3. NONPOINT SOURCE CONTROL MEASURES

I. INTRODUCTION

Immense quantities of pollution enter practically all streams without ever flowing through pipes, sewers, treatment plants or stormwater outfall structures. Such wastewater sources have been characterized as "sources without a post office address." Wastes in this category include runoff from land surfaces, roof downspouts, streets, parking lots and construction sites. Such wastes can have detrimental effects on groundwater and surface water resources. The particular use of the land often determines the extent and seriousness of such nonpoint pollution sources.

Recognition of the seriousness of nonpoint source pollution has increased during the recent years; yet, there has been little evidence of constructive programs for its regulation. The importance of nonpoint sources of pollution and methods for their control has only been brought into sharp focus through the current 208 Water Quality Management studies. While nonpoint source problems have long been recognized by pollution control agencies, point sources, such as municipal and industrial waste discharges, were not only more definitive, but administratively and technically much easier to control and demonstrate a beneficial effect on water quality. However, with the recognition that current water quality standards cannot be attained without the control of nonpoint sources, attention is now being focused on the necessary controls of such sources.

Control of nonpoint sources of pollution is an essential part of a water quality management program. Relating the conclusions of a recent study by the Federal Council on Environmental Quality to the St. Louis 208 study area, it can be estimated that from 40 to 80 percent of the total pollution entering surface waters in a metropolitan area comes from sources other than municipal or industrial waste treatment plant discharges.

There are two ways nonpoint source pollution can be controlled: 1) through treatment of all land runoff (termed structural control measures), which is rarely economically feasible for all sources; or 2) controlling how the land is developed and utilized by preventing or minimizing pollution runoff discharges from it (termed nonstructural control measures).

Structural control measures do not strive to eliminate sources of pollution or actions that cause it, but collect and concentrate pollutants for treatment. Structural control measures for controlling urban runoff are physical actions that collect, store and treat the runoff water, or through contour landscaping, strive to imitate the pre-development hydrology of a site after it is developed.

A nonstructural control measure is an action, either physical or legislative, which attempts to prevent pollution from occurring. An example of a nonstructural control is an ordinance which regulates the use of septic tanks in areas determined to be environmentally sensitive; or, an innovative approach to streetsweeping so that more potential pollutants can be removed from urban surfaces.

A full range of structural and nonstructural control measures were developed during Phase 2 of the 208 program (Element 11 Report). They were evaluated for cost-effectiveness and implementability in each of the counties. The nonpoint source control recommendations presented in this section are a composite of the most appropriate structural and nonstructural controls for addressing this area's nonpoint problems.

In our nonpoint source control recommendations, nonstructural controls are emphasized. Nonstructural controls are less expensive and are often more implementable than structural controls. The lack of federal and state grant assistance to governments who are willing to implement structural controls is a major impediment; without grants, these governments are often faced with costs that are both politically and practically too high.

II. METHODOLOGY FOR DEVELOPING NONPOINT SOURCE CONTROLS

Nonpoint source problems were identified, by constituent, for each of the watershed areas within each of the counties in the St. Louis 208 area. Total annual loadings of nonpoint source pollution were then compared to annual point source loadings and conclusions were drawn regarding relative significance (Element 11, Appendix B). Nonpoint source

pollution constituents natural in origin were separated from those anticipated to be man-induced.

As the pollution sources were revealed and the 208 water quality goals formulated, pollution control strategies were developed. An example of this method was the development of the pollution control strategy for individual home treatment systems (IHTS). From this overall strategy, specific nonpoint source controls, such as minimum lot size and site inspection, were detailed. Thus, the plan formulation involved four basic steps:

1. Problem identification.

2. Setting of goals

3. Development of control strategies

4. The design of nonpoint pollution controls

Problem Identification

Through the use of computer modeling and supplemental sampling, the major sources of nonpoint pollution in the St. Louis 208 area were determined to be:

1. Stormwater runoff of sediments and several contaminants from developed urban areas.

2. Stormwater runoff of sediments from unprotected soil exposed by construction activities.

3. Proliferation of poorly designed and installed individual home treatment systems (IHTS), along with inadequately maintained or malfunctioning septic tanks and other IHTS.

4. Runoff of sediment and chemical nutrients from agricultural lands.

The development of a comprehensive problem statement resulted in the formulation of a number of overall nonpoint source program goals.

Setting of Goals

Four major goals were identified which provided the framework for future nonpoint source activities:

1. To reduce concentrations of fecal coliform, phosphate, ammonia, oil and phenols in area watercourses.

2. To coordinate point and nonpoint source controls for optimum water quality improvement.

3. To reduce pollution loadings from urban runoff, septic tank seepage and agricultural runoff.

4. To establish a waste load allocation system for the Mississippi River drainage on a multi-state basis.

Development of Control Strategies

Control strategies were devised which detailed the kind of specific actions necessary to meet the overall nonpoint source program goals. The strategies evolve from three general areas of nonpoint control considered critical to the 208 St. Louis area: urban runoff, construction site runoff, and individual home treatment systems. These strategies are:

--Urban runoff pollution from existing and new developments should be minimized to the extent that is economically feasible. This strategy contains elements of environmental design; combined sewer control; commercial, industrial and high density residential controls.

--Construction site runoff strategy requires sediment control. Because many areas in the metropolitan region will undergo development or redevelopment over the next 25 years, water quality should be protected by reducing sediment loading at the construction site.

--The IHTS control strategy consists of two aspects: IHTS performance can be improved by assuring that new systems are developed in environmentally suitable manner; the performance of existing IHTS can be upgraded with a comprehensive operation and maintenance program.

The Design of Nonpoint Pollution Controls

Nonpoint source controls were developed during the second phase of the 208 study by designing systems based on the three strategies outlined above. An initial analysis examined a full range of structural and nonstructural controls for nonpoint pollution problems within each county (Element 11, Chapters 3 and 4). This set of Phase 2 controls was devised as a response to anticipated nonpoint source problems; effectiveness and feasibility of enforcement and implementation were considered in the development of these controls. The controls were presented for public evaluation and review at the February, 1976, Citizen Workshops. Participants were asked to determine which controls merited further investigation during Phase 3 of the study (Element 18 Report). Staff and consultants also eliminated some of the obviously expensive and impractical controls prior to Phase 3.

During Phase 3 of the study, the remaining nonpoint source controls were evaluated based on these criteria: water quality effectiveness, cost, and implementability. Three levels of desired water quality were used to evaluate effectiveness (Element 23, Chapters 2 and 3):

Level 1--Current nonpoint source controls would be adequate; no additional controls would be necessary.

Level 2--The objective of this level is to achieve the State of Missouri's proposed water quality standards. From a nonpoint source standpoint, this means that all controls devised will be directed at reducing sediment and peak runoff. It is important to note that reductions in sediment discharges would also reduce loadings of phosphate, BOD, ammonia, and some fecal coliform as an incidental benefit.

Level 3--This level is directed at obtaining the water use objectives developed in the St. Louis 208 Program. In general, the standards that would have to be met are more stringent

than the proposed State of Missouri standards. Most notably, Level 3 established a criteria of 0.05mg/l for phosphate (the State has not established a criteria) and more stringent criteria for fecal coliform and ammonia than proposed by the State. Nonpoint source controls for Level 3 would not only require detention of runoff, but also treatment for the constituents mentioned above.

Nonpoint source controls were categorized by the water quality level that could be achieved. Further, a detailed inventory of existing nonpoint sources practices was compiled by county. An assessment was made as to the feasibility of enforcement and implementation of specific controls within each county. Costs were developed for each control using different methodologies for the respective control measures (Element 11 and Element 24). Cost information was presented at workshops, committee meetings and state and federal meetings with the primary objective of determining the most effective nonpoint source control strategy to pursue. Through this review procedure, Level 2 control measures were deemed the most practical and implementable of the three levels. Further, Level 2 controls will aid in the attainment of the overall program goal of fishable and swimmable waters by 1983.

III. NONPOINT SOURCE CONTROL MEASURES

Using the methodology described above, recommendations for the control of nonpoint sources of pollution in the 208 study area have been developed. The nonpoint source control recommendations in this Plan report are a summary of the detailed recommendations which can be found in the Element 21 Reports; those reports should be consulted for more detailed information.

The format for presenting these recommendations is as follows: for the two major categories of nonpoint source pollution--individual home treatment systems and urban stormwater runoff--

1. A general description of the problems caused by the nonpoint source is given.

2. The specific recommendations are described.

3. The cost of the recommendations are presented.

4. A county-by-county analysis of implementation issues is provided. A more detailed analysis is presented in Section 6 of this report.

Although the effect of agricultural runoff on nonpoint source loading in the study area has been estimated, agricultural nonpoint control measures have not been developed in this Plan. The State of Missouri is developing control measures for agricultural runoff on a state-wide basis. Obviously, for a complete and effective nonpoint source control program, both urban and rural aspects must be coordinated; during 208 continued planning, the State's agricultural runoff recommendations should be integrated into the nonpoint source control program for this study area.

Individual Home Treatment Systems (IHTS)

In 1975, individual systems were used by more than 136,000 people in the study area (Element 11 Report, Appendix F). Eight watersheds each had more than 5,000 people using these systems. Improper installation, operation and management of these systems cause water quality problems throughout the 208 study area.

Problems caused by these systems can be easily identified, as when effluent from a drain field runs off onto adjacent property; or they can be just one of a number of sources which contribute to the degradation of a stream. Throughout the 208 study, numerous identified problems were brought to staff's attention by citizens. Based on this experience, and in the opinion of local officials, there are many malfunctioning systems within the study area. The 208 study also estimated the relative impact of individual systems on water quality by estimating the pollution loading they contribute as a percentage of the total pollution loading in a stream (Element 11 Report, Appendix B).

A. Control Recommendations

The objective of an IHTS control program is to minimize public health and nuisance problems and local water quality problems. An effective IHTS control program is designed around four basic areas:

1. Insure proper location, design and installation of new systems.

2. Insure the proper operation and maintenance of new and old systems.

3. Provide means for the proper disposal of IHTS residue (septage).

4. Provide special controls for problem sites.

A detailed description of the recommendations for each of these areas is as follows:

1. Insure proper location, design, and installation of new systems. The key aspect of these controls is the building permit: the use of an IHTS would be an important element of the permit application. The following factors should be considered by a county or municipal building department before a permit is issued for a lot with an IHTS:

a. Lot Size. For subdivisions of between 2 and 10 houses, a minimum lot size of 15,000 square feet is permissible as long as the IHTS drain fields are separated by at least 300 feet. For subdivisions of between 11 and 25 houses, a minimum lot size of 30,000 square feet is permissible as long as the IHTS drain fields are separated by at least 400 feet (see Figure 22). Individual systems are not recommended for subdivisions of more than 25 houses. The combination of the minimum lot sizes and distances between drain fields are aimed at achieving an overall development density of one discharging IHTS per 2 acres. This density includes a factor of safety to protect water quality from potential pollution sources.

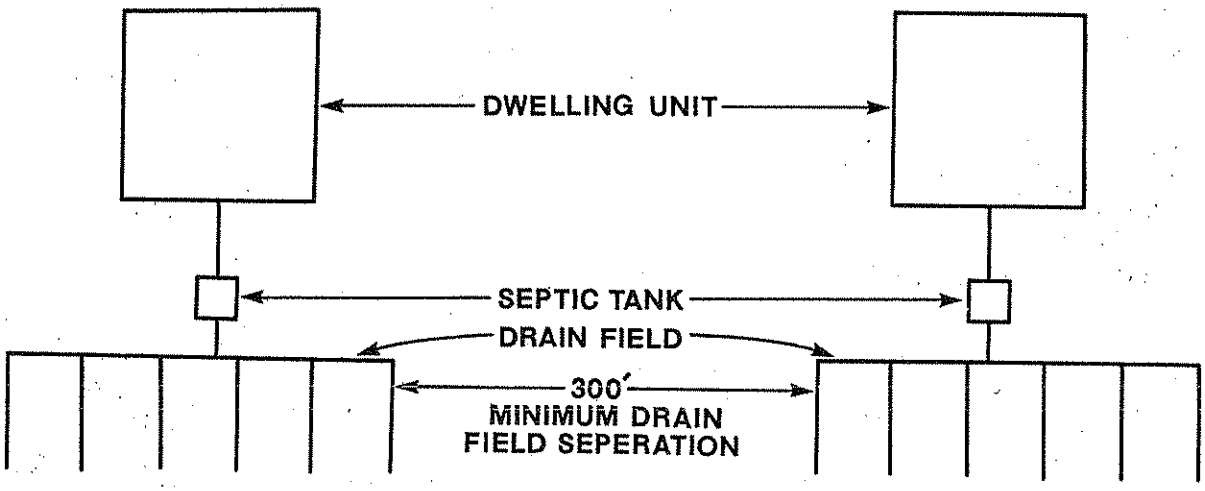
While in some instances such a density of one IHTS per 2 acres may exceed the amount necessary, reductions can be considered depending upon such factors as shape and dimension of lots; the location and layout of the disposal field; and the proximity of drinking water sources, especially on adjacent property. Any modifications in area should depend on the evaluation of the particular installation by the permitting local authority.

b. Inspection and tests. Site inspection by a Registered Professional Engineer (or a trained technician) should be carried out prior to application for a building permit. If the site is determined by the inspector to be environmentally sensitive, a sample of soil from the proposed location of the absorption field should be collected and submitted for a laboratory permeability test. The results of the test will be used as a guide for determining the type of IHTS that should be used (or what modifications may be necessary) and the size of the soil absorption field.

c. Site design. An engineering design of the proposed IHTS should be submitted with the application for a building permit. This design should include:

IHTS LOT SIZE AND SEPARATION RECOMMENDATIONS

2-10 HOUSING UNITS
MINIMUM LOT SIZE = 15,000 SQ. FT.



