MENTAL PROTECTION AGENCY
CHICAGO, IL 60604 • WATER DIVISION
NT OF NATURAL RESOURCES
• BUREAU OF ENVIRONMENTAL IMPACT

Environmental Impact Statement

Final

Wastewater Treatment Facilities for the Geneva Lake Area, Walworth County, Wisconsin

FINAL ENVIRONMENTAL IMPACT STATEMENT

on the

WASTEWATER TREATMENT FACILITIES

for the

GENEVA LAKE AREA

WALWORTH COUNTY, WISCONSIN

Prepared by the

United States Environmental Protection Agency

Region V

Chicago, Illinois

and the

Wisconsin Department of Natural Resources
Madison, Wisconsin

with assistance from

WAPORA, Incorporated
Chicago, Illinois

June 1984

Submitted by:

Howard S. Druckenmiller
Director
Bureau of Environmental Analysis and Review
Department of Natural Resources

Valdas V. Adamkus
Regional Administrator
U.S. Environmental Protection Agency

BEFORE THE DEPARTMENT OF NATURAL RESOURCES

Public Hearing to Receive comments on the Final Environmental Impact Statement (FEIS) Prepared by DNR and EPA for the Geneva Lake Area Wastewater Facilities Plan, Walworth County, Wisconsin.

NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN that pursuant to Chapters NR 150.07(6) and NR 150.09, Wis. Admin. Code, and 40 CFR 6.400 [c] the Department of Natural Resources and the United States Environmental Protection Agency (EPA) will hold a public hearing for the purpose of receiving the views and comments of the public on the FEIS on the proposed Wastewater Facility Plan for the Geneva Lake Area. The communities addressed include the City of Lake Geneva, the southeast shoreline of Geneva Lake in the Town of Linn, and the Lake Como Subdivision in the East Planning Area and the Villages of Walworth, Fontana and Williams Bay as well as contiguous unsewered shoreline areas in the West Planning Area.

Time: 7:00 p.m., Wednesday, July 25, 1984

Place: Big Foot High School Library, Walworth, WI

Following the completion of the hearing on the FEIS and the close of the record by the hearing examiner, the Department and the EPA will review the record including all testimony, evidence and written comments received during the hearing process and will determine if they have complied with Section 1.11, Wis. Stats., the Wisconsin Environmental Policy Act, and 42 U.S.C. 4371, the National Environmental Policy Act. At that time the Department will also complete its review of the proposed Geneva Lake Area Facility Plan. The Department will issue in conjunction with the U.S. Environmental Protection Agency, a final written Record of Decision on the proposed action on the proposal.

At the first part of the hearing all interested persons or their representatives will be given an opportunity to present their views or comments concerning the proposed Facility Plan and the FEIS. The hearing examiner may limit oral presentation if he feels that the length of the hearing will be unduly increased by repetition. Each interested person will also be given the opportunity at the hearing to present facts, views or comments in writing.

According to the provisions of NR 150.09(4), any person may petition for an opportunity to cross examine the person or persons responsible for a specific portion of the FEIS or present witnesses or evidence. The petition shall include a statement of position on the action or proposal and specific statements or issues that are desired to be cross examined or presented.

Petitions shall be filed with the Department within 20 days of the publication of this notice. Failure to file such a petition shall preclude the opportunity to cross examine and to present witnesses or evidence under oath.

If the Department finds that the action or proposal may affect substantial interests of the petitioner, an order shall be issued stating what persons will be made available for cross examination. Denials of petitions will be in writing. Failure to issue an order within 10 days of the filing of the petition shall constitute a denial. The opportunity to cross examine or present witnesses or evidence under oath will be given after the informational portion of the hearing is completed.

Written comments on the FEIS will be accepted and considered if received by the Bureau of Environmental Analysis and Review, Department of Natural Resources, Box 7921, Madison, WI 53707, by 4:30 p.m., on Thursday, July 26, 1984.

Copies of the FEIS on the proposed Geneva Lake Area Facility Plan are available for public review at the following Department of Natural Resources offices:

Bureau of Environmental Analysis and Review, 101 South Webster Street, Third Floor, Madison, Wisconsin.

Southeast District Headquarters, 2300 North Third St., P.O. Box 12436, Milwaukee, WI 53212.

Copies of the FEIS can be obtained by writing: Harlan D. Hirt, Chief, Environmental Impact Section, U.S. EPA Region V, 230 S. Dearborn St., Chicago, IL 60604.

In addition, copies have been sent to the following libraries and public offices for public review:

Lake Geneva Public Library
918 Main St., Lake Geneva

Williams Bay Public Library
W. Geneva St., Williams Bay

Fontana Public Library
Hwy. 67, Fontana

Walworth Memorial Library
Walworth

Dated at Madison, Wisconsin, this 22nd Day of June, 1984

By Milton Donald
Milton Donald, Hearing Examiner

5023S

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

JUN 15 1984

5WFI

TO ALL INTERESTED AGENCIES, PUBLIC GROUPS AND CITIZENS:

AWSCPC, CHO OH

Full Containment Facility

The Final Environmental Impact Statement (EIS) for the Geneva Lake Area, ~~Walworth County, Wisconsin,~~ is provided for your information and review. This EIS has been prepared in compliance with the National Environmental Policy Act of 1969 and the subsequent regulations prepared by the Council on Environmental Quality and this Agency.

Upon publication of a notice in the Federal Register on June 22, 1984, a 30-day comment period will begin. Please send written comments to the attention of ~~Harlan D. Hirt, Chief, Environmental Impact Section, 5WFI, at the above address~~. After the close of the comment period, a Record of Decision will be provided to all who received the Final EIS.

I welcome your participation in the EIS process for the Geneva Lake Planning Area.

Sincerely yours,

~~Valdas V. Adamkus~~
~~Regional Administrator~~

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FINAL ENVIRONMENTAL IMPACT STATEMENT

ON THE

GENEVA LAKE AREA FACILITIES PLANS

WALWORTH COUNTY, WISCONSIN

Prepared by the US Environmental Protection Agency Region V and the Wisconsin Department of Natural Resources.

For further information contact:

William Spaulding, Project Officer
USEPA, Region V
230 South Dearborn Street
Chicago, IL 60604
312/886-0215

Steven Ugoretz
WDNR
Bureau of Environmental Impact
P.O. Box 7921
Madison, WI 53707
608/266-6673

ABSTRACT

Wastewater collection and treatment facilities plans have been prepared for the Geneva Lake East Planning area and the Geneva Lake West Planning area. The communities addressed include the City of Lake Geneva, the southeast shoreline area of Geneva Lake in the Town of Linn, and the Lake Como subdivision in the East Planning area and the Villages of Walworth, Fontana and Williams Bay as well as contiguous unsewered shoreline areas in the West Planning area. Facilities planning documents have concluded that the appropriate approach to wastewater management in unsewered portions of the study area would be to abandon existing onsite wastewater treatment systems, to construct wastewater collection and conveyance facilities, and to convey wastewater to upgraded and expanded treatment plants at Lake Geneva, Williams Bay, and a combined Walworth/Fontana plant at the Village of Walworth.

Based on a review of facilities planning documents, USEPA and WDNR determined that the Facilities Plan Recommended Action (FPRA) could result in induced growth and secondary impacts, socioeconomic impacts, and potential wetland impacts. The potential significance of these issues necessitated the preparation of an Environmental Impact Statement (EIS). The EIS

has evaluated the FPRA, and developed an EIS Alternative which includes an analysis of continued use of onsite wastewater treatment systems in currently unsewered areas. The EIS also evaluates impacts on the natural and man-made environment associated with both alternatives.

EXECUTIVE SUMMARY

PURPOSE OF AND NEED FOR ACTION

The Geneva Lake-Lake Como study area is located in the southeast corner of Wisconsin, approximately 50 miles southwest of Milwaukee and 75 miles northwest of Chicago. The study area encompasses approximately 44 square miles in the southern portion of Walworth County, and includes the City of Lake Geneva, the Villages of Walworth, Fontana, and Williams Bay, and the Towns of Geneva, Linn and Walworth. The locale is very popular as a summer resort area because of the recreational resources afforded by the 5,000-acre Geneva Lake and the 1,000-acre Lake Como, and the area's proximity to both Chicago and Milwaukee.

In May 1974, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) adopted A Regional Sanitary Sewerage System Plan for Southeastern Wisconsin. This document was prepared in accordance with Section 66.945 (10) of the Wisconsin Statutes and Section 208 of the Clean Water Act, and provides guidance for wastewater management planning to the local units of government located in SEWRPC's seven-county region. Based on a cost-effectiveness analysis, Donohue & Assoc., Inc., the facilities planner, defined five revised sewer service areas (RSSAs) as the areas for which the wastewater collection and treatment facilities are being planned.

Four municipal and three private wastewater treatment plants (WWTPs) currently serve the existing sewered areas within the study area. Municipal WWTPs are located at Fontana, Lake Geneva, Walworth, and Williams Bay. Private WWTPs serve the Americana Hotel (formerly the Playboy Club), Interlaken Resort, and Kikkoman Foods.

Several factors led to the consideration of a regional wastewater management plan for the Geneva Lake-Lake Como study area. In Fontana, before a third treatment lagoon was constructed, effluent from the original two seepage lagoons had overflowed into Buena Vista Creek and thus into Geneva Lake. The City of Lake Geneva's WWTP is currently meeting its interim effluent standards for discharge to the White River. However, the

Wisconsin Department of Natural Resources (WDNR) has issued more strict effluent discharge standards which the existing plant cannot meet. The Walworth WWTP, which is exceeding its hydraulic design capacity, is meeting interim standards but is incapable of meeting final standards. The Williams Bay plant has components that are in poor condition and is experiencing hydraulic problems in both its primary and secondary clarifiers. All of these plants have experienced hydraulic increases in recent years due to population increases; a trend that will continue into the next 20 years.

The facilities plans prepared by Donohue & Assoc., Inc. propose to serve portions of the study area with centralized wastewater collection and treatment facilities that are currently served by onsite wastewater treatment systems. Geologic conditions on some parcels in the study area present limitations to the use of onsite wastewater treatment systems. Concern that onsite systems may be contaminating surface and groundwater resources has led some homeowner and beach associations to develop centralized domestic water supplies.

Because of the perceived problems associated with existing wastewater management, the USEPA awarded Step 1 planning grants to the Village of Walworth, the City of Lake Geneva, the Village of Fontana, and the Village of Williams Bay between February and July of 1977. Although separate planning grants were awarded, special conditions of the grants stipulated that facilities planning efforts be coordinated, and that areawide solutions to wastewater management be jointly investigated.

In February 1978, the US Environmental Protection Agency (USEPA) issued a Notice of Intent to prepare an EIS on the proposed project. This action was taken based upon USEPA's review of the Facilities Plan, which indicated the possibility of significant environmental impacts resulting from the proposed project. The Wisconsin Department of Natural Resources (WDNR) concurred with the USEPA decision to prepare an EIS, and the two agencies agreed to prepare a joint EIS to satisfy both Federal and State requirements. The EIS was to be prepared concurrently with the completion of the facilities planning documents.

Pursuant to subsequent grant amendments, the facilities planners submitted the following documents to WDNR for review:

- Preliminary Geneva Lake Facilities Plans, Volume 2 - Treatment Alternatives, East Planning Area (Donohue & Assoc., Inc. 1981a)

- Preliminary Geneva Lake Facilities Plans, Volume 2 - Treatment Alternatives, West Planning Area (Donohue & Assoc., Inc. 1981b)

- Addendum to the West Geneva Lake Facilities Plans, Volume 2 (Donohue & Assoc., Inc. 1982a)

- Geneva Lake Facilities Plans, Volume 2 - Process Specific Addendum, East Planning Area (Donohue & Assoc., Inc. 1982b)

- Final Draft Geneva Lake Facilities Plans, Volume 2 - Treatment Alternatives, West Planning Area (Donohue & Assoc., Inc. 1983).

- Addendum 1 to Volume 2 - Facilities Plans for the Lake Geneva West Planning Area - Walworth/Fontana (Donohue & Assoc., Inc. 1983b)

ISSUES

On the basis of USEPA's Notice of Intent to prepare an EIS, the Directive of Work to WAPORA, Inc. (the EIS Consultant) and the facilities plan, the following issues have been determined to be significant and are addressed in this Final EIS:

- The likelihood that new interceptors and expansions in wastewater treatment capacity would artificially induce more residential development in the study area than would otherwise be anticipated to occur

- Secondary impacts of such development on agricultural lands and existing open space areas

- Impacts of the project on wetland resources in the study area

- Economic impacts that could result in the displacement of homeowners

- Controversy surrounding the regional approach to wastewater management planning

- Extent of present problems resulting from use of onsite wastewater treatment systems
- Future impacts resulting from continued use of onsite systems
- Cost-effectiveness of upgrading existing onsite systems versus expanding centralized wastewater collection and treatment facilities.

WASTEWATER MANAGEMENT ALTERNATIVES

Existing Onsite Wastewater Treatment Systems

Currently unsewered portions of the RSSAs were surveyed for performance data on onsite wastewater treatment systems. Within these surveyed areas, there are approximately 1,700 onsite wastewater treatment systems comprised mostly of septic tank and soil absorption systems. Information concerning onsite systems has been derived from collection of original data and use of existing published and unpublished sources. Information on existing systems was obtained from Walworth County Planning, Zoning, and Sanitation Office records. Interviews with County sanitation personnel also were useful in assessing environmental conditions and assessing the suitability of septic tank and soil absorption systems for treating wastewater. Two septic leachate detector surveys, color infrared aerial photography, a mailed questionnaire, and a sanitary survey also were used to assess the effectiveness of existing onsite wastewater treatment systems.

Fontana RSSA (Southwest Shore Area)

The Fontana RSSA includes the northeast quarter of Section 11 between Fontana and Williams Bay, and most of Section 18 lying outside the Village of Fontana. Included in Section 18 are the Oak Shores, Lake Geneva Club, Shore Haven, Camp Sybil, Academy Estates, and Maple Hills subdivisions and the Northwestern Military and Naval Academy, in addition to individual parcels. The aerial photographic survey identified no failing or marginally failing onsite systems within the area. In the Oak Shores Subdivision, the sanitary questionnaire responses indicated that 2 out of the 10 respondents reported conditions that qualify as obvious problems with onsite wastewater treatment. In the Lake Geneva Club Subdivision, two residents have identified frequent pumping and backups as typical experiences. One holding tank was installed because the parcel had insuffiсent size for a soil absorption system. There were three systems in Shore Haven and Camp Sybil for which failures were indicated on questionnaires, sanitary surveys or permit records. Three owners reported that they have cesspools, all of which were described as satisfactory. One holding tank was installed because insufficient lot area was available. In the Academy Estates Subdivision one holding tank was installed. The Maple Hills Subdivision contains 30 residences, with information from questionnaires available for five systems. Unplatted lands in the vicinity of these subdivisions are large parcels with minimal problems. The Northwestern Military and Naval Academy replaced the seepage bed for their main building in 1974. During the 1982 septic leachate survey, a plume and a surface breakout were identified as coming from the system that serves auxiliary housing units on Shadow Lane.

Williams Bay RSSA (North Shore Area)

The unsewered area within the Williams Bay RSSA consists primarily of the Cisco Beach and Rowena Park subdivisions. Also included are the Sylvan Trail and Ara Glen subdivisions and contiguous parcels. One holding tank and one cesspool are reportedly located in Cisco Beach. One resident in an area with a somewhat high water table reportedly had backups and wet ground, and indicated that the County sanitarian refused permission to extend the seepage bed because local soils had inadequate percolation rates. Consequently, the resident pumped the septic tank frequently during wet weather. Upgraded soil absorption systems have been installed for 10 systems since 1970.

Lake Geneva RSSA (Southeast Shore Area)

The major unsewered areas within the Lake Geneva RSSA are the southeast shore area (from the Lake Geneva Country Club golf course to Big Foot Beach State Park), Hillmoor Heights, and the Forest Rest and Geneva Bay Estates subdivisions. Subdivisions along the southeast shore (Trinke, Lake Geneva Beach, Robinson, and Robinson Hillside), are of primary concern.

Within the Trinke Subdivision, a large area has soils with a high water table. Of 33 houses in the area, three utilize holding tanks and one has a mound system. From the questionnaires and sanitary surveys, four residents indicated that they have problems with their systems (one pumps the septic tank as a holding tank). The shallow water table extends into the Lake Geneva Beach Subdivision near the lakeshore, and along Hillside Drive. A small area within the Robinson Hillside Subdivision also has a high water table that would preclude installation of soil absorption systems. In addition, some areas in the Trinke and Robinson Hillside subdivisions have soils with a somewhat high water table such that mounds would be required. Generally, soils in this area are moderately coarse textured, especially in the lower protions of the soil profile. Most residences are on deep, well drained soils. The GLWEA sampling and subsequent WAPORA sampling of the two creeks in the area identified elevated fecal coliform concentrations in Hillside Creek, but the source of the fecal material could not be positively identified.

The aerial photographic survey identified one confirmed and three marginally failing onsite systems in Lake Geneva Beach. Of the six questionnaire respondents in Robinson Hillside, one indicated conditions that qualify as an obvious problem. In Robinson, five residents indicated obvious problems, either by way of the questionnaire or sanitary survey; four of these were reportedly cesspools and one reported frequent pumping. In Lake Geneva Beach, five residents reported conditions that qualified as obvious problems, mostly excessive maintenance and cesspools. In addition, two holding tanks are known to exist in Lake Geneva Beach. In Trinke, three residents reported excessive maintenance of their system, and one indicated wet and soggy ground over the seepage field. Holding tanks are utilized for three new residences. All except one of these problem systems are on soils with an elevated water table such that the depth requirement for conventional seepage beds cannot be attained.

Lake Como RSSA

The Lake Como RSSA encompasses all of the Lake Como Beach Subdivision and some adjacent parcels along County Road H. Approximately eight drainageways have a high water table. At least two of these drainageways contain continuously flowing springs and have been utilized for drinking water supply by area residents. Soils along the lakefront also have a high water table. A small percentage of residences are located on parcels with a high water table.

The number of currently failing systems was identified by evaluating data from the aerial photographic survey, the questionnaire results, the sanitary survey results, and the County sanitarian's records. According to these data, approximately 21 systems are currently failing. Most failing systems were near the western end of the subdivision within two blocks of the Lake. Proximity to drainageways and limited depth to the water table appeared to be the primary factors in these failures. Inadequate systems also were a common factor in the failures. An analysis of past failures that have been corrected revealed that a high water table was the most important factor, followed by inadequate system design. Approximately one-half of the past failures were rectified by installation of holding tanks. The remainder extended the seepage bed or dry well, or had mounds constructed.

Description of Final Alternatives

The three final alternatives for providing wastewater treatment for the RSSA include: No Action; the Facilities Plan Recommended Alternative (FPRA), which consists of providing centralized collection and treatment for all portions of the RSSAs; and the EIS Alternative, which consists of providing management of onsite systems for currently unsewered portions of the RSSAs and centralized collection and treatment for portions of the RSSAs currently sewered. Table 1 shows a summary of the estimated total present worth and annual user costs for the FPRA and the EIS Alternative for service areas in the Geneva Lake RSSAs.

Table 1. Summary of estimated total present worth and annual user cost for the FPRA and EIS Alternative for major service areas in the Lake Geneva RSSAs.

Area	Total Present Worth FPRA	Total Present Worth EIS	Annual User Cost FPRA	Annual User Cost EIS
Lake Geneva	$ 5,733,370	$8,058,345	103	150
Lake Como	12,279,070	2,994,813	732	213
Southeast Shore	3,455,399	719,968	640	169
RSSA Subtotal	21,467,839	12,114,016[a]		
Walworth	1,157,228	1,096,423	117	119
Fontana	4,703,983	4,018,754	203	170
Southwest Shore	1,759,355	585,400	366	136
RSSA Subtotal	7,620,566	5,759,564[a]		
Williams Bay	2,705,402	2,836,318	160	170
Northwest Shore	1,595,310	516,874	545	172
RSSA Subtotal	4,300,712	3,352,192[a]		
TOTAL	33,389,117	21,225,772		

[a] Includes additional minor service areas evaluated in the EIS Alternative.

No Action Alternative

The No Action Alternative implies that neither USEPA nor WDNR (except on an individual basis through the Wisconsin Fund where eligible individual onsite systems can be funded for upgrades through NR 128.30) would provide funds to build, upgrade, or expand existing wastewater treatment systems. Wastewater would continue to be treated by existing WWTPs and existing onsite systems. Each individual WWTP would be responsible for improving operations and for making any necessary non-structural process adjustments to maintain permitted treatment levels throughout the 20-year design period. County sanitarians would continue to be responsible for permitting and regulating existing onsite systems, and would continue to require replacement or repair of obviously failing systems in unsewered areas.

The existing Lake Geneva WWTP now fails to meet effluent limitations for total phosphorus under its current limits. With no action, the existing facilities would not be able to provide treatment to meet final (1986) WPDES permit requirements. The hydraulic problems at the existing Williams Bay WWTP reportedly cause the plant to overflow and discharge partially treated effluent to Southwick Creek (which flows to Geneva Lake) in violation of the WPDES permit. Because of these hydraulic limitations, it is likely that overflows would continue to occur without some form of upgrading. The existing Fontana WWTP is currently operating with no violations of surface water, groundwater, or public health standards, however, portions of the WWTP are 25 years old. Under the No Action Alternative, the older portions of the WWTP would require major structural and mechanical renovation and additional seepage lagoon area would be required to serve 20-year wastewater treatment needs. Flow at the Walworth WWTP currently exceeds design capacity and some portions of the WWTP are in poor structural condition. Without major structural improvements, the WWTP and polishing lagoon will not be able to meet future effluent requirements. If USEPA or WDNR did not provide funding, each of the municipalities may be required to finance WWTP improvements on their own.

Under the No Action Alternative, local health authorities would continue to have inadequate information with which to identify failing systems and to design onsite system repairs appropriate to the problems and their causes. They are unlikely to have the time, personnel, or monitoring capabilities necessary to be able to specify innovative attempts to solve all problems. The result will be an increasing number of holding tanks on small lots and on lots with high groundwater. If no action is taken, existing onsite systems in the study area potentially would continue to be used in their present condition. Although some replacement systems would be funded by WDNR, new and some replacement systems would be financed solely by their individual owners.

Facilities Plan Recommended Alternative

The Facilities Plan Recommended Alternative (FPRA) includes construction of collection sewers and interceptors in most currently unsewered areas of the RSSAs, upgrading of the Lake Geneva WWTP to serve the east end of the planning area, upgrading of the Williams Bay WWTP, and construction of a new WWTP at Walworth to serve the west end planning area communities of Walworth and Fontana. The existing Fontana WWTP and Walworth WWTP would be abandoned. The facilities proposed for construction as the FPRA are described in the following paragraphs.

Collectors and Interceptors

For the FPRA, conventional gravity collection sewers are proposed, but not costed, for collection of wastewater in all unsewered areas of the RSSAs. Conventional gravity sewers were selected based on cost-effectiveness analyses presented in the facilities planning documents. Gravity collection sewers and interceptors consisting of gravity sewers, pumping stations and force mains are proposed. The interceptors were sized by the facilities planner for a 50-year design period.

Lake Geneva WWTP

The FPRA proposes to serve the City of Lake Geneva, the Lake Como Beach Subdivision, and the southeast shore of Geneva Lake. The WWTP would be designed to handle an average daily (summer) flow of 2.13 mgd, and a peak daily flow of 5.2 mgd. Following primary treatment, effluent would flow by gravity to a renovated trickling filter. The increased hydraulic capacity trickling filter will utilize 6-foot deep plastic media instead of the existing rock media. Trickling filter effluent will flow by gravity to a new secondary clarifier. One 70-foot diameter secondary clarifier will replace two existing clarifiers, because the existing units are too small and shallow and have mechanical and structural problems. Clarified secondary effluent will flow by gravity to the existing chlorine contact chamber, which will be converted into an effluent pump station.

A rapid infiltration treatment system will be located near the STH 50 and US 12 interchange. The infiltration system will consist of eight seepage cells which allow for resting thus permitting nitrification and denitrification to occur. This practice will minimize the impact of nitrates on groundwater. The design average dosing rate will be approximately 23 inches per week.

Walworth/Fontana WWTP

The Walworth/Fontana WWTP proposed under the FPRA would replace the existing Walworth and Fontana WWTPs, both of which would be decommissioned and abandoned. The proposed WWTP would serve the Village of Walworth, the Village of Fontana, and subdivisions along the southwest shore of Geneva Lake. The design capacity of the proposed WWTP would be 1.16 mgd.

A new oxidation ditch treatment system for Walworth and Fontana will comprise a new subregional treatment facility on the existing Walworth polishing lagoon site adjacent to Piscasaw Creek. Conveyance facilities will include upgrading the Fontana pump station; construction of a new force main conveying Fontana wastewater out of the Geneva Lake drainage basin; construction of an interceptor to convey Fontana wastewater from the drainage basin divide to the existing Walworth treatment plant site; replacement of Walworth's existing treatment facility with a metering station; and construction of an additional gravity interceptor paralleling Walworth's existing gravity outfall to convey combined Walworth and Fontana flows from the existing Walworth WWTP site to the new oxidation ditch WWTP site.

Following preliminary treatment, a dual oxidation ditch channel with intrachannel clarification and subsurface aeration will provide secondary treatment. Wastewater then will receive tertiary filtration using low head filters. Filtered effluent will receive ultraviolet (UV) disinfection and be discharged to Piscasaw Creek.

Williams Bay WWTP

A cost-effectiveness analysis performed by the facilities planner determined that Williams Bay would be better served with their own facilities. The Village of Williams Bay then withdrew from the Geneva Lake facilities planning effort, with the intent of submitting independent facilities planning documents at a later time. However, since Williams Bay is in the study area for this project, preliminary information developed by the Village's consultants (Robers and Boyd) and supplemented by the facilities planner (By letter, Alan L. Berg, Donohue and Assoc., Inc., to Mark B. Williams, WDNR, 3 November 1983) concerning construction of a new aerated lagoon WWTP for Williams Bay has been included in this EIS.

For this alternative, Williams Bay would construct a new 0.9 mgd aerated lagoon WWTP, with effluent treatment and disposal by rapid infiltration of the Village's existing seepage lagoons, which will be upgraded and expanded. Items to be constructed or expanded include: a new aeration lagoon with a liner, aeration equipment and structures, and miscellaneous electrical, mechanical, plumbing, and ventilation services.

The EIS Alternative

Evidence demonstrating an excessive number of failures of onsite systems and the resulting adverse effects of such failures within the planning area have not been presented. Contrary to this, the needs documentation information indicated that the number of failing onsite systems within the RSSAs is low, and documented evidence of surface water and groundwater pollution resulting from failing onsite systems is minimal. As a result, a third alternative (herein referred to as the EIS Alternative) has been developed for evaluation.

The EIS Alternative includes upgrading existing onsite systems with obvious and potential problems identified in the needs documentation process, and improved management of existing and future onsite systems in the area of the RSSAs not currently served by sewers; upgrading the Lake Geneva WWTP; construction of a new WWTP to serve Williams Bay; and construction of a new WWTP to serve the Villages of Walworth and Fontana. The service areas of the proposed WWTPs would include the year 2005 population expected for currently sewered portions of these communities only, and would not include expansion of sewers into currently unsewered areas.

Onsite Systems

Under the EIS Alternative, existing unsewered areas within the RSSAs would remain on onsite systems. Management districts would be formed to administer funds; inspect, design, and construct upgraded systems; ensure proper operation and maintenance of the systems; and monitor performance of systems. The management districts would likely use State funding for completing the necessary facilities planning and design work for construction grant application under NR 128.08. The EIS Alternative feasibility analysis and costs presented in this EIS are based on using a variety of sub-code systems. The sub-code systems appear justified within a management district because the district would have the resources to monitor performance of the systems and would have the authority to establish special rules concerning operation. Also, numerous sub-code systems have been operating satisfactorily, especially for seasonal residences, within the planning area without any demonstrably harmful effect on the environment. The district would arrange for the inspection, design, and construction of upgraded systems. Individual upgrades would be made in consultation with the property owner and the system design would be selected from a range of technical options.

Lake Geneva WWTP

The proposed WWTP facilities to serve the Lake Geneva RSSA would have a design capacity of 1.7 mgd. The WWTP facilities would be similar to those proposed for the FPRA, and would consists of upgrading the existing trickling filter facilities plus construction of new seepage cell facilities and a sludge storage lagoon at a new site located southeast of the STH 50 and US 12 interchange. Some treatment units would be smaller than those proposed for the FPRA since only 1.7 mgd of wastewater would be treated (daily average) instead of 2.1 mgd.

Walworth/Fontana WWTP

During conduct of the facilities planning efforts, the facilities planner investigated a second alternative for Walworth/Fontana, consisting of a new aerated lagoon WWTP followed by a rapid infiltration treatment system. The new WWTP would be located at the Donald Rambow farm or any other appropriate parcel on the southwest border of the Village of Walworth. The aerated lagoon system would consist of three cells designed to remove 80% of the influent BOD. Oxygen transfer within the aerated lagoon would be provided by positive displacement blowers and static tube aerators. A third, quiescent cell would be provided for effluent polishing. The quiescent cell also would serve as the dosing cell for the land application system. The aerated lagoons would be designed to produce an effluent containing less than 50 mg/l BOD.

All flow through the WWTP, from the force main discharge to the seepage cells, would be by gravity. Eight rapid infiltration seepage cells would be provided, to allow for alternate dosing and resting. This would enhance treatment and prolong the life of the system. Dosing and resting seepage cells would alternately saturate and drain the soil, creating anaerobic and aerobic conditions, respectively. This would allow both nitrification and denitrification to occur, which would minimize the effect of nitrates on groundwater. A system of observation wells also would be installed around the perimeter of the seepage cell system, to monitor groundwater quality.

The Rambow site was retained as a suggested site only for costing purposes; i.e., if facilities at the Rambow site are cost-effective, then facilities located in another area near the Village potentially would be cost-effective. If an aerated lagoon land application system does prove to be cost-effective, then further site evaluations could be undertaken to find an acceptable site near to or within the Village.

