LAND APPLICATION OF WASTEWATER SYSTEMS IN AUSTRALIA

A Report of Foreign Trip

DECEMBER 1974

U.S. ENVIRONMENTAL PROTECTION AGENCY
Municipal Construction Division
Office of Water Program Operations
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ABBREVIATIONS

Board	-	MMBW-Melbourne and Metropolitan Board of Works
BOD	-	biochemical oxygen demand
cm	-	centimeter
COD	-	chemical oxygen demand
Farm	-	Werribee Farm soil treatment system of MMBW
in.	-	inch
MMBW	-	Melbourne and Metropolitan Board of Works
N	-	nitrogen
mgd	-	million gallons per day
mg/L	-	milligrams per litter
ppm	-	parts per million
P	-	phosphorus
SS	-	suspended solids

TERMS

Conventional secondary treatment - Reduction of pollutant concentrations in wastewater by physical, chemical or biological means.

Crop irrigation - Application on land of water to meet the growth needs of plants.

Evapotranspiration - The unit amount of water used on a given area in transpiration, building of plant tissue, and evaporated from adjacent soil, snow, or intercepted precipitation in any specified time.

Grass filtration - Same as overland flow.

Land application or Land Treatment - The discharge of wastewater onto the soil for treatment, reuse or crop irrigation.

Overland flow - Wastewater treatment by grass filtration, flooding or spray-runoff, in which wastewater is applied onto gently sloping, relatively impermeable soil which has been planted to vegetation. Biological oxidation occurs as the wastewater flows over the ground and makes contact with the biota in the vegetative litter.

Raw sewage - Untreated wastewater.

Secondary treatment - Something more than primary treatment, usually treatment by physical, chemical, or biological means such as trickling filters, activated sludge, or chemical precipitation and filtration. Sometimes called mechanical treatment.

CONVERSIONS

Acre feet - million gallons (US) x 3.06 (Imperial) x 2.55
Currency exchange - A$ = Australian dollars
A$1.00 = US$1.35
US$1.00 = A$0.74

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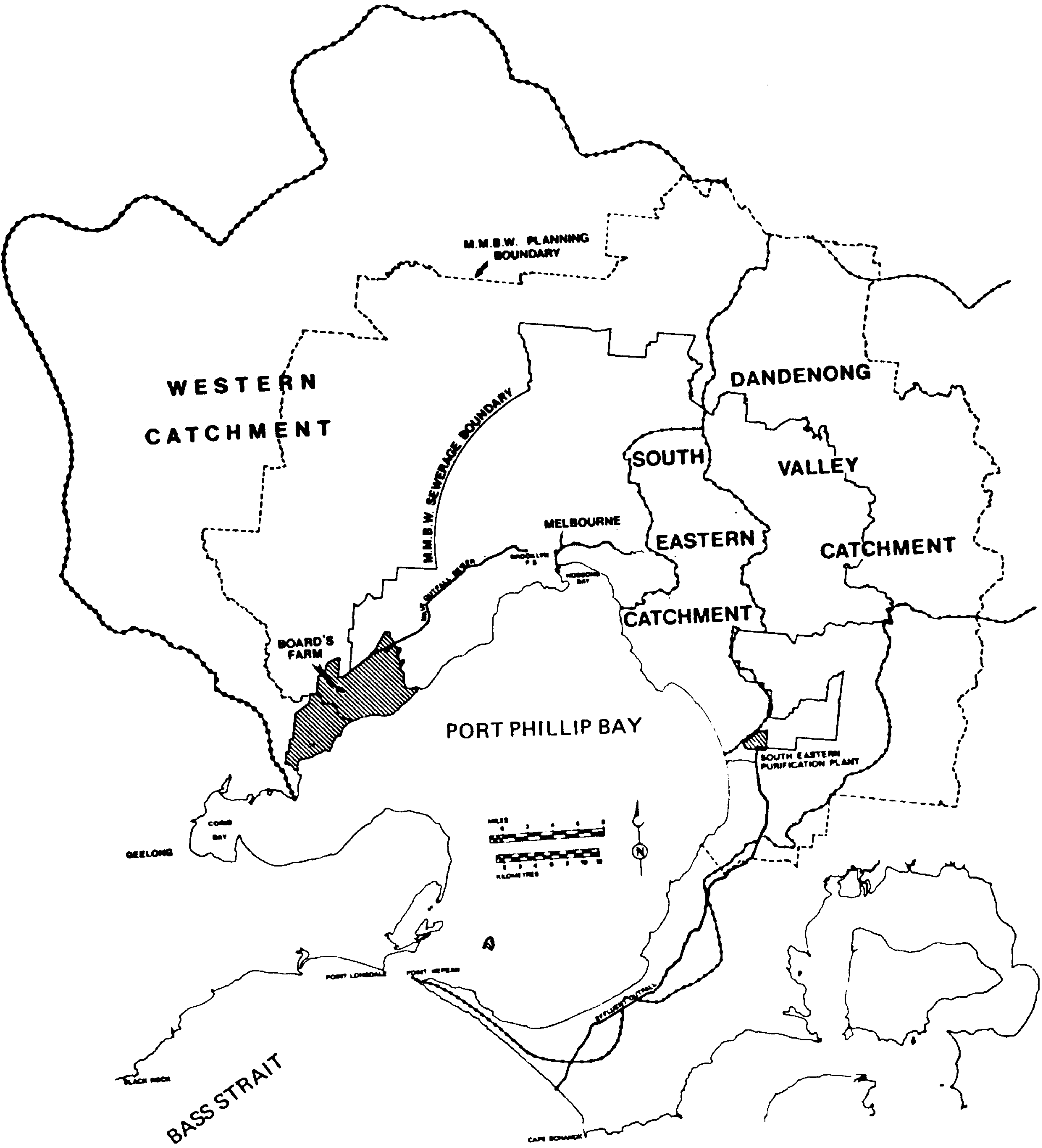
LAND APPLICATION OF WASTEWATER SYSTEMS IN AUSTRALIA

ABSTRACT

This is a report of the soil treatment system in Australia operated by the Melbourne and Metropolitan Board of Works (MMBW) since 1897 and of some six smaller land treatment systems in the State of Victoria. The Melbourne system, located at Werribee in the State of Victoria, is currently handling an average daily hydraulic load of 150 mgd (US). The annual percapita cost for the fiscal year ending June 1974 was US $1.53 for operating the Werribee Farm. However, as the populations of Melbourne and Geelong increase, and the urban areas extend outward toward the Werribee Farm, obtaining additional land use adjacent to Werribee has not been possible. As a consequence, MMBW is constructing conventional mechanical secondary treatment works and plans to transfer some of the hydraulic load from the Werribee Farm to the new South East Mechanical System. In spite of this, however, by 1980 the Board estimates that the pollutant loading will return to the maximum that the Werribee Farm can handle. Speculation, caused by the building of conventional mechanical treatment works, has led to reports in the United States that the Board plans to discontinue the land treatment system. The Board has stated in the most positive terms that it intends to operate its soil treatment system indefinitely to the limits of its capacity. This report is the result of site visits and interviews in Australia by Belford L. Seabrook, Office of Water Program Operations, during the period between October 15, 1974 and November 3, 1974.



MELBOURNE AND METROPOLITAN AREA

CONCLUSIONS

With some modifications, most of the conclusions in the report (of which I was the Project Officer) entitled, "Survey of Facilities Using Land Application of Wastewater", July 1973, EPA-430/9-73-006, can be applied to the Melbourne system and to the other systems I visited

1. Land application of wastewaters from community and industrial processing sources is practiced successfully and extensively in Australia.

2. The MMBW Werribee Farm uses raw sewage, as do some other land treatment systems; but in other projects various degrees of municipal sewage treatment are practiced prior to land application. Most prior treatment is primary treatment in which suspended solids, grit and oils are removed.

3. Under proper conditions, land application of wastewater is a workable alternative to advanced or tertiary treatment of municipal wastes.

4. Land application of wastewaters is practiced for several specific reasons. Among the major reasons are: to provide for supplemental irrigation water; the desirability of augmenting groundwater sources; excessive distances to suitable bodies of receiving waters; extraordinary cost to construct facilities to reach suitable disposal sites.

5. Land application of wastewaters can be considered as a part of a water reuse cycle. Emphasis should be placed on wastewater utilization, reuse and renovation.

6. Except for the Werribee Farm, present land application facilities generally are not "stressing" the system. Many smaller facilities were found to be using effluent on a crop-need basis.

7. Small communities and food processing industries will probably continue to be the principal users of land treatment of effuents for the near future. Melbourne is the exception for size with a mean daily flow of 150 mgd.

8. A variety of beneficial uses are being made of wastewater effluents. Although the Werribee Farm uses all of its effluents for the production of grass on which livestock is fed, a variety of beneficial uses is being made of wastewater in many smaller Australian communities.

9. A large variety of potential opportunities for land application of wastewater exist in many communities.

10. Successful operation of a land application system requires the inputs from a variety of disciplines. For many systems, the services of a geologist and environmental engineer are required. For systems designed to augment the indigenous crop water requirements by supplemental irrigation, the advice and guidance of an agronomist and soils specialist will be needed. For larger systems, social and behavioral scientists, as well as medical-health personnel, may be required to assist in evaluating and securing acceptance of this alternative means of utilization.

