) for an individual sewage disposal system shall be determined as a function of the estimated quantity of sewage flow in gallons per day (Q) and the percolation rate in minutes per inch (t), according to the formula:

$$A = \frac{Q \times \sqrt{t}}{5} \qquad (1)$$

"Additional Area: The absorption area so calculated shall be increased by not less than an additional twenty (20) percent if wastes from a garbage grinder are discharged into the system and by not less than an additional forty (40) percent if wastes from an automatic washing machine are discharged into the system."

Water Use

In sizing a wastewater system, the question of water use or wastewater generation certainly must be addressed. In using the above regulation for Colorado it appears that water use must vary between 75 and 180 gallons per capita per day.* However, in the literature it has been well documented in

*(75 x 1.5) + 20% + 40% = 180 gpcd

six different studies that water use with all the appliances averages 44 gallons per day per capita (Table II). If this is the case and local governments are still inclined to require these large systems, our attention must be directed back to the ability of the soil to accept wastewater and compare this with the assumption inherent in the formula accepted by the Colorado Department of Health. However, before discussing their equation, a very brief and simplistic introduction on the basic equation for porous media will be made.

TABLE II

SUMMARY OF AVERAGE DAILY RESIDENTIAL WASTEWATER FLOWS[7]

Study	No. of Residences	Duration of Study	Wastewater Flow	
			Study Average	Range of Individual Residence Averages
		months	gpcd	gpcd
Linaweaver, et al.	22	--	49	36 - 66
Anderson and Watson	18	4	44	18 - 69
Watson, et al.	3	2-22	53	25 - 65
Cohen and Wallman	8	6	52	37.8 - 101.6
Laak	5	24	41.4	26.3 - 65.4
Bennett and Linstedt	5	0.5	44.5	31.8 - 82.5
Siegrist, et al.	11	1	42.6	25.4 - 56.9
Otis	21	12	36	8 - 71
Duffy, et al.	16	12	42.3	-
		Weighted Average	44	

Flow in Porous Media Reviewed

Flow in porous media is defined by Darcy's Law:

$$Q = K A \frac{dh}{dz} \qquad (2)$$

in which Q equals the flow rate in cubic centimeters per day; K equals the hydraulic conductivity, in centimeters per day; A equals the cross-sectional area of flow in square centimeter; dh/dz equals the hydraulic head gradient in centimeters per centimeter; and H equals gravitational plus matric potential in centimeters[4]. These parameters may be defined more fully and the

equation simplified because of the following: "The hydraulic conductivity K, which is defined in soil physics as the one-dimensional flow rate through unit area at unit hydraulic gradient is a reliable measure for any soil to accept and conduct liquid, the more so since it applies to both saturated and unsaturated soil.[2] Furthermore, "The hydraulic head gradient will be approximately 1.0 in the soil at steady infiltration."[2] In practice, the hydraulic gradient continually changes as the depth of the water increases in the bed or as the moisture tension below the bed changes due to change in depth to groundwater. However, for design purposes, the hydraulic head gradient will be assumed as unity.

For ease in understanding, Darcy's Law may be transformed and simplified, taking into account the above assumptions. In sizing a leachfield the objective is to balance the wastewater loaded into the leachfield with the capacity of the soil to accept and treat the wastewater from the leachfield. To the general observer, the hydraulic conductivity may be seen as the "acceptance rate" for a given soil. With this understanding the equation may be transformed into simple English.

$$\text{Leachfield Area} = \frac{\text{Wastewater Flow}}{\text{Soil Acceptance Rate}} \qquad (3)$$

Dissecting the Current Colorado Equation

The equation used by the State of Colorado (1) may be transformed to the simplified Darcy equation (3). However, when simplifying, the question arises as to where to assign the constant, "5". If we place it in the numerator it becomes a flow adjustment factor and the equation takes the following form:

$$A = \frac{Q/5}{(t^{-.5})} \qquad (4)$$

On the other hand, if we place it in the denominator it becomes a loading rate adjustment factor and the equation takes this form:

$$A = \frac{Q}{5(t^{-.5})} \qquad (5)$$

By substituting various values for the percolation rate, "t," into equations (4) and (5) we can get a feel for how these equations relate to the current research on wastewater infiltration. Because the first form of the equation (4) produces the most realistic values, some time may be spent defining output from this equation.

Breaking out the numerator, which defines wastewater flow, we arrive at the following:

$$\text{Wastewater Flow} = Q/5 = 180/5 = 36 \text{ gpcd.} \qquad (4a)$$

Similar substitution of various values of the percolation rate "t" of 5 to 60 minutes per inch into the denominator or "Soil Acceptance Rate" part of the equation,

$$\text{Soil Acceptance Rate} = (t^{-.5}) \qquad (4b)$$

gives values of 0.447 to 0.129 gallons per square foot per day.*

New Equation Development Constraints

In developing a new equation for Larimer County two constraints had to be met.

1. The size of the leachfield required by Larimer County as determined by a new sizing equation must meet and exceed state requirements; and

2. The information required to implement this new sizing equation could not go beyond current practice and readily available techniques, i.e., the percolation test must remain as the standard for evaluating soils.

The New Equation

The intent of a new equation for Larimer County was to minimize the magical safety factors, 5 percent, 20 percent, 40 percent, 150 percent, etc.; incorporate available research data; utilize a simple, straightforward approach; and provide an equation that may be applied to new innovative systems. When the regulations were revised by the Larimer County Health Department a special committee was formed. Part of this committee included a group of engineers who worked on the new sizing equation. In the review process the equation was broken down into two parts, the definition of wastewater generation in the numerator, and the definition of soil acceptance in the denominator. In general, the process began with an assumed value for wastewater generation in the numerator and followed with development of a function of the percolation rate "t" to describe the acceptance rate in the denominator. Next, values for "t" of 5 through 60 were substituted into the equation and the required leachfield areas derived. These area requirements were then compared against those required leachfield sizes under the state regulations. The committee reviewed the possible wastewater generation rates and the corresponding exponential function for "t" and selected the following equation:

$$\text{Area (feet}^2) = \frac{\text{number of bedrooms x 100}}{t^{-.42}} \qquad (6)$$

Because the function of "t." which represents the soil acceptance rate, cannot be derived on an average calculator, Table III was generated in the revised regulations.

DISCUSSION

Why a New Equation?

There are a number of reasons for developing a new equation for Larimer

*mm/day = 40.75 gallons per square foot per day

TABLE III

LEACHFIELD SIZING TABLE

Perc Rate Min/Inch	Soil Acceptance Rate	Absorption Area* Per Bedroom(s) in Sq. Ft.			
		1	2	3	4
5	.509	197	393	590	786
6	.471	212	424	637	849
8	.418	240	479	719	958
10	.380	273	526	919	1092
12	.355	284	568	852	1136
14	.330	303	606	909	1212
16	.312	320	641	961	1282
18	.297	336	673	1010	1347
20	.284	352	704	1056	1408
22	.273	366	733	1099	1465
24	.263	380	760	1140	1520
26	.255	393	786	1179	1572
28	.247	405	811	1216	1622
30	.240	417	834	1252	1669
32	.233	429	857	1286	1714
34	.227	440	880	1320	1760
36	.222	451	901	1352	1802
38	.217	461	922	1382	1843
40	.212	471	942	1412	1883
42	.208	481	961	1442	1922
44	.204	490	988	1470	1960
46	.200	499	999	1498	1997
48	.197	508	1017	1525	2034
50	.193	517	1034	1551	2068
52	.190	526	1052	1577	2103
54	.187	534	1068	1603	2137
56	.184	542	1085	1627	2169
58	.182	550	1101	1651	2202
60	.179	558	1117	1675	2233

*$m^2 = 9.294 \times 10^{-2} \times ft.^2$

County. The most obvious was to correct the thinking that followed the state equation. The assumed wastewater flow rates could not be justified to the public and consulting engineers. Similarly, the soil loading rates needed to be corrected. The support data for both these aspects were constantly being challenged by the general public and consulting engineers, and for good reason.

Another major reason for the new equation was to enable engineers to adjust system size in a rational manner to account for alternative wastewater generation and treatment. Attempts by engineers to modify the state's equation had been arbitrary and lacked documentation.

Wastewater Generation Evaluation

Fifty gallons per capita per day was selected as a representable value for wastewater generation. For additional safety this was assumed to apply to potential use or 100 gpcd* per bedroom. By comparing this with a frequency distribution for water/wastewater flows (Figure 1) it appears to include an adequate safety factor. Two examples illustrate how this number is related to actual water use.

If we have a three-bedroom home, we may assume a 300-gallon per day wastewater load. Average occupancy for this home in Colorado is 3.2 persons, which gives us 94 gpcd, a value that exceeds the wastewater flow value for 99 percent of the population. Another case may be that same house occupied by six people. This gives us 50 gpcd, which would cover about 70 percent of the population, according to Figure 1.

The probability of wastewater generation rates exceeding 50 gpcd does exist; however, the total population of homeowners does not need to pay for this additional leachfield area. Homes with excessive water use may pay for the additional leachfield area or develop ways of conserving water.

Use of the New Equation

The equation as written, with the sizing table, may be applied directly to single family housing in soils with percolation rates of 5 to 60 minutes per inch. Any extrapolation of this equation for other conditions or wastewater generation should be done by an experienced engineer. The engineer must understand the following about the equation:

1. The equation assumes a realistic average wastewater flow rate which is well documented.

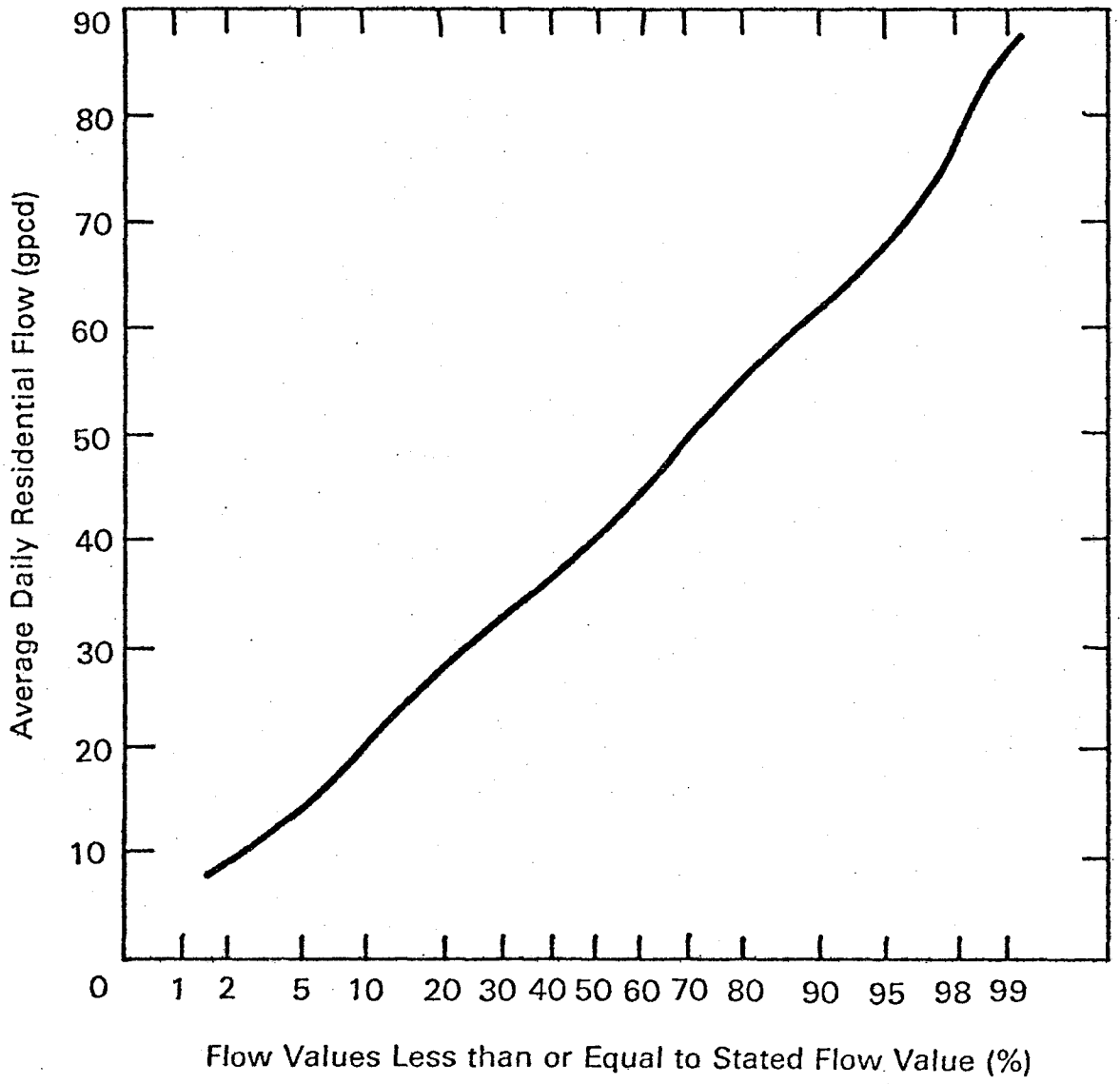
2. The soil absorption rate is conservative, as required by the constraint of meeting and exceeding the existing state sizing requirements.

3. Use of other flow rates present in the state regulations may result in system oversizing, because of the safety factors which are included in these wastewater generation estimates. Because

*liters per day = 3.78 x gpcd

FIGURE 1

FREQUENCY DISTRIBUTION FOR AVERAGE DAILY
RESIDENTIAL WATER USE/WASTE FLOWS



of the difficulty in mixing the state and the new Larimer County equation, one sizing equation and the corresponding wastewater generation rates should be used in most cases.

4. When using some method for wastewater reduction, the engineer must understand the origin of the figures and how to apply them.

An example of how one may apply flow reduction in the new equation may be simply illustrated. For greywater recycling (bath and laundry water) in toilets, a savings of 16 gallons per capita per day is a reasonable figure[7,8]. Recently published averages for wastewater generation translate to a 36 percent reduction in wastewater generation. This reduction may be applied to the new Larimer County equation by reducing the flow per bedroom by 36 gallons per day.

It is important to be consistent in the use of regulations and data. Care must be taken not to confuse existing state requirements with research data. One should work with one set of information or the other. If one must use both, then percentage flow reduction, not volumatic flow reduction, must be applied.

CONCLUSION

The new sizing equation for leachfields in Larimer County provides the local health department with a rational tool which may be applied to a variety of systems in the future. The form of the equation is simple and straightforward and does not include unjustified or hidden safety factors.

Once the consulting engineers and sanitarians in Larimer County become familiar with the equation and understand its foundation, they may wish to expand its application. The field of on-site wastewater treatment is in a state of evolution. New approaches for water conservation will be put into practice. These new approaches affect on-site wastewater design and, therefore, require regulations which may accommodate these changes. The form of the new equation developed in Larimer County is a first step in meeting the changes occurring today in rural America in wastewater technology.

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EPA SMALL WASTEWATER FLOWS CLEARINGHOUSE SUPPORT FOR DEVELOPING REGULATIONS

by

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I am currently working with the EPA Small Wastewater Disposal Clearing House and I thought I would tell you first why that clearing house was developed. The fact that everybody is here today is a good indication why. Robert pointed out another statistic - about one-third of the population in the country is served by on-site units. Another statistic is that only 32 percent of the soils are suitable for the standard type of unit. We have the Clean Water Act which basically is established for the larger central systems, but the 1978 revision expanded consideration to small or alternative systems. In doing so they felt the need for a clearinghouse which would allow for increased education of people.

Thus, in 1979 the clearinghouse was established at West Virginia State University and with the following functions. We are monitoring 50 journals around the world. One of these journals is the Environmental Sanitation Abstracts from Bangkok, Thailand. They perform a similar task, only they work more in Asia, Africa and underdeveloped countries. We monitor the information they abstract, and may select some for our computer data base. After we select an article in a journal, we assign it to be abstracted, key worded, and then it is put into our computer data base. At the present time, we have a publication which defines those abstracts. The 1979 Bibliography of Small Wastewater Flows is currently available. The update should be coming out soon. This time it will be published through NTIS which is a government reference library. It will supply copies on anything that is published by the government. The cost of the bibliography is $7.00, and it can be acquired by writing to the WVU Bookstore, Morgantown, West Virginia, 26505.

We also have a manufacturer's list. Manufacturers have proven to be very helpful in collecting information and also generating research data. For example, in pressure sewer systems there are a number of manufacturers that are very much involved in developing package-type applications where the complete pressure sewer pumping station unit is self-contained. All you have to do is dig a hole, plug it in, hook up the wastewater to it and you are all set to go. That relieves individuals or communities of many of the problems associated with engineering - it is pre-engineered. So, we have the manufacturer's list, if you have any difficulty finding information on a certain type of unit or certain subject.

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We keep track of 208 and 201 projects. We have an Innovative/Alternative list which identifies small alternative systems that are being put in around the country. The list includes different people that you could contact to get additional information.

We also have a special list of people in each state. Thus, as the general public calls us up and says, "I have got a problem," we can refer them to perhaps an Extension Agent (Robert Ward or Ralph Hansen at CSU) or to different state people.

We also indirectly monitor research projects; whenever a project is initiated they usually come to us first to find out what is available. For example, there is a research project EPA has just issued, and some of the topics are pressure sewer systems, different mound distribution systems, super-snooper (a sensing system to determine pollution), aerial infrared photography to identify leaching field failure, and a few more. We are in contact with the people doing that research and, as such, we can relate information or relate you to those people in case you have exactly the same situation.

Another publication that we have is a record of codes and regulations from different states. This is something that we have tried to put together with the cooperation of different states and localities. It is not complete in some cases because the local officials would not send in copies of the regulations; but we do have a list of regulations from most states and I would say we are 90 percent complete.

How do you access this information? We have a toll free number - (800) 624-8301, and a staff of environmental engineers, professors at West Virginia Universities, who are on call to answer your questions. We can send you publications which are in the bibliography - we have copies of most of them - or we can just give you the references. One service we do provide is a computer search. If you tell us what information you need, we can do a computer search of the data base and develop a reference list on that topic. The cost of a computer search is $25.00.

We also have a newsletter which comes out, hopefully, four times a year if EPA is printing. You can call us and get your name on that mailing list. The newsletter will keep you informed on what new information is available; for example, the update on the bibliography. Thank you.

EPA'S SMALL ALTERNATIVE WASTEWATER SYSTEMS STRATEGY: STATUS REPORT

by

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Good morning. I am very glad to see so many of you here this morning. This is my return trip to Fort Collins. I was here for Bob Ward's last conference in 1978. At that time I was with EPA's research office in Cincinnati. EPA's Municipal Environmental Research Laboratory was just beginning, at that time, to do work in the institutional or management side of small flows research. I'm glad to report that the final report for that work will be out soon.

A number of other reports have also been prepared recently which I will discuss in my presentation. At the time I was here in 1978, it had only been a few months after the Clean Water Act Amendments of 1977 were enacted by Congress. This Act started the Rural Set-Aside Program, initiated the Innovative/Alternative Set-Aside Program, and resulted in subsequent regulations which required wastewater facility planners to look at alternative systems.

Need for SAWS Strategy

Naturally, regulations don't automatically yield the kind of results that we, as program managers, like to see. It became increasingly obvious that there were many different EPA offices involved in small systems management, and there were various states engaged in the programs. There needed to be more coordination and consistent philosophy developed about what was going on. About a year ago I transferred to Washington to work with the Water Planning Division; this Division is in charge of the 208 Areawide Water Quality Management Program. One of my principal responsibilities there was to develop the Small Alternative Wastewater Systems (SAWS) Strategy which Steve Dix mentioned before. Although I was a principal author of that report, a number of other people played a very important part in drafting the report ("A Strategy for Small Alternative Wastewater Systems," EPA Office of Water Program Operations, Washington, Dec., 1980).

