LAND DISPOSAL OF WASTEWATER WITH SPRAY IRRIGATION BY SMALL MICHIGAN MUNICIPALITIES-- AGRICULTURAL, INSTITUTIONAL, AND FINANCIAL CHARACTERISTICS

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ABSTRACT

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By

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Disposing of waste products has long been a problem for societies. With recent heightened concern for our environment waste disposal has come under more stringent regulation, culminating with the Federal Water Pollution Control Act Amendments of 1972 which sets a national goal of elimination of the discharge of pollutants into navigable water by 1985. Local communities, however, are faced with the problem of how to meet these standards while the demands for other local services such as police and fire protection, water, health, and transportation also may be increasing. The choice among alternative waste disposal systems and the implementation of that choice is of the utmost importance to a local community and its ability to meet its commitments.

Exhaustive research has been undertaken on the chemical, biological and hydrological implications of land disposal technology for wastewater management. Much less attention has been given to the relevant agricultural,

institutional, and financial questions involved in land disposal. While many chemical, biological and hydrological questions remain, this study assumes they can be solved and focuses instead on the institutional, financial and agricultural implications of the land disposal alternative.

Data were collected from files of the Municipal Wastewater Division and the Construction Grants Division, both in the Michigan Department of Natural Resources, consulting engineering firms, local decision makers from communities utilizing land disposal by spray irrigation, the Municipal Finance Commission, and various departments at Michigan State University. Sixteen small municipalities were examined and summarized according to institutional arrangements, financial and agricultural characteristics, as well as describing the systems in physical terms. Legislation relevant to wastewater treatment was examined since it is within that legal framework that communities must function. Three alternative methods of institutional arrangements were illustrated by case studies of communities utilizing different approaches including an area wide sewage authority and two methods of county involvement.

The communities ranged in size from 1,000 to 9,000 design population, with a mean of 3,140. The total land disposal sites ranged from 40 to 450 acres with a mean of 140 acres of which 61 acres are used for lagoons or spray irrigation. Nine of the communities combined with other units of government while 7 acted as entities in constructing

land disposal systems. Local decision makers should realize the importance of the "living filter" concept of land disposal and allow for flexibility in rate and time of application and plan the agricultural sector of the system as an integral part of the land disposal process. Long term use of the system depends on removing those nutrients from the soil that the wastewater adds. Grants tended to increase over the time of construction of the project. Excess funds cannot be counted on since the executive branch of the federal government may perceive other national goals as having more priority than wastewater treatment and not release all funds authorized by the legislative branch. Finally, a check list of items to be considered by local decision makers is included to help them determine if land disposal is a meaningful alternative for their community and a cost-benefit study of a land disposal system is conceptualized.

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CHAPTER I

INTRODUCTION

Returning human waste products to the soil is not a new concept. In many parts of the world, recycling waste products back to the land has been used continuously since man first organized into societal groups. With this organization usually came a concentration of people so that the problem of waste disposal grew along with the numbers of people. Some areas of the world continued to use land as the primary receiving medium. Other areas, however, found that if they were fortunate enough to have a water source such as a stream available, that water source would be utilized to assimilate the human waste produced without apparent harm to water quality. Mohenjo-daro, a settlement on the Indus River, approximately 5,000 years old, has revealed through excavations that sewage removal was practiced in that community. Pipes from bathrooms lead to under floor drains which went through the outer walls of the house to the street where they connected with a larger sewer to carry away the waste.[1] The waste probably reached the Indus River at some point which illustrates a second treatment method, that of dilution.

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[1]Metcalf, L. and H. Eddy. American Sewerage Practice, Vol. III, Disposal of Sewage, McGraw-Hill, 1935, p. 1.

In the land disposal method, the plants and soil organisms act as a living filter in the treatment process. The stabilized effluent is spread on the soil and the phosphorus and nitrogen portions attach to the surface of soil particles where plants may readily utilize them in the photosynthetic process. Hydrocarbons in the effluent become food for soil microbes and the water portion may become part of the water used by the plants or be filtered through the soil to join groundwaters. It is estimated that 75 to 90 percent of the nutrients can be removed by this natural process.[2] Dilution on the other hand, depletes the supply of oxygen in the receiving waters and can hasten eutrophication. Even assuming a stable effluent (meaning that the biochemical oxygen demand, the amount of oxygen demanded by the effluent to stabilize the organic compounds it contains has been met), the dilution process adds nitrogen and phosphorus to the receiving waters and will, therefore, greatly stimulate aquatic growth. This accelerated growth requires greater amounts of oxygen. If the oxygen demands can not be met in the stream, then eventually the aquatic life in the waterway will perish. In order to prevent this outcome, tertiary treatment, or treatment to remove the phosphorus and nitrogen from the water, must be undertaken, often at considerable expense.

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[2]Pound, E. E. and R. W. Crites. Wastewater Treatment and Reuse by Land, Vol. II, Land Application. EPA-660/2-73-006b, August, 1973, p. 54.

The process involved in current technology using land disposal by spray irrigation are really quite simple. After the collection process, the influent is discharged into a series of lagoons, the first type of which is typically an aeration lagoon. Aerobic bacteria are encouraged in this lagoon (there may be more than one) and act to stabilize the BOD of the influent. Aeration is usually accomplished by mechanical stirring devices or by subsurface pipes perforated with small holes through which air compressors pump air. Some systems use anaerobic (without oxygen) bacteria in which case mechanical aeration is not needed. These aeration lagoons have the capacity to hold at least a week's production of sewage and usually hold more. After the sewage has been aerated, it flows into a storage lagoon, the second type of lagoon. Some settling occurs in this lagoon during the storage period which can approach six months during the winter season when the ground is frozen and cannot accept irrigation. (Recent Penn State experiments show that winter irrigation may be possible under some conditions.[3]) When the stabilized sewage is drawn out of the storage lagoon it is subjected to a chlorination treatment to rid the final effluent of any bacteria which might be injurious to the public health. High capacity pumps then deliver the treated effluent to

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[3]Myers, Earl. Pennsylvania State University, Seminar at Michigan State University, May 20, 1974.

the spray irrigation site where three types of sprayers are common. The most prevalent is the solid set type followed by the center pivot and traveling gun types. Most systems are designed to deliver approximately two inches per week but flexibility should be built in to include factors like soil type, topography and crop needs at various stages of development so that the 2 inch parameter is merely a guide, not an absolute.

Small rural municipalities are often hard pressed to provide the many services demanded from them. Police, fire, water, roads, schools and other services all clamor for a larger share of the tax dollar. As sewage treatment standards rise, as levels of performance are increased to meet national goals, even more stress is placed on these governmental units. Can land disposal be a viable alternative for these communities? Metcalf and Eddy, sanitary engineers wrote in 1935, "The fact that sewage farming is the oldest method of sewage treatment. . .should not detract from its value."[4] That is still true. In a time of heightened environmental awareness, the natural recycling processes of land disposal have much support.

Although land disposal may be feasible for many communities, it should not be considered a panacea for every community's sewage problems. It is a relatively land

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[4]Metcalf, L. and H. Eddy, op. cit., p. 250.

intensive technology and many urban areas would have difficulty assembling the necessary land mass. Much research is currently being conducted on the hydrological, chemical and biological implications of land disposal by spray irrigation. Hopefully, this careful research will provide answers to determine when these systems are technically feasible. Most such technical studies, however, are undertaken with the assumption that the economic and institutional problems are readily solvable. This study, while recognizing the importance of the technical problems in land disposal, nevertheless, assumes they can be resolved and tries to examine some of the relevant institutional and economic issues of land disposal by spray irrigation as well as summarizing these systems in Michigan in physical terms. If the institutional and economic feasibility are demonstrated, many small municipalities may choose land disposal of sewage effluents by spray irrigation to meet national goals by 1985.

Data for this study were collected from files and interviews with individuals in the Wastewater Division of the Michigan Department of Natural Resources, the Construction Grants Division of the DNR and the Municipal Finance Commission. Local leaders, both municipal and county, were contacted on field visits and the engineering consulting firms who designed the systems were surveyed. Information was also gathered from various departments at Michigan State University.

CHAPTER II

LEGAL BACKGROUND OF WASTE WATER TREATMENT IN MICHIGAN

This section is a summary of some of the relevant laws relating to the area of wastewater treatment in Michigan. The laws that are summarized are the Federal Water Pollution Control Act Amendments of 1972 (Public Act 92-500), Act 98 of the Public Acts of Michigan-1913, Act 245 of the Public Acts of Michigan-1925, Act 342 of the Public Acts of Michigan-1939, Act 185 of the Public Acts of Michigan-1957, Act 233 of the Public Acts of Michigan-1955, and Act 329 of the Public Acts of Michigan-1966. Act 98 details the Michigan Department of Public Health's role in this area. Act 245 is the enabling legislation for the Water Resources Commission. Acts 342 and 185 detail county involvement. Act 233 outlines an area authority approach, and Act 329 explains the ranking and financing of these project.

The Federal Water Pollution Control Act has as its objective "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Elimination of the discharge of pollutants into navigable water is a national goal set for 1985. Defining what is meant by elimination of pollutants and arriving at standards and guidelines are major responsibilities of the Environmental Protection Agency. These standards and guidelines will have

a great impact on the role land disposal will play in sewage treatment. The rules (in this case, those in the Federal Water Pollution Control Act as amended and Environmental Protection Agency regulations) affect the behavior (type of sewage treatment system chosen) which affects performance (quantity and quality of the inputs and outputs of different treatment systems). This Act is important because it sets the stage for what can follow.

Title One of the Act recognized the importance of coordinated research and technical services in reducing and preventing pollution. Funds are earmarked for water quality surveillance, pollutant effects on the environment, pilot and demonstration programs showing improved methods of pollution reduction or elimination, and the problems of rural sewage treatment, agricultural pollution and their various implications. State responsibilities to qualify for grant moneys and the conditions of these grants is given in Section 106 of Title One. Probably the single most important statement regarding land disposal in the Act comes in Section 107 of Title One.

> "This program (speaking of the Lake Erie demonstration program) shall set forth alternative systems for managing wastewater on a regional basis and shall provide local and state governments with a range of choice as to the type of system to be used for the treatment of wastewater. The alternative systems shall include both advanced waste treatment technology and land disposal systems including aerated treatment-spray irrigation technology."

Thus an old technology, land disposal, was given new life

as a credible alternative to conventional treatment and dilution of the effluent in a waterway.

Federal grants for the construction of treatment works is the topic of Title Two of the Act. The purpose of this section of the Act is to assist in the "implementation of waste treatment plans and practices which will achieve the goals of this Act." One of the important conditions for receiving a Federal grant is demonstrating that alternative treatment systems have been thoroughly explored. The maximum grant for any project is 75 percent of the eligible construction costs except those systems which are incorporated in planning area wide waste treatment systems and may, therefore, qualify for further considerations.

Further sections are included in the Act on standards and enforcement, permits and licenses, and administration. Throughout the Act, the administrator is given the duty of promulgating various rules and initiating various actions within the broad framework of the Act. Such is the case of many rules involving Federal grants on treatment facilities. The Federal Register [Vol. 38, No. 39, February 28, 1973] contained these rules and regulations. Included in these administrative rules is a summary of the grant process definitions and an explanation of the allocation of funds. The State's function in determining the priority of grant recipients and the application process for grants are

enunciated. The grant is awarded as a percentage of allowable costs and not on the total cost of the project. The identification of allowable project costs and unallowable costs (therefore, ineligible for Federal grants) plus those costs which might be approved by a regional administrator of EPA are also included in the rules for construction grants. Finally, land purchased after October 17, 1972 for use in the treatment process (land disposal by spray irrigation) is eligible for Federal grants. Prior to this date the local unit of government had to bear the total burden for the land used in the treatment process and in some cases this cost is quite substantial. This rule may encourage land disposal in highly urbanized areas where land costs would likely be a greater proportion of total construction costs than the smaller, more rural communities this study examined.

Act 98 of the Public Acts of Michigan of 1913 as amended is the guiding Act for the Michigan Department of Public Health regarding their role in sewage disposal. It provides that the MDPH, through the State Health Commissioner, has supervision over water and sewer systems in the state. This supervision is in the form of examining plans and specifications for the systems, issuing construction permits, supervision of water and sewer systems, certification of operators of the systems and provides for penalties for violation of this Act.

All cities, villages, townships and counties are subject to this Act if they are engaged in furnishing sewage or water treatment services as pointed out in Section one. Section two of the Act gives the State Health Commissioner, or his representatives, power to inspect these facilities and he may promulgate those rules he deems necessary to the operation of sewage systems as Section three (b) states. He, or his representative, may also classify systems by size, location, type, etc. and operators by skill, experience, and knowledge to prevent harmful discharge which affects the health of the people of Michigan. Each operator shall be examined to determine their qualifications and each system will have a certified operator responsible for the operation of the system.

The chief executive of each governmental unit (city, village, township, etc.) is responsible for filing plans and specifications for sewage systems owned or operated by that unit to the MDPH for the purpose of review for adequacy in protecting public health and issuing a construction permit. Periodic reports on the operation of the system are required and should the system be found wanting by the State Health Commissioner or his agents, adjustments may be ordered to bring the system up to standards. Another duty of the State Health Commissioner is to cooperate with Federal and/or state agencies in the determining of grants to assist local governmental units in constructing the systems. Legal action

may be taken in the name of the State of Michigan against violators of the provisions of Act 98. In a 1973 agency reorganization, the people of the Department of Public Health responsible for carrying out the provisions of this Act were switched to Wastewater Division of the Department of Natural Resources by Executive Order of the Governor of the State of Michigan to prevent overlapping of duties of the two agencies. Members of the Wastewater Division of the Department of Natural Resources still work very closely with the Department of Public Health to protect the health of the people of the State of Michigan.

Act 245 of the Public Acts of Michigan of 1929 as amended created the Water Resources Commission which was given the task of protecting the waters of the state. The Commission consists of seven members: the directors of the Department of Natural Resources, Department of Public Health, Department of State Highways, Department of Agriculture, or their representatives, and three individuals (one each) representing conservation groups, municipalities and industrial management appointed by the Governor. The Commission meets each month and is charged with investigating uses of the state's waters, both surface and subsurface. They may make surveys of the state's waters and advise in the formation of flood control districts authorized by the legislature. The Commission is to act as the coordinating agency for water resources with other agencies or governmental units and is

directed to take advantage of any Federal laws enacted which further the purposes of this Act, including the Water Resources Planning Act and the Federal Water Pollution Control Act. The Commission has the authority to act in a court of law in the name of the people of Michigan to enforce laws relating to pollution and floodway control and can investigate conditions relating to pollution and floodway control. It can set rules and standards regarding pollution and issue permits to ensure compliance to these standards. Anyone who contemplates a new use of the state's waters for waste disposal purposes (sewage, laundromats, and car-washes) must file with the Commission a report setting forth the quantities and qualities of water used and the source and discharge points of the water. The Commission may accept or reject the proposal and should the user feel aggreived, he may request a hearing. Following the hearing, the Commission will issue a final order of determination at which time the user's only recourse is through the court system, should the user continue to disagree with the ruling. Anyone who violates a final order of determination is subject to the penalties of the Act which are that the Commission request the Attorney General to start civil action. This action may include an injunction and fines which can include a maximum of $10,000 per day penalty, a maximum of $25,000 fine for knowingly providing the Commission with false or

misinformation and a maximum $50,000 penalty for a second conviction for the offense. It is up to the court's discretion to rule on recovery of injuries done to natural resources of the state, the amount of the penalties, and the imposition of probation upon a violator.

This Act specifically excuses copper and iron mining operations, providing those operations meet some broad requirements. The Water Resources Commission hands are not tied to sewage problems, however. Their role is with anything that depletes the quality of the natural resource--water. To carry on surveillance work of the state's waters, other than municipalities, a yearly fee of at least $50 and not more than $9,000 per manufacturing location may be assessed according to a formula developed by rules of the Commission which shall include volume and nature of the discharge, stream characteristics, laboratory tests required and other factors.

Act 342 of the Public Acts of Michigan of 1939 as amended is sometimes referred to as the County Public Improvement Act of 1939. It is "an act to authorize counties to establish and provide connecting water, sewer and/or sewage disposal improvements and services within or between cities, villages, townships,. . .or any duly authorized established combinations thereof. . ." This Act enables the counties to enter into contractual arrangements with other governmental units providing for acquisition, construction, and financing

of the improvements and to pledge the counties full faith and credit by vote of the county commissioners along with the cooperating governmental unit in securing the bonds necessary to finance the improvements. The county board of commissioners by resolution must approve the establishment of the improvement and designate a county agency to locate, acquire, construct and maintain the system. The authorized county agency may be the board of county road commissioners, the drain commissioner, or the county board of public works. The authorized agency has several powers as enumerated in Section three which include making proposed alterations of the facilities, determine rates and assessments and adjust those rates, to act as applicant for any grant or gift and to make any rules governing the operation of the facilites. A board of review shall be selected by the county commissioners and they shall reexamine and arbitrate rates and assessments as brought to their attention by individuals, firms or units of government.

The capital and maintenance costs must be paid back to the county by the contracting governmental unit during a period not to exceed forty years from sources such as connection charges, monthly rates, user assessments or by a property tax levy. Any who would choose not to pay these fees will have the amount added to the tax rolls as a lien against the property and may be collected in accordance with the tax laws of the state. A local unit of government may enter into a contractual agreement with the county under

the provisions of Act 342 of 1939 as amended when public notices are given that a resolution authorizing such action has been adopted by the governmental unit, that the purpose of the agreement is given, that the source of repayment of obligations is put forth and that the right of referendum is explained. The contract is not effective for forty-five days after public notice during which time a petition supported by 10 percent or 15,000, whichever is less, of the registered electorate may request a referendum. If an election on the matter is required, a simple majority by voters within the governmental unit is needed to ratify the contractual agreement with the county.

Once a contract is agreed upon, bonds may be sold in the name of the county (providing both governmental units pledge full faith and credit) and are exempt from taxation by any taxing authority within the state. The maximum interest rate for the bonds under this Act is ten percent. The Municipal Finance Commission, however, has final approval as to whether the bond issue meets the requirements of the Act. The issue may be of either the revenue or general obligation type bond. In case a local governmental unit can not meet its obligations by the before mentioned sources of property tax, special assessments, user charges or grants, and defaults on the bond payments, the state treasurer may be authorized to withhold unrestricted state funds, such as sales tax revenue to reimburse the county for the deficiency

it must make up, having pledged its full faith and credit, until the local unit of government can again meet its obligations. The authorized county agency is, under Act 149 of 1911, given the power of eminent domain over private property for a public use. For a sample contract between a village and county under the provisions of Act 342, refer to Appendix 1.

Act 185 of the Public Acts of Michigan of 1957 as amended is entitled, "An act to authorize the establishing of a department and board of public works in counties; to prescribe the powers and duties of any county subject to the provisions of this act; to authorize the issuance and payment of bonds; and to prescribe a procedure for special assessments and condemnation." A county board of commissioners may choose to establish a department of public works under the povisions of this Act by a two-thirds vote of the commissioners. The department of public works is designed to operate under a board of public works which may have three, five, or seven members appointed by the board of commissioners. An alternative is that if there is already established a board of country road commissioners, they may be appointed as a board to become the board of public works. Also, if there is a county drain commissioner, that person will automatically become a member of the board of public works.

Tha board organizes itself regarding officers with the chairperson, vice chairperson, and secretary being selected once each year. Monthly meetings are required to carry on the board's functions. The board may hire a director of public works and other professional help they deem necessary. The board of public works has the power to acquire water, sewage or refuse systems in one or more areas of the county. This power extends to construction, operation and maintenance of these systems. Another feature of this bill is that it enables a board of public works to make lake improvements in the county as defined in the Act. Also, a part of the system, such as a supply source for a water system or a disposal site for sewage or refuse, may be located outside of the county with the contractual consent of the municipality outside the county where that part of the system is located.

The board of public works has the power to acquire any of the types of systems mentioned after the board of commissioners, by majority vote, approves the system and the local municipality involved through its governing body gives its consent. Financing may be achieved by revenue bonds, bonds issued in anticipation of special assessments and by advances from the county or public or private corporation. Bonds issued must be approved by both the board of public works and the county board of commissioners with a three-fifths majority required by the commissioners in order to secure the county's full faith and credit. Local municipalities

must pledge their full faith and credit for their bond obligations which may be met by levying a tax on property, user charges, special assessments, connecting charges or by state moneys reimbursed to the municipality. Should there be a failure to meet financial obligations on the part of the local municipality, state funds earmarked for that municipality and not pledged for debt retirement, may be diverted as partial payment to the county. The county may also order local municipal officials to levy additional taxes in an amount great enough to meet the obligations it has pledged itself to.

Chapter two of Act 185 of Public Acts of Michigan of 1957 as amended deals with the special assessment procedures and processes. This will be relevant only if a part or all of the financing will be achieved by special assessments. Although citizen input is provided for in a public hearing, the primary decision making power rests with the board of public works in the assessment process.