11. Operation of land application facilities can be accomplished without creating a nuisance or downgrading the adjacent environment. The site visits indicated that a majority of the facilities were operated by well-trained personnel, aware of the need for careful operation of the systems.

12. Environmental analysis of the effects of land application facilities reflects a general improvement of the environment rather than impairment of the indigenous ecology. Several facilities were observed where the effluent provided the only irrigation water available. No instances of health hazards were reported from any existing facility.

13. Local public opinion - objection to becoming the recipients of "somebody else's waste" - could be a major limiting factor in the development of large land application systems at distances from wastewater sources. Psychological concern over distasteful characteristics of effluents can result in distrust of the ability of public agencies to operate, control and manage such systems. However, successful examples of effective operations, such as the Werribee Farm, demonstrate that public acceptance can be achieved.

14. Monitoring of land application facilities and effects has been minimal and mostly inadequate.

15. Energy requirements for land application systems may be an important consideration.

16. The nature and quantity of receiving waters must be carefully evaluated prior to diverting effluent to land application.

17. When wastewater is discharged to land, and this method is used as a means of advanced treatment by natural means, the land must receive priority for this use over other optional land uses. The needs of crop production, recreation and other benefits can be in conflict with the utilization of a land application system for the treatment of wastewater. For instance, the planting, cultivation and harvesting of crops and the use of recreation facilities may interfere with continuous application of wastewater onto land areas. The need for the system to either utilize all of the flow or provide sufficient retention storage for needed periods of non-operation must be considered. The objective of providing adequate treatment of the effluent cannot be sacrificed for other needs and uses of the land; proper handling of the wastewater must be the first priority.

18. Choice of ground cover can play an important role in the success of a land application system.

19. Land application facilities that have been used for many years are available for the study of long-term effects of such use. They offer the opportunity to study effects on soils and groundwaters.

20. Observations in the field of land application systems did not reveal the existence of specific health hazards and disclosed very little concern over threats to the health of on-site workers, residents of neighboring areas, domestic animals or wildlife, or of those who consume or come in contact with land-applied wastewaters.

SUMMARY

In the State of Victoria, and in some of the other Australian States, there are numerous country towns which use effluent from sewage treatment plants for the irrigation of pastures, recreation grounds, orchards and golf courses. There are some 50-60 treatment works in Victoria alone from which the effluent is taken for irrigation.

At the end of this report, in the section, entitled, "Other Land Treatment Systems", I will comment on the other systems in Victoria which I visited. The first and major part of this report however will concern the Werribee Farm soil treatment area operated by the Melbourne and Metropolitan Board of Works (MMBW). The Board (MMBW) was constituted in 1890 by an Act of the Parliment of Victoria to develop and operate a system of main and general sewerage for the metropolis. James Mansergh, an eminent sanitation engineer from London, submitted eight alternative schemes, five of which involved treatment by land; two, disposal by ocean outfall; and one, by chemical precipitation. Mansergh stated that the Werribee site was well situated for land purification of sewage because it was exceptionally dry and had an abnormally low rainfall compared with surrounding districts. His recommendation, based on proven success in England, and on the benefit of irrigation in an area of low rainfall, was for disposal by flood irrigation on prepared land without prior treatment of the sewage. Even today raw sewage is used at the Werribee Farm. Work began in 1892; and in 1897 the sewage from the first property (a hotel) was delivered to the system. Mansergh, of course, could not have foreseen Melbourne's rapid population growth nor the demands that

would be placed on the Werribee Farm within 30 years of its establishment. By the late 1930's, the heavy waste loadings had made it necessary to not only enlarge the area of the Farm but also to complement land filtration (called crop irrigation in the United States) is called crop irrigation, with sedimentation, grass filtration (overland flow) and lagooning. Despite these additions to the Farm's land treatment operations, the 1897 system remains, to this day, basically as it was originally conceived and built. Even the introduction of the South-Eastern Sewerage System (in 1974) on the opposite side of Port Phillip Bay fulfills Mansergh's original concept of a disposal system serving each side of the Bay. The relationship of the Werribee Farm to the South-Eastern Sewerage System can be seen on the accompaning map of the Melbourne Metropolitan area. In June 1974, there were some 800,000 ratepayers (population 1,880,000) being served by the Board. The Werribee Farm serves about 95 per cent of the sewered areas in the metropolis. The balance is served by four other major and two minor systems. In addition to Werribee, the other major systems are Braeside, Lower Plenty, Altona and Heatherton. The minor systems are Kew and Maribyroong.

For the fiscal year ending June 1974, the annual per capita cost of the Board's Werribee system was A$1.13 (US$1.53) for 95 percent of the population of 1,880,000. This figure includes all current costs. The capital costs of the land and the original construction were written off years ago. The average daily flow to the Werribee Farm is 125 million British Imperial gallons (150 mgd US).

Because the cost of purification at Werribee is substantially less than by mechanical treatment, as well as because the quality of the effluent from Werribee is higher, the MMBW intends to continue to utilize land treatment to the extent possible. However, as the populations of Melbourne and Geelong increase, and the urban areas extend outward toward the Werribee Farm, the acquisition of additional land adjacent to Werribee has not been possible. As a consequence, MMBW is constructing conventional secondary mechanical treatment works and plans to transfer about 45% of the hydrological load from the Werribee Farm to the new South East mechanical system. In spite of this, by 1980/81 the MMBW estimates that the pollutant loading will return to the maximum that the Werribee Farm, as presently operated, can handle.

Currently, all sewage to the Werribee Farm is raw sewage. This has been the practice since land treatment was started in 1897. However, in order to provide increased treatment capacity at Werribee, MMBW is giving consideration to using a combination of part primary to full secondary treatment in conjunction with biological processes.

In summary, the MMBW Werribee system is in full operation, is most successful, is substantially lower in annual per capita cost of operations, and MMBW intends to continue to operate its land treatment facilities indefinitely.

LAND TREATMENT IN THE UNITED STATES

The Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), the legislative history of the Act, and the regulations which have been issused in accordance with the provisions of the Act, provide the statutory basis for consideration and funding of land-application systems in the treatment of municipal wastewater.

The rationale and goals within which land-application systems are to be considered are contained in the following sections of the Act:

Section 208 - Areawide Waste Treatment Management

Section 201 - Facilities Planning

Section 304 - Best Practicable Treatment Technology (BPT)

Section 212 - Cost Effectiveness Analysis

These sections, together with the regulations pertaining to these sections of the Act, and the Program Memoranda to the EPA Regional Administrators, have resulted in a growing interest in the United States in soil treatment systems for municipal wastewater. The EPA Deputy Administrator, on November 1, 1974, wrote to the Regional Administrators urging them to ascertain that the regional review of application for construction of publicly-owned treatment works requires that land application of wastewater be considered as an alternative waste management system. The DA said that the RA's should refuse to fund projects using other systems of waste treatment if it can be demonstrated that land treatment is the most cost-effective alternative; is consistent with the environmental assessment; and, in other aspects, satisfies applicable tests. This memorandum is included as Attachment A.

In addition to the potential for being the most cost effective treatment alternative (note the Werribee total annual per capita cost for the fiscal year ending June 1974 is US$1.53 for sewage treatment serving a population 95 percent of 1.88 million people), another significant reason for the growing interest in land treatment is that PL 92-500 gives authority to the EPA Construction Grants Program to fund publicly-owned soil treatment systems including the acquisition of the land that will be an integral part of the treatment process -- Section 212(2)(A).

The EPA report, entitled, Survey of Facilities Using Land Application of Wastewater by American Public Works Association identifies certain existing soil treatment systems that were started in the United States as early as 1880. However, these early systems started as disposal projects, and there is a major gap in reliable design data and information. The consequences of this dearth of design information has handicapped the construction grants program, primarily because of the lack of standard criteria. Another deterrent has been the lack of information concerning potential health hazards from soil treatment systems.

Strangely, however, the same dearth of information concerning potential health hazards from secondary treatment and discharge to surface waters has not slowed the demand for the more costly conventional reinforced concrete treatment works. In fact, it seems to me that there could be far greater health hazards from secondary discharge into surface waters because these waters are so often used as sources of potable water by other downstream municipalities.

Because the Werribee system is relatively large and has been operating long and successfully, it was decided that EPA representatives should make site inspections to obtain first-hand knowledge technical data. In this connection, visits were to be made to other Australian soil treatment systems as well. Information was to be collected regarding: operating costs of the Werribee system; future plans for soil treatment operations, and extent of public acceptance throughout Australia of land treatment.

SITE VISITS IN AUSTRALIA

During the period between October 15, 1974 and November 3, 1974, I visited various locations in Australia and consulted with various municipal officials, State officials, consulting engineers, and other persons for the primary purpose of observing and collecting information and data on existing long established land treatment systems of municipal and industrial wastewater. During 4 days (October 21-25, 1974) I was accompanied by Dr. Curtis C. Harlin, Jr., of the Water Quality Research Laboratory, Robert S. Kerr Environmental Research Laboratory, EPA, Ada, Oklahoma. Together we visited the Melbourne and Metropolitan Board of Works land treatment site at Werribee, Victoria, and the Latrobe Valley Water and Sewerage Board at Traralgon, Victoria. Following these two visits, Dr. Harlin and I separated and visited different land systems in order that between us, we would have the opportunity to observe, inspect, and collect information from the greatest number of systems in Australia. Dr. Harlin visited the following additional soil treatment systems:

Mildura Sewerage Authority, Mildura, Victoria

Zinc Corporation Ltd., Broken Hill, New South Wales

The Broken Hill Water Board, Broken Hill, New South Wales

The Engineering and Water Supply Dept., Adelaide, South Australia

South Australia Department of Agriculture, Adelaide, South Australia

This report does not contain any information collected by Dr. Harlin at these sites, which I did not visit.

