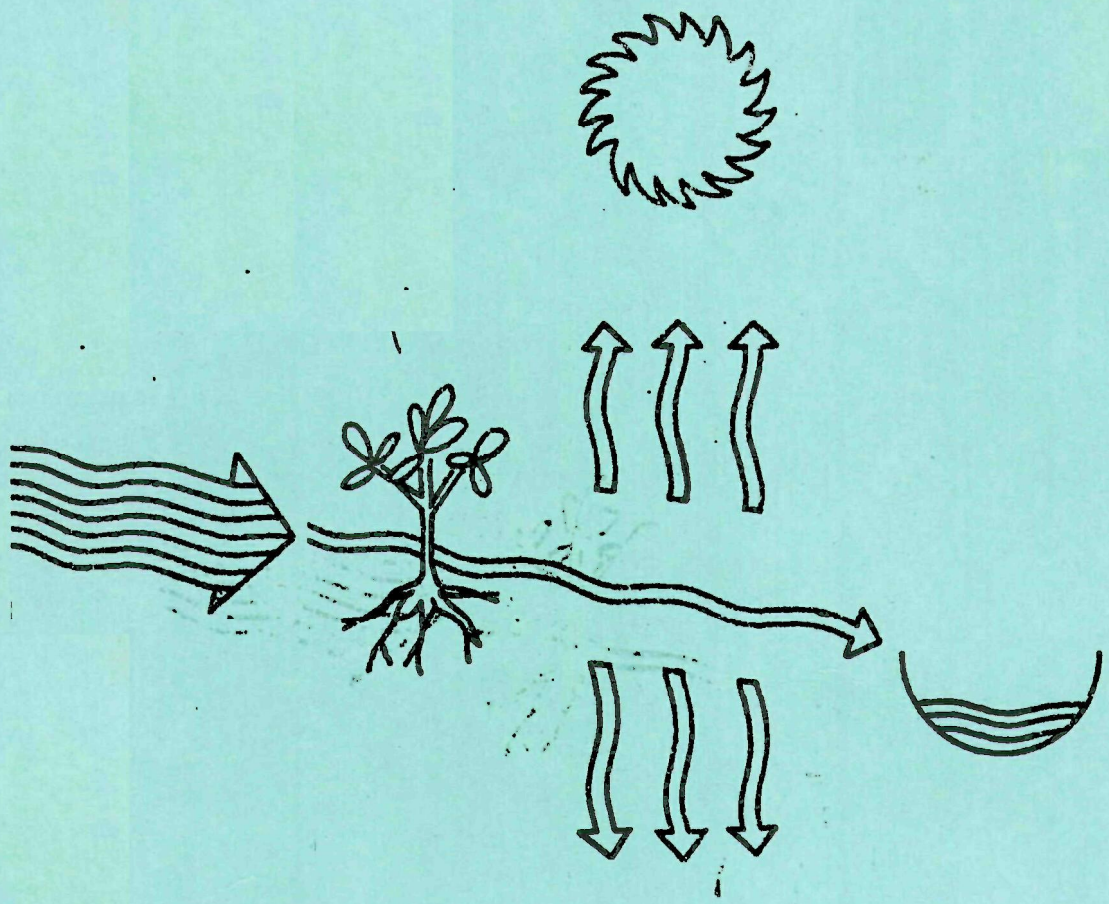
# National Seminar on Overland Flow Technology for Municipal Wastewater

September 16, 17 and 18, 1980
Dallas, Texas



EPA U.S. Environmental Protection Agency

Robert S. Kerr
Environmental Research Laboratory

Office of Water Programs Operations

Center for Environmental
Research Information

# NATIONAL SEMINAR ON OVERLAND FLOW TECHNOLOGY FOR MUNICIPAL WASTEWATER

September 16, 17 and 18, 1980

SEMINAR SPONSORS

Dr. Curtis Harlin
Robert S. Kerr Environmental Research Lab

Mr. Dick Thomas
EPA Construction Grants Program

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National Seminar on
Overland Flow Technology for
Municipal Wastewater