Property may be acquired by purchase or condemnation under this Act. The final chapter, chapter three, deals with the condemnation procedure to be followed. The board of public works directs its attorney to file in court a declaration of necessity of taking for a public use without the consent of the owners, and for just compensation to be made. The court appoints three disinterested parties to act as court commissioners to determine the necessity for

taking and to appraise the value of the property rights taken. The court then confirms or rejects the court commissioners report and should the court accept the report, the property owners may accept the findings or ask for review from a higher court. An example of a contract between a municipality and a county under the provisions of Act 185 is included in Appendix 2.

Act 233 of the Public Acts of Michigan of 1955 provides that muncipal authorities may acquire, own and operate sewage disposal and water supply systems, contract with governmental units for the system's use and issue bonds to finance the authorities activities. The legislative bodies of two or more such municipalities indicate their desire to form an area authority by agreeing to articles of incorporation for such an area authority. Public notice of the intent to form an authority is required and for a period of sixty days this intent is not finalized subject to a ruling by the local court should a challenge to the formation of the authority arise. The articles of incorporation will list the member municipalities, its purposes, its officers, employees and their duties, its method of selecting a governing body and other matters deemed important.

Area authorities may have standing in any court in the state. They may adopt bylaws and conduct the authorities' business, maintain an office, sue and be sued, determine a design, construct, operate and maintain facilities under the

supervision of the state commissioner of health as provided in Act 98 of 1913, acquire property, issue bonds to finance the authority's business and promulgate rules to regulate project use. The authority is also given the power to condemn property. Municipalities may join an existing authority with the consent of the governing bodies of the current authorities members and the governing body of the proposed member.

The authority may execute contracts for construction, operation and financing of sewage and/or water systems with the member municipalities for a period not to exceed forty years and the contract also allocates the share of services and costs on an annual basis to each member municipality. Money may be raised by special assessments on those who benefit from the service, user charges and connecting fees, and state funds unless they are expressly prohibited for this purpose to meet the annual requirement. Public notice of the contract must be given in the participating municipalities. If a challenge is raised and ten percent of the registered voters agree to the challenge by petition, then a general election will be held to decide whether the contract will be executed. Simple majority rules in the case of a referendum. When the contracts have been executed, the authority may issue bonds which are backed by the full faith and credit pledges from each municipaltiy participating in the authority. Revenue bonds only are the type of bonds

to be issued by an area authority since they must be retired by revenue generated by the system. On large projects, as defined in the Act, six percent is the maximum interest rate allowable on these bonds and the transaction must have the approval of the Municpal Finance Commission. Should any municipality default on its obligation, it may in addition to its full faith and credit, pledge up to 25 percent of the money due it from the state sales tax which normally is returned to the municipality. For an example, see Appendix 3 and the articles of incorporation for the Harbor Springs Area Sewage Authority.

Act 329 of the Public Acts of Michigan of 1966 is an Act to prevent inadequately treated sewage or waste discharge into state waters and to provide financial assistance to construct facilities to prevent such discharge. A state water pollution control fund is created to assist local units of government in financing treatment systems to prevent pollution. This fund was initially capitalized by the sale of $285 million in bonds in 1968 and refunded in 1972 by a $50 million bond issue. Payments from this fund are made to eligible recipients following approval of a joint resolution by both houses of the legislature. A priority list is compiled by the Water Resources Commission according to the rules of this Act of eligible participants and all or part of that list may receive water pollution control fund assistance for a given year depending on legislative prerogative.

No state grant shall be offered which exceeds twenty-five percent of the total treatment system cost eligible for Federal grants. The sum of state and Federal grants for any project must not exceed ninety percent of the cost of the treatment system eligible for Federal participation. Those projects in the construction stage prior to July 1, 1971 (most systems included in this study fit in this category) qualified for an additional state advance. This state advance was given in anticipation of the Federal share of eligible costs so that the total of the state grant, the Federal grant and the state advance of the Federal share was at least 55 percent of the eligible cost of the system. During the course of construction, the grant amounts are subject to adjustment. The Water Resources Commission shall certify to the state treasurer, the amount of the state grant and advance and include documents giving approval for the system regarding design and necessity of the system. The Water Resources Commission must make what rules it deems necessary to carry out the functions of this Act.

Grants and advances to local municipalities are funded in the descending order of their priority. Should funds run low before the last priority is met, grants and advances may be fulfilled from the next year's appropriation to the fund. Local agencies must be reimbursed in full for their state advance of the Federal share by additional Federal moneys before Federal funds may be diverted to the state

water pollution control fund. In other words, 55 percent of eligible costs is the minimum grant level for a project. All additional Federal money goes to the local unit until the maximum grant participation is reached (80 percent of eligible costs according to the Federal Water Pollution Control Act of 1972 as amended) before any Federal funds reach the state water pollution control fund. The Water Resources Commission may approve grants to assist local communities in preparing plans for pollution control systems. Records of projects under construction must be kept including total cost, grant totals and the source of those grants, and what grant moneys were used to purchase.

The method of giving priority ranking to projects is based on Water Resources Commission rules which gives consideration to projects which have a grant under the Federal Water Pollution Control Act as amended, those that eliminate sewage discharge or serious health hazards in communities with no sewers, communities under a sewer ban imposed by the Michigan Department of Public Health under provisions of Act 98 of 1913 as amended, and projects which correct a combined sewer or storm sewer discharge in compliance with a Water Resources Commission order.

Points are awarded to a project to determine its priority based on financial need of the community and on the basis of the uses made of the water and the resulting need to

control pollution. Some of the use categories are public health, safety and welfare not including bathing, domestic water supply, commerical water supply, irrigation or livestock use, recreational uses, and fish, animals, birds and aquatic life. Points may be awarded for each of these categories as well as being awarded in consideration of the case of court ordered installations or by order and agreement of the Water Resources Commission and the Department of Public Health. The Water Resources Commission will break any ties should the sum of financial need points and pollution control need points for any two projects be the same. Finally, the application procedure and deadlines are explained in the Act.

CHAPTER III

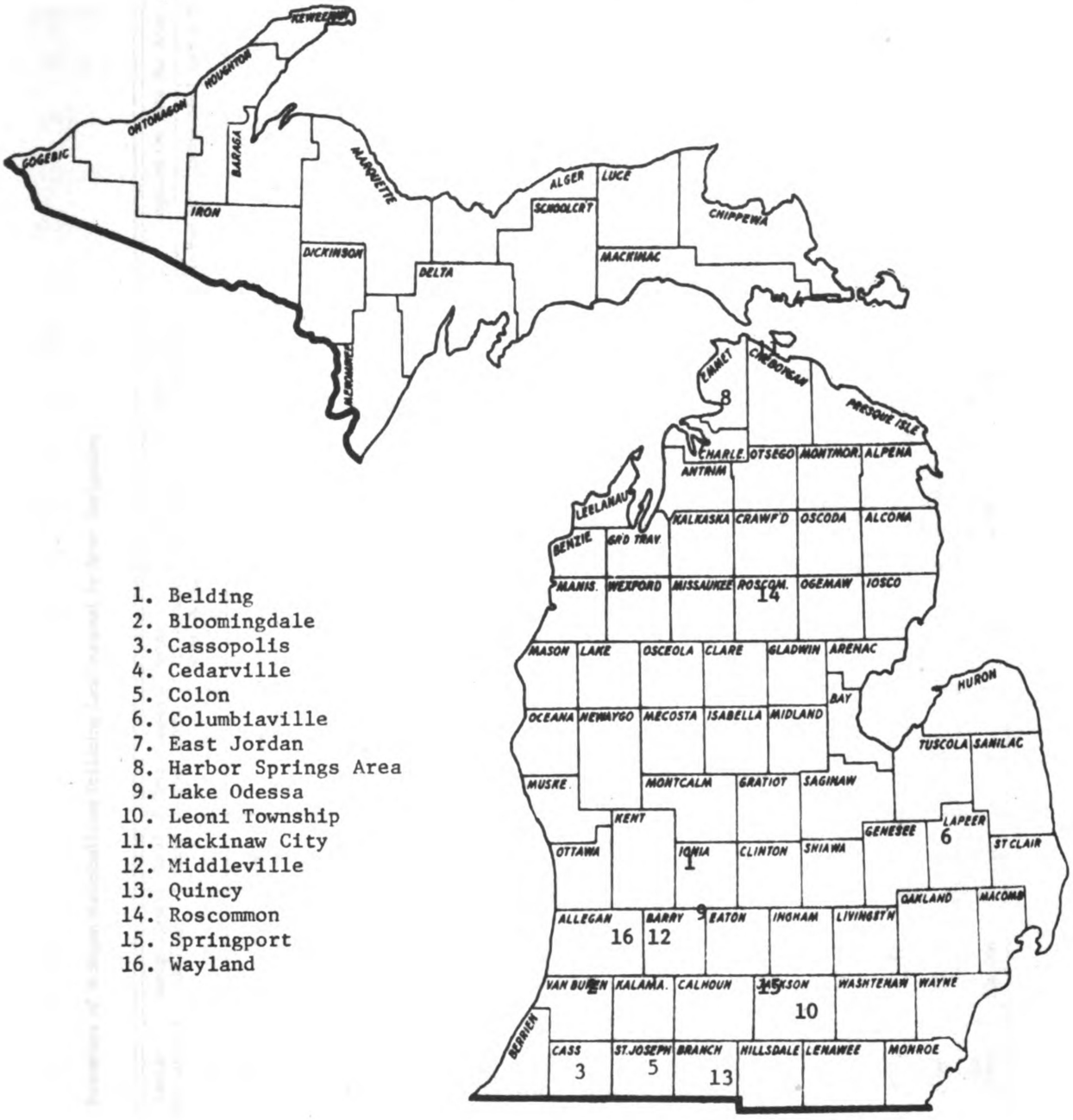
PHYSICAL FEATURES

Communities which utilize land disposal by spray irrigation are scattered throughout the lower peninsula and one is located north of the Straits in Mackinac County. This study did not include the extremely large installation at Muskegon County or any private developments. It did include Belding, Bloomingdale, Cassopolis, Cedarville, Colon, Columbiaville, East Jordan, Harbor Springs, Lake Odessa, Leoni Township, Mackinaw City, Middleville, Quincy, Roscommon, Springport, and Wayland. Figure 1 details the location of municipalities using land disposal by spray irrigation in Michigan according to the "Superlist" prepared by the Wastewater Division of the Michgian Department of Natural Resources.

Table 1 lists the physical data collected for this study. The first category, design population (maximum population the system is designed to accommodate), ranged from a low of one thousand to a high of nine thousand with a mean of 3,140 for these systems. Sanitary engineers use one hundred gallons per capita per day as a parameter to determine domestic sewage requirements for all uses. On this basis the systems have an expected flow from one hundred

Figure 1

Location of Selected Municipalities
Utilizing Land Disposal of Wastewater by Spray Irrigation



1. Belding
2. Bloomingdale
3. Cassopolis
4. Cedarville
5. Colon
6. Columbiaville
7. East Jordan
8. Harbor Springs Area
9. Lake Odessa
10. Leoni Township
11. Mackinaw City
12. Middleville
13. Quincy
14. Roscommon
15. Springport
16. Wayland

Table 1. Physical Parameters of Michigan Municipalities Utilizing Land Disposal by Spray Irrigation

Municipality	Design Population (1)	Design Flow Gal/Day (2)	Total Acres (3)	Total Lagoon Area, Acres (4)	Spray Irrigation Area, Acres (5)	Type Aeration (6)	Type Spray Irrigation (7)	Application Rate Per Acre		
								Inches/Hr	Inches/Wk (8)	Inches/Yr
Belding	8000 (1993)	800,000	100	51.4	15.6	Anaerobic	Solid set	.12	2 to 4	80
Bloomingdale	1000 (2000)	100,000	190	12	25.8		Solid set	.10	2	52
Cassopolis	2200 (1970	220,000	40	18.6	8	Anaerobic	Solid set	.04		
Cedarville			120		10		Solid set			
Colon	1390 (1966)	139,000	159	16.4	30		Solid set	.18	2.5	65
Columbiaville	1100 (1990)	110,000	115	9.4	38				.5	
East Jordan	3700 (1990)	370,000	65	22	43		Solid set	.12	2.8	62
Harbor Springs Area	5000 (1970)	580,000 sum 460,000 win	450	21.4	51.3	2@ 15hp Mechanical	Traveling gun Center Pivot		4	90
Lake Odessa	2200 (1990)	800,000	120	20	72	Mechanical	Solid set		2	50
Leoni Twp.	9000 (1975)	900,000	250	36.8	140	Hinde Blower 1@ 50hp	Solid set	.36	3.3	86.3
Mackinaw City	1200 (1980)	84,000	120	15	35		Solid set		2.4	
Middleville	2200 (1990)	220,000	125	22	30		Solid set		2.7	80
Quincy	2500 (1990)	225,000	123	13	53	Hinde Blower 2@ 10hp	Solid set		2	52
Roscommon	1550 (1990)	155,000	80	16	24		Solid set	.20	3.3	86
Springport	1100 (1990)	170,000	56	4.5	20	Mechanical 2@ 7.5hp	Solid set	.20	2.5	87.5
Wayland	5000 (1990)	500,000	133	31	53	1@ 25hp Mechanical	Traveling gun Center Pivot		2.5	76

thousand gallons to nine hundred thousand gallons per day. Industrial uses generally account for any additions to this parameter and any system designed for less would be based on measured flow in the existing system. The one hundred gallon figure is not only a round figure to work with but in most cases, allows for increased water usage per capita over present usage amounts per day. The mean total acres for these projects is 140 acres. This is the total number of acres purchased or in some cases already owned by the local unit of government. Figure 1 in Appendix 7 shows the relationship between the design population and total acres. A simple regression, using design population as the independent variable and calculated by the least squares method, projects this relationship from the data collected during the study.

The total land area required is quite important. When these systems were being designed and built, the local unit of government had to bear the total cost of the land used in the disposal process. After October 17, 1972 the land used in the disposal by spray irrigation became eligible for grant participation. Therefore, these communities, in an effort to cut costs, desired to purchase a little land as possible for the disposal process. At the same time, state health officials wanted to establish a relatively large buffer zone around the lagoons and spray irrigation sites. This is a relatively new technology and officials

want to control any possible health hazards or nuisances that might be anticipated. The state officials pressed for the establishment of an 800 foot buffer strip around the lagoons and irrigation site as a suggestion, not a regulation. On a large project this buffer is a small portion of the total land required. However, on the systems studied in this report, the buffer area becomes a significant part of the total land required. On a project with sixty-one acres in lagoons and irrigation, the average for this study an 800 foot buffer strip around the site would make the total area approximately 235 acres or almost four times the area in lagoons and spray irrigation. These projects averaged 140 acres (therefore, an average buffer strip of 340 feet) so a compromise position was reached. The compromise involved substitution of other forms of protection for the land buffer such as fencing around the project, retaining dikes to prevent any runoff, tree windbreaks to prevent particle drift and lower pressure, large diameter spray heads to achieve larger droplets and less drift as well as other management practices. As more experience with this technology has accumulated, the buffer zones are substantially less than the 800 feet first proposed. Even if the municipality didn't control all land close to the site, general isolation and the absence of any planned development adjacent to the site is an important consideration from the

state officials' point of view.[1] For aesthetic reasons, all types of sewage treatment works are isolated as much as possible. Land disposal systems are no exception.

The lagoon area for these land disposal systems ranged from 4.5 acres to 51.4 acres with a mean of 20.6 acres. Some of these systems were designed originally for discharge into a water course or as seepage lagoons in which case land disposal was a recent addition to assist the systems in meeting environmental guidelines for the quality of the effluent. There are many such lagoon systems in small Michigan municipalities[2] and land disposal is a relatively inexpensive addition which enables these lagoon systems to meet effluent quality guidelines. Figure 2 in Appendix 7 illustrates the relationship of the design population and number of acres in lagoons. With design population as the independent variable, a simple regression calculated by least squares and having lagoon acres as the dependent variable, shows that as population increases by 1,000, total lagoon acres increase by 4.1 acres.

The next physical parameter considered in the study is that of acres under spray irrigation. The range was

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[1]Private conversation with a representative of the Wastewater Division of the Michigan Department of Natural Resources, September 11, 1974.

[2]"The Superlist" A listing of Michigan Municipal Wastewater Treatment Facilities. Compiled by the Wastewater Division of the Department of Natural Resources. Over 125 systems use lagoons in Michigan exclusive of those utilizing spray irrigation.

quite large according to the data and was from 8 acres to 140 acres. Figure 3 of Appendix 7 illustrates the relationship of design population to irrigated acres. Several of the points are widely scattered about the regression line which strongly suggests that the two variables, design population and irrigated acres, are not closely correlated. Other factors might enter into this relationship such as whether the system was originally designed and still partially used as either seepage lagoons or stabilization lagoons seasonally discharged. Vegetative characteristics is another variable which should be considered in this relationship since some plants thrive in a very wet environment.

Soil type and its ability to accept the water also has a great bearing on the amount of land needed for irrigation. Members of the Wastewater Division of the Michigan Department of Natural Resources assert that one of the single most important design problems with land disposal systems is that sanitary engineers have been overly optimistic with the rate of application of the effluent. Consequently the systems might not perform up to expectations. The data base that sanitary engineers have had to work with about soil often addresses itself to load bearing capacity, seepage rates or suitability for septic tank disposal fields. This is an area where agricultural crops and soils scientists can lend their expertise to help determine how much water a given site can process. Their experience with irrigation helps them

determine how much water is lost by evapotranspiration (evaporation losses and plant uptake) and how much can be expected to percolate into a given soil series. However, the rules are changed here from conventional irrigation practices because the soils are often subjected to sustained periods of saturation which can drastically alter a soil's capacity for irrigation. Needed research in this problem area is ongoing and data is being monitored from communities which have systems in operation to obtain information concerning different crops and soils reaction to various rates of application and how that in turn affects the treatment capability of the soil regarding phosphorus and nitrogen removal.

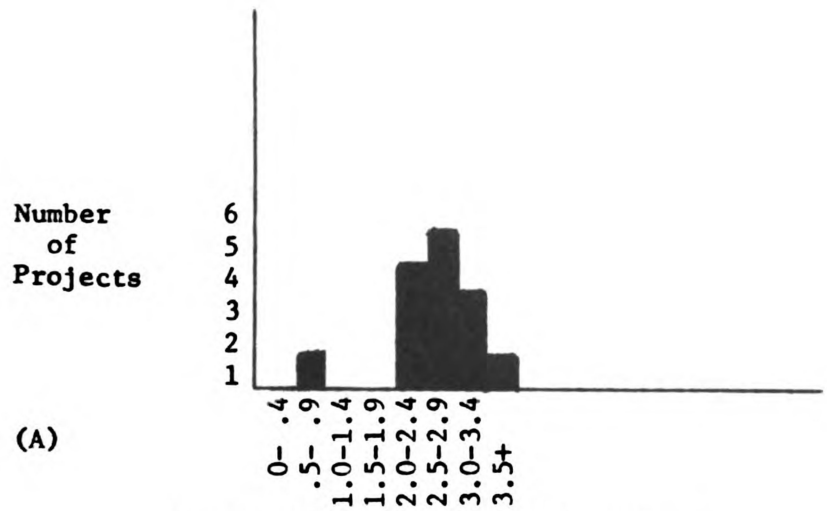
Most of the irrigation locations have the solid set type of spray irrigation. This usually means fixed mains and laterals covering the whole irrigation area. Relatively little labor is needed for operation of a solid set system. A combination of a traveling gun and center pivot system is used at two of the projects. A center pivot system needs relatively level terrain to operate effectively and is definitely out of the question for such vegetation as trees, although it works well for crops like corn and hay. A traveling gun needs a smooth track to run on but can irrigate a variety of vegetation and terrain on either side of the path. It requires some labor to move and set up from one path to another. By its nature a solid set system can apply

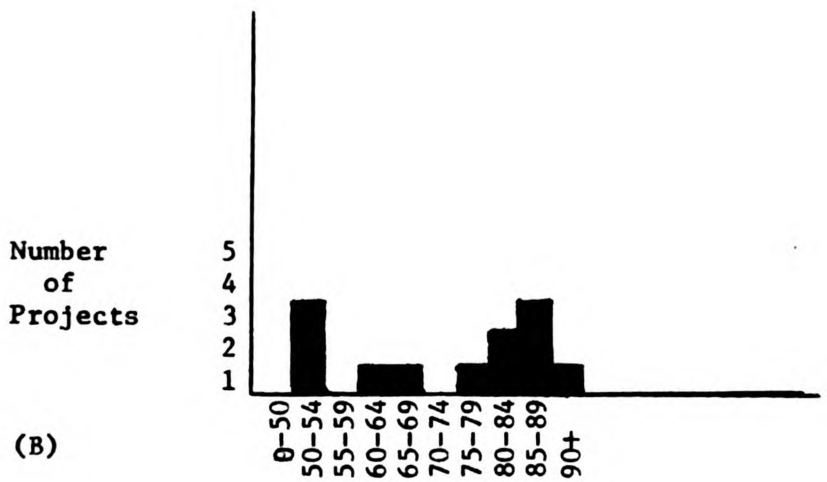
a very low rate over a large area at a given point in time while the center pivot or traveling gun relies on a more intensive instantaneous application pattern. This factor may gain importance in a setting of possible erosion or if so much water is applied at one time that saturation occurs which could drastically alter bacterial action due to the absence of oxygen. Saturation could also occur, however, with a solid set system with similar consequences.