11-25 HOUSING UNITS
MINIMUM LOT SIZE = 30,000 SQ. FT.

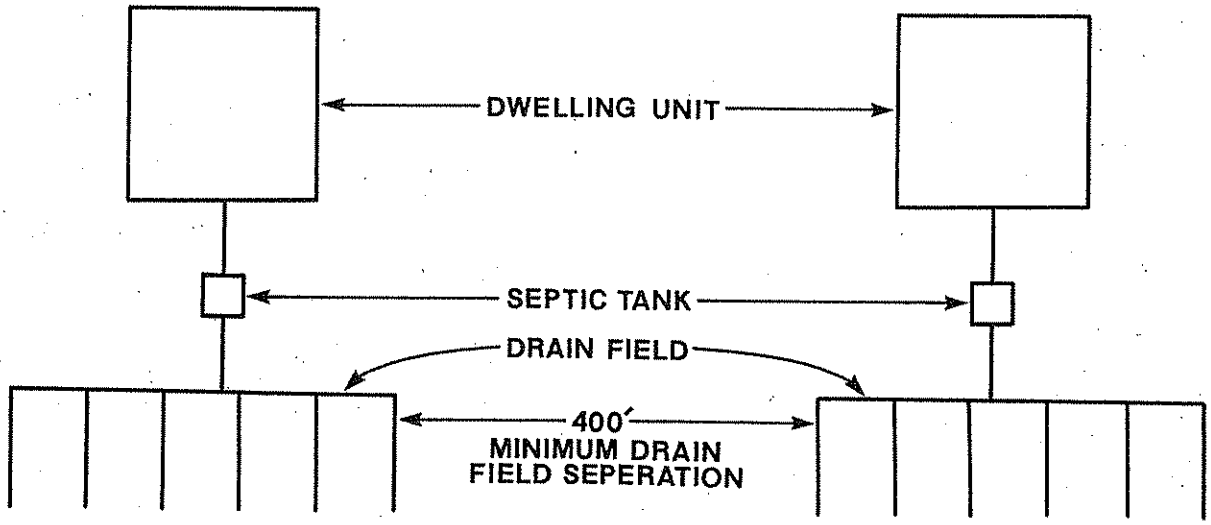


figure 22

--A general description of the site.

--Specific comments on the characteristics of the site, such as soil type, soil thickness, soil permeability (percolation); surface slope; underlying geology; proximity to lakes, streams, drainage ways, and depth to groundwater.

--A description of the proposed IHTS to be used on site (see Figure 23 for examples).

--A site plan showing location of all IHTS components as well as location on the property of all existing and proposed structures; pipelines and other buried utilities; property boundaries; water supply wells; lakes; ponds; streams; sinkholes and other subsurface features (such as abandoned cisterns) which could affect the operation of the IHTS.

This engineering design should be submitted to the county building department for review. The department may request further explanation or documentation of design procedures from the design engineer if necessary. Upon the approval by the county building department of the engineering design, a building permit will be granted.

d. System requirements. There are several types of IHTS which are acceptable in the 208 study area (the specific IHTS model must meet 208 criteria and installation requirements as outlined in section e.):

--A septic tank/soil absorption system which is properly designed for local conditions during the building permit process.

--An aerated individual wastewater treatment system with either:

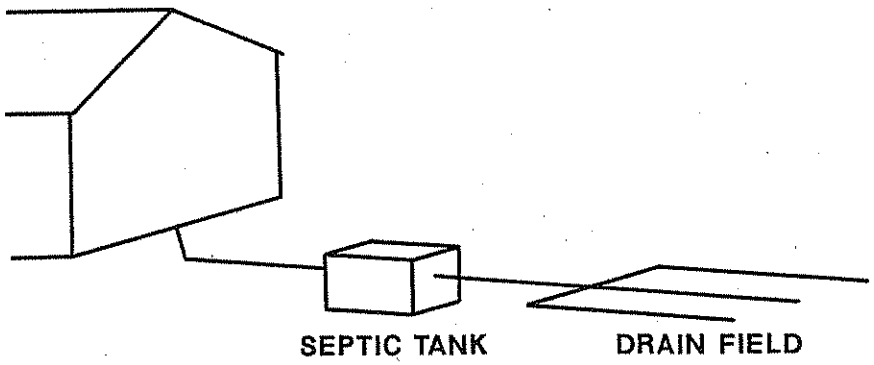
1) An adequately designed soil absorption or sand filter system, designed by a Registered Professional Engineer.

2) An effluent holding chamber with disinfection system and sprinkler or other controlled surface distribution system which discharges all effluent on property. Public access to the area should be limited for health reasons in case the chlorinator fails.

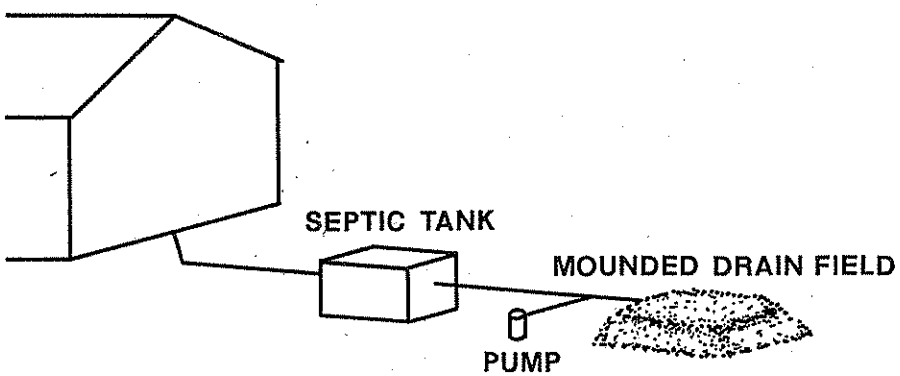
--Alternative home treatment systems would be acceptable if they are in compliance with 208 criteria and requirements (examples of alternative IHTS's can be found on pages 3-61 through 3-63 of the Element 11 Report).

EXAMPLES OF INDIVIDUAL HOME TREATMENT SYSTEMS (IHTS)

IHTS WITH TRADITIONAL DRAIN FIELD



IHTS WITH MOUNDED DRAIN FIELD



AERATED IHTS

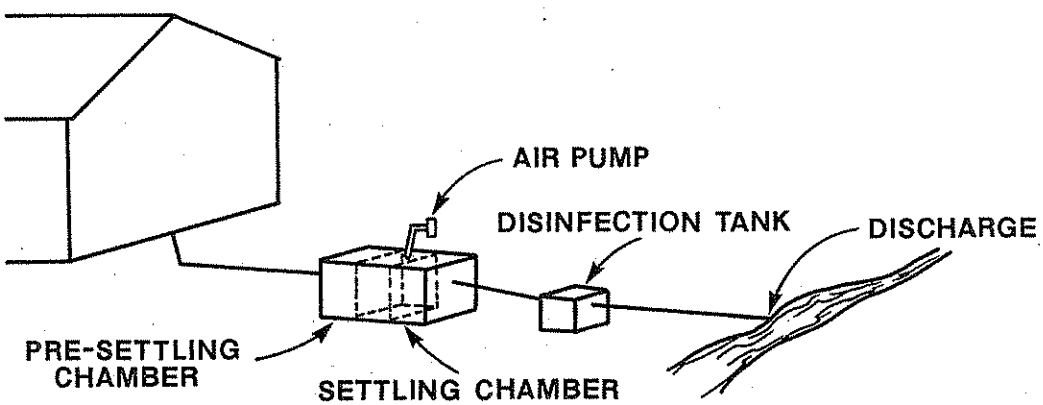


figure 23

e. Installation requirements. Presently, installers of IHTS units are not licensed or bonded by county or local authorities within the 208 study area. Since it is recommended that the installation of units be supervised by a trained inspector from the building department, regulation of IHTS installers would not be necessary. The inspectors will provide the proper safeguards regarding the performance and installation of the unit. Prior to burial of the unit, one final inspection should be made to determine that the system was installed as specified in the site design.

2. Insure Proper Operation and Maintenance.

a. Operation permits. Operation permits would be required for all systems after inspection determined the system to be working properly. Permits would expire every two to three years and would be renewed after an inspection by the building department determined the system to be working properly.

b. Maintenance and repairs. Maintenance and repairs would still be voluntary unless the system failed and the owner would not or could not effect necessary repairs. If an inspection resulting from a private complaint or the regular two-to-three-year inspection revealed system failure, the owner would be denied an operation permit and given 90 days to correct the problem. If the problem was corrected in that interval, the permit would be reissued. Otherwise, the owner would be fined. (Inspection would be required to determine that th problem had been corrected. If the tank was pumped, the owner would submit a receipt from a septage hauler.)

If the owner still did not repair or maintain the system, the building department could:

--Deny an occupancy permit so that if the property was sold, the house could not be occupied until the IHTS was put in working order.

--Levy additional fines until the system is repaired; or put a lien on the offender's property.

--Make necessary repairs and bill the owner. If the owner refused to pay, a lien could be placed on the property.

3. Disposal of IHTS Waste Sludge. An important element of an IHTS regulatory program is to provide the means for the property removal and disposal of the waste sludge (septage). To function properly, the system must be periodically pumped of its septage; without periodic pumping, the system

provides practically no treatment. Proper disposal of the septage must be assured; pollution problems could result from disposing the septage improperly.

a. Removal of septage. Septage haulers should be licensed by the building department to insure that they pump and dispose septage in the proper manner. Licenses should expire every two to three years. All haulers should keep records of systems pumped and receipts from septage disposal plants showing how many loads of septage were discharged.

According to these records, if the septage pumped by a hauler exceeded the amount legally discharged by more than 5 percent, the hauler's license could be suspended. Repeat offenses could result in longer suspensions, fines or permanent revocation of the license.

The licensing program would be operated jointly with the IHTS operation permit program. For IHTS users to receive an operation permit, proof that their system was properly pumped (a receipt from a hauler) would be sent to the regulatory agency. This receipt could be used to make spot-checks on the accuracy of the information provided by the haulers.

b. Disposal of Septage. The 208 Plan recommends developing a system of Regional Sludge Processing Centers that would be utilized by haulers to dispose of septage. The location of these centers and their service areas are described in Section 4 of this report.

4. Controls for Problem Sites. During inspection and testing of the proposed system site, if the inspector determines the area to be one of 7 types of environmentally sensitive areas-areas with thin soils; soils with low permeability; areas underlain by solutioned or fractured limestone; aquifier recharge areas; moderate to steep land surface slope; lake-stream border areas; high watertable areas--special precautions must be taken to insure that the system does not adversely affect water quality. The recommendations presented below are general; the inspector and regulatory agency should design site specific solutions.

a. Areas with thin soils. Acceptable systems for thin soil include but are not limited to:

--Evapotranspiration systems, with either:

1) An extra large shallow drain field designed so that no part of the system is more than 30 inches below the ground surface. Criteria for sizing the drain field to utilize evapotranspiration effectively are given in the Element 21 Report, Appendix B.

2) An aerated tank equipped with a holding tank followed by chlorinator; and controlled surface distribution system for use of effluent for irrigation.

--Augmentation or replacement of soil for absorption system using:

1) Mounded soil absorption system.

2) Sand filter (to be used with aerated tank only). Design criteria for sand filters and mounded soil absorption fields are given in the Element 21 Report, Appendix B.

--Water conservation devices such as low-volume flush toilets and pressure reducing valves. With water conservation measures in use, soil absorption fields can be sized smaller in proportion to the reduction of household wastewater discharge.

--Separate gray water/black water system in which black water is treated in a septic tank-soil absorption system or an aerated system and gray water is recycled where possible and treated in a separate soil absorption field.

b. Soil with low permeability. In addition to those systems recommended for areas with thin soils, these systems could also be used:

--System sized on the basis of soil absorption trench sidewall area, instead of or in addition to bottom area. Sidewall area alone could be used where permeability of compacted soil on trench bottom is insufficient to allow infiltration of normal volume of effluent. Trench area should be sized so that required average flow rate through the trench walls is no greater than 75 percent of the laboratory coefficient of permeability of the soil in gpd/ft.

--System with two soil absorption fields, each designed for full capacity of IHTS effluent. These absorption fields are to be operated one at a time on an alternating basis to allow the soil in each to dry and recover its permeability and treatment capability between uses.

c. Areas underlain by solutioned or fractured limestone. System should not be located where structural failures are likely to occur; where rapid flow of effluent through limestone is likely to endanger quality of nearby surface or groundwater; or where change in water table elevation due to use of a discharging IHTS is likely to cause structural failure.