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# Agenda

TUESDAY, SEPTEMBER 16, 1980

*8:00 a.m.* *REGISTRATION*

*SESSION 1*

Introduction and Overview

*9:00 a.m.* *WELCOMING ADDRESS*

Mr. Myron O. Knudson
Director of Water Division
Region VI
Dallas, TX

*9:15 a.m.* *OVERVIEW*

Dr. Curtis Harlin
Robert S. Kerr Environmental Research Lab
Ada, OK

*9:30 a.m.* *POLICY AND GUIDANCE - FEDERAL SUMMARY*

Mr. Dick Thomas
EPA Construction Grants Program
Washington, DC

*10:00 a.m.* *COFFEE BREAK*

*10:30 a.m.* *POLICY AND GUIDANCE - STATE SUMMARY*

Mr. Jon Dyer
Environmental Technology Consultants, Inc.
Springfield, VA

*11:00 a.m.* *PANEL DISCUSSION WITH STATE AGENCY REPRESENTATIVES*

*12:00 Noon* *LUNCH*

# Agenda

TUESDAY (continued)

*SESSION 2*

Research and Development

Moderator - Mr. Ancil A. Jones
EPA Region VI
Dallas, TX

*1:30 p.m.* *ADA, OK*

Mr. Bert E. Bledsoe
Robert S. Kerr Environmental Research Lab
Ada, OK

*2:00 p.m.* *UTICA, MS*

Mr. Robert E. Peters
Waterways Experiment Station
Vicksburg, MS

*2:30 p.m.* *PAULS VALLEY, OK*

Dr. Charles H. Lawrence
University of Oklahoma, Health Sciences Center
Oklahoma City, OK

*3:00 p.m.* *COFFEE BREAK*

*3:30 p.m.* *DAVIS, CA*

Dr. Robert G. Smith
University of California
Davis, CA

*4:00 p.m.* *EASLEY, SC*

Dr. A. Ray Abernathy
Clemson University
Clemson, SC

*4:30 p.m.* *DISCUSSION*

*5:00 p.m.* *RECESS*

# Agenda

WEDNESDAY, SEPTEMBER 17, 1980

*SESSION 3*

Process/Removal Mechanisms

Moderator - Mr. Richard Duty
Robert S. Kerr Environmental Research Lab
Ada, OK

*9:00 a.m.* *INTRODUCTION*

Mr. Richard Duty

*9:30 a.m.* *ORGANICS*

Mr. John Bouzoun
U.S. Army Cold Regions Research and Engineering Lab
Hanover, NH

*10:00 a.m.* *HEALTH ASPECTS*

Dr. O. M. Aly
Technological Resources, Inc.
Camden, NJ

*10:30 a.m.* *COFFEE BREAK*

*11:00 a.m.* *NUTRIENTS*

Dr. William H. Patrick, Jr.
Louisiana State University
Baton Rouge, LA

*11:30 a.m.* *SUSPENDED SOLIDS*

Dr. Lloyd Ketchum, Jr.
University of Notre Dame
Notre Dame, IN

*12:00 Noon* *LUNCH*

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WEDNESDAY, (continued)

*SESSION 4*

Case Histories

Moderator - Mr. Dick Thomas

*1:30 p.m.* *SHAFTER, CA*

Mr. Richard W. Corneille
Metcalf & Eddy, Inc.
San Bernardino, CA

*2:00 p.m.* *KENBRIDGE, VA*

Mr. Donald Deemer
Technological Resources, Inc.
Camden, NJ

*2:30 p.m.* *DISCUSSION*

*3:00 p.m.* *COFFEE BREAK*

*3:30 p.m.* *VINTON, LA*

Dr. Kelly Peil
Roy F. Weston, Inc.
Houston, TX

*4:00 p.m.* *HEAVENER, OK*

Mr. Jimmie M. Alford
Alford Engineering Company
Hot Springs, AR

*4:30 p.m.* *DISCUSSION*

*5:00 p.m.* *RECESS*

*5:30 p.m.* *SOCIAL HOUR - Cash Bar*

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THURSDAY, SEPTEMBER 18, 1980