Williams Bay WWTP

For the EIS Alternative, a new Williams Bay aerated lagoon - rapid infiltration WWTP would be constructed, as proposed in the FPRA. The only difference is that a 0.7 mgd WWTP (average daily summer flow) would be built instead of a 0.9 mgd WWTP, due to the reduced flow from a smaller service area.

AFFECTED ENVIRONMENT

Natural Environment

The EIS presents information on the natural environment in the area including air quality, geology, soils, prime farmland, groundwater, surface water, as well as terrestrial and aquatic biota including wetlands. The major elements of the natural environment that will affect decisions concerning wastewater management alternatives are soils, groundwater, and surface water.

The soils in the study area exhibit considerable variability in composition and characteristics. The depth to water table and low soil permeability are the principal factors limiting the use of onsite systems. However, interpretation of soil properties in lakeshore subdivisions currently served by onsite systems indicates that relatively small portions of these areas present severe limitations to conventional or alternative soil absorption systems. These severe limitation areas are located primarily in undeveloped areas along water courses, in low areas or in nearby lakeshore areas.

Groundwater in the Geneva Lake - Lake Como study area is an important resource since it supplies 100% of the area drinking water. The groundwater aquifers are located in sandstone at depth and in unconsolidated sand and gravel glacial deposits. Groundwater within the study area is generally suitable for drinking water purposes and meets drinking water standards and criteria in almost all cases. Laboratory analysis of well water samples taken during a 1983 sanitary survey of unsewered areas showed no significant concentrations of nitrate-nitrogen in any well water samples taken and limited fecal coliform concentrations in only two instances. Groundwater monitoring data from existing land application facilities in the study area indicate that while the facilities are causing minor localized increases in constituents such as nitrates, these facilities should not limit any future uses of groundwater in the study area.

The surface waters of concern in this EIS are Geneva Lake, Lake Como, the White River, Piscasaw Creek, and many intermittent and perennial streams. The White River flows northeast out of Geneva Lake and joins the Fox River 12 miles from the study area. Below the Lake Geneva WWTP, the 7 day, 10 year low-flow is estimated to be 0.89 cfs. The existing design flow of the treatment plant is 1.7 cfs, so that under low-flow conditions approximately 52% of the streamflow is effluent, thus strongly influencing water quality.

Piscasaw Creek is an intermittent headwater stream that flows south along the western township line of the Town of Walworth. Channelization has reduced the quality of the creek due to reduced residence time and loss of flow to dilute wastewater effluent. WDNR (1981a) has reported that the 7 day, 10 year low-flow is approximately 0.70 cfs. Existing effluent discharges from the Walworth WWTP lagoons total approximately 0.22 cfs. Under the present wastewater management configuration, approximately 24% of the volume of Piscasaw Creek is WWTP effluent in the mixing zone below the plant.

Geneva Lake is a deep glacial lake with no major stream inflows. Recharge is through wetland drainage, groundwater inflow, direct precipitation and numerous small perennial and intermittent streams. Lake Geneva has been classified as a mesotrophic or moderately "enriched" lake. However, symptomatic evidence of water quality degradation has recently been present, leading to a concern that the lake may become eutrophic in the long term.

Lake Como is a shallow impounded wetland lake which has been classified as a highly eutrophic lake. Nutrient sources derive from the muck and peat sediments as well as surface runoff from agricultural lands in the watershed.

Manmade Environment

The EIS presents information on the manmade environment of the study area including land use, population, economic conditions, recreation and tourism, personal and government finances, and cultural resources. One of the most significant elements of the manmade enviornment that will affect decisions concerning wastewater management is the existing and projected populations of the various communities.

The Geneva Lake - Lake Como study area is an established recreational area with a population composed of permanent, seasonal, and transient residents. The US Bureau of the Census collects data only on the permanent residents although data is provided on both seasonal and permanent dwelling units. During the period from 1940 to 1970, population in the area grew at a much faster rate (84.9%) than the State (40.8%) and nation (53.8%). During the decade 1970 to 1980, the area only grew by 11.4%. Data on past trends in seasonal population are not available, however, 80,000 to 100,000 people are estimated to visit the area during the summer months. Base-year 1980 permanent and seasonal population estimates prepared for each of the RSSAs as part of this EIS are shown in Table 2.

Projections for both seasonal and permanent population have been prepared for the Geneva Lake-Lake Como Revised Sewer Service Areas for the year 2005. These projections are based on data assembled by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) for areas slightly larger than those currently being planned for. Design year 2005 peak (seasonal and permanent) population estimates prepared for the EIS for the RSSAs are shown in Table 3. Design year 2005 peak population estimates prepared by the facilities planners are shown in Table 4. Differences between the two estimates are attributable to a larger 1980 base year seasonal population in the EIS estimates and different assumptions on the

Table 2. Base-year population for the RSSAs in the Geneva Lake-Lake Como study area.

Area	Base-Year 1980 Permanent Population	Seasonal Population	Peak Population
063 Fontana			
RSSA	1,920	3,342	5,262
Sewered	1,688	2,856	4,544
Unsewered	232	486	718
066 Walworth			
RSSA	1,693	90	1,783
Sewered	1,555	84	1,639
Unsewered	138	6	144
067 Williams Bay			
RSSA	1,951	2,262	4,213
Sewered	1,759	1,911	3,670
Unsewered	192	351	543
908 Lake Como			
RSSA	1,379	1,344	2,723
Sewered	0	0	0
Unsewered	1,379	1,344	2,723
059 Lake Geneva			
RSSA	6,395	1,983	8,378
Sewered	6,049	1,431	7,480
Unsewered	346	552	898
Combined Total			
RSSA	13,338	9,021	22,359
Sewered	11,051	6,282	17,333
Unsewered	2,287	2,739	5,026

Table 3. Design-year population for the RSSAs in the Geneva Lake-Lake Como study area.

Area	Year 2005 Population	Population Change 1980-2005 Net	Population Change 1980-2005 Percentage
063 Fontana			
RSSA	6,346	1,084	20.6
Sewered	5,309	765	16.8
Unsewered	1,037	319	44.4
066 Walworth			
RSSA	2,618	835	46.8
Sewered	2,320	681	41.5
Unsewered	298	154	106.9
067 Williams Bay			
RSSA	5,862	1,649	39.1
Sewered	4,909	1,239	33.8
Unsewered	953	410	75.5
908 Lake Como			
RSSA	3,374	651	23.9
Sewered	0	0	0
Unsewered	3,374	651	23.9
059 Lake Geneva			
RSSA	13,029	4,651	55.5
Sewered	11,880	4,400	58.8
Unsewered	1,149	251	27.9
Totals			
RSSA	31,046	8,687	38.8
Sewered	24,418	7,085	40.9
Unsewered	6,628	1,602	31.9

Table 4. Donohue & Associates, Inc. population projections for 2005 (Donohue & Assoc., Inc. 1983b).

Area	2005 Population	
	Permanent	Seasonal[a]
063 Fontana RSSA	2,300	3,944
066 Walworth RSSA	2,207	2,207
067 Williams Bay RSSA	3,420	5,927
908 Lake Como RSSA	1,970	3,365
059 Lake Geneva RSSA	11,530	17,750

[a]Although Donohue lists this figure as seasonal, this is actually peak population.

use of SEWRPC projections by the facilities planners. The EIS concludes that SEWRPC projections for population growth for the period 1980 to 2005 "captures" both seasonal and permanent population. The facilities planning documents have added a 53% increase on top of the projections to accommodate what is believed to be needed for the seasonal population.

ENVIRONMENTAL CONSEQUENCES

The EIS discusses the construction, operational, and secondary environmental impacts associated with implementation of the wastewater management alternatives. It also presents mitigative measures that can be applied to reduce or eliminate the impacts identified.

Construction and Operational Impacts

Construction of either the FPRA or the EIS Alternative will have construction related impacts on elements of the environment. In general, excavation and construction of wastewater collection and conveyance lines in unsewered areas under the FPRA would have a greater short-term impact than would the EIS Alternative which calls for upgrading a limited number of onsite systems. Air quality impacts would derive from fugitive dust from site clearing, grading, excavating and related activities. Soils exposed during construction would be subject to accelerated erosion. Increased erosion resulting from construction could result in sedimentation including nutrient and other pollutant inputs to surface waters. Construction activities associated with components of either of the proposed alternatives would result in some impacts to wildlife and vegetation.

The construction of WWTPs and rapid infiltration treatment systems has the potential to irreversibly convert prime farmland to a developed land use. On the west end, the facilities planners, and subsequently the EIS Alternative, evaluated rapid infiltration on an 80 acre site on the southwest border of the Village of Walworth. This site is actively farmed, prime agricultural land on Class I-1 soils. This class of soils represent less than 1% of the most valuable soils in the State of Wisconsin. The farm is located in an A-1 exclusive agricultural use zoning district and the owners are participating in the state preferential tax assessment program. The adverse impacts that would occur from using this site for land application of wastewater would be significant and long term.

The operational impacts of greatest concern are the effects of WWTP effluent on surface and groundwaters. Under the FPRA, oxidation ditch WWTP effluent from the Walworth/Fontana plant would be discharged to Piscasaw Creek. Based on wasteload allocation studies prepared by WDNR effluent quality discharged from this facility would be sufficient to sustain full fish and aquatic life standards. Both the FPRA and the EIS Alternative proposed land application by rapid infiltration at the Lake Geneva WWTP and the EIS Alternative evaluates land application for the west end Walworth/ Fontana WWTP. These would result in the removal of WWTP effluent from

Piscasaw Creek and the White River. Removal of the effluent would upgrade the quality of these receiving waters in the short term but would reduce their productivity and low flow stabilization in the long term.

The principal impact of concern in land application of wastewater by rapid infiltration is nitrate-nitrogen concentrations in groundwater. The national primary drinking water standard for nitrate-nitrogen is 10 mg/l. Sampling data from three existing rapid infiltration facilities in the Geneva Lake study area indicate that these facilities may cause minor changes in localized concentration of nitrates, however, they are minor in degree and well below drinking water standards. None of the alternatives are expected to result in any restrictions in current uses of groundwater in the study area.

Fiscal Impacts

The costs of implementing a wastewater management alternative in the study area could be apportioned between USEPA, the State of Wisconsin and local residents. Apportionment of the costs are made on the basis of what costs are eligible to be funded by the State of Wisconsin or USEPA. Because of their position on the State priority list, it is likely that the City of Lake Geneva will receive Federal Construction Grants funding for upgrading their wastewater treatment facilities, including 85% funding for portions of their plan that are "alternative or innovative." In the other communities, application would need to be made under the Wisconsin Fund which provides grants for up to 60% of the eligible costs.

Even with State or Federal grants, the wastewater management alternatives could have an adverse financial impact on community residents, as measured by their ability to afford the estimated average annual user costs. The capital costs of the alternatives also could have a significant negative impact on the financial conditions of some of the individual communities. The financial burden incurred could limit the ability of those communities to engage in other capital improvement projects and potentially could impact their ability to provide other public services.

Secondary Impacts

Secondary impacts are likely to occur when improvements in wastewater treatment capacity and capability lead to changes in the study area that, in turn, induce or stimulate other developments which would not have taken place in the absence of a project. One of the more significant factors influencing the development potential of an area is the presence or absence of centralized wastewater collection and treatment systems. In some situations, improvements in wastewater treatment capacity and capability can induce, or stimulate, growth that would not have occurred without the improvements. It is not clear at this time whether the development potential of the study area is directly related to the presence or absence of centralized wastewater collection and treatment systems. However, the population of the East Planning area used in the design of the FPRA is projected to increase by 90.2% between 1980 and 2005, from 11,101 to 21,115. The population analysis developed for the EIS, however, differs substantially from the FPRA, for the East Planning area. The EIS projects a population increase of 47.8%, from 11,101 to 16,405. There is some question whether the projections on which the FPRA is based would be realized. However, the potential would exist to "induce" population growth to these levels by providing wastewater treatment capacity as proposed by the FPRA. For the West Planning area, induced growth effects are expected to be minimal because the communities have projected small population increases.

Both the FPRA and the EIS Alternative will result in increased residential development with attendant additions in impervious surface area, storm sewers, and drainage ditches. The degree of impact on water quality in the study area will vary based on the amount and density of residential development that occurs. The EIS shows that a large concentration of residential growth will occur in the Lake Geneva RSSA under the FPRA, including the southeast shore of Geneva Lake. The water quality impact of this growth is anticipated to be substantial. The new growth would be concentrated closer to the lake at higher residential densities permitted on sewered lots and would introduce biologically available nutrients to the lake.

CONCLUSION

The EIS reviews in detail the existing information about the natural and manmade environment in the Geneva Lake-Lake Como study area that is useful in evaluating wastewater management alternatives. Shallow depth to water table and limited permeability may restrict some future use of soils for onsite treatment of wastewater, however, there are currently only a limited number of systems that are known to be malfunctioning. A review of surface and groundwater data from wells in the area shows almost no indication of contamination from onsite systems.

After evaluating the information presented in this EIS, the EPA has developed recommendations for wastewater management in the planning area. The WDNR does not make recommendations, and the recommendations contained in this final EIS should not be interpreted as representing the views of the WDNR.

The EIS has analyzed two principal alternatives for wastewater management in the RSSAs including the Facilities Plan Recommended Alternative and the EIS Alternative. For the unsewered areas within the RSSAs (and outside the RSSAs), USEPA recommends establishment of management districts for upgrading and operating the onsite systems. Because no Federal funds would be expended for collection system extensions, sewer extensions into unsewered areas would be a local option for area residents.

For the East Planning area, USEPA recommends that Lake Geneva construct a WWTP of 1.7 mgd to accommodate the projected flows from the city only. If the city elects to construct a larger WWTP, the USEPA would consider the additional capacity ineligible for a Federal grant. The improvements will consist of upgrading and constructing some new units at the existing WWTP and constructing a land application facility using rapid infiltration basins at the southeast intersection of US 12 and State Route 50 in the Town of Lyons.

For the West Planning area, USEPA concurs with the recommendation that Williams Bay pursue further facilities planning independently. The existing WWTP may be upgraded or replaced and the existing seepage basins would be upgraded and expanded to accommodate the additional flow and to improve operations. For Walworth and Fontana, USEPA defers to the local recommendation that a surface water discharge facility be constructed at the site of the existing Walworth polishing lagoons because Federal funds are not proposed for construction of the facilities. An oxidation ditch with intrachannel clarifiers followed by sand filters would be constructed. The Fontana WWTP will be phased out and the flows pumped to Walworth.

GENEVA LAKE-LAKE COMO ENVIRONMENTAL STATEMENT
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LIST OF APPENDICIES

1.0. PURPOSE OF AND NEED FOR ACTION

1.1. Project History

The study area addressed in this Environmental Impact Statement (EIS) is located in the southeast corner of Wisconsin, approximately 50 miles southwest of Milwaukee and 75 miles northwest of Chicago (Figure 1-1). The study area encompasses approximately 44 square miles in the southern portion of Walworth County, and includes the City of Lake Geneva, the Villages of Walworth, Fontana, and Williams Bay, the Towns of Geneva, Linn and Walworth, as well as minor portions of the Towns of Bloomfield, Delavan, and Lyons. This part of Walworth County is located just south of the Kettle Moraine area and is characterized by steep, hummocky, moraine ridges that trend in a northeast-southwest direction reflecting glacial deposition over a preglacial bedrock valley. The locale is very popular as a summer resort area because of the recreational resources afforded by the 5,000-acre Geneva Lake and the 1,000-acre Lake Como, and their proximity to both Chicago and Milwaukee.

In May 1974, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) adopted A Regional Sanitary Sewerage System Plan for Southeastern Wisconsin (Planning Report 30). This document was prepared in accordance with Section 66.945(10) of the Wisconsin Statutes and Section 208 of the Clean Water Act, and provides guidance on wastewater management planning to the local units of government located in SEWRPC's seven-county region. Recommended sewer service areas (SSA) were delineated in the plan and are subject to revision at the local level. Five SSAs were located in the Geneva Lake-Lake Como study area (Figure 1-2). Based on a cost-effectiveness analysis, Donohue & Assoc., Inc. (1981a) revised the boundaries of the five SSAs during the course of facilities planning and the preparation of this EIS. These five revised sewer service areas (RSSAs) are the areas for which the wastewater collection and treatment facilities are presently being planned (Figure 1-3).

Currently, four municipal and three private wastewater treatment plants (WWTPs) serve the existing sewered areas within the study area. Municipal WWTPs are located at Fontana, Lake Geneva, Walworth, and Williams Bay.

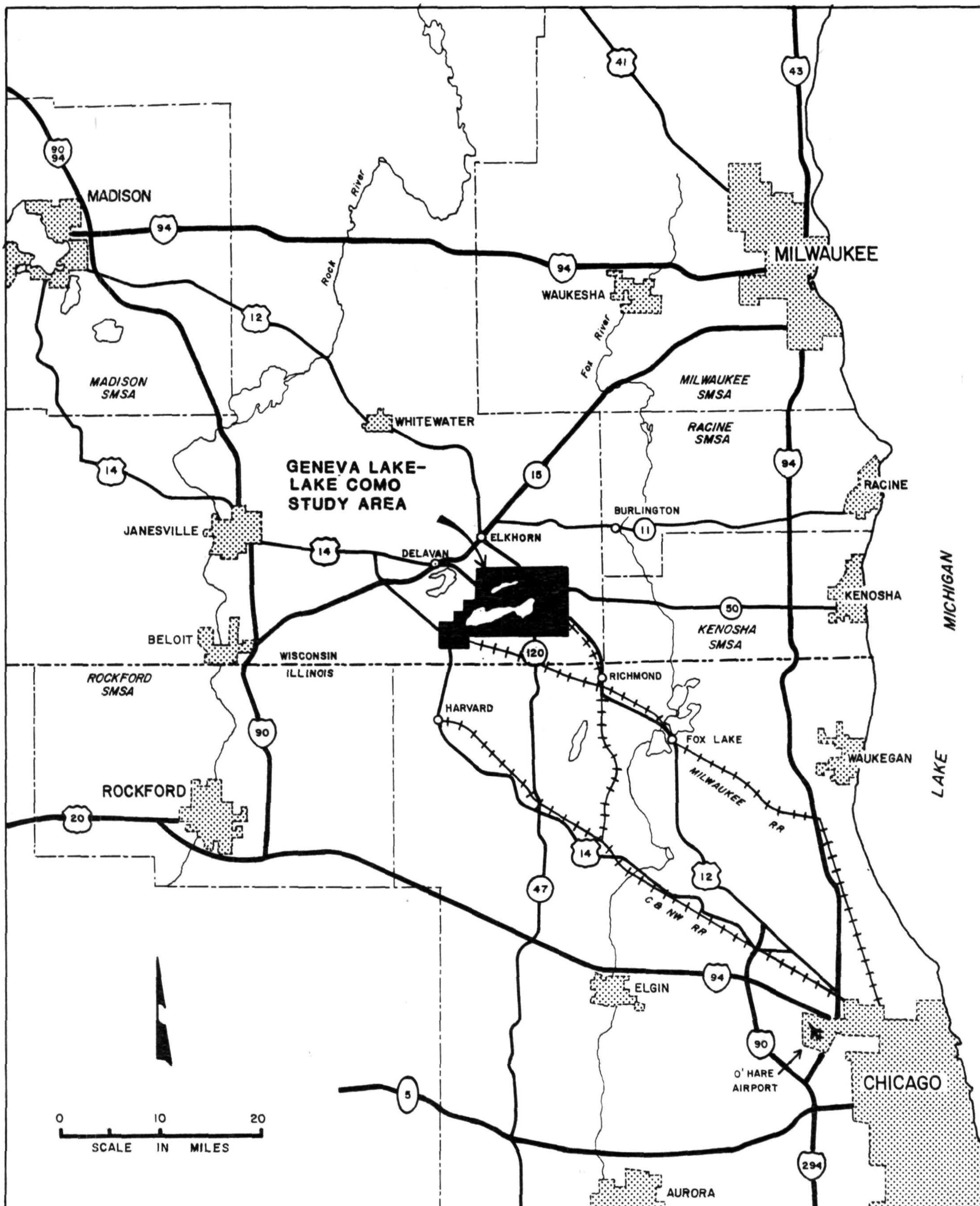


Figure 1-1. Geneva Lake-Lake Como regional location map.

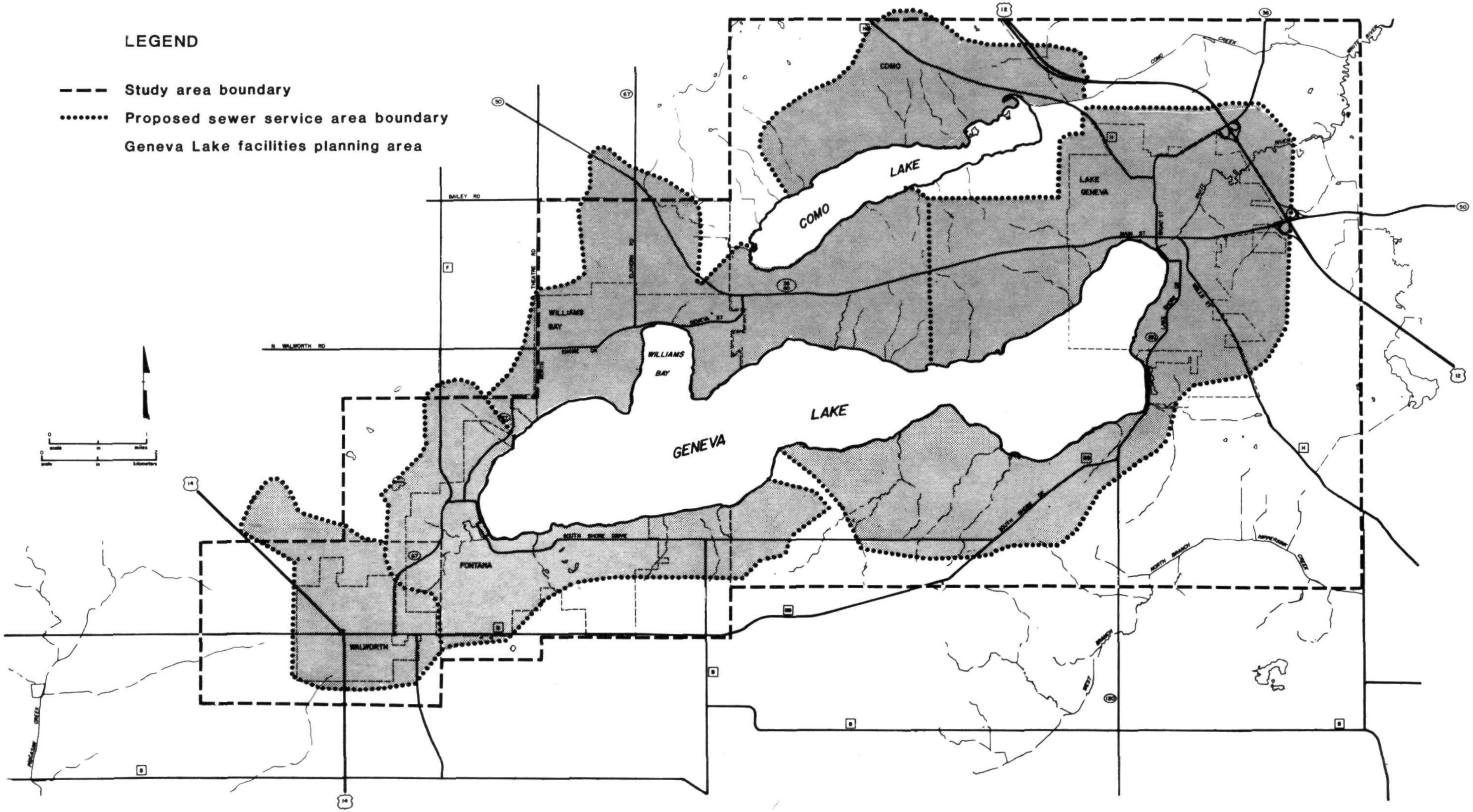


Figure 1-2. Geneva Lake-Lake Como sewer service area.

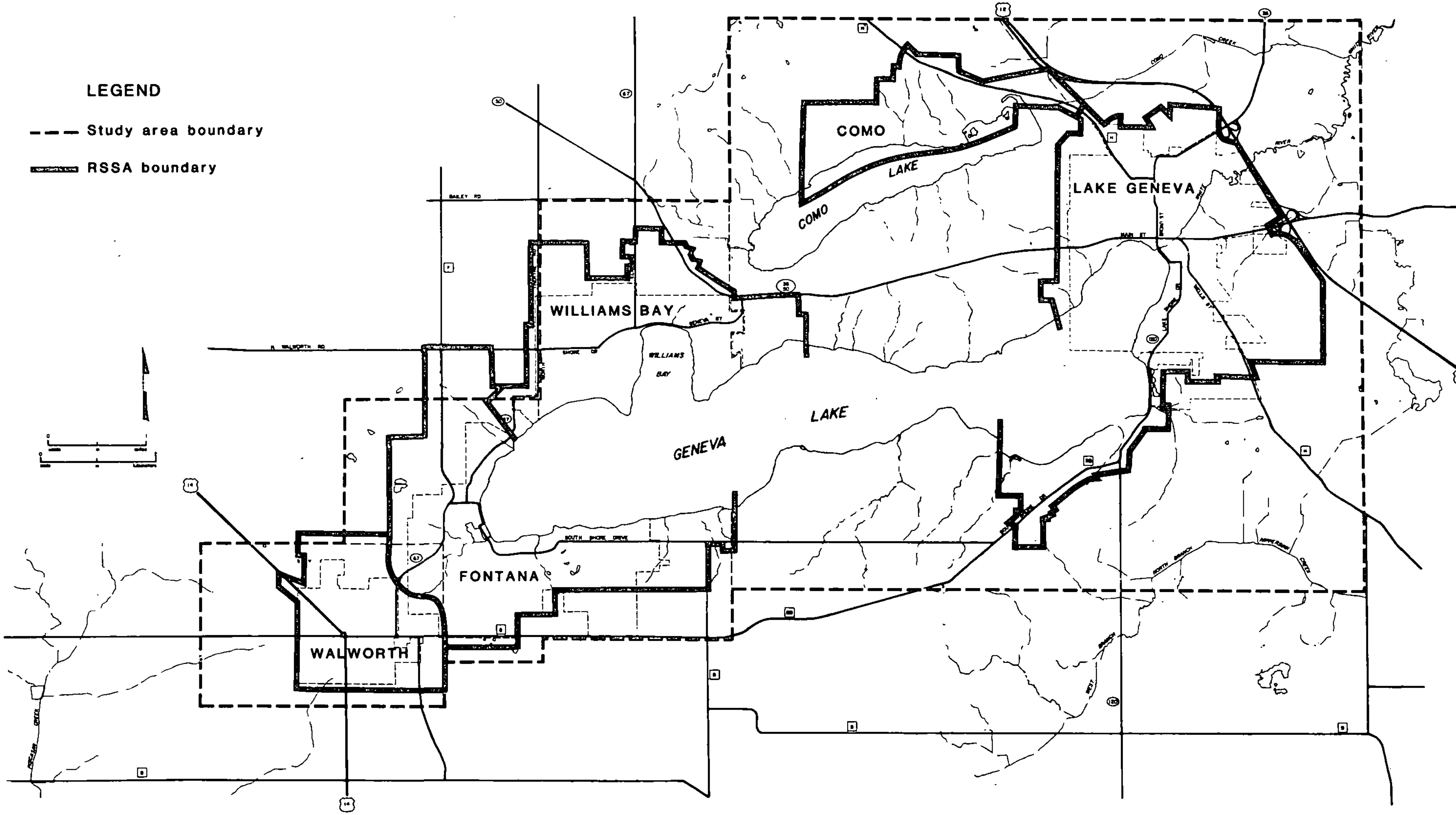


Figure 1-3. Geneva Lake-Lake Como revised sewer service area.

The Fontana plant consists of two treatment trains with a combined daily capacity of 0.9 million gallons per day (mgd); a 25-year old trickling filter with primary and secondary clarification units; and a 10-year old activated sludge plant. The effluent from these two trains is combined, chlorinated and discharged to three seepage lagoons. The City of Lake Geneva operates a 1.1-mgd facility with primary clarifiers and two parallel trickling filter/final clarifiers. This WWTP discharges effluent of secondary treatment quality to the White River. The Village of Walworth constructed a 0.15-mgd trickling filter in 1952 and added two polishing lagoons in 1965. Effluent flows from the trickling filter a distance of 2.8 miles to the lagoons and is then discharged to a drainage ditch leading to Piscasaw Creek, a tributary of the Rock River. The Village of Williams Bay operates a 0.8-mgd activated sludge treatment plant built in 1931 and rebuilt in 1968. Final effluent is directed to one of two seepage lagoons for disposal.

Private WWTPs serve the Americana Hotel (formerly the Playboy Club), Interlaken Resort, and Kikkoman Foods. The Americana Hotel is located east of Route 12 and the City of Lake Geneva. Its 0.4-mgd WWTP is a contact stabilization-type activated sludge compact plant with chlorination and polishing lagoons and discharges to the White River. The Interlaken Resort is located on the southwestern tip of Lake Como and although listed as a municipal plant, it serves only the resort. This 0.125-mgd WWTP is a contact stabilization-type activated sludge compact plant with tertiary sand filters and discharges to two onsite seepage cells. The Kikkoman Foods soy sauce manufacturing facility and treatment plant are located approximately three miles northwest of the Village of Walworth. The 0.25-mgd WWTP has an aerated equalization basin preceding the contact stabilization package units. This WWTP discharges to two onsite seepage beds. Kikkoman Foods will continue to utilize the existing seepage cells for disposal of noncontract cooling waters, and have decided to dispose of sanitary and process wastewaters to the Walworth/Fontana Wastewater Treatment Plant. Alternatives for treatment and disposal of sanitary or process waste streams from Kikkoman Foods were not extensively evaluated by this EIS. These three private plants are located outside the RSSAs and the flows are not included in alternatives considered herein.