One of the reasons that the SAWS strategy was developed is because it became very obvious to EPA both in the 208 Program as well as in the 201 Construction Grant Program that conventional wastewater systems were far too costly for most small communities. This realization is why, of course, the amendments were drafted in 1977. However, despite this, many local communities still weren't aware of what the wastewater management options were. Many of the engineering firms weren't aware, or, for other reasons, were not inclined to recommend alternative wastewater systems to their clients. Many of the states had similar biases against the use of alternative systems. In addition, as several speakers this morning have mentioned, the use of alternative systems requires the adoption of special types of management programs to insure proper system operation and maintenance. Many states don't have proper legislation or the resources, either at the state or local level, to properly develop and implement these kinds of

management programs. In addition, many people just weren't familiar with what the management options were. For these reasons, EPA has been conducting research in the Small Systems Management area and has developed guidance materials to help people understand alternative management approaches and to assist in the implementation of the kind of management programs we feel are necessary to assure proper system operation and maintenance.

There are a number of reasons why small systems might not get proper consideration in the 201 process. As I mentioned before, many local and state officials and engineers have a bias against the use of alternative systems. As management systems are implemented, more field experience will become available indicating how the systems will operate if properly managed. The distribution of additional guidance materials will also encourage increased use of small alternative systems.

One of the problems with adopting management programs that people need to be aware of when designing management programs is fragmented responsibility among various agencies at the state and local levels. In the case of Pitkin County, which Mr. Nelson talked about, the county has overcome this problem by working very closely with the planning department, the building department and others who are involved in the process. This is certainly to be commended. But, in many situations, this is not the case. Wastewater planners should examine the need to transfer functions or develop better operating agreements in order to improve system management. Your community might also need new ordinances or state legislation to encourage proper management. I am talking in very general terms. Other speakers may direct their comments more specifically to Colorado.

Many state regulations are unnecessarily restrictive. The regulations may prohibit the use of certain types of alternative systems. The requirements for sizing or other design criteria may make alternative systems uneconomical or otherwise discourage the use of small systems. When you are developing your own ordinances, be sure that you give the systems a fair chance; at the same time, the regulations should encourage proper system operation and maintenance.

Strategy Recommendations

I want to talk more specifically about the SAWS Strategy. The SAWS Strategy summarizes the issues and problems in using small systems and outlines what is being done at the federal, state and local levels in the area of small systems management. The SAWS Strategy is intended to encourage the use of small systems wherever economically and environmentally sound. Of course, fostering of small systems will be done directly through the 201 Construction Grant Program, and somewhat less directly through the 208 Water Quality Management Program. The SAWS Strategy was initially developed by EPA's Water Planning Division. The objective was to outline the role of water quality management agencies in assisting the development and implementation of SAWS management programs.

The Strategy broadened to include not only 208 but also the 201 program.

There are a number of different offices within EPA that are engaged in small alternative wastewater activities. The SAWS Strategy has become

a vehicle to obtain greater coordination among these different efforts, as well as to communicate to consultants, state and local officials and others what the different offices within EPA were doing. It is very confusing when you have four or five different offices doing similar work. In addition to EPA, there are many other federal agencies that provide assistance in the SAWS area. The SAWS Strategy has been helpful in communicating to these agencies what EPA is doing and to serve as a vehicle for increasing coordination and cooperation among the federal agencies.

We don't have time today to go into all of the detailed recommendations in the Strategy. The recommendations are organized in seven different areas. The highest priority we had from the national program level was to improve public information including additional guidance about the operating characteristics of SAWS technology and the management aspects of implementing SAWS facilities. In the SAWS education area we are preparing guidance manuals, conducting workshops, and providing technical assistance. The technical assistance will be done primarily through our regional offices. Since EPA is a decentralized agency with ten regional offices, many of the recommendations in the SAWS Strategy will need to be carried out by the regional offices. When Joe Webster talks, he will hopefully tell you what the regional office in Denver is doing to implement our strategy.

The third task as outlined in the SAWS Strategy is to promote cooperation among various federal agencies. We have been working very closely with Farmers Home, Housing and Urban Development, Community Services Administration and other federal agencies to clarify procedures for funding and to clarify policies on what kinds of facilities are eligible under various federal funding programs.

Under Task Four, we're recommending that the Construction Grant Program be streamlined to cut down the time required to implement small flows facilities. There are a number of proposed legislative changes in the Construction Grant Program which may have a significant impact on small communities. I will discuss these proposed amendments later.

Our office also works very closely with the research side of EPA in identifying what kind of research would be helpful in implementing small community wastewater systems. Steve Dix mentioned a number of research projects which are underway at the Municipal Experimental Research Laboratory now. One research objective is the evaluation and development of improved techniques for problem assessment for facilities planning. The Cincinnati office published a report which describes different management options for implementing SAWS management programs ("Management of On-Site and Small Community Wastewater Systems: Interim Report," prepared for EPA MERL by Roy F. Weston, Nov., 1979). The report documents case study experiences of nine communities around the country and in nine states. It is very helpful for someone who is implementing a program to see what someone has already done in order to avoid the same mistakes. The report is also useful in showing your state legislature and local officials that this approach has been done successfully elsewhere. You are not really reinventing the wheel.

The final report of this project outlines a detailed process by which you can conduct SAWS institutional analysis and develop a specific program for your particular community.

Water Quality Management agencies, particularly in Colorado, have shown a keen interest in small systems. In fact, nationally the agencies here in Colorado have played a leading role in coming to grips with identifying the kinds of impacts small systems have, and outlining options for dealing with those impacts. We certainly hope that their recommendations are being implemented. Unfortunately, as some of you may know, the 208 Program is one of the casualties in the new budget. The Grant Program itself won't be around much longer. But, we are hopeful that the recommendations that were drafted will be implemented.

State Role in SAWS Programs

There are a number of different activities that states can engage in to promote the implementation of SAWS technologies and management programs. Potential state activities are outlined in Table 1. This is a fairly long laundry list. It is not necessary for a state to initiate programs in all of these areas. Our objective is to provide incentives to the states to modify their small systems policies and procedures. Potentially, such incentives could be provided through the 106 Program, which provides support for the staffing of state water pollution control programs; and the 205(g) Program, which provides monies for managing the Construction Grant Program; as well as the State/EPA agreements, which are negotiated by the regional offices with the states. This latter approach is fairly new. To my knowledge, New York and New Jersey are the only states that have specific language in their State/EPA agreements. These agreements outline specific activities that the states plan to do in the small community area. I encourage Region VIII and the states, particularly Colorado, to work with the regional office in seeing what specific modifications might be made in their programs to encourage the use of small systems.

Our office is, of course, aware of limited state resources. Although states may not be able to fully implement a SAWS program, much can be done to promote small community systems within the constraints of existing staffs. In terms of policy and planning, states can develop their own strategies to encourage local communities, health districts, planning districts, or whoever, make better use of small alternative systems. States also can revise their Construction Grant procedures to speed up the review of small community plans and applications. States can encourage engineers and local officials to look at small systems in developing the scope of work for facilities planning. A state could outline the kinds of sanitary surveys that should be conducted.

The state should look at its regulations both in terms of enabling legislation for setting up different kinds of management districts as well as reducing unnecessary roadblocks for the implementation of alternative technologies. I was glad to hear that Colorado has its own Cost-Share Program, but I was disappointed to hear that it really hadn't been used to support alternative systems. Hopefully, that will change. The state and substate units can do a lot in terms of technical assistance. Working directly with engineering firms and local communities, the state can improve the awareness of alternative technologies, can participate directly in drafting management programs and setting up interagency operating agreements and other types of legal vehicles necessary to implement the SAWS program.

TABLE 1

STATE SAWS

PROGRAM ACTIVITIES

PLANNING/POLICY

- PROBLEM ASSESSMENT
- INSTITUTIONAL/LEGAL ANALYSIS
- MODEL FACILITY PLANS
- IMPROVED FACILITY PLAN REVIEWS AND PROCEDURES
- SAWS ADVOCATE
- CLARIFICATION OF STATE/LOCAL RESPONSIBILITIES

REGULATIONS

- REVISED DESIGN CRITERIA
- ENABLING LEGISLATION
- MODEL CODES AND OPERATING AGREEMENTS

FINANCING

- FACILITY PLANNING COST SHARE
- PRIORITY LIST/SET ASIDES
- USER CHARGE SYSTEM GUIDANCE

EDUCATION/TRAINING

- TECHNICAL ASSISTANCE
- WORKSHOPS
- MANUALS/PUBLIC INFORMATION
- TRAINING/CERTIFICATION/LICENSING

SAWS Resource Materials

Several manuals and other guidance materials have been prepared recently to assist facility planners and others interested in improving the management of alternative wastewater systems. A brochure titled "Small Wastewater Systems: Alternative Systems for Small Communities and Rural Areas" is particularly helpful in outlining to your local officials what the basic alternatives are. In very simple diagrams and descriptions the brochure outlines 21 different SAWS technologies. The brochure quickly lets people know that septic tanks are not the only alternative system that should be considered in their facility plan. At the other end of the spectrum, the report "Design Manual: On-site Wastewater Treatment and Disposal Systems" gives extensive field operating and cost data on alternative systems.

Another report which was prepared by the Municipal Environmental Research Laboratory in Cincinnati outlines guidance on how to conduct facility planning for small communities.

Planning Wastewater Management Facilities for Small Communities

Another document recently released is "Facilities Planning 1981," which summarizes all regulations dealing with facilities planning. From here on, program changes will be updated annually.

Nearing completion is A Model Facilities Plan for Small Communities. This report should be available later this year. The model plan takes an example community and lays out the format and the kind of information which our office feels would be necessary to prepare an adequate facilities plan for a small community. In addition, EPA's Facility Requirements Division is preparing additional guidance on developing management programs for on-site systems. EPA will be conducting a national conference on SAWS management in early 1982; date and location to be determined.

Proposed Clean Water Act Amendments

There have been a number of proposed amendments to the Clean Water Act affecting the Construction Grant Program. As some of you may have heard, the initial Office of Management and Budget recommendation for the 201 Program for the fiscal year 1982 was zero funding. Currently appropriated, but unobligated funds would still be available. This potential cutback would have a significant impact among small communities, particularly in those states which have full obligated Construction Grant funds. Although some states have a backlog of money which will enable them to award new grants, many states could come to a standstill. The administration has proposed that the Construction Grant Program be funded in fiscal 1982 at the 2.4 billion dollar level rather than 3.5 billion dollar level if certain modifications were made to the Construction Grant Program. The recommended changes would require amendments to the Clean Water Act.

The proposed amendments were submitted by EPA to Congress in late April. A schedule for Congressional consideration has not yet been established. Of course, it remains to be seen what Congress does with these specific recommendations. Many of these proposals are likely to produce much lobbying and Congressional debate.

TABLE 2

PROPOSED CHANGES IN

CLEAN WATER ACT

NEW ALLOTMENT FORMULA BASED ON 1980 NEEDS SURVEY

CHANGES IN ELIGIBILITIES (No Local Sewers)

ONE-YEAR EXTENSION OF I/A PROGRAM

I/A AND RURAL SET-ASIDES OPTIONAL

NO FUNDING OF RESERVE CAPACITY CONSTRUCTION

PRIORITY LIST BASED UPON PUBLIC HEALTH AND WATER QUALITY IMPACTS

OPTION TO REDUCE COST SHARE AMOUNTS (By Category/Step)

The proposed amendments are summarized in Table 2. Among the proposals is a one-year extension of the Innovative and Alternative Program, which is scheduled to expire at the end of the 1981 fiscal year. The proposed amendments would make both the rural set-aside as well as the I/A set-aside programs optional for the states rather than mandatory. Another amendment would prohibit EPA funding of construction of reserve capacity. EPA could fund the planning and design of reserve capacity, but the construction itself would only be for those facilities necessary to meet existing community needs. Another proposal would require state priority lists to give more emphasis to public health and water quality impacts.

Construction funds are proposed to be limited to treatment facilities and interceptors; EPA would no longer provide financing for construction of local sewers. That change could have a significant impact. Some of these changes may, in fact, encourage local communities to look at alternative systems more directly. However, where the state no longer participates in a set-aside program, the communities may be hard pressed to get federal grant support.

The Governors will be given the opportunity to reduce the cost share amount. Currently EPA provides 75 percent of each of the three steps in the Construction Grant Program (except where communities are participating in the I/A Program, where it goes up to 85 percent of the I/A portion). If this particular recommendation is approved, a Governor can, for example, choose to provide only 50 percent of facility planning costs, whereas treatment construction might continue to receive a 75 percent federal assistance. This change would increase the cost to the local community for meeting pollution control needs. At the same time, however, it would provide assistance to more communities.

The next few months should be very interesting to see what Congress will do with these recommendations. Our office will be monitoring closely to see what kinds of impacts these changes will have on the small community programs.

SMALL AND ALTERNATIVE WASTEWATER SYSTEMS STRATEGY IMPLICATIONS FOR COLORADO FROM A REGION VIII PERSPECTIVE

by

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INTRODUCTION

Background

The need for a comprehensive management approach to on-site sewage disposal is well documented in both the literature and numerous water quality management planning documents. In November, 1978 the GAO issued a report to Congress dealing with on-site disposal. In their report it is noted that comprehensive management of small systems is an important key to their use as alternatives to central collection and treatment. The GAO report recommended to the Administrator of the Environmental Protection Agency that:

(1) Regulations be revised to require "...that facilities plans consider water pollution problems in all community areas, including a comprehensive strategy to control pollution throughout the community."

(2) States and communities be encouraged "...to obtain the authority necessary to establish effective public management programs for septic systems."

(3) Minimum standards for public management of septic systems be established.

This report and many others were, in part, responsible for the Small Alternative Wastewater Systems Strategy (SAWS) that has been discussed.

The major objective of the Strategy is the "...development of a comprehensive planning and management approach to promote the use of and improve the performance of small alternative wastewater systems."

Intent

It is the Region's intent to implement this Strategy through various programs authorized by the Clean Water Act including State/Areawide Planning (Section 208), Water Pollution Control Program Grants (Section 106), The Construction Grant Program (Section 201), and The Construction Grant Management Program (Section 205(g)).

The granting and management of these funding sources are handled in the State/EPA Agreement (SEA).

Over the past several years, the Agency has initiated the State/EPA Agreement as a management tool designed to make more efficient use of

available resources and to focus top management's attention on environmental priorities.

In general, the Agreement process includes:

- Identifying priority problems
- Identifying available resources.
- Developing solutions and defining the necessary tasks, schedules, funding and responsibilities to achieve those solutions.
- Implement the Agreement - evaluate and revise as necessary.

The annual negotiation process of the State/EPA Agreement will be the forum to promote the creative, effective, and efficient implementation of the SAWS Strategy. The actual preparation of a Statewide management plan for small waste flows will be subject to future negotiations between the State and the Region. It will be dependent upon available resources and the relative priority of that task.

Perspective

From a regional perspective in the water quality management program, there is a strong need to improve the coordination and leadership on the part of state water quality management agencies in dealing with the control of pollution from on-site disposal. Almost all local areawide planning agencies have identified problems stemming from inadequate control programs for on-site disposal. These local planning agencies continue to request funding from the federal water quality management program to fully examine the problems and develop control programs. In our review of these funding requests, it has been apparent that there is duplication of effort inherent in each of them. Sorting out these proposals and making suggestions for future work is a role the statewide water quality management agency needs to play rather than the EPA. EPA cannot continue to fill that role; therefore, where the need exists each state should develop a comprehensive management strategy for on-site disposal.

Some state and areawide water quality planning agencies have addressed pollution problems from on-site disposal in great detail. Within the region, Teton County 208 Agency, Lake Agassiz Regional Council (Fargo, North Dakota), Sixth District Council of Governments (Rapid City, South Dakota), Larimer-Weld Regional Council of Governments, Pikes Peak Area Council of Governments, Pueblo Area Council of Governments, and the State of Wyoming have been most active. I would like to spend a little time discussing the current study being conducted by the State of Wyoming, as it is a good example of an attempt to deal with on-site systems in a comprehensive fashion.

WYOMING ON-SITE PROGRAM

Background

The study is being conducted as a part of the statewide continuing planning process. Areawide water quality management plans for Teton County, the Big Horn Basin and Southwestern Wyoming (Lincoln, Uinta, Sweetwater

Counties) and the Statewide WQM plan have pointed to the need for this study. There were major unanswered questions regarding financial programs, institutional structures, management alternatives and revisions to existing rules and regulations. The Statewide WQM plan identified small systems management as one of the most critical water quality management problems in the State.

In July of 1980, the Wyoming Department of Environmental Quality and management consulting firm initiated a project "...aimed at strengthening the institutional and financial management capabilities of local governments in regulating on-site and small wastewater systems within their jurisdictions and maximizing the role and effectiveness of the state in supporting local government in this area." A draft document titled "Managing On-Site Wastewater Systems in Wyoming"has just been published (April 1981) for review and comment.

Approach

During the study over 100 interviews were conducted with local planners, elected officials, and state or county health staff. Subjects covered in the interviews included: local permit procedures; inspections; types and extent of problems; enforcement; and local responsibilities for and attitudes on on-site system management.

In addition to interviews, over 300 questionnaires were sent to the key officials of each municipality and county in Wyoming. Subjects such as permits for on-site systems, funding, lack of information, planning and disposal of septage were covered. 113 responses were received (35 percent response).

As on-site management task force was used to guide the study and make recommendations for change in financial, technical, legal and administrative procedures. The task force membership included:

- Water Quality Division of DEQ
- Wyoming Association of County Commissions
- Wyoming Association of Municipalities
- State Agriculture Commissioners
- Wyoming Association of City and County Sanitarians
- Teton County Planning Office
- Wyoming Planning Association
- U.S. Soil Conservation Service

The results of both the interviews and questionnaires were used in making final program recommendations.

Recommendations

Recommendations for changes in the state and local programs have been made. These include:

- Revisions to state on-site disposal regulations
- Content of Delegation Agreements
- Proposal for intergovernmental agreements between the Department of Environmental Quality and the Department of Health

- Financial requirements for state program ($920,000/year for all 23 counties)
- Legislative changes necessary to strengthen the state and local government management program (Funding and Enforcement)

While Wyoming's management program for on-site wastewater systems is not yet in final form, it is important to note the comprehensive coverage of their study. If the state is able to make the recommended change, they will have a comprehensive management approach to on-site disposal that fits the intent of the SAWS Strategy.

COLORADO PROGRAMS

In Colorado, local areawide water quality planning agencies have been active in addressing on-site disposal problems.

Larimer-Weld

Larimer-Weld Regional Council of Governments considers on-site disposal as one of the most critical water quality problems in the area. The current work by this agency includes developing a self-sustaining financial program for on-site disposal and development of small system regulations to cover the design, construction, and annual operation and maintenance for individual sewage disposal. A commitment has been made by the Agency to pursue the comprehensive planning and management approach defined in the SAWS Strategy.

Pikes Peak COG

The Colorado Springs Agency has identified on-site disposal as a high priority water quality problem in El Paso County. They are currently working on a comprehensive management plan that will address: alternative systems, cost-effectiveness guidelines, failing systems, maintenance procedures, users fees, institutional arrangements and areas unsuitable for on-site disposal.

Pueblo COG

Pueblo Council of Governments have been involved in an on-site demonstration project over the past several years. Bruce Nelson will discuss their program.

Northwest COG

Problems with on-site disposal have been identified in their WQM plan. They are working to identify areas unsuitable for on-site disposal and implement through city and county ordinances.