| | |
|---|---|
| | *SESSION 5* |
| | Design |
| | Moderator - Mr. Dick Thomas |
| *9:00 a.m.* | *DESIGN EXAMPLE* |
| | Mr. Donald Deemer |
| *10:30 a.m.* | *COFFEE BREAK* |
| *11:00 a.m.* | *SUMMARY AND CLOSING REMARKS* |
| | Dr. Curtis Harlin |
| | Mr. Dick Thomas |
| *12:00 Noon* | *ADJOURN* |

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# Abstracts

EPA POLICY AND GUIDANCE ON OVERLAND FLOW

Richard E. Thomas, Municipal Construction Division
U.S. Environmental Protection Agency

Overland flow is a developing alternative technology in the context of policies, regulations, and guidance for the Federal Construction Grants Program administered by the Environmental Protection Agency (EPA). Its use is encouraged in the policy statement issued in October 1977, placing strong emphasis on the need to give full consideration to land treatment during the planning of facilities receiving construction grant funding.

Consideration of overland flow in facility planning presents specific and rather unique circumstances because it is a developing technology and there is limited operational experience. The EPA has adopted a position of flexibility for case-by-case determinations and recognizes that most overland flow projects meet the criteria for being designated as innovative. This approach fosters the adoption of innovative and alternative technology concurrently with development of expertise and guidance at the State and local levels. EPA has issued general guidance on preapplication treatment and system designs as it becomes available. The Agency will continue to provide additional technical information as it becomes available. The Agency will also provide technical assistance on the planning and design of specific projects until there is sufficient operational experience to provide a firm basis for routine use of overland flow technology.

POLICY AND GUIDELINES - STATE SUMMARY

Jon C. Dyer, President
Environmental Technology Consultants, Inc.

Land treatment of municipal wastewater is a reliable and proven technology that has come back into serious consideration in recent years. Although most states have regulations and guidelines addressing land treatment, overland flow technology is mentioned in only sixteen. However, some of these sixteen states have only draft regulations and guidelines that are not yet adopted as law (although they are used by the state agencies).

Overland flow technology is being recognized for the first time in many of these states. There is a positive correlation between states that have existing or planned overland flow systems and those that have regulations and guidelines. Many states appear unaware of, unconcerned for, or misinformed about overland flow technology as a viable and potentially cost-effective wastewater treatment alternative.

Political and geographic differences strongly influence each state's position. Soil type is the most important geographic influence while water rights considerations are the most important political problem. The states that recognize overland flow as a viable alternative generally have set forth guidelines addressing buffer zones, slopes, pretreatment, site conditions, etc.

Public health and protection of surface waters are of major concern. A comparison of state requirements and technical concerns reveals the different emphasis in state policy. Many state regulations need to be revised in light of utilizing this alternative technology. Use of overland flow technology can be beneficial to local and state pollution control strategies.

DEVELOPMENTAL RESEARCH FOR OVERLAND FLOW TECHNOLOGY

Bert E. Bledsoe, Research Chemist
Robert S. Kerr Environmental Research Laboratory, U.S. Environmental Protection Agency

A chronological description of overland flow development technology conducted by the Robert S. Kerr Environmental Research Laboratory is presented. The data accumulated are from pilot-scale field activities. Raw, primary, and secondary domestic wastewaters have been applied. A brief review of published data is reported but emphasis is on the most recently acquired data.

The initial study demonstrated the feasibility of treating raw domestic wastewater by overland flow. The removal efficiencies were determined for most classical wastewater parameters with varying hydraulic loading. The relatively low phosphorus removal was the basis for a continuation study for enhanced phosphorus removal by chemical addition of aluminum sulfate. The pretreatment studies include three levels of preapplication treatment and two loading rates for both primary and secondary treated wastewaters.