My site observations include the following:

Melbourne and Metropolitan Board of Works, Melbourne, Victoria

Latrobe Valley Water and Sewerage Board, Traralgon, Victoria

Mansfield Sewerage Authority, Mansfield, Victoria

City of Benalla Sewage Authority, Benalla, Victoria

Shepparton Sewerage Authority, Shepparton, Victoria

Town of Kyabram Sewerage Authority, Town of Kyabram, Victoria

City of Bendigo Sewerage Authority, Bendigo, Victoria

HIGHLIGHT OF SITE VISITS

The highlight of the visit to Australia was the MMBW Werribee land treatment farm where the net annual cost was A$1.13 (US$1.53), as of June 1974, for 95 percent the population of 1.88 million served by this sewage system. For 1975, the projection of annual costs for an estimated population of 1.925 million, is A$1.45(US$1.95) per capita. These costs are for an average daily flow of 125 million British Imperial gallons (150 mgd US).

It has been said, "if you don't know where you're going, any road will get you there." This could have been as true of the Melbourne and Metropolitan Board of Works, as it is of individuals. Fortunately for the people of Melbourne, the Board of Works has, since its inception, known where it was going and has charted a course that has led to a land treatment system equivalent to tertiary treatment at a fraction of the cost of conventional mechanical secondary treatment.

LIST OF PRINCIPAL PERSONS INTERVIEWED

(In chronological order of meetings)

1. Alan H. Croxford, Chairman, MMBW
2. A. G. Robertson, Engineer-in-Chief, MMBW
3. Frank B. Barnes, Assistant Engineer-in-Chief for Engineering Services, MMBW
4. Jack Gray, Assistant Engineer-in-Chief for Operations, MMBW
5. James B. MacPherson, Werribee Farm General Manager, MMBW
6. Frank McCarthy, Werribee Farm Operations, MMBW
7. Allan Robbins, Werribee Farm Construction, MMBW
8. Keith Levey, Werribee Farm Engineer, MMBW
9. Bruce Salau, Werribee Farm Records, MMBW
10. Arthur Pierce, Werribee Farm Stockman, MMBW
11. Basil Holmes, Secretary to MMBW
12. George Samuel, Chairman, Perth Metropolitan Water Supply Sewerage and Drainage Board, Perth, Western Australia
13. O. Max Falkiner, Member, Legislative Council (Upper House) NSW Parliament, Sydney, NSW

14. William Kennedy, Member, Legislative Council (Upper House) NSW Parliament, Sydney NSW

15. E.J. Coffey, Director, State Pollution Control Commission, Sydney, New South Wales

16. Norman B. Hannah, U.S. Consul, Sydney, NSW

17. James C. Marshall, U.S. Commercial Officer, Sydney, NSW

18. Robert Brown, Deputy U.S. Consul, Melbourne, Victoria

19. Gordon Coulson, Chief Engineer, Latrobe Valley Water and Sewerage Board, Traralgon, Victoria

20. Dr. R.G. Downes, Director, Ministry for Conservation of Victoria, Melbourne, Victoria

21. D. Little, Chairman, Environmental Protection Authority (EPA) in Ministry for Conservation, Melbourne, Victoria

22. J.H. Alder, Deputy Chairman, EPA in Ministry for Conservation, Melbourne, Victoria

23. Don A. Reinsch, Caldwell Connell Engineers, 434 St. Kilda Road, Melbourne, Victoria

24. Honorable John Jess, Retired Member, Federal Parliament, of Australia, Melbourne, Victoria

25. R.A. Sisson, Operations Engineer, Mansfield Sewerage Authority, Mansfield, Victoria 3722

26. Keith D. Borley, System Engineer, Benalla, Victoria 3672

27. W.F. Humphreys, System Engineer, Shepparton Sewerage Authority, Shepparton, Victoria 3630

28. C.L. Godfrey, Town Engineer, Town of Kyabram, Victoria 3620

29. Mayor A.M. Rowlands, Town of Kyabram, Victoria 3620

30. H.M. Moors, Engineer/Secretary, City of Bendigo, Victoria

THE WERRIBEE FARM - INTRODUCTION

There are 17 residences located in the midst of the Werribee Farm which are used by farm employees and their families. I visited several of the homes of farm employees, met members of their families including the children, and enjoyed a Sunday picnic on the front lawn of one of these residences. There is no evidence of health hazards caused by sewage irrigation in the adjacent fields, and no concern was expressed by the occupants of these houses about potential health hazards. To the foreign observer that I was, these residences appeared no different than any other farm residences, and their occupants appeared no different than any other farm families, either in Australia or in the United States. Incidentally, on previous trips to Australia, I visited many rural communities in every Australian state, except the Northern Territory; and I lived and worked on farms in the United States over a period of several decades. In my judgment, the farm houses located on the Werribee Farm are better than the majority of farm dwellings in the United States, and the occupants are living under better health conditions than some of their counterparts in both Australia and the U.S.

The Werribee Farm soil treatment system is the outstanding project in Australia from the standpoints of the lowest annual operating costs, success, size and extent of experience with the use of wastewater effluents. The map of Melbourne on page 2 shows the relationship of the Board's Werribee Farm to Port Phillip Bay and the surrounding Melbourne and Metropolitan areas. The South Eastern Purification Plant (secondary treatment) is also shown on this map.

The Farm has served the residents of Melbourne as a reliable and economical means of wastewater treatment and utilization since 1897. The use of wastewater for irrigation of pasture land, and the subsequent production of cattle and sheep, is an outstanding example of reclamation and conservation. Over the years, however, population and industry have increased greatly. As a result, the Farm is no longer able to cope satisfactorily with the volumetric and organic loadings imposed upon it. Public and governmental awareness and increasing interest in air and water pollution have focused attention on odors from the Farm and on the quality and effects of effluent discharged to Port Phillip Bay. The challenging objective of developing a master plan for water quality management at the Board's Farm is to eliminate or minimize the adverse conditions while retaining or even increasing the benefits attributable to reclamation and conservation.

LIVESTOCK AND THE TREATMENT PROCESS

The livestock at the Farm are not only money-earners from the point of view of meat, they are also an essential part of the treatment operations.

Because wastewater treated at the Farm contains a high proportion of natural fertilizers, it promotes a prolific growth of pasture; but since crop irrigation is an efficient method only if the vegetation cover is kept short, cattle and sheep are effectively used to "mow" the grass.

Sheep were introduced to the Farm in 1900 and cattle some 10 years later. In the years since, the Board has sold more than 1.7 million sheep and well over a quarter million head of beef cattle from its Angus and Hereford herds.

Grazing of sheep is on a seasonal basis, and the Board buys the animals in various parts of the southeastern corner of Australia to fatten them for market. The beef cattle, on the other hand, are bred on the Farm and remain there until they are ready for sale. The most suitable animals are retained for breeding and the others are sold as prime meat on the hoof at Newmarket, Melbourne.

Sales of cattle are subject to the condition that they must be immediately slaughtered at an abattoir in the Melbourne metropolitan area, and those killed must undergo rigid inspection. This condition, imposed in the 1920's by the Parliament of Victoria, was a political one obtained by the commercial beef producers and had no health hazard basis.

Diversion to the South Eastern Purification Plant of a portion of the wastewater now reaching the Farm will ease, but not solve, the situation for a number of years, but continued growth in the Western Catchment will produce flows and loadings well in excess of those at present. For example, the loading of biochemical oxygen demand will total about 750,000 pounds per day before completion of the South Eastern Purification Plant; diversion to that plant will remove slightly over 100,000 pounds per day; increased development in the Western Catchment will gain this amount back before 1985; and, less than fifty years hence, the total loading may exceed 1,000,000 pounds per day.

The Farm system serves about 95 percent of the sewered areas in the metropolis. Except for wastes from the greater part of the Municipality of Sunshine, which are discharged directly in the Main Outfall Sewer, and from Williamstown, which enter the main system at Spotswood, all wastes collected by the Farm system flow by gravity through two main sewers -the North Yarra and the Hobsons Bay Main Sewers which unite at Spotswood.

The combined flow then continues for 2 1/4 miles via a 9 ft. 3 in. diameter trunk sewer which terminates at the Brooklyn pumping station. Flows in this sewer enter the pumping station through two penstocks, or control gates, set at the bottom of a well, 144 ft. deep and 22 ft. in diameter. The penstocks control the flow into each of two protective screen wells, 156 ft. deep and 22 ft. in diameter.

From each screen well, the flow continues to its corresponding pump well.

The two pump wells are each 178 ft. deep (internal) and 66 ft. in diameter. Four pumps are installed in each well, and the eight pumps are driven by individual electric motors, the combined rating of which totals 12,800 horsepower. Each pump has a maximum capacity of 42 mgd (50 mgd, US).

When Melbourne's sewerage scheme was originally designed, Port Phillip Bay was selected as the most suitable body of water for the final disposal of the effluents after purification.

The most suitable method of purification known in European countries at the time was land treatment, and the site chosen near Werribee, between the Geelong Road and Port Phillip Bay, possessed all the factors essential for the satisfactory operation of the method -- ample area, reasonable isolation, suitable soil and climatic conditions.