--Use of evapotranspiration systems with disinfection of effluent is required if probable movement of effluent to surface of subsurface potable water supplies is suspected by inspector.

--Water conservation measures would be beneficial.

d. Aquifier recharge areas. Acceptable systems for recharge areas include but are not limited to:

--Use of adequate soil absorption system for removal of bacteria and nitrate. Alternate use of two full-sized absorption fields is highly desirable.

--Evapotranspiration systems.

e. Moderate to steep land surface slopes. Acceptable systems include but are not limited to:

--Contoured or stepped soil absorption fields, sized according to soil and geologic considerations.

--Mounded soil absorption field.

--Terraced or stepped sand filter system.

(Design criteria for these systems are given in the Element 21 Report, Appendix B.)

--Water conservation devices such as low-volume flush toilets and pressure reducing valves.

f. Lake-stream border areas. Distances between wells, lakes and streams and the IHTS should be determined by an inspector on the basis of site inspection and a soil permeability test. Measures to protect lakes and streams should include all the following:

--Surface discharge into intermittent streams, wet-weather drainageways and roadside ditches should not be permitted even if such ditches and drainageways cross the property of the IHTS owner.

--Distances of absorption field for lakes, wells and streams should be great enough so that effluent undergoes sufficient contact with soil under aerobic conditions to remove most phosphates, nitrates and bacteria.

--IHTS discharge should be prohibited in fractured or solutioned limestone areas near lakes or streams unless the inspector provides evidence that special measures have been taken to ensure that effluent undergoes sufficient soil contact for treatment, as specified in the above, before it reaches bedrock.

Criteria for determining minimum distances for the above recommendations are given in the Element 21 Report, Appendix B.

g. High water table areas. Installation of IHTS should be prohibited where the long-term maximum water table elevation is less than five feet below the bottom of the soil absorption field.

IHTS installation should also be prohibited unless a properly designed mounded soil absorption field allows for flow of effluent vertically downward through at least 5 feet of soil before it reaches the water table.

Justification of this criteria is given in the Element 21 Report, Appendix B.

B. Cost of Recommendations

IHTS control is anticipated to cost $680,000 per year in the St. Louis 208 study area. This translates into annual operating cost of between $150 and $200 per household using IHTS units. Table 9, abstracted from the 21 Reports, presents the estimated cost to households.

The Clean Water Act of 1977 has made some of the costs of maintaining individual systems grant eligible as long as a public agency runs the maintenance program. The capital costs of a maintenance program--septic tank pumpers for instance--could be eligible for federal grants of up to 85 percent of their cost. Communities or sewer districts who take advantage of this program could substantially reduce the cost of proper IHTS maintenance to their constituents. In 208 continued planning, efforts will be made to establish IHTS maintenance programs.

TABLE 9

COST OF IHTS CONTROL PER HOUSEHOLD

	New or Replaced System	Renovated System	Old System
CAPITAL COSTS PER HOUSEHOLD			
Engineering Design and Inspection	$550	$450	--
Agency Review or Inspection	50	50	--
Installed System	2,100	1,600	--
TOTAL CAPITAL COST	2,700	2,100	--
ANNUAL O&M COSTS PER HOUSEHOLD			
Permit Inspection	25	25	25
Permit Administration	5	5	5
Pumping and Cleaning	75	75	75
Supplies and Power	90	50	--
TOTAL ANNUAL COST	$195	$155	$105

C. Implementation of IHTS Recommendations

FRANKLIN COUNTY:

Present IHTS Regulations

1) Location, Design, Installation

The minimum lot size for IHTS installation is 20,000 square feet. A percolation test is required for lots of one acre or less to receive a building permit. A site engineering design is not required for the application of a building permit.

There are two types of systems approved in Franklin County:

a. A septic tank designed and installed according to the Building Official Conference of America BOCA Code.

b. An aerated system with or without drain fields (if discharge is contained on the owner's property).

A Building Department inspection of the system is required before the unit is buried as a condition of the building permit.

2) Operation and Maintenance

Operation permits are not required. Maintenance and repair is on a voluntary basis by the owner. Conventional septic tank systems, particularly those installed prior to the control of IHTS by the County Building Department, are maintained by pumping only when failure is evident. The County Building Department will respond to complaints regarding the systems. The Building Department has no enforcement capability of its own and compliance is generally voluntary.

3) Disposal of Waste Sludge

Haulers are not licensed and records are not maintained of either septage pumped or the septage discharged at treatment plants.

4) Special Problem Sites

For areas with thin soils, recommendations are made on an individual basis between the property owner and the County

Building Department. Presently, aerated systems with surface discharges are used with some systems freely discharging and others contained in tanks and ponds. There is a small percentage of areas underlain by solutioned or fractured limestone. For areas with steep-to-moderate slopes, systems are designed on an individual basis by agreement of the property owner and the County Building Department. Generally, the absorption field or surface discharge point is located a sufficient distance from the downslope boundary insuring that effluent is contained on the property. Distances to wells, lakes and streams from an IHTS tank and absorption field are specified in the BOCA Code. The direct discharge of IHTS effluent to lakes and streams is not permitted; however, in discharging to road ditches on the property, the flow often ends up in lakes and streams.

Recommendations for Improving Present Franklin County IHTS Regulations

There are two issues which must be addressed before Franklin County can implement the 208 IHTS recommendations:

1) There is a question concerning whether Franklin County, as a Missouri second class County, has the statutory powers to implement the full set of recommended IHTS controls. It is questionable whether the county can regulate IHTS through a permit system, and enforce IHTS regulations through fines and property liens. Clarification of this issue has been sought through an opinion from the Missouri Attorney General (see Appendix F).

2) The cost of the recommendations to the homeowners is high. Without some method of lessening this financial burden, implementation of the controls will be resisted by County residents. The 1977 Clean Water Act provides this needed financial assistance through federal grants of up to 85 percent of the costs of installing and maintaining "innovative and alternative" treatment systems, which include IHTS. To be eligible for these grants, an area must be under the jurisdiction of a public management agency; the County itself is not grant eligible. Public management agencies-sewer districts--must be created in unincorporated areas as a precursor to grant eligibility.

In the light of these issues, the following actions could be taken by Franklin County to upgrade their present IHTS regulations. It is emphasized that these actions are not binding on the County; ultimate decisions on the extent and format of IHTS control lies with the County.

1) To help administer and enforce an upgraded IHTS program, County Public Health and Public Works Departments should be established. These new departments could work with the present IHTS regulatory agencies--the Planning and Building Departments-to develop a comprehensive regulatory program.

2) A Registered Professional Engineer (or a trained technician) should be used by the building department staff to inspect IHTS units.

3) The U.S. Soil Conservation Service is currently undertaking an extensive soil analysis of Franklin County. When completed, information from this analysis should be used to develop measures to mitigate IHTS problems in unfavorable soil conditions.

4) The Building Department must gain increased support from the Prosecuting Attorney in the area of enforcement, as well as partaking in a more active role in the licensing of septage haulers.

5) For new developments of two to 25 homes using IHTS as a method of wastewater treatment, an overall density of one system per two acres should be maintained. The Building and Planning Departments could work with the developer to develop methods of meeting this goal at the lowest possible cost. Modifications could be made based on local geological conditions.

6) The County Court should form sewer districts where necessary for the purpose of IHTS regulation. These districts could be eligibile for federal and state grants which would defray the cost to the homeowners.

JEFFERSON COUNTY:

Present IHTS Regulations

1) Location, Design, Installation

The present minimum lot size for IHTS installation is 20,000 square feet. Site inspection is carried out by an official of the County Building Department as a requirement for obtaining a building permit. The permit can be denied if the plan includes an IHTS and the inspector determines that the site is unsuitable for it. A percolation test is required. A Site Engineering Design is not required for a building permit.

There are two types of systems approved by the Jefferson County Building Department:

a. A septic tank with a conventional soil absorption system, sand filter or waste stabilization lagoon.

b. Eco-robic (brand name) system, with or without further treatment devices.

A Building Department inspection of the system is required before the unit is buried as a condition of the building permit.

2) Operation and Maintenance

An operation permit is not required. Maintenance and repair is on a voluntary basis by the owner. Conventional septic tank systems, particularly those installed prior to the control of IHTS by the County Building Department, are maintained by pumping only when failure is evident. The County Building Department will respond to complaints regarding the systems. The Building Department has no enforcement capability of its own and compliance is generally voluntary.

3) Disposal of Waste Sludge

Haulers are not licensed and records are not maintained of either the septage pumped or the septage discharged at treatment plants.

4) Special Problem Sites

In areas with this soil, the Building Department may deny a building permit or allow only these systems: a shallow drain field utilizing evapotranspiration, or a holding tank system with a chlorinator and effluent surface spray. Much of northern Jefferson County is underlain by solutioned or fractured limestone. Inspection of proposed sites prevents the development of systems in these areas. On areas of moderate to steep slopes, Jefferson County can allow a stepped or contoured soil absorption field or they may deny a permit. The minimum distance to lakes, streams, wells and other surface waters is specified in the County Building Code. An IHTS cannot be placed in an area where the maximum seasonal groundwater elevation is less than four feet below the bottom of the absorption field trench.

Recommendations for Improving Present Jefferson County IHTS Regulations

Jefferson County faces the same issues that Franklin County does in implementing the IHTS recommendations. In addition, the County does not have a planning department to coordinate a comprehensive control program. When the County achieves first class status, questions concerning its ability to enact and enforce IHTS controls will be resolved and the County could form a planning department without a popular vote.

In the light of these issues, the following actions could be taken by Jefferson County to upgrade their present IHTS regulations. It is emphasized that these actions are not binding on the County; the ultimate decision on the extent and format of IHTS lies with the County.

1) Jefferson County Planning Department should be formed to enact a comprehensive IHTS control program .

2) A Registered Professional Engineer (or trained technician) should be used by the Building Department to inspect IHTS units.

3) An analysis of county soils should be performed which can be used to mitigate IHTS problems in unfavorable soil conditions.

4) The Building Department must gain increased support from the prosecuting attorney in the area of enforcement, as well as partaking in a more active role in the licensing of septic haulers.

5) For development of two to 25 homes using IHTS as a method of wastewater treatment, an overall density of one system per two acres should be maintained. The Building Department could work with the developer to develop methods of meeting this goal at the lowest possible cost. Modifications could be made based on local geologic conditions.

ST. CHARLES COUNTY:

Present IHTS Regulations

1) Location, Design, Installation

The minimum lot size for IHTS installation is 18,000 square feet. Site inspection is carried out by an official of the

County Building Department as a requirement for obtaining a building permit. The permit can be denied if the Plan includes an IHTS and the inspector determines the site is unsuitable for it. A percolation test is not required. However, the hydraulic characteristics of the soil are analyzed. A site engineering design is not required for the application of a building permit.

St. Charles County requires a three chamber 1,250 gallon tank with either:

a. A soil absorption field sized for 100-125 square feet of absorption area per bedroom.

b. Effluent holding tanks periodically pumped.

c. Effluent holding tanks equipped with a chlorinator and irrigation system.

The Building Department must inspect the system before it is buried as a condition of the building permit.

2) Operation and Maintenance

St. Charles County does not require operation permits. The systems are voluntarily maintained and repaired by the owner. Conventional septic tank systems, particularly those installed prior to the control of IHTS by the County Building Department, are maintained by pumping, generally only when failure is evident. The County Building Department can respond to complaints regarding systems under the permit program. Compliance is generally voluntary because the Building Department has no enforcement capability of its own.

3) Disposal of Waste Sludge

Haulers are not licensed and records are not maintained of either septage pumped or septage discharged at treatment plants.

4) Special Problem Sites

Measures presently used where soils are thin include:

a. A shallow soil absorption field designed to utilize evapotranspiration to discharge part of the effluent.

b. A treatment tank effluent holding tank which is pumped periodically.

c. An effluent holding tank equipped with a chlorinator and hooked to a sprinkler system, which discharges the effluent on the property as irrigation water.

Most of the areas underlain by solutioned or fractured limestone are in the southwestern part of the County; special considerations are given for IHTS units to be located there. In areas where slopes are significant, stepped or contoured solid absorption fields are recommended.

Minimum distance to lakes, streams, walls and other surface waters are specified in the County Building Code. The use of IHTS in highwater table areas is not permitted. Denial of a permit for this reason is based on a site inspection by a County Building Department inspector.

Recommendations for Improving Present St. Charles County IHTS Regulations

St. Charles County faces the same issues described for Franklin County regarding implementation of the recommended 208 IHTS controls. The following actions could be taken by the County to upgrade their present IHTS regulations. It is emphasized that these actions are not binding on the County; ultimate decisions on the extent and format of IHTS control lies with the County.

1) A Registered Professional Engineer (or trained technician) should be used by the Building Department staff to inspect IHTS units.

2) Information from the U.S. Soil Conservation Services detailed soil analysis of St. Charles County should be used to develop specific measures to modify IHTS units in unfavorable soil conditions.

3) The Building Department must take a stronger role in enforcement of IHTS regulations, as well as partaking in a more active role in the licensing of septage haulers.