Several factors have led to consideration of a regional wastewater management plan for the Geneva Lake-Lake Como study area. In Fontana, before the third lagoon was constructed, effluent from the original two seepage lagoons had overflowed into Buena Vista Creek due to increases in wastewater flows and reduction of infiltration capacity in the seepage lagoons over time. The City of Lake Geneva WWTP is currently meeting its interim effluent standards, however, the Wisconsin Department of Natural Resources (WDNR) has issued more strict effluent discharge standards which the existing plant cannot meet. The Walworth WWTP, which is exceeding its hydraulic design capacity, is meeting interim standards but is incapable of meeting final standards. The Williams Bay plant has components that are in poor condition and is experiencing hydraulic problems in both its primary and secondary clarifiers. All of these plants have experienced hydraulic increases in recent years due to population increases; a trend that will continue into the next 20 years. For more detail on the existing wastewater treatment facilities and water quality problems see Section 2.1.

The facilities planning documents propose to serve portions of the study area with centralized wastewater collection and treatment facilities that are currently served by onsite wastewater treatment systems. These existing onsite systems include single tank cesspools, holding tanks, septic tanks with dry wells, and septic tanks with various forms of soil absorption systems. Geologic conditions on some parcels in the study area present limitations to the use of onsite wastewater treatment systems. The shallow depth to the seasonal high water table on some parcels limits the effectiveness of some onsite systems and on many lots poses constraints to development. Concern that onsite systems may be contaminating surface and groundwater resources has led some homeowner and beach associations to construct centralized domestic water supplies. For more details concerning onsite system problems see Section 2.2.

Until the 1960s, public control over the installation of onsite wastewater treatment systems was nonexistent or only advisory. During the 1960s and 1970s, the State government and local health departments formulated and implemented procedures for preconstruction approval of onsite systems. The design and construction of onsite wastewater treatment systems is now regulated in Wisconsin by Chapter ILHR 83 of the Wisconsin Administrative Code. These procedures and design standards are administered by the Department of Industry, Labor, and Human Relations at the State level and by the Walworth County Planning, Zoning and Sanitation Office at the county level.

Because of the perceived problems associated with existing wastewater management, the USEPA awarded Step 1 planning grants to the Village of Walworth, the City of Lake Geneva, the Village of Fontana, and the Village of Williams Bay between February and July of 1977. Although separate planning grants were awarded, special conditions of the grants stipulated that facilities planning efforts be coordinated, and that areawide solutions to wastewater management be jointly investigated. Facilities planning for the four communities was initiated during the summer of 1977. Tasks completed under the initial grants included preparation of the following:

- Infiltration/Inflow (I/I) analyses for Fontana (Donohue & Assoc., Inc. 1978d), Lake Geneva (Donohue & Assoc., Inc. 1978b), Walworth (Donohue & Assoc., Inc. 1978), and Williams Bay (Donohue & Assoc., Inc. 1978c)

- Sewer System Evaluation Survey (SSES) for Fontana (Donohue & Assoc., Inc. 1980a)

- Combined facilities plan for Fontana, Lake Geneva, Walworth, and Williams Bay (Donohue & Assoc., Inc. 1978a).

The facilities plan prepared by the Jensen and Johnson Division of Donohue & Assoc., Inc. (1978a) outlined immediate needs for existing wastewater collection and treatment facilities, provided data on problems associated with onsite wastewater treatment systems, and identified environmental resources that could be affected by various wastewater management actions for the entire SSAs. The combined facilities plan concluded that two regional plants, one at Walworth and one at Lake Geneva, were the most cost-effective, environmentally sound wastewater management plan for the study area.

In February of 1978, USEPA issued a Notice of Intent to prepare an EIS on the proposed project. This action was taken based upon USEPA's review of the facilities plan, which indicated the possibility of significant environmental impacts resulting from the proposed project. The Wisconsin Department of Natural Resources (WDNR) concurred with the USEPA decision to prepare an EIS, and the two agencies agreed to prepare a joint EIS to satisfy both Federal and State requirements. The EIS was to be prepared concurrently with the completion of the facilities planning documents. WAPORA, Inc. (EIS consultant to USEPA) prepared a preliminary plan of study for preparation of the EIS in September 1978.

Tasks necessary to complete the facilities plan were identified at several meetings between Donohue & Assoc., Inc., WDNR, USEPA, the grant applicants and WAPORA, Inc. in 1978 and 1979. These tasks were incorporated into engineering agreements calling for expanded facilities planning. Following approval of the engineering agreements by all six participating local governments, the lead communities, Lake Geneva and Walworth, executed Step 1 facilities planning grant amendments for the remaining facilities planning effort. The grant amendments were approved by USEPA in June 1980.

Pursuant to the grant amendments, the facilities planners subsequently submitted the following documents to WDNR for review:

- Preliminary Geneva Lake Facilities Plans, Volume 2 - Treatment Alternatives, East Planning Area (Donohue & Assoc., Inc. 1981a)

- Preliminary Geneva Lake Facilities Plans, Volume 2 - Treatment Alternatives, West Planning Area (Donohue & Assoc., Inc. 1981b)

- Addendum to the West Geneva Lake Facilities Plans, Volume 2 (Donohue & Assoc., Inc. 1982a)

- Geneva Lake Facilities Plans, Volume 2 - Process Specific Addendum, East Planning Area (Donohue & Assoc., Inc. 1982b)

- Final Draft Geneva Lake Facilities Plans, Volume 2 - Treatment Alternatives, West Planning Area (Donohue & Assoc., Inc. 1983a).

- Addendum 1 to Volume 2 - Facilities Plans for the Lake Geneva West Planning Area - Walworth/Fontana (Donohue & Assoc., Inc. 1983b).

1.2. Legal Basis for Action and Project Need

The National Environmental Policy Act of 1969 (NEPA) requires a Federal agency to prepare an EIS on "...major Federal actions significantly affecting the quality of the human environment..." In addition, the Council on Environmental Quality (CEQ) has established regulations (40 CFR Part 1500-1508) to guide Federal agencies in determinations of whether Federal funds or Federal approvals would result in a project that would significantly affect the environment. USEPA has developed its own regulations (40 CFR Part 6) for the implementation of the NEPA review. As noted above, USEPA Region V has determined that, pursuant to these regulations, an EIS was required for the Geneva Lake-Lake Como study area.

The State of Wisconsin has a similar statute, the Wisconsin Environmental Policy Act (WEPA, Section 1.11), which is patterned after NEPA. Under WEPA, State agencies must consider the environmental implications of all their proposals. Before proceeding with any major action that would significantly affect the quality of the human environment, State agencies must prepare a detailed statement concerning the environmental effects of the proposed action. The regulations governing the preparation of a State EIS are set forth in Chapter NR 150 of the Wisconsin Administrative Code. If a proposed project includes both Federal and State involvement and has potential significant environmental impacts, a joint EIS can be prepared by the State and lead Federal agency to satisfy the requirements of both NEPA and WEPA. A memorandum of agreement was signed between USEPA and WDNR in 1980 as joint lead agencies in preparing a joint USEPA/WDNR Environmental Impact Statement.

The Federal Water Pollution Control Act of 1972 (FWPCA, Public Law 92-500), as amended in 1977 by the Clean Water Act (CWA, Public Law 95-217) and as amended in 1981 by the Municipal Wastewater Treatment Construction Grant Amendments of 1981 (Public Law 92-217) established a uniform, nationwide water pollution control program according to which all state water quality programs operate. WDNR has been delegated the responsibility and authority to administer this program in Wisconsin, subject to the approval of USEPA.

Federal funding for wastewater treatment projects is provided under Section 201 of the FWPCA. The USEPA will fund 75% of the grant eligible costs for conventional collection and treatment facilities for grant awards made prior to 1 October 1984. For grants awarded after 1 October 1984, Federal participation will be for 55% of all grant eligible costs. For alternative collection systems and treatment systems (e.g. pressure sewers, septic tank effluent sewers, septic tanks, and soil absorption systems), the funding level is 85% of the eligible costs for grant awards made prior to 1 October 1984 and is 75% of all eligible costs for grants made after 1 October 1984. After 1 October 1984, the conventional sewer costs for which USEPA will not provide funding assistance are collection sewers land and easement costs, sewer laterals located in the street or in easements required to connect house laterals with the sewer main, and house laterals for connection to the system. Alternative system components for which USEPA will not assist in funding are easement costs and house laterals for connection to an onsite pumping or treatment system. Grant eligibility of the onsite portions of alternative systems varies depending on their ownership and management. Privately owned systems constructed after 27 December 1977 are not eligible for Federal grants. Grants of up to 60% of the eligible costs of a pollution abatement program are potentially available from the Wisconsin Fund, a state program designed to assist in financing pollution abatement projects, when the pollution abatement programs meet Federal and state grant requirements but do not rank high enough on the Federal priority list to receive Federal funding.

The dispersal of Federal funds to local applicants is made via the Municipal Wastewater Treatment Works Construction Grants Program administered by USEPA. The Municipal Wastewater Treatment Construction Grants Amendments of 1981 became law (Public Law 97-217) on 29 December 1981, and significantly changed the procedural and administrative aspects of the municipal construction grants program. The changes reflected in these amendments have been incorporated into EPA's manual Construction Grants - 1982 (CG-82) Municipal Wastewater Treatment (USEPA 1982a). Under the 1981 Amendments, separate Federal grants are no longer provided for facilities planning and design of projects. However, the previous designation of these activities as Step 1, facilities planning, and Step 2, design, are retained in CG-82. The term Step 3 grant refers to the project for which grant assistance will be awarded. The Step 3 grant assistance will include an allowance for planning (Step 1) and design (Step 2) activities. Prior to the amendments of 1981, the program consisted of a three-step process: Step 1 included wastewater facilities planning; Step 2, the preparation of detailed engineering plans and specifications; and Step 3, construction of the pollution control system.

The CG-82 states that projects which received Step 1 or Step 2 grants prior to the enactment of the 1981 amendments should be completed in accordance with terms and conditions of their grant agreement. Step 3 grant assistance includes a design allowance for those projects which received a Step 1 grant prior to 29 December 1981. A municipality may be eligible, however, to receive an advance of the allowance for planning or design if the population of the community is under 25,000 and the State reviewing agency (WDNR) determines that the municipality would be unable to complete the facilities planning and design to qualify for grant assistance (Step 3). Communities in the Geneva Lake-Lake Como study area are still in the Step 1 phase of the grant application process, although the City of Lake Geneva is proceeding with Step 2 work.

Communities also may choose to construct wastewater treatment facilities without financial support from the State or Federal governments. In such cases, the only State and Federal requirements that apply are that the design be technically sound and that the WDNR be satisfied that the facility will meet discharge standards. In addition, WDNR requires that the facilities planning requirements be satisfied; specifically, cost-effectiveness analysis and environmental assessment. These would be reviewed on a case-by-case basis by WDNR (By telephone, Mark Williams, WDNR, 1 August 1983). Any applicable local ordinances would still have to be met.

If a community chooses to construct a wastewater collection and treatment system with USEPA grant assistance, the project must meet all requirements of the Grants Program. The CWA stresses that the most cost-effective alternative be identified and selected. USEPA defines the cost-effective alternative as the one that will result in minimum total resource costs over the life of the project, as well as meet Federal, state, and local requirements. Non-monetary costs also must be considered, including social and environmental factors. The most cost-effective alternative is not necessarily the lowest cost alternative. The analysis for choosing the most cost-effective alternative is based on both capital costs and operation and maintenance costs for a 20-year period, although only capital costs are funded. Selection of the most cost-effective alternative must also consider social and environmental implications of the alternative. An alternative that has low monetary costs but significant environmental impacts may not be preferred over an alternative with higher monetary costs but lesser social and environmental impacts.

Wisconsin was required by the Federal Clean Water Act (PL 92-500) to establish water quality standards for lakes and streams, and to establish effluent standards for the discharge of pollutants to those lakes and streams. Federal law stipulates that, at a minimum, discharges must meet secondary treatment requirements. In some cases, even more strict effluent standards are recommended by WDNR and are subject to USEPA approval and conformance to Federal guidelines.

All wastewater treatment facilities are subject to requirements of Section 402 of the Clean Water Act, which established the National Pollutant Discharge Elimination System (NPDES) permit program. Under NPDES regulations, all wastewater discharges to surface waters require an NPDES permit and must meet the effluent standards identified in the permit. The USEPA has delegated the authority to establish effluent standards and to issue discharge permits to the WDNR. The USEPA, however, maintains review authority. The WDNR issues permits under the Wisconsin Pollutant Discharge Elimination System (WPDES) program which encompasses the requirements of the Federal program. Any permit proposed for issuance may be subjected to a state hearing, if requested by another agency, the applicant, or other groups and individuals. A hearing on a WPDES permit provides the public with the opportunity to comment on a proposed discharge, including the location of the discharge and the level of treatment.

1.3. Study Process and Public Participation

In the Geneva Lake/Lake Como study area, participants in the wastewater planning process during the past six years have included: the City of Lake Geneva, the Villages of Fontana, Walworth, and Williams Bay, the Towns of Geneva and Linn (grantees), the State of Wisconsin, USEPA, Donohue & Assoc., Inc. (facilities planners), Robers and Boyd (consultants to Williams Bay), WAPORA, Inc. (EIS consultant), and other Federal, State, local, and private agencies and organizations. A policy advisory committee composed of local officials, and a citizens advisory committee composed of local residents were developed for this project. These committees and the local news media have been active throughout the project. A public hearing was held on 26 August 1981 to present the Geneva Lake East Planning Area recommended plan. A public hearing on the Geneva Lake West Planning Area was held on 27 October 1981. USEPA and WDNR conducted a public hearing on the Draft Environmental Impact Statement on 9 February 1984.

Major work efforts in the preparation of this EIS took place during 1979 and 1980 and resulted in the preparation of an Affected Environment Report (modified as Chapter 3) in November 1980, additional field work in late summer of 1982, and preparation of the Draft EIS in 1983. The Final EIS was prepared in 1984.

1.4. Issues

On the basis of USEPA's Notice of Intent to prepare an EIS, the Directive of Work to WAPORA, Inc. (including modifications), and the Facilities Plan, the following issues have been determined to be significant and are addressed in this EIS:

- The likelihood that effects of constructing new interceptors and wastewater treatment capacity would artificially induce more residential development in the study area than would otherwise be anticipated to occur
- Secondary impacts of such development on agricultural lands and existing open space areas

- Impacts of the project on wetland resources in the study area
- Economic impacts that could result in the displacement of homeowners
- Potential impacts resulting in a shift from seasonal to permanent occupancy
- Controversy surrounding the regional approach to wastewater management planning
- Extent of present problems resulting from use of onsite wastewater treatment systems
- Future impacts resulting from continued use of onsite systems
- Cost-effectiveness of upgrading existing onsite systems versus expanding centralized wastewater collection and treatment facilities.

2.0. DESCRIPTION AND EVALUATION OF PROJECT ALTERNATIVES

This chapter describes and evaluates alternative methods for collecting, treating, and disposing of wastewaters generated within the Geneva Lake Revised Sewer Service Areas (RSSAs). This chapter begins with a description of centralized wastewater collection and treatment systems currently operating within the RSSAs (Section 2.1.). A description of existing onsite wastewater treatment systems currently used in the RSSAs and information documenting the extent of public health and pollution problems caused by use of these onsite systems also is provided (Section 2.2.). Sections 2.3. through 2.6. contain project planning and design information for the RSSAs, and describe alternatives available (both centralized and onsite) for continued wastewater management throughout the planning period. The chapter concludes with an evaluation of the costs, reliability, flexibility, implementability, and acceptability of the various alternatives developed for the RSSAs (Section 2.5.).

2.1. Existing Centralized Wastewater Conveyance and Treatment Systems

Four municipal wastewater treatment plants (WWTP) are located within the Revised Sewer Service Areas. These WWTPs serve the City of Lake Geneva, the Village of Williams Bay, the Village of Fontana, and the Village of Walworth. Associated with each of these WWTPs is a centralized sewage conveyance system which collects wastewater and conveys it to the WWTP. Three private WWTPs (Interlaken Resort, Americana Hotel, and Kikkoman Foods) are located outside of the RSSAs. The facilities serving Interlaken Resort and Americana Hotel will remain in operation as private systems. Kikkoman Foods will discharge its sanitary wastewater and process wastewater to the Walworth/Fontana Wastewater Treatment Plant, but will continue to operate their existing seepage cells for the disposal of noncontract cooling water. The location of each WWTP is shown in Figure 2-1. Detailed descriptions of major treatment units at each WWTP are contained in the Facilities Plan Volume 1, prepared by Donohue & Assoc., Inc. (1978a), and in the various Infiltration/Inflow analysis reports prepared for the respective municipalities. A brief description of each wastewater conveyance and treatment system (based upon information presented in vari-

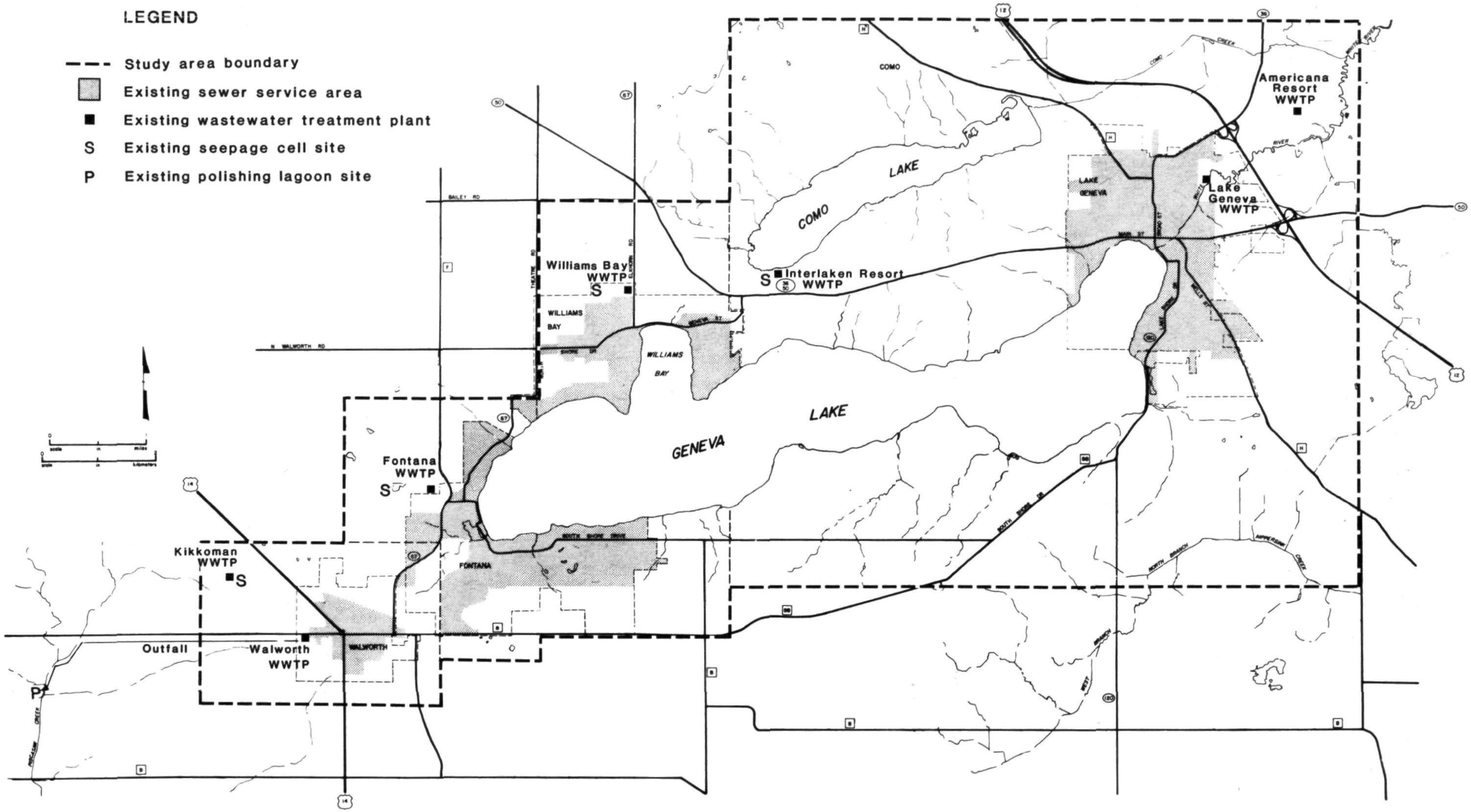


Figure 2-1. Location of municipal and private WWTPs in the vicinity of Geneva Lake.

ous facilities planning documents, observations made during a site inspection of each WWTP in August 1979, and recent telephone interviews with WWTP operators and/or the WDNR) is presented below.

2.1.1. City of Lake Geneva

Conveyance Systems

The City of Lake Geneva is served by separate storm and sanitary sewer systems. The sanitary sewer system consists of approximately 153,120 feet of gravity sewer ranging in size from six inches to 21 inches in diameter, and contains approximately 12,400 feet of four-inch, six-inch, and eight-inch diameter force mains. The sanitary sewer system contains eight lift stations owned by the City and one privately owned lift station. Sanitary sewers were first installed in 1890 in the downtown area of the City. Sanitary sewers currently serving Lake Geneva are constructed of vitrified clay, concrete, and asbestos cement pipe (Donohue & Assoc., Inc. 1978b).

A separate storm sewer system conveys surface runoff to Geneva Lake and to the White River. In some areas, the lack of adequate storm drainage facilities causes periodic street flooding. The City of Lake Geneva is planning to alleviate the flooding problem in the near future as part of their continued storm sewer development program (Donohue & Assoc., Inc. 1978a). There are no known cross connections between the sanitary and storm sewer systems.

The City of Lake Geneva currently has a sewer use ordinance which prohibits discharge of clearwater (e.g., storm water) into the sanitary sewer system. An infiltration/inflow (I/I) analysis was conducted by the City's engineers, Donohue & Assoc., Inc., to determine if excessive amounts of extraneous clearwater (e.g., rainwater seeping through the ground, or stormwater leaking out of storm sewers) were entering the sanitary sewers through broken pipes, loose joints, or illegal sewer connections. Excessive I/I is defined as that amount of extraneous water that can be removed from the sewer system (e.g., by repairing the leaks or plugging the illegal connections) for less cost than that required to treat the I/I at the WWTP.

The I/I analysis, which concluded that the Lake Geneva sanitary sewer system is not subject to excessive I/I as defined by current USEPA guidelines, was approved by the WDNR on 25 August 1976.

Treatment System

The City of Lake Geneva owns and operates the Lake Geneva WWTP located along the White River at a site in the northeastern portion of the City. The WWTP was initially constructed in 1930 as a trickling filter treatment facility and was extensively modified in 1966. Disinfection and phosphorus removal facilities were added in 1977. Present average design capacity of the plant is 1.1 million gallons per day (mgd).

All wastewater from the City flows to the WWTP through a 21-inch diameter gravity sewer (Figure 2-2). Wastewater entering the WWTP is first comminuted and then pumped to aerated grit removal facilities. Following grit removal, the wastewater flows through two primary clarifiers. Effluent from the primary clarifiers is next directed to two parallel treatment trains, each containing one trickling filter and one final (secondary) clarifier. Final clarified effluent is either recirculated through the treatment process or lifted to the chlorine contact chamber. Effluent then is disinfected by chlorination in the chlorine contact chamber and discharged through a short outfall sewer to the White River. Alum and polymers are added at various locations in the treatment system to achieve phosphorus removal. Primary and secondary sludge is stabilized by a single-stage anaerobic digester. WDNR permits call for digested liquid sludge to be hauled to agricultural lands in the area for land application.

WWTP Operating Data

The Lake Geneva WWTP was inspected by WAPORA, Inc. on 29 August 1979. All treatment units generally were operating satisfactorily on the day of inspection. The WWTP effluent characteristics for 1981 and 1982 are listed in Table 2-1. Current (interim) WPDES permit limitations for the WWTP (until 1985) are listed in Table 2-2. Effluent BOD, suspended solids, and pH concentrations generally met requirements of the current WPDES permit

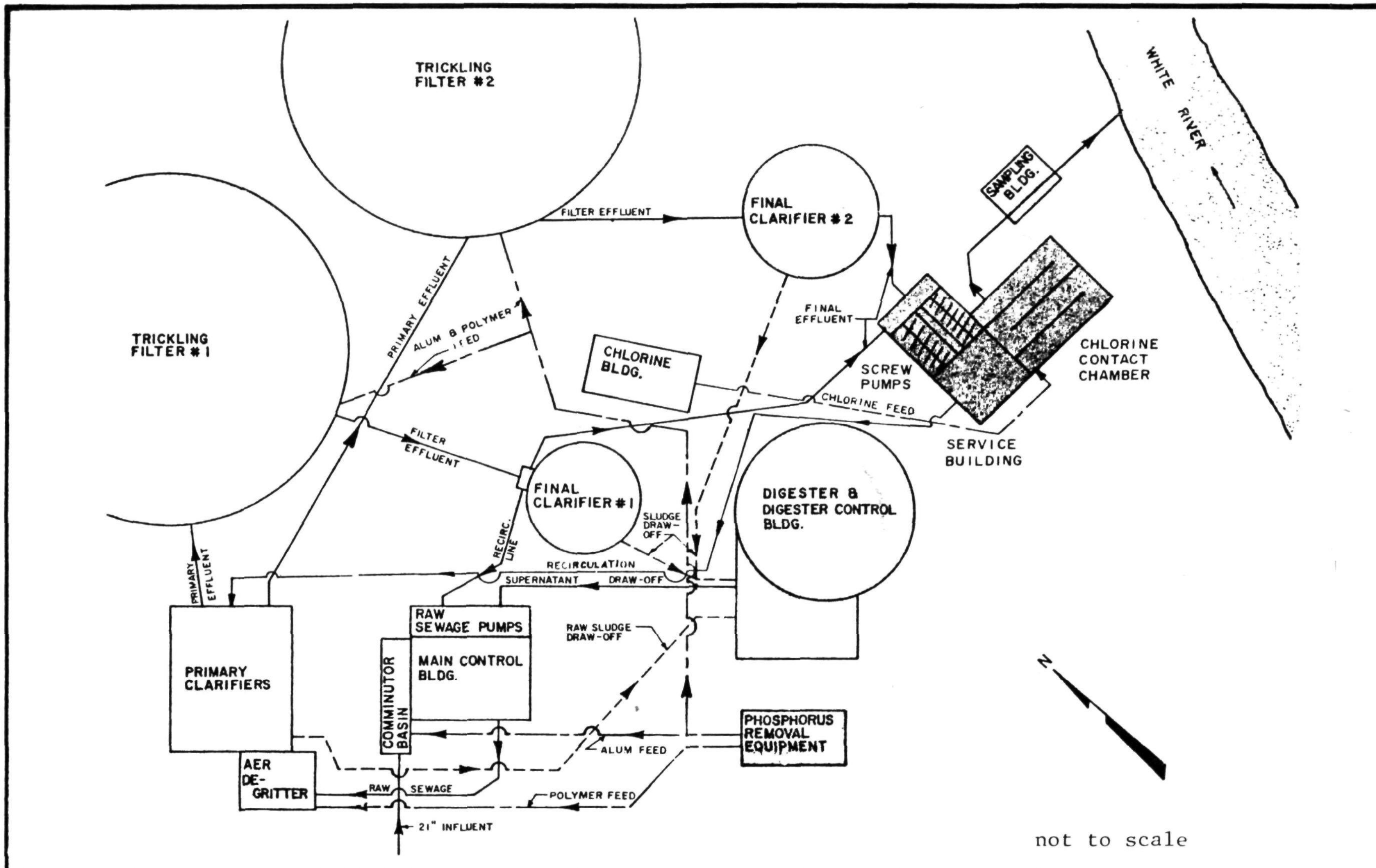


Figure 2-2. Schematic diagram of the City of Geneva Lake WWTP (Donohue & Assoc., Inc. 1978b).

Table 2-1. Summary of Lake Geneva WWTP effluent characteristics for 1981 and 1982 (By telephone, Charles Pape, WDNR, 23 March 1983).

Month	Flow (mgd)	BOD (mg/l)	Suspended Solids (mg/l)	pH (Std. Units)	Maximum Residual Chlorine (mg/l)	Fecal Coliform (#/100ml)	Total Phosphorus (mg/l)
1981							
January	0.682	31	34	7.5	-	620	1.076
February	0.659	44	31	7.4	-	67	1.033
March	0.666	22	26	7.5	-	161	0.852
April	0.746	22	23	7.6	0.808	35	1.076
May	0.763	18	21	7.4	0.885	44	0.738
June	0.815	15	21	7.4	1.328	75	1.092
July	0.808	11	19	7.5	0.808	95	1.017
August	0.838	15	23	7.4	0.620	36	1.091
September	0.785	16	23	7.4	0.571	569	1.054
October	0.661	16	24	7.4	0.479	661	0.962
November	0.624	14	24	7.5	0.644	129	0.949
December	0.573	13	27	7.4	0.545	80	-
Average	0.718	20	25	7.5	0.744	214	0.995
1982							
January	0.746	57	38	7.6	0.582	4900	1.530
February	0.765	38	36	7.6	0.700	1004	1.419
March	0.839	23	29	7.5	0.556	1808	1.088
April	1.024	29	29	7.6	0.966	686	1.005
May	0.766	22	22	7.4	0.518	392	0.924
June	0.755	19	23	7.3	0.954	159	1.043
July	0.902	17	23	7.5	0.990	112	1.110
August	0.775	16	21	7.4	0.818	348	1.480
September	0.622	18	20	7.7	0.767	430	2.020
October	0.592	14	22	7.5	0.640	253	1.053
November	0.622	16	26	7.7	1.113	670	1.431
December	0.927	15	25	7.5	0.759	1052	1.230
Average	0.778	24	26	7.5	0.780	949	1.278

Table 2-2. Lake Geneva WWTP interim WPDES permit effluent limitations for discharges to the White River[a] (By telephone, Charles Pape, WDNR, 23 March 1983).