State

At this point, we feel that the state in cooperation with local planners and health officials needs to develop a comprehensive management strategy to deal with on-site disposal. There is certainly an ongoing set of procedures used by the state and counties to issue permits for individual systems. When the word strategy is used, it is used to mean a plan or approach to solve problems. The Region feels that a strategy should identify goals and

objectives, define priorities, and outline a sequence of activities to develop and implement programs. Things that could be gained from a state comprehensive management strategy would be:

- Uniform approach
- Technical assistance
- Financial assistance
- Systems implemented in all counties

Summary

The commitment by EPA Region VIII to implement the SAWS Strategy has been reviewed. In addition, a comprehensive on-site management strategy by the State of Wyoming has been discussed, and activities by Colorado's Area-wide WQM Planning Agencies have been summarized.

Region VIII is concerned by the lack of a comprehensive management strategy for an on-site disposal in the State of Colorado. We will work within existing water quality programs to assist the State in dealing with this activity.

CONSTRUCTION GRANT PROGRAM FOR INNOVATIVE AND ALTERNATIVE SYSTEMS

by

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I work in the Control and Technology Branch of the Construction Grant Program in EPA Region VIII. One of the primary functions of the branch is working with the innovative and alternative wastewater treatment program, including small systems. Don Niehus briefly mentioned the legislation that provides for this. Fiscal 1979 was the first year in which money was set aside by law from state construction grant allotments to provide funding for small alternative systems, i.e., systems serving 3,500 or less. The law also provided a set-aside for an extra ten percent bonus on top of the 75 percent grant to communities which used innovative or alternative waste treatment technology.

The present Administration has proposed that there be no construction grant appropriation for FY1982, but has indicated a willingness to consider asking Congress for $2.4 billion if certain changes are made in the grants program to make it more effective. Significant cuts are also proposed in already appropriated funds for FY1980 and FY1981. This makes it imperative now, more than ever, that each construction grant dollar be well spent. This is especially true in the case of small communities where user costs are often high.

In the mid-to-late 70's EPA headquarters initiated a review of a number of facilities plans that had been prepared for communities throughout the country. The review concluded that in many cases, the costs to the community were excessive and that less costly solutions would have worked just as well and been less environmentally damaging. A typical example is a community of 1300 located on a lake in the eastern part of the country. Waste disposal was by septic tanks, some of which had failed, and direct discharge to the lake. The community obtained a grant from EPA and hired a consultant who developed a plan to sewer the entire lake and construct a sophisticated treatment plant capable of phosphorus removal. The plan was approved and the project constructed at a cost of $4-1/4 million. The community had about 600-650 connections, so the capital cost per connection was on the order of $6,500 or $7,000. Twenty-two percent of the population was over 65 and had fairly small incomes. In fact, the median family income was approximately $8,000 per year. Some of the people who hooked on to the system refused to pay what they considered to be exorbitant user charges. Others, when they found out what the user charges would be refused to hook up to the system. Needless to say, there were some law suits involved. In looking back on that project, where do you lay the blame - on the consultant, the State, EPA, or the community?

Probably all should share in it. This project points out the problems a small community with a wastewater treatment plant can have. The attitude has been, and still is to a certain extent, that the solution to wastewater treatment problems is gravity collection systems and central treatment. As a result of its mid-seventies review, EPA had concluded this isn't necessarily the case.

When the Water Pollution Control Act was amended in 1977, the small systems cause was aided by set-asides prescribed in the law specifically for small communities using alternatives or conventional treatment. This amounts to four percent of each year's Construction Grant allotment for rural states for fiscal years 79, 80, and 81. We are limited by law, in regard to small systems, to funding only development that took place prior to December, 1977.

To date in Region VIII, we really don't have a lot of experience in dealing with small systems, though progress is being made. There are a number of small communities that have used alternative technology, but these have been confined mostly to total containment lagoons and land treatment projects. Most of these projects are in the Dakotas, Montana and Wyoming - those being the states which have a construction grant set aside specifically for small communities. Several projects involving pressure sewers have been funded with others under consideration. Under consideration for funding is a small project using a small-diameter gravity collection system and a mound system for effluent disposal.

In this case, the proposed project is the cost-effective solution to the town's problem, though not by a significant margin. The fact that the town may receive 85 percent funding rather than 75 percent was undoubtedly a big factor in the town's decision to select the mound system.

The construction grants program is changing rapidly, and it is hard to believe how rapidly the changes are coming. Proposed rescissions in the amount of monies already appropriated would reduce the amount currently available in EPA Region VIII, about $198-$199 million, by approximately $87 million. Some of this reduction is from FY80-81 appropriations and some from what is called the Talmadge-Nunn appropriation which did not carry a fiscal year appropriation and would have been available until spent.

Legislative proposals are just that. We don't know what is going to happen. But in Region VIII, if the Administration's proposed legislative changes are made and $2.4 billion are appropriated by construction grants in FY82, our six states will receive a total of $35 million. That is going to range from 1 million and 20 thousand dollars in North Dakota to 15 and one-half million in Utah, $7-1/2 million in Colorado. So that is quite a change going back a few years in Colorado when you were getting on the order of 30-40 million dollars annually. The big implication for small wastewater flows is that while 2.4 billion is a lot of dollars, this region of EPA doesn't get that many total dollars and since less money is going to be available, the states and EPA are really going to have to sharpen our management of the Construction Grants Program. I really don't see that there is any way around serious consideration of small on-site systems.

208 EFFORTS TO PLAN FOR BETTER MANAGEMENT OF SMALL WASTEWATER FLOWS

by

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The Pueblo 208 Water Quality Management Plan identified a problem in Pueblo County which is common to many Colorado counties, that of groundwater contamination due to on-site septic tank systems. Six specific areas within Pueblo County where extensive use of septic systems occurs were identified. These areas were then prioritized by problem severity and corrective actions proposed. Some form of centralized sewage collection and treatment were recommended for three areas of greatest concern due to poor septic system site characteristics or ground or surface water pollution. An on-site system management program was also proposed during the interim until the central collection/treatment systems are constructed. For the remaining three areas, an improved management program for on-site sewage disposal was the recommendation.

The Pueblo Regional Planning Commission has for the last 2-1/2 years been pursuing the development of an on-site sewage disposal system management program for these areas. This management program is targeting on the operation, maintenance, and repair phases of on-site wastewater disposal systems although much of the information gathered may be valuable for the future planning, design, and installation of such systems.

To evaluate the feasibility of carrying out such a maintenance program in Pueblo County, a demonstration project was begun with the purpose of: (1) studying various management and operation techniques; (2) developing transferable technology for application of the maintenance concept in Colorado; and (3) to provide a data base with regard to actual operating costs, cleaning frequency, system failure rates and causes, and the benefits and shortcomings of the program.

The structure of the demonstration project was developed to investigate both system operational failure through on-site inspections and functional failure through a groundwater monitoring program.

We are now beginning the third year of the demonstration project and have recently completed a progress report summarizing our findings. The demonstration project consists of about 100 septic tanks in a region of relatively compact rural housing density (1 to 1/4 acre lots). A groundwater monitoring program was implemented in conjunction with the maintenance program in order to monitor possible changes in the groundwater quality due to improved septic system maintenance.

Participation in the program by homeowners is strictly voluntary, and all services except system repair are provided free of cost.

All the septic systems involved in the program were inspected and pumped the first year of the program. Homeowners completed questionnaires designed to collect pertinent information as to the history of their disposal system and as to their impressions of a managed on-site disposal system maintenance program. The second year inspections were made of all systems and waste accumulation measurements made. Tanks which needed cleaning were then cleaned.

Products of the first two years of the demonstration project include:

(1) development of operation's plans and procedures;

(2) development of management alternatives;

(3) data on groundwater in the study area; and

(4) data on failure rates, cleaning, and repair of septic systems.

The operations and procedures developed in the demonstration project are now being incorporated into an implementation plan for each of the problem areas. Each implementation plan will set out for the sewerage authority in the particular area various management and operational alternatives, and a recommended course of action for their consideration. Discussions of these alternatives will be held with the governmental entity, whether it be a metropolitan district, water and sanitation district, or town, and a program will be chosen and implemented.

The function of the Regional Planning Commission in this process is to suggest the alternatives, identify the pros and cons, make recommendations, and give technical and management assistance to implement the chosen alternative. This type of approach allows opportunity for local government input and a program customized to fit the needs and finances of a particular area.

At present this approach is being followed in setting up maintenance programs in Pueblo West and the St. Charles Mesa areas of Pueblo County. Implementation plans are being drafted and preliminary discussions have been held with the Pueblo West Metropolitan District and the St. Charles Mesa Sanitation District. It is expected that program implementation will begin this summer.

The groundwater data collected thus far in the demonstration project have not indicated any definitive trends other than seasonal water quality changes. The monitoring is continuing into 1982.

Information collected during the demonstration project has been informative and is being utilized to formulate program operational plans. Waste accumulation rate is one of the more valuable pieces of information collected. We have found that, in general, about 77 percent of the tanks in the program area will probably require pumping every two to three years. The remaining 23 percent required pumping after just one year. Of surprise to us was that in 87 percent of those tanks where pumping appears to be required yearly, it was due to excessive scum buildup and not due to sludge deposition.

Operational failure rates are being tabulated and historical failure rates were determined from a questionnaire sent to homeowners in the

demonstration project. The annual average operational failure rate over the last ten years within the study area has been at about 2.9 percent per year. The second year of the maintenance program showed a 2.4 percent failure rate for the year. This 5/10 of a percent reduction outwardly appears insignificant, but given the assumption that as the mean age of the systems increases the failure rate will likely also increase, it does indicate possible benefit from maintenance.

One of the most important aspects of a maintenance program appears to be the public's cooperation and understanding of septic systems. A participant survey was taken after the end of the 1979 project field season. Of the respondents, 98 percent felt the program had, in general, been fair to good. However, 42 percent felt that they had no better understanding of septic systems due to the program and 87 percent felt there was a need for more information about the program and septic systems in general. During the 1981 program, we will be sending out an informational pamphlet on septic systems and the maintenance program. These pamphlets will also be available to the general public at various locations throughout the County. The questionnaire also revealed that a large percentage (30-40 percent) of the participants had no opinion about the operation of a maintenance program by any entity, public or private. A similar questionnaire will be sent out in 1981 or early 1982 to assess the attitudes of participants after three years of the program.

The economics of an organized, managed, on-site system maintenance program is of vital concern to both the homeowner and the management-operating agency. Cost estimates developed during the operation of the demonstration project suggest that an on-site wastewater disposal system maintenance program in the Pueblo West area would be significantly less costly to the homeowner than installation of a central sewer collection and treatment system. Conservative estimates for a full-scale maintenance program over a 20-year period resulted in a cost of approximately $4 to $5 per household/month. The cost of central sewage collection and treatment services for the same area, including connection fee and monthly sewer charge over a 20-year period, would be an estimated $14 to $16 per household/month. Cost figures are being developed for other areas of the County as well and are expected to be equally favorable toward on-site system maintenance.

In the next two years we expect to have fully operational maintenance programs in all six areas of Pueblo County. We will be watching closely to evaluate the cost effectiveness of this small flows management technique in these various areas. We have high expectations for this program and are working hard to make it a viable wastewater treatment approach for the future.

WASTEWATER MANAGEMENT ALTERNATIVES FOR THE ROARING FORK VALLEY

by

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INTRODUCTION

Colorado is currently being impacted by recreation and energy development. Many rural community areas (e.g., mountain valleys) are growing or expanding rapidly. The nature of this growth is beyond central systems, on large lots, and on environmentally fragile areas. There is a need to look at other means of wastewater treatment and disposal besides the conventional collection system with treatment by a central wastewater system.

PURPOSE AND SCOPE

The purpose of this paper is to delineate all the alternatives, on-site and sewers, for wastewater treatment in the Roaring Fork Valley. Specific details are provided for an area east of Carbondale. The alternatives examined are chosen to explain the role that small flow technology can play in a rural area being impacted by recreation and energy development.

The scope of this application is limited by:

1. Main emphasis on alternative technologies;
2. Only rough cost estimates are made;
3. Public acceptance has not been considered;
4. Local government input has been limited; and
5. Sewer system alternatives are developed for comparison purposes only.

CURRENT SITUATION

Conditions of the Planning Area

The planning area is a low-lying area approximately one square mile in size along the Roaring Fork River east of the town of Carbondale. The planning area consists of approximately 34 homes which are unincorporated. These homes use on-site systems as the means to treat and dispose of their household wastewater. The water supply for each home is from an individual on-site well. There are no commercial establishments or industry in the planning area.

The planning area at the moment is not organized, in terms of wastewater treatment and planned development. Garfield county's ISDS regulations

do provide controls on design and installation of on-site systems, but the homeowner is responsible for the operation and maintenance of the system.

The geology of the planning area consists of mostly alluvium which is generally sands and gravel with local clays and boulders. Other types of geology in the planning area are Eagle Valley evaporite and terrace gravels (El Dorado Eng., 1977).

The planning area, besides the homes, mainly consists of a system of ditches which supply water for the production of alfalfa, brome, orchard grass, etc.

Demographic Data and Land Use Data

Since the planning area is unincorporated, population data could not be found. A rough estimate was calculated using 3.5 persons per unit (Wright-McLaughlin Engineers, 1980). Thus, the approximate current population is 119 persons.

A survey conducted in 1975 by Colorado Mountain College for the town of Carbondale reported the demographic information shown in Table A-1. This information, to some degree, is applicable to the planning area because it is close to the town of Carbondale and the basic economic effects on the people throughout the Roaring Fork Valley are the same except in the upper part of the valley in and near the Town of Aspen (El Dorado Eng., 1977).

As can be seen by the demographic information, the population is young, has a relatively high income level, and labor oriented. El Dorado Eng. (1977) stated that the data shows the effect of the energy-related development in the area, such as a large work force receiving good wages, and that nearly 50 percent of the population has resided in the town less than two years, indicating the transient nature of the population.

The land use patterns of the general area are shown in Figure B-1. The zoning classifications are:

Agricultural/Residential/Rural Density	A/R/RD
Residential/Limited/Urban Density	R/L/UD
Residential/Limited/Suburban Density	R/L/SD
Planned/Unit/Development	P/U/D
Planned/Development	P/D
Agricultural/Industrial	A/I

The planning area is designated Agriculture/Residential/Rural Density. The area zoned for residential development near the planning area is:

1. Te-Ke-Ki (P/D), presently undeveloped;

2. Aspen Crystal River Estates (R/L/SD), presently undeveloped; and

3. Ranch of Roaring Fork (P/U/D) partially developed.

Currently Garfield County is not allowing the homeowners in the planning area to subdivide their land until the area wastewater problem is solved (Baldwin, 1980).

Table A-1. Demographic information.

Demographic Factor	Grouping	% in Group
Age	0-5	12.06
	6-12	14.58
	13-18	11.69
	19-25	15.07
	26-40	26.54
	41-65	15.42
	66+	3.66
Income, Dollars	0-10,000	31.00
	10,001-15,000	39.00
	15,001-25,000	26.02
	25,000+	3.36
Employment	Laborer	23.09
	Professional	7.39
	Management	6.24
	Indirect support	3.46
	Agriculture	2.31
	Small business	7.16
	Service	9.93
	Professional	6.70
	Educational	5.87
	Other	27.94

Source: El Dorado Eng., 1977.

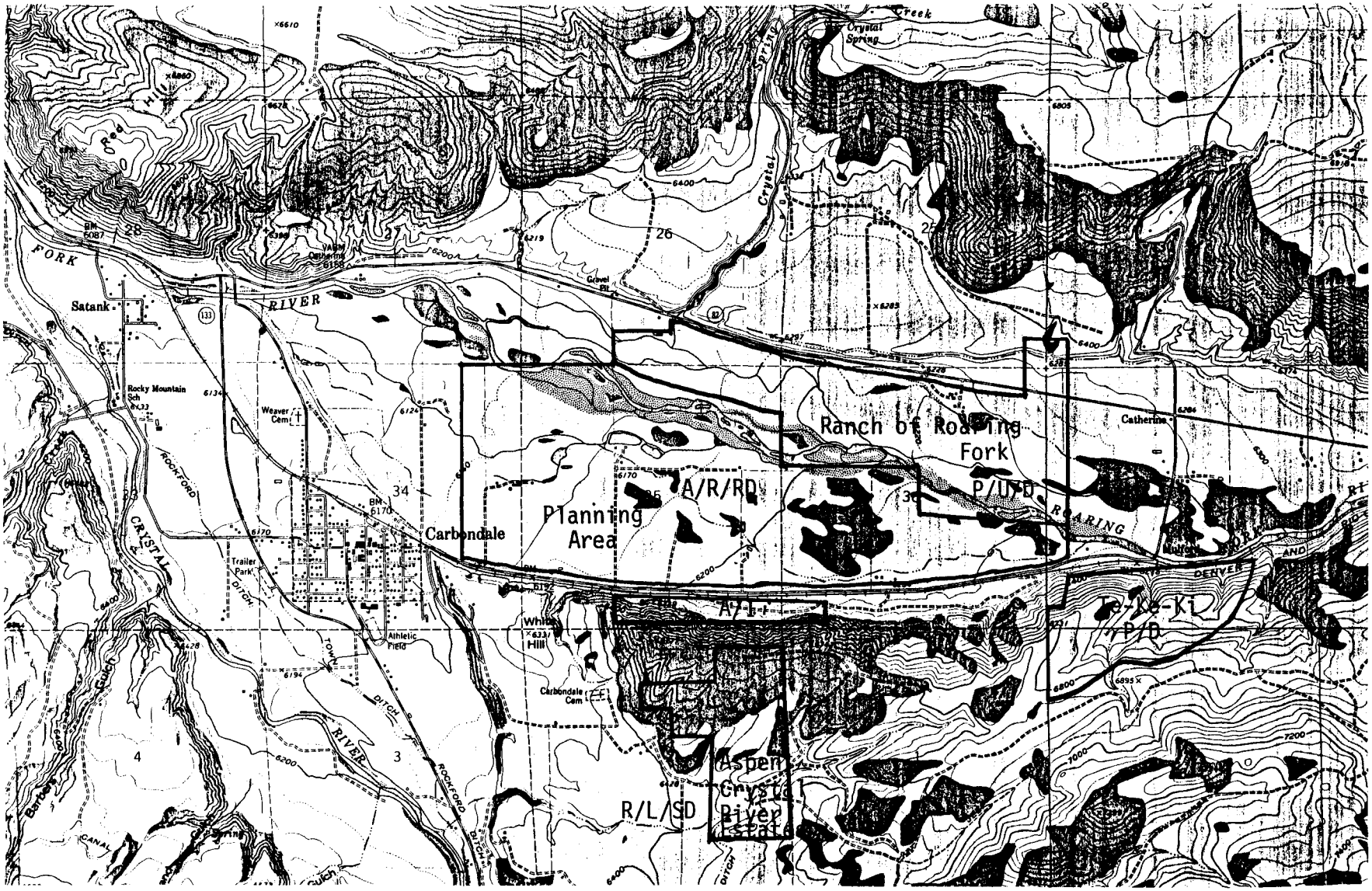

Figure B-1. Map of planning area and zoning classifications

Water Quality and Uses

Water supply of the homeowners in the planning area is from individual water wells. The Town of Carbondale also has water wells in the planning area.

Some water quality data of the Roaring Fork River was compiled by the Colorado West Area 208 agency. The Colorado West Area 208 agency presented this data in terms of the water quality criteria in the "Water Quality Data Base Update--White and Colorado River Basins) (WQDBU) (El Dorado Eng., 1977). The WQDBU summarized the water quality of the Roaring Fork River as follows:

> In general, metal and non-metal concentrations on the Roaring Fork River increased somewhat since the original water quality evaluation. Mercury concentration may be sufficient to inhibit fish and wildlife community development and livestock use. Fish and wildlife may also be jeopardized by phosphate concentrations. The remaining parameters generally indicate an improvement in water quality or no changes when new data are compared against original data. Overall, the water quality of the Roaring Fork Sub-Basin comes within water quality criteria limits.