4) For new developments of two to 25 homes using IHTS as a method of wastewater treatment, an overall density of one system per two acres should be maintained. The Building Department could work with the developer to develop methods of meeting this goal at the lowest possible cost. Modifications could be made based on local geological conditions.

ST. LOUIS COUNTY:

Present IHTS Regulations

1) Location, Design, Installation

The present minimum lot size is 20,000 feet. IHTS are not permitted in subdivisions having more than ten homes. Site inspection is carried out by an official of the Public Works Department as a requirement for obtaining a building permit. The permit can be denied if the plan includes an IHTS and the inspector determines that the site is unsuitable for it. A percolation test is required. A site engineering design is not required for a building permit.

Two types of septic tanks are approved for use in St. Louis County--the Jet Home Treatment Plant and the Brooks Anti-Septic System. Based on a percolation test, either a conventional system or an upflow sand filter is required for all systems.

A Building Department inspection is required before the unit is buried. A $5,000 surety bond is also required of the installer before the unit is buried.

2) Operation and Maintenance

Operation permits are not required. Maintenance and repair are voluntary by the owner. The County Health Department responds to complaints of failed systems and is fairly effective in gaining the cooperation of owners of failed systems in making necessary repairs.

3) Disposal of Waste Sludge

Haulers are licensed and required to dispose of septage in one of two approved locations: one at MSD Coldwater Creek Treatment Plant and the MSD Lemay Treatment Plant. However, no records are maintained of amounts of septage collected and disposed of by each hauler; illegal discharges of septage are known to take place.

4) Special Problem Sites

On the basis of site inspection, two measures may be taken in thin soil areas:

a. The building permit can be denied on the basis of the inspector's judgement that the soil is too thin to provide adequate filtering and absorption.

b. A sand filter can be installed. This effectively replaces the soil as the filtering and absorption medium.

On the basis of percolation test results, three measures can be taken in areas where soil permeability is low:

a. The building permit can be denied on the basis of unfavorable percolation test results.

b. A sand filter can be installed as the absorption medium in place of the unsuitable soil.

c. An extra large soil absorption field sized on the basis of the percolation test can be installed.

In areas underlain by solutioned or fractured limestone, a building permit may be denied because the site is unsuitable for placement and operation of IHTS. The "Land-Block" soil absorption field is used in hilly areas of St. Louis County. This is a stepped drain field in which level soil absorption trenches are placed at different elevations along the ground contours and connected with water-tight pipes. Distance to wells, lakes and streams from IHTS tank and absorption field are specified in BOCA. In high watertable areas, the percolation test procedure requires that a hole be made to a depth of at least six feet below the finish grade of the proposed soil absorption field. If standing water occurs in the hole, the site is deemed unsuitable for an IHTS.

Recommendations for Improving Present St. Louis County IHTS Regulations

St. Louis County presently has an acceptable IHTS control program.

Urban Stormwater Runoff

A comprehensive program for controlling the pollution caused by urban runoff should consist of measures that reduce the quantity and prevent the degradation of the quality of the runoff. Both nonstructural and structural controls can be used for these purposes.

Nonstructural control measures are actions, either physical or legislative, which attempt to prevent pollution before it

becomes a problem. A nonstructural control could be an ordinance requiring developers to limit the runoff from a developed site at pre-development levels; or such a control can require a developer to build a stormwater detention basin as part of a development plan. Structural controls do not strive to eliminate sources of pollution or actions that cause it; rather, they collect and concentrate pollutants for treatment. Structural controls are generally instituted as remedial actions to address problems caused by development. Nonstructural controls have been given emphasis in the recommendations for urban stormwater runoff controls because prevention of pollution problems is less expensive than correcting them after they occur. In the light of the lack of federal grant programs for the construction of urban runoff structural controls, using ordinances and regulations to control runoff is an attractive alternative to constructing detention ponds: both controls accomplish the same purpose; the latter approach, however, is more expensive. Major emphasis in the urban runoff recommendations, therefore, is placed on approaches that can be integrated into existing agency programs at minimal costs.

The 208 recommendations for the control of urban stormwater runoff are divided into three categories of control that are designed to address the quantity and quality aspects of urban runoff: control of stormwater runoff; onsite detention; and urban cleanliness programs. The first two categories affect quantity and quality; the latter category affects only quality. These recommendations apply to the urban and urbanizing portions of the 208 study area: St. Louis City and County; northern Jefferson County; the urbanizing sections of St. Charles County (the "golden triangle" area). In Franklin County, these controls apply to watersheds in the eastern portion of the County and watersheds which include Union, Washington, and Sullivan.

A. Control of Construction Site Runoff

Because construction activity requires the use of heavy equipment and other contrivances for removal of vegetation, site grading and preparation, access roads, foundation work, and delivery of supplies, resultant soil erosion can pose a significant water quality problem if uncontrolled. Soil erosion from construction sites can be from 10 to 1,000 times that found on deposition in storm sewers, catch basins, streams and lakes. Sedimentation is injurious to the receiving water course and its resident aquatic wildlife. In addition to sediment, runoff from construction sites also can contain nitrates and phosphates used for fertilizer, and

other chemical pollutants such as paints, oil, herbicides and pesticides. However, most of these constituents will fix to sediment, so if sediment controls are involved, these other pollutants are also controlled.

To control sediment from construction sites, it is recommended that developers provide "erosion control plans" as one prerequisite for obtaining building permits. This requirement would be applicable to all development and redevelopment sites of an acre or more. The goal of the erosion plan is to limit the amount of sediment washing off a construction site to no more than 5 tons per year. The plans should be reviewed by a Registered Professional Engineer from the building or planning department and should incorporate some of the following practices for pollution abatement:

--Structures and vegetative measures that will protect environmentally sensitive areas.

--Measures to control the speed and volume of water runoff; detain storm water on the construction site; divert water away from graded areas; and trap sediment on the site.

--Stabilize exposed soils by adhering to time limits set out in the schedules for site grading, seeding and mulching. Use of staged grading, seeding and sodding.

--Require an outline of procedures for the maintenance and inspection of structural and vegetative controls for graded areas, borrow pit areas, stockpile areas and other disturbed areas.

The actual methods used for control-sedimentation ponds, diversion basins, mulches, bedding, etc., would be up to the discretion of the developer and would be determined by site characteristics and economics. Methods used to limit runoff during construction should be integrated into the design of the on-site detention measures that limit runoff for the life of the development.

1. Cost of Construction Site Runoff Controls. The cost of construction site runoff controls will be borne by developers and ultimately passed on to the purchasers. In other areas of the United States which have regulations similar to those recommended in this Plan, the cost to developers averages $1000 per acre. For a three-house per acre development, therefore, the cost to the buyer would increase $333. There is a lack of St. Louis area data on

these costs; it can be assumed, however, that local costs would not vary from the national experience.

B. On-Site Detention of Urban Runoff

The purpose of on-site detention is to reduce sediments and peak runoff. This lowers turbidity, instream erosion, and scouring. As a result, the utility of the stream for aquatic life and its aesthetic value is improved. On-site detention requires that all new development and redevelopment limit the volume of stormwater runoff and sediments to pre-development levels.

There are three elements of the 208 recommended controls for on-site detention of urban runoffs:

1. Predesign runoff control plans should be developed for watersheds in the 208 area expected to have significant amounts of growth.

The runoff plans should define specific treatment systems and other controls to reduce the peak flow from a 15-year storm on the developed site to the peak flow of a 15-year storm on the undeveloped site. In addition, the sediment discharge from a 5-year storm on a developed site should be reduced to the sediment discharge from an undeveloped site with natural or grass vegetation cover.

The runoff plan should include the following information:

a. Physical description of the watershed showing soil type, potential for erosion, existing land uses, proposed land use and mapping of the watershed before and after development.

b. Estimates of the amounts of runoff before, during and after development.

c. Development of construction erosion controls.

d. Development and design of permanent runoff control facilities stating the location, size and cost.

e. Development of specific guidelines to be used by developers in the design of subdivision and other types

of development to ensure the new development is consistent with the watershed plan.

f. Methodology for operating, financing and implementing of the watershed stormwater runoff control plan.

2. Ordinances should be designed to implement the urban stormwater runoff control plans and provide the authority to set or adopt specific technical design criteria and guidelines for the design of a stormwater runoff control system.

The design criteria and guidelines should be updated and modified as conditions change and new control technologies are developed. The change to the design criteria and guidelines could be made without changing or amending the enabling ordinance. An outline of a model stormwater control ordinance can be found in the Element 21 Report, Appendix A.

The ordinance will set design criteria and guidelines for all new development in areas not covered by the watershed stormwater control plans discussed above. In areas where these control plans have been developed, the ordinance requirements would be superceded.

3. The counties should develop and adopt a specific set of design criteria and guidelines for the design and construction of stormwater runoff control systems.

The design criteria and guidelines should establish the analytical procedures and design standards to be used in the runoff control plans and for the design location and construction of runoff control facilities. A preliminary draft of suggested design criteria and guidelines for the control of urban stormwater runoff can be found in the Element 21 Report, Appendix A. The design criteria and guidelines should contain the analysis of stormwater runoff events and the design of stormwater treatment facilities.

4. Developers will be encouraged to limit the amount of impervious area and to reduce the buildup of pollutants on the land surface.

The stormwater treatment systems will usually involve some form of a detention pond similar to Figure 4 in Appendix A of the Element 21 Reports. The stormwater treatment system

will consist of a bar screen and trash chamber followed by a sedimentation pond with a volume large enough to provide the required flow storage to reduce the 15-year storm peak flow rate to predevelopment levels and a volume large enough to provide storage of the removed sediment from a 5-year storm. The amount of sediment storage should depend on the expected cleaning frequency and the requirements of the sediment disposal system. An outlet structure would be designed to provide the required discharge flow rate for the design storm while an overflow would allow the discharge from larger storms without structural damage to the facility. Two example basins have been analyzed and preliminary urban runoff control systems developed. Element 21, Appendix A, presents runoff control systems for Coldwater Creek and Fishpot Creek watersheds in St. Louis County which represent the type of control systems which could be developed in urbanizing areas. Examples of stormwater control measures are shown in Figure 24.

1. Cost of On-Site Detention. The estimated cost of providing on-site detention for new development through the development of comprehensive urban stormwater control plans is shown in Table 10. These costs were estimated in the following manner (detailed cost methodologies are presented in the Element 11 and Element 21 Reports):

--Land use projections were used to determine in acres the extent and location of the commercial, industrial and residential growth between 1975 and 2000.

--The projected changes in acreage were multiplied by a capital cost of $6,000 per acre and an annual operation and maintenance cost of $85 per acre, costs incurred for similar programs in other parts of the country.

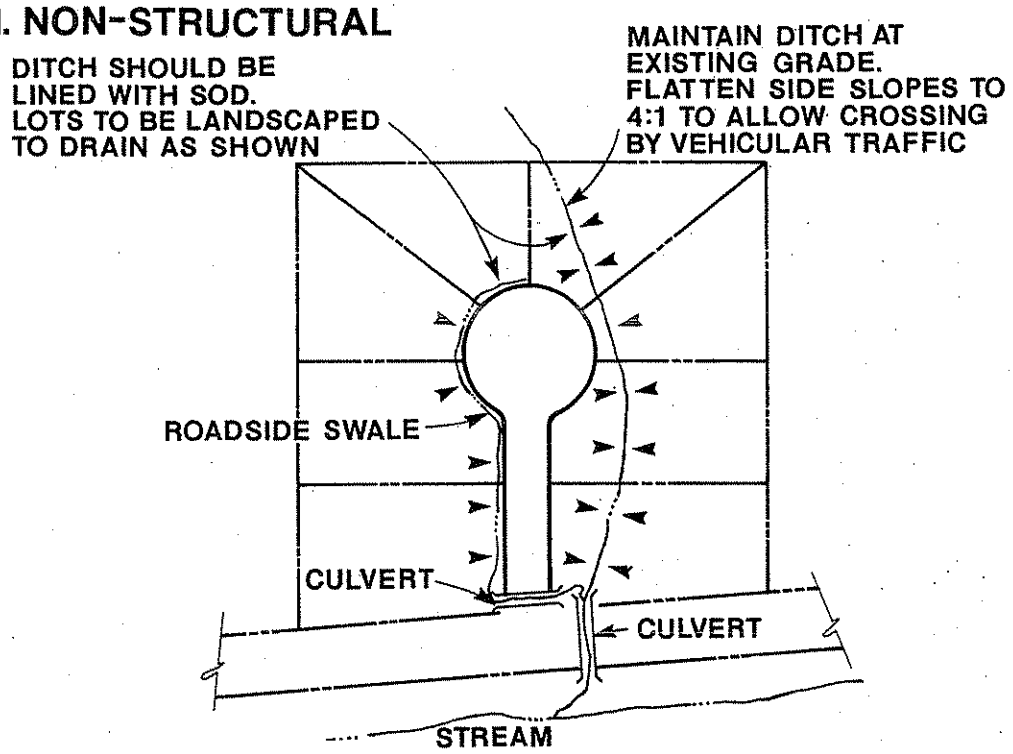
C. Urban Cleanliness Programs

Urban cleanliness programs help prevent excessive degradation of urban runoff by removing potential pollutants from the urban surface prior to rain washing them away. These measures help to reduce the adverse effects of "shock loading"--the rapid increase in pollution caused by a runoff event--by preventing pollutants from being washed into rivers and streams. The recommended urban cleanliness program applies to the developed and developing areas of St. Charles County and St. Louis City and County.