A common design parameter for application of wastewater per week is two inches. These municipal projects ranged from .5 to 4 inches with a mean of approximately 2.5 inches per week. Yearly application rates ranged from 50 to 90 inches with a mean of approximately 72.2 inches. Figure 2 shows the distribution of project application rates, both weekly and yearly for the municipalities in this survey. When speaking of application rates, flexibility should be a key word. Decision makers should realize that harvesting a product from the land is an important part of the complete "living filter" cycle. This may mean that at certain times during the possible irrigation season, prudent management decrees that irrigation be minimized or even stopped. Examples might be during planting, germination or other critical periods during crop development and harvesting. During other times, application rates may substantially exceed two inches per week but at that particular stage of crop development, plant uptake and use of water and nutrients

Figure 2

Application Rate of Wastewater





may allow high application rates without experiencing a breakdown in the living filter concept. This acknowledgement of flexibility is often overlooked by officials connected with these projects and that could lead to poor, long-run performance of spray irrigation systems. Agricultural production should be an integral part of the design of land disposal systems.

CHAPTER IV

FINANCIAL CHARACTERISTICS

This section relies on the information presented in Table 2 on the next page, Financial Characteristics of Michigan Municipalities Utilizing Land Disposal by Spray Irrigation. It was compiled from the files and records of the Construction Grants Division of the Michigan Department of Natural Resources and the Municipal Finance Commission.

The Environmental Protection Agency has the duty under the Federal Water Pollution Control Act Amendment of 1972 to promulgate rules concerning the construction of water pollution control facilities which includes land disposal systems using spray irrigation. To assist in the construction of these facilities, Federal money has been allocated for this purpose consistent with Title II of the Act, Grants for Construction of Treatment Works. The Environmental Protection Agency rules and regulations concerning Title II appear in the Federal Register.[1] As the previous discussion about these rules and regulations pointed out, all costs associated with a treatment facility are not eligible for Federal grant participation. At the time of the grant application, each project is scrutinized by the Environmental Protection Agency

[1] Federal Register, Vol. 38, No. 39, Wednesday, February 28, 1973, p. 5329.

Table 2. Financial Characteristics of Michigan Municipalities Utilizing Land Disposal by Spray Irrigation

Municipality	Initial Amount Eligible for Federal Grant (1)	Initial Federal Grant (2)	Initial State Grant (3)	Initial State Advance (4)	Local Bonds (5)	Present Amount Eligible for Federal Grant (6)	Present Federal Grant (7)	Present State Grant (8)	Present State Advance (9)	Contract Amount (10)	
										Total	Per Capita
Belding	(Project completed before current grant rules in effect received a demonstration grant totaling 84,375)										
Bloomingdale	216,900	10,840	54,225	54,225	395,000	216,500	30,310	54,225	54,225	514,290	514.30
Cassopolis	(Project completed before current grant rules in effect)										
Cedarville	447,600	22,380	111,900	111,900	520,000	643,348	351,060	160,837	160,837	1,186,700	
Colon	394,400	19,720	98,600	98,600	935,000	592,856	197,320	148,214	99,108	1,279,930	920.80
Columbiaville	726,700	36,330	181,675	181,675	680,000	730,929	233,520	182,732	131,945	1,071,000	973.60
East Jordan	500,000	24,400	122,000	122,000	255,000	503,214	161,500	125,804	90,107	514,650	139.10
Harbor Springs Area	902,000	45,100	225,000	225,000	550,000 *72,250	1,094,287	146,300	261,250	261,250	1,197,000	239.40
Lake Odessa	620,300	8,550	155,075	177,540	360,000	708,645	290,320	177,161	99,435	708,645	318.70
Leoni Twp.	Jackson County is constructing several other township projects simultaneously with Leoni. An accurate breakdown of grants for Leoni Township is not available until all projects under the grant are completed.										
Mackinaw City	590,000	295,000	147,500	---	235,000	762,220	419,210	190,550	---	835,750	272.10
Middleville	400,000	8,486	100,000	111,514	230,000	318,248	127,049	79,560	32,084	318,250	144.70
Quincy	650,000	32,500	162,500	162,500	375,000	696,722	226,810	174,180	121,551	782,075	312.80
Roscommon	396,000	380,000	99,000	---	278,000 *13,000	455,200	421,800	109,000	---	800,000	516.10
Springport	243,600	12,180	60,900	60,900	480,000	273,618	96,920	68,405	53,569	785,000	713.60
Wayland	336,100	16,800	522,361	84,025	1,435,000	416,495	133,100	542,460	75,417	2,116,500	423.30

*Cash

to determine which items are eligible for Federal grant participation consistent with their rules. This is the initial amount of the project eligible for grant participation and makes up the first column of Table 2.

A Federal grant offer is then tendered to the community or its authorized agent (county or authority) based on the information in the grant application. This initial Federal grant, found in the second column of the table, was often a very small percentage of the initial amount eligible for grants. It was usually in the five percent range and depended greatly on how much money had been released to the Environmental Protection Agency during the year the grant application was made. The maximum amount of the Federal grant is, as has previously been noted, 55 percent of the amount eligible for grant participation.

The initial state grant and the initial state advance comprise the third and fourth columns. The state grant may not exceed 25 percent of the amount eligible for grants on these projects,[2] most of which were started in 1970 and 1971. The initial state advance is really an advance against the prospective Federal share of eligible costs. Act 329 of the Public Acts of Michigan, 1966 as amended, provides in section three that the "combined state grant,

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[2]Act 329 of the Public Acts of Michigan of 1966 as amended, Section 3.(1).

state advance of the Federal share and Federal grant apportioned to the treatment works shall not be less than 55 percent of the eligible cost." Since the typical Federal grant for 1970 and 1971 was in the 5 percent range, and the state grant maximum was 25 percent, this meant that approximately 25 percent of the eligible costs fell in the state advance category. After the initial grants were offered, the local community or its agent then lets the contracts and issues bonds or cash in the amount of 45 percent of eligible costs plus all costs not eligible for grant participation under the Environmental Protection Agency rules and regulations.

The present amount eligible for Federal grants, sixth column, reflects for the most part, changes due to the fact that the initial amount eligible for grants is based on a sanitary engineering firms estimate of the various project costs while the present (or final eligible for grants if the project has received its final EPA inspection) amount eligible for grant participation reflects the amounts bid by construction firms. That figure may be more or less than the estimates. Another factor accounting for some variation is that during the course of construction unplanned circumstances may arise which necessitate a change order which is an approval by state engineers to procede a different way or make additions or subtractions from the original permit specifications. These change orders usually

modify the amount eligible for grants.[3] The Environmental Protection Agency may change a rule or correct an oversight during this time also. An example is requiring a tractor and mower for site maintenance which increases the amount eligible for grants and the grant itself. Graph (A) of Figure 3 illustrates the relationsship between the mean initial amount eligible for Federal grant and the mean present amount eligible for Federal grant for the projects included in the study. The means are $494,100 and $570,170 respectively with the increasing being $76,070.

The present Federal grant reflects to a large extent the amount of money released to the Environmental Protection Agency during the period the project was under construction. The Construction Grants Division of the Michigan Department of Natural Resources then apportions Federal funds channeled through it by the EPA to all of the projects under construction and during the 1970-71 fiscal year increases were made from 5 to 10 to 14 percent as more money was made available as construction was completed. In almost every case the Federal grant was increased substantially and as Graph (B) of Figure 3 illustrates, the mean present Federal grant is greater than the mean initial Federal grant by $133,915, $204,090 versus $70,175.

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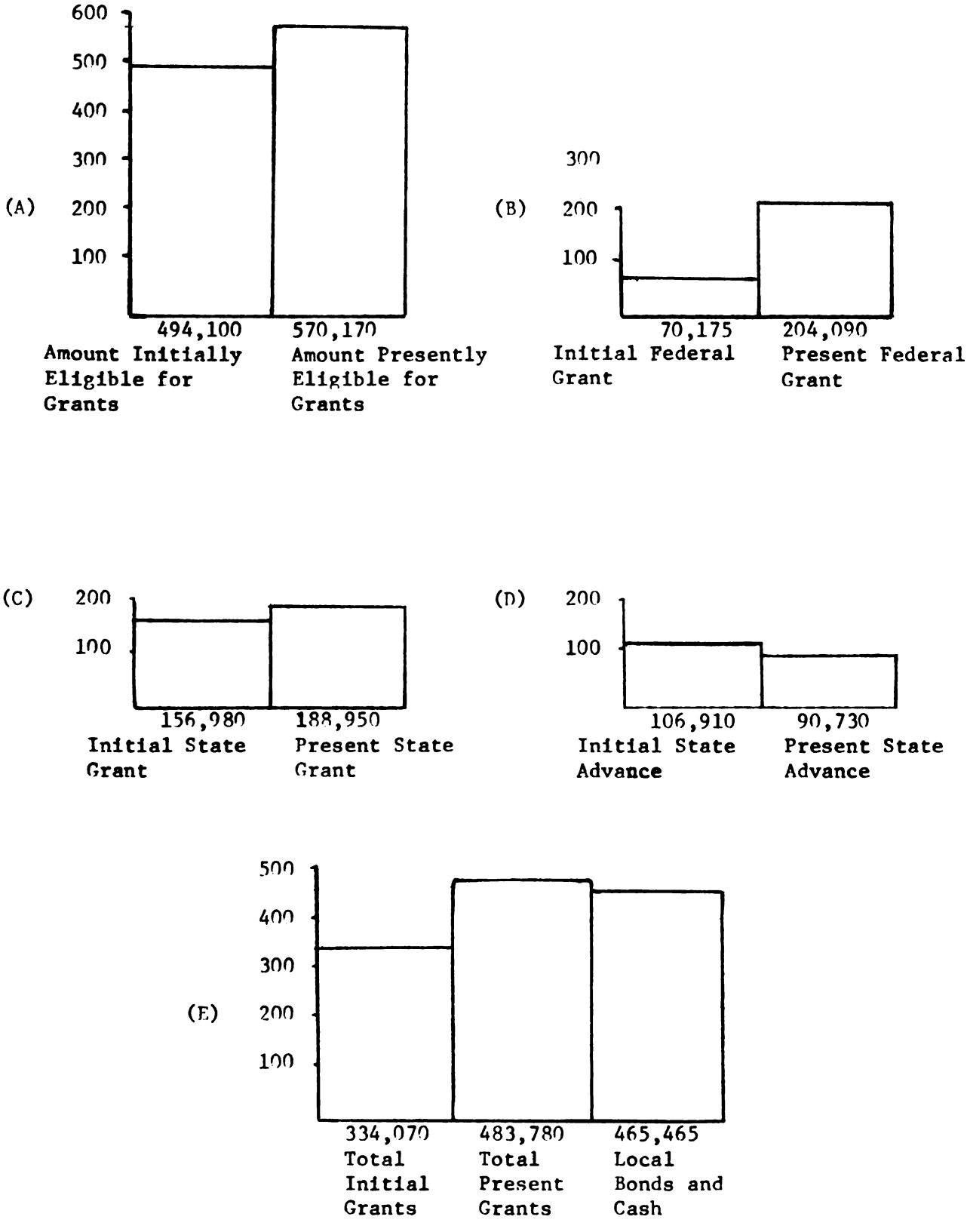
[3]Private conversation with a representative of the Construction Grants Division, July 16, 1974.

Figure 3

Initial and Present Grant Characteristics of
Michigan Municipalities Utilizing Land Disposal by Spray Irrigation



The state grant reflects the effort of the Construction Grants Division of the Michigan Department of Natural Resources to keep the grant in the immediate range of the statutory limitation. Therefore, as the amount eligible for grants has increased, so has the state grant although not as spectacularly as the Federal grant since it started at a higher level of participation than the Federal grant did. It increased from an initial mean of $156,980 to a present mean of $188,950 with the mean increase to each community of $31,970 as Graph (C) of Figure 3 shows.

The present state advance has declined as might have been predicted since the Federal grant has increased so dramatically and the state advance is given in anticipation of prospective Federal funds. But the state does not take away the advance dollar for dollar when the Federal grant is increased. Instead, state officials explain,[4] the local municipality must be up to the maximum 75 percent grant participation level (80 percent if in an areawide plan) from both Federal and state sources before the state advance is decreased. An example would be if an areawide project initially received a 55 percent grant based on a 5 percent Federal grant, 25 percent state grant, and 25 percent state advance, received an increase in the Federal grant participation to the 40 percent level, the state advance would be

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[4] Ibid.

cut back to 15 percent of the amount eligible for grants. The sources would then contribute 40 percent, 25 percent and 15 percent reaching the maximum 80 percent level for the community and in effect, the state's Water Pollution Control Fund would increase by 10 percent of the amount eligible for grants. Graph (D) of Figure 3 illustrates that while the mean of present state advances is $16,180 less presently than it was initially, it has not decreased to zero which would indicate that Federal grants were at the maximum level.

When the grants from state and federal sources are adjusted throughout the construction period, it may lead to some projects being over funded as Graph (e) of Figure 3 shows. Once bids are let a commitment is made on the amount of bonds to be issued locally based on the existing grants. However, these grants change and as Graph (E) illustrates, the mean increase in grants for each project amounted to $149,710. If the project can be completed at the bid price, then often a surplus exists at the community level.[5] What can be done with this money? Bonds might be redeemed with it but very often municipal bonds are issued so that they may be redeemed only after a specific period of time has elapsed and provisions aren't made at the time of the issue to allow the bonds to be retired early. Extensions to the collection system might be made if that is a

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[5]Private conversation with a representative of the Construction Grants Division, July 18, 1974.

felt need of the community. Bond retirement and system improvement are the only two things that local bond money may be used for should there be a surplus of funds. But which is grant money and which is bond money and do the same rules apply to municipalities for their use? So far state officials[6] have urged the further construction of pollution abatement facilities with the excess funds but admit some municipalities do pretty much as they please with the funds. One should not, however, be lulled into the belief that a surplus is inevitable. Several projects did not have this "problem" and local decision makers probably were grateful that the Municipal Finance Commission must see that the total financing is in hand when bonds are issued and does not rely on Federal government largess to participate further than the initial proposal.

The last heading in Table 2 is the contract amount both total and per capita. Data for the total contract was sometimes hard to glean as to whether it was simply the amount of construction contracts or if all contingencies were added. The small systems had a very high per capita investment but this generally included a collection system which is a substantial part of the total cost. There is also an indication of returns to scale for large systems but this is not a phenomenon which can be attributed to land disposal alone. Costs for the treatment site which

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[6] Ibid.

normally include lagoons and spray irrigation equipment but does not include land was gathered when that information was available. Treatment site costs are summarized in Table 4, seventh column. It is difficult to draw inferences from the data because it can not always be determined if apples are being compared to apples, i.e., that the same costs are being compared among projects.

Table 3 illustrates the relationship between grants received from all sources and bonds issued by local municipalities to finance wastewater treatment using land disposal and spray irrigation. The ratio of bonds to grants (third column) is important because it compares communities on the basis of how much local money was invested for each dollar received in grants. (The grants are ultimately traceable to local sources since they come from all tax dollars collected, so the present grants column reflects the gross and not the net transfer into a community.) Communities which issued local bonds in an amount larger than the grants received often were communities which had considerable local resistance to a sewage system at the time. Local decision makers often felt frustrated that the decision to proceed was out of their control as was the decision on the amount of grants the system was eligible to receive. In the effort to meet national wastewater goals they and their constituents often perceived that the costs to them were far greater than the benefits that would accrue to their community.

Table 3. The Relationship Between Grants and Local Bonds in Selected Michigan Municipalities

Municipality	Local Bonds	Present Grants	Ratio of Bonds to Grants
Belding	---	---	
Bloomingdale	395,000	138,760	2.85
Cassopolis	---	---	
Cedarville	520,000	672,730	.77
Colon	935,000	444,640	2.10
Columbiaville	680,000	548,200	1.24
East Jordan	255,000	377,410	.68
Harbor Springs Area	550,000	668,800	.82
Lake Odessa	360,000	566,920	.64
Leoni Township	---	---	
Mackinaw City	235,000	609,760	.39
Middleville	230,000	238,680	.96
Quincy	375,000	522,540	.72
Roscommon	278,000	530,800	.52
Springport	480,000	218,890	2.19
Wayland	1,435,000	750,970	1.91

CHAPTER V

AGRICULTURAL, INSTITUTIONAL AND MISCELLANEOUS CHARACTERISTICS

Soil type on the disposal sites range from sand to clay and silt loams with most of the soils falling in the loamy sand to sandy loam category. Coarser soils have a high percolation capacity but may be less effective in the treatment of wastewater than finer textured soil. However, the heavier clay loam and silt loam soils do not have the infiltration capacity of water that coarse soils will so a tradeoff probably exists among soil types regarding application rate and treatment ability which needs to be further defined by more research in this area.[1] Column one of Table 4, Agricultural, Institutional and Miscellaneous Characteristics of Michigan Municipalities Utilizing Land Disposal by Spray Irrigation, denotes the general soil types found at the disposal sites.

Some of the crops currently grown under spray irrigation in Michigan are nursery crops, forest products, corn and hay. As mentioned earlier, several projects at this

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[1]Ellis, B. G., et al. "Land Treatment of Wastewater in Southeastern Michigan," Department of Crop and Soil Sciences, Michigan State University, East Lansing, Michigan, June, 1973, Table 15 and p. 77.

Table 4. Agricultural, Institutional and Miscellaneous Characteristics of Selected Michigan Land Disposal Systems

Municipality	Soil Type (1)	Agricultural Crops and Management (2)	Michigan Act (3)	Type of Bonds Issued (4)	Interest Rate (5)	Project Initiated By (6)	Cost Lagoons* and Irrigation (7)	Engineering** Services (8)
Belding	Sandy Clayey	Nursery Crops-Professional Management		General Obligation		Local State		1,2,3,4
Bloomingdale	Sandy Loam		342	General Obligation	5.59	State	152,000	1,2,3,4
Cassopolis	Sand Clayey sand					Local State		1,2,3,4
Cedarville	Sandy		185	General Obligation	(FHA) 5.00	State	571,000	1,2,3,4
Colon			185	General Obligation	5.98	Local State	394,000	1,2,3,4,5
Columbiaville			342	General Obligation	5.30	State	477,860	1,2,3
East Jordan	Sandy	Plan lease to farmer		Revenue Bonds and G.O. Bonds	5.18 rev 5.25 g.o.	Local		1,2,3,4
Harbor Springs Area	Sandy	Research by Forest Service	233	Revenue Bonds	(FHA) 5.00	Local	274,760	1,2,3,4
Lake Odessa	Clay loam Silt loam			General Obligation	6.64	State	285,350	1,2,3,4
Leoni Twp.	Loam Sandy loam	Leased to farmer on cash basis	185	General Obligation	4.76	State		1,2,3,4
Mackinaw City	Sandy			General Obligation	5.80	State	68,400	1,2,3
Middleville	Sandy Sandy loam	Corn for feed 1/3-2/3 share		Revenue Bonds	7.00	State	205,660	1,2,3,4
Quincy	Loam Sandy loam			General Obligation	6.54	State	490,000	1,2
Roscommon	Sand Clay Loam		185	Revenue Bonds	(FHA) 5.00	Local State	247,600	1,2,3,4
Springport	Clay loam		342	Revenue Bonds	5.41	State	278,640	1,2,3,4,5
Wayland	Sandy loam	Alfalfa-grass hay Farmer pays by bale	185	General Obligation	5.08	Local State		1,2,3,4

*Contents of contracts differ among projects

** Key (1) Engineering and design; (2) Link with regulatory agencies; (3) Funding expertise; (4) Public relations; (5) Agricultural expertise.

point break the cycle with no harvestable products being contemplated at this time on the irrigation site. This could, in the long run, result in nutrient buildup in the soil such that the effectiveness of the treatment site is substantially impaired. Another problem not yet resolved is what agency is responsible for products grown under spray irrigation. This leads to a boundary problem, a problem of where final responsibility lies, which may have to be settled by a legislative directive. Members of the Departments of Agriculture and Natural Resources have been involved in discussions relating to crop uses. Their position may be described as cautiously optimistic. Information is still being gathered and options are being left open so that as more knowledge is built up about the technology more definitive decisions can be made.[2] Some crops have been used for horses and turkeys and use for dairy animals is anticipated shortly. This is an area where experience in other states and countries might be used to advantage. Environmental Protection Agency publication EPA-430/9-73-006 entitled, "Survey of Facilities Using Land Application of Wastewater" summarized many uses of crops both on domestic and foreign projects.