Other water quality information for the Roaring Fork River can be obtained from the Water Quality Management Plan (Wright-McLaughlin Eng., 1974) and the Colorado West 208 plan.

A report entitled "Test Hole Rf-A Phase II Ground Water Supply Evaluation for the Town of Carbondale" by Wright-McLaughlin Engineers (1976) summarized the groundwater quality of the well, which is in the planning area, as follows:

> The quality from the well should be similar to that of the Roaring Fork, which is of good chemical quality. The hardness was somewhat high with a high value of 250 mg/L sampled during the test. No chemical constituents exceeded the upper limits for potable water supply as recommended by the United States Public Health Service.

The Colorado West Area 208 plan stated:

> Potential conflicts between septic systems (on-site systems) and domestic groundwater supplies are of particular concern to Garfield County near Carbondale (planning area); however, historical data did not indicate any existing problem.

Thus, the water quality of the planning area seems to meet all standards in terms of drinking water standards and the water quality criteria-standards. But potential problems do exist between the on-site systems and the groundwater due to the high groundwater levels in the planning area. These high groundwater levels may cause insufficient depth of soil below the soil absorption fields at certain times of the year to act as an effective treatment mechanism for the removal of pathogenic organisms and nutrients present in the wastewater. This, in turn, could result in

pollution of groundwater and surface waters downstream and the drinking water supplies of the people in the general area.

Non-Point Source Pollution

The possibility of non-point source pollution in the planning area is mainly from runoff from livestock areas and leachate from septic tanks.

In a letter to El Dorado Engineering, Mr. Woodyard, District Conservationist, Soil Conservation Service, U. S. Department of Agriculture, stated that: "Non-point source pollutions stemming from livestock waste is not a problem in the Carbondale area."

As noted earlier in a statement by the Colorado West Area 208 plan: "potential conflicts between on-site systems and groundwater supplies exist." These potential problems and their solutions will be discussed in later sections.

Existing Wastewater Treatment Systems

The planning area currently is served by on-site systems. The types of on-site systems used by the 34 homes in the planning area are the standard system, of which there are approximately 19, and the evapotranspiration system, which make up the rest of the 34 systems. The sludge pumped from the septic tanks is disposed of in Garfield County landfills.

Other existing wastewater treatment systems near the planning area are the centralized wastewater treatment system of the Carbondale Sanitation District and a package wastewater treatment system of the Ranch of Roaring Fork.

The Carbondale Sanitation District centralized wastewater treatment system consists of pretreatment, an activated sludge process, clarification, and chlorination followed by a polishing pond. The design capacity of the centralized wastewater treatment system is 0.5 MGD. The current performance of the treatment plant is above average (El Dorado Eng., 1977).

The Ranch of Roaring Fork package wastewater treatment system consists of contact stabilization, extended aeration plant, and chlorination followed by a polishing pond. The wastewater treatment system has a rated capacity of 115,000 GPD in the contact stabilization mode and 62,000 GPD in the extended aeration mode. The performance of the system in 1977 consisted of satisfactory BOD reduction, but suspended solids was typically above 30 mg/L. The polishing pond was deepened and enlarged to obtain better suspended solids removal in 1977 (El Dorado Eng., 1977).

Performance of Existing Systems

In the planning area 12 of the 34 homes were surveyed to determine:

1. If there were any problems with their on-site systems; and
2. When the last time was that the system was pumped.

This was done to evaluate the performance of the existing systems.

The performance of existing systems seems to be satisfactory for the homeowners of the evapotranspiration systems. Most of these systems have been installed within the past three or four years.

The performance of standard systems seems to be less satisfactory than the evapotranspiration systems. Some of the homeowners of these systems have not pumped their septic tank in seven years. Also, a few other homeowners stated that during the spring, if they use a lot of water, their system will fail. One homeowner stated that there is a high turnover rate in the planning area and most new homeowners do not ask questions about the on-site system such as when the septic tank was last pumped and where the septic tank is located. She also said that some people will probably say their system is working satisfactorily when it isn't because they do not want to invest their money into fixing the system.

The performance of existing systems is not monitored in any way by the county in terms of groundwater monitoring or in terms of inspecting the system after it has been installed. As noted many times earlier, the services needed by on-site systems are totally the homeowner's responsibility.

FUTURE SITUATION

Demographic Projections

Currently the county planning department is not allowing the subdivision of any land in the planning area until the wastewater treatment problem is solved (Baldwin, 1980). Before this decision was made by the County Planning Department, the development of the planning area was accomplished by the Senate Bill 35 Exception. The population increased in this manner from approximately 88 persons in 1977 to 119 persons in 1980.

The future population of the planning area will be determined by the type of wastewater system selected by the county or by the homeowners. For example, if the planning area decides upon sewering the area, the population would tend to increase because this type of system allows more homes to be connected to the system at smaller user charges. If the planning area decided upon better management of the on-site system as the way of improving the wastewater treatment, the development of the planning area would probably proceed as before by the Senate Bill 35 Exception which would probably be a much slower population growth than the first example.

Among other factors affecting the planning area is the Growth Management Plan of Pitkin County. This plan regulates the growth of the entire county. This regulation will aggravate the already difficult housing situation in Pitkin County and also tend to push development further down the valley to the Carbondale area near the planning area. Also, housing costs in Aspen (Pitkin County) are well in excess of $100,000, causing people who work in Aspen to seek housing elsewhere in the valley, especially between Basalt and Carbondale (El Dorado Eng., 1977).

The planning area will also be affected by energy development occurring on the western slope. The energy development will cause an influx of people to settle on the western slope, causing more housing problems.

Forecast of Flow and Waste Concentrations

In calculating the wastewater flow of the planning area, a few assumptions will be needed. The assumptions are:

1. The planning area will not be rezoned;

2. The "saturation" number of houses in planning area is 68; and

3. All houses will connect to the sewer line.

Thus, a rough estimate of the population, using 3.5 persons per house (Wright-McLaughlin Engineers, 1980), is 238 persons. So, an estimate of the wastewater flow using 75 GPD per person (LCHD, 1980) is roughly 17,850 GPD. The estimate does not include inflow into the sewer lines by groundwater if conventional sewers are used. This infiltration could be considerable due to the high water table in the planning area.

The waste concentration of the planning area will be dependent upon the type of collection system used. The waste concentration of the planning area with a conventional collection system will be approximated from the Carbondale Sanitation District waste concentration which is:

Parameter	Typical Average	Monthly Average
BOD	150-250 mg/L	215 mg/L
Suspended Solids	150-220 mg/L	175 mg/L

Source: El Dorado Eng., 1977.

The planning area waste concentration will probably be less than the Carbondale's Sanitation District due to the high groundwater table which would dilute the concentration of the wastewater.

WASTEWATER MANAGEMENT ALTERNATIVES

Alternative 1--Education Program

An education program is a program to educate the homeowners on the different aspects of on-site systems, particularly operation and maintenance. The educational program would still incorporate the ISDS regulations and land use controls of each county.

Alternative 2--Management Assistance Program

A management assistance program is a program to provide technical assistance to homeowners as requested or deemed necessary by public health or environmental factors and to remind the homeowner when to pump his/her septic tank. This program would still incorporate the ISDS regulations and land use controls of each county. The education of the homeowner would also be an important function of this program since this program is mainly geared toward assisting the homeowner.

Alternative 3--Operation and Maintenance Program

An operation and maintenance (O & M) program is based on the renewing of the on-site systems permit. Currently the counties of Colorado issue permits for the construction of on-site systems. The O & M program is based on the renewing of this permit. The renewing of the permit would allow the homeowner to use an on-site system as a means of wastewater treatment and disposal. The renewal process would require the homeowner to have his or her system inspected and/or septic tank pumped before his permit can be renewed. The renewal times will depend on the type of on-site system used by the homeowner.

Alternative 4--Fully Centralized Management Program

A fully centralized management program is a program which provides all services required by on-site systems. The planning function of a fully centralized management program is a more comprehensive plan than what was described in the land use controls section. Besides zoning and subdivision regulations, planning involves preparation of a wastewater disposal plan for the community indicating the relative suitability and opportunities for on-site alternatives and centralized wastewater collection and treatment systems. These plans can be prepared for an entire community as well as specific sub-areas, such as subdivisions and other development areas. Coordination of agencies and programs is also a part of the planning function (Roy F. Weston, Inc., 1979).

Alternative 5--STEP Collection System with Treatment

A pressure sewer system, more specifically a septic tank effluent pump (STEP) system, is a system in which the septic tank effluent is pumped to a treatment site.

In a STEP system, the wastewater from the house flows into the septic tank where the solids settle and the grease and oil are trapped. The effluent from the septic tank then flows into a storage tank where a pump is located. When the effluent in the storage tank reaches a certain level the pump switches on and pumps the effluent into a small diameter pipe which carries the effluent to a treatment site.

The storage tank maintains a lower effluent level than the septic tank to provide a reserve capacity. The reserve capacity is needed just in case the system malfunctions and the effluent cannot be pumped out of the storage tank. Thus, the homeowner could continue to use water for a day or two before the storage tank is filled. This time would allow the maintenance personnel to correct the malfunction (Bowne and Ball, 1980).

There are a number of ways to treat the effluent from the septic tank. Table A-2 lists the type of treatment processes which could be used.

For purposes of this study, a package plant (5a) and a sewer line to centralized wastewater treatment plant (5b) in Carbondale are the only treatment processes considered. This in no way reflects badly upon the other treatment processes - it is simply beyond the scope of this study to consider all forms of central treatment systems. This study is concentrating on non-central management.

Table A-2. Treatment Processes.

Package Plants	
	Extended aeration package plant
	Fixed film package plant
Lagoons	
	Aerobic lagoon
	Anaerobic lagoon
	Facultative lagoon
Oxidation Ditch	
Soil Absorption Field	
Centralized Wastewater Treatment Plant	

The STEP system does require an organization to do administrative work and operation and maintenance of the STEP system and wastewater treatment plant.

Alternative 6--Conventional Collection System with Treatment by Carbondale's Sanitation District

This alternative would require the planning area to become part of the Carbondale Sanitation District. The Carbondale Sanitation District would run a trunk sewer to the planning area where homeowners would then connect to this sewer line.

The wastewater treatment alternatives described above for the planning area are listed in Table 5-3. The first four alternatives deal with the improvement of management of on-site systems. The last two alternatives deal with different ways to sewer the planning area. The table presents the type of institutional arrangements considered for the alternative and whether that alternative needs additional personnel to help administer it. The table also presents a rough estimate of the initial physical cost of the alternative in terms of physical structures to be constructed or repaired and whether that alternative needs a monthly fee to cover operation and maintenance costs. The alternatives with no in their monthly fee column are financed by other means for their operating costs.

The institutional arrangement for the first three alternatives would probably be best administered by the county in cooperation with the Extension Service. Alternatives 4 and 5a would probably be best administered by some

Table 5-3. Cost and potential institutional arrangements of the wastewater management alternatives.

Wastewater Management Alternative	Potential Institutional Arrangement	Additional Personnel	Initial Physical Costs	Monthly Fee
1. Education program	County & Extension Svc.	No	0	No
2. Management Assistance Program	County & Extension Svc.	Yes	0	No
3. Operation and Maintenance Program	County & Extension Svc.	Yes	0	No
4.* Fully Centralized Management Program	Sanitation District	Yes	190,000	Yes
5a* STEP System with Package Plant	Sanitation District	Yes	286,294	Yes
5b* STEP System with Treatment by CSD	CSD	Maybe	244,110	Yes
6.* Conventional Collection System with Treatment by CSD	CSD	No	473,110	Yes

NOTE: All costs are discussed in more detail in Appendix B.

*Alternatives are eligible for grants from state and federal agencies.

form of sanitation district because the management entity would need taxing power. The last two alternatives (5b and 6) call for the planning area to become part of the Carbondale Sanitation District.

SELECTION OF ALTERNATIVE

The selection of the alternative is largely dependent upon what is acceptable to the public and the local government. Some of the questions the public and local government should consider are what type of development will be spurred, what the environmental effects are, and whether it is within the community's economic range.

The development of the planning area may depend upon the alternative selected. For instance, if one of the first four alternatives were selected, the development of the planning area would probably proceed as before with homeowners subdividing a small parcel of his/her land to sell. As noted earlier, from 1977 to 1980 approximately nine houses were built in the planning area by this method.

The last two alternatives (5 and 6), which call for the sewering of the planning area, would probably have a tendency to promote development.

The environmental effects on the planning area will probably be affected by the type of development in the planning area. For example, increased development in the planning area means more environmental impact consequences. Conversely, reduced development in the planning area means reduced environmental impact consequences.

In conclusion, each community should evaluate its own needs and desires and select a particular technology that best matches its:

1. Economic status;
2. Development goals; and
3. Environmental characteristics.

For many small communities, the most effective wastewater treatment for the least cost will involve some form of on-site technology. A range of alternatives for the Roaring Fork Valley have been developed, described, and compared to the more traditional and expensive central sewer alternatives. The final choice of the most appropriate alternative must be made by a well-informed public and its representatives.

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APPENDIX

INITIAL COSTS

The assumptions needed to calculate the initial physical costs are:

1. The planning area remains zoned A/R/RD--Agricultural/ Residential/Rural Density.

2. The saturation population of homes according to the zoning classification of A/R/RD is 68 homes.

3. All homes with standard systems need to be replaced by evapotranspiration systems (Alternative 4).

4. All houses in planning area will connect to the sewer mains (Alternatives 5 and 6).

5. Management implementation has been agreed upon by those affected.

As pointed out in Table 5-2, the initial physical costs of alternatives 1, 2, and 3 are zero in terms of physical structures to be constructed or repaired. However, operating costs of these alternatives need to be obtained. For example, operating cost could be paid for cooperatively by the extension service, county, and state. But initial costs may be substantial to homeowners whose systems are proven not to meet the minimum separation between the maximum seasonal level of the groundwater table and the bottom of the absorption system or proven to endanger public health by contamination of the groundwater by their effluent. If the county health department does prove one of the two listed above, the county can require the homeowner to repair or replace the system.

Alternative 4--Fully Centralized Management Program

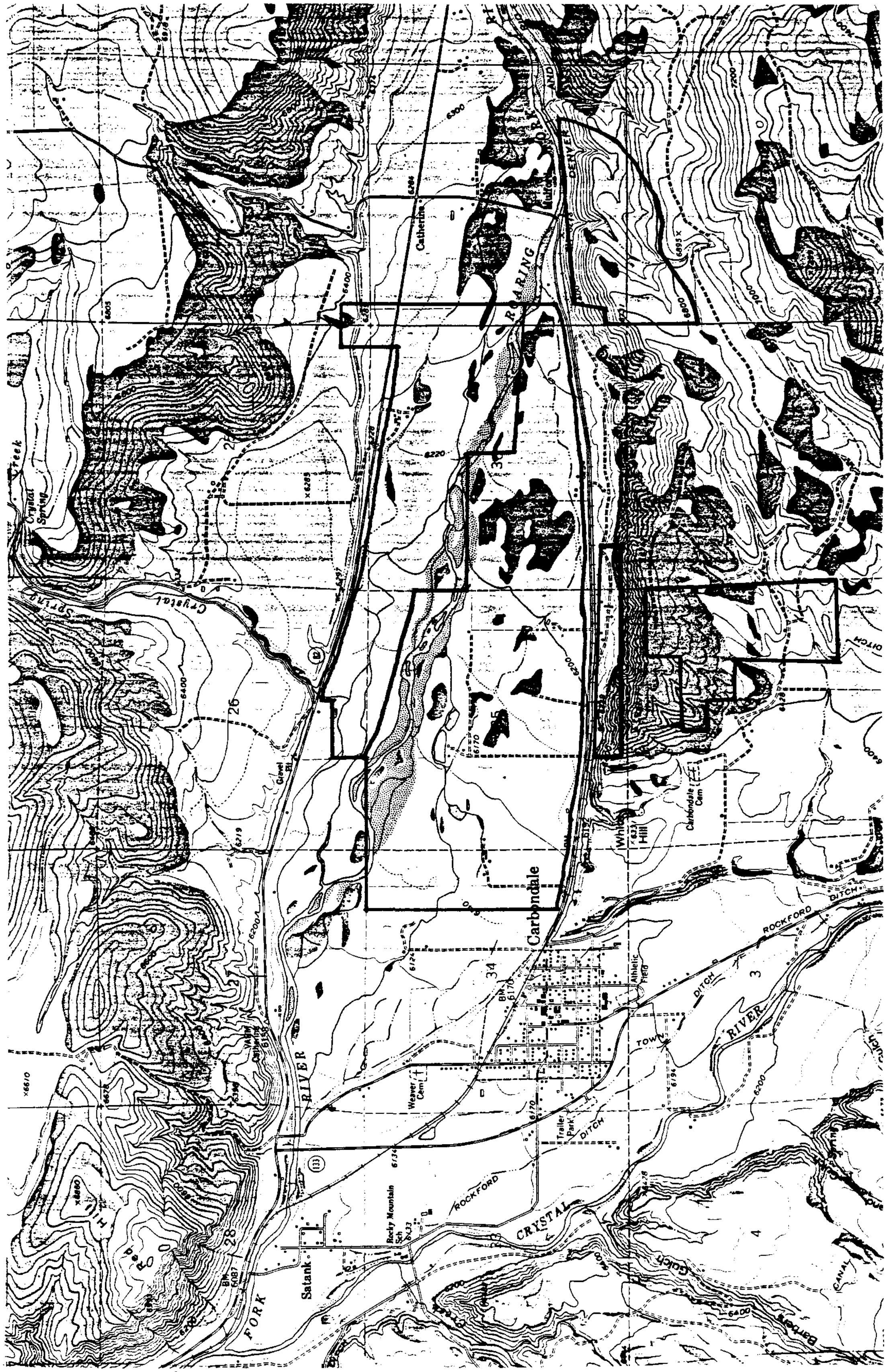
Replacement of existing standard systems with evapotranspiration systems 19 houses @ $10,000	$190,000
Total Initial Cost	$190,000

Alternative 5a--STEP Collection System with Extended Aeration Package Plant

Collection System

Storage Tank and pump 34 houses @ $2,200 per unit (Ball, 1981)	74,800
4 inch sewer main (PVC pipe) 15,845 ft. @ $7 per foot (Ball and Browne, 1980)	110,915
2 inch sewer line (PVC pipe) 2,500 ft. @ $3 per foot (Kriessl, 1977)	7,500

Treatment System	
Extended Aeration Package Plant (Orcutt, 1981)	$ 48,079
Installation; excavation, transportation, etc.	5,000
Land Cost	40,000
Total Initial Cost	$286,294
Alternative 5b--STEP Collection System with Treatment by CSD	
Collection System	
Storage tank and pump 34 houses @ $2,200 per unit (Ball, 1981)	74,800
4 inch sewer main (PVC pipe) 15,845 ft. @ $7 per foot (Ball and Browne, 1980)	110,915
2 inch sewer line to main (PVC pipe) 2,500 ft. @ $3 per foot (Kriessl, 1977)	7,500
Life Station (pump and force main) (Heller, 1981)	8,520
Treatment System	
Connection cost to CSD 34 homes @ $1,250 per home (Holgate, 1981)	42,500
Total Initial Cost	$244,235
Alternative 6--Conventional Collection System with Treatment to CSD	
Collection System	
8 inch trunk sewer 15,845 ft. @ $22 per foot (Wright-McLaughlin Eng., 1980)	$348,590
Manholes 70 @ 800/unit (Wright-McLaughlin Eng., 1980)	56,000
Lift Station (pump and force main) (Heller, 1981)	8,520
4 inch sewer line to main 2,500 ft. @ $7 per foot	17,500
Treatment System	
Connection cost to CSD 34 homes @ $1,250 per home (Holgate, 1981)	42,500
Total Initial Cost	$473,110


Carbondale
Satank
ROARING
FORK
RIVER
CRYSTAL
ROCKFORD
DITCH
Catherine
Crystal Spring
White Hill
Carbondale Cem
Weaver Cem
Rocky Mountain Sch
Athletic Field
Trailer Park

TECHNICAL MANAGEMENT NEEDS FOR SMALL FLOW TECHNOLOGY

by

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INTRODUCTION

The Clean Water Act of 1977, in Title II providing for construction grants for wastewater treatment works, expanded the definition of acceptable alternatives to include individual on-site home sewage disposal systems. These systems are eligible to receive federal monies for rehabilitation under certain conditions, notably the requirement that any such system be managed by a public body. The successful operation and maintenance of all types and sizes of wastewater treatment technology is critical to the ability of the technology to perform its designed tasks. This fact has not received the attention it deserves, since high priority has, until recently, been placed on construction of treatment plants. The problems that have developed from poor operation and maintenance have prompted several legal and administrative initiatives, both nationally and at the state level, to improve current operation and maintenance of wastewater treatment technology.