An area of 8,847 acres was acquired, and the preparatory work began in 1893. As the city has grown, it has been necessary to expand the Farm area and today it covers 27,000 acres or nearly 42 square miles.

The Board's Farm at Werribee begain operating in 1897. By 1900, it handled a wastewater flow averaging 12 million gallons per day (14.4 mgd, US). Since that time, the flow has increased as a result of growth of population and industry in the metropolitan area; and at present, averages about 125 mgd (150 mgd, US or 568,650 cubic meters). The mode of operation, originally begun as irrigation of 6,000 acres of land to produce pasturage for cattle and sheep, has been expanded over the years to include all-year use of anaerobic and aerobic lagoons, sedimentation basins and open sludge digestion lagoons, as well as overland flow (grass filtration) from mid-autumn to mid-spring when irrigation demands are minimal or nil.

Rainfall at the Farm averages 19 in. (48.3 cm.) annually, of which about 12.5 in. (32.2 cm.) of evenly distributed rainfall can be expected during the crop irrigation season; whereas the evapotranspirational potential during the same period averages about 35.6 in. (90.4 cm.), indicating that a major portion of the annual application of 44 in. (112 cm.) of sewage effluent has evaporated. The daily flows of raw sewage arriving at the Farm vary greatly depending upon rainfall. The current average flow is about 150 mgd (568,650 cubic meters); however, during storm periods, peak flows as high as 300 mgd (1,140,000 cubic meters) may occur. Temperature variations are from a low of 40 degrees F (4.4 degrees C) in winter to a high of 112 degrees F (44 degrees C) in summer.

SOIL CHARACTERISTICS

There is no detailed classification of the Farm soils, but the surface of the soil profile consists of a red-brown silt clay loam which is slightly acid. Clay occurs at a depth of about 12 in. (30 cm.). The depth of the clay subsoil is substantial, extending far below any core samples that have been recorded. The report issued by the U.S. Army Corps of Engineers in January 1974, entitled, "Selected Chemical Characteristics of Soils, Forages, and Drainage Water from the Sewage Farm Serving Melbourne, Australia", contains much detail on soil and forage characteristics.

GENERAL OBSERVATIONS

Many aspects of the Farm operations are praiseworthy. Widespread recognition of the need to conserve or reuse natural resources has evolved only in recent years; however, since 1910 the Farm has reused wastewater from Melbourne for irrigation of pasture land. This process has converted land of little potential for agriculture to prime pasture which now carries over 20,000 cattle and 10,000 sheep. By using the natural resources, water and land, the Farm has marketed more than 270,000 cattle and 1,500,000 sheep since 1910. Taking into account the equipment and manpower costs related to livestock production, the net returns from sales presently average over A$500,000 (US$675,000) per year and significantly reduce the costs directly associated with sewage purification at the Farm. Thus, from conservation and financial standpoints, the Farm represents a valuable valuable resource to the residents of Melbourne.

Conversely, there are features of the Farm which have led to concern about continuing its present mode of operation. As both Melbourne and Geelong extend outwards toward the Farm, and as the volume of traffic on the Princess Highway increases, odors from the anaerobic lagoons, sludge digestion, and grass filtration processes have become a matter of increased importance and public notice. In addition, the effluent from the Farm is the major source of nutrient chemicals - compounds of nitrogen and phosphosous discharged to Port Phillip Bay. At a time when public and governmental attention is being focused on the water quality of the Bay, these loads, as well as those of other chemicals contained in the effluent, are of increasing concern.

Initial diversions from the Farm system to the Board's South Eastern Purification Plant are scheduled for 1975. Although this will result in lower loadings at the Farm in the short-term, growth of population and industry tributary to the Farm will generate additional loadings well in excess of those diverted.

THE MOSQUITO PROBLEM

I inquired about the mosquito problem in flat areas where there was often little movement of the surface water. I was told that a larvicide, called, Abate, made by American Cyanamid Corporation, Wayne, New Jersey, was an effective chemical in controlling mosquitos, sand fleas and gnats that often thrive in grass irrigated with sewage effluent. Quite likely there are similar chemicals made by other firms, but this is the only one that I could identify by name and source. Please note EPA Press Release dated March 14, 1975, Attachment B, which identifies Altosid SR-10 as an acceptable mosquito control pesticide for use in the United States.

FARM OPERATIONS

It is logical to consider operations at the Farm from two standpoints: first, in relation to its primary function for wastewater treatment and second, in terms of its use for livestock production. In addition, approximately three-fourths of the Farm area is a declared Wildlife Sanctuary and provides a habitat for a variety of waterfowl and other birds and animals.

WASTEWATER TREATMENT

In the early years, treatment at the Farm consisted of land filtration by irrigation of pasture land with the underflow collected in drainage channels and discharged to Port Phillip Bay. During winter, wastewater flows in excess of the land's capacity were held in shallow lagoons along the foreshore. Increasing flows during the intervening 70 years have lead to increasing the size of the Farm from about 6,000 acres to nearly 27,000 acres. Of this total, about 17,000 acres are used for some form of treatment, and the balance is devoted to dry grazing, roads, buildings, yards, and other purposes.

The use of grass filtration (overland flow) during winter months began about 1928 and made it possible to phase out the shallow lagoons along the foreshore previously used for winter flows. Farm operations were extended west of Little River in 1930, and in 1939 the Board gave Geelong an assurance that wastewater would be treated by sedimentation prior to its conveyance across the river.

Figure 1: Areas used for various treatment methods during 1958/59 at Werribee Farm