Another interesting agricultural aspect of these systems appears in Appendix 4. This is a lease agreement between a

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[2]Personal conversation with a representative of the Michigan Department of Agriculture, October 8, 1974.

farmer and a county concerning the operation of an irrigated site. The responsibilities of each party are enumerated concerning the distribution of input costs and returns as with any lease. It has an initial three year trial period during which time there is no charge to the leasee but also no recourse for crops damaged by construction. It is renewable for five year terms following the three year period. Risk of crop failure is partially shared since the final payment is made based on the number of harvested acres. The leaseee must believe that the returns to the comparative advantage of the nutrients and irrigation outweigh the risks associated with too much water. Column three of Table 1 details the amount of land purchased by the municipalities, except East Jordan which utilized existing land at the municipal airport.

Various institutional arrangements were employed by these communities when they chose to cooperate with other levels of government. Of course some acted independently but others chose to use the previously discussed provisions of Acts 185 and 342, the two county level options or an area authority as in Act 233. While several municipalities acted independently, a common comment from them was that if the project had to be done over, county participation would more seriously be studied and considered. Although state legislation existed, the county did not have the machinery or institutions (usually a Board of Public Works) in operation

so the local municipality decision makers opted to proceed on their own. A procedure to follow for adopting the provisions of Act 185 is included in Appendix 5.

Table 4 also lists, in the fifth column, the rate of interest paid for the municipal loans to finance the local share of the pollution control facilities. If the information is separated according to county affiliation versus individual action as in Appendix 7, Figure 4 and a regression line is prepared using design population as the independent variable and the interest rate on bonds as the dependent variable for each set of data, both regressions express a negative slope which means that as population increases, bond interest rate falls. For small municipalities acting independently, the interest rate starts out very high. However, when a county backs a small local municipality's bond issue, it gives a full faith and credit pledge which increases tremendously the total property value behind the issue so that in the event of default there is a much larger resource base guaranteeing the bonds. This reduces the risk significantly which is reflected in lower interest rates a much larger unit of government might enjoy and over the life of a project, gain a significant reduction in total costs.

There are three possible types of bonds that may be used to finance a sewage system. They are special assessment bonds, revenue bonds, and general obligation bonds. None

of these municipalities chose special assessment bonds and sometimes a type of bond may be specified depending upon adoption of a specific method of government cooperation (Act 233 requires revenue bonds). Special assessment bonds[3] are limited as to funds they can raise because they may not exceed 25 percent of the assessed valuation of any property and if vacant land exists in the service area with low valuation the amount raised may be quite small. Along with the problem of the possible low amount of capital that might be raised is the institutional problem of implementing assessments. Review boards are often confronted with the problem of whose interests count in making decisions about "equitable" distribution of the costs (assessments) of the system. This practical political problem is almost impossible to solve so that everyone feels better off in the end. Possible strategy involving the merits of adopting revenue or general obligations bonds is discussed in Appendix 6 with particular reference to those situations where municipalities chose to act alone in acquiring financing. A final alternative would be to obtain a court order to force installation of pollution control facilities in which case general obligation bonds can be issued without regard to limitation as to amount. If that occurs, however, the interest rate will probably be very high due to the risk involved.

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[3] Act 3 of the Public Acts of Michigan of 1895 as amended. (Quoted in unpublished documents prepared for the Village of Colon by a consulting firm.)

Few of the projects involved were initiated entirely at the local level. Usually the Water Resources Commission, if not in the forefront, was hovering in the background assisting the projects along as Act 245 of 1929 as amended directs them to. Many times the pollution of a lake or stream precipitated action and in one case inadequate facilities to handle school wastewater and the resulting threat to stop school operations prompted action. The institutions of law have been invoked through the court system in many instances, both by the state and local citizens seeking to promote adoption of pollution control facilities and by local citizens seeking to halt or alter the proposed technology. Few people want to have any kind of sewage treatment facility located near them and as was mentioned earlier maximum isolation of the facility is an important consideration from the point of view of state agencies involved. When a relatively different technology is proposed, the reaction is sometimes even stronger. It may be necessary to change the rules so that not only those who sell real estate to the project be compensated, but those who perceive they have suffered a loss of other forms of property rights (fresh air, aesthetics, declining property values, etc.) may also be compensated. There are administrative risks involved with payment of consequential damages--how much to pay, and where to draw the line. The values involved are subject to question. This tradeoff will

depend to a great extent on whether land disposal will perform up to current expectations and on whether the technical questions can be solved.

A common concern of local officials involved in constructing land disposal systems was that of the changing design criteria or changing requirements placed upon them during the formative stages of the project. Land disposal by spray irrigation, although not entirely a new technology, is a different application of existing technology and a large body of knowledge concerning it just does not exist. Basic questions of how much water, how fast it is applied to how large an area for what level of treatment have to be pieced together from relatively few sources under quite different conditions. There are no absolutes encased in concrete. While state agencies were concerned with the longer run problem of successful operation over a period of years and insuring public health, local officials seemed to have a goal function oriented toward a somewhat shorter time horizon, that of meeting the known quality standards currently in existence at what they perceived to be the least cost to their constituents. In all fairness, state agencies have been willing to compromise regarding the tradeoff between costs and performance where state or EPA rules and guidelines allow modification. The question remains who makes the rules that state and federal agencies follow and it ultimately comes back to the political process.

CHAPTER VI

CASE STUDIES

This section examines three systems in some detail. They are Bloomingdale, Wayland and the Harbor Springs Area Authority and each represents a different institutional relationship with other units of government. Some communities chose to complete their own system but these three communities chose to cooperate with other governmental units to a greater or lessor degree by utilizing Act 342, Act 185 and Act 233, respectively. Copies of relevant contractual agreements are included in Appendix 1, 2, and 3. The summaries of waste treatment related laws and these individual case studies and associated material is in no way meant to substitute for competent, professional legal assistance. It merely tries to present some of the institutional alternatives available and how other communities acted on these alternatives.

Case 1: Bloomingdale

Bloomingdale is a community of approximately 500 people located in VanBuren County about twenty miles northwest of Kalamazoo. This community along with many other Michigan communities was assisted in making a decision to build a sewage system by an order from the Water Resources

Commission to halt pollution of streams and lakes in the area. The initial approach suggested was that of stabilization lagoons, discharged seasonally since that was a relatively inexpensive way to meet the Water Resources Commission order. In October of 1968, however, the Michigan Department of Public Health recommended land disposal of the effluent instead of seasonal discharge to a watercourse since land disposal would achieve a high degree of phosphorus removal as well as removing suspended solids and coliforms.

The first village plans were to proceed on their own. However, in September of 1970, the village secured the assistance of the Van Buren County Road Commission, acting within the provisions of Act 342 of 1939, as the county agency to help implement the project. Many local individuals were against installation of the sewer project in the first place and could have petitioned for a referendum under the provisions of Act 342. There seemed, though, a recognition that this action would merely delay the Water Resources Commission order, maybe forcing a court order which would place the community in a most unfavorable position for the sale of bonds to finance the sewer project. The prevalent local attitude seemed to be resentment directed toward the Water Resources Commission order, not the county involvement through Act 342, although the board of county road commissioners absorbed some of the locally generated frustrations.

In April of 1971, the village increased its tax rate by 6.5 mills in anticipation of the issuance of bonds by the county agency, the road commission, in order to meet the village obligations to the county agency. In May of the same year, general obligation bonds were issued in the amount of $395,000 by the County Road Commission. At the same time, tap-in fees of $250 were established along with a monthly service charge of $8.50. Construction of the system went on through the year and was completed during 1972.

The disposal site consists of two lagoons, each approximately six acres in size, and twenty-six acres under irrigation. The irrigation system is of the solid set type designed so that 20 percent of the acreage is irrigated per day with the two weekend days having no irrigation to complete the weekly cycle. The site chosen was an alternative site because the first choice was too expensive from the village's point of view. The soils are Owosso sandy loam, Belding sandy loam and Wasepi sandy loam with slopes in the one to five percent range. Although these soil series drain well, part of this particular property complicated construction of the lagoon and dike system by causing erosion and ultimately added to the construction costs. Had this information been known at the beginning of the project, a tradeoff might have been highlighted

relative to the added cost of the site acquisition versus the added cost of the site construction on the less desirable site.

Many unknowns are involved in a project of this scale. Regulations of participating county, state, and federal agencies changed during the course of construction of the project, necessitating changes in the field. This was a thorn in the side of many local people as was the fact that they didn't own and could exercise little control over a sewer system they were obligated to pay for over the next eighteen years. Perhaps an educational campaign about the program might have smoothed ruffled feelings, perhaps not. This project, like many others for small municipalities, is relatively costly on a person or family basis. It is quite likely the people from Bloomingdale felt they were paying much more for the sewer system than the benefits from that system were accruing to them. A possible solution is that if benefits to the rest of society can be attributed to the sewer system, society may have to stand ready to transfer (grant) additional funds for the construction of such facilities. Granting agencies seemed to reach a similar conclusion as later projects seemed to enjoy a higher rate of participation, placing less burden on the local municipalities.

Case 2: Wayland

It is possible under Act 185 of the Public Acts of 1957 to obtain county department of public works cooperation on a sewage project without the option of a referendum for the electorate in the local municipality. Such was the case in Wayland where a sewer bond issue had gone down to defeat three times. Finally, the city council, in April of 1970, negotiated a contract with the Allegan County Board of Public Works under the provisions of Act 185 to act in the city's behalf in constructing a sewer system. Local leaders undoubtedly felt that although a sewer system had not been forced on the unsewered community as yet, various state agencies had been developing acceptable sewage alternatives since the early 1960s with local officials, and in the absence of positive local action, the state could force Wayland to install a sewage system at great disadvantage to the local people. Many in the community were upset with the actions taken by the city council but their appeals to state officials and agencies ultimately were dented since the law had been followed. This did not, however, convince many individuals that the benefits to them exceeded the costs.

The first plans for treatment for Wayland called for stabilization lagoons and discharge of the stabilized effluent into the Rabbitt River during periods of high flow. The summer of 1970 brought a change in the plans to include

spray irrigation. Although not presently needed, project officials felt that upcoming controls of phosphorus levels in the effluent made land disposal much more attractive than the dilution alternative, so land disposal by spray irrigation was included in the specifications. The Michigan Department of Public Health concurred with this decision and bidding was opened on the project in October of 1970.

In December of 1970, two significant things happened. First, the low bid on the project was approximately one half million dollars more than expected and second, citizens of Leighton Township, adjacent to Wayland and the proposed site for the actual treatment and disposal process threatened legal action because they didn't want the honor of disposing of someone else's sewage without proper compensation. The initial county contract called for $1,180,000 in county backed bonds. Since local voters had rejected the sewer proposal three times, there was quite a battle in the County Board of Commissioners to get the necessary three-fifths majority to pledge the county's full faith and credit for this bond issue. When the bids were opened, the city council agreed to support the additional quarter million in bonds needed to finance the project along with additional state and federal grants. The Allegan County Board of Public Works amended the contract with Wayland reflecting this change, but the county commissioners rejected the change. Almost immediately, though, the board of commissioners

reversed itself and supported the additional bonding. What prompted this change of heart is not readily apparent. Probably the rejection of additional fundings was brought about by Wayland dissidents to the project and the final acceptance by the city council making its interest count. The second. problem, that of the disposal site being in Leighton Township, was solved quite neatly by annexing the parcel to the city. The threatened legal action then materialized in the form of asking for an injunction on nuisance grounds but the case was dismissed. After these preliminaries were resolved, construction began in the spring of 1971 and in November of that year the project was dedicated.

The County Board of Public Works had acted in another village where the assessed valuation was too low to support a bond issue under the provisions of Act 185. County officials viewed their role simply as facilitating financing of the project by helping obtain a lower rate of interest on the bonds and acting as a clearing house by collecting payments for the bonds from Wayland. Other than that, the project in the areas of operation, maintenance and setting of rates. Many local people still felt that the county exercised too much control over their property rights (taxation) and the project should be entirely locally controlled (where it had been defeated three times).

The disposal site at Wayland contains two basic soil series, Melita loamy sand and Blount sandy loam with a

uniform slope of 2 to 3 percent. Mixed alfalfa, clover and timothy hay is grown on the irrigated portion of the site. It has been harvested by a local farmer who pays the city a mutually agreed upon sum per bale. It has been used for horse hay in the past although the Michigan Department of Agriculture has okayed its use for any livestock. Prospects were very good that this year's crop will be utilized by local dairymen. Although this project had much opposition in the beginning, it is a very well operated and maintained facility which allows the full land disposal cycle to operate in its favor.

Case 3: Harbor Springs

The area surrounding Little Traverse Bay in the extreme northwest portion of Michigan's lower peninsula provides some of the most breathtaking scenery and vacation area anywhere in the state. Hemingway tramped the area as a boy and later wrote about its rugged wilderness and beauty. Many summer homes were built in communities around the bay and helped support the area's economy when tourism in the state as a whole was in its bare infancy. Harbor Springs was one such community and it still relies on the tourist industry utilizing the crystalline waters of Little Traverse Bay for fishing, sailing, swimming, and other water sports, and the surrounding area for camping, sightseeing, snowmobiling and skiing as well as other recreational

activities. Perhaps it is this awareness of the relationship between their natural resources and the area's economic well-being that prompted positive action in dealing with pollution in the Harbor Springs area.

The late sixties were marked as a time of increasing concern about the effects of pollution on our quality of life. It was, however, easy to blame Chicago or Detroit or some other large metropolitan area for the problems of the Great Lakes. A newspaper article brought home the point, though, that Harbor Springs had its own problems. The existing sewer lines leaked and admitted groundwater which resulted in inadequate treatment at the overloaded sewage plant. This often led to the problem of inadequately treated effluent being discharged to Little Traverse Bay. A summer resident of the area in 1968 suggested that a new sewage system be considered. This, according to those who became intimate with the project, started the chain of actions resulting in the formation of the Harbor Springs Area Sewage Disposal Authority in accordance with the provisions of Act 233 of the Public Acts of Michigan of 1955.

The work of area residents culminated with the adoption of articles of incorporation for the HSASD Authority by the City of Harbor Springs and Little Traverse Township. This ratification was completed in October of 1969 and took effect in November of 1969. If a referendum had been called for under the provisions of Act 233, it would have

had to occur within 30 days of initial ratification of the Articles of Incorporation by the member units. There was, however, very strong local support the HSASD Authority and a recognized need for its existence. The original authority articles of incorporation provided for a seven member board, four from the city and three from the township. For action involving bonds, five of the board members must approve the issue but for other measures a simple majority is adequate for passage. An informal board effort has been made up to this time to divide as evenly as possible the formal leadership positions on the board between the city and township members with the object of promoting cohesive and unified action.

During 1970 the Authority board laid much of the groundwork for the system. An operating contract between the authority and its two constituent parties was agreed to. This contract specifies how the benefits and costs of the project are distributed and what the rights, duties and obligations of each party to the contract are. Also, during 1970, the site selection process was going on. Engineering studies were progressing, federal and state grants were being pursued and finally, in December of that year, contracts were let and revenue bonds were issued in the amount of $550,000. Construction started the spring of 1971.

This action took place before the Federal Water Pollution Control Act Amendments of 1972 directed that alternative methods of disposal (land versus conventional systems of dilution by waterway) be considered by grant recipients. How, then, did the Harbor Springs area choose land disposal over any other method? Land disposal requires more land than other systems and in the Harbor Springs Area enough land to support the system was relatively accessible and moderately priced. The consulting engineers they chose had experience with land disposal and that probably influenced the choice as well as assistance from the Michigan Department Public Health engineers. The primary reason for the choice of the land disposal alternative, however, probably rests with the local citizenry and their desire to protect Little Traverse Bay. With the advantage of no discharge into the bay, equipment malfunction or human error would not have the impact on a land disposal system that the same circumstance might have on a conventional system. The Authority was confident the land disposal system, acting as a living filter, would remove almost all of the nutrients in the effluent. To this time the system has lived up to their expectations.

The HSASD Authority is indeed an area undertaking. The original authority had two members. It has now been expanded to four members by amending the articles of incorporation. The two new members are the Village of Alanson

and the Township of Littlefield, who joined the Authority in August of 1972. Planned expansion is already in progress to include the new customers. The prospect of this expansion must have been foreseen during the site selection process since the location of the lagoons and irrigation area is very compatible with the addition of Alanson and Littlefield Township to the system.

Soils at the disposal site are very sandy and according to the survey work done by M.S.U. soils experts, may be placed in a series of Kalkaska sand, Blue Lake loamy sand or Mancelona sand. The topsoil of all of these series are characterized as drouthy and low in organic matter. Rapid drainage and low water holding capacity as well as a surface layer which is often subject to wind erosion, are additional attributes of these soils. The vegetation is mainly weedy pasture with some brushy trees on a slope which ranges from 2 to 8 percent. The area under irrigation is being used by the U.S. Forest Service experimenting with various species of trees and shrubs and how irrigation with the treated effluent affects their performance.

Local opinion has so far been favorable. Expansion has been allowed for the vital tourist industry of the area with very little sacrifice on the part of the environment. Faith in the system's ability to work

effectively may partially be reflected in plans to build condominiums on land adjacent to the lagoon complex. As in the case of many public services, some interests may benefit more than other interests from the installation of the sewage system. Many interests must believe, however, that they are receiving indirect benefits such that they are also better off.

CHAPTER VII

FURTHER ECONOMIC IMPLICATIONS

When approaching the problem of analyzing the performance of land disposal of municipal wastewater by spray irrigation or any other public program, the analyst should be aware of some of the major areas of concern when evaluating the program for purposes of preparing a cost-benefit study. Those major problem areas might be, 1) Why is government involved in this output? 2) How is the output defined and measured? 3) Does the project make an impact? 4) How are the products priced? 5) what are the indirect impacts? 6) What are the distributional affects of the project? and 7) What is the time dimension and valuation?[1]

The assumption will be made that decision makers have already allocated funds to the treatment of wastewater and the decision remains as to how those funds should be spent among alternative technologies. Conceptually, a cost-benefit study could be used with equal validity to guide decision makers as to the problem of what portion of the total grants budget for the country should be allocated

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[1]Discussion notes from A. Allan Schmid, AEC 811, Public Program Analyses, Spring 1974. Much of the material is drawn from Public Water Resource Project Planning and Evaluation: Impacts, Incidence, and Institutions. Bromley, Schmid and Lord, Center for Resource Policy Studies and Programs, University of Wisconsin, 1971.

to health, education, housing, recreation, wastewater control, or any other competing interest. This decision as to how the pie gets divided among competing interests, however, probably reflects those interests ability to effectively articulate their demands and the power to make their wants and preferences count. If a cost-benefit ratio can be conjured up to support the position that the competing interest takes, it may be incorporated into the presentation made to decision makers in the application for funds. The implication then arises that cost-benefit ratio's can be manipulated rather easily to support many different positions. This is quite true. Compiling a cost-benefit analysis involves many normative decisions and the aggregate of those decisions may have a great bearing on the final number, the ratio between costs and benefits. Consistency in rules should therefore apply as much as possible across different types of projects so that results may be meaningfully compared. Probably more important though, is that analyst's make their values as explicit as possible so that results may be interpreted with the knowledge that one set of inputs and outputs may have been favored over another set.

Many economists take the position that markets should be established where ever possible to insure that Pareto better trades are made (trades in which at least one participant is better off and everyone else is at least

as well off as previously and therefore total welfare is increased). What then is the case for the government providing any goods or services (public goods) in addition to those provided by market exchange in the best of all possible worlds? Public goods are often defined as those goods which have the characteristics of zero marginal costs and high exclusion costs. The almost classic example is national defense. Once defense is provided for Smith, defense for Jones, his next door neighbor is essentially free, and the cost to make Jones vulnerable to attack while still protecting Smith is very high. The characteristics for goods range from the pure public to the pure private, where benefits of the trade can be captured entirely by the participants. The gray area in between the polar positions is where many goods and services fall, including wastewater treatment. The additional cost for a new customer in the system is essentially zero until the capacity of the system is exceeded. It is not in this case possible to easily exclude those down stream from enjoying the benefits of cleaner water. Their strategy would be that of a free rider, to let others bear the costs but to try and share some of the benefits. Under slightly different institutional arrangements in the west, wastewater is traded and considered a publicly produced private good.

How a public good is defined is largely a function of what the definer perceives as the special characteristics

of the good, and different people using different goods as models to arrive at different definitions of public goods. Peter Steiner chooses a relatively broad approach when he defines public goods as

> ". . .any publicly induced or provided collective good. . .Collective goods arise whenever some segment of the public collectively wants and is prepared to pay for a different bundle of goods and services than the unhampered market will produce. A collective good thus requires (1) an appreciable different in either quantity or quality between it and the alternative the private market would produce and (2) a viable demand for the difference."[2]

Usually an individual can not bear the costs of wastewater treatment for a river entirely because not enough of the benefits can be captured by him. As a result, nothing is done in the private sector. If the public can not effectively articulate demands through the private market, provision should be made so that demand can be answered through collective action which is the rationale for government involvement.