One research initiative by the National Science Foundation (NSF) was directed toward defining the role appropriate technology (of which on-site wastewater treatment technology is a part) can play in solving environmental problems faced by the U. S. today. As part of this effort, an NSF grant was received last fall by Dr. Robert Ward, here at Colorado State University, to investigate the technical management of appropriate wastewater treatment technology. I came to CSU about the same time with a B.S. in chemistry and work experience as a lab and field technician for a water treatment manufacturer. I began work on the project in January, and the scheduled date of completion is January, 1983.

The purpose of this project is to define the operation and maintenance phase of an on-site wastewater management organization's responsibility. Specifically, the following technical management requirements will be scientifically quantified:

1. Functions - system inspection and monitoring
   - water quality monitoring
   - data analysis and interpretation
   - decision-making based on data (to adjust, clean, pump, repair, modify, etc.)
   - residuals treatment and disposal

2. Resources: number and training of personnel, facilities, equipment, etc.

3. Benefits obtained from various levels of technical management

   - public health safeguards
   - environmental pollution (water, odor, land, etc.)
   - economics (initial and operational costs, water and energy conservation, influence on population growth).

APPROACH

The first phase of the project was the collection of existing literature regarding operation and maintenance of on-site systems. This included existing library literature as well as manufacturers' bulletins. A mailing was made to 125 manufacturers of complete on-site system technology and producers of the many various system components including pumps, aerators, piping, chemical analysis equipment, etc. A large response was obtained.

Next the systems were classified as to function. All operation and maintenance recommendations for each system or component were compiled from the various sources and referenced. Much of this information was complementary; some was conflicting.

At the same time, questionnaires were sent to 15 existing local on-site technology management bodies and ten state agencies. This phase of the project will determine existing levels of operation and maintenance at the local level, as well as the legal framework and technical assistance and supervision existing at the state level. This summer numerous site visits, especially in California, are also planned. Preliminary results of this determination of current technical management will be presented by Professor Hansen for Dr. Ward later in the program.

PRELIMINARY RESULTS

The systems and components to be treated were identified and classified as follows:

1. Flow Control
   - low flow toilets
   - bath, laundry/toilet wastewater recycle systems
   - holding tank system
2. Treatment
   - septic tanks
   - extended aeration package plants
   - fixed film package plants
   - small composting toilets (single compartment)

- large composting toilets (dual compartment)
- incinerating toilets

3. Disposal
   - subsurface and ET systems (mound, evapotranspiration, seepage pit, leaching chambers, subsurface sand filter)
   - intermittent sand filters (accessible)
   - recirculating sand filter

4. Flow Diversion and Dosing
   - dosing chambers
   - diversion systems (valves or diversion boxes for alternating beds)

5. Disinfection
   - chlorine/iodine
   - ozonation (electrical ozone generation and contact system)
   - ultraviolet irradiation

Operation and maintenance recommendations were listed in terms of both procedures and anticipated cost for each of the above systems or components under four headings:

1. Labor
2. Materials
3. Power
4. Residuals

For example, the following costs and procedures were gathered for septic tanks:

Labor
- annual inspection
- pumping of sludge and scum every 3-5 years (1,3,5) every 1-3 years (2,6)
- individual home; $40-60/pumping (2)
- cluster; 2-3¢/gallon septage (2)

Materials
- none

Power
- none

Residuals
- septage (pumped as above)

Other - user education (what can be disposed of, water conservation)

These findings are fairly homogeneous, among the various sources of information. A much more extensive and somewhat conflicting body of recommendations was compiled for extended aeration package plants. Some of the apparent difference of opinion may be due to the large range of flow rates which these systems are designed for. A unit servicing a single household, for example, should require less attention than one handling the flow from multiple dwellings. The results obtained thus far will be combined and reconciled with manufacturers' recommendations to obtain a more definitive compilation of operation and maintenance requirements.

CONCLUSION

Work has begun on the first two phases of research:

1. Determination of required operation and maintenance needs of appropriate technology; and

2. Determination of existing levels of operation and maintenance.

Organization of this information into the five categories of technology given above will permit the application of it to any desired combination of technologies. This may lead eventually to the generation of a computer program embodying realistic recommendations for the technical management of a community's on-site systems. Thus, an inventory of a community's existing and proposed systems would be fed in. The program, which would contain files on operation and maintenance requirements, would print out personnel, facilities, and equipment requirements along with proposed procedures and work schedules and anticipated costs. Such information should help communities to better evaluate and plan for non-central management organizations.

THE CONSULTING ENGINEER AND REGULATIONS ON ON-SITE SYSTEMS

by

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One of the things I noticed this morning is that most of the previous speakers, at least 80 percent of them, have mentioned education - the need to educate the public about septic systems. I hadn't intended to bring this up, but it reminds me of something that happened in Evergreen a few years ago. A gentleman came out from Chicago on vacation, decided he liked the area, bought a lot, and proceeded to get a contractor and excavator involved. They got me involved to design a septic system for him. He went back to Chicago and I don't remember all the details now, but there was some holdup in the system being installed - some little lag in the sequence of events. He came up to see how things were going one day and met his excavator on the site. He asked him why the system hadn't been installed yet. The excavator said, "Well, we have had this little delay, and now we have a kind of a serious problem." He said, "I need a check for $200 from you right off because I've got to buy some items for your septic field." The poor fellow said, "Well, what do you need?" He said, I have to order these leeches out from the lab back east and when you delay the excavation here a little bit the leeches die. I've got to get more leeches." So the poor guy, because of his great knowledge of septic systems, said, "Well, okay." He wrote out a check for $200; then he asked, "By the way, how many leeches did the engineer design for the system?" The excavator said, "Well, he designed it for 12 leeches based on the number of bedrooms you have." He said, "Well, I would like to be a little conservative. How much would it cost for 15 leeches?" The excavator said, "Well, that will be another $35. So he gave him $235. About two weeks later he came back and the excavator still had not started the system, so he asked about it. The excavator said, "Well, we've got the leeches back-ordered; it will be a while." Finally, he came into my office and asked if I could expedite the leeches. It took a little while for the situation to sink in, but I finally got him straightened out. But it does point out that there are an awful lot of people who feel out of sight, out of mind! They don't know what they are doing. This fellow really believed he had to have leeches in his system.

Before I start my other remarks I want to take exception to something that was said by Gary Broetzman earlier regarding engineers not generally oriented toward encouraging on-site disposal. I think that generally he is right, but a lot of us with smaller consulting companies don't generally get involved in the big systems, anyway. Personally, I feel that it is far more to the benefit of the people of Colorado - or any other state, for that matter, to treat their effluent and dispose of it by some sub-surface absorption system to keep the water in the state rather than put it in the South Platte River and let Nebraska or somebody else downstream have it. I personally don't try to push sewering every area in the mountains, which of course is impossible.

Now when Bob called me to come up here today, I got to thinking about this. He told me, "I want you to talk about what you as consulting engineers think about regulations for on-site systems. Well, having done several hundred or maybe a few thousand on-site systems, I couldn't really think of anything good to say about regulations. But, on the other hand, I couldn't think about anything real bad to say about regulations. It is difficult when you get an on-site where there are really difficult topography or bedrock conditions and you have to try to live with some very, very rigid, inflexible or seemingly inflexible regulation. There are times when you just can't find anything good to say about regulations!

Let's face it, however, we all live in a society where we are constantly becoming more and more concentrated. We are faced with not only limited water supply but also with groundwater quality that is rapidly becoming contaminated. However, it is apparent in the last few years that the public is becoming aware of the need to protect the environment and conserve what they have.

Speaking for myself (I don't want to include any other engineers in this), the first thing that pops in my mind regarding the regulations is, as I mentioned a minute ago, certain inflexibility. This inflexibility appears in certain counties or with certain portions of the regulations. I know, it was not intended to be that inflexible originally. It is very difficult at times; for instance, the ten-foot property line to system separation distance. In several counties, you can work with that and they will let you get closer if need be. There are other counties where it is black and white and that is the way it is going to be. Everybody knows that there is no real reason for that ten-foot requirement except to provide a little working room around the system if needed.

So, flexibility in applying the regulations or interpreting the regulations in some cases is very, very important. We like to work with the counties and state in solving problems. Get the problem licked, because there are many, many sites in the mountains, not so much as in the flat lands, where it is very, very difficult to solve a person's problem and stick strictly to the regulations.

Now I have one thing I ought to bring up. It's quite a concern of mine. I thought this would be a wonderful group to discuss it with, because for one thing it gives sanitarians more to do and everybody knows they need something else to do! Systems installed in the last eight years generally, unless they are abused by the owners, have not failed. You find very few cases of failure in the system unless it has been abused - like stables and horses over it and that type of thing. The regulations in Colorado in the area of sewage disposal systems seem to be working, in my opinion, very well in that the failures have been held to a minimum.

But we are still getting well contamination. I would like to start with a challenge to the regulatory agencies to work together. I would like to see them develop whatever regulatory process they need for the installation of wells to be overseen or inspected on a local level. I have talked to several hydrogeologists, friends of mine, and some people in the state and county agencies, and we all feel that this is a rather serious problem in that much of the contamination of the wells and the groundwater system is coming from improper installation of the wells. In this state the law

is very definitive on well installation and appears to be quite adequate. However, 99.9 percent of the wells are not installed per regulations. The well driller goes to the site and puts in an eight-inch hole, 20 feet deep. Then he proceeds to drop into this eight-inch diameter hole a 7-3/8 inch O.D. steel casing. This leaves him with 3/16 of an inch to grout. He is supposed to grout down the full 20 feet. I prefer it be grouted into the bedrock. Well, how much grout do you suppose you can get down and how far down 3/16-inch annulus. The average well is probably grouted to a depth of six inches - maybe even 18 inches if you're really lucky. I have done a little bit of research on this, and every well that we have found that is contaminated has been improperly grouted. I just feel that with all of these sanitarians they have a wonderful opportunity to check on the installation of wells when inspecting septics. If there are any well drillers out there I know I am going to be shot, because we have been through this before. It is a very, very serious problem and I think everybody realizes it. I just like to see all of these regulatory agencies work together, because I think we can develop the regulations to solve the problem. I won't say we have developed septic tank regulations as far as we can, but we are lagging behind with the well installation. Nobody pays any attention except at the state level, where two fellows inspect all well drillers for the whole state. Two or three well drillers have admitted to me that they may see an inspector once every 12-15 years. If you like to solve problems, I would like to throw this one out as a challenge.

I do believe that the state's regulatory process really has worked quite well in Colorado. The state guidelines, as much as I hate to admit to Elwood, really have done a very good job. I do believe that the counties have generally picked up the ball and done a very good job in writing regulations with one exception. To the best of my knowledge only one county does this. I bring it up because I want to make sure other counties don't do the same thing. Don't introduce into your regulations minimum lot size requirements. After all, we already have them in distance requirements. You have minimum distance requirements - why do you need a minimum site size requirement? You have a redundancy that is imposing an unneeded hardship on some property owners. It just doesn't work. That is really a zoning tool. Let separation of distances do the job.

So, the guidelines as prepared by the state for on-site disposal have provided an excellent base on which the local agencies can build its regulations and, I believe, in general the local agencies have done a good job of drawing up their regulations based upon their knowledge and experience to adopt the guidelines to local conditions. As an engineer, I do believe that this system of regulations of on-site disposal systems in Colorado may not be perfect, but it does work.

ALTERNATIVE MANAGEMENT STRATEGIES FOR COLORADO'S SMALL WASTEWATER FLOWS

by

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Colorado, as many states have over the years, continues to search for ways to effectively and efficiently manage its small wastewater flows. Small wastewater flows have, historically, not received high priority for management resources due to their often perceived minor impact on health and the environment. Consequently, a well thought out and/or well funded approach to their management is often lacking.

As a result of this lack of priority, responsibility for their management has, if it existed at all, moved around between county and state and within agencies and/or sections at each level of government. Further compounding the lack of priority and adding to confusion over the legitimate nature of small flows was the attitude, and funding, of the federal government (U.S. EPA) for small flows management.

States and counties, during the late sixties and early seventies, were trying to cope with wastewater management for 30 percent of the population which was using a technology not recognized by many in water quality management as being a viable approach. The concept of wastewater management at that time was sewers!

Also, during the late sixties and early seventies there was a recognition that many on-site systems, especially those in mountain areas, may fail in one of two ways. The easily recognized type of failure of an on-site system is the operational failure--the system simply ceases to operate properly. In this case, wastewater cannot exit from the home and the system "backs up." This type of failure usually gets a prompt response from the homeowner and is repaired.

The second failure is more functional in nature. The functional failure does not affect the system's operation (i.e., the wastewater exits from the home satisfactorily), but the system does not provide proper filtration and purification of the wastewater before it reaches the ground or surface waters. This latter failure is very difficult to identify and has not been dealt with directly in regulations for on-site systems.

The confusion over the role of small flow technology and its regulation was further heightened by entrepreneurs of the early seventies introducing new systems to treat wastewater which did not fit the old regulations. The "no man's land" which was created caused many counties and states to more closely examine their small flow regulations and to develop a strategy for dealing with all types of small flows in a more coherent manner.

Federal Role

During the mid-seventies many small communities, after installing a federally financed sewer system, found that they were unable to properly support (wastewater volume and financially) the new system. This fact slowly caused, at the federal level, a reevaluation of the role small flow technology could, and should, play in an overall attempt to manage wastewater in the United States.

This national evaluation has been accompanied by considerable research on small flow technology and by some states which have established innovative approaches for their management. The importance and priority of small waste flows has also increased in recent years as the billions of dollars poured into wastewater treatment plant contribution has provided wastewater treatment for most of the larger towns and cities.

Today, at the federal level, there has been a recognition of the need to address small waste flows and clearly identify a role for them in the overall approach of the U. S. EPA to wastewater management. This role has generally been spelled out in the Small and Alternative Wastewater Systems (SAWS) Strategy issued in December, 1980.

The SAWS Strategy, as do many federally designed approaches to managing water quality, defines a large role for the state water quality management agencies.

Local Government Role

Local governments, primarily at the county level, have had to deal with small flows management for many years and only recently has any assistance in this effort been available. Many of the old management approaches resulted in high failure rates (operational and functional) and this then led to the general conclusion that sewers were the only answer.

The problem was not that the technology was poor, but was due primarily to our lack of understanding as to how the systems functioned and what was needed to ensure their proper operation. As this information has become available, county regulations have become more technical with the result being better management, at least design and installation of small flow systems.

The regulations are not static as the technology and our understanding of it is not static. Consequently, counties with the available resources are able to keep their regulations current. However, many counties do not have the resources to develop current regulations and there is a tendency to let someone else say when and how regulations should be revised.

State Role

Colorado's state strategy to manage small flows has, for the past few years, revolved around an Advisory Committee for Individual Sewage Disposal Systems. This committee develops guidelines (sample county regulations) that it considers the minimum necessary to properly manage small flows. The guidelines are updated periodically. The counties develop their regulations from the guidelines.

The Colorado Department of Health, besides actively participating in the Advisory Committee, has coordinated a state effort to assist counties in managing small waste flows, but this effort has been hindered recently by personnel turnover. This management strategy has, except for personnel turnover, worked well for Colorado and does provide a mechanism to keep county regulations current.

Objective

With the new federal SAWS Strategy being developed and its implication to states in the management of small waste flows and the need to always keep small flow regulations current, it is perhaps a proper time for people in Colorado, involved in all phases of the small flows management effort, to examine our current management approach and see if it, or another approach, meets our current and projected needs.

The purpose of this paper is to briefly review the small flows "industry," describe its major components, and describe the existing and alternative approaches for its management.

THE SMALL FLOWS SYSTEM

The need for, and management of, small wastewater flows involves a number of different techniques, services and groups of people. The technologies range from holding tanks and the classic septic tank/leach-field systems to small package plants. The services range from engineering design to pumping. The people involved include the public who utilize the technology, the industry personnel who service the technology, the government employees who ensure the health and environment are protected, and the personnel of supporting organizations who provide everything from testing to education.

Service of Small Flows

Around the technology revolves a large number of services provided by the small flows "industry." Services can be categorized as: (1) planning; (2) design; (3) installation; (4) operation; (5) maintenance; and (6) repair. These services cover the initial acquisition of the technology through its continuing satisfactory performance.

The public, which utilizes the small flows technology, has historically acquired the above services from the "industry" by personal contact. Today, this is still the major means of a person having small flow technology installed at his or her home, business or institution (e.g., school). There are, however, more organized means being formulated, tested and implemented in the United States for acquiring these services. Sanitation districts, which have historically been organized to provide sewer systems, are now being organized to provide small flow management services. In the latter case, the sanitation district is often referred to as community management organization or non-central management.

The "industry" supplying the services consists of a number of businesses, some devoted exclusively to servicing small flows (e.g., pumpers) and others for which small flows are a fraction of their total business (e.g., consulting engineers). The industry has slowly evolved over the years as

the technology handling small flows has become more sophisticated. The industry is currently expanding as it attempts to expand the services available to include more operations and maintenance, areas traditionally handled by the homeowner in the past.

Figure 1 is a graphic representation of the industry providing small flow service to the public via individual contacts and organizations. This chart represents the small flows service system.

Regulation of Small Flows

The small flow service system, in treating and disposing of wastewater, has the potential, if not performed correctly, to endanger health and/or pollute the environment. In both cases, it is possible for someone with a poorly functioning system to hurt the general welfare of the public. Because of this fact, government regulation must play a role in the small flows service system. Government regulation is needed to ensure that proper services are professionally rendered.

Government regulation is often viewed as a hindrance to an industry as it attempts to "get the job done." There is no doubt that making sure a job is done correctly is more time consuming than simply getting the job done. Perhaps the industry as a whole would not have been viewed so poorly in the 1960s and early 1970s if the small flow service system had been better able to provide the right technology in a professional manner. Those who desire to see the small flow industry well established and respected realize government regulation is a price that must be paid--there is no room in the industry for those who would perform a service poorly or incorrectly. The question, the one being dealt with in this paper, is how can such regulation be provided in the most effective, efficient and professional manner.

Government regulation of the small flow system comes mainly from the local (county) and state governments. In Colorado, it is mainly a county responsibility; however, in other states it is more of a state responsibility, while in others it is split evenly between county and state.