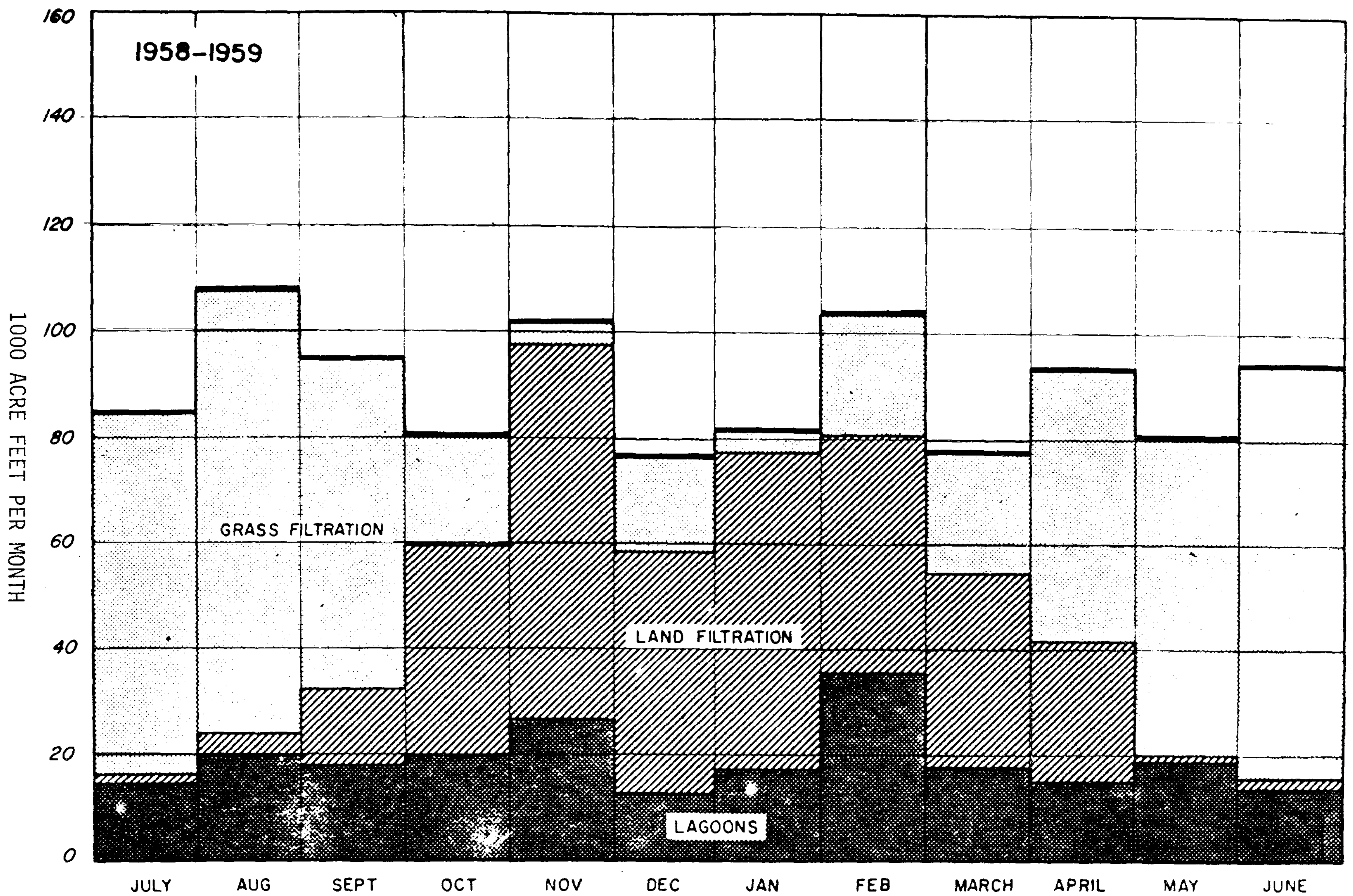
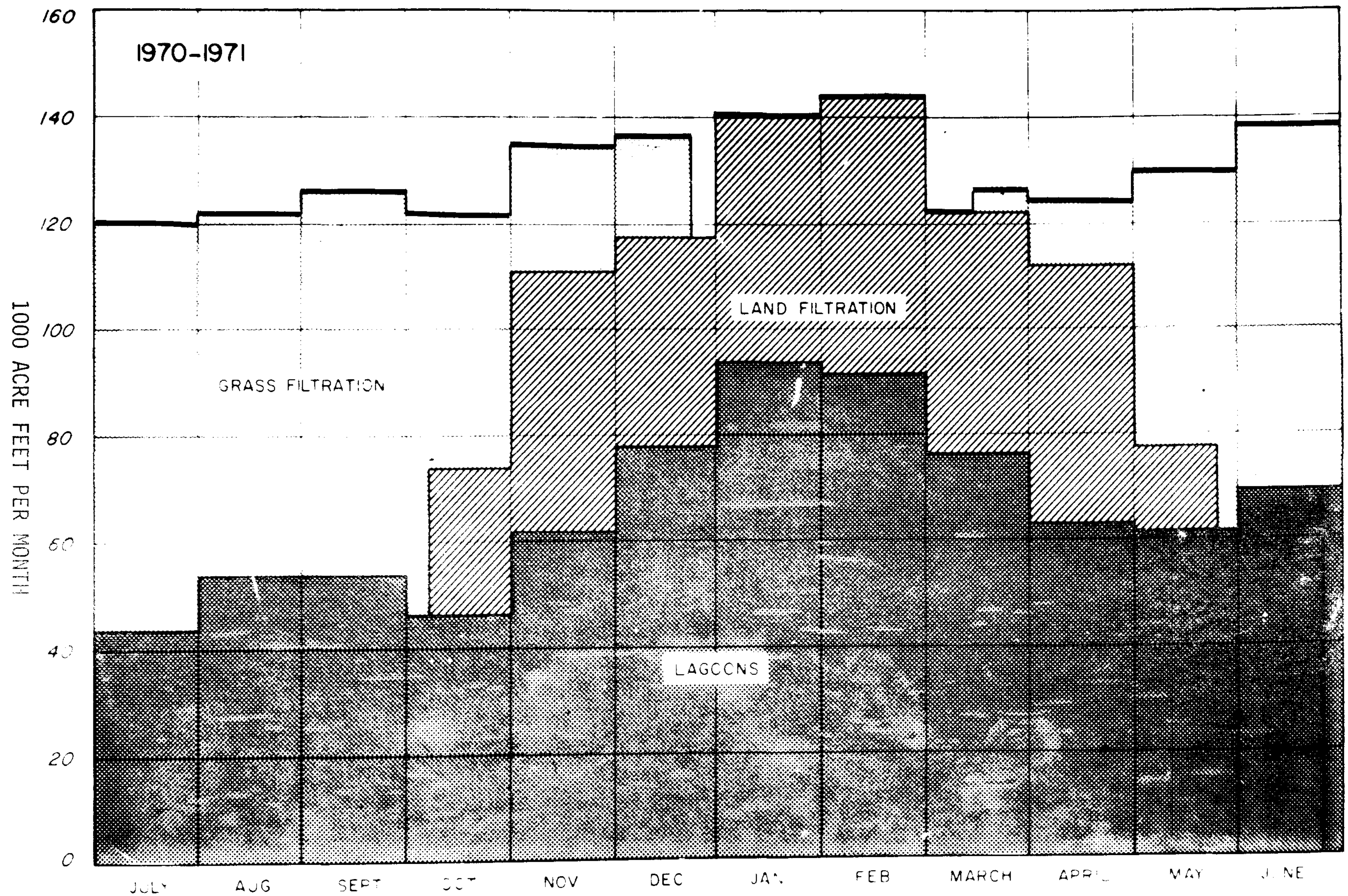


Figure 2: Areas used for various treatment methods during 1970/71 at Werribee Farm



Anaerobic and aerobic lagoons were introduced about 1935. Lagoons can handle higher loadings of organic matter than either of the two other methods of treatment, and as a result, their area has been increased greatly in recent years to match increases in loadings. For purposes of comparison, numerical values for the years ending 30 June 1959 and 30 June 1971 are listed in Table A and the monthly variations during each year are shown on Figures 1 and 2.

Table A. Loadings and Treatment Processes, 1959 and 1971

	Year Ending 30 June	
	1959	1971
Total wastewater volume, milllion gallons (US)	35,160	50,900
Average BOD5, milligrams per liter	451	588
Pounds per day	384,000	661,000
Crop irrigation, million gallons (US)	13,320	10,680
Percent of total	38	21
Overland flow, million gallons (US)	13,680	15,360
Percent of total	39	30
Lagoons, million gallons (US)	8,160	24,960
Percent of total	23	49

On arrival at the Farm, the wastewater is distributed to the various treatment areas through a network of channels. Three methods of purification are used. Short explanations of each method along with pertinent comments follow.

Crop Irrigation (land filtration). This is the primary method which is used throughout the summer. The land filtration areas are carefully prepared pastures, about 20 acres in exent, and divided into 50 bays by low check banks. They are subsoiled, graded evenly and sown with selected pasture grasses.

The wastewater is applied as in normal flood irrigation. Every 18-20 days, each block is covered to a depth of about 4 in. In all, about 600 acres are irrigated each day. The wastewater filters through the soil and when purified seeps into deep earth drains.

The periodic irrigation of pastures with wastes containing a large proportion of fertilizing materials promotes a very vigorous growth of grass. Rotational grazing by sheep, cattle and some horses is essential to maintain these pastures in a condition suitable for continued wastewater purification.

Application rates for crop irrigation are controlled by the ability of the soil to absorb water, rather than by the strength of the wastewater. Examination of irrigation records from 1935-1971 shows wastewater irrigation depths average about 3.5 feet per year and range between 2.9 and 4.2 feet per year. In a given year, the application rate depends on the rainfall pattern and evaporation. Including annual rainfall, the land receives more than 5 feet of water depth per year. Based on present wastewater strength, the average application rate amounts to 30 lb. of BOD per acre each day.

Crop irrigation is quite effective in reducing the concentrations of many chemical constituents of concern in terms of their effects on the receiving waters. Compounds of nitrogen, phosphorous, and most of the heavy metals are reduced dramatically. Table B shows results of analyses made on the incoming wastewater and the average for effluent collected from seven different drainage channels which pick up the underflow from the irrigation areas.

Table B. Chemical Characteristics of Untreated Wastewater and Effluent from Crop Irrigation Treatment

Constituent	mg/L Concentrations 2/ Untreated Wastewater	Effluent	Percent Removal
Organic nitrogen	14.3	1.0	93
Ammoniacal nitrogen	35.0	3.2	91
Nitrite	0.75	1.3	-
Nitrate	0	0.4	-
Orthophosphate	26.2	2.6	90
Total Phosphorous	32.1	2.9	91
Sodium	400.0	770.0	-
Potassium	95.0	26.0	73
Calcium	65.0	45.0	30
Magnesium	80.0	107.0	-
Copper	0.45	0.07	84
Nickel	0.20	0.16	20
Chromium	1.0	0.09	90
Cadmium	0.01	0.006	40
Zinc	1.3	0.18	86
Lead	0.55	0.12	78
Mercury	0.0015	0.0003	80

Source: MMBW Analyses on samples collected 17 May 1972.

2/ Concentrations of nitrogen compounds expressed as N; phosphorous compounds as PO_4; all other as the particular element.

Overland Flow (grass filtration). This process is used in purifying the greater part of the normal winter flow when reduced evaporation makes crop irrigation impracticable. In this method, the wastewater is first directed into sedimentation tanks and, when the sludge has settled, the water is allowed to flow slowly but continuously over graded areas on which Italian rye grass supplements the natural herbage to make a dense growth. The plants act as a filter in which micro-organisms absorb the organic matter in the wastewater so that by the time it reaches the drain, it has the required standard of purity. The overland flow areas are grazed only in the summer when they are not needed for purification purposes.

Detention times are about 2 days. In contrast with crop irrigation, loading rates are governed by wastewater strength rather than by volume. Because of the short detention time, daily loadings rather than long term ones are important. Maximum loadings of about 90 lb. of BOD per acre each day can be handled. In practice, however, it is more convenient to control application by regulating wastewater volume to the overland flow areas. To keep BOD loading rates within the maximum, the volumetric rate of application of sedimented wastewater is held at about 1 mgd per 50 acres. Experience at the Werribee Farm indicates that daily BOD application rates average about 70 lb. per acre per day.

<u>Oxidation Ponds Treatment.</u> This process operates throughout the year to handle the balance of the normal flows which cannot be treated by the other methods and also copes with the wet weather excess flows. During this treatment, the wastes flow slowly through large areas of shallow ponds where purification is effected by oxygen which is partly absorbed from the atmosphere and partly provided by algae in the presence of sunlight.

Oxidation Ponds. In the lagoon treatment process, wastewater passes through anaerobic lagoons and then through aerobic lagoons. Detention times, relatively short in the former and long in the latter, depend on the rate of wastewater addition, but generally are about one month. BOD loading rates vary with wastewater strength and the volume added. Experience indicates that average loading rates of about 60 lb. of BOD per acre per day can be handled in winter, while about 100 lb. per day can be handled in summer when photosynthetic activity is greater due to higher temperatures and longer hours of sunlight.