Effluent Parameter	Average Quantity[b] kg/day (lb/day)	Concentration (mg/l) Minimum	Average	Maximum
BOD_5 (monthly)	187(413)	-	45	-
BOD_5 (weekly)	249(550)	-	60	-
Suspended solids (monthly)	187(413)	-	45	-
Suspended solids (weekly)	249(550)	-	60	-
pH (pH units)	-	6.0	-	9.0
Total residual chlorine (daily)	-	-	-	0.5
Fecal coliform (#/100 ml) (monthly)	-	-	NL[c]	-
Total phosphorus (monthly)	4.2(9)	-	1.0	-

[a]Permit applies until 31 December 1985.
[b]Based on design flow of 1.1 mgd.
[c]No limits set. Reporting only.

during this period, however, the BOD monthly average limit was exceeded once in 1982. Current effluent limits were often exceeded for maximum residual chlorine and total phosphorus. The existing treatment plant experiences hydraulic problems in the primary and final clarifiers and in the chlorine contact chamber. These units do not have adequate capacity at average design flow conditions (Personal interview, Robert Shepstone, Treatment Plant Operator, City of Lake Geneva, 29 August 1979).

2.1.2. Village of Williams Bay

Conveyance Systems

The Village of Williams Bay has separate sanitary and storm sewer systems. The sanitary sewer system collects domestic, public, and commercial wastewater and conveys it to the WWTP located near the northern Village limits. The sanitary sewer system consists of approximately 81,400 feet of gravity sewer ranging in size from 6 to 15 inches in diameter, seven lift stations, and approximately 9,300 feet of forcemain ranging in size from 4 to 8 inches in diameter. Pipe materials used in construction of the sanitary sewer system are vitrified clay, cast iron, concrete, and polyvinyl chloride. There were occasional bypasses or overflows of sewage from the Williams Bay collection system (Donohue & Assoc., Inc. 1982a).

The Village also is served by a separate storm drainage system containing approximately 19,200 feet of storm sewer consisting of reinforced concrete pipe. Areas within the Village that do not have storm sewers (i.e., areas east of Elkhorn Road) are served by drainage ditches, private catch basins, and curbs and gutters which all flow toward Geneva Lake. There are no known direct cross-connections between the storm and sanitary sewer systems.

The Village of Williams Bay has a sewer ordinance which controls installation and use of sanitary sewers in the Village, and prohibits discharge of clearwater into the sanitary sewer system. A detailed discussion of the Village's sanitary and storm sewer systems and a copy of the sewer use ordinance are presented in the I/I analysis prepared by Donohue &

Assoc., Inc. (1978c). The I/I analysis, which concludes that the Williams Bay sanitary sewer system is not subject to excessive infiltration/inflow as defined by current USEPA guidelines. On 15 January 1979, WDNR concluded that the I/I is excessive and that a SSES should be performed.

Treatment System

The Village of Williams Bay WWTP was initially constructed and placed in operation in 1931, and was extensively modified in 1969. The WWTP provides secondary treatment utilizing the conventional activated sludge process (Figure 2-3). Final wastewater effluent is pumped to two seepage lagoons for final treatment and disposal by rapid infiltration. The WWTP has an average hydraulic design capacity of 786,000 gpd. The WWTP consists of a comminutor, a primary clarifier, a parshall flume, a pumping station, two aeration tanks, a final clarifier, a chlorine contact tank, an effluent pumping station, a sludge thickener, three anaerobic digesters, and four sludge drying beds.

Primary sludge can either be pumped to a gravity thickener or to a single anaerobic digester. Waste activated sludge is always thickened in the gravity thickener and stabilized in a two-stage anaerobic digestion system. A portion of the digested sludge is wet-hauled for disposal on farmland or to a sludge lagoon. The remainder of the sludge is dewatered on drying beds and hauled to farmland for application.

Operating Data

The Williams Bay WWTP was inspected by WAPORA, Inc. on 29 August 1979. All treatment units were hydraulically overloaded at the time of the visit. The treatment plant operator reported that the Williams Bay area received heavy rains during the night of 28-29 August 1979 and the plant was receiving wastewater flow beyond its capacity (Personal interview, Danny Mullins, Treatment Plant Operator, Village of Williams Bay, 29 August 1979). Effluent characteristics for the Williams Bay WWTP for the years of 1981 and 1982 are summarized in Table 2-3. The WDNR WPDES permit policy requires the average monthly BOD concentration in wastewater prior to land applica-

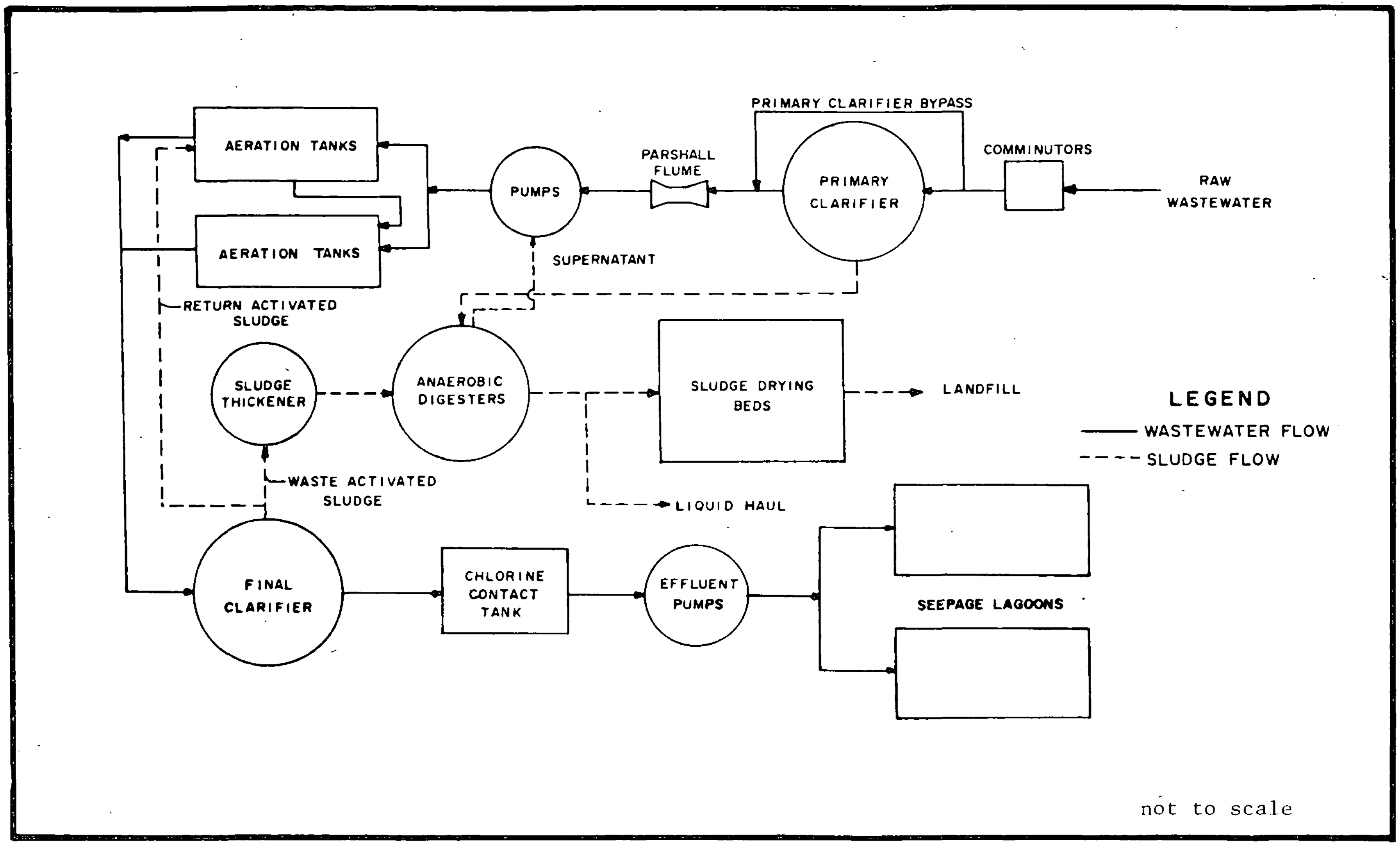


Figure 2-3. Schematic diagram of the Village of Williams Bay WWTP (Donohue & Associates, Inc. 1978c).

Table 2-3. Summary of Williams Bay WWTP effluent characteristics for 1981 and 1982[a] (By telephone, Charles Pape, WDNR, 23 March 1983).

Month	Flow[b] (mgd)	BOD (mg/l)	Suspended Solids (mg/l)	pH (Std. Units)	Fecal Coliforms (#/100ml)
1981					
January	0.436	57.3	2.7	7.4	-
February	0.492	41.6	4.1	7.3	-
March	0.467	47.0	5.6	7.4	-
April	0.571	29.7	3.1	7.4	-
May	0.521	27.3	5.8	7.4	-
June	0.499	33.4	3.5	7.6	-
July	0.530	71.2	5.1	7.8	-
August	0.574	39.6	13.0	7.6	-
September	0.507	33.5	8.0	7.4	-
October	0.478	38.6	6.0	7.4	-
November	0.438	42.0	5.8	7.4	-
December	0.446	25.6	5.5	7.3	-
Average	0.497	40.6	5.7	7.5	-
1982					
January	0.420	47.0	9.2	7.3	-
February	0.440	55.7	54.8	7.3	-
March	0.670	59.8	14.5	7.5	4
April	0.753	58.6	6.7	7.1	10
May	0.590	30.0	15.6	7.1	29
June	0.568	73.0	4.2	7.1	106
July	-	-	-	-	-
August	-	-	-	-	-
September	-	-	-	-	-
October	0.432	37.6	3.4	7.1	40
November	0.471	32.7	39.8	7.6	40
December	0.620	30.8	8.8	7.7	5432
Average	0.551	47.2	17.4	7.3	809

[a]An audit of the laboratory indicates that the accuracy of the data is questionable.

[b]Flow meter is capable of measuring approximately 90% of plant capacity (0.65 mgd). Therefore, accuracy of flow data is not known.

tion to not exceed 50 mg/l in 80% of samples taken. This limit was exceeded two times in 1981 and four times (out of nine months for which data are available) in 1982. Effluent quality produced by the Williams Bay WWTP is generally satisfactory. Final chlorinated effluent from the plant is pumped to two seepage lagoons for disposal. At the time of the site visit, one lagoon was almost empty and the other lagoon contained little effluent.

Some portions of the WWTP are in poor structural condition. Concrete tankage of the older portion is spalling. Hydraulic problems have been experienced at the plant. Effluent pumps reportedly do not have adequate capacity to pump final effluent to the seepage lagoons (Personal interview, Danny Mullins, Treatment Plant Operator, Village of Williams Bay, 29 August 1979).

According to the Addendum to West Geneva Lake Facilities Plan (Donohue & Assoc., Inc. 1982a) the collection system has "occasionally" experienced problems resulting in the overflow or bypass of wastewater to Southwick Creek (which flows to Geneva Lake) in violation of the WPDES permit. The Village has addressed this problem by renovating a lift station and initiating limited sewer rehabilitation. Robers and Boyd, the Village's engineers, in a report which summarized their review of the Facilities Plan documents, pointed out the following deficiencies in the existing WWTP (Robers and Boyd, "Williams Bay Wastewater Treatment Plant Proposed Expansion" 31 March 1981, included as Appendix CC of Donohue & Assoc., Inc. 1983a):

- The final clarifier size limits the effective WWTP capacity to approximately 0.5 mgd. When this flow is exceeded, solids can be washed out of the clarifier and the unit will sometimes overflow
- Aeration tank freeboard is inadequate
- The existing pipe network has hydraulic problems
- Digesters, sludge drying beds, and chlorine contact tank do not have adequate capacity for future flows

- Laboratory and maintenance facilities are inadequate
- Automatic samplers, a standby generator, a sludge hauling/disposal vehicle, and observation wells at the seepage cells are now lacking and should be provided.

In 1982 the Village installed monitoring wells at seepage cell No. 2 to evaluate operation of the cell and potential of adjacent land for expansion. The initial sampling report of the well driller (Warzyn Engineering, Inc. 1982) found that, although Cell No. 2 was typically loaded heavily (up to 4 feet/day), the impact on groundwater quality was not "significant". A review of data presented in the report indicates that BOD, chlorides, total Kjeldahl nitrogen, and sodium appear to be elevated above background levels. No values for the parameters measured were above limits set by the National Primary Drinking Water Standards (NPDWS), except for one well located 1,700 feet down gradient (with respect to groundwater flow) which had a nitrate-nitrogen level of 11.0 mg/l (the NPDWS limit is 10 mg/l). Wells adjacent to the lagoon had nitrate nitrogen levels of 4.5 and 5.4 mg/l (Warzyn Engineering, Inc. 1982).

2.1.3. Village of Fontana

Conveyance System

The Village of Fontana sanitary sewer system consists of approximately 121,100 feet of gravity sewer ranging in size from 6 to 12 inches in diameter, approximately 21,000 feet of force main, and nine lift stations. The sanitary sewer system was initially constructed in 1956 using vitrified clay pipe. Since then, numerous extensions have been added to the sanitary sewer system using various pipe materials including: polyvinyl chloride (PVC), concrete, asbestos cement, plastic reinforced asbestos cement, and cast iron. There are five wastewater overflows located at the five lift stations which prevent the backup of raw sewage into basements in the event of lift station failure due to prolonged power outage or mechanical breakdown.

The Village has a sewer use ordinance which limits connections to the sanitary sewer system and prohibits discharge of clearwater into the sanitary sewer system. An I/I analysis of the Fontana sewer system concluded that the system was subject to excessive infiltration/inflow as defined by USEPA. The I/I analysis recommended that the Village eliminate identifiable sources of I/I through Sewer System Evaluation Survey (SSES) and rehabilitation efforts. A subsequent SSES report (Donohue & Assoc., Inc. 1980a) estimated average and peak I/I flows to be 0.432 mgd and 1.843 mgd, respectively. The SSES concluded that average and peak I/I could be reduced through rehabilitation efforts to an estimated 0.170 mgd and 0.698 mgd, respectively. The SSES report was approved by the WDNR on 19 January 1980. Although some rehabilitation work has been completed, the flow reductions projected have not been achieved (By telephone, Joseph Rogge, Fontana WWTP Operator, 28 October 1983).

Treatment System

The Village of Fontana WWTP is located on the northwest side of the Village at an elevation higher than its service area. The original WWTP was built in 1958 and major additions were made in 1972. All wastewater is pumped from the main lift station, located on the west side of South Shore Drive near Lake Street, through a force main to the WWTP. Wastewater flows enter a flow division box and are directed to the trickling filter treatment train (constructed in 1958) or the contact stabilization activated sludge process train (constructed in 1972). The combined treatment facilities have an average design capacity of 0.9 mgd and a peak daily capacity of 1.8 mgd.

The treatment facilities constructed in 1958 include a primary clarifier, rock media trickling filter, final clarifier, and an anaerobic digester (Figure 2-4). Plant additions constructed in 1972 included enlargement of the main lift station; addition of a 14-inch force main parallel to the original 10-inch force main; a magnetic flow meter and recorder; a wastewater flow division box; field erected contact stabilization activated sludge process equipment including contact zone, reaeration zone, final settling zone, and aerobic digester; heated primary anaerobic digester with gas mixing equipment; chlorination equipment and chlorine contact tank; a cover for the existing trickling filter; and an addition to the original service building.

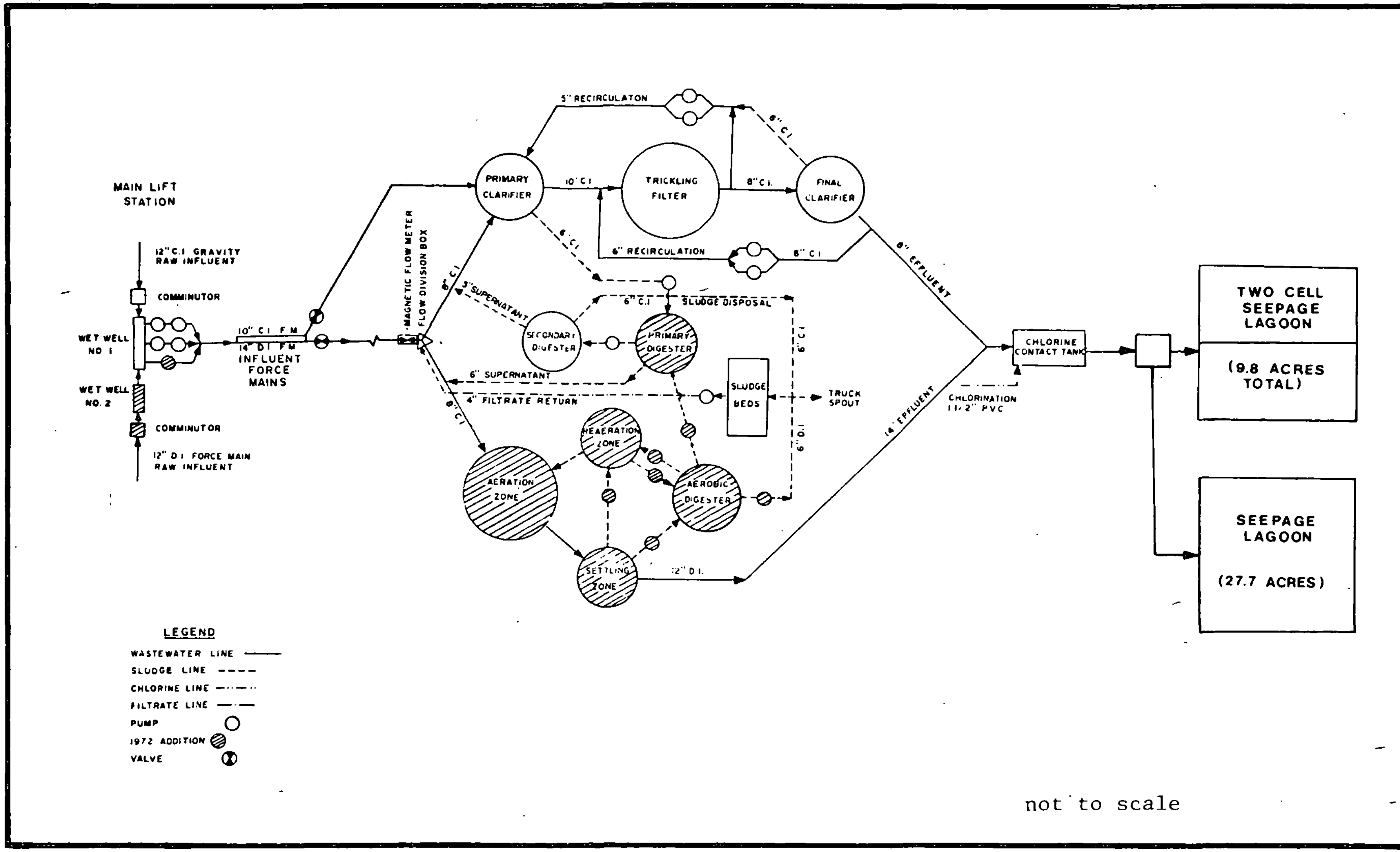


Figure 2-4. Schematic diagram of the Village of Fontana WWTP (Adapted from Donohue & Assoc., Inc. 1978d).

Clarified effluent from both treatment trains is combined and enters the chlorine contact tank. Total disinfected plant effluent flows through an 18-inch gravity outfall sewer to three seepage lagoons, located approximately 600 feet west of the treatment site, for disposal. The original seepage lagoons (9.8 acres total) were constructed to operate in series, which complete effluent seepage to groundwater and overflow to adjacent lands. However, a third 30-acre seepage lagoon was constructed in 1979 to alleviate the problem of WWTP effluent overflowing the existing lagoons and entering Geneva Lake via Buena Vista Creek (Personal interview, Joe Rogge, Treatment Plant Operator, Village of Fontana, 30 August 1979).

Primary and secondary sludge from the trickling filter treatment train is stablized in a two-stage anaerobic digester. Waste activated sludge from the contact stablization plant is aerobically digested, and then stored in the second-stage of the anaerobic digester. Digested sludge is pumped to onsite sludge drying beds. Dried sludge is made available to local citizens for pickup for use on lawns and flower gardens. All sludge made available is utilized on a local basis.

Operating Data

The Fontana WWTP was inspected by WAPORA, Inc. on 30 August 1979. All treatment units generally were operating satisfactorily on the day of inspection. Effluent characteristics for the Fontana WWTP for the years 1981 and 1982 are summarized in Table 2-4. Effluent quality produced by the WWTP is generally satisfactory. Final chlorinated effluent from the WWTP flows by gravity to the one of three seepage lagoons for disposal. WDNR's WPDES policy limits the BOD concentration of wastewater applied to the lagoons to a maximum 50 mg/l and 80% of samples taken. The average monthly BOD limitation was not violated by the Fontana WWTP during 1981 or 1982.

A lysimeter was installed eight feet below the surface of the new seepage lagoon at the time of construction to monitor wastewater effluent percolating through the soil. Since monitoring began in 1979, NPDWS drinking water limits for the parameters measured have never been exceeded

Table 2-4. Summary of Fontana WWTP effluent characteristics for 1981 and 1982 (By telephone, C. Pape, WDNR, 23 March 1983).

Month	Flow (mgd)	BOD (mg/1)	Suspended Solids (mg/1)	pH (Std. Units)
1981				
January	0.54	14	11	7.3
February	0.63	15	11	7.0
March	0.59	15	11	7.0
April	0.71	12	12	7.0
May	0.66	13	8	7.0
June	0.69	11	11	7.2
July	0.73	11	13	7.2
August	0.77	16	10	7.2
September	0.61	10	11	7.2
October	0.57	11	10	7.2
November	0.49	10	10	7.2
December	0.53	11	12	7.3
Average	0.63	12	11	7.2
1982				
January	0.49	13	12	7.2
February	0.50	11	11	7.2
March	0.77	11	12	7.2
April	0.90	12	10	7.2
May	0.70	12	9	7.2
June	0.66	16	17	7.3
July	0.88	17	11	7.4
August	0.76	21	16	7.5
September	0.57	14	10	7.5
October	0.66	11	12	7.6
November	0.69	7	7	7.8
December	0.89	14	8	8.0
Average	0.71	13	11	7.4

(Appendix C). However, sodium concentrations, total dissolved solids concentrations, and conductivity are elevated above background levels (By telephone, Roger Scovill, WDNR 3 May 1983).

Operational procedures practiced at the plant are currently not in compliance with WDNR policies governing rapid infiltration facilities. Site hydraulic limitations and lagoon design prevent a dose/rest cycle as required by WDNR. The dose/rest cycle is promoted to maintain an aerobic/anaerobic environment in the soil which facilitates nitrification and denitrification. The lagoons currently operate with a minimum of two feet of standing water at any time, however, effluent from the lagoons does not cause any surface water, groundwater, or public health violations.

These seepage lagoons were permitted as a temporary disposal (treatment) facility. Site investigations performed for the facility included eight soil borings at the current seepage site to determine soil texture and profile and thus, suitability for rapid infiltration. Laboratory permeability tests were only performed on one sample which indicated an exceptionally low permeability ($K=1.6 \times 10^{-6}$ cm/sec). This permeability is lower than is being experienced currently at the site. Thus the laboratory data is insufficient to conclusively determine the long-term ability of the site to treat and dispose of wastewater. Due to the lack of conclusive laboratory data, EPA considers the site to have an undefined potential for continued use but the WDNR has decided that the Fontana lagoons should be taken out of service.

2.1.4. Village of Walworth

Conveyance Systems

The Village of Walworth is served by separate sanitary and storm sewer systems. The sanitary sewer system collects and conveys domestic, commercial, and industrial wastewater generated within the Village to the existing WWTP. The sanitary sewer system consists of approximately 53,000 feet of collector, interceptor, and outfall sewer ranging from six to ten inches in diameter. There is one lift station connected to approximately 680 feet of six inch diameter force main. The sanitary sewer system consists primarily of vitrified clay pipe (Donohue & Assoc., Inc. 1976). Approximately 90 percent of the existing sewer system was constructed in the early 1950's. There is one bypass in the sanitary sewer system located immediately upstream of the WWTP through which untreated wastewater can be bypassed directly to two existing polishing lagoons located adjacent to Piscasaw Creek.

The Village of Walworth has approximately 8,300 feet of storm sewers ranging in size from 12 to 30 inches in diameter. The Village has a sewer use ordinance which prohibits connection of clearwater sources to the sanitary sewer system. An I/I analysis was conducted in 1976 which concluded that the Walworth sanitary sewer system is not subject to excessive I/I as defined by USEPA guidelines. The I/I analysis was approved by the WDNR on 2 January 1977.

Treatment System

The Village of Walworth owns and operates the Walworth WWTP located at Beloit Street at the western edge of the Village. The WWTP was initially constructed in 1952 with polishing lagoons added in 1966 and disinfection facilities added in 1975. Average hydraulic design capacity of the plant is 0.15 mgd with an estimated peak hydraulic design capacity of 0.3 mgd. Treatment capabilities of the plant and polishing lagoons are classified as secondary.

Raw wastewater enters the plant through a ten-inch diameter sewer and passes through a comminutor and/or bar screen (Figure 2-5). After passing through the comminutor, the wastewater is pumped to an Imhoff tank. Imhoff tank effluent is sprayed over a rock media in the trickling filter by means of a rotary distributor. Effluent from the trickling filter is conveyed to the final clarifier where biological solids are allowed to settle. Effluent from the final clarifiers is chlorinated prior to discharge to a ten-inch diameter outfall sewer. The WWTP effluent flows by gravity approximately three miles to a polishing lagoon lift station. Pumps at the lift station discharge the WWTP effluent through a six-inch diameter force main and a diversion box to the two polishing lagoons, which cover a combined area of approximately ten acres. Effluent from the lagoons is discharged into Piscasaw Creek, a tributary of the Rock River.

Solids contained in the comminuted wastewater are allowed to settle in the Imhoff tank. Additional solids collected in the final clarifier are also returned to the Imhoff tank. Solids in the bottom of the Imhoff tank are stabilized by anaerobic digestion. Currently, digested sludge is removed by a commercial septage hauler (J&J Septage Hauler, Elkhorn, WI) and wet-hauled to local farms for land application.

Operating Data

The Walworth WWTP was inspected by WAPORA, Inc. on 30 August 1979. All treatment units generally were operating satisfactorily on the day of inspection. Effluent characteristics for the Walworth WWTP for the years 1981 and 1982 are summarized in Table 2-5. During this period, effluent BOD_5, suspended solids, and pH concentrations generally met the requirements of the current interim WPDES permit (Table 2-6). However, the maximum pH limit was exceeded twice in 1981 and three times in 1982. The Village of Walworth's interim WPDES Permit expires on 31 December 1985. The existing Walworth WWTP will not be able to meet final permit conditions established by the WDNR.

Wastewater entering the Walworth WWTP presently is exceeding the plant design capacity. In 1972, the Village proposed abandonment of the existing plant and construction of a new WWTP. Approval of this proposal has been delayed pending completion of facilities planning activities required by USEPA and the WDNR (Donohue & Assoc., Inc. 1978a). Portions of the Walworth WWTP are in poor structural condition (e.g., the concrete walls of the trickling filter unit are spalling).

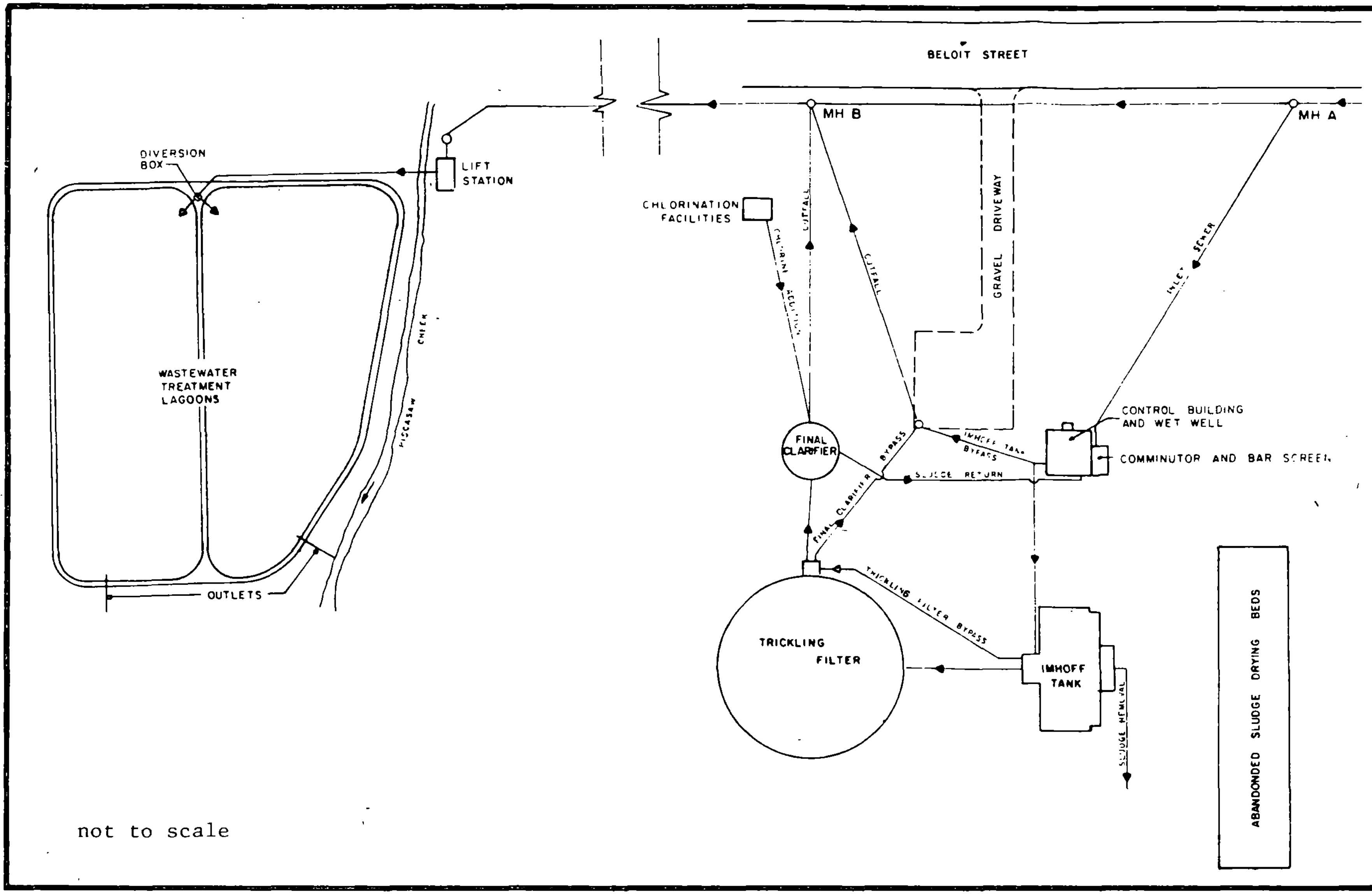


Figure 2-5. Schematic diagram of the Village of Walworth WWTP (Donohue & Assoc., Inc. 1976).