The federal government, through agencies such as the U. S. EPA and Farmer's Home Administration, provides incentives and general directions that it wishes to see the management of small flows take. For example, the U. S. EPA through grants to state water quality management agencies (Section 106 grants), regional government agencies (Section 208 grants), and communities for construction of wastewater treatment facilities, can greatly influence the general direction a state or community might proceed in managing its wastewater.

State government regulation of small flows is not well defined and varies from state to state. In most cases, the state efforts in regulation of small flows have been of a coordination nature.

Counties have historically been the front line of small flows regulations. This regulation takes many forms--for example, zoning, subdivision regulations, and permits. Counties have the front line designation primarily due to their historical efforts to protect health. The regulations most directly related to small flows have, consequently, been the responsibility

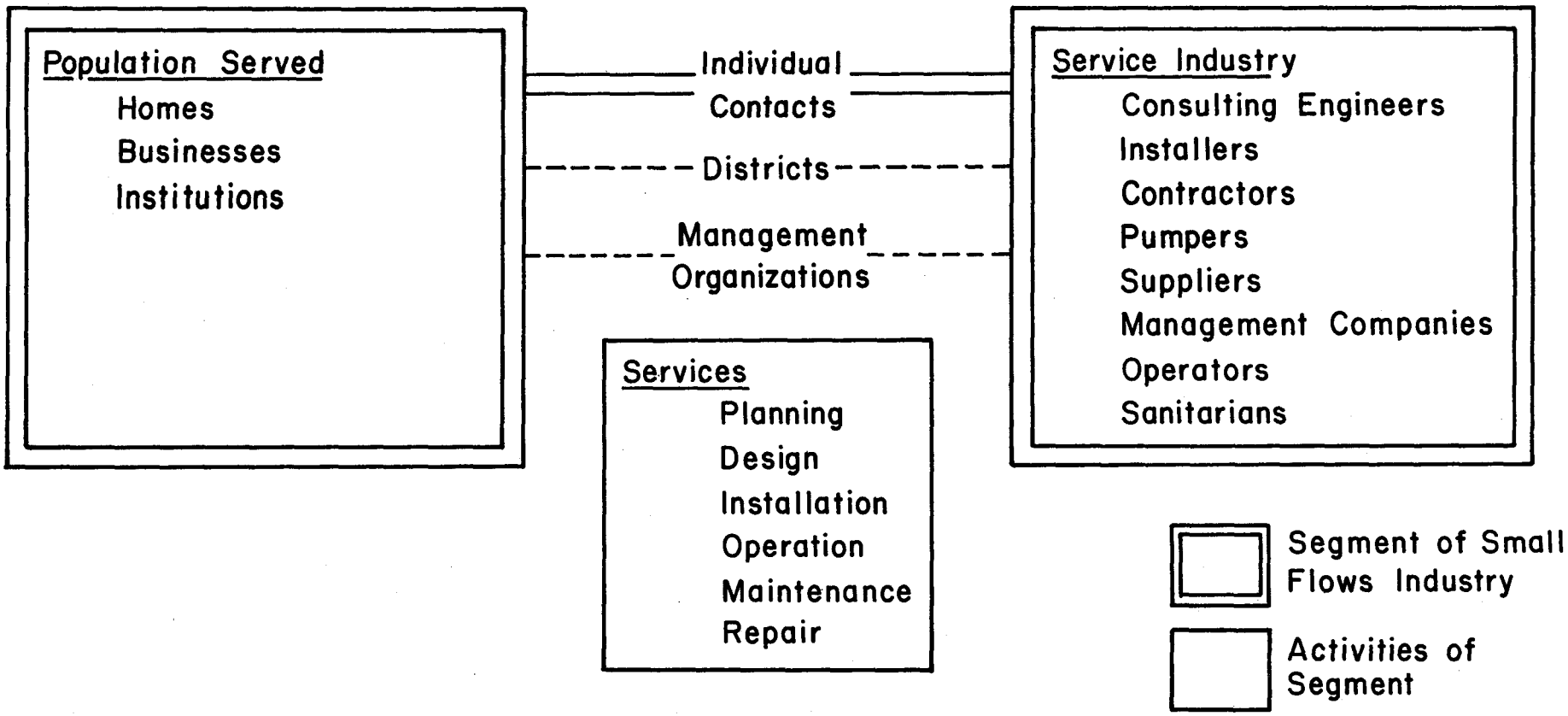

Figure 1. Small flows service system.

of county health departments.

As the technology for handling small flows has evolved and the services rendered by industry have increased, counties have attempted to keep pace. The limited budgets of county health departments have, in general, not permitted the acquisition of staff necessary to keep up with all aspects of small flow management. The limited county staff have to deal with an increasingly complex technology, thus inefficiencies develop. Given the complex technology, how can the counties, in cooperation with the state, regain the efficiency desired in small flow management?

The place of government regulation in the small flows "industry" can be graphically represented as in Figure 2. As noted earlier, government regulation is established to ensure that the services of the small flows industry are provided in such a manner as to protect the public health and environment, thus it "oversees" the service industry, and, as such, becomes a major component of the service system.

Supporting Organizations

The small flow service industry, and its regulation by government, receives support from a number of organizations in the form of education, research, extension, training and testing of equipment. These organizations are not directly involved in providing services, as defined earlier, nor are they directly regulatory in nature, but they do attempt to help the system and its regulation operate in an effective and efficient manner.

Education is directed at three levels: (1) the education of professionals working in the field (e.g., sanitarians and engineers); (2) the training of field personnel in proper installation procedures, maintenance functions, operational characteristics, etc.; and (3) education of the public as to the importance of the small flow technology and its need to be utilized correctly.

Research has over the past ten years greatly increased our understanding of small flow technology, particularly with respect to its capabilities and limitations. This work has been funded by a number of different organizations such as the National Science Foundation and the U. S. EPA.

The National Sanitation Foundation provides unbiased testing of small flows equipment which is critical to good management. They, along with several professional societies (e.g., National Environmental Health Association and the American Society of Agricultural Engineers), have also provided the forums for exchange of technical literature which is very important to a field developing as rapidly as the small flows field is currently. The American Clean Water Association, besides serving as a forum for information exchange, lobbies in Washington, D. C. for the small flows industry.

Figure 3 graphically illustrates the overlay of the supporting organizations to the small flows service systems.

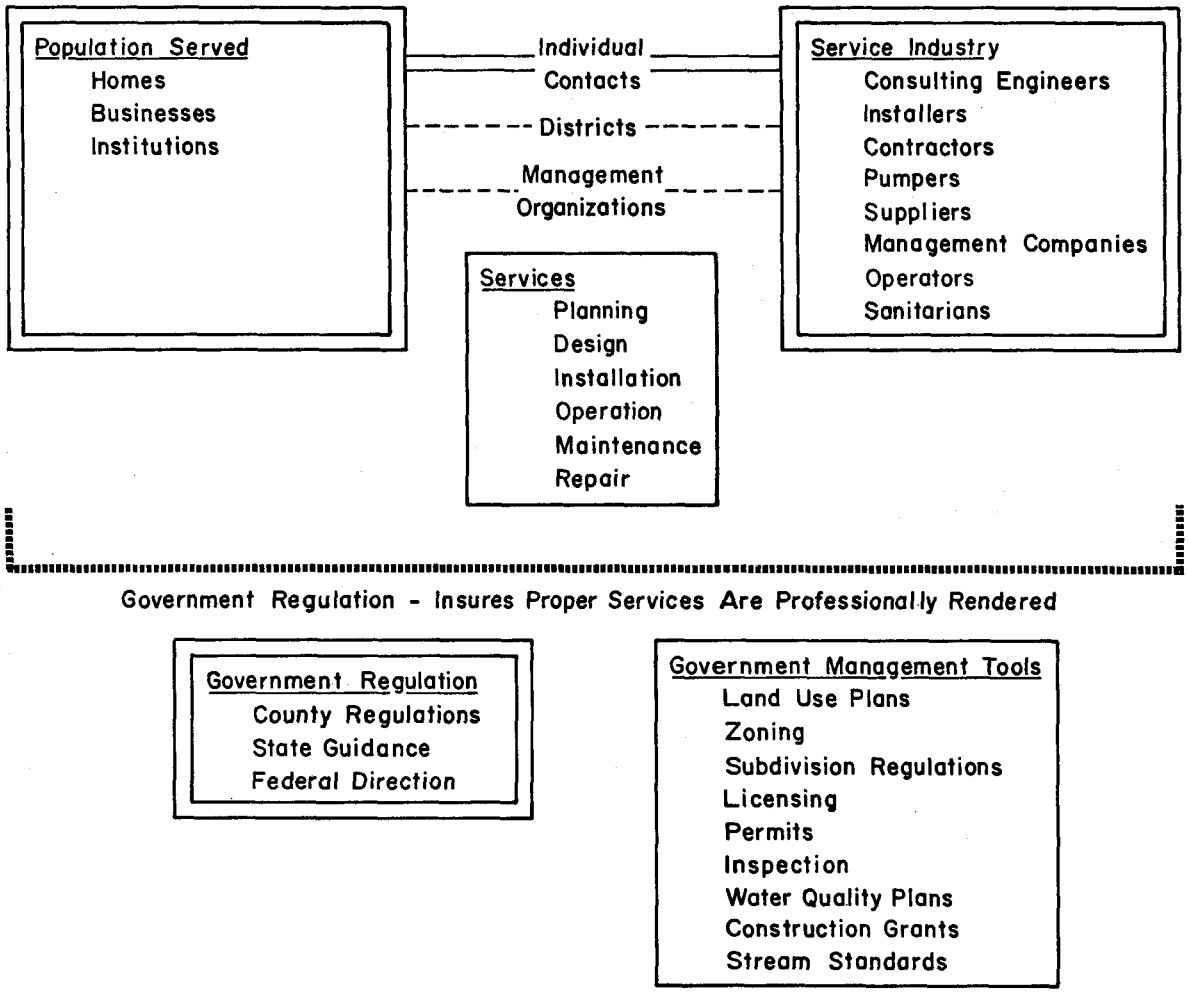

Figure 2. Government regulation of small flows service system.

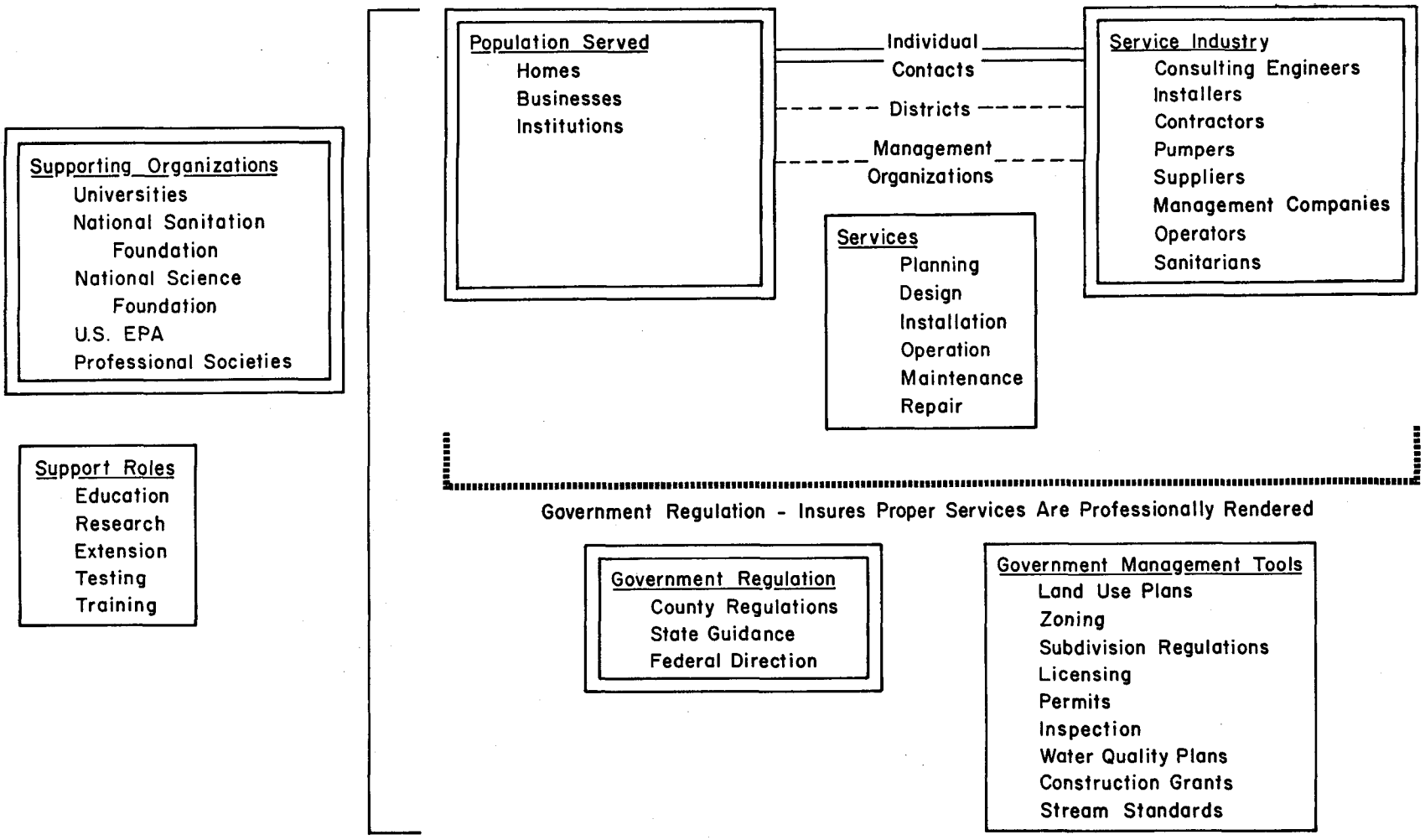

Figure 3. The total small flows service system.

CURRENT COLORADO MANAGEMENT STRATEGY

As noted earlier, the Colorado strategy for managing small flows has evolved over the years and today consists of a state/county cooperative effort centered around an Advisory Committee for Individual Sewage Disposal Systems. This committee prepares guidelines considered the minimum regulations necessary for a county's management effort. The guidelines are updated periodically and counties have the right to develop regulations beyond the minimum. Resources limitations in most counties preclude development of regulations beyond the minimum, however.

The Colorado guidelines cover most aspects of small flows management; however, from a practical viewpoint, the counties are really only involved in design, installation and repair. Operation and maintenance is left to the homeowner. Even though counties have the authority to inspect systems at any time, it is not practical to do this unless a problem has arisen. Figure 4 is a graphic representation of the current management strategy.

A survey of three Colorado communities dependent upon small flows technology revealed that 55 percent of the homeowners did nothing to their system unless it backed up into the house (Dix and Ward, 1978). This lack of ongoing operation and maintenance points out a major weakness of the current strategy, especially if functional failures are common.

Other states are attempting to deal with weaknesses in the management of small flows. These will now be reviewed as a way to provide information on alternatives available to Colorado.

MANAGEMENT STRATEGIES DEVELOPED BY OTHER STATES

There are a number of different management strategies used by states in regulating the planning, design, installation, operation, maintenance and repair of on-site systems. These strategies (policies) have been summarized by the Small Wastewater Flows Clearinghouse (1981). Eight states have the state as the sole permitting authority while thirteen have a local government (e.g., county) as the sole permitting authority. The remainder share the authority between local and state governments or have combinations (i.e., regional offices) provide the service. Most states have a minimum set of rules with which everyone must abide. The alternative on-site systems permitted varies from state to state; however, most states have a means by which alternative systems can be used on a experimental basis.

Leachfield sizing criteria utilize a number of different factors. Seven states utilize the U. S. Public Health Service Manual while 30 use the perc test in combination with some means of estimating flow (e.g., number of bedrooms and "anticipated flow"). Many of these 30 states also require some form of soil evaluation (i.e., soil profile, soil survey, or soil evaluation) in addition to the perc test. Seven states use only soil and site evaluations; they do not utilize the perc test (Small Wastewater Flows Clearinghouse, 1981). The perc test may be a part of a site evaluation, but it is not the sole sizing criteria.

From the above review, it can be seen that several states are trying new approaches to the regulation and management of small flow technology. To get a better picture of these new approaches, several states will be

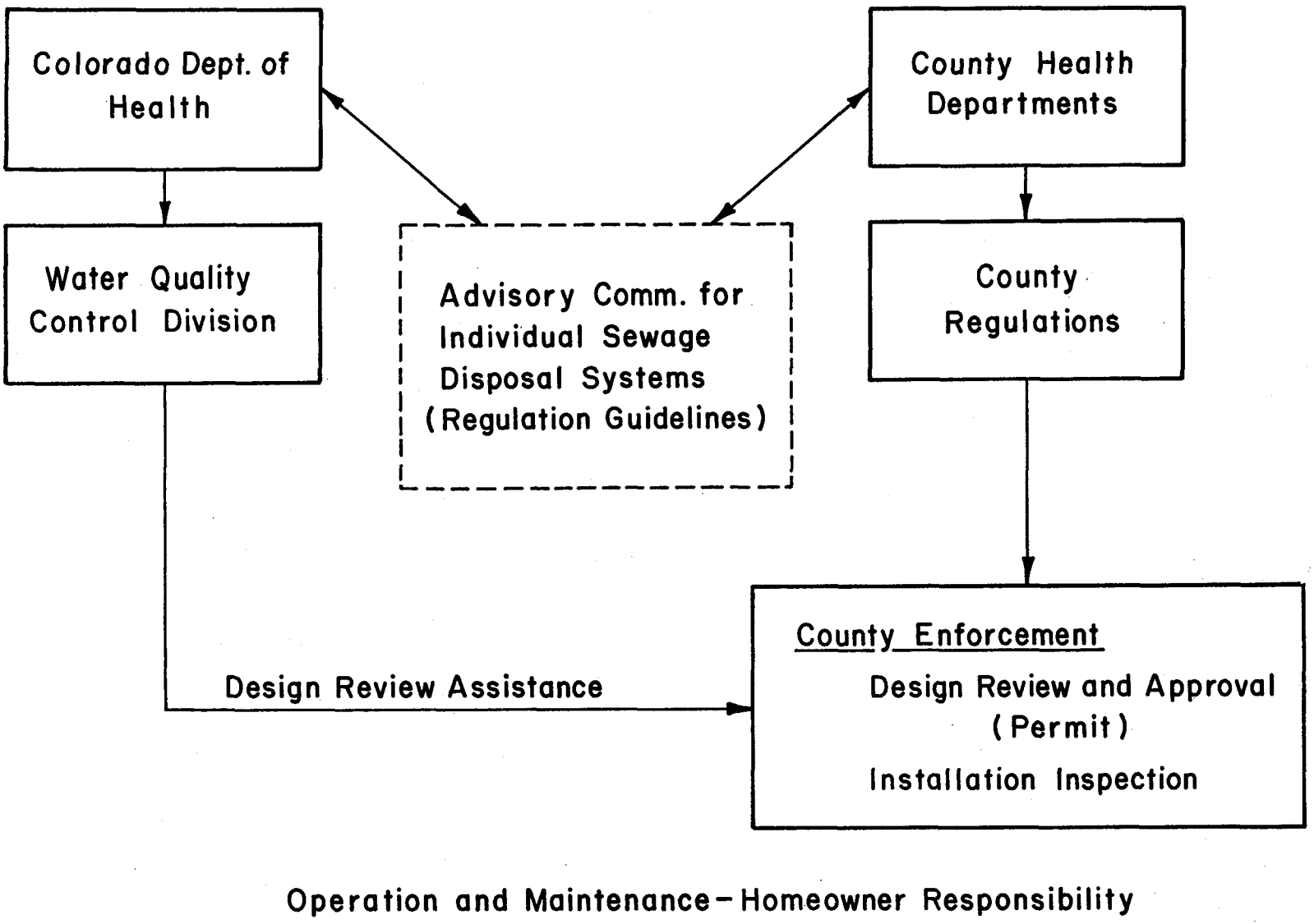

Figure 4. Government management strategy currently employed in Colorado.

reviewed in detail.