The analyst's next problem is to determine the output of the project and how to measure that output. In the discussion of a firm, an economist can say the output (corn) is some function of the inputs (fertilizer, seed, sunshine, water, etc.). These items lend themselves to relatively easy definition in terms of both quality and quantity. Many

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[2]Peter Steiner, "The Public Sector and the Public Interest," Public Expenditures and Policy Analysis. Edited by Haveman and Margolis. Chicago: Markham Publishing Co., 1970, pp. 28.

public sector project outputs are not easily defined in quality or in how that output affects different parts of the public. It is often a normative decision. One estimation of final output for wastewater treatment systems might be a better environment but how is the environment defined and measured? Economists have not learned to measure environment directly so intermediate measures or substitute measures of an output are sought that lead us to believe the environment is improving. In this case examining nitrogen, phosphorous and oxygen levels in waterways is one alternative measurement of environment. Downstream reparians may experience higher quality drinking water and recreation, and wildlife may be enhanced. These outputs are not unique to land disposal since other wastewater treatment alternatives might obtain the same ends. If these were the only outputs then the logical alternative would be simply the method of treatment which had the least cost. Simply, if the numerator of tow fractions is equal (benefits) then the denominator which is less will yield the most attractive ratio (minimum cost). However, there are other outputs associated with land disposal not mentioned above.

A unique output of land disposal is the opportunity to use the nitrogen and phosphorus in the effluent for the production of crops. This can result in the saving of energy necessary to produce the nitrogen and phosphorus as well as positive yield responses (probably due more to

irrigation than the nutrients). Another output important in some areas of the country is the resulting recharge of ground waters by land disposal. A third opportunity for benefits by land disposal is that the effluent may be useful in land reclamation in such areas as strip mine spoil banks. These outputs emphasize the using of flow resources where possible so that fund resources may be left intact.

The thread of causality between improved performance in wastewater treatment and a better environment is relatively direct and strong. In this project is is much easier to see the relationship between the project and the final output than in other public projects involving education, health, law enforcement, etc. In many program analysis, establishing causal relationships is much more critical than is wastewater treatment which has a rather direct impact. Once the output is arrived at the next step is to place a value on the output. Direct monetary valuation may be divided in two areas when considering the pricing of a public good, market and nonmarket. Three methods are commonly used in the market area to calculate direct monetary input. They are market analogies, observing market behavior (price-quantity relationships) and intermediate goods. If a public campground was proposed it might be appropriate to examine private campgrounds in the area to determine the price of the output, a campsite, when calculating benefits. Another method is construction of a price-quantity relationship (demand curve) by normatively stating that at a given

level of output it is expected that a certain price can be charged. The third method would probably be the most effective in evaluating some of the outputs of wastewater treatment (nutrient rich irrigation water) is used in a production function which has a readily priced product (corn). Part of the project benefits are obtained, therefore, by estimating the increase in value of the corn attributable to the nutrient rich irrigation water. As already mentioned in western states under alternative institutional arrangements, the practice of trading effluent is well established and if similar institutions were proposed in Michigan a range of values for the output might be proposed by market analogy.

Nonmarket pricing methods include the political process and alternative cost. The political process is a legitimate pricing mechanism but it is very arbitrary and normative. Should the decision maker be too far off he would supposedly be answerable at the next election. This method need not be any more normative than a market price since the political process also greatly affects property rights which affect market prices. Political power expressed by property rights is an input in the determination of market prices and although it is much more subtle form of control than direct political intervention it is probably as effective in the end.

The alternative cost approach implies that the decision to proceed has been made and economists should

simply seek the least cost combination. An option can always be found which accomplishes the same output at a higher cost and by assuming the benefits for the high or low cost option are the same, the cost benefit ratio appears favorable. To rationalize this approach, the assumption must be made that people will be willing to pay a price sufficient to justify the inefficient method and alternative cost equates costs of the inefficient project to benefits of the least cost project. As was pointed out earlier, this is not a legitimate application of cost benefit analysis and one should simply seek the least cost method of performing the project.

Finally, there still may be some categories which defy accurate pricing. For those areas an analyst might list them as well as possible in physical terms so that the decision maker is aware of their existence. An example might be psychic cost to those individuals displaced from their homes by the adoption of a land disposal technology.

The determination of the projects indirect impacts is the next area to consider and this poses the question of how far to pursue indirect impacts. It is quite difficult to trace impacts beyond one round, but that round has a dual concept. One concept is that of following impacts in both directions from the project, but only to include monetary impacts from the first step either in the input (induced effect) or output (stemming effect) direction.

The second concept of a round is to allow only one series of transactions to enter the calculations and not try to follow these transactions as they feed back into the project and impact businesses which have induced and stemming effects. Market frictions and complementary private investments are two forces which make accurate measurement of indirect impacts difficult, especially after the impacts are removed farther than one round from the project. In the case of land disposal, examples of induced effects might be the effects on the local agri-business suppliers (fertilizer, seed, machinery, etc.) and stemming effects might be increased business by a marina due to cleaner water or a change in local markets due to the crops grown on the project.

Many analysts claim that a project may have a benefit in that it leads to regional development. They must realize, however, that the project may merely be shifting resources from one region to another and in order to know if there are some benefits that should accrue to the project, analysts must know how the resources were employed prior to the project. What becomes of the output previously produced by the resources? If that value is completely foregone, it must be deducted from the benefits of the project because the value of the output previously attributable to the resources, their opportunity cost, can not be ignored. In the aggregate it is the net addition to output which should appear as a benefit, not the gross output.

Distribution of the costs and benefits is the next general topic. The benefits of a better environment through cleaner water are spread quite widely. Costs may fall on more easily defined groups, however. Fertilizer dealers, adjacent land owners, and crop farmers might be adversely affected by the land disposal technology. Also a distribution factor to consider in these projects is the cost sharing arrangements between governmental units. These institutional arrangements and the resulting transfers of funds were enumerated earlier in the study. Since benefits for clean water are widely scattered and hard to capture on the local level, state and national decision makers encourage wastewater treatment facilities by sharing in the construction costs of these projects. Cost sharing is consistent with the often implicit assumption that communities should share costs in about the same proportion as benefits that accrue to them. Institutional changes were made to encourage a higher level of wastewater treatment, a performance criteria. Some public programs such as social programs are designed by the political process to aid specific disadvantaged groups so that the benefits outweighed the costs. In these cases, the analyst must determine if the benefits actually reached the target group and if in fact the benefits were greater than the costs to them.

The final discussion concerns the valuation of the project over time. Different projects have different sizes

and flows of benefits and costs. Some projects have net benefits which accrue later in the project life. Two items assume major importance here, one being the length of time benefits may be counted and the second is the discount rate. Even if benefits are the same for the period, the pattern of accrual may be different and it is desirable to reduce these differing streams to a single value at the same point in time. Probably, wastewater treatment under alternative methods would have returns in approximately the same patterns. Valuation over time becomes more complex when analyzing projects in two or more distinct areas like education, health and wastewater treatment.

One method is to determine the present value of the investment stream by discounting the flow of income back to the initial period. To do that, net returns are sumed and divided by one plus the discount rate to the power associated with the time period or

$$Ro + \frac{R_1}{1+r} + \frac{R_2}{(1+r)2} + ,. \ . \ . \ ., \frac{R_n}{(1+r)^n} \quad \text{or} \quad \sum_{t=o}^{t=n} \frac{B_t}{(1+r)t}.$$

The magnitude of the discount rate is critical in these calculations since a high discount rate favors early returning projects and low rates favor later returning projects. A second method is to calculate the internal rate of return which is the rate of discount which makes the present value of the costs equal to the present value of the benefits.

Another concern which merits discussion is how certain items enter the cost-benefit ledger after they have been valued. They may be categorized either as positive benefits or negative costs. Crops produced on land disposal sites may fit in this category. It would be consistent to call them a benefit or a negative cost. There is a greater affect on the cost-benefit ratio, however, if the denominator is reduced (negative cost) rather than if the numerator increases (benefit added). The analyst has the opportunity then to make a normative decision which largely reflects his preferences about whose interest should count.

In summation, this discussion has tried to develop why government supplies wastewater treatment service (public good), what the final output is (better environment) and the causality between the project and the output. Pricing of various components of benefits and costs were discussed and those components which can not be priced should be described in physical terms. Direct and indirect impacts (land, marinas, agri-business dealers, sociological impacts, etc.) were discussed along with distributional affects and the problems of valuation over time. Cost benefit analysis is intended as a tool to assist in the decision making process. Cost-benefit analysis is made up of a series of discrete decisions by the analyst and it is important to recognize the often implicit normativeness of those decisions. Throughout the process there are opportunities for groups to see that their interests count in the calculation of the final ratio.

CHAPTER VIII

SUMMARY

This report has been an attempt to summarize some of the relevant economic, agricultural and institutional characteristics of land disposal systems using spray irrigation of wastewater in Michigan. The basic technique of using the land for waste disposal is as old as Man himself. The current process involves lagoons for primary and secondary treatment with the land providing advanced treatment, acting as a living filter to remove nutrients, produce a crop and return viable water to the ground waters. There are many demands placed on local communities for services and they are often hard pressed to meet those demands. National policy calls for elimination of water pollution by 1985. How do local municipalities respond to this additional demand? Do our current institutions affect the desired behavior of the participants involved such that the performance goal of zero pollution may be reached? The report attempts to examine important institutional problems on the assumption that technial problems associated with land disposal systems have been or will be solved.

Legislation relevant to this issue in Michigan examined included acts relevant to the Michigan Department of Public

Health involvement, enabling legislation of the Water Resources Commission, county and area authority organizational approaches, the priority in terms of financial need, and the federal government's involvement through the Federal Water Pollution Control Act Amendments of 1972. These acts are very important for they are part of the institutions which establish the limits of options available to facilitate satisfactory physical and economic performance. An example is one form or another of intergovernmental cooperation. Many Leaders of local communities which acted as an entity commented that although the option of intergovernmental cooperation was known about, administrative machinery was inadequate to put the option into practice. At that time local decision makers perceived the cost of organization, the cost in terms of time, money and transfer of local authority to bring that machinery into being was greater than the benefits. Many leaders have since changed their minds. The institutions were there, but simply were not used.

Sixteen land disposal systems were then summarized according to the data collected in physical, economic and institutional terms. The projects had a design population of from 1,000 to 9,000 people with a mean of 3,140. The total disposal site area ranged from 40 to 450 acres with a mean of 140 acres of which an average of 61 acres was used

for either lagoons or spray irrigation. The mean application rate approximated 2.5 inches per week on soils mainly on the loamy sand to sandy loam texture. Sanitary engineers are discovering that often, especially on heavier textured soils, application rates are very optimistic and at least one Michigan land disposal project has had very poor performance in treating watewater. Crops and soils scientists may make a large contribution to land disposal technology along with sanitary engineers and other specialists. The technology of land disposal is diverse and calls for the integration of the knowledge of many disciplines.

The financial characteristics were examined next with the recurring theme that grants increased in total over the time of construction. Often this led to having excess funds when the project was completed. This might be an appropriate place to make an institutional change better defining the granting process. EPA is dependent on the legislative and executive branches of government for the funds it funnels through the state granting agency. National priorities may change and recently one of the concerns of national decision makers has been inflation. Therefore, even though the legislature earmarked pollution control grants for EPA to transfer to the states, the executive branch failed to release a significant portion of those funds. Consequently, plans must be made to operate with available funds, not funds that <u>might</u> be available. Surely

the goals of the Federal Water Pollution Control Acts Amendments will be set back, but to national political decision makers the tradeoff must be made because they perceive the costs of inflation outweight the benefits of controlling water pollution.

Some changes have been made including making land costs eligible for grants. Other possible changes which might be made are municipalities and farmers entering into a rental or lease agreement for the right to spread the effluent or for its sale. What would be the effects of large scale use of agricultural land for effluent disposal be under alternative arrangements? What groups gain and what groups lose? What would happen to the price of food, to the number of farmers, to agricultural suppliers? Would anyone's health be jeopardized by the consumption of food from this source? These questions all need further research and study. Our economic system is complex and interdependent however, and suggested changes to reach zero pollution by 1985 with land disposal as the panacea are very optimistic. Further technical and institutional research is needed to try and discover the consequences of alternative policies so that the choice may be made from as much knowledge as possible.

Small communities may be faced with appraising alternative methods of meeting national wastewater goals and this

research effort has led the authors to believe that land disposal by spray irrigation is a meaningful option for many communities. A checklist of items for decision makers to consider concerning land disposal might run as follows:

I. Physical Characteristics

1. Is sufficient land available at a moderate price on a site that can be isolated so that possible nuisances are minimized?

2. Are soils and topography suited for sustained high rates of irrigation?

3. Can a crop be grown, harvested and marketed to remove nutrients from the site?

4. Preliminary help may be obtained through the Director, Wastewater Division, Department of Natural Resources, Stevens T. Mason Building, Lansing.

II. Financial considerations

1. Grant applications through the Federal Water Pollution Control Act and the availability of grants now versus future availability. Information may be obtained through Director, Construction Grants Division, Stevens T. Mason Building, Lansing as a first step.

2. Other grant sources such as FHA. Assistance may be obtained from the Director, FHA, 1409 South Harrison Road, East Lansing.

3. What types of bonds and what sources of revenue are most desirable for the community? Here, private bond opinioning firms and financial consultants assistance is recommended.

4. Can existing facilities be incorporated into land disposal system?

5. Will advanced wastewater treatment lead to community growth?

6. What are the probable operating costs of land disposal?

III. Institutional Arrangements

1. Will the community act as an entity or in conjunction with other governmental units?

2. Might leasing arrangements for land or selling of the effluent be possible?

3. Would development easements on buffer areas be possible in lieu of fee simple purchase?

4. Who manages and operates the agricultural sector of the projects?

5. What are the impacts on agriculture and agribusiness firms in the community?

These are a few of the many economic and institutional questions which might arise concerning the choice of land disposal of municipal wastewater by spray irrigation.

APPENDICES

APPENDIX 1

APPENDIX 1

SAMPLE CONTRACT BETWEEN A VILLAGE AND COUNTY PURSUANT TO ACT 342 OF THE PUBLIC ACTS OF MICHIGAN, 1957 AS AMENDED

THIS CONTRACT, made and entered into this _____day of _____, 197_, by and between the COUNTY OF_____, a Michigan county corporation (hereinafter referred to as the "County"), by and through its Board of County Road Commissioners, as County Agency Under Act 342, Public Acts of Michigan, 1939, as amended, party of the first part, and the VILLAGE OF_____, a Michigan municipal corporation located in the County of _____ Michigan (hereinafter referred to as the "Village"), party of the second part.

WITNESSETH:

WHEREAS, it is immediately necessary and imperative for the public health and welfare of the present and future residents of the Village, that adequate and proper facilities for the disposal of sewage be acquired and constructed to service the Village; and

WHEREAS, the County, under the provisions of Act 342, Public Acts of Michigan, 1939, as amended (hereinafter sometimes referred to as the "Act"), has established the Board of County Road Commissioners as the County Agency

for the administration of the powers conferred upon the County by said Act, which County Agency (hereinafter sometimes referred to as the "Board") is under the general control of the Board of Commissioners of the County of _____; and

WHEREAS, said Act authorizes a county to acquire sewage disposal systems as defined in said Act, and to improve, enlarge, extend and operate such systems; and

WHEREAS, by the terms of said Act, the County and the Village are authorized to enter into a contract for the acquisition, improvement, enlargement or extension of a sewage disposal system and the payment of the cost thereof by the Village, with interest, over a period of not exceeding forty (40) years, and the County is then authorized, pursuant to appropriate action of its Board of Commissioners, to issue bonds of the County to provide the funds therefore, secured primarily by the full faith and credit contractual obligation of the Village and secondarily by the full faith and credit pledge of the County if duly authorized by appropriate resolution of its Board of Commissioners; and

WHEREAS, said Act provides the only practicable method and means for acquiring and financing the necessary sewage disposal facilities and appurtenances so vitally necessary for the public health and welfare of the residents of the County residing in the Village, and will result in the

lowest cost for the money necessary to be borrowed for such purpose; and

WHEREAS, plans and an estimate of cost of the said sanitary sewer improvements have been prepared by _____, consulting engineers, of _____ (hereinafter sometimes referred to as the "consulting engineers"), which said estimate of cost totals _____Dollars; and

WHEREAS, in order to issue such bonds, it is necessary for the County and the Village to enter into a contract as provided in said Act; and

WHEREAS, it is also necessary for the County and the Village to contract relative to the operation and maintenance of said sewage disposal system;

NOW, THEREFORE, in consideration of the premises and the covenants of each other, the parties hereto agree as follows:

1. The County and the Village approve the establishment of a sanitary sewage disposal system in the County of _____ under the provisions of Act 342, Public Acts of Michigan, 1939, as amended, consisting of a treatment facility, lift stations, sanitary sewer interceptors, trunks and other lines, force mains and pump stations, together with all necessary appurtenances and rights in land adequate and sufficient to furnish sanitary sewer disposal service in those areas in the Village in need of such service. Said areas, and the sewer improvements to be located therein,

shall be as set out in the plans for the project prepared by the consulting engineers and referred to in the preamble hereto.

2. The sewage disposal system referred to in paragraph 1 above is designated by the County Board of Commissioners as _____ COUNTY SANITARY SEWAGE DISPOSAL SYSTEM NO. ___ (VILLAGE OF _____), hereinafter sometimes referred to in this contract as the "System".

3. The Village hereby consents to the use by the County of the public streets, alleys, lands and rights-of-way in the Village for the purpose of constructing, operating and maintaining the System and any improvements, enlargements and extensions thereto.

4. The System is designed to service those areas in the Village in need of sanitary sewer service and is immediately necessary to protect and preserve the public health, and the Village does, by these presents, consent to such service being furnished by the System to the individual users in these areas.

5. The Board and the Village hereby approve and confirm the hiring of the consulting engineer by the County, the plans for said System as prepared by said consulting engineers and the estimated cost thereof in the sum of _____ Dollars. Said estimated cost includes all surveys, plans,specifications, acquisition of property for rights-of-way, physical construction necessary to acquire and construct

the System, the acquisition of all materials, machinery and necessary equipment, and engineering, engineering supervision, administrative, capitalized interest, legal and financing expenses necessary in connection with the acquisition and construction of the System, and the financing thereof.

6. The Board will acquire and construct the System, and for that purpose will take bids for the acquisition and construction thereof prior to the time that any bonds are issued for the purpose of financing part of the cost of the System. The Board shall in no event enter into any final contract or contracts for the acquisition and construction of the System if such contract price or prices will be such as to cause the actual cost of the System to exceed the estimated cost as approved in paragraph 5 of this contract, unless the Village, by resolution of its Village Council, (a) approves said increased total cost and (b) agrees to provide funds to meet the excess over the estimated cost, either in cash or by specifically authorizing the maximum principal amount of bonds to be issued, as provided in paragraphs 9 and 10 of this contract, to be increased to an amount which will provide sufficient funds to meet said increased cost and a similar increase in the installment obligations of the Village pledged under the terms of this contract to the payment of such bonds.

7. The System shall be acquired and constructed by

the Board in accordance with the plans and specifications therefor approved by this contract: Provided, however, that minor variations from said plans and specifications may be made without the approval of the Village if such variations shall not materially affect such plans and specifications. All matters relating to engineering plans and specifications, together with the making and letting of final construction contracts for the System, the approval of work and materials thereunder, and construction supervision, shall be in the exclusive control of the Board. All acquisition of rights-of-way shall be done by the Village.

8. The County does hereby let and lease the said System to the Village, and the Village does hereby hire said System from the County, for a term commencing upon the completion of the System, or any substantial part thereof, and ending upon the expiration of this contract. The Village shall be responsible for the operation, maintenance and management of the System for and on behalf of and as the agency of the Board and the County for such purpose. Said System shall be maintained in good condition and repair to the satisfaction of the Board, which shall have the right to inspect the System at any time and to require the Village to make any repairs or replacements and to do any further acts which in the judgment of the Board may be necessary in order to maintain the System in good repair and condition.

If the Village shall neglect at any time to make such repairs and replacements and to take such action as may be required by the Board within a reasonable time after being notified by the Board to do so, then the Board shall have the right to make the necessary repairs and replacements and the Village shall reimburse the County for the expense thereof within thirty (30) days after such expense has been incurred. The Village will, at no expense to the County, provide insurance on the machinery, pumping stations or similar equipment of the System against fire or loss by explosion or destruction, of the comprehensive type customarily carried, and will also provide sufficient liability insurance protecting the Village and the County against loss on account of damage or injury to persons or property imposed by reason of the ownership or operation of the System or resulting from any act of omission or commission on the part of the Village or its agents, officers or employees in connection with the operation, maintenance or repair of the System.

9. To provide for the construction and financing of the System in accordance with the provisions of Act 342, Public Acts of Michigan, 1939, as amended, the Board shall take the following steps:

(a) The Board will submit to the Board of Commissioners of the County of _____ a resolution providing for the issuance of bonds in the aggregate

principal amount of _____ Dollars (except as authorized pursuant to paragraph 6 of this contract) to finance part of the cost of said System. The balance of said cost shall be provided from the proceeds of grants from the Michigan Water Resources Commission. Said bonds shall mature serially, as authorized by law, over a period of approximately sixteen (16) years, and shall be secured primarily by the contractual obligation of the Village to pay the installments due, plus interest, as hereinafter provided in this contract, and secondarily, if approved by a majority of the members of the Board of Commissioners, by the full faith and credit of the County of _____. After due adoption of the resolution, the Board will take all necessary legal procedures and steps necessary to effectuate the sale and delivery of said bonds.