Cumulative relative frequency distribution plots of effluent concentrations for total suspended solids, total organic carbon, total phosphorus, ammoniacal, nitrate, and total Kjeldahl nitrogen are discussed for the different application rates and degrees of pretreatment. Nutrient removal with respect to horizontal distance or contact time is presented for varying hydraulic loading and preapplication treatment. Data presented will support the hypothesis of biochemical transformations of nitrogen with nitrification in the upper and denitrification in the lower portions of the treatment plots. The following additional topics will be discussed: the nitrate flush from initial start of application cycle; seasonal variation of selected parameters; effect of rainfall during application and drying cycles; and preliminary data on the effect of application cycle with a constant hydraulic load.

OVERLAND FLOW TREATMENT OF MUNICIPAL LAGOON EFFLUENT

C. R. Lee, Soil Scientist
R. E. Peters, Agricultural Engineer
Environmental Laboratory, U. S. Army Engineer Waterways Experiment Station

Overland flow treatment of a municipal lagoon effluent has been studied for four years at Utica, Mississippi. A research facility was established in 1975 under the joint sponsorship of the U. S. Army Corps of Engineers and the U. S. Environmental Protection Agency. The facility consists of 24 research plots, 8 plots each on slopes of 2, 4, and 8%. Each plot is 4.5 m wide with a slope length of 45 m. The experimental layout enabled duplication of four different modes of operation on each slope for a comprehensive evaluation of overland flow treatment of wastewater.

Factors evaluated were wastewater application rate (0.071 to 0.847 cm/hr), period (6, 18, 24 hr), and frequency (5 or 7 days/week); slope; crop management; removal efficiency of biochemical oxygen demand, suspended solids, algae, nitrogen, phosphorus, heavy metals, and coliforms; and effects of storm events. Results of three years of data collection will be discussed.

MUNICIPAL WASTEWATER TREATMENT BY OVERLAND FLOW AT PAULS VALLEY, OKLAHOMA

Charles H. Lawrence, Professor
University of Oklahoma Health Sciences Center
Department of Environmental Health

This study assessed, on a seasonal basis, (a) the treatment of raw municipal wastewater by rotating boom, fixed riser, and trough methods of application on overland flow modules constructed on 2 and 3 percent slopes, (b) the treatment of wastewater stabilization pond effluent utilizing the fixed riser and trough methods of application also on plots having 2 and 3 percent slopes, and (c) the treatment achieved by overland flow compared to a wastewater stabilization pond receiving the same wastewater.

The research protocol also involved the determination and comparison of (a) the bacterial and viral components of the wastewater before and after application to the overland flow plots, (b) the airborne bacteria upwind and downwind of the rotating boom applicators, and (c) the composition of the soil before and after wastewater application.

The raw overland flow treatment system achieved, under summer and winter operation, BOD and suspended solids levels comparable to those of mechanical secondary treatment; however, fecal coliform analyses indicated reductions of less than one order of magnitude. No meaningful phosphorus reductions were observed especially during the summer when most plots produced increases in effluent phosphorus concentrations. The nitrogen balance indicated organic nitrogen reductions of approximately 50 percent for both seasons with ammonia removals being about the same for the winter but somewhat higher for the summer. No appreciable changes in nitrate concentrations were observed. Of those tested, no single method of application, slope, or combination thereof was found to be consistently superior.

The viral assay revealed that the plots were able to effect 100 percent reductions except during peak summer loadings. Airborne bacteria were isolated in significantly greater quantities downwind of the rotating boom; however, no airborne viruses were isolated from the same locations.

The limited soil analyses conducted indicated an increase in calcium and copper and a decrease in phosphate and potassium in the surface soil samples.

Overland flow provided only limited benefits for the treatment of wastewater stabilization effluent. Neither overland flow nor the wastewater stabilization pond demonstrated a superior overall performance for the treatment of raw domestic wastewater.