Treatment Efficiency. As shown by the annual averages on Table C, the three treatment processes vary in their ability to remove organic matter and other chemical constituents in raw wastewater. The crop irrigation process is the most effective, but as noted above, area loading rates are low and only about 20 percent of the year's flow at the Farm can be treated by this process. The reductions it achieves in compounds of nitrogen and phosphorous are particularly noteworthy. In raw wastewater given crop irrigation treatment, only 5 pounds pass through the top soil and are found in the effluent. In contrast, the comparable values for overland flow are 40 pounds of nitrogen and 65 pounds of phosphorous, while for lagoons, the values are 65 and 70 pounds respectively. In terms of nitrogen removal, crop irrigation is 8 times more effective than overland flow and 13 times more effective than lagoons. Similarly, for phosphorous removal, it is 13 and 14 times more effective, according to MMBW.

Table C. Estimated Performance by Treatment Processes on Annual Basis

Characteristics	Method of Treatment		
	Crop Irrigation	Overland Flow	Lagoon System
Percent of total flow treated	20	30	50
Percent removal			
BOD	98	96	94
Suspended solids	97	95	87
Total nitrogen	95	60	40
Total phosphorous	95	35	30
Detergent	80	50	30
E. Coli	98	99.5	99.8

Odors. Sources of odors at the Farm have been studied intensively several times, particularly in 1950, 1966, and 1968-1970. The 1966 work disclosed that the "odor potential", based on measured hydrogen sulphide emissions, was four times greater in winter than in summer, and that sedimentation and sludge digestion basins, lagoons, and overland flow areas were the principal sources. Crop irrigation areas and effluent channels were found to be relatively insignificant sources. At each of the major sources, the treatment processes are, or are prone to be, anaerobic. Sedimentation and sludge digestion basins are open, and hydrogen sulphide and other odorous gases are readily released to the atmosphere. The anaerobic lagoons, an inherent part of the lagoon system presently used, are economic on space due to the high BOD loading which they can handle, but are the odorous component. During winter, the area of anaerobic lagoons is greater than in summer, which leads to the release of greater quantities of hydrogen sulphide. In the 1966 tests, this gas was detected over about half of the area used for overland flow.

Livestock Production. Since 1910, the Farm has operated a commercial beef enterprise, producing 20-22 month old steers and fat cull cows for the Melbourne market. During the past 62 years, over 270,000 cattle have been marketed. Since 1946, almost the entire cattle output has been bred and raised on the Farm. In addition, sheep are brought in and fattened on the Farm, and during the same period, more than 1.5 million have been marketed.

Early prohibitions against marketing the cattle for human consumption because of the incidence of beef measles (cysticercosis) were overcome in 1946 by the adoption of the carcass inspection and branding program. In addition, the Farm stock has built up an immunity, and market rejection for this reason is rare - 29 rejections out of over 116,000 cattle marketed since 1946.

In summary, the principal purposes of operating the Werribee Farm has been to renovate the sewage effluents and to recover resources that could be converted into cash. Research for the sake of research alone have not been a major factor, although some elements of research have been done to seek out solutions to specific problems. The Werribee Farm has 31 test wells for monitoring the influent (daily) and the effluent (twice weekly) to Port Phillip Bay.

The Board has some information on soil analyses at certain locations. In certain small areas affected by salt accumulation caused by groundwater, there is some information. There is limited data on receiving water quality, odors, and potential health hazards, as well as information on BOD, SS, COD, pH, fecal coli, P, total N, nitrate, nitrite and Cl.

OTHER SYSTEMS

Three of the other major systems -- Braeside, Lower Plenty, Altona -- and the minor systems at Kew and Maribyrnong all use a treatment process which involves sedimentation of the wastewater and subsequent biological purification of the settled wastewater by trickling filters and oxidation ponds, followed by chlorination. In the larger plants, the settled material is broken down in special heated tanks, by biological processes to an inert, humus-like material.

The extended aeration process at the Heatherton plant is suited to the short term purpose of this plant. It is an activated sludge process in which the wastewater is retained for purification in metal tanks for over 24 hours.

THE STORM DRAINAGE SYSTEM - MMBW

Since 1923, the Board has been empowered, by Act of Parliament, to deal with main drainage works and control of watercourses and drains in the metropolitan area. By agreement with councils, the Board deals only with drainage, downstream of the point where the catchment area exceeds 150 acres. Responsibility for the drainage upstream of this point remains with the municipal councils.

The Board now has under its control about 720 miles of rivers, creeks, watercourses and drainage works, including nearly 40 miles of the Yarra River. It has constructed some 255 miles of drainage works.

In addition to the normal range of drainage work, major projects have been undertaken from time to time and, in recent years, includes work on the Yarra River, Moonee Ponds, Elster and Gardiners Creeks and works at Altona. Work has also started on the Mordialloc Settlement Drain.

CORPS OF ENGINEERS REPORT

In May 1972 a team from the U. S. Army Corp of Engineers made an intensive inspection and study of the Werribee Farm land treatment system. An important aspect, among others, was to learn as much as possible about long term responses of the soil/plant ecosystem to sewage applications. Accordingly, soil and plant samples were collected and analyzed for their nutraient and heavy metal contents.

A report published by the Corps in January 1974, entitled, Selected Chemical Characteristics of Soils, Forages, and Drainage Water from the Sewage Farm Serving Melbourne, Australia, presents and discusses the findings of this study. Specifically, data resulting from the analyses of soil and plant samples, from sites under irrigation for periods of 48 to 73 years, is discussed in relation to a control sample, length of time under irrigation, resultant water quality produced by the treatment system, and expected ranges of constituent concentrations found in soils and plants from the literature on the subject. A copy of the Corps report is attachment hereto.

MOVIE OF WERRIBEE FARM

The MMBW has produced a 16mm film, entitled Werribee - In Harmony with Nature, showing the land treatment operations at the Werribee Farm. This is a nontechnical film, 773 ft. in length. Copies can be purchased from the MMBW. EPA has ordered 10 copies of this film, one for each Regional Office. Persons wishing to buy a copy should address their inquiries to James B. MacPherson, Manager, Werribee Farm, Melbourne and Metropolitan Board of Works, 625 Little Collins Street, Melbourne, Victoria 3001, Australia.

Other Land Treatment Systems in Victoria, Australia Latrobe Valley Water and Sewerage Board, Traralgon

The Latrobe Valley Water and Sewerage Board was constituted in 1954 as a regional water supply and wastewater disposal authority and its first major project was to construct a wastewater outfall from the Morwell area to a point near Bass Strait at Dutson where either ocean or land disposal would take place. Land disposal at Dutson was ultimately adopted.

A plan showing the location of the outfall and disposal area is attached.

The Latrobe Valley Outfall was commissioned in 1956 to accept wastes from the Gas and Fuel Corporation's Lurgi Brown Coal Gasification Plant and the Australian Paper Manufacturers Maryvale Mill, having a designed trunk capacity of 9 mgd (US).

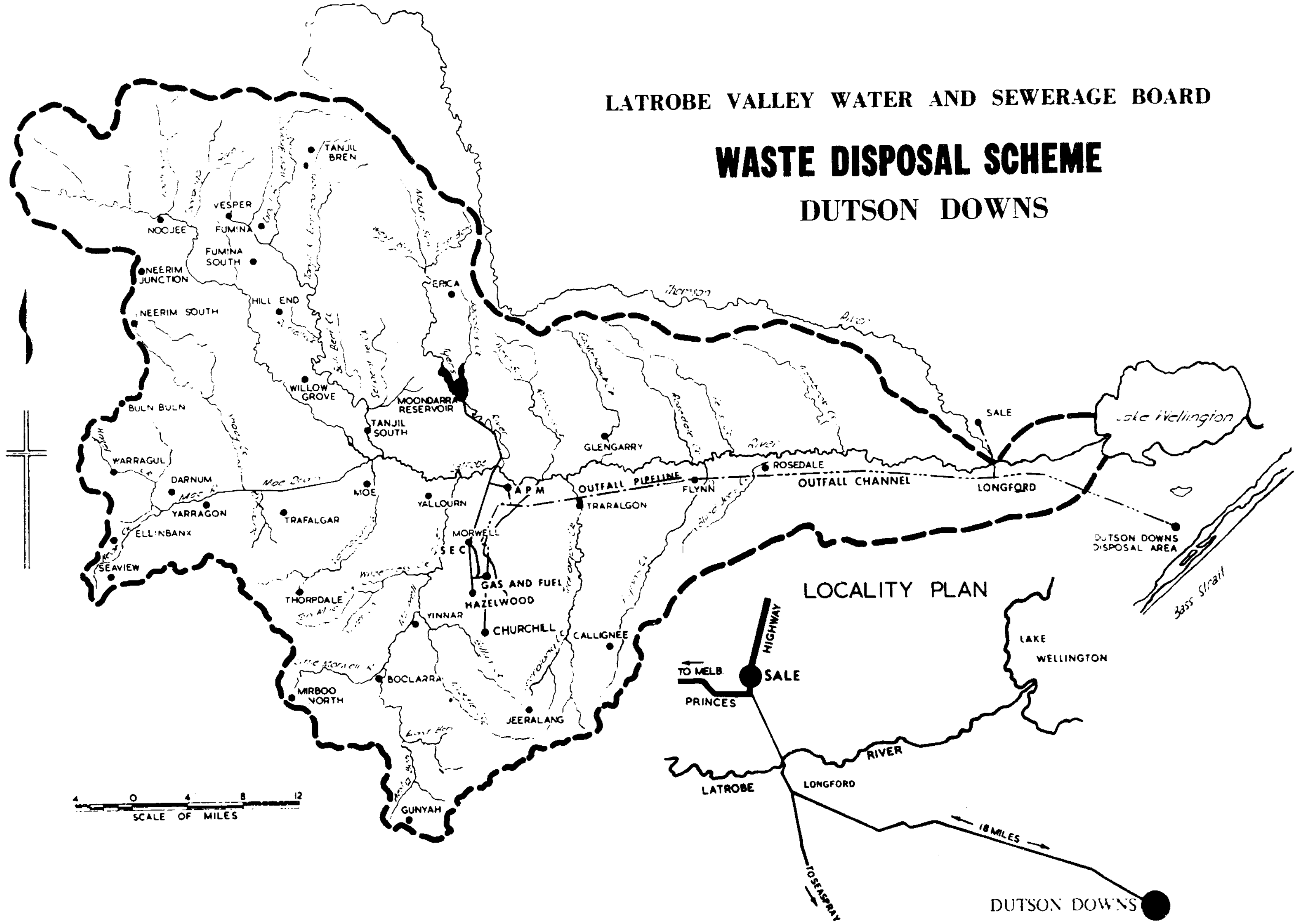
However, from 1964 increasing contribution of domestic wastes occurred, and the closure of the Lurgi Plant in 1969, together with acceptance of saline wastes from the State Electricity Commission's Hazelwood Power Station in 1971 caused marked changes in quality and quantity of effluent accepted into the Dutson Disposal Area.