(b) The Board shall take all steps necessary to take bids for and enter into and execute final construction contracts for the acquisition and construction of the System, as specified and approved in paragraph 1 of this contract, in accordance with the plans and specifications therefor as approved by this contract. Said contracts shall specify a completion date agreeable to the Village and the Board.

(c) The Board will require and procure from the contractor or contractors undertaking the actual construction and acquisition of the System necessary and proper bonds to guarantee the performance of the contract or contracts, and such labor and material bonds as may be required by law, in such amount and such forms as may be approved by the Board.

(d) The Board, upon receipt of the proceeds of sale of the bonds, will comply with all provisions and requirements provided for in the resolution authorizing the issuance of the bonds and this contract relative to the disposition and use of the proceeds of sale of the bonds.

10. The cost of the System to be financed by the issuance of the aforesaid bonds shall be charged to and paid by the Village to the Board in the manner and at the times herein set forth. The principal amount thereof ($_____) shall be paid to the Board in fifteen (15) principal installments, plus interest and other expenses as hereinafter provided, on April 1st of each year as follows:_____.

It is understood and agreed that the bonds of the County hereinafter referred to will be issued in anticipation of the above contractual obligation, with principal maturities on May 1st of each year, commencing with the year 197_, corresponding to the principal amount of the

above installments, and the Village shall also pay to the Board in addition to said principal installments, on April 1st and October 1st of each year, commencing April 1, 197_, as accrued interest on the principal amount remaining unpaid, an amount sufficient to pay all interest (not capitalized) due on the next succeeding interest payment date (May 1st and November 1st, respectively) on said County bond from time to time outstanding. Interest due May 1, 197_ and November 1, 197_ shall be capitalized. The Village hereby specifically agrees that the said bonds shall bear interest at a rate or rates to be determined upon public sale thereof, subject to such maximum interest rate limitations, if any, as may be provided by law. From time to time as the Board is billed by the paying agent or agents for the bonds to be issued for their services as paying agent, or registering bonds, and as other costs and expenses accrue to the Board from handling of the payments made by the Village, the Board shall notify the Village of the amount of such paying agency fees and other costs and expenses, and the Village shall, within thirty (30) days from such notification, remit to the Board sufficient funds to meet such paying agency fees and other costs and expenses.

Should cash payments be required from the Village in addition to the amounts specified in the preceding paragraph to meet additional costs of constructing the System, the Village shall, upon written request by the Board, furnish to the Board written evidence of its agreement and ability to make such additional cash payments, and the Board may

may elect not to proceed with the acquisition or financing of the System until such written evidence, satisfactory to the Board, has been received by it. The Village shall pay to the Board such additional cash payments within thirty (30) days after written request for such payment has been delivered by the Board to the Village.

The Board shall, within thirty (30) days after the delivery of the County bonds hereinbefore referred to, furnish the Village with a complete schedule of maturities of principal and interest thereon, and the Board shall also (a) at least thirty (30) days prior to April 1st of each year advise the Village, in writing, of the exact amount of interest due on the County bonds on the next succeeding May 1st and payable by the Village on April 1st, as hereinbefore provided, and (b) at least thirty (30) days prior to October 1st of each year advise the Village, in writing, of the exact amount of principal and interest due on the County bonds on the next succeeding November 1st and payable by the Village on October 1st, as hereinbefore provided.

If any principal installment or interest is not paid when due, the amount not so paid shall be subject to a penalty in addition to interest, of one percent (1%) thereof for each month or fraction thereof that the same remains unpaid after the due date.

1. The Village, pursuant to the authorization of Section 5a, Act No. 342, Public Acts of Michigan, 1939, as

amended, hereby irrevocably pledges its full faith and credit for the prompt and timely payment of its obligations pledged for bond payments as expressed in this contract, and shall each year, commencing with the year 197_, levy an ad valorem tax on all the taxable property in the Village in an amount which, taking into consideration estimated deliquencies in tax collections, will be sufficient to pay such obligations under this contract becoming due before the time of the following year's tax collections. Such annual tax levies, by virtue of the provisions of Section 6, Article IX of the Michigan Constitution of 1963, shall be without limitation as to rate or amount, being for the purpose of providing funds to meet the contractual obligations of the Village in anticipation of which the County bonds hereinbefore referred to are issued. Nothing herein contained shall be construed to prevent the Village from using any, or any combination of, the means and methods provided in Section 5a of said Act No. 342, Public Acts of Michigan, 1939, as now or amended, for the purpose of providing funds to meet its obligations under this contract, and if at the time of making the annual tax levy there shall be other funds on hand earmarked and set aside for the payment of the contractual obligations due prior to the next tax collection period, then such annual tax levy may be reduced by such amount.

12. The Village may pay in advance any of the payments

required to be made by this contract, in which even the Board shall credit the Village with such advance payment on future due payments to the extent of such advance payment.

13. The Village may pay additional moneys over and above any of the payments specified in this contract, with the written request that said additional funds be used to purchase bonds prior to maturity, in which event the Board shall be obligated to apply and use said moneys for such purpose to the fullest extent possible. Such moneys shall not then be credited as advanced payments under the provisions of Section 12 of this contract.

14. In the event the Village shall fail for any reason to pay to the Board at the times specified the amounts required to be paid by the provisions of this contract, the Board shall immediately notify in writing the County Treasurer of the County of _____, or such other official charged with the disbursement of the Village of funds returned by the State and now or hereafter under the Act available for pledge, as provided in this paragraph, particularly funds derived from the State sales tax levy, and the Village Treasurer of such default, and the amount thereof, and if such default is not corrected within ten (10) days after such notification, the County Treasurer, or such other official charged with disbursement of the Village of the aforesaid funds, particularly funds derived from State sales tax levy under the law and payable to the

Village pursuant to Section 10, Article IX of the Michigan Constitution of 1963, is, by these presents, specifically authorized by the Village to withhold from the aforesaid funds the maximum amount necessary to cure said deficit, subject to any statutory limit thereon, and to pay said sums so withheld to the Board, to apply on the obligations of the Village, as herein set forth. Any such moneys so withheld and paid shall be considered to have been paid to the Village within the meaning of the Michigan Constitution of 1963, the purpose of this provision being solely to voluntarily authorize the use of said funds owing to the Village to meet any past-due obligations of the Village under the provisions of this contract. In addition to the foregoing, the Board shall have all other rights and remedies provided by law to enforce the obligations of the Village to make its payments in the manner and the times required by this contract.

15. It is specifically recognized by the Village that the debt service payments required to be made by it pursuant to the terms of Section 10 of this contract are to be pledged for and used to pay the principal of and interest on the bonds to be issued by the County, as provided by this contract and authorized by law, and the Village covenants and agrees that it will make all required payments to the Board promptly and at the times herein specified, without regard to whether the System is actually completed or placed in operation.

16. If the proceeds of the sale of the bonds to be issued by the County are for any reason insufficient to complete the System, the County shall issue additional bonds in an aggregate principal amount sufficient to complete the System and the annual payments required to be made by the Village hereunder shall automatically be increased in an amount so that the total payments required to be made, as increased, will be sufficient to meet the annual principal and interest requirements on the bonds herein authorized, plus the additional bonds to be issued. In lieu of said additional bonds, the Village may pay over to the Board in cash sufficient moneys to complete the System.

17. After completion of the System and payment of all costs thereof, any surplus remaining from the proceeds of sale of bonds shall be used by the Board for either of the following purposes, at the option of and upon request made by resolution of the Village Council, to wit: (a) for additional sanitary sewer improvements in the Village, subject to approval of the Board, or (b) credited by the Board toward the next payments due the Board by the Village hereunder.

18. All contracts for connection to the System, whether such connections are made during construction or after the System is placed in operation, shall be made by the Village. The actual costs of such connections shall be paid by the Village except to the extent that the costs of such connections are included in the cost of the System.

19. The obligations and undertakings of each of the parties to this contract shall be conditioned on the successful issuance and sale of bonds pursuant to Act 342, Public Acts of Michigan, 1939, as amended, and if for any reason whatsoever said bonds are not issued and sold within three (3) years from the date of this contact, this contract, except for payment of preliminary expenses and ownership of engineering data, shall be considered void and of no force and effect. In the event that said bonds are not issued and sold, all preliminary costs, including specifically legal and engineering fees, shall be paid by the Village, and the Village shall have ownership, possession and use of all plans and specifications, surveys and other engineering data and materials prepared.

20. The Board and the Village each recognize that the holders from time to time of the bonds issued by the County under the provisions of Act 342, Public Acts of Michigan, 1939, as amended, to finance part of the cost of the System, will have contractual rights in this contract, and it is therefore convenanted and agreed by each of them that so long as any of said bonds shall remain outstanding and unpaid, the provisions of this contract shall not be subject to any alteration or revision which would in any manner materially affect either the security of the bonds or the prompt payment of principal or interest thereon.

The Village and the Board further covenant and agree that they will each comply with their respective duties and obligations under the terms of this contract promptly at the times and in the manner herein set forth, and will not suffer to be done any act which would in any way impair the said bonds, the security therefor, or the prompt payment of principal and interest thereon. It is hereby declared that the terms of this contract, insofar as they pertain to the security of any such bonds, shall be deemed to be for the benefit of the holders of said bonds.

21. This contract shall remain in full force and effect for a period of forty (40) years from the date hereof, or until such lesser time as the bonds issued by the County are paid in full. At such time within said forty-year term as all of said bonds are paid, this contract shall be terminated and ownership of the System shall be transferred to the Village. In any event, the obligation of the Village to make payments required by Section 10 of this contract shall be terminated at such time as all of said bonds are paid in full, except for any deficiency or penalty thereon which may at this time remain unpaid.

22. The Village shall defend, indemnify and save harmless the County and Board from and against any and all claims of any nature whatsoever, including damage to property of the County or Board or injury to or death of employees

or agents of the County or Board, arising out of the construction, operation and/or maintenance of the System.

23. This contract shall inure to the benefit of and be binding upon the respective parties hereto, their successors and assigns.

24. This contract shall become effective upon approval by the Village Council of the Village, by the Board of Commissioners of _____ County, as County Agency, and by the Board of Commissioners of _____ County, and when duly executed by the President and Village Clerk of the Village of _____ and by said Board of County Road Commissioners, for and on behalf of the County. This contract may be executed in several counterparts.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed as of the day and year first above written.

COUNTY OF_____
By its Board of County Road Commissioners
as County Agency

By_____
Chairman

By_____
Secretary

VILLAGE OF_____

By_____
President

By_____
Village Clerk

APPENDIX 2

APPENDIX 2

SAMPLE CONTRACT BETWEEN A CITY AND COUNTY PURSUANT TO THE PROVISIONS OF ACT 185 OF THE PUBLIC ACTS OF MICHIGAN, 1957 AS AMENDED

THIS CONTRACT, made and entered into this _____ day of _____, 19__, by and between the COUNTY OF_____, a Michigan county (hereinafter referred to as the "County"), by and through its Board of Public Works, party of the first part, and the CITY OF _____, a Michigan municipal corporation located in the County of _____, Michigan (hereinafter referred to as the "City"), party of the second part.

WITNESSETH:

WHEREAS, it is immediately necessary and imperative, for the public health and welfare of the present and future residents of the City, that adequate and proper facilities for the disposal of sewage be acquired and constructed to service those areas of the City presently in need thereof; and

WHEREAS, the County, under the provisions of Act 185, Public Acts of Michigan, 1957, as amended (hereinafter sometimes referred to as the "Act"), has established a Department of Public Works for the administration of the powers conferred upon the County by said Act, which department is under the

immediate control of a Board of Public Works (hereinafter sometimes referred to as the "Board"), and under the general control of the Board of Commissioners of the County of ____; and

WHEREAS, said Act authorizes a county to acquire sewage disposal systems as defined in said Act, and to improve, enlarge, extend and operate such systems; and

WHEREAS, in the terms of said Act, the County and the City are authorized to enter into a contract for the acquisition, improvement, enlargement or extension of a sewage disposal system and the payment of the cost thereof to be financed by the City, with interest, over a period of not exceeding forty (40) years, and the County is then authorized, pursuant to appropriate action of its Board of Commissioners, to issue bonds of the County to provide the funds therefore, secured primarily by the full faith and credit pledge of the County if duly authorized by appropriate resolution of its Board of Commissioners; and

WHEREAS, said Act provides the only practicable method and means for acquiring and financing the necessary sewage disposal facilities and appurtenances so vitally necessary for the public health and welfare of the residents of the County residing in the City to be served, and will result in the lowest cost for the money necessary to be borrowed for such purpose; and

WHEREAS, plans and an estimate of cost of the said sanitary sewer improvements have been prepared by_____, consulting engineers, of _____(hereinafter sometimes referred to as the "consulting engineers"), which said estimate of cost total $_____; and

WHEREAS, in order to issue such bonds, it is necessary for the County and the City to enter into a contract as provided in said Act, and

WHEREAS, it is also necessary for the County and the City to contract relative to the operation and maintenance of said sewage disposal system;

NOW, THEREFORE, in consideration of the premises and the convenants of each other, the parties here to agree as follows:

1. The County and the City approve the establishment of a sanitary sewage disposal system in the County of _____ under the provisions of Act 185, Public Acts of Michigan, 1957, as amended, consisting of a sewage treatment facility, lift stations, sanitary sewer interceptors, trunks and other lines, force mains and pump station, together with all necessary appurtenances and rights in land adequate and sufficient to furnish sanitary sewer disposal service in those areas in the City in need of such service. Said areas, and the sewer improvements to be located therein, shall be as set out in the plans for the project prepared by the consulting engineers and referred to in the preamble hereto.

2. The sewage disposal system referred to in paragraph 1 above is designated by the County Board of Commissioners as _____ COUNTY SEWAGE DISPOSAL SYSTEM NO.___(CITY OF _____), hereinafter sometimes referred to in this contract as the "System".

3. The City hereby consents to the use by the County of the public streets, alleys, lands and rights-of-way in the City for the purpose of constructing,operating and maintaining the System and any improvements, enlargements and extensions thereto.

4. The System is designed to service those areas in the City in need of sanitary sewer service and is immediately necessary to protect and preserve the public health, and the City does, by these presents, consent to such service being furnished by the System to the individual users in these areas.

5. The Board and the City hereby approve and confirm the plans for said System prepared by the consulting engineers and the estimate cost thereof in the sum of $_____. Said estimated cost includes all surveys, plans specifications, acquisition of property for rights-of-way, physical construction necessary to acquire and construct the System, the acquisition of all materials, machinery and necessary equipment, capitalized interest, and engineering, engineering supervision, administrative, legal and financing expenses

necessary in connection with the acquisition and construction of the System and the financing thereof.

6. The Board will acquire and construct the System, and for that purpose will take bids for the acquisition and construction thereof prior to the time that any bonds are issued for the purpose of financing part of the cost of the System. The Board shall in no event enter into any final contract or contracts for the acquisition and construction of the System if such contract price or prices will be such as to cause the actual cost of the System to exceed the estimated cost as approved in paragraph 5 of this contract, unless the City, by resolution of its City Council, (a) approves said increased total cost and (b) agrees to pay the excess over the estimated cost, either in cash or by specifically authorizing the maximum principal amount of bonds to be issued, as provided in paragraphs 9 and 10 of this contract, to be increased to an amount which will provide sufficient funds to meet said increased cost and a similar increase in the installament obligations of the City pledged under the terms of this contract to the payment of such bonds.

7. The System shall be acquired and constructed by the Board in accordance with the plans and specification thereof approved by this contract: Provided, however, that minor variations from said plans and specifications may be made without the approval of the City if such variations

shall not materially affect such plans and specifications. All matters relating to engineering plans and specifications, together with the making and letting of final construction contracts for the System, the approval of work and materials thereunder, and construction supervision, shall be in the exclusive control of the Board. All acquisition of rights-of-way shall be done by the City.

8. The County does hereby let and lease the said System to the City, and the City does hereby hire said System from the County, for a term commencing upon the completion of the System, or any substantial part thereof, and ending upon the expiration of this contract. The City shall operate, maintain and manage the System for and one behalf of and as the agency of the Board and the County for such purpose. Said System shall be maintained in good condition and repair to the satisfaction of the Board, which shall have the right to inspect the System at any time and to require the City to make any repairs or replacements and to do any further acts which in the judgment of the Board may be necessary in order to maintain the System in good repair and condition. If the City shall neglect at any time to make such repairs and replacements and to take such action as may be required by the Board within a reasonable time after being notified by the Board to do so, then the Board shall have the right to make the necessary repairs and replacements, and the City shall reimburse the

County for the expense thereof within thirty (30) days after such expense has been incurred. The City will, at its own expense, provide insurance on the machinery, pumping stations or similar equipment of the System against fire or loss by explosion or destriction, of the comprehensive type customarily carried, and will also provide sufficient liability insurance protecting the City and the County against loss on account of damage or injury to persons or property imposed by reason of the ownership or operation of the System or resulting from any act of omission or commission on the part of the City, its agents, officers or employees, in connection with the operation, maintenance or repair of the System.

9. To provide for the construction and financing of the System in accordance with the provisions of Act 185, Public Acts of Michigan, 1957, as amended, the Board shall take the following steps:

(a) The Board will submit to the Board of Commissioners of the County of _____ a resolution providing for the issuance of bonds in the aggregate principal amount of _____ Dollars (except as authorized pursuant to paragraph 6 of this contract) to finance a part of the cost of said System. Said bonds shall mature serially as hereinafter provided, and shall be secured primarily by the contractual obligation of the City to pay the installments due,

plus interest, as hereinafter provided in this contract, and secondarily, if approved by a three-fifth (3/5) majority of the members of the Board of Commissioners, by the full faith and credit of the County of _____. After due adoption of the resolution, the Board will take all necessary legal procedures and steps necessary to effectuate the sale and delivery of said bonds. The balance of the cost of the System shall be paid from proceeds of grants from the Michigan Water Resources Commission.

(b) The Board shall take all steps necessary to take bids for and enter into and execute final construction contracts for the acquisition and construction of the System as specified and approved in paragraph 1 of this contract, in accordance with the plans and specifications therefor as approved by this contract. Said contracts shall specify a completion date agreeable to the City and the Board.

(c) The Board will require and procure from the contractor or contractors undertaking the actual construction and acquisition of the System necessary and proper bonds to guarantee the performance of the contract or contracts and such labor and material bonds as may be required by law, in such amount and such forms as may be approved by the Board.

(d) The Board, upon receipt of the proceeds of sale of the bonds, will comply with all provisions and requirements provided for in the resolution authorizing the issuance of the bonds and this contract relative to the disposition and use of the proceeds of sale of the bonds.

10. The cost of the System to be financed by the issuance of the aforesaid bonds shall be charged to and paid by the City to the Board in the manner and at the times herein set forth. The principal amount thereof ($_____) shall be paid to the Board on the due dates and in the amounts as set out in Schedule A attached hereto and made a part hereof. It is understood and agreed that the bonds of the County hereinbefore referred to will be issued in anticipation of the above contractual obligation, with principal maturities on the first day of the next calendar month following the due date of principal installments, in amounts corresponding to the principal amount of the above installments, and the City shall also pay to the Board in addition to said principal installments, on April 1st and October 1st of each year, commending October 1, 197_, as accrued interest on the principal amount remaining unpaid, an amount sufficient to pay all interest (not capitalized) due on the next succeeding interest payment date on said County bonds from time to time outstanding. All interest due on the bonds on November 1, 197_ and May 1, 197_, and

one-half of that due November 1, 197_, shall be capitalized. The City hereby specifically agrees that the bonds shall bear such rate or rates as may be determined upon public sale thereof, subject only to such maximum interest rate limitation, if any, as may be provided by law. From time to time as the Board is billed by the paying agent or agents for the bonds to be issued for their services as paying agent, or registering bonds, and as other costs and expenses accrue to the Board from handling of the payments made by the City, the Board shall notify the City of the amount of such paying agency fees and other costs and expenses, and the City shall, withing thirty (30) days from such notification, remit to the Board sufficient funds to meet such paying agency fees and other costs and expenses.

Should cash payments be required from the City in addition to the amounts specified in the preceding paragraph to meet additional costs of constructing the System, the City shall, upon written request by the Board, furnish to the Board written evidence of its agreement and ability to make such additional cash payments, and the Board may elect not to proceed with the acquisition or financing of the System until such written evidence, satisfactory to the Board, has been received by it. The City shall pay to the Board such additional cash payments within thirty (30) days after written request for such payment has been delivered by the Board to the City.