New Hampshire

New Hampshire has attempted to improve its management of small flow technology by greatly improving planning for the use of the technology. Any proposed subdivision which requires New Hampshire Water Supply and Pollution Control Commission approval (and there are very few exceptions) must have that approval before improvements are made and before lots can be sold, rented or leased. Approval is dependent upon the applicant demonstrating that every lot is suitable for subsurface disposal. Each lot must be evaluated via a test pit and a more elaborate perc test than normally utilized by most states. For good soils (defined via soil classifications), evaluating every other lot will suffice (Shaw, 1978).

As a result of the above strict subdivision regulations, when subdivision approval is granted, a lot is approved for subsurface disposal of effluents from a septic tank for single-family residence of not more than four bedrooms. The actual design criteria for on-site systems is much like Colorado's. Operation and maintenance are the homeowner's responsibility.

New Hampshire, with a stringent subdivision approval process, eliminates many problems that develop further down the management line when subdivisions are approved without each lot being evaluated--a problem common to many states. The flexibility to deal with the site-specific problems is greatly reduced when lot boundaries are set without consideration for on-site wastewater treatment and disposal. At the planning stage, many, if not most, problems can be eliminated by careful consideration of lot boundaries and acceptable leachfield areas.

Maine

Maine in improving its regulation of on-site systems, has concentrated on strengthening the site evaluation (the design phase of the total management system). This has been accomplished with, basically, two major changes: (1) the application for a proposed on-site system must be completed by a licensed "site evaluator;" and (2) the system feasibility and size is based strictly on soil classification--no perc tests are used. Observation holes (test pits) are used to visually and by "feel" classify soil. The soil's parent material is identified, it is classified texturally, drainage conditions are determined and depth to limiting factors is determined. Disposal area size is then obtained from a chart relating area to the above site conditions.

Site evaluators are licensed by the state. The test to become a site evaluator involves two parts: (1) written-to test familiarity with the regulations; and (2) field--to illustrate proficiency in soil profile description and classification. A text has been prepared to educate those interested in becoming a licensed site evaluator.

Maine implemented the above changes in 1974 and as of August, 1979, had 156 licensed site evaluators. On-site system failure rate prior to 1974 was 30 percent. Site evaluations conducted by licensed site evaluators are spot-checked. Maine feels this is a strong point in their

regulations since soil conditions at a site do not change--if a mistake was made it can readily be identified. With the perc tests, it is almost impossible to check the work of a leachfield designer. Because of the above, site evaluators are reluctant to approve a site with severe restrictions. Contractors and real estate people have come to realize this and site limitations now play a larger role in early land use decisions (Moreau, 1980).

Pennsylvania

Pennsylvania has attempted to strengthen the same part of the total system as Maine; however, they chose to better equip the personnel reviewing the applications as opposed to those who submit them. In Pennsylvania, there are statewide regulations for small flow systems. These regulations are enforced by a local "Sewage Enforcement Officer." Sewage enforcement officers (SEOs) must be certified by the state. The state pays one-half the cost of SEOs. The purpose of certifying SEOs is to provide a high degree of technical competency within local government for administration of the state law. Certification is by exam and tests for two years. The state has an ongoing training program for SEOs.

Soil category and limiting factors at a site play a large role in the feasibility and size of a leachfield. Six perc tests are run after a site has been judged feasible via a test pit.

Sale of lots in Pennsylvania must show on the contract that an on-site system must be used, if this is the case. The buyer must also apply for the permit before signing the contract. Any contract signed without the above is null. No waive of rights on this subject is permitted. As in Colorado, subdivisions are generally reviewed, not each lot. The contract signing regulations are an attempt to ensure each buyer that he/she is aware of the sites limitations, if there are any (Murtha, 1980).

States Emphasizing Local Management Organizations

Beyond the specifics of on-site system design, several states (e.g., California and Illinois) are actively encouraging formations of local community organizations which are to deal with all aspects of managing on-site systems. California has developed, at the state level, a policy ("Action Plan") for alternative wastewater management programs (California State Water Resources Control Board, 1979). This plan consists of six components:

1. Construction grants to assist communities with risk-taking when new technology is tried;

2. Research to develop new alternatives;

3. Demonstration to illustrate applicability of technology in solving wastewater problems for small California communities;

4. Development of guidelines for experimental systems;

5. Public information to create an awareness of alternatives; and

6. Policy development to coordinate above tasks.

Illinois passed a law (Public Act 80-1371) to assist communities in creating "wastewater disposal zones." The zones are areas within which an organized approach is to be taken with regard to wastewater management and specifically deals with on-site and small flows technology. The Illinois EPA is assisting in the implementation of this act by drawing up model ordinances and analyzing the law for potential problems (Beck, 1980). No zones have operating experience in Illinois yet (Leinicke, 1981), while California has a number of operating community management organizations (Wheeler and Bennett, 1979).

ALTERNATIVE MANAGEMENT STRATEGIES

Given the previous discussions, there are two major directions in which Colorado could proceed in improving its management of small wastewater flows. One would involve maintaining the current management structure, but rewriting the state guidelines to include tighter management of all phases of the small flows technology. The second would involve restructuring the Colorado state/county relationship for managing small flows. The major reason for restructuring would be to make better use of the small number of personnel currently dealing with small flows management at all levels of government.

Expanding Guidelines

The current Colorado guidelines, from which counties develop regulations, do not adequately deal with the planning, operation or maintenance phases of the total small flows service system. The guidelines do cover the design, installation and repair phases well. There may be some desire; even here though, to determine if the use of a soil classification system for sizing would be better than the current perc test oriented regulations.

In the planning phase, subdivision regulations in Colorado generally permit the approval of a subdivision with few lots being actually tested for on-site technology, if that is the wastewater technology to be used. Thus, the severe limitations of on-site technology on a particular lot are not known, generally until after a subdivision is approved, lots are sold and the lot owner applies for a permit. At this point, considerable flexibility in dealing with the problem from an areawide viewpoint has been lost. There may be some lots with many acceptable leachfield sites while other lots have none. The overall effect is to greatly increase the cost of wastewater treatment and disposal for the subdivision's residents over what it would have been with proper, early planning as the subdivision was being laid out.

In the operation and maintenance areas, the guidelines need to develop a more active role for regulation than has existed in the past. As noted by Ruiter (1981), the role can occur at many different levels of activity, each with its advantages and disadvantages. To continue to leave these phases of the management effort in the hands of the homeowner means that at least 55 percent of the on-site systems in Colorado are in some stage of failure.

Given the limited resources for small flows technology management available at the state and county level, it may not be feasible for Colorado, in its guidelines, to push for a more active role of counties in planning, operation and maintenance. It may be more realistic to encourage communities to establish their own complete management program covering all aspects of proper management, as California, Illinois and Iowa have done. This has the added advantage of keeping the regulation in the community and funded on a utility basis--wastewater management is another service provided by the community (similar to water supply, electric power service, trash removal, etc.). The only difference between this wastewater service and that of a city would be the absence of a large capital intensive sewer system and central wastewater treatment plant. There would still be central management of the communities' wastewater.

Expansion of the current guidelines to include stronger planning, operation and maintenance of on-site systems can be accomplished by the current Colorado Advisory Committee for Individual Sewage Disposal Systems. As the guidelines are expanded, however, it may be more effective and efficient to also consider a restructuring of Colorado's state/county cooperative approach to small flows technology management.

Restructuring State/County Management

The review of other states' management approaches for small flows technology revealed a wide range of management strategies--from almost complete state control to almost no regulation at any level of government. Within this range of management strategies there are almost an infinite number of alternatives. Invariably there are tradeoffs between efficiency in regulation and local control that must be considered in any restructuring effort.

As a means of illustrating how several of the alternatives could be utilized in Colorado, two examples are given in Figures 5 and 6. These examples come from different ends of the spectrum with the structure in Figure 5 utilizing statewide regulation with county enforcement. This would result in efficient development and enforcement of regulations, but would remove local control of such regulations. It would also ask the counties to support the enforcement of state regulations in much the same way the U. S. EPA asks states to enforce federal regualtions. As with the federal/state connection, financial support by the state of county enforcement may make the strategy in Figure 5 more feasible. This has been the approach used in Pennsylvania.

The central state approach also has the advantage of permitting the development of a well-trained group of people in Colorado dealing with the statewide problem of small flows. The new Small Wastewater Flows Section of the Water Quality Control Division would be a focal point for addressing the problems and coordinating enforcement at the local level. At the local level, the County Small Flows Specialist would receive more state support (training, education materials, technical support, etc.) and, therefore, be better prepared to handle the unique problems that are constantly facing the county sanitarians. The statewide coordination would also permit a more uniform approach to small flows management than has been possible in the past.

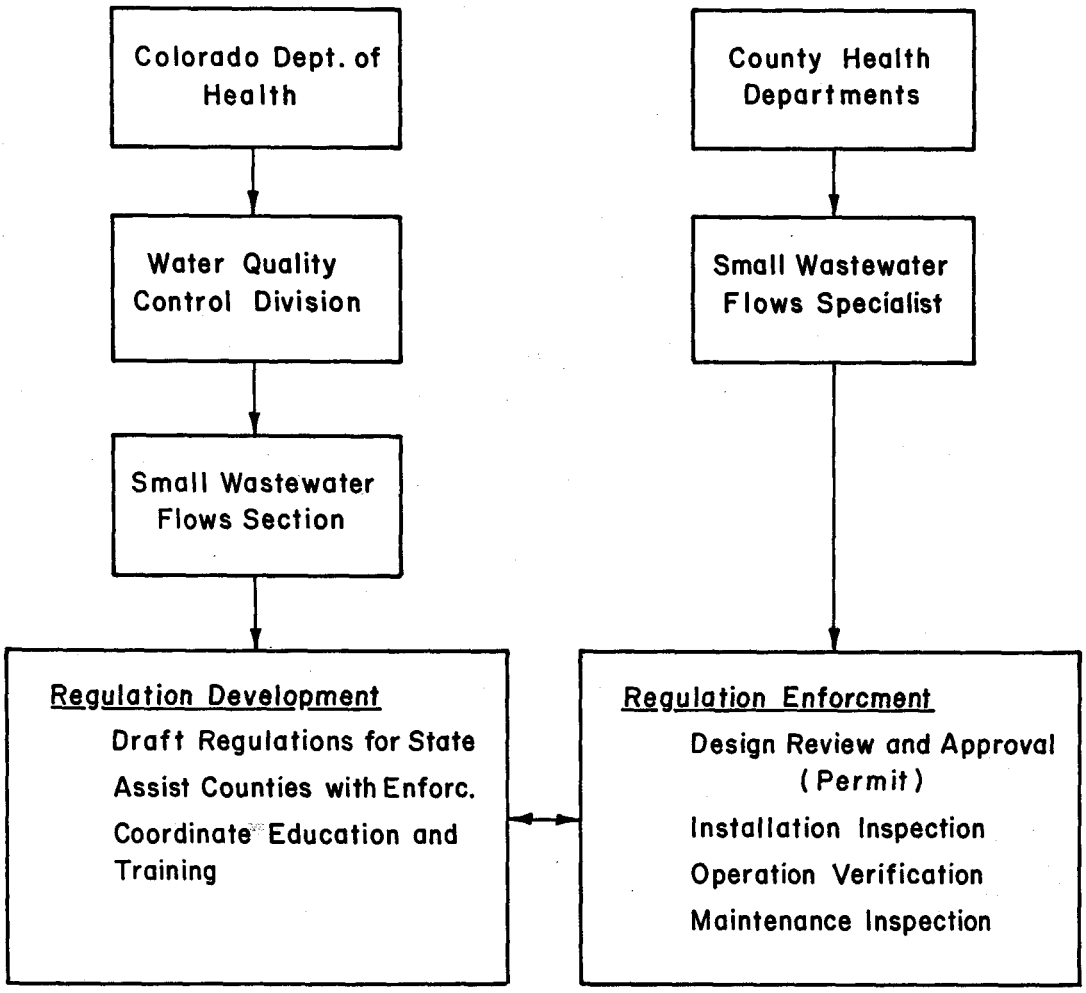

Figure 5. Alternative management strategy--statewide regulation with county enforcement.

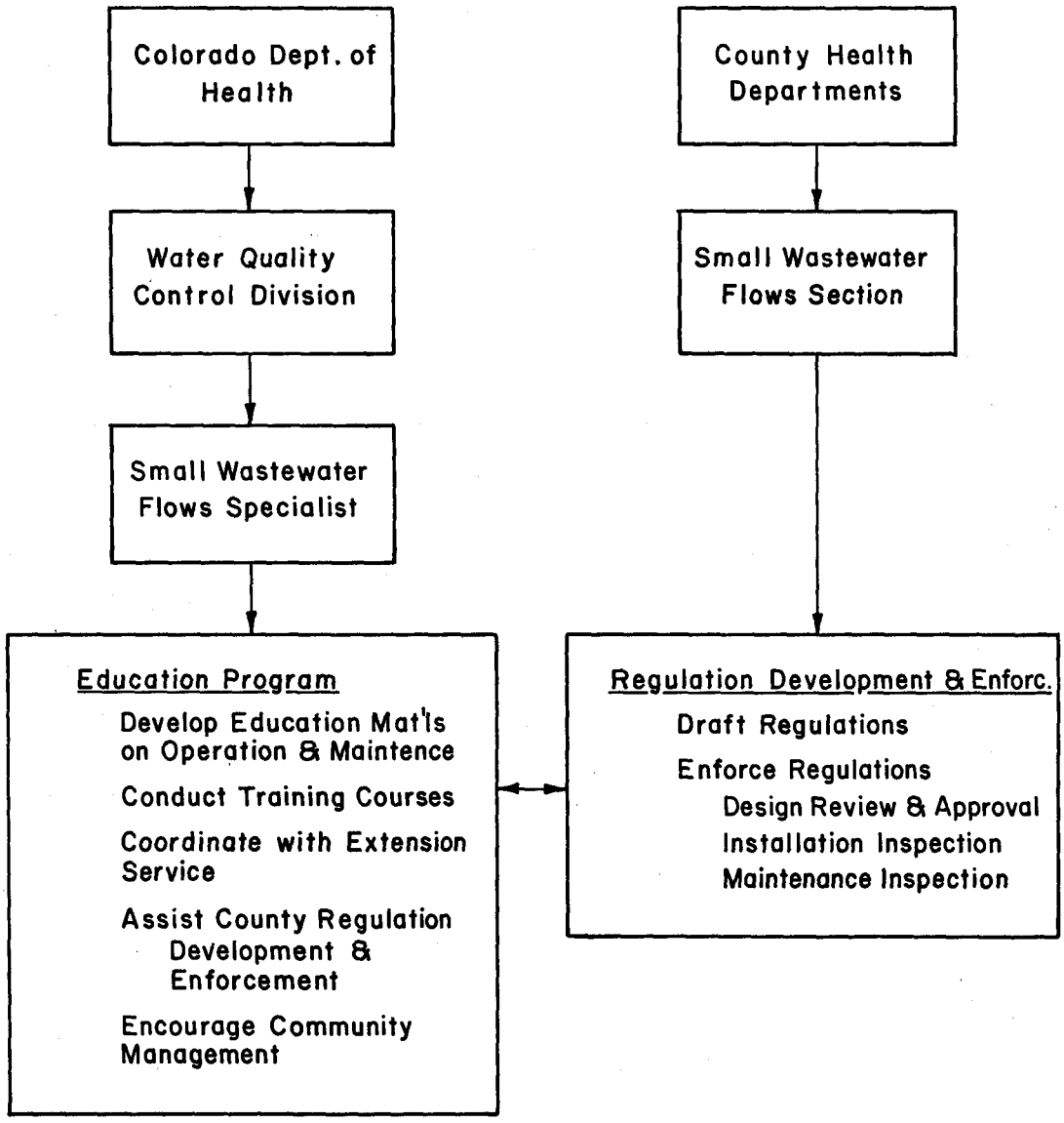

Figure 6. Alternative management strategy--statewide education with county regulations.

The county-centered regulation program, graphically presented in Figure 6, would have each county preparing and enforcing its own regulations. The State Small Flows Specialist would coordinate a statewide education program and, thus, provide the counties with information on regulation development and enforcement. The counties, however, would have the ultimate responsibility.

The advantage of the county-centered management strategy is strong local control. The disadvantage is the duplication of regulation development in all the counties and the lack of uniformity across the state. This approach would also tend to require more personnel at the county level to handle the total effort.

The current Colorado structure for managing small flows may be viewed as being between the above two structures. It provides for state development of guidelines which are then used by counties to develop regulations. Beyond the guidelines, however, the state serves mainly as a reviewer of "engineered" systems. Thus, there is little day-to-day support at the state level for counties attempting to enhance their management of small flows.

SUMMARY AND CONCLUSIONS

The small flow management system has been defined in terms of the groups of people involved and the role of each group in seeing that the proper services are professionally rendered. The management strategies utilized by several states, to regulate small flows, have been reviewed and discussed, in general terms, as to how such approaches may apply to Colorado. Several examples are presented to illustrate the possible alternative management strategies available to Colorado.

Colorado currently has a management system that works well. The changing technology and the increasing need for better maintenance, however, have created a need for Colorado, and its counties, to evaluate their current position. Hopefully, the concepts and information presented in this paper will assist in such an evaluation.

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PANEL DISCUSSION REMARKS

Panel Moderator: Don Niehus

I have been very impressed throughout the entire day with the tremendous variety of activities that are going on in the state of Colorado regarding small alternative wastewater systems. I think Colorado has a great opportunity to do good things here and to be a leader on a national level. It was very useful for the previous speaker to give you a perspective on what other states are doing. These programs can provide models for what the state of Colorado might choose to do in the small flows area. In addition to the states that were mentioned specifically in the paper, there are several other states which are also leaders in this area - primarily North Carolina and New York. As the state of Colorado gets further involved in its SAWS program, officials may want to contact the Small Flows Clearinghouse for information and resource contacts in other states. In addition, the state should seek to creatively use the State/EPA Agreement as a means to expand its SAWS program. The regional office in Denver will want to work very closely with the state in exploring SAWS management functions to outline in the State/EPA agreement what roles the state might want to play.

Each of the speakers has some prepared remarks. Robert Ward's paper, I'm sure, identified some specific issues which we would like to explore further in this session. I believe that three issues are very important. I would ask each of the speakers to please respond to these issues after finishing with his opening remarks. After the opening statements, the audience will be given an opportunity for comments and questions.

The three issues that I would like to throw out to start the discussion are very general. The first is: What should be the role of the state, particularly given the limited resources and other competing responsibilities of the State Department of Health and other state departments? And second: How can the state respond to the specific needs of small communities, particulrly given the potential changes in the federal construction grant program? And third: How can the state assist implementation of management programs, either through the 201 process or outside of the 201 process itself, particularly in regard to some of the very good work that has been done by the 208 agencies in the state? I'm sure I'm speaking on behalf of the regional office, as well as the national EPA office. We feel that the 208 agencies in Colorado have done a remarkable job in working in the small alternative wastewater area. We look forward to seeing their recommendations implemented.