Disposal at Dutson has always been by way of pondage of effluent on site for the colder half of the year, followed by irrigation over some 2, 500 acres of pasture. Sheep and beef cattle are run on this area and adjacent areas of developed dry pasture totalling 6, 500 acres.

LATROBE VALLEY WATER AND SEWERAGE BOARD

WASTE DISPOSAL SCHEME

DUTSON DOWNS



Present Methods of Disposal. Currently all wastewater is transported to the Dutson Disposal Area by a gravity outfall system starting from the town of Churchill, via Morwell, Traralgon, Rosedale and Longford.

The outfall system comprises some 25 miles of reinforced concrete pressure pipeline to downstream of Rosedale followed by the same length of open channel.

On reaching the disposal area, all wastewater passes through a paper fiber settling pond in order to remove some of the suspended fibrous material before any irrigation occurs. Failure to do this can result in the covering of pastures with sheets of "cardboard" and consequent growth retardation.

From this pond the wastewater flows into holding storages which are drawn on for irrigation water during the dry part of the year.

The irrigation layout consists of main distribution channels, head ditches, thirty-three feet wide bays, and drains which lead all runoff to the south shore of Lake Coleman.

The present stocking rate at the disposal area is 1,200 beef cattle and 8,000 sheep.

The system serves a population of 55,000 people and several industries.

The collection system is 60 miles in length with an average daily flow of 9.6 mgd (US). The only alternative to this land treatment system that was considered was ocean dumping. The annual rainfall is 23 in. (58 cm.). Winter temperatures vary from 32 degrees F-65 degrees F; and summer temperatures vary from 50 degrees F-100 degrees F. The soil is sandy.

The variable mixture of wastes has caused many problems. Gas making wastes contain large slugs of tar. Paper wastes contain large quantities of grit and fiber which vary wildely from day to day. The State Electricity Commission wastes consist of up to 10,000 ppm of dissolved solids, mainly sulphates and carbonates. Increasing amounts of domestic sewage without provision for peak storage has resulted in operating problems in wet weather. There has been an odor problem caused by the gases from the open collection channels which are mostly hydrogen suphide, mercaptans, ammonia and carbon dioxide. Although some of the wastewater is held in ponds for periods up to six months the intense dark color is not reduced and the salinity increases slightly. There appears to be a build up of ground salinity on irrigated areas during extended dry weather periods. The increase in the use of brown coal by the State Electricity Commission in the future is expected to contribute to a substantial increase in saline wastes. Unless some changes are made in the operation of the system soon, it would appear that these problems could be expected to increase. Operating costs have varied widely due to fluctuations in labor costs and sheep and cattle prices, but since 1969 the operating costs have been running between US$.045 to US$.058 per 1000 gallons (US).

Mansfield Sewerage Authority

This land treatment system, serving a population of 2,000 was started in 1970. The average daily flow is 144,000 gallons (US), primary treatment only. The total area consists of 64 acres (soil type-loam) of which 8 acres are used for ponding. Crops grown are rye, clover and barley grass. The effluent is applied by spray irrigation, which is operated for 6-8 hours at night, 5-6 days a week because of a lower night power rate. The Authority does not own any livestock or harvest any of the grass or hay, but has a contract arrangement with a farmer to do this. The livestock owner pays a small fee for grazing. The system works well and so far there have been no problems. There are no objectionable odors.

City of Benalla Sewerage Authority

This soil treatment system, serving a population of 8,000 was started in 1936. The average daily flow is 600,000 gallons (US), secondary treatment. The total land area consists of 320 acres of sandy loam, of which 290 acres are in grass for grazing livestock owned by the Authority. Additional adjacent land is leased for growing hay. Negotiations are proceeding to buy some adjacent land to expand the irrigation operations. Flood-type irrigation is used. Lagoons are used only for wet weather storage. The only odors are from the lagoons, when they are in use. Until cattle prices declined in the last year there has been no cost to the city for operations, but the current cost is now approximately $1.00 to $2.00 per capita per year. The system works well and there are no unusual problems.

Shepparton Sewerage Authority

This Authority does not use a soil treatment system, but uses lagoons only and discharges the effluent to the Goulburn River. The population is 20,000, but 87% of the daily average flow of 7.7 mgd (US) originates from 3 food processing plants. The City's consulting engineers are studying the effect on the Goulburn River from the wastewater, and are considering a land treatment system but have not yet made a report.

Town of Kyabram Sewerage Authority

This soil treatment system, serving a population of 5,000, was started in 1941. The average daily flow is 360,000 gallons (US), secondary treatment. The total land area consists of 120 acres of which 60 acres are irrigated and 55 acres are in holding ponds. The Town is attempting to purchase 30 acres of adjacent land to expand the system. The soil is loam and clay. The grass is grazed by sheep owned by the Authority. The only objectionable odors are in the vicinity of the trickling filter. The secondary treatment plant is an old plant that was built before the effluent was first applied to crop irrigation in 1941. A fruit canning plant in the city is not connected to the city system, but has its own land treatment system adjacent to the city system.

City of Bendigo Sewerage Authority

This land treatment system, serving a population of 46,000 people was started in 1922. The average daily flow is 3.6 mgd (US), primary treatment. The total land area consists of 800 acres, of which 400 acres of grass are irrigated and 250 acres are in trees. The area in trees is mostly a buffer area. The soil is loam, silt and clay. The normal average annual rainfall is 18 in. (45.7 cm.) but in the last 2 years the rainfall has averaged 40 in. (101.6 cm.) per year. Flood irrigation is used. The principal industries are meat processing plants and the fatty acids from the processing plants cause objectionable odors in the oxidation ponds. The soil treatment system is functioning well and the city plans to continue to use it, but is considering the Dutch carousel treatment method to upgrade its primary treatment facilities because of the fatty acids from meat processing wastes.

MISCELLANEOUS COMMENTS CONCERNING THE WERRIBEE FARM

The Melbourne and Metropolitan Board of Works is in the process of making laboratory studies of trace elements in the livers of cattle grown at Werribee Farm. The results of these studies will be reported to EPA when they are completed, hopefully in mid-1975.

Certain additional soil samples were taken from Werribee Farm during my visit, using the same procedures suggested by Dr. Thomas D. Hinesly for Corps of Engineers samples taken in 1972. The samples are currently being analyzed and will be compared with the U.S. Army Corps of Engineers 1972 soil tests. This will be done in cooperation with the Corps.

REFERENCES

1. Melbourne and Metropolitan Board of Works, Reports, Publicity Brochures, Newsletters, Staff Newspaper, Unpublished Memoranda, Calculations, Lists, Fact Sheets, Charts, Sewerage Committee Notes, Board of Works Notice Papers, and Interviews with Board Officials, Employees and Specialists.

2. Survey of Facilities Using Land Application of Wastewater, Prepared by American Public Works Association, July 1973. No. EPA-430/9-73-006: National Technical Information Service No. PB-227-351 A/S. U.S. Government Printing Office Stock No. 5501-00666; Cat. No. EP2.2:aW28/4.

3. Article, Waste into Wealth, Water Spectrum 1972.

4. Report, Program for Development of a Master Plan for Water Quality Management at the Board's Farm, March 1973, by Caldwell Connell Engineers.

5. Data and statistics from certain Principal Persons Interviewed.

6. Data and statistics from Dr. Thomas D. Hinesly, University of Illinois.

7. Reports, Data, Fact Sheets and Interviews with Engineers and Officials of other Land Treatment Systems Visited.

8. Notes from personal observations during Site Visits.

ATTACHMENTS

Memorandum from EPA Deputy Administrator to RA's, Attachment A.