There are three elements of the recommended urban cleanliness program:

EXAMPLES OF URBAN RUNOFF CONTROL

1. NON-STRUCTURAL



2. STRUCTURAL

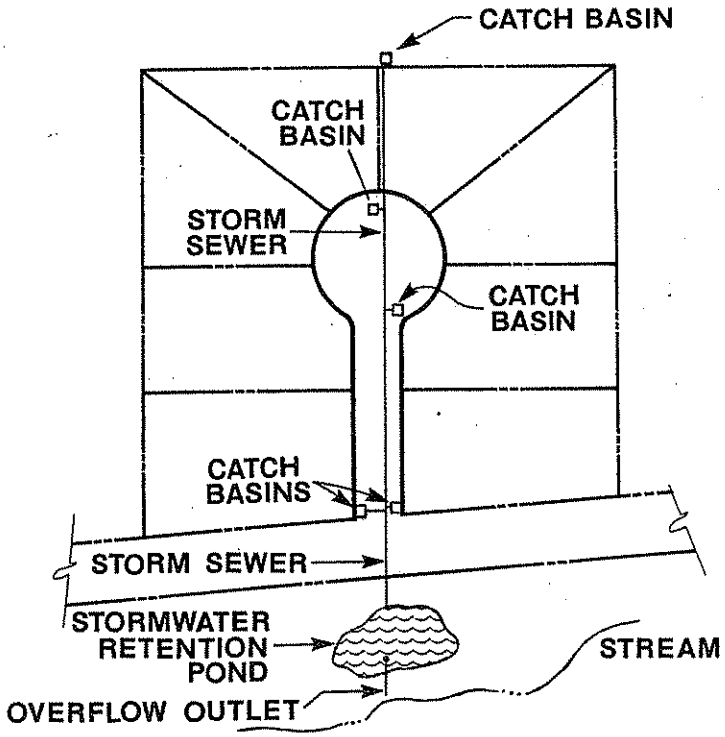


figure 24

TABLE 10

ON-SITE DETENTION COSTS FOR NEW DEVELOPMENT: 1975-2000

County	Land Use	Capital Cost ($)	Annual Operation & Maintenance Cost ($)
Franklin	Commercial	6,300,000	89,200
	Industrial	6,516,000	92,300
	Residential	64,932,000	920,000
	TOTAL	77,748,000	1,101,500
Jefferson	Commercial	8,928,000	126,500
	Industrial	6,486,000	91,900
	Residential	94,764,000	1,120,200
	TOTAL	110,178,000	1,338,600
St. Charles	Commercial	3,870,000	54,900
	Industrial	41,430,000	586,800
	Residential	111,000,000	1,572,500
	TOTAL	156,300,000	2,214,200
St. Louis	Commercial	30,414,000	531,600
	Industrial	42,414,000	600,000
	Residential	164,052,000	2,323,600
	TOTAL	236,880,000	3,455,200
208 Study Area	Commercial	49,512,000	802,200
	Industrial	96,846,000	1,371,000
	Residential	434,748,000	5,936,300
	TOTAL	581,106,000	8,109,500

--Improved streetsweeping techniques.

--Private parking lot maintenance

--Leaf collection and disposal.

A fourth program element--catch basin maintenance--applies only to the combined sewer area of St. Louis City and County.

1. Improved Streetsweeping Techniques. Many municipalities in the St. Louis region have streetsweeping programs. In almost all cases, broom-type sweepers are used. These are typically very efficient at picking up coarse debris; however, since most of the material on street surfaces that is detrimental to water quality is too small to be picked up by these machines, the benefit of broom sweeping as a water quality control measure is limited.

To improve the water quality benefits of streetsweeping, vacuum streetsweepers should eventually be substituted for broom-type sweepers. Vacuum sweepers have the capability of picking up minute particles; they can remove 90 percent of contaminants found on street surfaces.

Streetsweeping to achieve water quality benefits should be done with the following frequency: high density residential and commercial area--at least once a week; central business districts--daily. Emphasis should be placed on sweeping areas that do not have on-site detention ordinances.

2. Private Parking Lot Maintenance. Parking lots, as do street surfaces, accumulate surface debris from vehicles and air pollution fallout. They must, therefore, also be swept periodically to prevent excessive amounts of surface build-up from washing away. Parking lots greater than one acre in size should be swept at least three times a week; this will result in a 75 percent removal of surface pollutants.

3. Leaf Collection. Rotting leaves are a source of phosphate and biochemical oxygen demand (BOD). They also increase the costs for catch basin maintenance and streetsweeping. Leaf collection will not in itself markedly reduce urban runoff problems; it is, however, a necessary component of an effective urban cleanliness program.

Removing fallen leaves will not only reduce the frequency of catch basin maintenance and alleviate streetsweeping problems, it will also reduce operation and maintenance costs at on-site detention basins and at the two major treatment facilities that service MSD's combined sewer system.

4. Catch Basin Maintenance (applicable only to St. Louis City/County Combined Sewer Area). Catch basins are small, rudimentary sedimentation basins which trap and collect coarse materials discharged to a storm sewerage system. Frequent cleaning of catch basins can result in the removal of large volumes of sediments, vegetative debris, litter, waste oil and other materials. If the basins are not cleaned, these materials are discharged to the receiving water during the next major storm. Because many of the trapped organics decompose between storms, the discharge of these materials can exert significant amounts of BOD upon entering a watercourse.

With proper maintenance, catch basins can remove 40 percent of the BOD and 55 percent of the suspended solids in stormwater runoff. It is recommended that basins be cleaned twice a year, assuming other elements of the urban cleanliness program are implemented; frequent cleaning would be necessary if they are not implemented.

Cost of Urban Cleanliness Programs

Costs for the four elements of the recommended urban cleanliness program are presented in Table 11. This is a summary of more detailed tables presented in the Element 21 Reports; these reports should be consulted for detailed cost methodologies and assumptions.

D. Implementation of Urban Stormwater Runoff Control Recommendations

There are three challenges to implementing the recommended urban stormwater runoff control program: the three program elements must be applied in a coordinated manner; the program should be instituted on a watershed, rather than political subdivision basis; methods must be found for defraying the costs of the program. Each challenge presents many complicated issues, many of them beyond the scope of this Plan. They are issues that are being faced by water quality planning efforts nationwide.

These issues will be addressed in greater detail during continued 208 planning. During the next phase of this program, detailed analysis can be targeted to watersheds where stormwater problems are evident. Stormwater control plans will be developed for urbanizing watersheds and the anticipated water quality improvements will be estimated by computer

TABLE 11

URBAN CLEANLINESS COSTS FOR YEAR 2000

Control	County	Land Use Control Application	Capital Cost[1] ($)	Annual Operation & Maintenance Cost[1] ($)
STREETSWEEPING	St. Charles	Residential	38,000	--
		Industrial	114,000	--
		TOTAL	152,000	466,900[2]
	St. Louis City/County	Commercial	369,700	970,500
		Industrial	248,100	596,400
		Residential	901,800	2,176,300
		TOTAL	1,889,300	3,743,200
PRIVATE PARKING LOT MAINTENANCE	St. Charles	Commercial	--	155,500
	St. Louis City/County	Commercial	--	3,801,600
LEAF COLLECTION & DISPOSAL	St. Charles	Residential	414,000	488,400
	St. Louis City/County	Residential	7,192,000	2,436,000
CATCH BASIN MAINTENANCE	St. Louis City/County	Combined Sewer Area	--	506,318

[1]1977 Dollars.

[2]Cost for application to all urban land uses.

analyses. Presented below is a discussion of how the urban stormwater runoff control recommendations related to the 208 study area counties. Table 12 from the Element 13 Report shows the result of a survey of selected jurisdictions to determine the extent of urban stormwater runoff regulations within the study area.

a. Franklin County. Construction site runoff and on-site detention controls are recommended for new development in the urban and urbanizing portions of Franklin County, specifically the high growth watersheds in the eastern portion of the county and watersheds which include Union, Washington and Sullivan.

In other portions of the County, urban stormwater runoff is not projected to be a problem. Franklin County and Union both have regulations for controlling erosion during construction. There are no on-site detention requirements currently in force within the County.

Watershed stormwater runoff plans should be developed cooperatively by the County Planning Department, the affected municipality, and East-West Gateway (through the Franklin County Water Quality Board). Guidelines, criteria and ordinances should also be developed through this planning effort, which could be funded by 208 continued planning grants.

b. Jefferson County. Construction site runoff and on-site detention controls are recommended for new development in the lower Meramec watersheds including the City of Arnold (Watersheds #101, 102, 103, 106, 107, see Figure 5, p. 11). Construction site runoff controls are recommended for other urban and urbanizing areas of the County. Our survey of current stormwater runoff regulations indicated that the County and Arnold have limited regulations for controlling construction site runoff. There are no on-site detention regulations currently in force within the County.

Watershed stormwater runoff control plans should be developed for the lower Meramec watersheds. These plans should be developed cooperatively by Arnold, the County Building Department, and East-West Gateway (through the Jefferson County Water Quality Board). Guidelines, criteria, and ordinances should also be developed by this planning effort, which can be funded by 208 continued planning grants.

c. St. Charles County. Construction site runoff controls are recommended for new development in all developed and developing areas of the County. On-site detention

TABLE 12
SUMMARY OF CURRENT URBAN RUNOFF CONTROL MEASURES IN SELECTED JURISDICTIONS

Control Measure / Jurisdictions	Erosion Control				Storm Water			
	Grading Regulations	Erosion Control Regs. During Const.	Erosion Control Regs. Long Term	Sediment Discharge Regulations	Regulations Against Open Stockpiling of Raw Materials	Prohibition Against Increased Stormwater Runoff Due to Development	On-Site Detention of Stormwater	Limits on Amount of Impervious Area on a Site
CITY OF ST. LOUIS								
ST. LOUIS COUNTY	●	●	✱			●	●	
Creve Coeur	●	●	●			●	●	○
Eureka								
Fenton	Contract w/ St. Louis Co.					Contract with St. Louis Co.		
Florissant								
Kirkwood	○	○	○			○	○	
Manchester	○	○	○			○	○	
Maplewood								
Olivette	●	●	●			○	○	○
University City								○
ST. CHARLES COUNTY		○	○					
City of St. Charles	●	○						
Lake Saint Louis	●							
St. Peters		○	○		○			
FRANKLIN COUNTY	●	●						
Pacific					○	○		
Union	●	●						
JEFFERSON COUNTY		○	○					
Arnold	○							
Herculaneum					○			
METROPOLITAN SEWER DISTRICT						○	○	○

● Regulation exists ○ limited regulation exists ✱ regulations being developed

controls, including the development of urban stormwater runoff control plans are recommended for developed and developing areas in these watersheds: Cole Creek, Sandfort Creek, Spencer Creek, lower Dardenne Creek, Belleau Creek, lower Peruque Creek (Watershed numbers 406, 407, 409, 410, see Figure 5, P. 11). Urban cleanliness programs are recommended for these areas: the Cities of St. Charles, St. Peters, Lake Saint Louis, and O'Fallon; developed and developing unincorporated areas.

Our survey of current stormwater regulations indicated that St. Charles County and the cities of St. Charles, St. Peters and Lake Saint Louis have regulations for controlling construction site runoff. The City of St. Charles has a street-sweeping program.

Application of these controls will require coordination between the County government, the affected municipalities, and East-West Gateway (through the St. Charles County Water Quality Board). The County Soil Conservation District should also be involved in developing the control plans since they are currently involved in sediment control planning. Continued 208 planning grants could be used for developing the necessary control plans, criteria and ordinances.

d. St. Louis City and County. Construction site runoff, on-site detention and urban cleanliness controls are applicable to all watersheds within the City and almost all watersheds within the County. Construction site runoff and on-site detention controls are especially critical to the developing western portions of the county: Grand Glaize, Fishpot, Caulks, and Creve Coeur Creek watersheds.

St. Louis County has comprehensive regulations for construction site runoff and on-site detention. Of the County municipalities surveyed, Olivette and Creve Coeur have construction site runoff controls and limited on-site detention controls; Kirkwood and Manchester have limited construction site and on-site detention controls.

Some of the necessary actions required to improve stormwater control in the City and County are:

--All stormwater control ordinances within watersheds should be standardized.

--Stormwater control plans should be developed for all applicable watersheds.

--All stormwater ordinances and regulations within watersheds should address the control requirements of the watershed and should be standardized between communities.

--Stormwater control planning by the County, MSD and municipalities should be coordinated.

These actions could be funded through 208 continued planning grants. The St. Louis City/County Water Quality Board should be involved in these planning efforts.

4. RESIDUAL WASTE CONTROL MEASURES

I. INTRODUCTION

To fully evaluate the problems, the solutions, and the environmental impact of residual waste disposal and management, it is necessary to first review some basic concepts. Residual wastes in the context of this Report are the residues removed from the various sources of domestic and industrial waste streams.