Table 2-5. Summary of Walworth WWTP effluent characteristics for 1981 and 1982 (By telephone, Charles Pape, WDNR, 6 May 1983).

Month	Flow (mgd)	BOD (mg/1)	Suspended Solids (mg/1)	pH (Std. Units)	Residual Chlorine Ave. (mg/1)	Residual Chlorine Max. (mg/1)	Fecal Coliform (#/100ml)
1981							
January	0.197	8.4	21.7	7.8	0.44	-	204
February	0.197	16.9	27.1	8.5	0.42	-	74
March	0.187	18.0	61.0	9.1	0.33	-	6
April	0.179	22.1	39.3	9.2	0.14	-	3
May	0.202	9.0	10.0	8.2	0.06	-	8
June	0.176	7.3	7.6	7.8	0.03	-	11
July	0.170	7.2	18.3	8.4	0.04	-	26
August	0.188	6.8	15.8	8.6	0.04	-	112
September	0.183	4.3	6.7	8.4	0.07	0.12	22
October	0.191	2.6	9.5	8.6	0.08	0.10	27
November	0.185	1.7	3.7	9.0	0.06	0.11	13
December	0.239	3.2	7.5	7.9	-	0.11	5
Average	0.191	9.0	19.0	8.4	0.16	0.11	43
1982							
January	0.240	12.0	9.0	7.8	0.08	0.10	307
February	0.228	47.0	16.6	7.6	0.11	0.20	9139
March	0.195	42.1	25.1	8.2	-	0.15	3348
April	0.183	24.7	37.0	9.2	-	0.10	20
May	0.174	21.4	46.5	9.3	-	0.15	31
June	0.201	22.3	64.0	9.4	-	0.10	8
July	0.207	17.7	23.8	9.0	-	0.06	86
August	0.191	7.3	11.9	8.7	-	0.07	17
September	0.168	12.0	14.5	8.5	-	0.10	17
October	0.168	9.7	21.5	8.5	-	0.12	61
November	0.173	8.7	8.6	8.1	-	0.10	49
December	0.181	4.9	5.3	8.1	-	1.5	13
Average	0.192	19.2	23.7	8.5	0.10	0.23	1091

Table 2-6. Walworth interim WPDES permit effluent limitations for discharge to Piscasaw Creek.[a] (By telephone, Charles Pape, WDNR, 6 May 1983)

Effluent Parameter	Average Quantity (Kg/day (lb/day)	Concentration (mg/l)		
		Minimum	Average	Maximum
	Winter (November through April)			
BOD_5 (monthly)	78.8 (162.6)	-	65	-
BOD_5 (weekly)	102.2 (225.2)	-	95	-
Suspended solids (monthly)	-	-	-	-
pH (std. units)	-	6.0	-	9.0
Fecal coliform (monthly)(#/100 ml)	-	-	NL[c]	-
	Summer (May through October)			
BOD_5 (monthly)	34.1 (75.1)	-	30	-
BOD_5 (weekly)	51.1 (112.6)	-	45	-
Suspended solids (monthly)	102.2 (225.6)	-	90	-
Suspended solids (weekly)	136.2 (300.2)	-	120	-
pH (std. units)	-	6.0	-	9.0
Fecal coliform (monthly)(#/100 ml)	-	-	NL[c]	-
Total residual chlorine (daily)	-	-	-	NL[c]

[a]Permit applies until 31 December 1985.

[b]Based on design flow of 0.30 mgd.

[c]No limits set. Reporting only.

2.1.5. Other Existing Wastewater Treatment Facilities Within the Study Area

Three private WWTPs also located within or near the RSSAs are:

- Americana Resort
- Interlaken Resort
- Kikkoman Foods.

These private wastewater treatment facilities were not inspected by WAPORA, Inc. Descriptions of the private WWTPs and associated facilities given in the following paragraphs are based upon information contained in various facilities planning documents.

The Americana Resort operates a year-round resort and condominium units east of the City of Lake Geneva. The WWTP at the Americana Resort consists of a field-erected contact stabilization activated sludge compact plant with chlorination. Effluent is directed to two small polishing lagoons (placed in series) prior to discharge to the White River. Waste activated sludge is aerobically digested and liquid hauled by a commercial septage hauler.

The Americana WWTP has a rated design capacity of 0.4 mgd and is believed to be achieving adequate treatment. There is also a smaller 0.1 mgd contact stabilization plant on the site which is not presently in use. According to the plant operator, wastewater flows at the Americana Resort average approximately 0.2 mgd during the summer and 0.15 mgd during the winter. The WWTP appears to have adequate capacity for some expansion (Donohue & Assoc., Inc. 1978a).

Interlaken Resort is located on the southwestern shore of Lake Como just off STH 50. The resort consists of both motel and condominium units and is operated throughout the year. The Interlaken WWTP consists of a field-erected contact stabilization activated sludge compact plant followed by tertiary sand filters. Chlorinated WWTP effluent is pumped to one of two soil absorption fields for disposal. Waste activated sludge is aerobically digested and disposed of in liquid form by a commercial septage hauler. The plant is designed to handle 0.125 mgd.

Two additional unused units are currently on the site. A small prefabricated activated sludge unit capable of handling 0.05 mgd, and a small lagoon formerly used for polishing plant effluent are available for further expansion. However, one factor potentially limiting capacity of the plant is the lack of suitable land for expansion of the soil absorption field (Donohue & Assoc., Inc. 1981b).

Kikkoman Foods operates a 0.24 mgd compact activated sludge plant approximately three miles west of the Village of Walworth. Industrial and sanitary wastes are combined and equalized in an underground vault before treatment. Effluent is discharged to two seepage lagoons operated in parallel. Sludge is aerobically digested, dried on sand beds, and disposed by landspreading onsite (Donohue & Assoc., Inc. 1981b).

The WWTPs are all operating below their capacity and within permit requirements according to recent operating data. However, during January 1983, the WDNR reported that recent groundwater monitoring at the Kikkoman seepage lagoons indicated potential problems (Donohue & Assoc., Inc. 1983a). One groundwater sample indicated high chloride levels. In addition, groundwater levels at the northwest and northeast corners of the seepage lagoons were determined to be 1.0 and 1.5 feet, respectively, below the bottom of the lagoons. The WDNR regulations (Section NR 214) require at least ten feet to be maintained between the bottom of seepage cells and high groundwater. Monitoring well data indicated that, at times, the groundwater level may be mounding to a level as high as 3 to 18 feet below the lagoon bottom. WDNR has concluded that serious problems exist with the present system and that significant upgrading will be necessary to enable long-term use of the site by Kikkoman. Recent facilities planning documents (Donohue & Assoc., Inc. 1981a, 1981b, 1982a, 1983a) recommend that, for the current 20-year planning period, the three private wastewater treatment systems remain as separate systems in lieu of being combined with municipal systems serving adjacent areas (Donohue & Assoc., Inc. 1983a).

Recently, Kikkoman Foods has proposed discharge of its sanitary and process wastewaters to the Walworth/Fontana Treatment System. This proposal has been made because of problems being experienced by Kikkoman Foods at their existing wastewater disposal system which have resulted from a high chloride concentration in their process wastewaters and a shallow water table below the existing seepage lagoons. Kikkoman will continue to dispose of noncontact cooling water at the existing seepage cells. Kikkoman's proposal has been accepted by the Villages.

2.2. Existing Onsite Waste Treatment Systems

Currently unsewered portions of the RSSAs were surveyed for performance data of onsite waste water treatment systems (Figure 2-6). Within these surveyed areas, there are approximately 1,700 onsite wastewater treatment systems comprised mostly of septic tank and soil absorption systems. Information concerning onsite systems has been derived from collection of original data and use of existing published or unpublished sources. Information on existing systems was obtained from Walworth County Planning, Zoning, and Sanitation Office records. Interviews with County sanitation personnel also were useful in assessing environmental conditions and suitability of septic tank and soil absorption systems for treating wastewater. Two septic leachate detector surveys, color infrared aerial photography, a mailed questionnaire, and a sanitary survey also were used to assess the effectiveness of existing onsite wastewater treatment systems.

2.2.1. Existing Onsite Systems

The majority of dwellings within the RSSAs use septic tank and soil absorption systems for wastewater treatment and disposal. Other dwellings primarily rely on holding tanks, although a few privies and cesspools remain in use. Nearly all septic tanks are constructed of precast concrete, although some bitumastic-coated steel and fiberglass tanks are also in use. Nearly all holding tanks are steel tanks. Soil absorption systems currently in use are primarily seepage beds, although mounds, dry wells, and seepage trenches are also utilized. Prior to 1966, design and installation of onsite systems was not regulated.

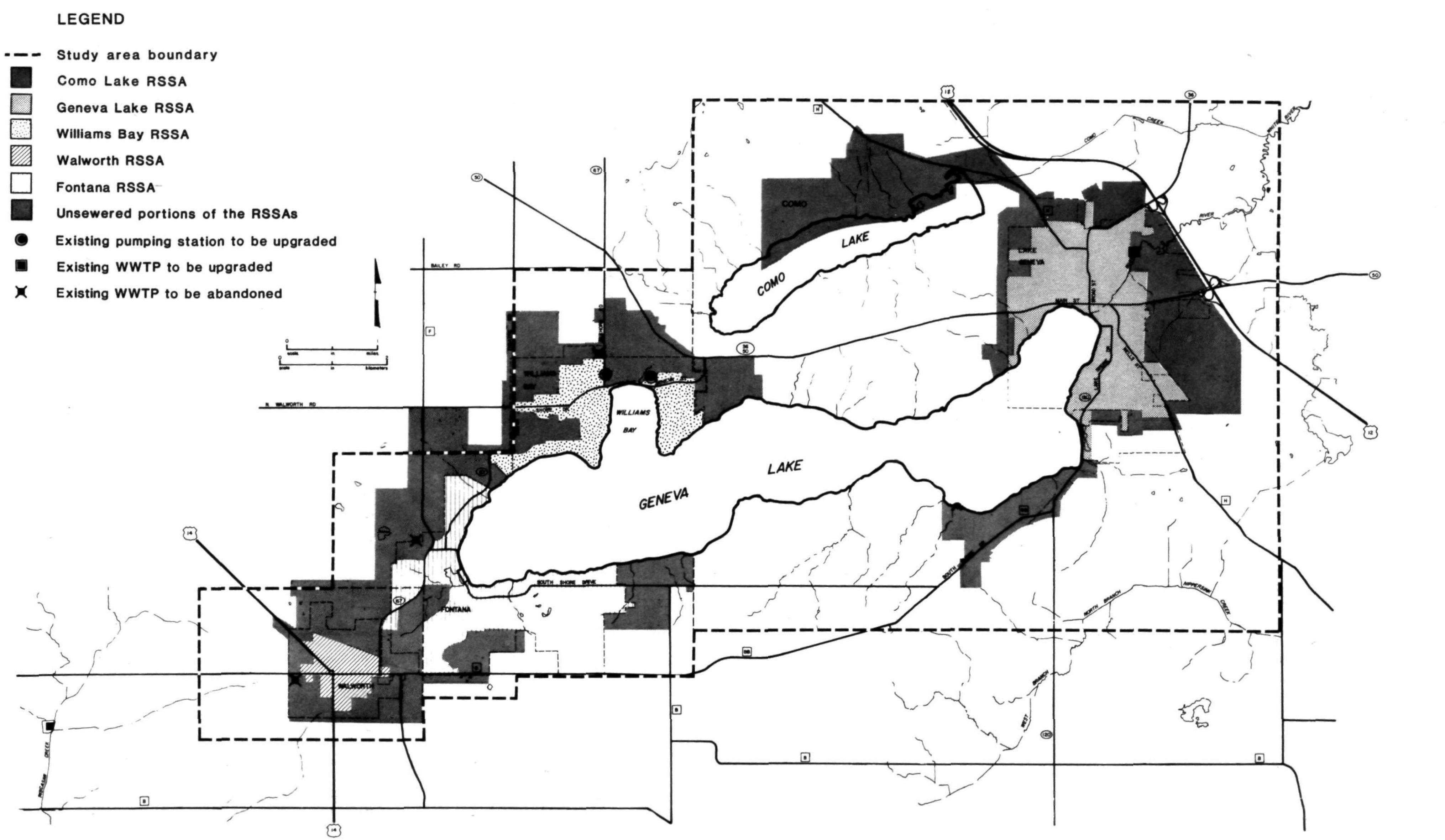


Figure 2–6. Location of currently unsewered portions of the RSSAs.

Since 1966, a permit has been required from the Walworth County Planning, Zoning, and Sanitation Office for design and construction of onsite systems. Until 1980, onsite permit records did not consistently indicate whether a system was inspected and installed according to the permit. In some cases inspections were made, but they were not routinely performed. Since 1980, the Wisconsin Administrative Code (Wis. Adm. Cd.) has required counties to inspect onsite systems during installation.

Prior to 1980, the Wisconsin Department of Health and Social Services was responsible for regulation of onsite systems. In 1980, this responsibility was shifted to the Department of Industry, Labor and Human Relations (DILHR). The DILHR is specifically responsible for reviewing and approving designs for large onsite treatment systems, for mounds, and for holding tanks per provisions of Wis. Adm. Cd. ILHR #83.

The "Wisconsin Fund" was authorized under State Statute, Chapter 144.245, which then implemented Wis. Adm. Cd. NR 128.30 to assist in funding of onsite systems. Each county must become qualified to administer monies and apply for funding on behalf of individual homeowners. Walworth County is qualified to administer funds. Funding is available at a 60% level, or a maximum of $3,000, for onsite systems. The residence, in order to qualify, must be occupied more than 51% of the year. Participation in the program in Walworth County has been active; approximately $100,000 has been disbursed to homeowners thus far for onsite system replacements (Personal interview, James Knilans, Walworth County Sanitarian, 10 May 1983).

Overall, only a small percentage of failing onsite systems have been identified within the study area. Those that have experienced failure are usually old, inadequately sized systems. Most upgrades of existing systems occur when an inspection of the existing system is necessary for a building permit for remodeling projects.

Within the RSSA, about 81% of the systems installed under the permit program since 1970 are conventional seepage beds, 10% are holding tanks, 7% are dry wells, and 2% are mound systems. The State directs that a soil absorption system be installed wherever feasible. Thus, the use of holding tanks illustrates the unsuitability of certain parcels for soil absorption systems. County sanitarians are not authorized to issue permits for soil absorption systems that would require a variance from the Wis. Adm. Cd.

The State, however, can authorize variances for certain conditions that do not meet the requirements of the Wis. Adm. Cd. Historically, the DILHR has not allowed variances for smaller size absorption systems based on water conservation or seasonal use. The DILHR does allow variances for distances to lot lines and depth to apparent groundwater (indicated by soil mottling) where monitoring demonstrates a lower water table. State approval must be obtained for alternative onsite wastewater treatment systems, such as, mounds, in-ground pressure systems, and holding tanks (By telephone, Dave Fredrickson, DILHR, 18 January 1983). Walworth County, by ordinance, no longer permits holding tanks to be installed for new residences (Personal interview, James Knilans, Walworth County Sanitarian, 10 May 1983).

2.2.2. Performance of Onsite Systems

The purposes of surveys and other data collection techniques described herein were to: (1) assess the performance of existing onsite wastewater systems in unsewered portions of the RSSAs and (2) to provide a locally-derived information base for describing and costing a non-sewered alternative for those portions of the RSSAs.

The performance of onsite systems was assessed according to whether they threatened public health, or impaired surface water quality or groundwater quality. Specific types of failures included:

- surface malfunctions (septic tank effluent that is not absorbed by the soil so that it flows to the ground surface)
- direct discharge of septic tank or other untreated wastewater to the ground surface, to ditches, or to streams
- contamination of groundwater in drinking water wells

- contamination of lakeshore areas by septic tank effluent that is insufficiently treated by the soil.

Recognizing that some poorly performing systems do not show signs of failure all the time, an assessment of potential problems was made in addition to quantifying actual documented problems. Criteria for estimating potential problems were based on USEPA, Region V Guidance: Site Specific Needs Determination and Alternative Planning for Unsewered Areas (USEPA Region V 1981). These estimates were expected to be higher than the actual number of system upgrades that might be justified by more detailed, site-specific investigations. However, data for both documented and potential problems were used in the subsequent development of alternatives for unsewered areas within the RSSAs being studied.

Types of information collected and evaluated in the site-specific needs documentation included:

- Soil characteristics -- US Department of Agriculture Soil Conservation Service soil survey data for the study area were interpreted to identify areas of soils with limitations that interfere with successful operation of soil absorption systems

- County sanitarians' records -- existing information from the County Planning, Zoning, and Sanitation Office, including the sanitarians' records for onsite system problems and new or upgraded systems, was reviewed

- Septic leachate surveys -- surveys providing continuous sampling of near-shore areas to determine where groundwater flow entering a lake may be contaminated by septic tank effluent were conducted by K-V Associates, Inc. in 1979 and by WAPORA, Inc. in 1982

- Sanitary opinion questionnaire -- a questionnaire sent to property owners in the unincorporated areas by Opinion Research Associates, Inc. in 1980 was analyzed for usable information

- Sanitary and water well survey -- residences who noted problems with their onsite systems on the questionnaire were surveyed and well water samples were collected for testing by WAPORA, Inc. in 1982

- GLWEA records -- sampling programs conducted by GLWEA concerning surface water and groundwater quality were reviewed and interpreted

- Parcel size analysis -- real estate assessment records of 1978, including the subdivision plat and certified survey maps from Walworth County were analyzed for contiguous lots under common ownership and for improvements (updated from building and sanitary permits)

- Aerial infrared photography -- records of possible surface malfunctions identified by photographic interpretation and field checked by the USEPA Environmental Photographic Interpretation Center (EPIC) were reviewed.

2.2.2.1. Soils Characteristics for Onsite Treatment

A soil survey for Walworth County was published by the USDA Soil Conservation Service in 1971. The survey describes soil profile characteristics, slopes, and engineering properties for various soil series found in the county. From the soil maps, soil series in some subdivisions of concern were measured by planimetry and listed to show the percentage of various soil mapping units within the subdivision. Soils mapped in selected subdivisions within the RSSAs were rated by SCS with respect to limitations for conventional drainfields. These soils were also rated for use with alternative soil absorption systems (Table 2-7). Based on these ratings, the percentage of soils unsuitable for any soil absorption system can be summed. For example, the Camp Sybil-Shore Haven-Lake Geneva Club area only has approximately 2% of its soils ranked unsuitable for onsite systems. Approximately 67% of the soils are suitable for drainfields, and an additional 31% are suitable for contour drainfields. By contrast, the Trinke-Lake Geneva Beach-Robinson area contains 31% soils ranked unsuitable for onsite systems, although the majority of those soils are mapped in a common park area and several large lots in Trinke. Similarly, in the Lake Como Beach Subdivision, 18% of the area consists of soils ranked unsuitable for any soil absorption system. These soils are predominantly located in marshy lakeshore areas. Other subdivisions in the RSSAs that are currently unsewered are located on soils suitable for absorption systems.

2.2.2.2. County Permit File Data

Files of the Walworth County Planning, Zoning, and Sanitation Office were reviewed for information concerning onsite system problems, the number

Table 2-7. Soil characteristics for onsite waste treatment systems in the RSSAs, by subdivision (SCS 1971).

SCS SOIL Name	Mapping Symbol	Surface Texture[a]	Slope Range %	Depth to Water Table (feet)	Permeability (inches per hour)	SCS Rating For Drainfield[b]	Suitability for Soil Absorp. Syst.[c]	Occurrence (%) of Soil Series in: Lake Como Beach	Cisco Beach	Lake Geneva Beach, Trinke, Robinson	Lake Geneva Club, Shore Haven, Camp Sybil
Alluvial land	Am	l	0-2	3-5	variable	V sev: fl	Un	1	-	-	-
Casco-Rodman	CrE2	sil-l-grl	20-30	5	0.63-20(18") 6.3	Sev: sl	Un	-	13	-	-
Elburn	EbA	sil	1-3	1-3	0.63-2.0(16")0.20 0.63(52").63-2.0	V sev: fwt	M	2	-	-	-
Fox	FsB	sil	2-6	5	0.63-2.0(38")6.3-20	Sl	D	-	-	5	-
Houghton	Ht	muck	0-2	0-1	0.63-2.0	Sev: hwt	Un	5	-	13	-
Kendall	KlA	sil	1-3	1-3	0.63-2.0(12")0.20 0.63(36")0.63-2.0	Sev: fwt	M	1	8	6	-
Marsh	Mf	muck	0-2	0-1	variable	V sev: hwt	Un	2	-	-	-
Matherton	MmA	sil	1-3	1-3	0.63-2.0(36")6.3-20	V sev: fwt	M	-	-	4	-
McHenry	MpB	sil	2-6	5	0.63-2.0(35")2.0-6.3	Sl	D	-	-	17	-
McHenry	MpC	sil	6-12	5	0.63-2.0(35")2.0-6.3	Mod: sl	Cd	-	-	2	-
McHenry	MpC2	sil	6-12	5	0.63-2.0(35")2.0-6.3	Mod: sl	Cd	-	-	7	-
Miami	MyB	sil	2-6	5	0.63-2.0	Sl	D	11	19	12	67
Miami	MyC	sil	6-12	5	0.63-2.0	Mod: sl	Cd	29	26	6	31
Miami	MyC2	sil	6-12	5	0.63-2.0	Mod: sl	Cd	-	-	2	-
Miami	MwC2	l	6-12	5	0.63-2.0	Mod: sl	Cd	3	-	-	-
Miami	MwD2	l	12-20	5	0.63-2.0	Sev: sl	Cd	19	19	-	-
Miami	MxC2	l	6-12	5	0.63-2.0(36")2.0-6.3	Mod: sl	Cd	-	2	-	-
Miami	MxE2	l	20-35	5	0.63-2.0(36")2.0-6.3	Sev: sl	Un	1	-	-	-
Palms	Pa	muck	0-2	0-1	0.63-2.0	V sev: hwt	Un	-	-	6	-
Pella	Ph	sil	0-3	0-1	0.63-2.0(12")0.20 0.63(42")0.63-2.0	V sev: hwt	Un	8	-	12	-
Plano	PsA	sil	0-2	5	0.63-2.0	Sl	D	1	-	-	-
Plano	PsB	sil	2-6	5	0.63-2.0	Sl	D	14	-	-	-
St. Charles	ScB	sil	2-6	5	0.63-2.0	Mod: shwt	M	2	13	8	-
Sebewa	Sm	sil	0-3	0-1	0.63-2.0(29") 20	V sev: hwt	Un	1	-	-	2

[a] Soil texture abbreviations are: l - loam, sil - silt loam, grl - gravelly loam.

[b] Rating abbreviations for seepage beds are: V sev - very severe; Sl - slight; Mod - moderate; hwt - high water table; fl - temporarily flooded; sl - slope; fwt - fluctuating water table; shwt - seasonally high water table.

[c] Soil absorption system abbreviations are: Un - unsuitable; M - mound; D - drainfield; Cd - contour drainfield.

and types of system upgrades recently completed, and the number of new systems installed. The information was used to estimate the percentage of onsite upgrades made per year, and to determine the types of replacements that currently are being installed. Information such as this is useful when selecting and evaluating onsite wastewater treatment alternatives.

The Walworth County Planning, Zoning, and Sanitation Office and the State DILHR require permits to be obtained by individual property owners prior to installation of a new or replacement onsite wastewater treatment system. In addition, County sanitarians make field inspections when complaints concerning failing systems or improperly constructed new onsite systems are received. These inspections are recorded at the County offices and indicate previous or potential problems. Most onsite system upgrades have been constructed as a result of additions and alterations to the residence, or as a consequence of an inspection for a loan approval.

Permit records for selected subdivisions within the RSSAs are summarized in Table 2-8 (for single family residences) and Table 2-9 (for large commercial structures). The records show that a large proportion (82%) of the systems installed since 1970 have been seepage beds. Since 1980, installation of systems in compliance with the Wis. Adm. Cd. has been more strictly enforced, and thus a higher proportion of mounds and holding tanks has been installed. Holding tanks have been installed primarily because of a high water table coupled with a small parcel size which eliminates consideration of a mound. Details for each shore area are discussed in the following paragraphs.

Southwest Shore Area

Permit records (Table 2-8) for Lake Geneva Club, Shore Haven, and Camp Sybil indicate that the majority of new systems and upgrades installed in selected subdivisions are seepage beds. Generally, the water table is deep and the percolation rate is high, so that dry wells or small seepage beds can be installed even though parcel sizes are small. Two holding tanks have been installed on parcels that were too small for seepage beds.

Table 2-8. New and upgraded wastewater systems since 1970 for single family residences for selected subdivisions within the RSSAs (from Walworth County sanitary permit records).

Subdivision	Seepage Bed		Pump Tank + Seepage Bed		Dry Well		Pump Tank + Mound		ST Only	Holding Tank		Total	
	New	Upgrade	New	Upgrade	New	Upgrade	New	Upgrade	Upgrade	New	Upgrade	New	Upgrade
Lake Geneva Club	0	0	0	0	0	0	0	0	2	0	1	0	3
Shore Haven-Camp Sybil	3	3	0	0	0	1	0	0	2	0	1	3	7
Trinke	1	0	1	0	0	0	0	0	0	4	0	6	0
Lake Geneva Beach	3	2	0	1	0	0	0	0	1	1	0	4	4
Robinson's 1st, 2nd, 3rd	0	3	0	0	0	0	0	0	5	0	0	0	8
Cisco Beach	4	3	1	1	0	6	0	0	4	0	0	5	14
Rowena Park	6	4	0	0	0	2	0	1	0	0	0	6	7
Lake Como Beach	60	96	1	2	1	7	0	3	20	6	11	68	139
Total	77	111	3	4	1	16	0	4	34	11	13	92	181

a. This system has a pump tank for lifting raw wastewater to the septic tank.

Table 2-9. System upgrades since 1970 for large commercial structures for the Lake Como Beach Subdivision (from the Walworth County sanitary permit records).

Structure	Business	System Permitted (existing components in parentheses)
Sugar Shack	Bar	Holding tank, two 2000 gal
Lake Como Club House	Club House	Septic tanks, two 2000 gal + (soil absorption system)
Marty & Kay's Tavern	Tavern	(Septic tank + dry well) + seepage bed
Tavern (near Club House)	Tavern	(Septic tank + soil absorption system) + 400 ft^2 seepage bed
Rocky & Pat's Tavern	Tavern	Holding tank 7,630 gal
Como Vista Motel	Motel - 8 units	Holding tank 5,000 gal
Blue Spruce Tavern	Tavern	Septic tank 1,000 gal + (seepage bed)
Como Cabins	Cottages	(Septic tank + dry well) + seepage bed

Southeast Shore Area

Permit records (Table 2-8) for Trinke, Lake Geneva Beach, and Robinson's first, second, and third subdivisions indicate that the number of new and upgraded systems is approximately equal. Most new systems have been installed in Trinke and have utilized holding tanks. These were installed because the water table depth was so shallow that mounds could not be permitted. In Lake Geneva Beach, four new and four upgraded systems have been installed. Of the eight systems, six have used seepage beds and one was a holding tank. A considerable number of solely septic tank replacements (five) have occurred in Robinson's first, second, and third subdivisions. The other three upgrades have utilized seepage beds.

Northwest Shore Area

The Cisco Beach and Rowena Park area has had 11 new systems and 21 upgrades installed (Table 2-8). All of these systems have used soil absorption systems, with the exception of four septic tank only upgrades. Dry wells (eight) are common upgrades of systems in both subdivisions.

Lake Como Beach

Permit records (Table 2-8) for Lake Como Beach indicate that 61 of the 68 new systems used seepage beds; one was a dry well; and six used holding tanks. The holding tanks were installed because a high water table prevented installation of seepage beds, and mounds were not yet permitted except on an experimental basis. Of the 181 upgrades, 115 used seepage beds, 26 used dry wells, four used mounds, 13 used holding tanks, and 34 were septic tank only. The majority of the holding tanks were installed because of a high water table and restricted parcel size. Most seepage beds were constructed as additions to existing soil absorption systems (either existing dry wells or seepage beds). The permit records include occasional comments that the upgrade is a repair, although the reasons for the repairs are rarely recorded. If an addition to a soil absorption system was permitted, and it was noted as a repair, then it was assumed that recurrent backups or surfacing effluent were the reasons for instituting upgrades.

Upgrades used for large commercial structures are listed in Table 2-9. Two taverns and the Como Vista Motel are located near the shore. The motel and one tavern have had replacements of soil absorption systems with holding tanks. The other tavern had its septic tank replaced. Two taverns are located near the Lake Como Beach Club House near the center of the subdivision. Taverns have had additional seepage bed area added to existing soil absorption systems. In addition, the Club House has had its septic tank replaced, the Sugar Shack on Hwy H has had a replacement holding tank installed, and a cottage motel on Hwy H has had a seepage bed added to its existing dry well.

2.2.2.3. Septic Leachate Survey

A septic leachate survey involves a scan of a shoreline area of a lake from a slow moving boat using an instrument called a septic leachate detector (ENDECO 2100, Environmental Devices Corp., Marion MA). The purpose of a septic leachate survey is to detect groundwater entering a lake that may be contaminated by septic tank effluent. Typically, soils remove a very high percentage of nutrients and bacteria from septic tank effluent (Jones and Lee 1977). However, due to soil limitations or improper system maintenance, partially treated septic tank effluent may enter a lake (Ellis and Childs 1973) and represent a potental health hazard and water quality problem.