DEVELOPMENT OF A RATIONAL BASIS FOR THE DESIGN AND OPERATION OF THE OVERLAND FLOW PROCESS

Robert G. Smith, Associate Development Engineer
Department of Civil Engineering, University of California, Davis

The Department of Civil Engineering at the University of California at Davis is conducting an overland flow research project under the sponsorship of the State of California Water Resources Control Board. The principal objectives of the research are to define the design and operating parameters that govern the treatment performance of the overland flow process and to develop a functional relationship between the governing parameters and treatment performance that can be used as a rational basis for design and operation of the overland flow systems.

The project is being conducted in two phases. Phase I involves pilot studies conducted indoors, using three 6 by 1.5-m overland flow beds. Phase II involves full-scale field studies conducted at a 9.3-hectare facility that is part of a 73-hectare overland flow facility operated by the city of Davis. Phase I pilot studies have been completed. Phase II facilities are under construction and research is scheduled to begin in the fall of 1980.

The principal findings from Phase I are:

1. Removal efficiency (E) of organic material from municipal primary effluent by overland flow is:

   a. independent of slope grade in the range of 2 to 6 percent;
   b. independent of hydraulic loading rate in the range of 2 to 11.7 cm/day, based on 30 m of slope length;
   c. governed only by the application rate per unit width of slope (q) and the slope length (z) and can be described as a function of these two parameters by a predictive model of the following form:

$$E = [1 - A \exp (- \frac{Kz}{q^n})] \, 100$$

   where A, K, and n are empirical coefficients.

2. The predictive model described above can be used as a rational basis for computing the total area required for an overland flow system that will achieve a specified organic removal efficiency.

3. Continuous application of primary effluent for a period of 3 weeks does not affect organic removal efficiency, but damage to the cover crop at the top of the slope begins to occur due to solids deposition.

THE EASLEY, SOUTH CAROLINA OVERLAND FLOW PROJECT

A. Ray Abernathy, Professor of Environmental Systems Engineering
Environmental Systems Engineering Dept., Clemson University

An overland flow treatment facility has been designed and constructed at Easley, South Carolina, to treat 75,000 gpd of oxidation pond effluent and 25,000 gpd of raw domestic sewage. Separate pumping and distribution systems were installed for each wastewater, and multiple plots were constructed so that various combinations of wastewater flow rate and wastewater application frequency could be studied. The system has been in operation for 18 months.

Removals of $BOD_5$, organic carbon, suspended solids, and compounds of nitrogen and phosphorus were measured as functions of flow rate and application schedule. Hydraulic recovery was measured to allow computation of removals on a mass flow rate basis. Samples were collected at intervals down the plots in order to relate removals to the distance of movement over the plot.

Results indicate that effluent quality for both types of wastewater is comparable to conventional activated sludge systems with respect to $BOD_5$ and suspended solids. Removals of compounds of nitrogen and phosphorus have been greater than would be expected from conventional sewage treatment systems. Hydraulic recoveries have been variable, depending on season, climatic conditions, and antecedent precipitation. On a mass flow rate basis the removals observed have been significantly greater than those of typical secondary treatment systems.

Limited data on viable microbial aerosols and ground water quality in test wells fail to show evidence of serious environmental degradation. There have been no problems with foul odors or public complaints.

REMOVAL OF ORGANICS BY OVERLAND FLOW

C. James Martel, Environmental Engineer
U.S. Army Cold Regions Research and Engineering Laboratory

Many studies have shown that overland flow systems can effectively remove organics from municipal wastewater. Typically, runoff concentrations of BOD are 10 mg/l or less. The mechanisms responsible for organic removal are sedimentation, filtration and biochemical oxidation. Sedimentation and filtration remove the particulate fraction and biochemical oxidation removes the soluble fraction.

Studies conducted at the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL) indicated that removal of BOD can be described by a first-order equation. The reaction rate constant for this equation was 0.03 $min.^{-1}$ An average detention time of 60 minutes was needed to attain 90% BOD removal.