The Board shall, within thirty (30) days after the delivery of the County bonds hereinbefore referred to, furnish the City with a complete schedule of maturities of principal and interest thereon, and the Board shall also, at least thirty (30) days prior to the due date of any City debt service payment hereunder advise the City in writing of the exact amount of interest or principal and interest due on the County bonds on the next succeeding maturity date.

If any principal installment or interest is not paid when due, the amount not so paid shall be subject to a penalty, in addition to interest, of one-half of one percent (1/2 of 1%) thereof for each month, or fraction thereof, that the same remains unpaid after the due date.

11. The City, pursuant to the authorization of paragraph (2), Section 12, Act No. k85, Public Acts of Michigan, 1957, as amended, hereby irrevocably pledges its full faith and credit for the prompt and timely payment of its obligations pledged for bond payments as expressed in this contract, and shall each year, commencing with the year 197_, levy an ad valorem tax on all the taxable property in the City in an amount which, taking into consideration estimated delinquencies in tax collections, will be sufficient to pay such obligations under this contract becoming due before the time of the following year's tax collections. Such annual tax levies, by virtue of the provisions of Section 6,

Article IX of the Michigan Constitution of 1963, shall be without limitation as to rate or amount, being for the purpose of providing funds to meet the contractual obligations of the City in anticipation of which the County bonds hereinbefore referred to are issued. Nothing herein contained shall be construed to prevent the City from using any, or any combination of, the means and methods provided in paragraph (2), Section 12 of said Act No. 185, Public Acts of Michigan, 1957, as now or hereafter amended, for the purpose of providing funds to meet its obligations under this contract, and if, at the time of making the annual tax levy, there shall be other funds on hand earmarked and set aside for the payment of the contractual obligations due prior to the next tax collection period, then such annual tax levy may be reduced by such amount.

12. The City may pay in advance any of the payments required to be made by this contract, in which event the Board shall credit the City with such advance payment on future due payments to the extent of such advance payment.

13. The City may pay additional moneys over and above any of the payments specified in this contract, with the written request that said additional funds be used to call or purchase bonds for redemption prior to maturity, in which event the Board shall be obligated to apply and use said moneys for such purpose, to the fullest extent possible. Such moneys shall not then be credited as advance payments under the provisions of Section 12 of this contract.

14. In the event the City shall fail for any reason to pay to the Board at the times specified the amounts required to be paid by the provisions of this contract, the Board shall immediately notify in writing the County Treasurer of the County of _____, or such other official charged with the disbursement to the City of funds returned by the State and now or hereafter under the Act available for pledge, as provided in this paragraph, particularly funds derived from the State Sales Tax levy, and the City Treasurer of such default, and the amount thereof, and if such default is not corrected within ten (10) days after such notification, the County Treasurer, or such other official charged with disbursement to the City of the aforesaid funds, particularly funds derived from the State Sales Tax levy under the law and payable to the City pursuant to Section 10, Article IX of the Michigan Constitution of 1963, is, by these presents, specifically authorized by the City to withhold from the aforesaid funds the maximum amount necessary to cure said deficit, and to pay said sums so withheld to the Board, to apply on the obligations of the City as herein set forth. Any such moneys so withheld and paid shall be considered to been paid to the City within the meaning of the Michigan Constitution of 1963, the purpose of this provision being solely to voluntarily authorize the use of said funds owing to the City to meet any past-due obligations of the City due under the provisions

of this contract. In addition to the foregoing, the Board shall have all other rights and remedies provided by law to enforce the obligations of the City to make its payments in the manner and at the times required by this contract.

15. It is specifically recognized by the City that the debt service payments required to be made by it pursuant to the terms of Section 10 of this contract are to be pledged for and used to pay the principal of and interest on the bonds to be issued by the County, as provided by this contract and authorized by law, and the City covenants and agrees that it will make all required payments to the Board promptly and at the times herein specified without regard to whether the System is actually completed or placed in operation.

16. If the proceeds of the sale of the bonds to be issued by the County are for any reason insufficient to complete the System, the Board and the City hereby agree to the issuance of additional bonds in an aggregate principal amount sufficient to complete the System and the automatic increasing of the annual payments required to be made as increased will be sufficient to meet the annual principal and interest requirements on the bonds herein authorized, plus the additional bonds to be issued. In lieu of said additional bonds, the City may pay over to the Board in cash sufficient moneys to complete the System.

17. After completion of the System and payment of all costs thereof, any surplus remaining from the proceeds of sale of bonds shall be used by the Board for either of the following purposes, at the option of and upon request made by resolution of the City Council, to wit: (a) for additional sewer improvements in the City, subject to approval of the Board, or (b) credited by the Board toward the next payments due the Board by the City hereunder.

18. All contracts for connection to the System, whether such connections are made during construction or after the System is placed in operation, shall be made by the City. The actual costs of such connections shall be paid by the City except to the extent that the costs of such connections are included in the cost of the System.

19. The obligations and undertakings of each of the parties to this contract shall be conditioned on the successful issuance and sale of bonds pursuant to Act 185, Public Acts of Michigan, 1957, as amended, and if for any reason whatsoever said bonds are not issued and sold within three (3) years from the date of this contract, this contract, except for payment of preliminary expenses and ownerhship of engineering data, shall be considered void and of no force and effect. In the event that said bonds are not issued and sold, all preliminary legal and engineering costs shall be paid by the City, and the City shall have ownership, possession and use of all plans and specifications, surveys and other engineering data and materials prepared.

20. The Board and the City each recognize that the holders from time to time of the bonds issued by the County under the provisions of Act 185, Public Acts of Michigan, 1957, as amended, to finance part of the cost of the System, will have contractual rights in this contract, and it is, therefore, covenanted and agreed by each of them that so long as any of said bonds shall remain outstanding and unpaid, the provisions of this contract shall not be subject to any alteration or revision which would in any manner materially affect either the security of the bonds or the prompt payment of principal or interest thereon. The City and the Board further covenant and agree that they will each comply with their respective duties and obligations under the terms of this contract promptly at the times and in the manner herein set forth, and will not suffer to be done any act which would in any way impair the said bonds, the security therefor, or the prompt payment of principal and interest thereon. It is hereby declared that the terms of this contract, insofar as they pertain to the security of any such bonds, shall be deemed to be for the benefit of the holders of said bonds.

21. This contract shall remain in full force and effect for a period of forty (40) years from the date hereof, or until such lesser time as the bonds issued by the County are paid in full. At such time within said forty-year term as all of said bonds are paid, this contract shall be terminated and ownership of the System shall be transferred to the City. In any event, the obligation of the City to make payments

required by Section 10 of this contract shall be terminated at such time as all of said bonds are paid in full, except for any deficiency or penalty thereon which may at that time remain unpaid.

22. The City shall defend, indemnify and save harmless the County and Board from and against any and all claims of any nature whatsoever, including damage to property of the County or Board or injury to or death of employees or agents of the County or Board, arising out of the construction, operation and/or maintenance of the System.

23. This contract shall inure to the benefit of and be binding upon respective parties hereto, their successors and assigns.

24. This contract shall become effective upon approval by the City Council of the City of _____, by the Board of Public Works of _____ County, and by the Board of Commissioners of _____ County, and when duly executed by the Mayor and City Clerk of the City of _____ and by the Board of Public Works for and on behalf of the County. This contract may be executed in several counterparts.

APPENDIX 3

APPENDIX 3

SAMPLE ARTICLES OF INCORPORATION OF AN AREA SEWAGE DISPOSAL AUTHORITY

These Articles of Incorporation are adopted by the incorporating municipal corporations for the purpose of creating an authority under the provisions of Act No. 233, Michigan Public Acts of 1955, as amended (hereinafter sometimes referred to as the "enabling act").

ARTICLE I.

The name of this Authority is "_____ Area Sewage Disposal Authority." The registered office of the Authority will be located in the City Hall of the City of _____, _____ County, Michigan.

ARTICLE II.

The incorporating municipal corporations creating this Authority are the City of _____ and the Township of _____, both in the County of _____, State of Michigan, which are hereby designated as the constituent municipalities.

ARTICLE III.

The purpose of this Authority is to acquire, own, improve, enlarge, extend and operate a sewage disposal system or any part thereof in accordance with the enabling act. The term "sewage disposal system" as used in these

Articles shall include all interceptor sewers, storm sewers, sanitary sewers, combined sanitary and storm sewers, sewage treatment plants, and all other plants, works, instrumentalities and properties used or useful in connection with the collection, treatment and/or disposal of sewage and/or industrial wastes.

ARTICLE IV.

This Authority shall be a body corporate with power to sue or to be sued in any court of this state. It shall be comprised of the territory lying within the corporate boundaries of its constituent municipalities. It shall possess all of the powers granted by statues now in effect or hereafter adopted or amended, and by these Articles, which are necessary to carry out the purposes of its incorporation, and those incident thereto. The enumeration of any powers herein or in the enabling act shall not be construed as a limitation upon its general powers unless the context shall clearly indicate otherwise. It shall have a corporate seal.

ARTICLE V.

This Authority shall continue in existence perpetually or until dissolved by act of the parties or by law: Provided, however, that it shall not be dissolved if such dissolution would or could operate as an impairment of any bonds or other contracts.

ARTICLE VI.

The fiscal year of this Authority shall commence on the first day of January and end on the thirty-first day of December in each year.

ARTICLE VII.

The governing body of this Authority shall be a Board of Trustees, hereinafter referred to as the "Board", which shall consist of seven trustees, four of whom shall be residents of the City of _____ and be apointed by the City Council of said City and three of whom shall be residents of the Township of _____ and be appointed by the Township Board of said township. Members of the first Board shall be so appointed within thirty days after these Articles become effective and their terms shall be staggered so that the four trustees from the City of _____ shall serve for terms expiring on June 30 in the years 197_, 197_, 197_, and 197_, respectively, and so that the three trustees from the Township of _____ shall serve for terms expiring on June 30 in the years 197_, 197_, and 197_, respectively. Succeeding trustees shall be so appointed on or before the fifteenth day of June of each year and shall serve for three-year terms beginning on the following July 1 and until their respective successors are appointed and qualified. Each trustee shall file his oath of office with the clerk of the constituent municipality from which he is appointed.

Trustees shall serve without compensation but the Board may by majority vote of its total membership authorize payment of actual expenses incurred by any trustee in connection with the business of the Authority. The members of the first Board shall qualify by filing their oaths of office and shall meet for the purpose of organization within thirty days after their appointment and thereafter the Board shall meet for such purpose on the third Monday in July of each year at the time and place fixed for the holding of regular meetings. At each such organization meeting the Board shall select a Chairman and a Vice-Chairman, who shall be members of the Board. The offices of Secretary and Treasurer may be combined and held by one person if so provided in the By-Laws. Such officers shall serve until the next annual organization meeting and until their respective successors shall be selected and qualified. Failure to hold meetings or appoint or select trustees or officers as herein provided shall not render invalid any action taken by the Board of its officers. No appointment of any trustee or election of any officer, and no action taken at any meeting, shall be invalid because it did not occur within or at the time specified in these Articles. Any member of the Board may be removed for cause at any time by majority vote of the legislative body which appointed him. Any officer of the Board may be removed at any time by majority vote of the total membership of the Board.

ARTICLE VIII.

In the event of a vacancy on the Board, the legislative body of the constitutent municipality which appointed the trustee whose position has become vacant shall fill the vacancy for the unexpired term. In the event of a vacancy in any office of the Board, such vacancy shall be filled by the Board for the unexpired term. In case of the temporary absence or disability of any officer, the Board may appoint some person temporarily to act in his stead except that in the event of the temporary absence or disability of the Chairman, the Vice-Chairman shall so act.

ARTICLE IX.

Regular meetings of the Board shall be held at such time and place as shall be prescribed by resolution or in the By-Laws of the Board. Special meetings of the Board may be called by the Chairman or any three members thereof, by serving written notice of the time, place and purpose thereof, upon each member of the Board personally, or by leaving it at his place of residence, at least twenty-four hours prior to the time of such meeting, or by depositing the same in a United States Post Office or mail box within the limits of the Authority, at least seventy-two hours prior to the time of such meeting, enclosed in a sealed envelope properly addressed to him at his home or office address, with postage fully prepaid. Special meetings of the Board at which all members are present shall be deemed to be valid even though

no written notice thereof may have been given as above provided. Any member of the Board may waive notice of any meeting either before or after the holding thereof and written consent to any action taken by the Board shall have the same effect as if the consenting member had been present and had voted in favor of such action. At least four members of the Board shall be required for a quorum. The Board shall act by motion, resolution or ordinance. For the passage of any resolution or ordinance providing for the issuance of bonds there shall be required the affirmative vote of at least five members of the Board. For all other actions, a majority vote of those present shall be sufficient for passage, unless otherwise provided herein or in the By-Laws. The Board shall have the right to adopt By-Laws and rules governing its procedure which are not in conflict with the terms of any statue or of these Articles. The Board shall keep a journal of its proceedings, which shall be signed by the Secretary. All votes shall be "Yeas" and "Nays", except that where the vote is unanimous, it shall only be necessary to so state. Each member shall be required to vote upon all matters unless he shall be disqualified therefrom. No member may vote upon any matter in which he has a personal interest. No trustee shall have any financial interest in any contract with the Authority.

ARTICLE X.

The Chairman of the Board shall be the presiding officer thereof. In the absence or disability of the Chairman, the Vice-Chairman shall perform the duties of the Chairman. The Secretary shall be the recording officer of the Board. The Treasurer shall be custodian of the funds of the Authority and shall give to it a bond conditioned upon the faithful performance of the duties of his office. The cost of said bond shall be paid by the Authority. All monies shall be deposited in a bank or banks, to be designated by the Board, and all checks or other forms of withdrawal therefrom shall be signed by two officers of the Board as shall be designated in the By-Laws or by resolution of the Board. The officers of the Board shall have such other powers and duties as may be conferred upon them by the Board. The Board shall prior to December 15 of each year, prepare, adapt and file with the legislative bodies of the constituent municipalities, an annual budget for the next fiscal year covering the proposed expenditures to be made for the organizing and operating of the Authority, and for the necessary funds required from each constituent municipality for the next fiscal year.

ARTICLE XI.

The Authority shall have power to acquire property necessary for its purposes by purchase, construction, lease gift, devise or condemnation, either within or without its corporate limits, and may hold, manage, control, sell,

exchange or lease such property. For the purpose of condemnation it may proceed under the provisions of Act 149, Public Acts of Michigan, 1911, as now or hereafter amended, or any other appropriate statute.

ARTICLE XII.

The Authority and its constituent municipalities may enter into a contract or contracts providing for the acquisition, purchase, construction, improvement, enlargement, extension, operation and financing of a sewage disposal system or any part thereof as authorized and provided in the enabling act. The Authority may, subject to the prior approval of the constituent municipalities, enter into contracts with any nonconstituent city, village or township for the furnishing of sewage disposal service by any sewage disposal facilities owned or operated by the Authority, which contract shall provide for reasonable charges or rates for such service furnished. No contracts shall be for a period exceeding forty years.

ARTICLE XIII.

For the purpose of obtaining funds for the acquisition, purchase, construction, improvement, enlargement or extension of a sewage disposal system or any part thereof, the Authority may, upon ordinance or resolution duly adopted by the Board, issue its negotiable bonds, secured by contractual full faith and credit pledges of each contracting municipality, in accordance with and subject to the provisions of the enabling act.

ARTICLE XIV.

The Board shall have power to secure all necessary services and to hire all necessary officers and employees to carry out the functions of the Authority and to fix the compensation therefore: Provided, however, that no officer or employee of any constituent municipality shall receive any compensation from the Authority except by the unanimous vote of the total membership of the Board

ARTICLE XV.

The Board shall cause an annual audit to be made of its financial transactions by an independent certified public accountant and shall furnish at least five copies thereof to each constituent municipality.

ARTICLE XVI.

These Articles shall be published once in a newspaper having general circulation within the territorial limits of the Authority, and one printed copy of the Articles, certified as a true copy thereof, with the date and the place of publication, shall be filed with both the Secretary of State and the Clerk of the County of _____ within thirty days after the execution thereof has been completed. The City Clerk of the City of _____ is hereby designated as the person to cause these Articles to be published, certified and filed as aforesaid. In the event he shall be unable to act or shall neglect to act, then the Township Clerk of the Township of _____ shall act in his stead.

ARTICLE XVII.

This Authority shall become effective upon the filing of certified copies of these Articles as provided in the preceding Articles.

ARTICLE XVIII.

These Articles of Incorporation may be amended at any time so as to permit any other municipality to become a constituent municipality of this Authority, if such amendment is adopted by the legislative body of each constituent municipality of which the Authority is composed. Other amendments may be made to these Articles of Incorporation at any time if adopted by the legislative body of each constituent municipality of which the Authority is composed. Any such amendment shall be endorsed, published, and certified, and printed copies thereof filed in the same manner as the original Articles of Incorporation, except that the filed and printed copies shall be certified by the recording officer of this Authority.

These Articles have been adopted by the several incorporating municipalities, as hereinafter set forth in the following endorsements, and in witness whereof the Mayor and City Clerk of the City of _____ and the Supervisor and Clerk of the Township of _____ have endorsed thereon the statement of such adoption.

The foregoing Articles of Incorporation were adopted by the City Council of the City of _____, and _____ County, Michigan, at a meeting duly held on the _____ day of _____, 197__.

CITY OF_____

_____
Mayor

_____
City Clerk

The foregoing Articles of Incoporation were adopted by the Township Board of the Township of _____, _____County, Michigan, at a meeting duly held on the _____day of_____, 19___.

TOWNSHIP OF_____

_____
Supervisor

_____
Township Clerk

APPENDIX 4

APPENDIX 4

LEASE AGREEMENT BETWEEN A FARMER AND COUNTY

1. The Lessor (County) plans to construct lagoon ponds and drainage ditches on parts of the above described land and construct an irrigation system consisting of either portable or stationary equipment for the purpose of irrigating crops with the effluent from the lagoon ponds of the System and is agreed that the purchase, operation, replacement and repair of the irrigation equipment shall be the responsiblity of the Lessor.

2. Lessee shall be entitled to all crops on the above described land for a period of 3 years from date of execution hereof including harvesting any crops maturing in the fall of the third year. He shall also determine the crops to be grown during the three year period. However, he shall not be entitled to be compensated for any damage to crops due to the construction of the lagoons, drainage ditches, irrigation system, and preparation of the land for the above facilities.

3. It is understood and agreed that Lessee will provide the equipment and all repairs and replacements thereto and all labor in connection with the farming operation on said property.

4. After the three year period Lessor will determine the crops to be grown and as soon as the irrigation system is in operation, Lessor will determine the rate of application of the effluent.

5. (Cross out Alternate not used) Alternate 1 It is further understood and agreed that the Lessor and Lessee after the initial period of three years shall share on a 40-60 basis in the crops harvested (40% to Lessor (County) and 60% to Lessee) and share on a 40-60 basis in the cost of seeds, fertilizer, liming materials, weed spray materials, twine and other similar materials (40% to Lessor (County) and 60% to Lessee). Lessors' share of all crops will be made available on the property on which it is grown at the time of harvest. The Lessee will have the option of purchasing Lessors' share of any crop at a price to be established by Lessor.

Alternate 2 It is further understood and agreed that the primary objective of the farming operation is to utilize the maximum amount of nitrogen and phosphorous in the growing of crops to be removed from the land. The principal crop to be grown is corn and it is to be removed as silage or mature corn. After the corn crop is removed it is understood a seeding of rye grass or rye will be seeded as a cover crop to be plowed under the following spring.

On the basis of this type of operation it is understood that after the initial three year period the Lessee

will pay cash rent to the Lessor at the rate of _____ dollars per acre for the productive land of the above description. Payment to be made as follows: One half on March 1 and one half on September 1 of each year.

It is understood and agreed that payment will be based on the acres from which a crop is removed whether a hay, corn or other grain crop.

6. In case of crop failure neither party shall have any claim against the other party.

7. Lessee assumes all liability for and will protect, indemnify and save Lessor, its successors and assigns harmless from and against all claims, actions, demands, judgments, losses, expense of suits or actions and attorney fees for injury to or death of any person or persons whomsoever arising from or in connection with or as a direct or indirect result of the negligence of the Lessee in the herein defined farming operation.

8. This lease agreement shall be for an initial term of 5 years from the date of execution and at the option of the Lessee it may be renewed for two successive terms of 5 years each provided the farming operation for the initial term and/or successive term is satisfactory with the Lessor. Application for renewal shall be made in writing and accepted by Lessor in writing at least 3 months before the term expires. If the farming operation is not satisfactory with the Lessor his lease may be terminated at the end of the

initial 5 year and/or successive period by giving notice in writing to Lessee 3 months before the expiration of the term.

9. It is understood as one of the terms of this lease agreement that Lessee will use ordinary diligence in the farming operation as to time of planting, tending and harvesting of crops. If after the initial three year period the Lessee is negligent in planting, tending or harvesting the crops specified by Lessor this negligence shall violate the terms of this lease agreement and at Lessors discretion this lease may be terminated by giving notice in writing to Lessee of such termination.