The septic leachate detector is a combination of two instruments: a conductivity meter and a fluorometer. The detector operates by drawing a continuous water sample from the lake, and detects elevated dissolved salts (by the conductivity meter) and dissolved organic compounds (by the fluorometer), two parameters typically associated with septic tank effluent. However, sources other than septic tank effluent may also produce strong detector responses which may falsely indicate or mask groundwater contaminated by septic tank effluent. For example, positive fluorometer responses can be attributed to wetlands or decaying aquatic plants, and positive conductivity responses can be caused by discharges of water softener or fertilizers. An operator's observations regarding possible sources of detector responses are critical to interpretation of the machine data.

The presence of septic leachate in lake waters does not prove that lake water quality is being degraded. In fact, field sampling of surface waters and groundwaters within effluent plumes on other mid-western, glacial lakes has demonstrated that septic leachate is often very low in biological nutrients, and devoid of fecal coliform bacteria due to adequate treatment by lakeshore soils. Yet fluorescence and conductivity often remain high and can be detected.

To assess the level of treatment provided by lakeshore soils locally, the strongest effluent plumes detected were sampled. To do this, small diameter probes were driven to groundwater at intervals along a shoreline transect laid out in proximity to where the plume was detected in the lake. The probes were pumped until the water drawn became clear, and then samples were collected. Groundwater samples collected along the shoreline transect were injected into the septic leachate detector. The sample with the highest conductivity and fluorescence was assumed to be the strongest part of the groundwater plume. A groundwater sample was collected from the probe at this time and sent to a laboratory for a thorough chemical and bacteriological analysis. For comparison, background groundwater samples were also taken from areas where septic tank contamination was believed to be absent or minimal. Background samples were both field checked with the detector and sent to the laboratory.

A septic leachate detector scan was performed along shoreline sections of Geneva Lake and Lake Como from 31 August to 3 September 1982. This study was accomplished to corroborate information from a septic leachate survey conducted in November 1979 by K-V Associates, Inc. (Donohue & Assoc., Inc. 1983a). Specific areas scanned and suspected effluent plumes are shown in Figure 2-7. Only two plumes of suspected wastewater origin were detected along the Geneva Lake shoreline. No plumes of wastewater origin were detected along the north shoreline of Lake Como. Onshore reconnaissance of all other positive leachate detector signals were determined to be stream source plumes. Results of laboratory analyses of water samples supported the field determination of the location of emerging wastewater plumes in Geneva Lake (Table 2-10, samples 3 and 4).

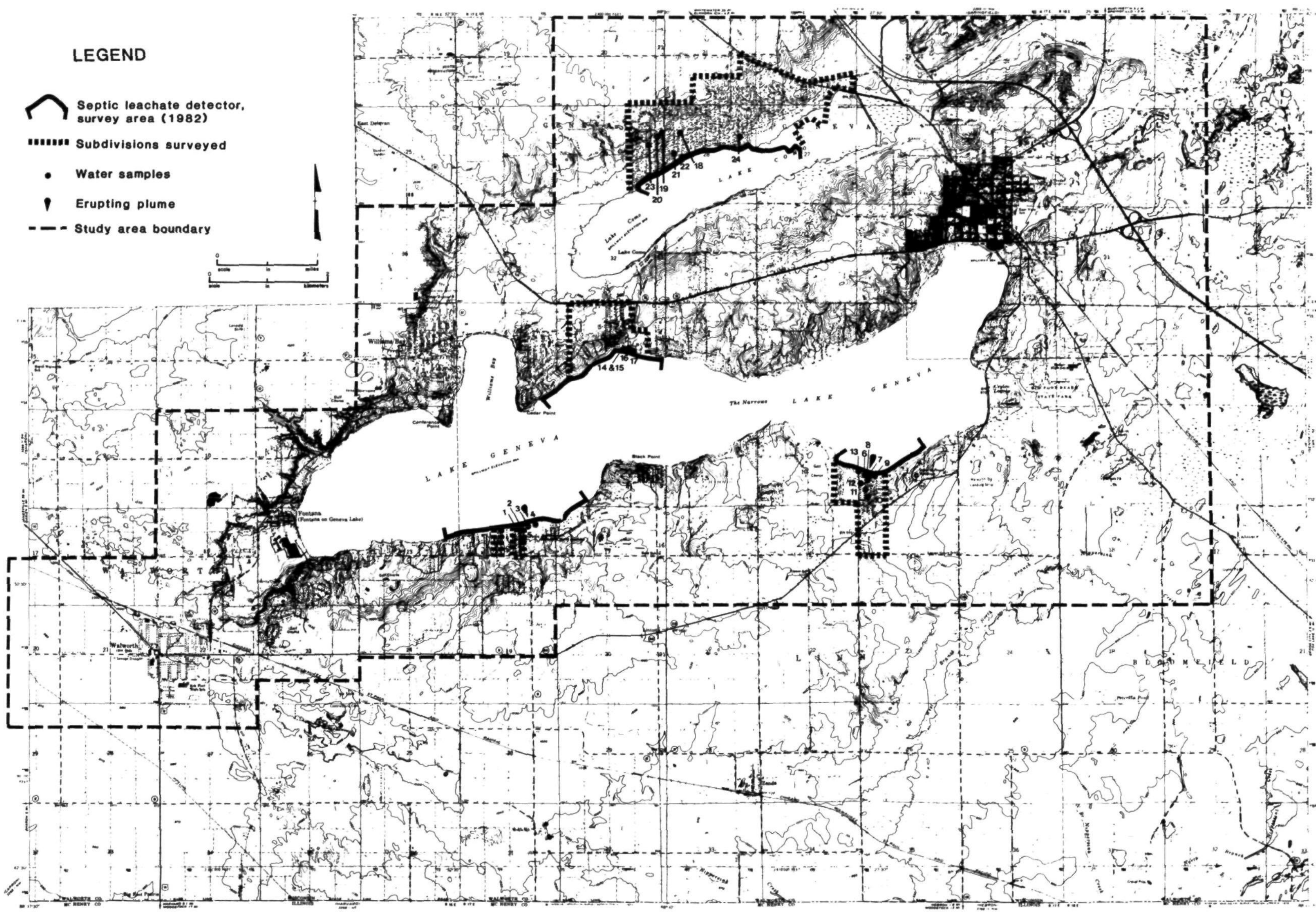


Figure 2-7. Suspected onsite treatment system effluent plumes detected in Geneva Lake.

Table 2-10. Results of the laboratory analysis of the shallow groundwater and ditch samples.

Sample	Type of Sample	Sample Location	Fecal Coliform Colonies/100 ml	Tot. Phos (mg/l)	TKN (mg/l)	NO_3-N (mg/l)	Chloride (mg/l)	Total Diss. Solids (mg/l)	Total Alk. (mg/l)	pH
1	grdwtr.	Geneva Lake	2	0.01	0.87	0.13	58.5	356	366	7.5
2	stream	Geneva Lake	+100[a]	0.18	0.05	3.81	92.2	676	417	7.3
3	grdwtr.	Geneva Lake	1	9.05	1.52	0.05	23.0	476	445	7.2
4	grdwtr.	Geneva Lake	1	0.22	0.09	4.48	20.4	434	369	7.2
5	grdwtr.	Geneva Lake	1	0.01	0.15	3.04	76.2	672	482	6.9
6	grdwtr.	Geneva Lake	1	1.01	0.82	0.05	18.6	384	346	6.8
7	grdwtr.	Geneva Lake	50	0.61	1.03	0.05	15.1	244	216	6.9
8	stream	Geneva Lake	1	0.01	0.52	0.18	13.3	378	330	6.8
9	stream	Geneva Lake	1	0.01	0.66	0.62	41.7	594	361	6.9
10	stream	Geneva Lake	4	0.01	0.05	1.97	42.6	478	300	6.8
11	stream	Geneva Lake	18	0.05	0.20	0.75	67.4	568	351	7.1
12	stream	Geneva Lake	87	0.01	0.22	0.54	67.4	542	346	7.5
13	stream	Geneva Lake	40	0.06	0.07	0.63	66.5	536	345	7.3
14	lake	Geneva Lake	35	0.01	0.05	0.14	12.4	254	180	7.8
15	lake	Geneva Lake	38	0.01	0.10	0.16	12.4	260	185	7.8
16	grdwtr.	Geneva Lake	20	0.01	0.05	4.20	58.5	396	377	7.1
17	grdwtr.	Geneva Lake	10	0.01	0.05	4.57	83.4	602	382	7.1
18	stream	Lake Como	1	0.02	0.04	4.43	62.9	570	375	6.8
19	stream	Lake Como	+100	0.01	20.7	2.61	35.5	504	404	7.5
20	stream	Lake Como	+100	0.01	0.61	5.76	33.7	440	365	7.5
21	stream	Lake Como	+100	0.60	0.19	3.89	38.1	496	379	7.9
22	stream	Lake Como	+100	0.01	0.05	3.34	43.4	478	372	7.9
23	spring	Lake Como	1	0.02	1.69	5.42	15.1	434	354	6.9
24	stream	Lake Como	+100	0.01	0.05	0.32	122	652	400	7.8

a. Laboratory analysis was sensitive to a maximum of 100 colonies per 100 ml.

Shallow groundwater transects were conducted at locations 3, 4, and 7 based upon strong signals recorded during the shoreline scan with the septic leachate detector. For Geneva Lake, sample 3 (a shallow groundwater sample collected in six inches of water just off shore) had a very high phosphorus concentration which indicated a highly probable breakthrough of septic tank effluent. Elevated fecal coliform bacteria levels at site 7 on Lake Geneva also gave a strong indication of potential septic tank effluent contamination of the groundwater. However, samples 6 and 7 were taken from the Lake Geneva Beach Association Park, which is a considerable distance (several hundred feet) from any wastewater source.

In addition to shallow groundwater sampling, samples were also collected from ephemeral streams and springs in the Geneva Lake-Lake Como area. Water in ephemeral streams may originate from springs, but may also come from tile drains emanating from households in adjacent subdivisions. Individual water samples from several streams were analyzed both by the leachate detector and also by laboratory analysis. Results of the stream sampling, however, were not easily interpreted (Table 2-10). For example, samples 10-13 in the Lake Geneva Beach Subdivision and samples 21-24 in the Lake Como Subdivision had elevated fecal coliform levels. However, examination of the watershed indicated these elevated levels may have been derived from animal sources, roads and parking lots, or other non-point sources. Samples 10-13, taken in sequence from the headwaters to the mouth of Hillside Creek, showed no distinct pattern of increase in any parameter examined. Nor was there any pattern in the stream examined at Lake Como. Thus, no conclusions were reached concerning water quality or public health impacts of onsite treatment systems on these surface waters.

As previously discussed, a septic leachate scan was performed in 1979 (K-V Associates, Inc. 1979) and results were reported in the Facilities Plan (Donohue & Assoc., Inc. 1981a). The previous survey encompassed the majority of the shorelines of Geneva Lake and Lake Como, including the sewered shoreline of Geneva Lake. Results of the most recent survey are generally comparable to the results of the previous survey for the unsewered portions of the RSSAs (Table 2-11). Some generalized conclusions drawn from the results from both septic leachate surveys include:

- Few emerging effluent plumes assumed to originate from onsite systems were found entering Geneva Lake or Lake Como
- The majority of positive detector responses were attributed to feeder stream watershed sources
- Water softener discharges were probably responsible for positive inorganic (e.g., dissolved salts) responses

Table 2-11. Comparison of the two septic leachate surveys. Only the shoreline lengths surveyed in August 1982 are compared to the shoreline lengths surveyed in November 1979.

Geneva Lake	1979	1982
Miles of shoreline compared:	6	6
Number of effluent plumes detected:	0	2
Number of stream source plumes detected:	5	11
Lake Como		
Miles of shoreline compared:	1	1
Number of effluent plumes detected:	3	0
Number of stream source plumes detected:	5	8

2.2.2.4. Property Owner Questionnaire

An opinion questionnaire (Appendix A of the Draft EIS) was prepared by Opinion Research Associates, Inc., and was mailed to the approximately 5,000 property owners in the areas served by onsite systems. Although more than 1,100 responses were received, only 318 respondents were aware of problems with onsite wastewater treatment facilities within their subdivision or immediate area. A summary of responses to the questionnaire, tabulated by subdivisions within the RSSAs, is listed in Table 2-12.

Although the response was good, the results of the opinion questionnaire must be used with care. Information regarding the occupancy, family size, age of house and onsite system, and type of system should be reliable. However, the nature of the survey (being an opinion survey rather than a factual survey) limits its usefulness for needs documentation pur-

Table 2-12. Questionnaire responses tabulated by subdivisions within the RSSAs.

	Occupancy			System type				Pumping history			
	Year-round	Seasonal	Weekend	ST-SAS[a]	HT[b]	CP[c]	Don't Know	Last year	Last 5 years	More than 5	Don't Know
Oak Shores	5	2	5	10	0	0	0	5	2	2	1
Lake Geneva Club	1	5	2	7	1	0	0	2	2	4	0
Shore Haven	5	6	2	13	0	0	0	1	9	2	1
Camp Sybil	0	7	1	5	1	1	1	2	0	2	1
Academy Estates	2	0	0	1	1	0	0	1	0	0	0
Maple Hills	3	1	3	7	0	0	0	1	5	1	0
Sec. 18	8	6	2	14	0	0	0	5	4	1	4
Sub-total	24	27	15	57	3	1	1	17	22	12	7
Trinke Estates	3	4	4	8	1	0	0	4	2	1	3
Lake Geneva Beach	10	13	4	25	0	1	0	12	10	0	4
Robinson's Sub.	3	5	4	8	0	2	0	3	5	2	1
Robinson Hillside	5	1	0	6	0	0	0	2	2	1	1
Sec. 11, 12 & 14	4	3	3	9	0	0	0	5	2	1	1
Sub-total	25	26	15	56	1	3	0	26	21	5	10
Lake Geneva Golf Hills	11	0	0	9	1	0	1	7	3	0	1
Forest Rest	2	2	1	4	1	0	0	1	2	0	2
Sylvan Trails	2	1	2	4	0	0	1	1	0	2	1
Rowena Park[d]	5	5	5	12	0	0	1	3	4	2	5
Cisco Beach	17	25	23	56	1	1	4	27	12	8	14
Ara Glen Estates	0	1	0	1	0	0	0	0	0	0	1
Sub-total	37	34	31	86	3	1	7	39	21	12	24
Lake Como Beach Sec. 21 & 22	131	40	58	204	13	1	6	82	62	28	53
TOTAL -	217	127	119	403	20	6	14	164	126	57	94

[a] Septic tank soil absorption system.
[b] Cesspool.
[c] Holding tank.
[d] One system was a privy.

Onsite system experience						House age			System age		
Back-ups	Wet ground	Odors	Other Problems	Surface Discharge	Inconvenience	0–5	5–10	10	0–5	5–10	10
2	4	2	1	2	5	0	0	8	0	1	8
3	0	0	0	0	1	0	0	8	2	2	1
2	1	1	0	0	3	2	1	10	3	1	7
0	0	0	0	0	4	0	0	8	0	0	5
1	0	0	0	0	2	1	0	5	1	0	6
2	7	1	0	0	2	3	0	10	3	0	8
11	**7**	**6**	**1**	**2**	**18**	**8**	**1**	**49**	**11**	**4**	**37**
0	1	1	0	0	2	2	0	7	3	1	4
2	4	6	0	2	9	1	1	23	3	3	18
4	0	2	0	1	5	1	0	8	2	0	6
1	1	0	0	0	2	1	1	4	1	1	3
2	0	1	0	1	1	1	0	7	3	1	4
9	**6**	**10**	**0**	**4**	**19**	**6**	**2**	**49**	**12**	**6**	**35**
2	2	2	1	0	2	0	0	7	1	0	4
0	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	2	2	0	2	2
0	1	0	0	0	2	1	2	11	2	1	9
6	4	7	1	3	19	4	2	45	8	7	35
0	0	0	0	0	0	1	0	0	1	0	0
8	**7**	**9**	**2**	**3**	**23**	**6**	**6**	**65**	**12**	**10**	**53**
11/39	4/24	13/38	3/6	35/44	34/94	23/43	12/21	156/319	42/77	41/61	115/240

poses. Certain questions were framed in an indeterminate manner, such as the question on experiences with the sewage treatment system. The question is not framed as a current or on-going problem so that, if an individual ever experienced a problem, these items would be marked. Indeed, many who marked one of these questions in the questionnaire noted further that they did not consider their system a problem or even an inconvenience. Also, "wet ground" and "odors" are not considered obvious problems for needs documentation purposes. Numerous respondents marked "other" for experience, but noted that their system worked well. Nevertheless, these systems were tabulated in the summary as "other problems."

The questions on whether the system discharges to a "ground surface ditch (sic), a creek, or lake" appeared to be misconstrued frequently. In marking a response, many underlined "ground surface," thus, these responses are ambiguous. Many respondents indicated that their system was a problem or an inconvenience even though they did not experience back-ups or surface breakouts of effluent. Others noted that they had to restrict water use in order to have the system operate satisfactorily.

Results of the questionnaire indicated that more than 90% of the onsite systems currently being used in each of the RSSAs are conventional septic tank and soil absorption systems. No breakdown of seepage beds, dry wells, or mounds was requested on the questionnaire. Of those respondents who knew how recently their septic tank had been pumped, nearly half to more than half indicated that their septic tank was pumped within the last year. Over 65% of the respondents had had their septic systems pumped out within the last five years. This indicated that most residents are sensitive to the local recommendation to have their septic tank pumped annually. The majority apparently do not experience problems as long as their septic tanks are pumped at regular and frequent intervals.

In summary, the experiences that a majority of residents have had with onsite wastewater treatment systems indicate that a large proportion of owners have never had problems. The percentage of residents who have experienced no backups or wet ground ranged from 70% to 85% for the various RSSAs. Because the majority of residents have not experienced problems, onsite wastewater treatment systems were presumed to be viable, long-term methods for wastewater management in currently unsewered portions of the RSSAs.

2.2.2.5. Sanitary and Well Water Surveys

A sanitary survey was conducted which involved 124 onsite sanitary inspections at residences in selected subdivisions within the RSSAs. Each onsite sanitary inspection consisted of a patterned interview with the resident, an inspection of the property with emphasis on the location of the onsite treatment system, and an inspection of the visible parts of the resident's water well. The resident interviews sought to gather information on:

- Type and age of the onsite wastewater treatment system
- Type of water supply and water use patterns
- Number of users of the onsite treatment system
- Types and frequency of noticeable problems with the onsite system
- Past repairs and frequency of maintenance of the onsite treatment system
- Locations of buildings, onsite system, and well.

Information gathered during each onsite sanitary inspection was recorded on standard forms (Appendix B of the Draft EIS).

The sanitary survey was designed to target dwellings thought most likely to be experiencing or to have experienced problems with onsite systems. In contrast with a random survey, such a targeted survey is expected to locate a higher proportion of problem systems and, thus, provide a better analysis of factors that contribute to problems locally. The source of information used to select dwellings for the survey was the 1980 property owner questionnaires. Dwellings were selected for the sanitary survey if the response indicated a possible problem.

Sixty homes from the Lake Como Beach Subdivision and 60 homes from Geneva Lake were targeted to be surveyed. Residences around Geneva Lake were located in the following subdivisions: Rowena Park, Cisco Beach, Sylvan Trail Estates, Robinson's subdivisions, Lake Geneva Beach, Trinke Estates, Camp Sybil, Shore Haven, and Lake Geneva Club. Follow-up contacts were made at the target residence if no one was home the first time. If no one was home a second time, another household in the same immediate area was selected. A total of 124 sanitary surveys were conducted by WAPORA, Inc. and USEPA personnel in August and September 1982. Of that total, 71 surveys were conducted at the targeted residence, and the remaining 53 surveys were conducted at nearby residences.

In conjunction with the sanitary survey, well water samples were collected from 33 residences and were tested for chlorides, nitrates, phosphorus, total dissolved solids, total alkalinity, pH, and fecal coliform. Wells were selected for testing if the homeowner was available when field collections were conducted, if no water softener or iron removal equipment was on the system, and if the well was adequately protected from surface contamination.

Data from the sanitary surveys (Table 2-13) noted occupancy, lot size, and the type of system. A great deal of information was unavailable or was obscured by differences in terminology. In numerous cases, the survey forms were not completely filled out because the resident was not knowledgeable about the facilities.

Occupancy of the surveyed residences was made up of 71 permanent (occupied more than six months of the year) and 53 seasonal households. Certain subdivisions, namely, Camp Sybil, Shore Haven, and Trinke Estates, contained nearly all seasonal residences.

Twenty of the residences were located on parcels of less than 7,500 square feet. The highest proportions of small lots were in Lake Geneva Beach, Robinson, Lake Geneva Club, and Cisco Beach subdivisions. Most surveyed parcels were in the 10,000 to 20,000 square-foot range (i.e., one quarter to one half acre).

Table 2-13. Summary data concerning types of onsite treatment systems from the August and September 1982 sanitary surveys of Geneva Lake and Lake Como, Wisconsin.

Subdivision	Occupancy: Permanent	Occupancy: Seasonal	Lot size (sf): 7,500	Lot size (sf): 7,500-9,999	Lot size (sf): 10,000-20,000	Lot size (sf): 20,000	Type of system: Septic tank + dry well	Type of system: Septic tank + seepage bed	Type of system: Septic tank + dry well + seepage bed	Type of system: Septic tank + pump tank + mound	Type of system: Cesspool	Type of system: Other
Lake Geneva Club	2	3	3	2	0	0	1	3			1	
Shore Haven	1	3	1	2	1	0	1	3				
Camp Sybil	0	6	0	2	0	0	1	5				
Subtotal, SW shore	3	12	4	6	1	0	3	11			1	
Trinke Estates	0	5	0	0	0	5	1	3		1		
Lake Geneva Beach	5	4	5	1	2	1	3	5			1	
Robinson's	3	7	5	0	4	1	2	8				
Subtotal, SE shore	8	16	10	1	6	7	6	16		1	1	
Sylvan Trail Estates	0	1	0	0	1	0	0	1				
Cisco Beach	13	4	3	5	8	1	3	13				2 unknown
Rowena Park	2	3	0	0	0	6	1	4				1 privy
Subtotal, N shore	15	8	3	5	9	7	4	18				3
Lake Como Beach	45	17	3	10	37	11	14	35	4	1	3	1 holding tank
Total	71	53	20	22	53	25	27	80	4	3	7	4

Types of sewage disposal systems encountered included septic tanks, grease traps, privies, cesspools, dry wells, seepage beds, and mounds. These also occurred in many combinations. The most common system, consisting of a septic tank and seepage bed, was encountered in 80 situations. Separate systems for laundry or kitchen wastewater were encountered occasionally. In these cases, only the primary system was tabulated.

The age of each treatment system (Table 2-14) was tabulated by the age of its oldest reported part. Of the total of 116 for which age was reported, 9 were less than 5 years old, 18 were 5 to 10 years old, 27 were 11 to 20 years old, and 62 were more than 20 years old. A number of the residents surveyed have remodeled and expanded their residence recently for permanent occupancy, at which time the onsite system was replaced or upgraded.

A total of 26 systems have had repairs or replacements of components out of the 124 systems surveyed (Table 2-14). The most common repair has been the addition of a seepage bed (12). The septic tank has been replaced or repaired on six systems and pipes cleaned or repaired on four systems. Many of these upgrades or repairs appear to coincide with a change of owners and/or a change in occupancy from seasonal to permanent. The County sanitarian's records indicate that 273 systems have been upgraded or repaired since 1970.

Each resident surveyed was asked how recently the septic tank had been pumped and the reason for pumping. These responses are summarized in Table 2-14, with the exception that, when the frequency of pumping was given, this number was utilized. Thus, these numbers are somewhat ambiguous. The number who pump annually or have pumped within the last year totaled 20. The number who pump annually to triennially totaled 66. A total of 27 systems have not been pumped within the past five years. Many reported that they pump annually or biennially because they have heard that it is good practice, not because it is necessary. The overall average appears to be about two years, which is more frequent than is typically thought necessary.

Table 2-14. Summary data on operation of onsite treatment systems, from the August and September 1982 sanitary surveys for Geneva Lake and Lake Como, Wisconsin.

	Age of System (years)				Pumping Frequency (years)				Repairs or Upgrades					Seasonal Problems		
Subdivision	5	5-10	11-20	20	1	1-3	4-5	5	New Septic Tank	Repair pipes	Add seepage bed	Add dry well	Other	backup	Seasonal wet ground	Frequent pumping
Lake Geneva Club	0	1	0	3	1	1	1	2	0	0	1	0		0	0	1
Shore Haven	0	0	1	2	0	3	0	1	0	0	1	0		0	0	0
Camp Sybil	0	0	0	5	2	2	1	1	1	0	0	0		1	0	0
Total SW shore	0	1	1	10	3	6	2	4	1	0	2	0		1	0	1
Trinke Estates	0	1	0	4	2	2	0	0	0	0	1	0	new pump	0	1	2
Lake Geneva Beach	0	1	0	8	3	3	1	2	0	0	0	0		0	0	1
Robinson's	0	1	3	3	0	10	0	0	1	1	0	1		1	0	0
Total SE shore	0	3	3	15	5	15	1	2	1	1	1	1		1	1	3
Sylvan Trail Estates	0	0	1	0	0	0	0	1	0	0	0	0		0	0	0
Cisco Beach	2	3	4	7	2	9	0	6	3	1	4	0	enlarged and cleaned ST + DW[a]	1	0	1
Rowena Park	0	2	1	2	0	5	0	0	0	0	0	0		0	0	0
Total N shore	2	5	6	9	2	14	0	7	3	1	4	0		1	0	1
Lake Como Beach	7	9	17	28	10	31	2	14	1	2	5	1	added mound	2	3	3
TOTAL	9	18	27	62	20	66	5	27	6	4	12	2	3	8	4	8

[a]ST + DW indicates septic tank and dry well.

The number of respondents who indicated that they have ongoing problems with their system totaled 23 (Table 2-14). No one area had a greater concentration than any other area. Excessive maintenance, that is, frequent pumping was the most frequently mentioned problem with (eight responses). Seasonal backups and seasonally wet ground were each noted as problems at eight and four systems, respectively.

The well water sampling results are presented in Table 2-15, and the sampling locations are plotted in Figures 2-8a through 2-8c. The nitrate-nitrogen (NO_3-N) data indicated that no groundwater wells had levels significantly elevated above background. The highest nitrate concentration measured was 2.85 mg/l while the Federal drinking water standard is 10 mg/l (USEPA 1976). Only two of the 33 wells tested had nitrate concentrations above 1 mg/l. Total Kjeldahl nitrogen (TKN), the sum of ammonia and organically bound nitrogen, was greater than 1 mg/l in seven well water samples. TKN is important not so much as a harmful pollutant, but as a source of nitrate nitrogen after oxidation. Elevated TKN also suggests relatively recent contamination by organic wastes. Currently, there are no Federal water quality criteria for TKN. Three wells in Lake Como Beach had a positive fecal coliform response (Table 2-15), while no wells in Geneva Lake subdivisions had a positive fecal coliform response. Federal drinking water criteria documents recommend a maximum limit of 100 colonies per 100 ml for bathing waters, and suggest that a level of virtually no organisms (i.e., disinfection) is desirable for drinking water. Chloride concentrations ranged from less than 1 mg/l to 121 mg/l. Three wells had chloride concentrations over 100 mg/l which may be an indication that either septic effluent is strongly influencing this well, or a water softener or some other source may be influencing these concentrations. Federal water quality criteria documents recommend a maximum limit of 250 mg/l of chlorides and sulfates for drinking water. A correlation between positive fecal coliform samples, chloride concentrations, and/or nitrogen concentrations for the wells sampled was not well established.

Five wells were known to be less than 30 feet in depth, and one of these was a dug well of 10 feet in depth. Two of the three positive coliform responses came from these wells. Two of the four chloride concen-

Table 2-15. Results of the laboratory analysis of well water samples from the sanitary survey of August and September 1982 for Geneva Lake and Lake Como, Wisconsin.

Sample No.	Subdivision	Well Depth (ft)	Fecal Coliform Colonies/100 ml	Total Phos. (mg/l)	TKN (mg/l)	NO_3-N (mg/l)	Chloride (mg/l)	Total Diss. Solids (mg/l)	Total Alkalinity (mg/l) as $CaCO_3$	pH
Geneva Lake										
1	Cisco Beach	106	1	0.07	4.90	0.05	2.7	354	386	7.1
2	Cisco Beach	127	1	0.01	0.05	0.05	8.9	378	310	7.0
3	Lake Geneva Beach	NA[a]	1	0.01	0.44	0.65	117	724	464	6.8
4	Lake Geneva Beach	45	1	0.01	0.15	0.16	2.7	328	294	7.0
5	Lake Geneva Club	187	1	0.01	1.97	0.05	1.7	344	323	7.0
6	Robinson's Sub.	100	1	0.01	0.05	0.54	101	636	366	6.8
7	Robinson's Sub.	44	1	0.01	0.17	0.05	3.5	342	282	6.9
8	Rowena Park	125	1	0.01	0.12	0.05	3.5	416	381	6.9
9	Trinke Estates	167	1	0.19	0.70	0.05	1.8	322	280	7.1
10	Trinke Estates	70	1	0.01	0.23	0.05	1.7	288	305	7.1
11	Trinke Estates	NA	1	0.05	0.60	0.05	1.7	400	294	7.1
12	Trinke Estates	NA	1	0.01	1.52	0.05	1.0	324	312	7.1
13	Sylvan Trail Estates	190	1	0.07	0.64	0.05	13.3	432	320	7.0
Lake Como										
14	Lake Como Beach	132	1	0.01	0.25	0.05	3.5	342	331	7.1
15	Lake Como Beach	100	1	0.01	0.16	0.05	48.8	538	348	7.0
16	Lake Como Beach	100	1	0.05	1.14	0.05	14.2	426	359	7.3
17	Lake Como Beach	18	1	0.01	0.64	0.05	121	686	412	6.9
18	Lake Como Beach	10	1	0.01	0.07	0.13	37.2	450	345	6.7
19	Lake Como Beach	100	1	0.01	0.48	0.14	17.7	502	368	7.2
20	Lake Como Beach	135	1	0.01	0.96	0.05	17.7	478	355	7.2
21	Lake Como Beach	120	1	0.01	1.12	0.05	1.7	364	354	7.0
22	Lake Como Beach	205	1	0.01	0.62	0.05	1.0	360	327	7.2
23	Lake Como Beach	90	1	0.01	0.05	0.05	1.0	430	364	7.3
24	Lake Como Beach	NA	1	0.01	0.05	0.05	4.4	404	378	7.0
25	Lake Como Beach	30	50	0.01	0.10	2.85	22.2	440	383	6.8
26	Lake Como Beach	20	1	0.01	0.48	0.17	10.6	386	330	7.9
27	Lake Como Beach	185	1	0.01	2.05	0.05	1.0	324	368	7.0
28	Lake Como Beach	23	1	0.01	0.05	0.61	94.9	610	415	7.0
29	Lake Como Beach	100	4	0.01	0.40	0.05	1.0	362	362	7.0
30	Lake Como Beach	NA	1	0.01	0.48	0.05	41.7	608	432	7.0
31	Lake Como Beach	125	1	0.02	0.17	2.07	24.8	490	377	6.8
32	Lake Como Beach	199	1	0.01	0.19	0.05	1.0	316	330	7.1
33	Lake Como Beach	150	1	0.05	1.64	0.05	2.7	370	370	6.9

[a]NA - indicates data not available.