Trace organic removal can also be described by first-order kinetics. The reaction rate constants were higher for trace organics removal than BOD removal. For example, chloroform had an average rate constant of 0.053 $min.^{-1}$ Volatilization appears to be the primary mechanism responsible for removal.

An empirical equation was developed at USACRREL which relates application rate to detention time and overland flow site characteristics. This equation was validated using data from the Utica Ms. and the University of California at Davis overland flow systems. The average difference between measured and predicted detention time values was found not significant at the 95% level. This equation can be used in design to predict the application rate needed to achieve the desired degree of organic removal.

HEALTH ASPECTS - OVERLAND FLOW SYSTEMS

Osman M. Aly, Director-Technical Services
Technological Resources, Inc.

The major public health concerns that usually arise in connection with land treatment of municipal wastewaters include the potential of occupational or environmental exposure to microbial pathogens, biological or chemical contamination of groundwater supplies, or contamination of food crops or livestock feed. Because of the nature of overland flow treatment systems, many of these health risks are minimized or completely eliminated.

Overland flow systems are designed for soils rich in clay content with low permeability or soils with impermeable barriers and, therefore, the potential of groundwater contamination is very limited or almost improbable. Because of the high hydraulic application rates, these systems are not suitable for the production of food crops for human consumption and, therefore, this health risk factor is nonexistent. Overland flow systems are also designed for the biological treatment of wastewater as it flows over the soil surface and a final discharge of the treated effluent to a receiving water body is required. Therefore, the relative health risks associated with these systems should be evaluated against the same yardsticks or criteria applied to other conventional biological treatment systems.

An overview of the processes and mechanisms involved in the removal of microbial and chemical contamination in overland flow systems is presented together with a discussion of mitigation measures that can be taken for minimizing potential health risks.

NITROGEN AND PHOSPHORUS REMOVAL PROCESSES IN OVERLAND FLOW TREATMENT SYSTEMS FOR MUNICIPAL WASTEWATER

William H. Patrick, Jr., Boyd Professor
Rashid A. Khalid, Associate Professor
Laboratory for Wetland Soils and Sediments, Center for Wetland Resources
Louisiana State University, Baton Rouge, LA 70803

Most municipal wastewaters contain significant concentrations of nutrients, primarily nitrogen and phosphorus, and can be serious pollutants if discharged to surface waters. Research studies conducted in the United States and elsewhere in the past decade indicate overland flow to be an effective treatment system for removal of nitrogen from municipal wastewater while phosphorus removal efficiency has been found to vary over a wide range. The nutrients' removal efficiency in the overland flow system is influenced by physical, chemical, biological and environmental factors which must be carefully considered in designing a treatment facility. This presentation will focus on the mechanisms of various nitrogen and phosphorus removal processes during overland flow application of wastewater and the factors that limit these processes.

Nitrogen removal is attributed to gaseous nitrogen losses through denitrification reactions, plant uptake by the established vegetation, and under alkaline conditions, to ammonia volatilization losses. The results of studies conducted in this laboratory and elsewhere suggest that the gaseous loss of applied nitrogen can be maximized during overland flow application of wastewater containing ammonium nitrogen if conditions favorable for simultaneous nitrification-denitrification reactions are attained. Some of the important factors that control these reactions are redox potential, pH, energy source, and microbial populations. The contribution of various mechanisms involved in the overall nitrogen removal is presented.

Phosphorus removal from the wastewater during overland treatment is attained through sorption by the soil complex and uptake by the growing plants. Extensive research has been conducted on the mechanisms and kinetics of phosphorus sorption which include adsorption and precipitation reactions. The capacity of a soil to sorb phosphorus depends primarily on the concentration of iron, aluminum, and calcium compounds in the soil which react with wastewater phosphorus. However, a number of physicochemical parameters including soil pH, redox potential and time of reaction significantly affect the equilibrium between solution- and solid-phase phosphorus and hence determine the magnitude of phosphorus removed from wastewater. The role of these physicochemical parameters in enhancing phosphorus removal in the overland flow treatment system is discussed in this presentation.