One of the basic concepts is the fact that matter cannot be destroyed, it can only be moved from one place to another in our environment. The residual waste challenge is how to dispose of these materials yet do the least damage to our air, water or soil.

Wastewater treatment processes are designed to remove solids and produce a "liquid effluent" suitable for discharge to a nearby watercourse. There is, however, an equally important "solids effluent," or residual waste. These wastes are often merely discharged to the soil. Since the passage of the 1972 Clean Water Act, renewed emphasis has been placed on the quality and disposal of the liquid effluent. The proper disposal of the "solids effluent," however, is also becoming increasingly important in the protection of our environment. Solids effluent disposal can involve potential protection of the soil, underground waters and the air. Conversely, it can potentially become a hazard to these elements of our environment if not handled correctly. This section is devoted to this final phase of the wastewater treatment process.

The ultimate and satisfactory disposal of residual wastes is dictated by many factors including the volume and character (constituents of the wastes); the location of residual waste sources; and the environmental impact of the disposal method on the disposal site location. Each method and disposal site requires its own particular evaluation.

The real purpose of residual waste treatment and proper disposal is basically a hygenic one--to reduce the number of

disease producing organisms and worm eggs and to prevent foul odors. Any types of treatment and disposal has to fulfill these basic environmental requirements in addition to being economically feasible, easy to operate and, if possible, it should yield usable "by-products."

The current major source of residual wastes is sewage, primarily from municipal systems but also from individual home treatment facilities. As a rule of thumb, domestic sewage contains 200 parts per million of solids or 1660 pounds of solids in a million gallons of sewage. In simplier terms, this is equivalent to about 1/2 teaspoon of solids in a barrel of water. Sewage derived solids are often augmented by the discharge of industrial wastes into the municipal sewer system. Such wastes may contain large amounts of solids and often exotic or toxic wastes. These additives may complicate the problem of treatment and ultimate disposal of the residues. Where a drinking water treatment plant is operating, disposal of solids used in water treatment processes may add to the residual waste problem at the wastewater treatment plant. This is especially true if the water supply is softened.

It is a 208 requirement that residual waste treatment and disposal planning and management must consider not only current sources of solid wastes, but those anticipated because of projected municipal and/or industrial expansion. All of these factors re-emphasize the need to evaluate each individual area's problems and develop recommendations for treatment methods best suited to that area's economy, environment, and above all, available land.

II. RESIDUAL WASTE DISPOSAL ALTERNATIVES

The simpliest and often the most economical residual disposal method is incorporating it into the other refuse, often in a semi-liquid state in a landfill. Some areas in this region have limitations on this method, permitting these practices only on specially designated sites and regulating the maximum amount of liquid residual wastes per ton of refuse in the fill.

Land application is another approach. It requires some form of pretreatment such as anarobic digestion, where the gases can be collected and utilized. The dried digested sludge is spread on land; or sometimes it is spread in a liquid form on the land. Careful controls are required to prevent noxious odors and to assure the applied sludge has been well

digested or well stabilized. Raw solids or inadequately digested sludge will generate obnoxious odors.

Using sludge cake as a soil conditioner, such as on reclaimed land, is another disposal method. This approach is preceded by some type of sludge conditioning and dewatering. However, the use of residual waste as a soil fertilizer, once popular, have been superceded by the use of commercial fertilizers. One reason for this change is that sludge conditioning and dewatering is accomplished by using some mechanical device such as vacuum filtration, filter presses, or centrifuge method. All of these devices are costly to operate because of the chemicals required to "condition" the sludge and power to run them.

Additional problems with odor, weed seeds, etc. arise with the use of dried sludge in urban areas. Also, the use of sludge on gardens where vegetables are eaten uncooked, involves a potential health hazard. Disease producing organisms may remain after the sludge is conditioned.

Waste incineration, either wet or dry, is yet a third method of disposal. This method must be carefully evaluated due to its potential air pollution impact, especially if the incinerated sludge contains heavy metals, such as mercury, lead or cadmium. It must also be recognized that even with incineration, an estimated one third of the orginal residual mass will be returned to the soil as incinerator ash. The disposal of this ash also involves potential hazards once it is placed in the soil.

The use of lagoons for residual waste storage and the transmission of residual wastes by pipeline are other possible alternatives to be tested in arriving at the most feasible methods for ultimate disposal. The emphasis that is and will increasingly be placed on the regulated disposal of hazardous waste will compound the problems of residual waste control. Missouri has recently passed new legislation in this area.

It is anticipated that industrial wastes containing hazardous material will be required, through permitting process, to remove certain wastes through pretreatment prior to discharging these wastes into a municipal sewerage system. This approach will pose a problem for proper disposal of these removed wastes. Incineration is a possibility, however, the most feasible approach will involve land fill disposal.

It must also be noted that land for use as landfills or for sludge storage lagoons which was often found close to the treatment works, is currently becoming rare. The distance

the residuals must be transported to an appropriate disposal site becomes an important consideration in choosing a disposal alternative. The effective, economical and practical implementation of these concepts for handling residual wastes was the basis for the alternative evaluation and the final recommendations in this section of this Report. The recommendations are summarized later in this section for each county in the 208 area.

Local Innovative Residual Waste Disposal Approaches

Before discussing the regional residual waste treatment centers, two innovative regional programs should be briefly discussed.

A. Bi-State Trash to Energy Program

At this time, the Bi-State Development Agency is evaluating the impact of creating and operating a series of regional solid waste disposal facilities. The goal of these facilities is three fold: alleviate the projected crush of solid waste; recycle certain materials; and produce, in conjunction with Union Electric, energy. The basic process is to collect solid waste, extract reusable materials, and burn the residue to produce electricity.

In disposing of wastewater treatment residuals, the burning for energy process presents an added alternative. Bi-State is looking at this option; however, transportation costs may be a limiting factor.

B. Industrial Waste Exchange

A second innovative regional activity is the Industrial Waste Exchange. The exchange, sponsored by the St. Louis Regional Commerce and Growth Association (RCGA), has had an immediate and positive 208 impact.

The Waste Exchange concept is based on the fact that some industries produce materials as by-products for which they have no use, but which may be useful to other industries. For example, acetylene manufacturers generate large amounts of contaminated lime waste and often must dispose of the lime in landfills at high costs. Steel mills can use lime to neutralize acid wastes in order to meet pH discharge regulations. If these two industries are brought together by an industrial waste exchange, both will benefit; the steel mill will have a cheaper source of lime, and the acetylene manufacturer will have additional income rather

than disposal costs. Just as significant are the environmental benefits. Some wastes, such as lime, are difficult to dispose of without endangering the environment through air or water contamination. Further, some sources of raw materials are rapidly being depleted and may soon become scarce. Through a waste exchange, industries can reduce both of these problems while benefiting themselves and the public.

The Exchange is a trading organization through which companies could offer waste products for sale and buyers bid for them. In its first year, the Exchange produced at least 13 deals. Since then, participation in the Exchange has been steadily increasing. The Exchange concept has been spreading throughout the country; Iowa, Texas, and Georgia have begun regional waste exchanges of their own.

The St. Louis Industrial Waste Exchange is a direct service to industry and the environment. It is also a resource conservation service to the general public. By putting waste users in contact with waste producers, the Exchange helps industry to find not only buyers for their wastes, but also cheaper sources for raw materials. Industrial wastes become resources instead of liabilities, reducing disposal costs, reducing costs of material acquisition, and conserving natural resources, including water quality. The Exchange may bring income to waste producers and may decrease the possibility of improper disposal or careless handling of what are often toxic waste materials.

The Exchange has the active support of governmental agencies and environmental groups. EPA has stated that it views the St. Louis project as a model for other industrial areas, and in March of 1977, presented the RCGA with an Environmental Quality Award for establishing the Exchange.

Clearly, this program is of great importance to 208 already and should be a greater resource in the future. The program should be expanded through continued 208 funding to serve a wider geographic area.

III. RESIDUAL WASTE CONTROL RECOMMENDATIONS

Since many of the wastewater problems are common throughout the St. Louis 208 region, the following section presents the proposed sludge management scheme on a regional basis. Each section describes the sludge handling systems proposed for subareas within the county. A general description of the

sludge processing facilities and disposal methods for the regional system are included. The proposed location of the sludge processing facilities and their service areas are shown in Figure 25. The capital and operations and maintenance costs of the centers are shown in Table 13. The capital cost for the system includes local equipment, transportation and regional sludge processing and disposal equipment. Allocation of the cost of the regional residuals waste centers to the individual household is described in Section 6. These costs and the facility descriptions are abstracted from the Element 22 Report.

Following the regional center discussion is a brief section on management concerns.

A. Franklin County

The proposed sludge management system for Franklin County includes the development of five regional processing centers at New Haven, Washington, Union, Sullivan and Pacific.

1. New Haven Regional Sludge Processing Center. This facility would process sludge from the New Haven treatment facility and the Zero Manufacturing Company. Sludge would be transported from Zero Manufacturing Company by truck, undergo aerobic digestion with New Haven sludge, and be pumped to a short-term sludge storage lagoon for a minimum of 90 days storage. Sludge would then be used for spreading in low rate agricultural re-use systems on farmland adjacent to New Haven.

2. Washington Regional Sludge Processing Center. A sludge processing center should be developed adjacent to the Washington wastewater treatment plant which would process sludge from nearby treatment facilities. Washington has also been designated as a regional center for receiving septage. Sludge from Washington and the other small treatment plants will undergo aerobic digestion prior to being pumped into short-term sludge storage lagoons. The sludge will receive a minimum of 90 days storage prior to being used for land spreading in the vicinity. The land spreading sites for low rate agricultural re-use of sludge are assumed to be within an average haul distance of ten miles from the treatment plant.

3. Union Regional Sludge Processing Center. A sludge processing center should be developed at Union to receive waste from the St. Clair treatment facility and other smaller facilities located between St. Clair and Union. Sludge from these facilities will be transported to the

REGIONAL SLUDGE PROCESSING CENTERS AND SERVICE AREAS

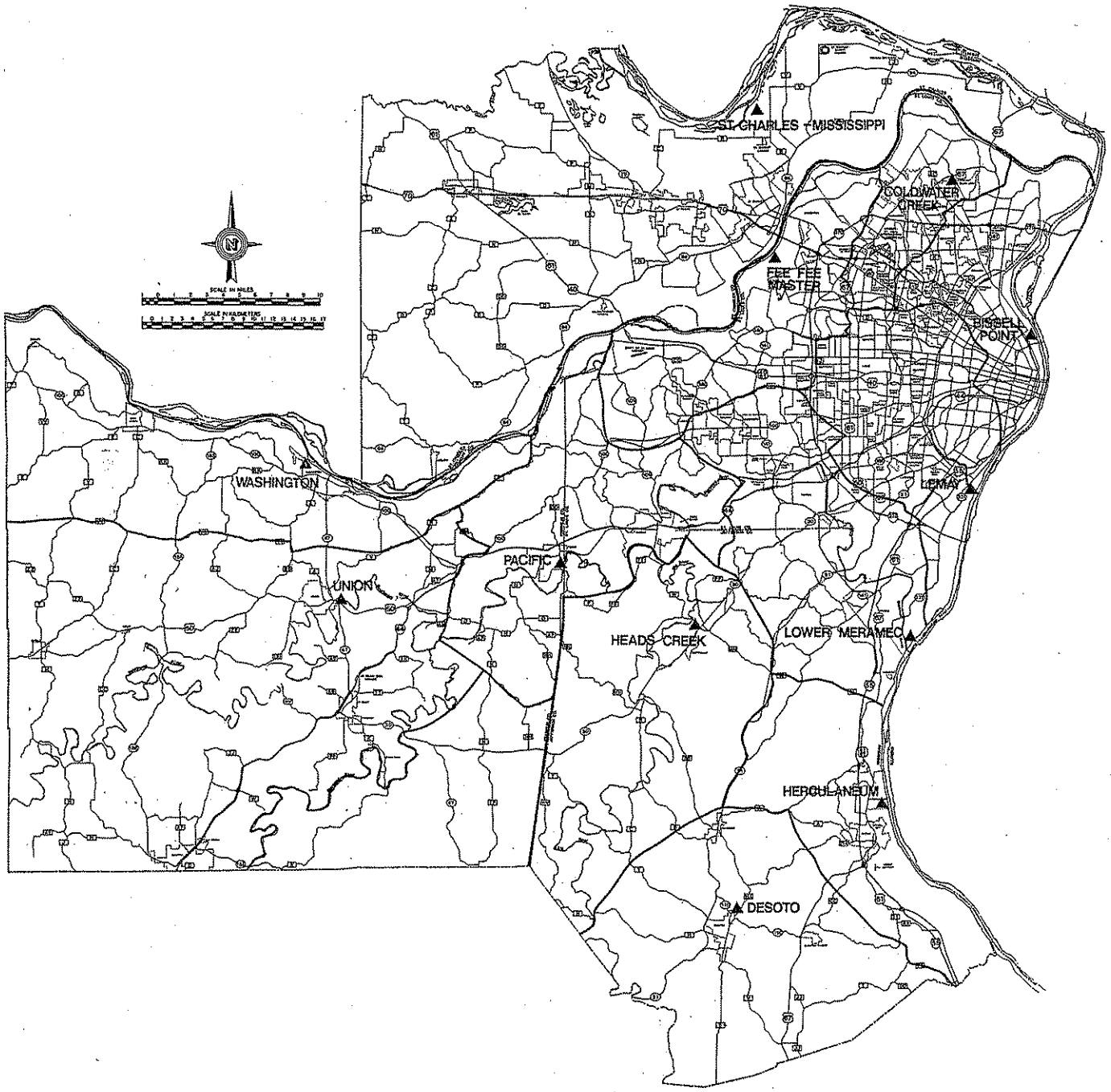


figure 25

TABLE 13

COST OF REGIONAL SLUDGE PROCESSING CENTERS

Regional Centers	Capital Cost*	Operation and Maintenance Cost* 1990	2000
FRANKLIN COUNTY			
New Haven	$ 274,000	$ 41,500	$ 54,000
Washington	755,000	139,000	146,000
Union	1,407,000	270,500	285,000
Sullivan/Oak Grove Village	601,000	105,000	112,000
Pacific	981,000	153,000	163,000
JEFFERSON COUNTY			
Herculaneum	2,216,000	470,000	495,000
DeSoto	1,188,000	124,000	144,000
Lower Big River/ Heads Creek	1,901,000	205,000	217,000
Lower Meramec**	5,204,000	1,152,000	1,213,000
ST. CHARLES COUNTY			
St. Charles Mississippi	4,700,000	1,214,000	1,278,000
ST. LOUIS CITY/COUNTY			
Coldwater Creek	10,000	635,000	2,000
Fee Fee Master	3,392,000	808,000	850,000
Lower Meramec**	5,204,000	1,152,000	1,213,000
Lemay	16,722,000	4,223,500	4,446,000
Bissell Point	6,467,000	4,371,000	4,601,000