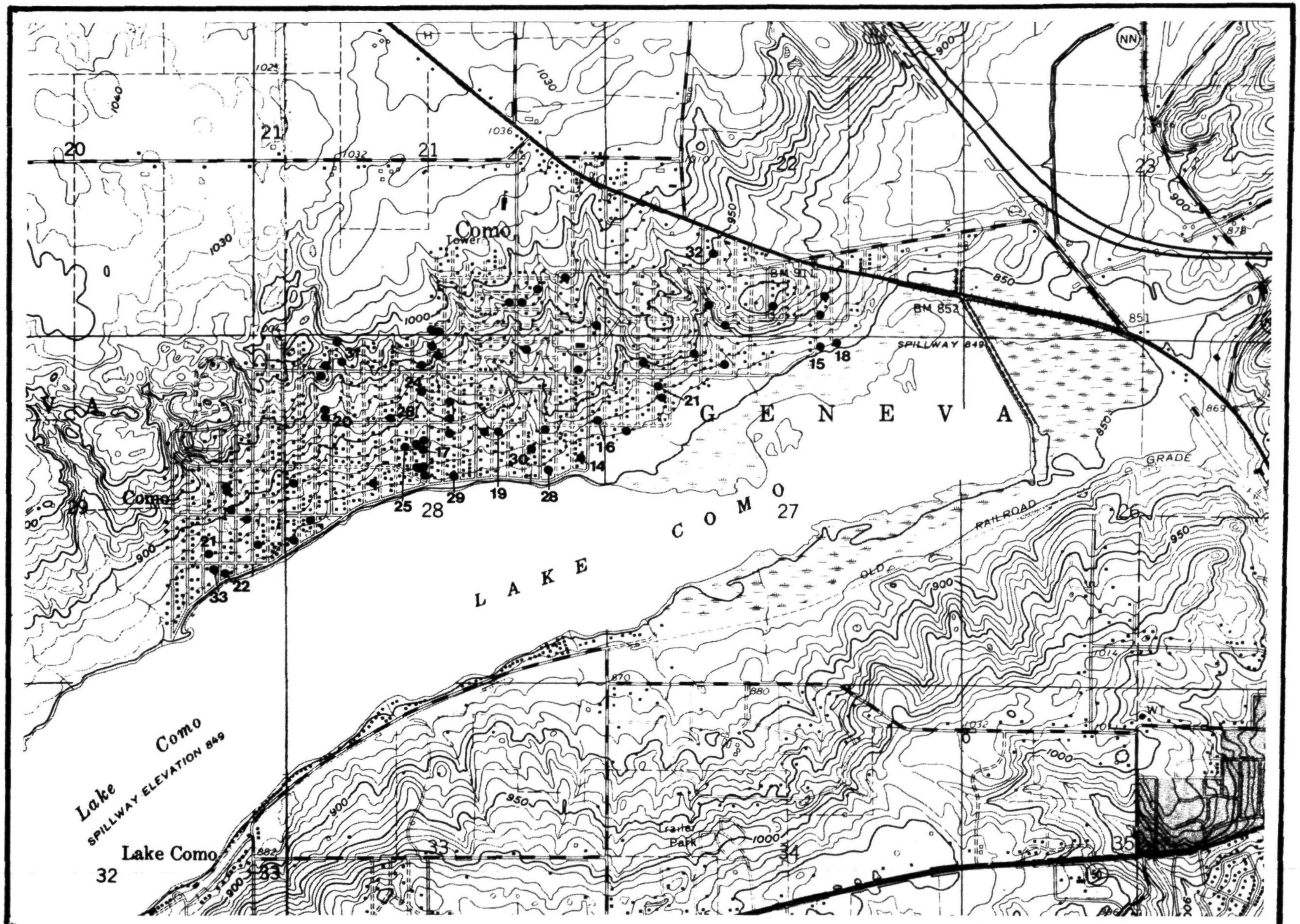


Figure 2-8a. Location of groundwater well sampling stations.

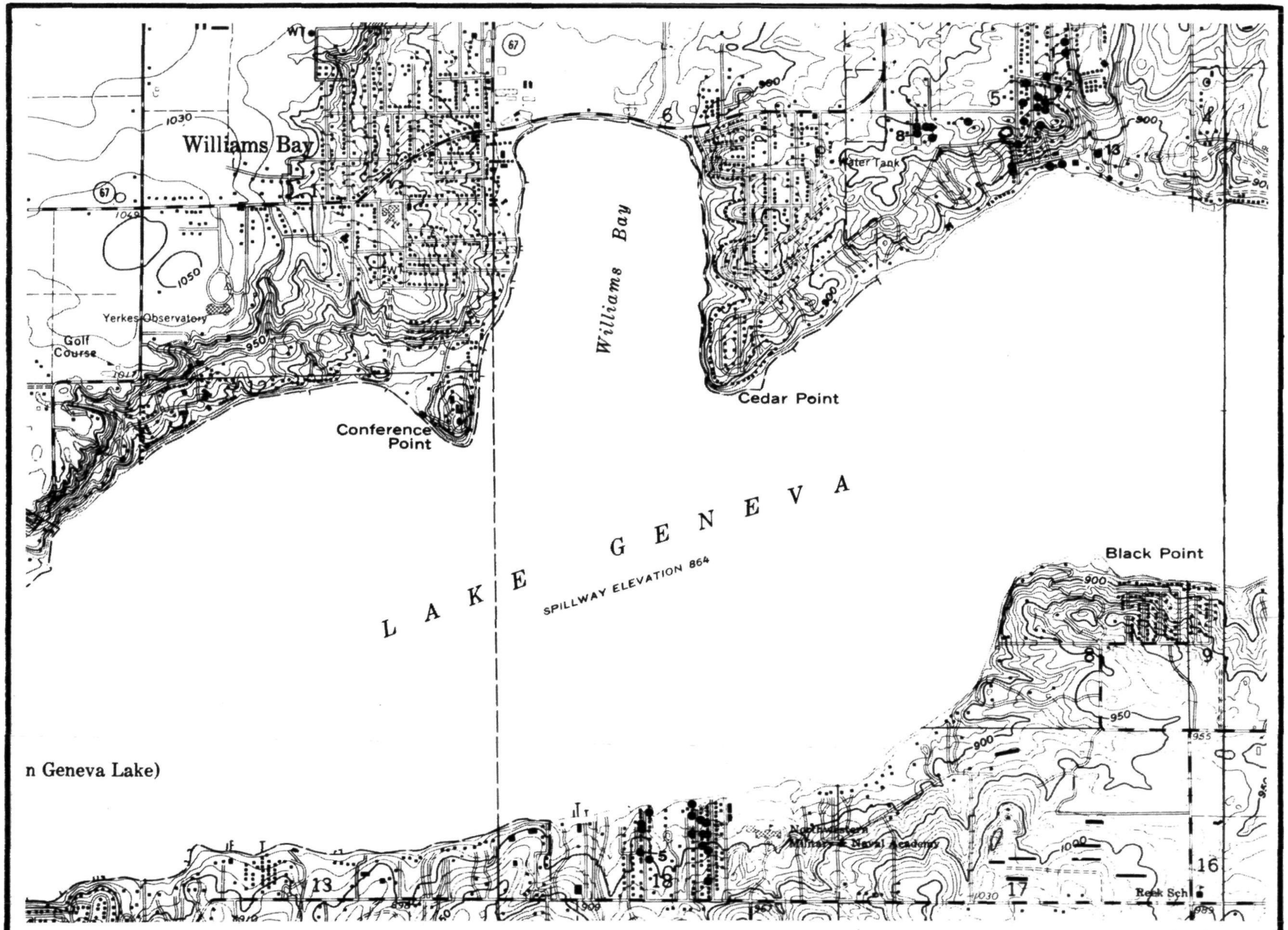


Figure 2-8b. Location of groundwater well sampling stations.

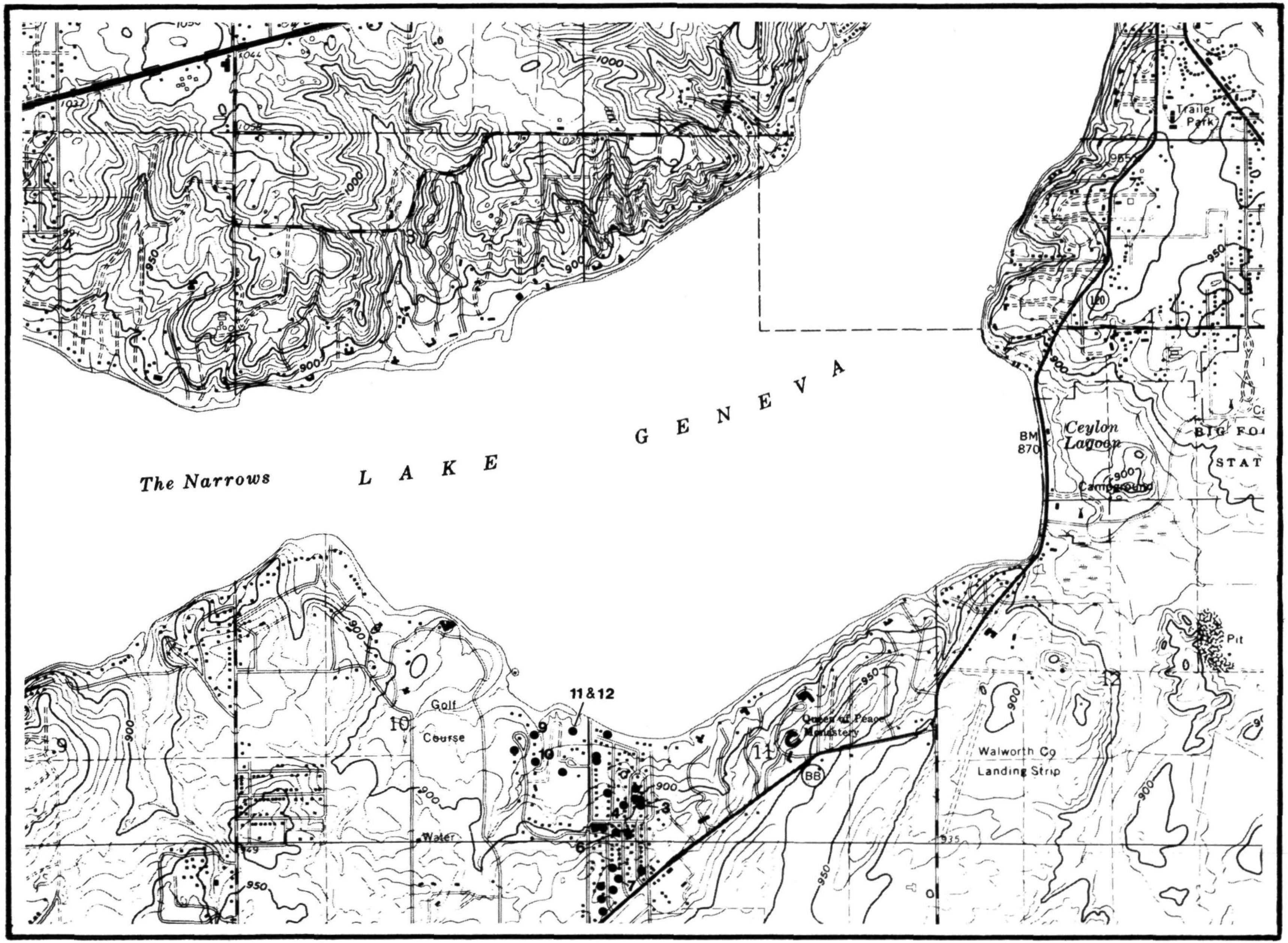


Figure 2-8c. Location of groundwater well sampling stations.

trations above 50 mg/l were also from these shallow wells. However, none of the elevated TKN concentrations was from these shallow wells, contrary to what one might expect.

2.2.2.6. Water Quality Sampling Results

Two Lake Geneva drainage area watersheds were analyzed to determine water quality impacts of existing land use on the basis of data in Table 2-10 and additional data provided by GLWEA (1982). Selected land use data from these sources for the Hillside Creek watershed on the southwest shoreline, and the Pottawatomie Creek watershed on the west shoreline of Lake Geneva are listed in Table 2-16.

Table 2-16. Selected land use data for comparison of watershed water quality determinants (all figures rounded to the nearest acre) (GLWEA 1982).

		Rural Land		Urban Land
Drainage Area	Total Acres Drained	Acres of Wetlands, Ponds, & Streams	Acres in Agricultural Use	Acreage, Total Sewered to Unsewered Acres
Hillside Creek	166	NR[a]	71	0/68
Pottawatomie Creek	514	26	63	77/19

[a]Not reported; assumed to be insignificant.

While Pottawatomie Creek drains more than three times as much land area as Hillside Creek and is a more significant source of water and nutrients to Lake Geneva (SEWRPC In pub.), land use characteristics of these watersheds are dissimilar. Therefore, it cannot be concluded that the higher nutrient load of Pottawatomie Creek is due only to its larger size. As presented by GLWEA (1982), Pottawatomie Creek watershed has a total of over 288 acres of combined dry-land natural areas and recreational land. These land uses are not manageable in terms of reducing nutrient or bacterial pollution loads. The same is true for the approximately 26 acres of combined wetlands, ponds, and stream acreage for the Pottawatomie Creek watershed. On the other hand, agricultural and residential land uses are significant nutrient sources that can be managed to achieve reduced nutrient loads by implementing erosion controls or by abating animal and human waste pollution.

As listed in Table 2-16, agricultural land use acreage figures for the two watersheds are similar. The use category of "developed land" is the only manageable land use type which varies significantly in areal extent between the two watersheds. This category includes residential, commercial, and industrial land uses, exclusive of green or forested surroundings. Nearly three quarters of the developed acreage in the Pottawatomie watershed is sewered (only 19 acres are not sewered). None of the 68 acres of developed land in the Hillside Creek watershed is sewered. Because assertions were made in the Facilities Plan (Donohue & Assoc., Inc. 1983a) that unsewered, developed lands are a significant source of nutrient and bacterial contamination, it was anticipated that water quality surveys of Pottawatomie and Hillside creeks would reflect qualitatively the extent of unsewered, developed land. Selected water quality data from surveys of these two watersheds conducted in 1975 and 1976 (GLWEA 1977) and subsequently in 1982 (refer to Table 2-10) are listed in Table 2-17.

Table 2-17. Selected water quality data for comparison of land use-water quality relationships.

Watershed	No. of Samples (data source)	Average Colonies /100ml.)	Average Coliform to Streptococcus Ratio	Average Nitrate-Nitrogen Concentration (mg/l)
Hillside Creek	n = 16 (GLWEA 1977)	526	1.25	0.24
Hillside Creek	n = 4 (Table 2-10)	37	NA[a]	0.97
Pottawatomie Creek	n = 16 (GLWEA 1977)	141	0. 90	0.49

[a]NA - data not available

No significant relationships were identified between the extent of unsewered, developed land (Table 2-16) and water quality data (Table 2-17). Factors which may have obscured the anticipated water quality impact of unsewered acreages in the Hillside Creek watershed include:

- Occurrence of historic drought during the sampling period covered by the GLWEA study (the summer and autumn of 1976)
- Existence of a barnyard or feedlot operation in the Hillside Creek watershed as identified in GLWEA (1982) land use tabulations.

An extended period of drought would decrease the likelihood of onsite treatment system failure and thereby increase the (apparent) significance in surface waters of non-human sources of bacterial indicator organisms. Stream access by dairy animals or even the presence of waterfowl or pets could account for the levels of fecal coliform reported for Hillside Creek waters by the GLWEA in 1975-1976 (Table 2-17). The probable presence of non-human sources of fecal coliforms is indicated by the relatively low ratios of coliform counts to streptococcus counts found by GLWEA in 1975-1976 for both of these streams. Both ratios are close to unity. A ratio approaching 4.4 is considered indicative of human waste sources (Geldreich 1965).

Speculations about the impact of the GLWEA sampling being conducted under drought conditions are somewhat corroborated by the relatively lower average nitrate concentrations found for Hillside Creek in the 1975-1976 survey as compared to the average from the 1982 watershed survey (Table 2-17). Nonetheless, the data (Tables 2-16 and 2-17) are insufficient for conclusive examination of land use and water quality relationship, particularly in light of the presence of a feedlot in the Hillside Creek area (GLWEA 1982) and the low ratios of fecal coliform to fecal streptococcus organisms found for both watersheds.

Although the Hillside Creek watershed has 3.5 times the amount of unsewered development as does the Pottawatomie Creek watershed, existing information on water quality is insufficient to indicate the need for providing sewer service.

2.2.2.7. Parcel Size Characteristics

One of the criteria that the County uses in evaluating new or replacement onsite systems is parcel size. Contiguous lots under one ownership were tabulated and the area calculated for developed and undeveloped parcels. A summary of parcel sizes for each subdivision within the RSSAs is listed in Table 2-18. A parcel size of 10,000 sf (minimum) within an existing subdivision currently is required for a new residence in Walworth County.

Small parcel sizes are indicative of potential difficulties in constructing and maintaining soil absorption systems. Either dry wells or reduced size seepage beds must be installed on small parcels. If individual wells are utilized, isolation distances (i.e., recommended distances between sanitary facilities and groundwater wells) are difficult to achieve and well pollution is possible. Small parcels are not necessarily a problem if the soils have relatively high permeabilities, if there is a deep water table, and if the residents produce small quantities of wastewater. For example, while developed parcels in the Camp Sybil Subdivision are small, few of the residents (all seasonal occupants) reported significant problems with their onsite systems.

A majority (approximately 55%) of the developed parcels in subdivisions along the southwest shore contain less than 10,000 sf each. These small lots are located primarily in the Lake Geneva Club, Shore Haven, and Camp Sybil subdivisions. Many other small parcels are available in the Maple Hills subdivision, but currently are undeveloped. Developed parcels in other subdivisions in the southwest shore area primarily are in the 10,000-20,000 sf size range.

Approximately 38% of the developed parcels along the southeast shore also contain less than 10,000 sf each. Lake Geneva Beach and Robinson's subdivisions contain a large portion of these small developed parcels. All developed parcels in Trinke Estates are larger than 15,000 sf.

Table 2-18. Summary of parcel sizes of contiguous lots in common ownership for subdivisions in square feet.

		2,000-5,000	5,000-7,500	7,501-9,999	10,000-12,500	12,501-15,000	15,001-20,000	20,000	Total
Oak Shores	residence	1	0	0	17	1	1	2	22
	vacant	0	0	0	0	0	0	0	0
Lake Geneva Club	residence	15	0	12	2	0	0	0	29
	vacant	0	0	1	0	0	0	0	1
Shore Haven -	residence	33	28	4	6	7	2	0	80
Camp Sybil	vacant	1	2	0	1	0	0	0	4
Academy Estates	residence	0	0	1	0	0	0	12	13
	vacant	0	0	0	0	0	0	3	3
Maple Hills	residence	0	0	1	3	5	4	15	28
	vacant	22	56	10	11	8	7	10	124
Subtotal, SW shore	residence	49	28	18	28	13	7	29	172
	vacant	23	58	11	12	8	7	13	132
Trinke Estates	residence	0	0	0	0	0	1	32	33
	vacant	0	0	0	0	0	1	5	6
Lake Geneva Beach	residence	0	24	11	9	4	11	10	69
	vacant	12	1	2	1	0	0	0	16
Robinson's Sub.	residence	3	29	7	15	7	6	6	73
	vacant	1	4	1	1	3	1	0	11
Robinson Hillside	residence	0	2	0	3	1	5	12	23
	vacant	1	1	0	5	1	1	8	17
Subtotal, SE shore	residence	3	55	18	27	12	23	60	198
	vacant	14	6	3	7	4	3	13	50
Lake Geneva	residence	6	23	8	30	10	6	2	85
Golf Hills	vacant	6	90	1	0	0	0	0	97
Forest Rest	residence	0	0	0	0	0	2	8	10
	vacant	0	0	0	1	0	0	4	5
Geneva Bay Estates	residence	0	0	0	0	0	7	12	19
	vacant	0	0	0	0	0	0	2	2
Subtotal, NE shore	residence	6	23	8	30	10	15	22	114
	vacant	6	90	1	1	0	0	6	104

Ara Glen Est.	residence	0	0	0	0	0	0	4	4
	vacant	0	0	0	0	0	0	5	5
Sylvan Tr. Est.	residence	0	0	0	0	0	1	8	9
	vacant	0	0	0	0	0	0	0	0
Cisco Beach	residence	17	37	27	33	14	14	7	149
	vacant	7	9	1	3	2	1	0	23
Rowena Park	residence	0	0	0	0	0	3	57	60
	vacant	0	0	0	0	0	0	6	6
Subtotal, NW shore	residence	17	37	27	33	14	18	76	222
	vacant	7	9	1	3	2	1	11	34
Lake Como Beach	residence	32	45	84	260	87	201	225	934
	vacant	191	104	94	306	34	65	61	855
TOTAL	residence	107	188	155	378	136	264	412	1,640
	vacant	241	267	110	329	48	76	104	1,175

Adjacent to the City of Lake Geneva (the northeast shore area), approximately 43% of the developed parcels in the Lake Geneva Golf Hills Subdivision and its addition (Hillmoor Heights) contain less than 10,000 sf each. The Forest Rest and Geneva Bay subdivisions consist entirely of parcels larger than 15,000 sf.

Of the northwest shore area subdivisions, only Cisco Beach has parcel sizes smaller than 10,000 sf. Approximately 55% of these developed parcels are less than 10,000 sf.

The Lake Como Beach Subdivision has 161 developed parcels of less than 10,000 sf (17%). These are distributed throughout the subdivision but most are located within 500 feet of the shoreline. Of the undeveloped parcels, 45% are less than 10,000 sf. Approximately 426 (46%) of the developed parcels in the Lake Como Beach Subdivision contain more than 15,000 sf each, which is an approximate minimum size for construction and operation of a full-size mound effluent disposal system.

2.2.2.8. Aerial Photographic Survey

An aerial photographic survey was conducted by the USEPA Environmental Photographic Interpretation Center (EPIC) in 1978-1979 to locate septic tank systems exhibiting apparent surface breakout failures in the study area. A field survey was conducted to confirm the apparent septic tank failures. The field survey identified 10 confirmed onsite system failures for Lake Como Beach and 9 marginally failing systems (Figure 2-9). A confirmed failure was a system at which strong evidence of effluent surfacing was observed at the time of the field inspection. A marginally failing system contained evidence of having failed in the past, or having the potential for malfunctioning during periods of excessive use or moderate to heavy rainfall. In the Lake Geneva area, the Lake Geneva Beach subdivision had one confirmed failure and three marginally failing systems, and the Lake Geneva Golf Hills Subdivision had one confirmed failure and two marginally failing systems.

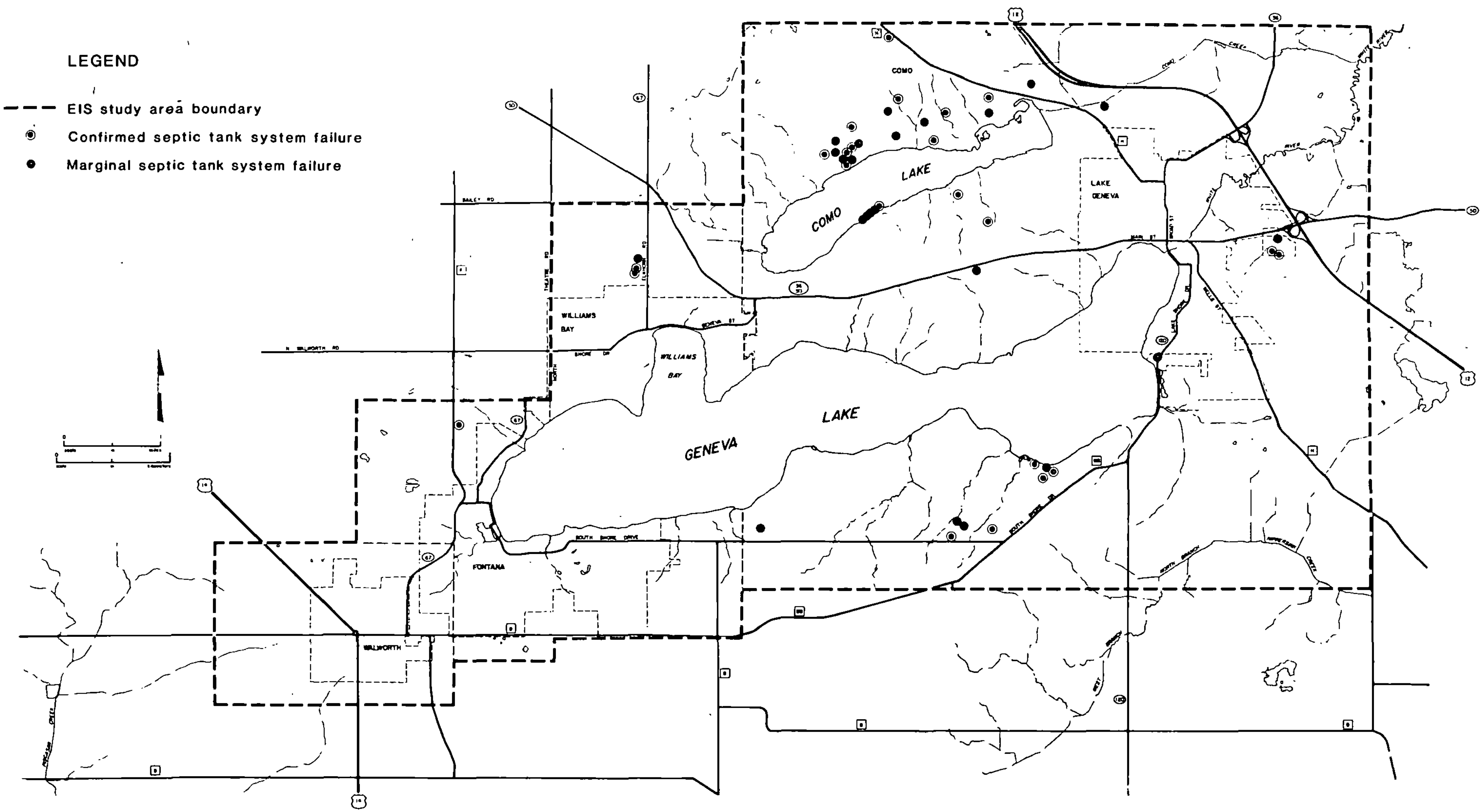


Figure 2-9. Location of confirmed and marginally failing onsite treatment systems.

2.2.3. Problems Caused by Existing Systems

Use of onsite systems that fail to function properly can result in backups in household plumbing, ponding of effluent on the ground surface, groundwater contamination that may affect water supplies, and excessive nutrients and coliform levels in surface water. The USEPA Guidance and Program Requirements Memorandums (PRMs) 78-9 and 79-8 (in effect when this project was initiated) required that documented pollution problems be identified and traced back to the causal factors. The USEPA Region V guidance document entitled "Site Specific Needs Determination and Alternative Planning for Unsewered Areas" provides guidance on how to satisfy these PRMs. Projects may be funded only where a significant proportion of residences can be documented as having or causing problems. The USEPA Region V interpretation of these regulations is that eligibility for USEPA grants is limited to those systems for which there is direct evidence that indicates they are causing pollution or those systems that are virtually identical in environmental constraints and in usage patterns to documented failing systems. The following four sections discuss the types of direct evidence of onsite system failure that are eligible for funding under the above referenced guidance.

2.2.3.1. Recurrent Backups

Backups of sewage in household plumbing constitute direct evidence if they can be related directly to design or site problems. Plugged or broken pipes or full septic tanks would not constitute an evidence of need. The opinion questionnaire and the sanitary survey utilized in this study provided information on backups within the study area. On the questionnaires, many respondents indicated that they had experienced backups but that they presently did not consider their system a problem or inconvenience. These systems are not obvious problems. On the surveys, several residents noted that they had sluggish drains after a period of wet weather. These qualify as obvious problems because repeated use of the facilities would cause a backup.

2.2.3.2. Surface Ponding

Ponding of effluent above or around a soil absorption system constitutes direct evidence of failure. Aerial photography was utilized to identify such failing systems within the RSSAs. The photographic analysis and subsequent field survey identified few confirmed failures with effluent ponding on the ground surface. Disposal areas of marginally failing systems were identified by the presence of lush vegetation over the beds or trenches, probably due to effluent rising near the soil surface. Groundwater ponding on the soil surface and effluent pipe discharges were presumed to be minor evidences of failures within the study area. Wastewater disposal permits also identified a small percentage of systems, as failing. The property owner questionnaire responses also indicated potential problems resulting in surface ponding. No distinction was made, though, between ponding (an obvious problem), and wet ground (not an obvious problem). Within the subdivisions in the RSSAs, 44 respondents out of a total number of 483 (9%) indicated that they experienced wet ground or ponding. Of 124 residences surveyed as part of the Sanitary Survey, only 5 indicated that they had problems with surface ponding or wet ground. The permit files contain correspondence concerning past experiences with surface failures but these have been repaired. This information was useful for assessing what types of environmental conditions and water use patterns caused surface failures.