EPA Press Release, dated March 14, 1975, which identifies Altosid SR-10 as an acceptable mosquito control pesticide, Attachment B.

Report, U.S. Army Corps of Engineers, January 1974 "Selected Chemical Characteristics of Soils, Forages, and Drainage Water from the Sewage Farm Serving Melbourne, Australia".

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SUBJECT: Land Treatment DATE: November 1, 1974

FROM: Deputy Administrator /s/ John Quarles

TO: Regional Administrators

The purpose of this memorandum is to express my concern that EPA must do a better job in assuring that land treatment is given full and adequate consideration as a possible method for municipal sewage treatment in projects funded with Federal grants.

Land application of wastewaters is practiced successfully and extensively in the United States. Many land treatment systems have been in continuous use since 1900. It is apparent from this long-term experience and documented research work that land treatment technology is a viable alternative to be considered as part of waste management systems.

In section 201 of the Federal Water Pollution Control Act Amendments of 1972, it declares that:

> "Waste treatment management plans and practices shall provide for the application of the best practical waste treatment technology before any discharge into receiving waters, including reclaiming and recycling of water, and confined disposal of pollutants so they will not migrate to cause water or other environmental pollution and shall provide for consideration of advance waste treatment techniques".

Pursuant to section 304(d)(2), which directs EPA to publish information on alternative treatment management techniques and systems available to implement section 201, the document "Alternative Waste Management Techniques for Best Practicable Waste Treatment" was published. Therein it considers land application as a viable alternative for best practicable waste treatment.

In addition, the Cost-Effectiveness Analysis Regulations which apply to all projects subject to best practicable treatment state that:

> "All feasible alternative waste management systems shall be initially identified. These alternatives should include systems discharging to receiving waters, systems using land or surface disposal techniques, and systems employing the reuse of wastewater".

The above requirements shall be met for all projects awarded after June 30, 1974. This means that land treatment must be considered in the basic selection of method for waste treatment.

I urge that you ascertain that your regional review of application for construction of publicly-owned treatment works require that land application be considered as an alternative waste management system. If it can be demonstrated that land treatment is the most cost-effective alternative, is consistent with the environmental assessment, and in other aspects satisfies applicable tests, the Region should insist that land treatment be used and should refuse to fund projects using other systems of waste treatment.

Your director of Water Programs Division has received the draft document "Evaluation of Land Application Systems". This document should be utilized during the review process. Additional assistance can be obtained by contacting the Municipal Construction Division (OWPO), the Municipal Technology Division (ORD), or the Robert S. Kerr Laboratory (ORD).

In order to promulgate proper consideration of land treatment systems by future grant applicants I suggest that the Regional Office provide opportunity for public awareness of land treatment technology. As an example, Region III is planning a two day symposium November 20-21, 1974 at the University of Delaware to highlight land application technology. The idea for the symposium originated in the Regional Office and was planned cooperatively between the regional staff and Office of Water Program Operations headquarters staff. The objective of the symposium is to clarify the technical and policy issues involved and to chart directions for future decisions on land treatment techniques. The symposium will provide useful information to over 300 engineers, scientists, public officials and private citizens. This technique or a similar one could be used by your region to emphasize consideration of land treatment.

ATTACHMENT B

(A - 107)
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FOR USE UPON RECEIPT

EPA REGISTERS "GROWTH REGULATING" MOSQUITO CONTROL PESTICIDE

The Environmental Protection Agency today announced registration of a "first of a kind" mosquito control pesticide for limited use by public health officials and other trained mosquito abatement personnel.

The pesticide, trade name Altosid SR-10, chemical name Methoprene, is a growth regulating chemical that prevents harmless mosquito juveniles from maturing into pesky adults. The mosquitoes are trapped by chemical action in their larval or pupal stages until they perish. Altosid is produced by the Zoecon Corp., Palo Alto, California.

Prior to registration, Zoecon field tested the material under EPA safeguards for the past two years in limited areas of 37 States ranging from New York to Hawaii.

The Altosid registration allows use against one category of mosquito--the "floodwater" variety--in flooded pastures or non-crop areas. Experience with the material, however, may warrant EPA's extending the registration to cover additional mosquito breeding areas. Altosid may be applied by either airplane or ground equipment.

The pesticide appears to offer certain environmental advantages over other EPA approved mosquito control techniques. It is "specific" to the mosquito, i.e. it kills mosquitoes but

(more)

appears to pose less of a hazard than other mosquito pesticides to applicators, fish, birds and most other wildlife. The Altosid label notes, however, that it may kill shrimp and crab and should not be used where these are important resources.

In addition, Altosid degrades quickly. Most of the material is gone within two weeks, less than half the time it takes other chemical mosquito controls to neutralize. The product also has a low application rate -- three to four ounces per acre of water.

EPA notified the public of receipt of the Altosid registration application in the July 31, 1974 Federal Register. In the March 3, 1975 Federal Register, EPA published "exemptions from tolerances" for residues of the chemical in drinking water, forage grasses and legumes, and certain other specific agricultural commodities. These exemptions represent EPA's findings that Altosid poses no human health problems if it contacts these food materials. Persons who feel they may be adversely affected by these exemptions may file written objections within 30 days to the hearing clerk, EPA, Room 1019 East Tower, 401 M Street, S.W., Washington, D.C. 20460.

A photo depicting the effects of Altosid is enclosed or available from the EPA Press Office (202) 755-0344.

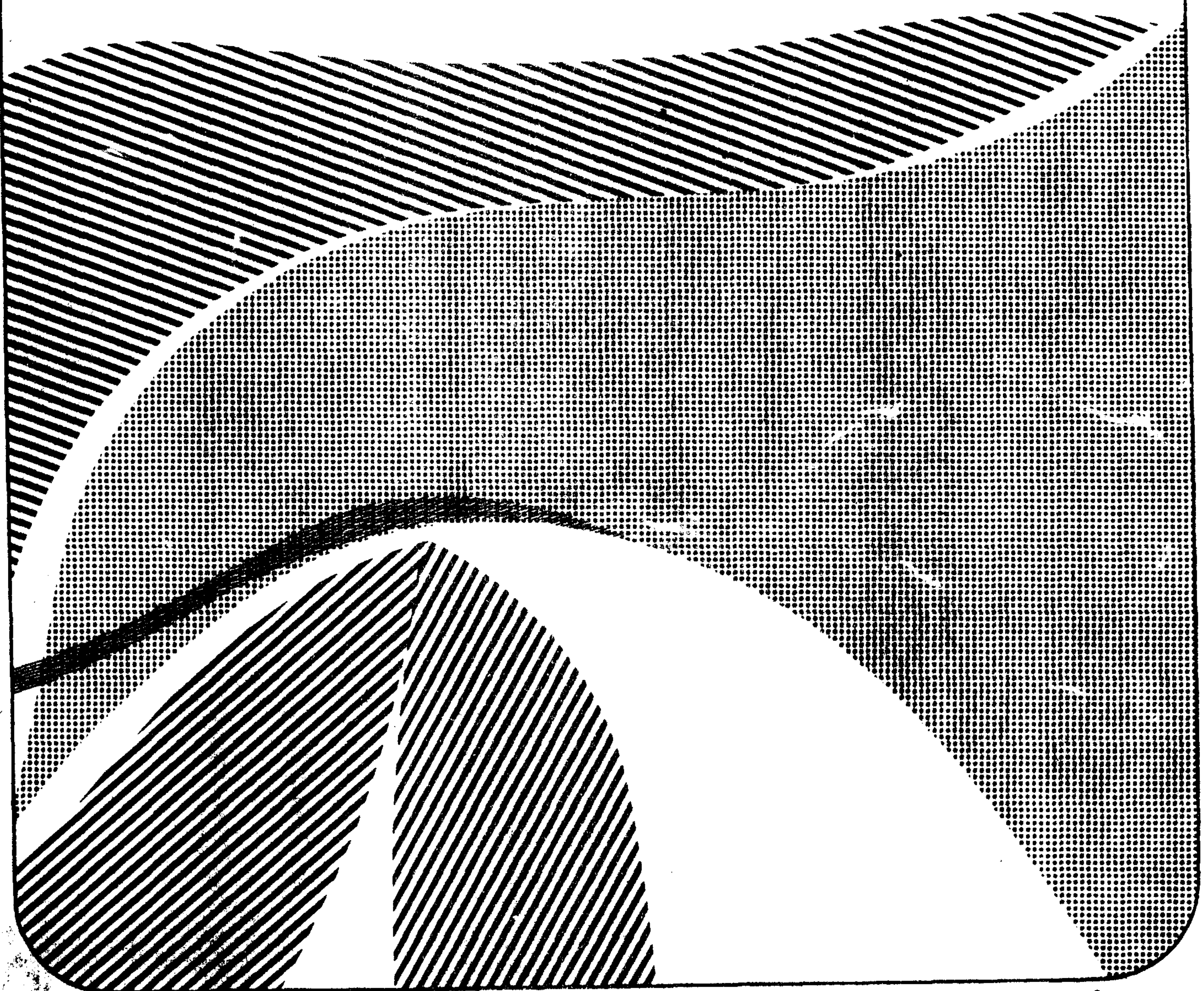
# # #

March 14, 1975

ATTACHMENT C

selected chemical characteristics of soils, forages, and drainage water from the sewage farm serving melbourne, australia

JANUARY 1974



prepared for **Department of the Army, Corps of Engineers**