Panel Member: Thomas Bennett (Planner, Water Quality Control Division, Colorado Department of Health)

Thank you. You have heard throughout the day some of the state's roles in ISOS management. Briefly, let me go back over these. There are the ISOS guidelines which the state has developed and turned over to counties for either modification or implementation as they are. We also have the responsibility for certification of mechanical systems,

utilizing data provided to us by independent testing labs. This is something that John Farrow is involved in and can discuss in greater detail. Subdivision review is conducted under Senate Bill 35, whereby the state has the opportunity to review subdivisions that are submitted by county government. This is not for the purpose of making decisions whether or not the development can or cannot or should or should not occur, but for the purpose of identifying potential problems and pointing out concerns to local government for them to utilize in their decision making process. "Identified areas" was mentioned briefly this morning as something that is not utilized very often any more. In areas where soils, groundwater, or geologic conditions identify the areas as having severe limitations for on-site systems, the county can designate areas for review of proposed systems by the water quality control division and commission. This is generally handled at the county level now utilizing their own ISOS regulations and, occassionally, the district engineer for the health department is asked to review the proposal. Finally, 208 and other grant programs are available for management areas for demonstration projects, etc.

As far as the state's role in the future, I think it will be guided by the limitations in staff and funding and the preference of local government and individuals who prefer the state remain in a role of providing technical assistance (i.e.: be there to answer questions, to provide review functions, but not take on any sort of role where the state becomes the decision-maker with regard to local growth and development). I think the state can also begin to utilize some of the information generated from the research and demonstration projects that we have heard about today to make recommendations to local government and, perhaps, guide some of the funding requests into areas where they can solve existing problems without overcomplicating the issue, such as building a central collection and treatment facility which the community can't afford to build, much less maintain. I think that the state will be directed in the area of being a source of technical expertise to make recommendations and guidance to local decision makers. Thank you.

Panel Member: John Farrow (Public Health Engineer, Water Quality Control Division, Colorado Department of Health)

Today was the first time that I have been aware of the Advisory Committee that is supposed to give direction to the State Health Department regarding changes that are required to be made in the guidelines that we adopt from time to time. The last guidelines were adopted in May of 1971 and it probably is time to start reevaluating some of the more recent advances in technology for disposal of sewage on individual lots. For instance, as you are probably aware, Colorado has a four foot limitation to groundwater or bedrock, whereas more recent studies have shown that this is far more conservative than is necessary. Perhaps it is time to reevaluate that. As Mr. Boulanger pointed out, the ten foot minimum to property lines are probably really an artificial constraint on system installation. Some other problems have developed, particularly with the evapotranspiration systems, that we need to completely

rethink what we want to do on that type of system.

What I see as the role of the state in individual sewage disposal systems is probably, due to constraints on budget and staff, that we will be strictly acting on an advisory basis, adopting guidelines, and allowing the counties to continue the enforcement of either these guidelines, which are adopted by default, or to adopt more stringent regulations where it really becomes necessary. Again, perhaps our regulations or guidelines should address not only the points they do address, the design and installation, but also point out some of the things that need to be addressed, the operation, maintenance, and repair of individual systems. Thank you.

Panel Member: Geoff Withers (Grants Coordinator, Colorado Department of Local Affairs)

As I was introduced, I work in the Department of Local Affairs. I heard last week, in the Republican House Caucus, the Department of Local Affairs referred to as a catchall for every agency they don't know where else to put. In that department, there are a number of divisions. I work in the Division of Local Government. There are a number of statutory responsibilities to local units of government and to state government - very few regulatory duties. We do administer a few small grant programs which the State of Colorado has got that assist mostly in water and sewage. Since that is what we are talking about today, I won't define any of the other things that we do. Statutorily we are required to deal with local units of government. So, if an individual homeowner has a problem with a septic tank, for example, we can't help him much. He can fill out an application and send it in for assistance, but we couldn't really accept that application unless it was submitted on behalf of an individual by a local unit of government. For example, counties more and more are seeing their responsibilities to all the unincorporated communities in their boundaries. Therefore, an unincorporated community which is not a special district or a homeowner's association could seek some sort of grant assistance through their county government. In fact, we have funded a number of preliminary sewer studies on behalf of the unincorporated communities by the county.

Briefly, the sewer programs that we have are:

1) a predesign engineering study grant program for communities of under 5,000 population (and again they have to be local units of government which we define as a special district, town, city or county). They cannot be homeowner's association like Farmer's Home might fund, and other federal agencies that will fund grants to small, or lower units of government. We do fund these preliminary studies which are like Step 1 in the 201 process.

2) The State administers through the Water Quality Control Division a Construction Grants Program which consists of the design (Step 2) and Construction (Step 3) of a particular project. The applications for those Steps 2 and 3 are submitted to our department, although the program is really administered by the Health Department. We determine the financial need and certify

that need before they can qualify for a grant.

3) The third program that we have in this regard is an emergency water and sewer grant fund which is also available to local units of government. Again they have to be special districts, towns, or counties. As a result of our involvement in the three programs, we don't really have a lot of contact with people who have septic problems unless there is a high failure rate, a sewer study is called for, and the study determines that they actually need to construct some sort of central collection system. Up to now, as far as I know, the state has not funded anything but central collection and treatment systems, as far as construction goes. We have studied problems that exist in places where no such system exists (i.e. where septic tanks are prevalent) but they haven't gone beyond the preliminary stages as far as I know.

What should the role of the state be? I think that we can eliminate barriers that exist, barriers which keep people from going ahead with a management agency approach to septic tanks or cluster systems. Mr. Boulanger earlier said that relatively few barriers exist in Colorado State Government, so perhaps we have been successful in that regard. I don't know, but would hope so!

How can the state respond to local needs? I think that perhaps we could be more proactive instead of reactive. That is, try to anticipate things before they become emergencies. Up until now we have tried, at least in the department I work in, to respond to local needs and, wherever a need exists or is identified (i.e. the squeaky wheel theory) we try to solve it rather than anticipate it. We do try to help them with some technical assistance in solving the problem. Perhaps we could be more proactive in our activity, but it is the only way we could be more responsive to local needs.

Panel Member: Steven Dix (Director, EPA Small Wastewater Flows Clearing House Technical Services)

I am going to be speaking more from a perspective of looking into a number of other states around the country and what they are doing. The State of Indiana is addressing these questions right now and their legislature has come up with $450,000 to get answers to these questions and is giving them to Purdue to do research and development on innovative and alternative systems, defining procedures for implementing new regulation, defining those regulations, and promoting small wastewater flows.

I think central to the issue of what the states should do is training and developing expertise on the subject. Minnesota is a good example of that. Their whole approach is to educate and then the system will be reformed. They also believe there it should be on a voluntary basis, and not shoved down people's throats. In that state they have regulations which cover systems only around water bodies, lakes and streams. The state has mandatory regulation for that similar to our regulations in Colorado. In the outlining areas of the county, the counties can do anything they want. To support this approach, Minnesota has a very active Extension program which

carries out workshops and collects information from the local areas while they are doing the workshops. They get feedback and revise the regulations or recommendations almost on an annual basis. They have found that local counties will adopt these regulations voluntarily - 80 or 90 percent have for the areas outside these critical areas around lakes and streams. So education, I think, is a very important part the State needs to emphasize.

Along with that, I think that there is a need for a small flows central coordinator or somebody who is a specialist on the staff who plays an active role. I don't think that this should be somebody who is assigned those responsibilities. You should not take one of the district engineers and say, "OK, now you're the small flows coordinator". They need to go out and find somebody with experience who understands the technology, has personal interest in it, and is willing to not only work with the professional engineers, district engineers, but who is also willing to work with the educational workshops and Extension Service. So I think one person with specific responsibilities at the state level is definitely required.

Another part that could be worked through with the workshops, like Minnesota, is certification of participants in the workshops. This, again, is on a voluntary basis in Minnesota, but it has proven to be quite effective in retraining professional engineers, which is a major need in the state. We have a few professional engineers here today, very few, and I think that it shows you that there are a lot of professional engineers who are not really interested in small flows. There needs to be an expansion of their knowledge and this is also borne out by Indiana. They are retraining their engineers and also certifying local Health Department people and district engineers. I think that is a very important aspect of it. It doesn't have to be required; I think it should be there and certification would be an exam where they really have to know what they are doing. It could expand out what Robert was referring to and follow the New Hampshire or Maine procedures where they have field lab work.

This gets back to another point we never got to. The clearing house is offering four workshops this summer. Two will be held in Philadelphia the middle of July. One will be held in Denver the first week of August; one will be held in San Francisco. These workshops will be similar to the design manual with the addition of problems and solutions. It will require feedback from the different individuals who participate in these workshops. We are working on getting a full soils lab to go with each workshop. This would help the people who come to these workshops learn how to identify soils and moisture content and some other basic information they need to know. These workshops are focused towards engineers and professors at universities (which, we found, is a major obstacle, since the engineers coming out of schools don't have any training on on-site systems). So this is the professor's workshop aimed at retraining professors at the university so they can pass on this information. The professor's workshop is the one that is going to be in Denver. So there are some limitations on those who can participate. There is a limit to the number that can participate and they will be selected. So people must apply to the workshop and then they will be notified whether they will be allowed to attend or not.

The other workshops in Philadelphia and San Francisco are pretty much open to consulting engineers and other people and it has a much higher capacity.

I'll go through a couple of other points without too much explanation. I think you need to get some local training manuals developed similar to EPA manuals. EPA manual is not the final say in everything. It is a good reference and a good beginning point, but there is a lot of research that is not in there. There are some other manuals around the states that cover some subjects better. So you should develop you own training manual. I think the state coordinator, I mentioned, could do that.

You need to develop procedures for developing new regulations. The advisory committee may be one form of doing that but I think you should reevaluate whether it is really effective in accomplishing what needs to be done. Perhaps the workshops could provide additional input. I also think you need more demonstration projects like what we heard about in Pueblo. The state would fund these and pass the information on. They can identify certain needs, perhaps in pressure sewers, mounds, small diameter effluent sewers, and collect information nationally. Also, perhaps, they could do a demonstration project in some area of need. This could be carried out as part of the 201 grant work. Lastly, I think, in addressing the Sanitarians who are here today, there needs to be more emphasis on self training or review of literature and giving people time to really upgrade their understanding about certain subjects. I know in my experience with the Health Department there is no time or encouragement to really improve one's knowledge. Perhaps, if there were a requirement to read a new paper once a month and report to everybody and get self training within within the Health Department, you might advance your knowledge of certain subjects.

GENERAL DISCUSSION

Comment

In response to Steve's recommendations for more demonstration projects, I think this would be a very valuable thing to do. The information from just one demonstration project, utilizing one method for dealing with the problem, is not sufficient. I think we do need to look at some of the other possibilities, pressure sewers and other means of collection. We run into problems in our state funding programs and funding regulations with regard to small flows. Some of the major costs involved in a program, such as the one undertaken in Pueblo, are particularly oriented towards the homeowner and where you are dealing with a project where people are participating on a voluntary basis, it is hard to come along and say, "Hey, we would like you to participate in this project. We are going to have some grant money and we will pay for some design work, for the pumping

and testing equipment. All it is going to cost you is to locate your septic tank, dig it up, install the riser, pay to have it pumped and repair any failures or damage to the system." And right off your response is going to be," when I flush and it doesn't go on the floor it must be working right. I don't need all of these additional expenses for your demonstration project." Some of these other alternatives such as the pressure system which are more capital intensive with more construction costs of publicly owned facilities involved, it would be less expense to the individual homeowner. So there are some constraints built into the grants program that we are dealing with that tend to make some systems more or less attractive either in the alternative technologies or in the standard collection and treatment system.

Question:

Being a consulting engineer and having worked with some small wastewater flow technology for years, I find myself wondering if the state has any interest in or means for gathering data on existing systems which have utilized some effective techniques for management over the years that could be refined or, continued to be watched, over the next period of time to help us in determining new metholologies? Does such organization exist at the state level?

Answer:

To the best of my knowledge there are no means of collecting information on existing systems. We have numerous manuals that tell you what the various alternative techniques are - how they operate, but I have not seen any information that has said, "OK, here is a system, this is what it costs to put in - these are the problems that have been identified in working with this particular system - this is how well it works." No, I don't know of any.

Comment:

It seem if the information flowed in directions it would be very helpful. It is nice to get it poured on you from the top, but it is also nice to feed it back up.

Narrator:

It would be helpful if there were some systems for us to gather this data from. Maybe there are and I am not aware of their existence. But, yes, this is something that really forms the basis for making a recommendation to a community - particularly a small community that can't afford either from a cost or flow standpoint - cannot afford the standard collection and treatment system. You can throw them the cookbook and say, "Here are all these different systems, take one," but without some basis for making a recommendation or being able to say here are the problems associated with these different systems, it is hard to say what you are going to be looking at as far as ongoing costs. Problems have been

identified with existing systems but we don't have, to the best of my knowledge, any way to capture that knowledge. We do need it.

Comment:

It seems to me you might be able to put out some sort of a call to either consulting engineers or to county planning and health departments, and might be able to get some of that kind of information. Maybe we need a Colorado clearing house like the one Steve is working on. I think you might be surprised at what information you could get back from the public sector.

Comment:

Last year the Department of Local Affairs formed a certain ad hoc committee to try to identify all the statewide water and sewer need in the whole state. We use some basic data like that in 208 plans which exist statewide. Of course there wasn't any handy data base for the water systems. We use all the data and tried to compile a set of criteria into which every system would fit - ranging from Category A: being the most immediate - people who had an obvious problem they had to fix quickly; Category B: these were less serious problems or problems that were emerging which they would have to deal with or plan for; and Category C: the people who had no obvious needs, no high population impact or anything. We developed these criteria and then tried to collect data statewide like the sewer category from the 208 plans in which some did identify failing septic systems and similar small community systems. It didn't tend to identify particularly good ones so in that way it is also a reactive kind of a system. We did compile all this data in a statewide list, sent it out to every possible level for review that we could think of. A lot of people have responded with changes in the information. It is becoming a fairly good source of information for problems that exist statewide. I'm not sure that's what you are talking about. You were talking more about people who are obviously demonstrating a good solution to a bad problem. It may be possible that we could use the same kind of a mechanism for something like that.

Comment:

In the area of small wastewater flows you are going to have to get most of the data base for good things, it seems to me, from a private sector because the Sanitarian only hears of it when it is a problem, generally speaking.

Narrator:

That is difficult to do.

Comment:

Yes. What I am suggesting is that you might appeal to the private

sector for some of that kind of information.

Narrator:

How would you suggest we appeal to the private sector?

Comment:

Possibly through some of the Civil Engineers Associations, Consulting Engineers Council, Home Builders Association, etc., I don't know exactly.

Comment:

I think that is a good idea but as far as actual operation, I think there needs to be some quality control.

Comment:

Maybe you can develop a questionnaire that you send back to the guy who volunteers to help.

Comment:

I think there is a lot of information that's already available nationally that could help you design or develop new systems here. I'm talking more about pressure sewer systems and a lot of this information is available from the manufacturers of these products. I will give you a quick statistic on pressure sewers. There are 35 pressure sewer systems going in around the country right now. You have one in Region VIII and that was the one he talked about, I believe, in South Dakota. Some of the regions are very active. Arkansas, and some of these states, have got a lot of these things going on. The reason I know about them is because they are at the 201 level and I'm sure there are many more systems at the private level that are not identified. For example, here in Colorado would be the pressure sewer system that utility engineering has built. Those systems are not known nationally. You can collect data from them, if you needed it, very easily. The other technology, small diameter effluent sewers, there are ten of those going in around in the country. Backup sewer: only one. Those are just a collection alternatives. So the demonstration aspects would be valuable to train local Sanitarians and local officials, but need not be restricted just to Colorado. You might send some people for additional training.

Question:

Could you describe the requirements for the Local Affairs grant program?

Comment:

The sewer study program to which I referred earlier in our depart-

ment administers has much fewer requirements or red tape than EPA 201 Step 1 does. It is much easier for an entity to qualify, for example, for under 5,000 population only, but it is easy, to get small projects for a study to determine feasibility and evaluate different alternatives. It is not as restrictive, I don't think, or as expensive usually with our requirements to do such a study. I would encourage you to find out about that. I can make information available to you about our program.

Comment:

I worked with Jeff on that program and it is as simple an application as I have seen. Basically, you fill out your name, the name of the community, and a few basic bits of information on location. As long as the Health Department or some other agency is really supporting it and there is documented problem, it goes through immediately. You do have to have some organized entity that takes responsibility for carryiny out the feasibility study. Larimer County did get involved in one of those projects because there was no way out. Larimer County assumed the organizational responsibilities for a subdivision that had failing systems. So if the local government is willing to take on those responsibilities, they can access the funds that Jeff has very easily.

APPENDIX

I. Followup Comments from Terry Trembly

II. List of Participants

Appendix I.

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June 3, 1981

Dr. Robert Ward
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Colorado State University
Fort Collins, Colorado 80523

Dear Robert:

It has taken me a while to get around to writing this letter. I hope it finds you well and swiftly recovering from your recent surgery. I would like to take this opportunity to congratulate you on a well-organized conference on Home Sewage Disposal in Colorado on May 6. Please extend my regards to Norm Evans and Ralph Hansen who did an excellent job in filling in for you.

It is workshops like these which, in my opinion, help to gain the attention of State and federal water pollution and public health officials for small system issues. As a case in point, Gary Broetzman, I believe, is beginning to take a closer look at the problems created by the proliferation of small wastewater systems throughout the State, and that concern is being translated into Water Quality Control Commission policy. The rapid energy growth on the Western Slope and the urban sprawl along the Front Range have created a development environment conducive to individual and small (less than 1 MGD) wastewater systems. There has historically been little concern over the adequacy and longevity of these systems after their initial installation. We are just now seeing the results of our mistakes from ten years ago. The State Health Department enforcement actions and grant requests for small system replacements are staggering.

My positive comments on your conference cannot be made without also expressing some constructive criticism for future conferences and potential research needs. I hope you find them useful. Throughout the conference I was looking for a discussion of the replacement problems and cost considerations of failing systems and the institutional and financial mechanisms available to deal with these issues. To my dismay, there was no discussion on them which, for many systems, are far more important than a simple O & M program. This is particularly true in the areas of new, unproven technology such as Pure Cycle, small package plants, and rural on-site communities with failing septic tanks.

The research being performed by Jim Englehardt, under your supervision, is a good start in the evaluation of technical management of small flow systems. However, I believe there are several areas where that work can and should be expanded to be useful. Four general areas which I believe need to be addressed

are: 1) severity of system failure (water pollution and public health); 2) frequency of system failure or need for replacement; 3) cost of system replacement by component; and 4) limits of detection for system failure.

Another area which I believe could use some clarification was the availability and efficiency of State and Federal grant programs for small systems. There appeared to be a tone of optimism among the participants in regard to the availability of grant funds for small systems. This is not the case in Colorado. Quite simply, no EPA funds have been available to Colorado for small systems. The likelihood of this improving are next to nil, because of severe cuts to the federal budget. I doubt that the State grant program looks much better in spite of Broetzman's comments to the contrary.

I personally deplore the idea of committing grant money to subsidize the errors of developers. This is an indirect development cost that never gets properly counted.

On a per capita basis, the potential costs of a wastewater system to serve a rural subdivision are much higher than that for a larger municipal type system. In some cases, this ratio is greater than two to one.

Further, the costs of arranging for and processing a grant request for these areas are general costs passed on to local government (i.e., County Planning, County Health, State Health, the consulting engineer, attorney, etc.), which are paid for from the County general fund or from the grant, if awarded. In my mind, partial capital replacement should be an up-front cost for small systems just as it is for municipalities and many special districts. It should be a part of the general fee structure along with O & M of the system. There are various alternative institutional structures to deal with this situation. However, to my knowledge, none have been clearly articulated and carefully evaluated in Colorado.

I would like to ask that you consider these constructive comments in your future research and conference topics. If you would like a clarification on these brief comments, I would be glad to discuss them with you at your leisure.

Very truly yours,

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Water Resources Projects Manager

TLT:pdo

HOME SEWAGE DISPOSAL IN COLORADO WORKSHOP

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