* 1977 Dollars
** Includes Jefferson and St. Louis Counties

Union processing center by truck and will be combined with septage from the area and the waste from Union. Aerobic digestion will be the method of treatment. Sludge will then be pumped to a short-term sludge storage lagoon to receive a minimum of 90 days storage prior to discharge for low rate agricultural re-use. Re-use sites are assumed to be within ten miles of Union.

4. Sullivan Regional Sludge Processing Center. The proposed Sullivan/Oak Grove Village wastewater treatment facility has been designated as a site for the development of the regional sludge processing center. Sludge would be transported to the facility from the Meramec Lake Park treatment facility. Sludge will undergo aerobic digestion followed by short-term sludge storage in a lagoon with a minimum of 90 days storage time. Sludge will then be loaded on trucks for haul to land spreading sites assumed to be within 10 miles of the treatment facility.

5. Pacific Regional Sludge Processing Center. The proposed treatment facility at Pacific has been selected for the development as a regional sludge processing center and would receive septage from the immediate vicinity. The treatment plant will also receive waste sludge from the Eureka facility and nearby small treatment plants.

Sludge will be transported to the regional sludge facility by truck. The sludge will undergo aerobic digestion and will be stored in a short-term sludge storage lagoon for a minimum of 90 days prior to being trucked to land spreading sites found within 10 miles of the City. If suitable agricultural re-use sites cannot be located, an alternative sludge treatment would be aerobic digestion followed by floatation thickening and filter press prior to landfill disposal.

B. Jefferson County

The sludge management system proposed for Jefferson County includes the development of four regional sludge facilities at Herculaneum, DeSoto, Lower Big River/Heads Creek and the Lower Meramec.

1. Lower Meramec Regional Sludge Processing Center. The proposed Lower Meramec facility has been designated as a regional sludge processing center. Sludge processing will involve air floatation of waste activated sludge with gravity thickening for the primary sludge. The thickened sludge with an expected solids concentration in

the neighborhood of three to six percent will then be subject to anaerobic digestion prior to being pumped into long-term sludge storage lagoons. Sludge lagoons to be located near the facility will have a designed storage life of approximately 20 years. The ponds will either have to be abandoned and new ponds constructed or cleaned at the end of 20 years.

It should be noted that several researchers, those involved with the Lower Meramec 201 Plan and the 208 Plan, have examined alternative methods of handling the sludge from the Lower Meramec facility. The alternative to the above recommendation would be to construct a pump station and force main to transport the sludge from the Lower Meramec facility to the Lemay plant where it would be burned. Preliminary economic analysis indicates that this alternative will be more expensive than the process outlined above.

2. Herculaneum Regional Sludge Processing Center. Herculaneum Sewer District treatment facility has been recommended for the development of a regional sludge processing center. This plant will receive sludge from several outlying plants which include Glaize Creek Sewer District and Festus/Crystal City.

The sludge will be transported to the processing center by trucks. However, sludge from Glaize Creek and Festus/Crystal City would have to be thickened in order to reduce transportation and sludge processing costs. Glaize Creek Sewer District would provide a sludge pump station to be followed by chemical conditioning and gravity dewatering. Sludge from the gravity dewatering is expected to have a concentration of approximately 4 to 6 percent solids and will then be transported to the regional sludge facility by truck.

A similar thickening process is envisioned for Festus/Crystal City (which is also designated to receive septage from the area). Sludge from the Festus/Crystal City plant will be pumped through chemical conditioning to a gravity thickener. Sludge from the gravity thickener (which is expected to also have solids concentrations of 4 to 6 percent) will then be transported by truck to the Herculaneum facility.

The Herculaneum facility would also provide a sludge pump station and chemical conditioning prior to gravity thickening for the sludge generated in their plant. The sludge from the area will be subject to anaerobic digestion and dewatered by the use of centrifuges. The centrifuge cake, which is expected to have a solids content in excess of 20

percent, would then be trucked to the Valley Disposal Landfill for incorporation into the landfill with refuse.

3. City of DeSoto Regional Sludge Processing Center. The City of DeSoto has been selected for the development of a regional sludge processing center. Sludge would be trucked to the processing center from Hillsboro and several small outlying treatment facilities.

Sludge from DeSoto and the outlying plants would be subject to aerobic digestion prior to discharge on sand drying beds. The cake from the sand drying bed would then be collected and placed in trucks for transport to the Valley Disposal Landfill for incorporation with municipal refuse.

4. Lower Big River/Heads Creek Regional Sludge Processing Center. The proposed Lower Big River/Heads Creek treatment facility has been selected for the development of a regional sludge processing center. Sludge would be collected from several small outlying treatment facilities in the Lake Montowese area.

The sludge would be transported from these various small treatment plants by truck. Sludge stabilization at the processing center should be accomplished by aerobic digestion. Sludge would be pumped to sand drying beds for drying, and then it would be disposed of at Valley Disposal Landfill.

C. St. Charles County

There were two sludge management alternatives analyzed for St. Charles County: 1) two subregional facilities serving the entire county; or 2) one sludge facility serving the entire county. In the first alternative, the proposed O'Fallon treatment facility and the existing St. Charles Mississippi facility would be the subregional centers. In the one facility alternative, the St. Charles Mississippi plant would be the sludge processing center for the county. Due to the capital cost advantage inherent with Alternative No. 2, a single sludge processing center to be located at the St. Charles Mississippi facility is recommended.

The City of Wentzville has been included in the single processing center approach. Due to the haul distance involved, a detailed cost-effective analysis should be included during 201 Facility Planning which would evaluate sludge processing at the Wentzville treatment plant versus hauling to the regional sludge center.

1. St. Charles Mississippi River Regional Center. Due to the the volume of sludge that would be generated at the facility (since the flow to the facility will be increased), the present sludge disposal system would require modification and expansion. The basic flow design of chemical conditioning, dewatering, incineration and ash pond disposal, however, should remain the same.

D. St. Louis City/County

The 208 Plan recommends development of five St. Louis City/County regional sludge processing centers at Coldwater Creek, Fee Fee Master, Lower Meramec, Lemay, and Bissell Point.

1. Lower Meramec Regional Sludge Processing Center. This facility is described on page 147.

2. Coldwater Creek Sludge Processing Center. The existing sludge processing equipment at the Coldwater Creek plant should be able to handle the additional sludge to be generated at the facility and from a small treatment plant at Lock and Dam 26 and the proposed West Alton facility. The existing anaerobic digestion sludge pumping stations and sludge storage lagoons have an adequate capacity to provide acceptable sludge storage for a 20-year planning period. The existing sludge lagoons are presently achieving solids concentrations in the neighborhood of 40 to 50 percent dry solids. With an increase flow to the Coldwater Creek Plant, the expected digestion performance should be somewhat lower than is presently being achieved. Even with the lower overall digestion performance, the sludge storage ponds are believed to have an adequate capacity for the planning period.

3. Fee Fee Master Regional Sludge Processing Center. Fee Fee Master Plant has been designated as a reional sludge management center. Sludge should be trucked from small treatment plants in the projected service area to the processing center.

Sludge treatment and stabilization will involve pumping waste activated sludge through chemical conditioning into a floatation thickener. The thickened sludge (expected to be about 3 percent solids) will then be combined with the primary sludge for anaerobic digestion. The stablized sludge will then be pumped to the large sludge storage lagoons with a design life of at least 20 years. It should be noted that periodically, or at least once every 20 years, sludge would be pumped from the ponds to some other alternate disposal

site. If the ponds are not cleaned, new ponds with an additional life must be constructed at the end of 20 years.

4. Lemay Regional Sludge Processing Center. The Lemay Plant has been designated as a regional sludge processing center and would receive waste sludge by truck from the Sugar Creek Plant. The Sugar Creek sludge would be combined with raw primary sludge. Waste activated sludge from the new secondary facility will be pumped through chemical conditioning and thickened with air flotation. The combined sludge will then be subjected to additional chemical conditioning and vacuum filters. Sludge cake from the vacuum filters will then be burned in the expanded incinerators and the ash pumped to ash storage ponds.* The vacuum filters and incinerators at the Lemay Plant would have to be expanded to accommodate the increased solids loads.

5. Bissell Point Regional Sludge Processing Center. The solids handling process at Bissell Point should be expanded to handle the increased solids loads expected with the development of a secondary treatment system. Waste activated sludge will be pumped through a chemical conditioning and thickened with air flotation. After thickening to a solids concentration of 3 to 6 percent, it will be combined with primary sludge and subject to further chemical conditioning and dewatering with vacuum filters. The cake from the vacuum filters will then be burned in the incinerators with the ash stored in ash storage ponds.* These ponds have limited storage capacity and require cleaning every three years. Operation costs include this periodic cleaning. The existing vacuum filters and incinerators will be expanded to accommodate the expected sludge load increases anticipated with the development of the secondary treatment system.

IV. RESIDUAL WASTE CONTROL RECOMMENDATIONS: IMPLEMENTATION ISSUES

Reviewing the residual waste program, there are a number of legal issues that have to be addressed. The first is that the system's capacity is based upon the adoption of the requirement that existing and future septic tanks be cleaned

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*These storage ponds have limited capacity and require cleaning every three years. Ultimate ash disposal is currently the subject of a MSD 201 Facility Plan and the results of this effort will be integrated into ongoing 208 planning.

periodically. The body of law upon which such regulation rests is the requirement for privy and cesspool cleaning and inspection. Other authorities who have researched this issue believe that this basis for septic tank inspection and pumping has a solid legal foundation. In a recent EPA sponsored report, Legal and Institutional Approaches to Water Quality Management Planning and Implementation (March, 1977), ordinances requiring that cesspools and privys be cleaned and inspected are specifically cited as the basis for public action. All authorities agree that this is a reasonable exercise of the power to protect public health and safety. Not only does this EPA volume cite the fact that the regulations to keep these facilities inspected and cleaned are valid, but furthermore, that if the public health is involved, the government may choose to insure sanitary practices by taking maintenance away from the individual owner or occupant and assuming the function itself or contracting out for the performance of this service. The courts have gone so far as to approve ordinances stating that charges for such activities may become liens upon the property if the property holder does not compensate the city for the services. Clearly an unclean cesspool is not the same health hazard as an unclean septic tank in a rural area, yet the requirement of protecting the public health and safety does apply in both cases and it is felt by the courts that this type of ordinance should be upheld.

The second critical link in the residual waste program proposed is the regulation of the hauling of septage. This is discussed in Section 3 but bears a quick review. It is generally recognized that because of the problems associated with hauling septage, septic tank haulers and pumpers should be licensed. A number of states (e.g., Connecticut and Maryland) and certain counties such as St. Louis County have required such permits. The requirements on some of these permits go so far as to be inspected before an initial license is granted and annually thereafter.

Linked to the licensing of haulers which is recommended strongly for this region is a third concern that is important to the residual center's concept. There must be a guarantee that septage, once pumped, must be deposited and disposed of within the regional centers system as proposed. Under many state and local regulations that have been reviewed, there are specific requirements that septage be disposed of only at sites which the governing agency has approved in writing. Therefore, the proposal to limit each septage hauler's permit or license to specific disposal sites has established precedent. A violation of the place of disposal would jeopardize any septage hauler's license.