# EFFECTS OF SUSPENDED SOLIDS ON OVERLAND FLOW DESIGN AND OPERATION

Lloyd H. Ketchum, Jr., Associate Professor of Civil Engineering
University of Notre Dame

Biochemical Oxygen Demand (BOD) loadings, nutrient loadings and hydraulic loadings usually have been used to establish design requirements for overland flow treatment systems. Design considerations for suspended solids have been limited to loadings the same as used for BOD, dealt with by allowing greater hydraulic loadings if greater pretreatment was provided or more-or-less have been ignored. Poor suspended solids reduction during operation often resulted. Those periods of poor suspended solids reduction often have been of short duration and with substantially higher effluent suspended solids concentrations than ordinarily observed.

This paper summarizes operating experiences observed at a number of sites and attempts to develop relationships between operating conditions which resulted in poor suspended solids removal. Those comparisons from site to site make some relationships more obvious than when limited to single site observations. Based on those observations, modifications in design approaches are recommended to improve effectiveness and consistency of suspended solids reductions in overland flow treatment.

Some of the factors considered are effects of rainfall, effects of pretreatment, types of soil, wastewater application techniques, and special emphasis is given to algae in the effluent. Also, the origin of effluent suspended solids is considered. The question which must be answered for more effective design and operation is: are effluent suspended solids a portion of the influent suspended solids, soil particles, grass fragments, algae from the influent or generated on the plot, bacterial cell fragments, or other particles generated on the plot?

# OVERLAND FLOW TREATMENT: A CASE HISTORY AT SHAFTER, CALIFORNIA

Charles E. Pound, Vice President
Richard W. Corneille, Project Manager
Metcalf & Eddy, Inc.

An overland flow treatment system followed by irrigation of city-owned crop lands is the recommended solution to wastewater management problems at Shafter, California. This method of treatment was found to be the most cost effective of the five other alternatives selected for competitive evaluation. The facilities plan is still under review by the California State Water Resources Control Board and no immediate acceptance of the plan is expected.

The purpose of this paper is to present the preliminary design considerations that went into the selection of the overland flow process as the best apparent alternative. In addition, this paper is intended to illustrate the difficulties that may be encountered in obtaining approval for an alternative technology that is relatively new and untried in the region. Two problem areas may exist in gaining approval. First, the governing board may be reluctant to gamble with the community's funds on an unknown and untried area of technology. Second, the reviewing or funding agency may be reluctant to approve a plan which might cast a shadow on their record of project success. Such problems support the need for Section 202 (a)(3) of Public Law 95-217 which is intended to guarantee results and assure regulatory authorities that innovative and alternative technologies will not become "white elephants."

CASE HISTORY - KENBRIDGE, VIRGINIA

D. Donald Deemer, Director-Project Development
Technological Resources, Inc.

The Town of Kenbridge, Virginia, is a small community with a population of less than 2,000, located in the Piedmont region of southeastern Virginia, approximately 75 miles southwest of Richmond. In 1976, a Step 1 Facilities Plan was developed for the town, the purpose of which was to determine the most cost-effective method for improving the town's wastewater treatment capabilities to conform with the proposed stream discharge requirements.

The Facilities Plan recommended abandoning an existing wastewater treatment system and building a new aerated lagoon system. However, due to a combination of factors, the Facilities Plan had still not received approval by the end of 1979. At this point, the community asked for and received permission to develop an Addendum to the original Facilities Plan to more fully evaluate the feasibility of utilizing some type of land application process instead of the aerated lagoon system.