COUNTY OF_____(Lessor)

BY:_____

IN THE PRESENCE OF:

_____

_____ (Lessee)

_____

_____

IN THE PRESENCE OF:

_____

_____

APPENDIX 5

APPENDIX 5

OUTLINE OF PROCEDURES FOR ACT 185 OF THE PUBLIC ACTS OF MICHIGAN, 1957 AS AMENDED

1. The local unit of Government adopts a resolution describing the project, the need for the project and requests County assistance through the Board of Public Works to establish, construct and finance the project.

2. A contract is prepared between the County and local unit for the acquisition, construction, financing and operation of the project. Previous to this preparation, engineering studies and financial determinations are made to establish the scope and cost of the project.

3. The local unit adopts a resolution approving the contract and permits execution thereof. Resolution and executed (4) contracts are forwarded to Board of Public Works.

4. The Board of Public Works adopts resolution approving the contract and recommending that the Board of Commissioners also approve the contract. The Board of Public Works also at this time prepares and submits to the Commission a bond resolution pertaining to the financing of the sytem. (At this time parallel contracts between units of Government that may involve treatment, operation, transportation, etc., should be negotiated).

5. The County Board of Commissioners adopts a resolution that establishes the system, and approves the contract permitting its execution. The Commissioners also at this time approves and adopts a Bond Resolution pertaining to the project. The Bond Resolution contains the pledge of the County's full faith and credit.

6. The Bond Resolution directs the Board of Public Works to adopt a notice of sale of bonds, permits the filing of an application with the Municipal Finance Commission and allows the sale and delivery of bonds.

7. Concurrently within the timetable of the above procedures the local unit must adopt and publish a Utility and Sewer Use Ordinance and a Tax Resolution declaring its intention to levy taxes for repayment of bonds.

8. A Finance Commission Application is prepared and submitted with certified copies of required exhibits as follows:

a. Local unit resolution approving contract.

b. Board of Public Works resolution approving contract.

c. Board of Commissioners resolution approving project.

d. Contract.

e. Bond Resolution.

f. Notice of sale.

g. Local unit utility ordinance.

h. Affidavit of publication of ordinance.

i. County Treasurers affidavit relative to sale taxes.

j. Local units tax resolution.

(A sequence numbers is issued each application)

9. The Finance Commission adopts an order of approval and an official notice of sale and forwards these documents to the applicant.

10. The Board of Public Works arranges for the sale of bonds and publishes the official notice of sale in a Bond Buyer publication and a local newspaper.

11. Upon the date set for sale of bonds, bids are received and the bonds awarded to the lowest, legal bidder by formal action of the Board of Public Works.

12. Bonds are printed and signed by the Chairman of the County Commission and the County Clerk in the presence of the Bond Buyer and delivery made immediately upon execution.

Capitalized interest if provided for, accrued interest and premium must be deposited in Bond Retirement Account, remainder goes to Construction Account.

APPENDIX 6

APPENDIX 6

ALTERNATE STRATEGIES OF REVENUE BONDS AND GENERAL OBLIGATION BONDS

Revenue Bonds:

Revenue bonds are bonds which the Village Council may issue pursuant to Act 94, Public Acts of Michigan, 1933, as amended. These bonds may be issued without vote of the electors, provided, however, that 10% of the registered electors of the Village may within 30 days of the publication of the ordinance authorizing the issuance of the bonds, which will occur immediately after its adoption, file a petition for a referendum on the question of the issuance of the bonds and if such a petition is filed, then the bonds may not be issued until they have been approved by a majority vote of the electors of the Village voting thereon. If no petition for referendum is filed, the revenue bonds may be issued without vote of the electors. The revenue bonds are bonds which would be payable solely and only from the earnings of the public improvement involved and would not be payable from the general funds of the Village or from taxes. Since the source of payment of revenue bonds is limited to the revenues of the public improvement derived from the imposition of rates charged for the use thereof, it is necessary in

order to market the bonds to establish rates for the use of the public improvement sufficient to produce net revenues each year (gross earnings less operation and maintenance expense) sufficient to cover the annual principal and interest requirements one and one-half times. Without this security factor it would not be possible to market the revenue bonds. It is possible under the provisions of the State Revenue Bond Act to combine the water system and the sewer system of the Village into a single utility and pledge the combined earnings of the water and sewer system for the payment of the bonds. This is highly desirable where the Village has an existing water system with an established earnings record,. . . ., as this will materially assist in the marketing of the revenue bonds. It is recommended that the revenue bonds issued by the Village in connection with the sewer project pledge the earnings of both the water and sewer system.

The surplus earnings derived from the rates established to provide the coverage noted above would be used, first, in a fixed amount each year to establish a bond reserve approximately equal to one year's principal and interest requirements on the revenue bonds and, second, to establish a replacement reserve to protect the Village and the bond holders from a disruption of service resulting from a major breakdown. The surplus earnings thereafter and to the extent not needed, even in the first few years, for the

payment of principal and interest on the bonds, operating expenses of the water and sewer system and the reserve requirements needed above, may be used to pay part or all of the debt service requirements of any general obligation bond issue by the Village for sewer purposes. It is further possible, under the provisions of the Revenue Bond Act, to defer repayment of principal for five years,. . .,in order to assure that the Village will at all times have sufficient funds to pay the principal and interest on the revenue bonds and such portion of the principal and interest on the general obligation bonds as the Village Council may desire and still establish the reserves for the revenue bonds noted above. There is no statutory limit on the amount of revenue bonds that can be issued. The amount of revenue bonds that can be issued will be controlled by the amount of revenue bonds that can be supported by reasonable rates for water and sewer service.

General Obligation Bonds:

The Village Council of a General Act Village,. . ., has a right to issue general obligation bonds of the Village in an amount not exceeding 10% of the valuation of the Village. . .Before the Village can issue general obligation bonds under the provisions of the General Village Act for Sewer purposes, their issuance must be approved by a 3/5 vote of the taxpaying electors of the Village who actually vote on the question of the issuance of the bonds. These bonds would be bonds which would pledge for their security

the general unlimited ad valorem taxing power of the Village and if necessary, the Village would be required to levy taxes beyond its statutory tax rate limit for the payment of these bonds. In fact, as noted above, the surplus earnings of the water system and the sewer system could be devoted to the payment of part or all of the principal and interest on the general obligation bonds and to the extent that funds were available from this source, the amount of taxation could be reduced or possibly even eliminated. In the event that the earnings of the water system and sewer system were not sufficient to pay part or all of the debt service on the general obligation bonds, the Village would have to levy ad valorem taxes from the payment of the bonds.

APPENDIX 7

Figure 1 of Appendix 7

The Relationship Between Design Population and Total Acres in the System

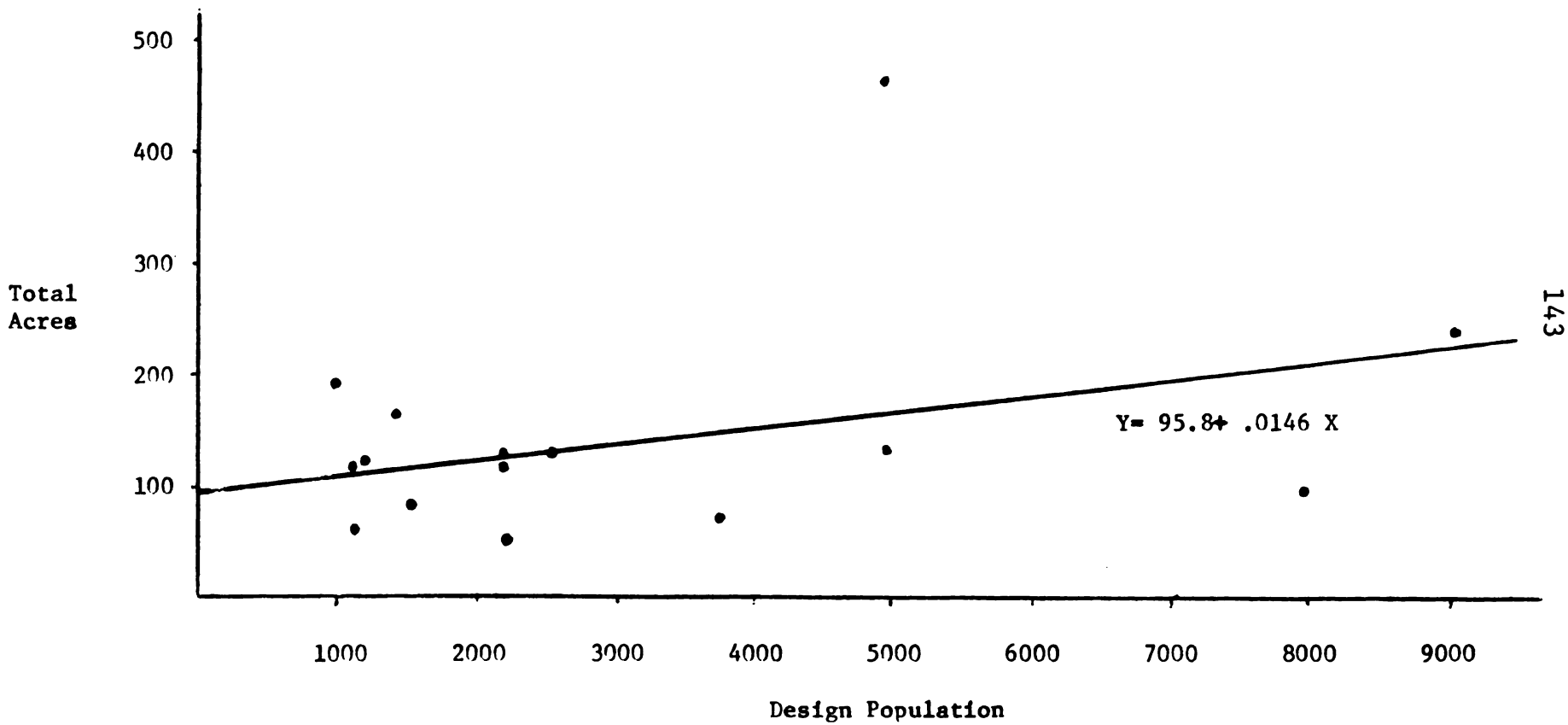


Figure 2 of Appendix 7

The Relationship Between Design Population and Lagoon Acres in the System

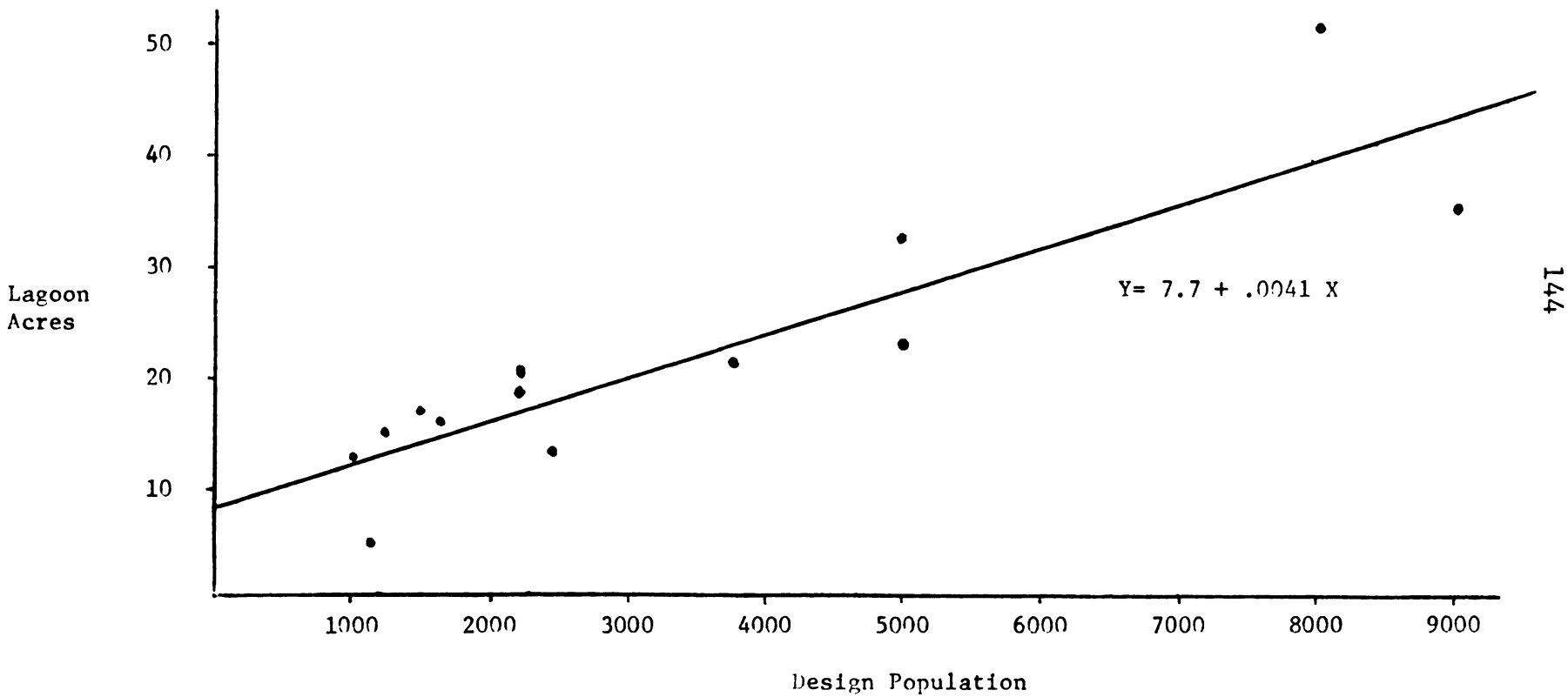


Figure 3 of Appendix 7

The Relationship Between Design Population and Irrigated Acres in the System

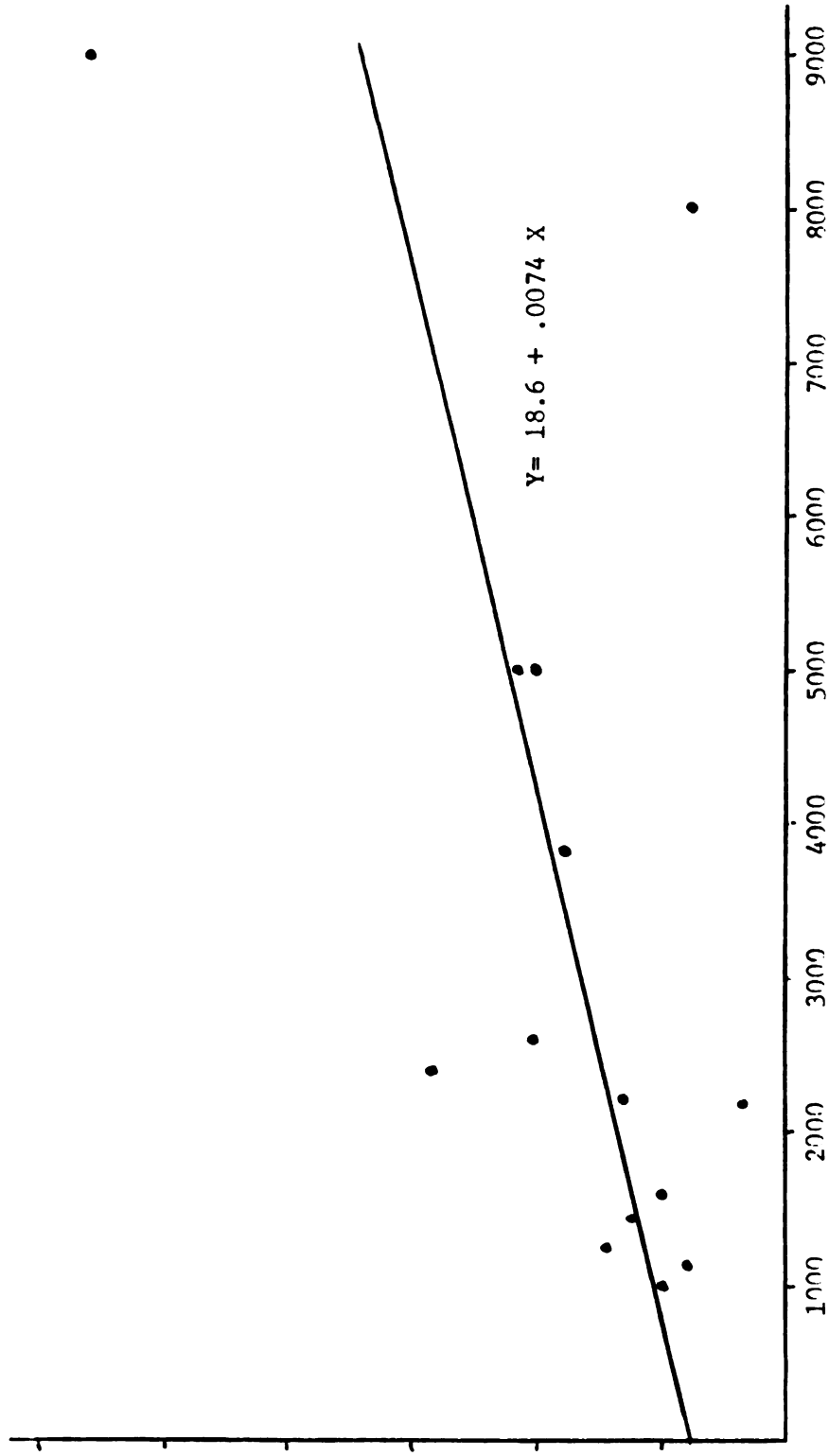
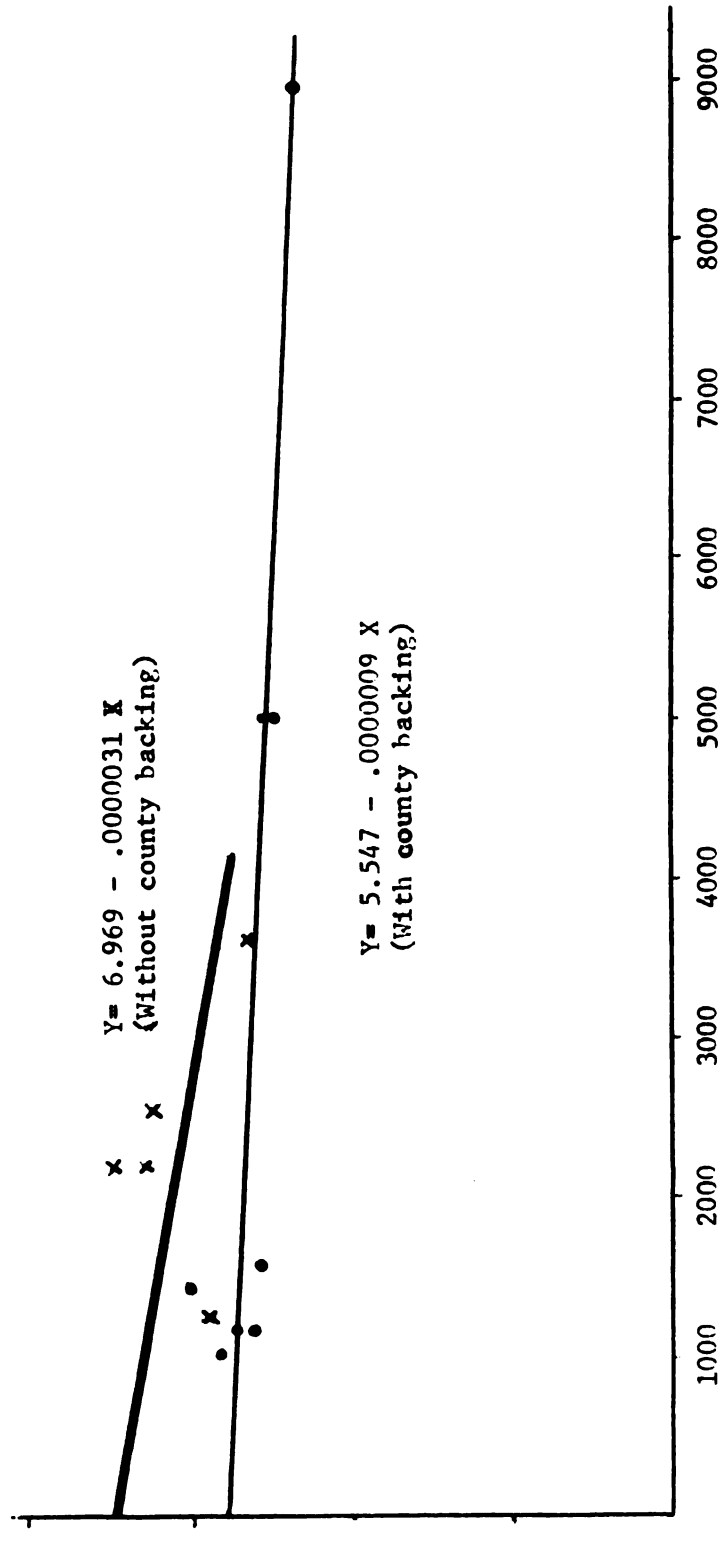


Figure 4 of Appendix 7

The Relationship Between Design Population and Interest Rate for the Systems



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