A Connecticut draft regulation proposes that any person or municipality holding a hauling permit must file a monthly written report with the State showing the address of the system serviced and the location where the septage was discharged. This is a very tight control system and is one that bears further thought if the St. Louis residual waste program is to be implemented.

While state and local legislation has been upheld, it is recommended that local (i.e., County) legislation be pursued in St. Louis. This appears to be both the quickest and most politically feasible approach.

Another major implementation issue is financing the sludge processing centers. EPA funds are available for the development of septage and residual waste disposal centers. These funds may now even be applied to the acquisition of public hauling vehicles. Nevertheless, the development and governing issues remain. The creation of special residual waste districts to develop and operate the regional centers would necessitate the overlaying of another district--a residual waste district--upon the treatment districts. This would produce confusion and might well hurt the overall program. A simplier approach would be for the designated regional centers to secure guarantees of participation through contracts with all residual waste contributors (public and private). These agreements would have to cover cost allocation formula, hauling permits, septic tank cleaning regulations etc. Admittedly, this would be a difficult process, yet it should be explored with the County Water Quality Boards during the continuing planning phase of this project. If rejected, water quality and costs will not be as projected in this Plan.

5. WATER QUALITY EFFECTIVENESS

I. INTRODUCTION

Three different approaches to water pollution control were defined during the 208 study. Each approach or level of pollution control will produce a different water quality in the rivers and streams of the study area at a different cost. This approach to water quality management allows decisions to be made on the basis of costs incurred to achieve various levels of water quality.

The three levels of water quality used in the 208 study in ascending order of stringency were:

> Level 1--Provides for the secondary treatment of point sources and a continuation of existing practices and controls for nonpoint sources.
>
> Level 2--Requires the control of point and nonpoint sources necessary to meet the State of Missouri's proposed water quality standards and streams use goals.
>
> Level 3--Calls for more stringent control of point and nonpoint sources of pollution in order to meet the water quality goals developed during the 208 study. It also requires that a higher quality of water be attained than that of Level 2.

Control strategies and their cost were developed for each water quality level. The future of water quality of this region's rivers and streams was then estimated based on the assumption that the control strategies for each respective water quality level would be implemented. This was in effect the cost-effectiveness analysis of the 208 study.

The cost-effectiveness analysis were presented to the public at the Phase III Workshops, held in November 1977. (Element 25 Report) Participants were asked to indicate their preference for a level of water quality which would be used

to develop the final pollution control recommendations. By indicating their preference, the participants indicated to staff and consultants what level of water quality the citizens of the region would be willing to pay for. The participants overwhelmingly chose Level 2 water quality; this is the level of water quality to which the control recommendations in this 208 Plan are attuned.

This section describes how the effectiveness analysis was performed and indicates generally what the resulting water quality would be if Levels 1, 2, or 3 controls are implemented. The water quality analysis for specific streams within the study area can be found in the Element 23 Report. The effectiveness evaluation of point source controls for each water quality level is described in the Element 20 Report.*

II. FORECASTING FUTURE WATER QUALITY

The key to the 208 effectiveness analysis was the ability to forecast future water quality by using two water quality computer models: the Hydrologic Simulation Program (HSP) model developed by Hydrocomp, Inc., and the LOADS model developed especially for the St. Louis 208 study. These two models account for all sources of pollution and simulate the physical, chemical and biological processes which occur in the aquatic environment. The models do not simulate every water quality constituent; the modelled constituents, however, represented the major water quality indices including fecal coliform, phosphate and ammonia.

A. Hydrologic Simulation Program (HSP)

The HSP model simulates the hydrologic cycle by using the following components (or modules): LANDS, CHANNEL and QUALITY. A comprehensive description of the HSP model can be found in the Element 8 Report. A general description of the model and its components is provided below.

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*Based on the strict technical definition and for the purposes of this study, all St. Louis 208 streams, except the Missouri and Mississippi Rivers, have been classified as water quality limited. The State of Missouri, however, has a process of classifying streams either water quality or effluent limited by including specific management criteria. Therefore, the State's method of stream classification may result in stream classifications different from those presented in the 208 Plan.

1. LANDS--Simulated the land surface phase of the hydrologic cycle to yield runoff which was used as inflow to the CHANNELS modules. The meteorologic conditions of the model area were represented by the data from existing climatologic stations. Each study area watershed was divided into 25 land segments. The division process was one of compromise between delineating segments which homogeneous runoff producing factors and the limitations of computer memory.

   The first analytical step was selection of watersheds with precipitation, flow and water quality records adequate for calibration purposes. The Meramec River basin below the U.S.G.S. gages at Sullivan, DeSoto and Union was selected. In addition, three tributaries to the Meramec River--Grand Glaize Creek, Fishpot Creek and Fox Creek--also had the flow and precipitation records required for water quality calibration.

   The second step was preparation of maps and other data showing areas of essentially homogenous runoff producing factors. The following factors were considered: rain gage location, soil types, geologic controls, vegetative cover and urbanization.

   In the final step, subwatersheds defined by hydrologic boundaries were combined to 25 land segments representing significant differences in these runoff producing factors.

2. CHANNEL--The river system was divided into reaches based on the physical characteristics of the river system and on the locations at which simulated water quantity and quality were desired. Each such location was the downstream terminus of a reach. The reach length was governed by the location of point sources and tributaries which would significantly affect the flow of the river. Every segment contained at least one reach, as the model has no provision for routing flow from more than one land segment into a reach. Task Report 8.q deals with the attainment of this data and lists the hydraulic features of these channel reaches. Task Report 8.p also reviewed several physical traits of area streams.

3. QUALITY--The water quality simulation model used the LANDS segments and CHANNEL reach setup. Land segment runoff from impervious surface, pervious surface and subsurface components was read into computer data files and utilized by the QUALITY model. The channel reach system is the same, but the QUALITY model has flow routing algorithms independent of CHANNEL.

Daily boundary conditions for the Meramec River near Sullivan, the Big River near DeSoto, and the Bourbeuse River near Union included quality parameters as well as flow. These parameters were temperature, dissolved oxygen, five-day biochemical oxygen demand, total dissolved solids, fecal coliforms, fecal streptococci, nitrate, ammonia, total phosphorus, phenol, and pH as related to alkalinity, dissolved carbon dioxide and total inorganic carbon. Values for these same quality perameters were obtained on a semi-monthly basis for 62 point sources of pollutants on the Meramec River.

B. PROGRAM LOADS

For those areas outside the Meramec River and Coldwater Creek, a special computer program was developed to assess proposed control strategies and resultant pollutant loads. Estimates of mean annual loads of 12 selected pollutants and corresponding pollution indices were calculated for each land segment in the St. Louis 208 study area. A pollution index is the quantity of a certain constituent which enters the stream system from one acre of land including the underlying groundwater, in a typical year. This index is valuable as an indicator of pollution intensity and is used as an aid in pinpointing areas in which water pollution problems are serious. Proposed alternative solutions for these problem areas can also be checked for efficiency using pollution indices. A new pollution index can be computed with a proposed solution in effect then compared with the original pollution index to analyze the relative change in pollutant load due to the proposed solution.

Pollution loads and indices were calculated for each segment using a computer program which sums loads of each pollutant according to land use and geophysical characteristics of the segment (i.e., geology, soil type and topography). After results were obtained from PROGRAM LOADS, corrections were made to account for the contribution of septic tanks to the annual loads of several constituents, as these contributions were not included in the loading factors input to the program.

The computer program which was written for the purpose of estimating total annual pollutant loads from all study area land segments is conceptually simple. The program operation consists of the following steps (for a more detailed description of PROGRAM LOADS, see the Element 11 Report, Appendix B):

A. The following general information is input:

1. A matrix of annual constituent loads to the stream, including flow. These loads are defined on a per acre basis for each combination of land use and geophysical type that exists in the study area.

2. A set of factors used in testing alternatives or local variations in existing conditions. These factors can be used to model reduction in loads of any combination of constituents due to proposed pollution control measures. They may also be increased to reflect higher pollution loads in the future if conditions are allowed to worsen.

B. For each segment the following information is input:

1. Segment area, divided according to land use. There are ten categories of land use designated for the study area.

2. Geophysical type of the land segment.

C. For each land use area within the segment, the program then selects an appropriate set of values for constituent loads per acre from the matrix, based on land use and geophysical type. Each constituent load per acre is multiplied by the land use area and, if applicable a multiplying factor, resulting in the annual load of that constituent from a particular land use area within the segment.

D. Step C is repeated until an annual load is obtained for each constituent from each land use area within the segment. The constituent loads for each land use are then summed to obtain constituent loads for the segment as a whole.

E. Results are printed out in tubular form and are found in the Element 28 Reports.

III. FUTURE WATER QUALITY

The following general comments are based on results from the computer modeling effort. Future water quality is described for each county assuming implementation of the three levels of water quality controls. Level 2 controls have been deemed the most implementable and economical; although, in some instances, Level 2 controls will not meet state standards.

FRANKLIN COUNTY

Level 1--Controls will result in little or no decrease in the number of fecal coliform and phosphate violations. Violations may even increase in areas of high growth.

Level 2--Controls will result in fewer fecal coliform violations in the Bourbeuse and Upper Meramec Watershed areas, but essentially no change in the Upper Missouri area. Phosphate violations will increase and poorer aesthetics will result.

Level 3--Fecal coliform violations will be largely eliminated in the Upper Meramec and Bourbeuse Watershed areas, while a few fecal coliform violations will continue to occur in the Upper Missouri area. The number of phosphate violations will remain constant, and future algal growth will be about as severe as present conditions.

JEFFERSON COUNTY

Level 1--Controls will result in little or no reduction in the number of fecal coliform and phosphate violations, except in the Lower Meramec, where a diversion of wastewater discharges is planned. Degradation from present conditions may occur in areas of rapid population growth. The number of ammonia violations will be reduced except in areas where expanding wastewater treatment plants discharge to smaller streams, such as Belew Creek in the Big River drainage. Ammonia violations in the Lower Meramec below Keifer Creek will be greatly reduced because wastes

presently discharged to that reach will be piped to the Mississippi River.

Level 2--Where treatment plant impacts are significant, controls will result in much fewer fecal coliform violations because of disinfection of wastewater effluents. Ammonia violations will be largely eliminated. The number of phosphate violations will increase in the Lower Mississippi Watershed area, remain at approximately present levels in the Big River and be slightly reduced in the Lower Meramec because of the wastewater diversion.

Level 3--Controls will result in slight improvements over Level 2 conditions in the Lower Mississippi and Lower Meramec Watershed areas. The number of phosphate violations will be significantly reduced in the Big River Watershed area.

ST. CHARLES COUNTY

Level 1--Controls will result in little or no reduction in the number of fecal coliform and phosphate violations, except in the Weldon Spring watershed area, where the improvements are expected to be modest. In the remainder of the County, some increase in the number of violations is expected due to population growth resulting in increased point source loads and urban runoff. Much of the point source load, however, will enter the Missouri or Mississippi Rivers, and will not impact the small tributaries. Some of these tributaries may actually experience improved quality due to consolidation and upgrading of point sources.

Level 2--Controls will result in much fewer fecal coliform violations in those locations where treatment plant discharges significantly impact water quality. The phosphate and ammonia violations would be virtually eliminated in those streams affected by the consolidated system. The number of phosphate violations, however, are not expected to decrease significantly outside the consolidated system service area.

Level 3--Controls will result in slight reductions over Level 2 in phosphate and ammonia violations, and significant reductions in fecal coliform violations, due to further disinfection of point source contributions.

ST. LOUIS CITY/ST. LOUIS COUNTY

Level 1--Controls will result in little or no reduction in the number of fecal coliform and phosphate violations except in the Lower Meramec. Because Level 1 controls do not require more stringent nonpoint source controls than presently exist, water quality will degrade in those areas of the county where urban runoff will be a significant pollution source. This will occur in the western part of the St. Louis County where new development is projected to be the greatest. The most significant pollution constituents will be BOD, metals, phenols and oil.

Level 2--Controls will result in significant reduction in the number of fecal coliform violations in these areas where treatment plants discharge to the small streams. Oil violations, and to a lesser extent phenol violations, will be fewer than the number occurring under Level 1 in these watersheds which will experience considerable development between the present and year 2000. All the urban areas, new and old development, will experience moderate (25 - 35 percent) reductions in the nonpoint contributions of BOD, aquatic growth nutrients (nitrogen and phosphorus) and fecal coliform bacteria. Most of these reductions in nonpoint contributions will prevent the water quality from deteriorating from the present conditions but will not result in dramatic improvements over the present conditions. The situation in the Lower Meramec River will not change much from Level 1 because the same regional collection of wastewater below Keifer Creek is projected. However, the urbanized tributaries of the Lower Meramec will show some improvement over Level 1.

Level 3--Controls will result in substantial improvement in the nonpoint problems due to the forecasted treatment of urban storm runoff. Level 3 controls will result in slight reductions over Level 2 in

phosphate and ammonia violations, and significant reductions in fecal coliform violations in the small streams receiving urban runoff due to disinfection of urban stormwater. The aesthetics of the waters in St. Louis County are forecasted to improve over the present conditions. The Lower Meramec quality will show some improvements over Level 2 due to the improvement in the upstream sources.