The additional land treatment evaluation determined that the overland flow process was best suited for the available site conditions and that it would be more cost-effective than the originally proposed alternative. The next step, prior to applying for Step 2 funding, was to establish a conceptual system design to satisfy the requirements of the Virginia State Water Control Board and the Department of Health. Since the overland flow process is not universally understood as yet and since there are no existing overland flow projects in Virginia, this particular stage has involved a great deal of discussion between the consultant and the regulatory agencies.

OVERLAND FLOW SYSTEM: VINTON, LOUISIANA CASE STUDY

Kelly M. Peil, Ph.D., P.E., Project Manager
Roy F. Weston, Inc.

The Town of Vinton, Louisiana, with a population of 4,000, is located in the Southwest coastal section of the State. The Town outgrew their 20 year old trickling filter plant and entered the Construction Grants Program in April 1977. The work completed to date includes: infiltration/inflow analysis, sewer system evaluation survey, specifications for rehabilitation, environmental assessment and facility plan. The selected treatment alternative was a 1.0 mgd overland flow system. The land application system was compared to alternatives consisting of: plant renovation and expansion, a new mechanical plant and a 3-cell lagoon system.

The preliminary design of the system will be discussed. However, since the treatment system is not in operation, this case study will emphasize the Step One portion of the Construction Grants program and transition from Step 1 to Steps 2 and 3. The Vinton project is one of the early land application projects in the Region VI EPA and presentation of some of the problems in this project may assist others in expediting their projects. Special emphasis will be made on the public concern over the health effects and nuisance of a land application system and the solution utilized to overcome these public concerns. The current status of the project and the next steps will be presented to conclude the case study.

OVERLAND FLOW SYSTEM APPLICATION AT HEAVENER, OKLAHOMA, FOR TREATMENT OF DOMESTIC WASTEWATER

Jimmie M. Alford, Consulting Sanitary Engineer
Hot Springs, Arkansas (Associate Project Engineer)

A unique combination of geological, hydrological, and economic circumstances permitted overland flow to be a cost-effective treatment alternative at Heavener, Oklahoma, a small community of 3,000 in southeast LeFlore County in the Ouachita Foothills.

Water quality criteria for the receiving stream is no more stringent than secondary treatment, but the municipal waste stream enters the Poteau River above the source for the municipal water supply. Public concern was generated, which caused a search for better-than-ordinary treatment processes and more efficient removal mechanisms.

The efficiency of soil removal mechanisms toward toxic chemicals, infectious biological agents, and other pollutant substances caused considerable interest in land application systems. Geological and hydrological conditions prevented the use of low-rate and high-rate systems or total containment. The results of facilities planning indicate the need for 90 acre feet of storage and up to 60 acres of application site. The proximity of a naturally occurring site having ideal length, width, and cross slopes added to the cost-effectiveness. Operational costs appear lower than other biological and mechanical alternatives. The proposed system is ready for final detailed design upon EPA approval of project documents.

Details are presented covering hydraulic and biological design criteria for pretreatment processes and the overland flow system. Operational costs, techniques, and control considerations are included.

DESIGN EXAMPLE FOR OVERLAND FLOW

D. Donald Deemer, Director-Project Development
Technological Resources, Inc.

The design of an overland flow land treatment system requires an interdisciplinary approach which involves knowledge of not only engineering principles but also experience in the areas of soils, hydrogeology, and agronomy. The purpose of this design example will be to outline a rational approach to the design of an overland flow treatment system and to set forth the various guidelines which should be followed during the design stage.

The problem originates with a need for upgrading the wastewater treatment facility for a small, rural community. An existing treatment system is evaluated for use as preapplication treatment. Due to design flows in excess of the existing plant capacity, the existing system cannot be used and a new preapplication treatment system must be designed.

The design of the overland flow system begins with a review of the stream discharge requirements and a preliminary investigation of the potential land treatment site. This is generally sufficient to establish whether the overland flow concept should be used. The next stage of the design involves the determination of loading rates, storage, and land area required. Having established this, the details of site development can be resolved. Finally, the method and details of the wastewater distribution system can be determined along with the type of cover crop to be used and the types of monitoring systems required.

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