2.2.3.3. Groundwater Contamination

Contamination of water supply wells constitutes direct evidence of soil absorption system failure when concentrations of nutrients indicative of soil adsorption system effluents greatly exceed background levels of groundwaters in the area and/or exceed primary drinking water quality standards. In order for well sampling data to qualify as direct evidence of failures, specific well information must be collected. This information includes depth of the well, its orientation with respect to soil absorption systems, and the degree of protection from surface contaminants.

Bacteriologically unsafe well water can result from improper well construction, improper pump installation, or groundwater contamination. Of the three, groundwater contamination seems to be the most minor cause. Well samples from the study area were tested for certain constituents (primarily conductivity, chlorides, ammonia, and nitrates), that would aid in identifying whether septic tank effluent is adversely affecting well water quality. Some wells in the study area are dug or driven, penetrating less than 30 feet. These shallow wells would have a high potential for contamination. While the well sampling conducted in conjunction with the sanitary survey showed these wells to have poorer quality water than deeper wells, drinking water quality standards were not exceeded, except for one fecal coliform sample from a 30 feet deep well in Lake Como Beach.

Other well water sampling programs conducted by GLWEA, K-V Associates, Inc., and Aqua-Tech Inc. also identified certain constituents that were elevated above background levels, but which did not exceed safe drinking water standards.

2.2.3.4. Surface Water Quality Problems

Surface water quality problems directly attributable to onsite systems must be serious enough to warrant taking action. Problems with public health implications from high fecal coliform counts, are serious enough to warrant attention. However, nutrient inputs, primarily nitrogen and phosphorus must be analyzed in terms of their contribution to water quality degradation and whether water quality would be significantly altered by an improvement action. A variety of means for evaluating the contribution of septic tank effluent to water quality problems are available and have been applied within the RSSAs.

Septic leachate detector surveys (Section 2.2.2.3.) were conducted to locate and quantify nutrient inputs from septic tank-soil absorption systems. When septic leachate plumes were located, groundwater samples were collected. The results indicate that most plumes of septic leachate origin had low levels of phosphorus and nitrate as compared to typical levels in unattenuated septic tank effluent. Coliform counts were rarely elevated;

elevated counts were obtained only where surface flows from streams entered lakes.

Water quality concerns in surface water focus primarily on bacteriological contamination rather than nutrient enrichment. Bacteriological contribution to surface waters from onsite systems in the study area was determined to be minimal, according to septic leachate detector sampling and other analyses.

Lush growth of macrophytes, algae, and zooplankton typically serve as indicators of nutrient enrichment. The septic leachate detector surveyors noted few places where evidence of nutrient enrichment was occurring. Mapping of aquatic biota often provides a general indication of the level of nutrient availability, although numerous sources may contribute to productivity. Specific connections between productive areas and septic tank effluents typically must be identified in order to determine the need for a project. None of the aquatic sampling programs conducted for this project made those specific connections.

2.2.3.5. Indirect Evidence

Indirect evidence that correlates with known failures can be used as an initial screening device for locating areas where failures are probable. Site limitations that imply failures are:

- Seasonal or permanent high water table
- Lack of isolation distances for water wells (depending on well depth and presence or absence of hydraulically limiting layers)
- Documented groundwater flow from a soil absorption system to a water well
- Slowly permeable soils with percolation rates greater than 60 minutes per inch
- Permeable bedrock within 3 feet of a soil absorption system
- Rapidly permeable soil with percolation rates less than 0.1 minutes per inch

- Holding tanks, which indicate that site limitations potentially prevent installation of soil absorption systems

- Onsite treatment systems that do not conform to accepted practices or current sanitary codes including, but not limited to, cesspools, the "55 gallon drum" septic tank, and other inadequately sized components

- Onsite systems in an area where local data indicate excessive failure rates or excessive maintenance costs.

These indirect evidences can be used to assess the probability that failures will occur in the near future, based on known failures of similar sized systems located in areas with similar water use patterns. In the RSSAs, inadequately sized systems have been the primary reason for additions to and replacements of existing systems. Most onsite systems recently upgraded in the study area were upgraded when a building permit for a structure alteration or addition was obtained; but some (especially in the early 1970s), were upgraded because they had failed. The primary environmental condition responsible for failures in the study area was a high water table. Only a few parcels within the RSSAs were determined to be unacceptable for soil absorption systems because the percolation rate is severely limiting. Also, rapidly permeable soils within the RSSAs were rarely encountered. Thus, it was concluded that most unsewered parcels within the RSSAs are suitable for onsite soil adsorption systems, as long as the water table depth is evaluated and designed for (e.g., by using mound systems) when necessary.

2.2.4. Identification of the Extent of Problems

Several currently unsewered subdivisions within the RSSAs were identified by Donohue & Assoc., Inc. as having combinations of problems and parcel size limitations such that off-site treatment (e.g., centralized collection and treatment) is necessary. These subdivisions were reevaluated where additional information was available, in order to clarify whether off-site treatment is necessary and whether off-site treatment is less costly than onsite treatment using an appropriate mix of technologies. To evaluate the existing sewage treatment systems and associated site conditions, each subarea was evaluated separately, as discussed in the following paragraphs.

2.2.4.1. Fontana RSSA (Southwest Shore Area)

The Fontana RSSA includes the northeast quarter of Section 11 between Fontana and Williams Bay, and most of Section 18 lying outside the Village of Fontana. Included in Section 18 are the Oak Shores, Lake Geneva Club, Shore Haven, Camp Sybil, Academy Estates, and Maple Hills subdivisions and the Northwestern Military and Naval Academy, in addition to individual parcels. Soils generally are moderately coarse-textured and the water table is deep. A few springs, though, are present south of South Shore Drive. Five ephemeral streams enter the lake within this area. Most residences are located within the Lake Geneva Club (31), Shore Haven (36), Camp Sybil (41), and Maple Hills (30) subdivisions. Residences predominately are occupied on a seasonal basis (158), compared to those occupied year-round (51). The Lake Geneva Club, Shore Haven, and Camp Sybil subdivisions have 48 occupied parcels of less than 7,500 sf, and 16 occupied parcels of between 7,500 sf and 10,000 sf.

The aerial photographic survey identified no failing or marginally failing onsite systems within the area. In the Oak Shores Subdivision, the sanitary questionnaire responses indicated that 2 out of the 10 respondents reported conditions that qualify as obvious problems. In the Lake Geneva Club Subdivision, two residents have identified frequent pumping and back-ups as typical experiences. One holding tank was installed because the parcel had insufficient size for a soil absorption system after the residence and a craft shop were altered. Sanitary surveys, questionnaires, and permit records were available for 14 of the 31 residences. The Shore Haven and Camp Sybil subdivisions have four parcels that lie in both subdivisions; thus, they are discussed together. Information was available on 32 out of 77 onsite treatment systems from questionnaires, sanitary surveys, and permit records. There were three systems for which failures were indicated. Three owners reported that they have cesspools, all of which were described as satisfactory. One holding tank was installed because insufficient lot area was available after a new house was constructed, and one other holding tank was reported. The Academy Estates Subdivision was subdivided and platted in 1975, consequently residences and associated onsite systems are of recent origin. One holding tank was installed. Information was available from questionnaires for two systems. The Maple Hills Subdivision contains 30 residences, with information from questionnaires available for five systems. One respondent indicated problems with backups. Unplatted lands in the vicinity of these subdivisions are large parcels with minimal problems. The questionnaires contained information from 11 residences and none noted serious problems. The marina, however, was noted as having problems with backups. Also, the Northwestern Military and Naval Academy replaced the seepage bed for their main building in 1974. During the 1982 septic leachate survey, a plume and a surface breakout were identified as coming from the system that serves auxiliary housing units on Shadow Lane.

The northeast quarter of Section 11 between Williams Bay and Fontana consists of Mogg's, Uihlein's and Robert's subdivisions, plus a few unplatted parcels. Approximately 18 residences and one business are located on these parcels. All are on large parcels, the smallest is about 20,000 square feet. The soils are deep and well drained, and the depth to the water table typically is greater than five feet.

Information from the questionnaires indicated that five septic tank and soil absorption systems and one cesspool were located within the area. The respondents indicated no problems of a serious nature.

2.2.4.2. Williams Bay RSSA (North Shore Area)

The unsewered area within the Williams Bay RSSA consists primarily of the Cisco Beach and Rowena Park subdivisions. Also included are the Sylvan Trail and Ara Glen subdivisions and contiguous parcels. The parcels within the Cisco Beach Subdivision are the smallest (81 of the 149 are less than 10,000 square feet), while the other subdivisions have none under 15,000 square feet. Soils are generally well drained, except for a portion of Cisco Beach and Sylvan Trail Estates that has a seasonally high water table of from one to three feet. The permeability of the soil is generally high, except in a few small areas.

One holding tank and one cesspool are reportedly located in Cisco Beach. One resident in an area with a somewhat high water table reported frequent pumping as a problem. Another resident reported that his system had backups and wet ground, and that the county sanitarian refused permission to extend the seepage bed because local soils had inadequate percolation rates. Consequently, the resident pumped the septic tank frequently during wet weather. Upgraded soil absorption systems have been installed for 10 systems since 1970.

Other subdivisions in the Williams Bay area had no systems that could be identified as obvious problems. Few systems required replacement (mostly for house additions) and soils and parcel size are not apparent problems.

2.2.4.3. Lake Geneva RSSA

The major unsewered areas within the Lake Geneva RSSA are the southeast shore area (from the Lake Geneva Country Club golf course to the Big Foot Beach State Park), Hillmoor Heights, and the Forest Rest and Geneva Bay Estates subdivisions. The highest density of residences is found in the Lake Geneva Beach and Robinson subdivisions along the southeast shore.

Subdivisions along the southeast shore, Trinke, Lake Geneva Beach, Robinson, and Robinson Hillside, are of primary concern. Within the Trinke Subdivision, a large area has soils with a high water table. Of 33 houses in the area, three utilize holding tanks and one has a mound system. From the questionnaires and sanitary surveys, four residents indicated that they have problems with their systems (one pumps the septic tank as a holding tank). The shallow water table extends into the Lake Geneva Beach Subdivision near the lakeshore, and along Hillside Drive. A small area within the Robinson Hillside Subdivision also has a high water table that would preclude installation of soil absorption systems. In addition, some areas in the Trinke and Robinson Hillside subdivisions have soils with a somewhat high water table such that mounds would be required. Generally, soils in this area are moderately coarse textured, especially in the lower portion of the soil profile. Most residences are on deep, well drained soils.

Two intermittent streams, Trinke and Hillside creeks, enter the lake in this area. The GLWEA sampling and subsequent WAPORA sampling identified elevated fecal coliform concentrations in Hillside Creek, but the source of the fecal material could not be positively identified.

The highest concentration of residences is in the Lake Geneva Beach (69 units) and Robinson (73 units) subdivisions, with smaller numbers in the Trinke (33 units) and Robinson Hillside (23 units) subdivisions. In the Trinke, Lake Geneva Beach, and Robinson subdivisions about 25% of the residents are permanent, while in Robinson Hillside nearly all of the residences are occupied year-round. Robinson Hillside is a relatively new subdivision with seven building permits issued since 1970, and has the greatest proportion of buildable parcels. Three residences in Robinson Subdivision are on parcels of less than 5,000 square feet; 55 residences in Lake Geneva Beach and Robinson are on parcels of 5,000 to 7,500 square feet and 18 residences in Lake Geneva Beach, Robinson, and Robinson Hillside are on lots of 7,500 to 10,000 square feet. The remaining 122 residences (62%) are on lots larger than 10,000 square feet.

The aerial photographic survey identified one confirmed and three marginally failing onsite systems in Lake Geneva Beach. Of the six questionnaire respondents in Robinson Hillside, one indicated conditions that qualify as an obvious problem. In Robinson, five residents indicated obvious problems, either by way of the questionnaire or sanitary survey; four of these were reportedly cesspools and one reported frequent pumping. In Lake Geneva Beach, five residents reported conditions that qualified as obvious problems, mostly excessive maintenance and cesspools. In addition, two holding tanks are known to exist in Lake Geneva Beach. In Trinke, three residents reported excessive maintenance of their system, and one indicated wet and soggy ground over the seepage field. Holding tanks are utilized for three new residences. All except one of these problem systems are on soils with an elevated water table such that the depth requirement for conventional seepage beds cannot be attained.

Areas of Sections 11, 12, and 14 between the subdivisions, Bigfoot Beach State Park, and along County Road BB are of lesser concern. Although only a forcemain is shown through this area, it is the intention of the City of Lake Geneva to ultimately provide sewer service to this area. A new lift station and forcemain will be constructed to replace the existing Bigfoot lift station and forcemain when it is constructed, the lift station and forcemain will have capacity to serve these areas of Sections 11, 12, and 14. Furthermore, it should be noted that the City of Lake Geneva is currently constructing a new interceptor known as the southeast interceptor. The design capacity for this interceptor included service to the areas south of Bigfoot Park. Approximately 26 permanent residences and 37 seasonal residences are located within this area. An additional five commercial structures, including at least one restaurant and the Queen of Peace monastery are within the area. Soils in this area primarily are deep and well drained, and are moderately coarse textured. Some areas along County Road BB have a seasonally high water table of 1 to 3 feet depth. Of the 10 questionnaire responses, two respondents indicated problems with backups (one of these indicated that their system was no longer a problem or inconvenience). The structure with continuing problems is a restaurant on County Road BB. Nearly all of the parcels are larger than 1/2 acre (21,780 sf) and have few limitations to utilization of onsite systems.

Another area of concern is Hillmoor Heights (the Lake Geneva Golf Hills Subdivision and Addition). It is assumed that the 83 residences are occupied year-round. Parcel sizes were determined to be as follows: six less than 5,000 square feet; 23 between 5,000 and 7,500 square feet, and eight between 7,500 and 10,000 square feet. A narrow band of soils in the Addition have a high water table, although only about three houses are located in this area. The aerial photographic survey identified one confirmed and two marginally failing systems. Questionnaire respondents indicated that two systems (of a total of 11 responses) were obvious problems. One of these was located in high water table soils, and the other system potentially utilized a holding tank (not verified).

West of Lake Geneva along the north shore of the lake are two subdivisions adjacent to the city limits, Geneva Bay Estates and Forest Rest. There are 30 residences in or adjacent to the subdivisions, and 20 of these are occupied year-round. Soils in the Geneva Bay Estates Subdivision have a seasonally high water table because the subdivision is located on the bottom and sides of a drainageway. The Forest Rest Subdivision is located on deep, well drained soils. The aerial photographic survey identified no failing systems in these subdivisions. In the Forest Rest Subdivision and in the contiguous parcels, all five sanitary questionnaire respondents indicated their systems were satisfactory, although one system uses a holding tank. All of the parcels in these subdivisions are larger than 15,000 square feet.

2.2.4.4. Lake Como RSSA

The Lake Como RSSA encompasses all of the Lake Como Beach Subdivision and some adjacent parcels along County Road H. There are approximately 950 residences in the RSSA, of which approximately one-half are seasonal. Permanent residences tend to predominate at greater distances from the lake, primarily because the parcels are larger and the residences were constructed more recently.

Approximately eight drainageways are located within the subdivision, and the soils along these drainageways have a high water table. At least two of these drainageways contain continuously flowing springs and have been utilized for drinking water supply by area residents, primarily because the water from local wells has high iron and sulfur content. Soils along the lakefront also have a high water table. A small percentage of residences are located on parcels with a high water table. Percolation rates measured for installation of onsite systems ranged from five to 60 minutes per inch, though most rates were near 30 minutes per inch. An occasional property was encountered that had percolation rates too slow for conventional soil absorption systems (60 minutes per inch).

The number of current failing systems was identified by evaluating data from the aerial photographic survey, the questionnaire results, the sanitary survey results, and the County sanitarian's records. According to these data, approximately 21 systems currently are failing. Failures primarily are surface seepage of effluent, although excessive maintenance to prevent surface failures and backups also are common. A few residents (approximately 8 out of 400) had no idea what kind of system was present (a number of these had no running water). Most failing systems were near the western end of the subdivision within two blocks of the lake. Proximity to drainageways and limited depth to the water table appeared to be the primary factors in these failures. Inadequate systems also was a common factor in the failures. An analysis of past failures that have been corrected revealed that a high water table was the most important factor, followed by inadequate system design. Approximately one-half of the past failures were rectified by installation of holding tanks. The remainder extended the seepage bed or dry well, or had mounds constructed. For many of the parcels on which holding tanks were installed, an area suitable for the extension of the soil absorption system or construction of a mound was not available.

A total of 32 residences are constructed on parcels less than 5,000 square feet, 45 are on parcels of 5,000 to 7,500 square feet, and 84 are on parcels of 7,500 to 10,000 square feet. A number of residences on two-lot parcels (4,000 square feet) have had upgraded soil absorption systems constructed on them with approval from the County sanitarian's office. These are allowed where soils are coarse-textured and the water table is low. Holding tanks have been installed on parcels that have restrictive soils or a high water table. Three of the 400 systems for which information is available are reported to be cesspools. Holding tanks are reported for 26 residences and three businesses. Only 11 of the 139 upgrades constructed since 1970 have been holding tanks. A few of the conventional upgrades installed in the early part of the decade have subsequently failed because they were not constructed in accordance with requirements of the Wis. Adm. Code.

2.2.5. Septage and Holding Tank Waste Disposal Practices

Septic tanks and holding tanks are pumped by contract septage haulers who provide their service on a by-call basis. Several commercial septage haulers operate in the area. The haulers are licensed and inspected by the WDNR Bureau of Solid Waste Management under the provisions of Chapter NR 113 of the Wis. Adm. Code.

Approximately 43 holding tanks currently serve residences within the RSSAs (approximately 22 permits were granted since 1970). In addition, approximately three businesses use holding tanks. The volume of holding tank waste currently pumped within the study area is approximately 2,000 gallons per residence per month, or approximately 600,000 gallons from residences and approximately 500,000 gallons from businesses per year. Owners of holding tanks installed subsequent to November 1980 must submit quarterly pumping reports to the County sanitarian detailing the date and the volume pumped. Records from five owners within the RSSAs have been submitted to the County sanitarian's office, one of which is a tavern in Lake Como Beach Subdivision. The records are not sufficiently extensive to establish a clear pattern of water usage. The volume utilized above (2,000 gallons per month) was based on existing records and estimated residence occupancy.

Septage (septic tank solids) volumes are difficult to determine because each residence and each type of onsite system produces septage at considerably different rates. The rule of thumb for a permanent residence is 65 to 70 gallons per capita per year (USEPA 1977b). Septage production from seasonal residences is assumed to be 15 gallons per capita per year. Approximately 71,000 gallons per year of septage currently is discharged from residences in the RSSAs. The volume of septage pumped from businesses is negligible in comparison.

Haulers dispose of holding tank wastes and septage on land. The haulers each have state inspected and approved sites where they may apply wastes to the land. The WDNR Bureau of Solid Waste Management has statutory authority over these licensed disposal sites. The Bureau inspects sites for initial licensing, and has responsibility for inspecting subsequent operations. Septage and holding tank wastes are surface-applied to the land throughout the year. Bureau regulations specify that no surface spreading of these liquid wastes may occur within 1,000 feet of a residence (500 feet if the homeowner grants permission); wastes must be spread on lands with at least 36 inches of soil; sites must satisfy requirements for separation distance from drainageways and wells; and wastes must be applied at a rate of less than 30 gallons per 100 square feet (13,000 gallons per acre) per day. This means that, currently, approximately 0.25 acres of land are required for septage disposal within the RSSAs.

2.3. Identification of Wastewater Management Options

2.3.1. Design Factors

Sections 2.1. and 2.2. of this EIS provided a description of existing centralized collection and treatment systems, and existing onsite treatment systems currently operating in the RSSAs. To plan for proper wastewater management in the future, one must first determine the future conditions. One must also determine what kind of economic evaluation criteria will be used for evaluating various alternatives, in order to compare all alternatives on an equal basis. These conditions (population, wastewater flows, effluent limitations, and economic criteria) remain the same and are applicable to all alternatives, regardless of what size or type of alternative collection and treatment system is evaluated.

2.3.1.1. Planning Period

Current USEPA guidelines specify that a planning period of 20 years be used in facilities planning (USEPA 1982a). Although some structures like sewer pipelines can last 40 or 50 years, most major sewage treatment process equipment has a design life of 15-20 years. A 20-year design period is reasonable since it is long enough to satisfy a community's needs for a reasonable period, yet allows for additional facility expansion or upgrade at a time when most equipment will be wearing out. Although it may be difficult to complete construction by 1985 (depending on what kind of facilities are evaluated and proposed), the Wisconsin Department of Natural Resources (WDNR) has approved the period 1985-2005 as the facilities planning period for this project. Population projections estimated for this period are presented in Section 3.2.2.

2.3.1.2. Flow and Wasteload Reduction

A design year peak population (Section 3.2.2.) typically is utilized to determine sewage flow that would be generated by residents and by commercial and industrial facilities. However, before a design flow can be determined, other flows and/or wasteloads must be evaluated to document that proposed treatment facilities would not be treating extraneous flows or pollutants that are not cost-effective to treat in a collection and treatment facility. Elimination or reduction of extraneous wastewater flows and wasteloads can substantially reduce the size of new or expanded treatment facilities. Methods of flow and waste reduction considered for use in the study area include reduction of infiltration and inflow to existing sewers, reduction of commercial/industrial wasteloads, water conservation measures, waste segregation, and a detergent phosphorus ban.

Infiltration/Inflow Reduction

Extraneous flow from infiltration/inflow (I/I) into sewer systems can be a significant part of the wastewater flow to a WWTP. Rehabilitation of existing sewer lines to eliminate I/I (when cost-effective) can often substantially reduce the required capacity of a new or upgraded WWTP.

As described in Section 2.1., an I/I analysis often is conducted when water other than wastewater is suspected to be entering a sewer system. I/I analyses were prepared for Lake Geneva (Donohue & Assoc., Inc. 1978b), Walworth (Donohue & Assoc., Inc. 1976), Fontana (Donohue & Assoc., Inc. 1978d), and Williams Bay (Donohue & Assoc., Inc. 1978c). Estimated I/I flows for these communities are presented in Table 2-19. No I/I flow was found in the Walworth system. Excessive I/I was found in the Fontana Wastewater Collection System; it was the only system where rehabilitation of the collection system might be cost-effective, according to USEPA guidelines.

A Sewer System Evaluation Survey (SSES) was prepared for Fontana (Donohue & Assoc., Inc. 1980a). An SSES is a detailed survey of limited portions of a collection system which were identified by the I/I analysis to

Table 2-19. Estimated I/I flows within centralized sewage collection systems as determined by I/I and SSES analyses for the RSSAs (Donohue & Assoc., Inc. 1976, 1978b, 1978c, 1978d, 1980).

RSSA	Average Annual I/I (mgd)	Maximum (Peak) I/I (mgd)
Lake Geneva	0.120	1.650
Williams Bay	0.217	1.200
Fontana	0.432	1.843
Walworth	0.0	0.0

have large amounts of extraneous flow. The SSES typically involves inspecting and evaluating each foot of pipe in the portion of the sewer system being studied, using smoke injectors, dye studies, and internal television inspection. The SSES determines where each fault is, what kind of fault it is, how much extraneous flow the fault allows to enter the system, and how much it will cost to repair each fault. The Fontana SSES report concluded that it was cost-effective to remove 1.145 mgd (61%) of the peak and 0.262 mgd (61%) of the annual average I/I. Rehabilitation costs were estimated to be $242,000 (Dec. 1979). After rehabilitation, the I/I flow was expected to be 0.699 mgd peak, and 0.170 mgd, annual average. Rehabilitation efforts on the Fontana collection system completed in 1982 helped reduce flows to the WWTP initially, but currently flows are as high (greater than 1 mgd) as they were prior to conduct of the rehabilitation program (By telephone, Ralph Wiedenhoft, Fontana WWTP Superintendent, 28 October 1983). Thus, I/I values shown in Table 2-19 for Fontana represent I/I values determined by the SSES prior to rehabilitation.

A review of the I/I analysis for Williams Bay indicated that the cost-effectiveness analysis was prepared using a large estimated population (5,500), as compared to the estimated peak population of 3,670 (sewered). Current USEPA guidelines (USEPA 1982a) suggest the I/I may be excessive if average daily flows are greater than 120 gpcd, or if peak flows received at the WWTP are more than 2.5 times the average design capacity. Approximately 3,670 persons generating average summer flows of 0.425 mgd equals 116 gpcd. The peak flows of 1.408 mgd received at the Williams Bay WWTP, divided by the average daily design flow of 0.786 mgd, equals a peak factor of 1.79. Since the value 116 gpcd is less than the 120 gpcd guideline and the 1.79 peak factor is less than the guideline of 2.5, I/I at the Williams

Bay WWTP is not excessive, as was determined by the original I/I analysis. However, WDNR has reviewed these documents, questioned population and flow figures, and indicated their belief that I/I is excessive. Therefore, the population and flow figures used in the Williams Bay I/I analysis were questioned and a reanalysis performed by the WDNR concluded that the I/I in the Williams Bay system is excessive. The WDNR recommended that a SSES be performed in the village.

Since the I/I analyses conducted for this project concluded that I/I is not excessive in Walworth or Lake Geneva, further actions regarding removal of I/I are not required in these areas. Fontana has conducted a SSES and a partially successful sewer rehabilitation program, thus further I/I removal efforts may be required. However, wastewater collection systems in these municipalities will continue to deteriorate throughout the 20-year planning period. Therefore, routine efforts to maintain the structural integrity of the collection system and to keep I/I at a minimum should continue throughout the planning period.

Commercial/Industrial Wasteload Reduction

In addition to flow, the "strength" of sewage also greatly affects the size and cost of sewage treatment processes. Average residential sewage flows typically have organic loadings, or sewage strengths, in the range of 150 mg/l to 300 mg/l of 5-day biochemical oxygen demand (BOD). Some industries typically discharge sewage with much more strength than residential sewage, with BODs often in the 1,000 mg/l to 3,000 mg/l range. USEPA requires approved sewer use ordinances and industrial pretreatment ordinances. These ordinances typically require all facilities that discharge wastewater from commercial and industrial processes to have a permit. The ordinances also allow the city to monitor industrial discharges and, if excessive or abnormally high or low strength wastewaters are being discharged, the city can assess additional financial charges or require pretreatment of the wastewater. In addition, the ordinances often prohibit discharge of certain stormwaters, high temperature wastes, greases and waxes, flammable materials, solids, unshredded garbage, oils, acids, heavy metals, toxic compounds, radioactive materials, or other materials in excess of limits established in the ordinance that could damage collection lines or could be detrimental to sewage treatment processes.

USEPA construction grants regulations regarding transport and treatment of compatible industrial wastewaters state:

> "(a) Grant assistance shall be provided for treatment works capacity to transport or treat compatible industrial wastewater, only if the treatment works (including each collector, interceptor, pumping station, plant component, and other system component) would be eligible for grant assistance in the absence of the industrial capacity (USEPA 1982b)."

In other words, USEPA generally would fund collection and treatment facilities needed for treating residential sewage, but would not fund additional treatment units or larger units required to treat high strength industrial flows that could be eliminated by industrial pretreatment.

Although the Geneva Lake area primarily is recreational in nature, several commercial and industrial facilities generate and discharge wastewater to existing collection facilities. The City of Lake Geneva and the Villages of Williams Bay, Fontana, and Walworth all have sewer use ordinances that allow control of what is discharged to the sewers. Industries currently do not discharge significant amounts of wastewater to the systems, thus implementation of additional industrial pretreatment monitoring and control programs probably is not necessary. It also does not appear that future treatment facilities will be designed for or subjected to unreasonable amounts of industrial wastewater flows. The cities in the study area, however, must continue the monitoring and enforcement of current sewer use ordinances in order to comply with Construction Grants regulations (USEPA 1982b).

Water Conservation Measures

Concerns over the high costs of water supply and wastewater disposal and an increasing recognition of the benefits that may accrue through water conservation are serving to stimulate the development and application of water conservation practices. The diverse array of water conservation practices may, in general, be divided into three major categories: (1) elimination of non-functional water use; (2) water-saving devices, fixtures, and appliances; and (3) wastewater recycle/reuse systems.

Elimination of Non-functional Water Use

Non-functional water use typically is the result of the following:

- Wasteful water-use habits such as using a toilet flush to dispose of a cigarette butt, allowing water to run while brushing teeth or shaving, or operating a clotheswasher or dishwasher with only a partial load,

- Excessive water supply pressure - for most dwellings a water supply pressure of 40 pounds per square inch (psi) is adequate, and a pressure in excess of this can result in unnecessary water use and wastewater generation, especially with wasteful water-use habits,

- Inadequate plumbing and appliance maintenance - unseen or apparently insignificant leaks from household fixtures and appliances can waste large volumes of water and generate similar quantities of wastewater. Most notable in this regard are leaking toilets and dripping faucets. For example, even a pinhole leak which may appear as a dripping faucet can waste up to 170 gallons of water per day at a pressure of 40 psi. More severe leaks can waste more water and generate even more massive quantities of wastewater.

Water-Saving Devices, Fixtures, and Appliances

The quantity of water traditionally used by household fixtures or appliances often is considerably higher than actually needed. Typically, toilet flushing, bathing, and clotheswashing collectively account for more than 70% of the interior water use and wastewater flow volume of a household (Siegrist, Woltanski, and Waldorf 1978). Thus, efforts to accomplish major reductions in wastewater flow volume, as well as its pollutant load, have been directed toward these uses. Some selected water conservation/wasteload reduction devices and systems developed for these household activities include:

- Toilet devices and systems
    - Toilet tank inserts - such as water filled and weighted plastic bottles, flexible panels, or dams
    - Dual-flush toilet devices

Shallow-trap toilets
Very low volume flush toilets
Non-water carriage toilets

- Bathing devices and systems
  Shower flow control devices
  Reduced-flow shower fixtures

- Clotheswashing devices and systems
  Wasteflow reduction may be accomplished through use of a front loading machine which requires less water. Also, a clotheswasher with a suds-saver feature provides for storage of washwater from the wash cycle, for subsequent use as wash water for the next wash cycle. The rinse cycle which uses fresh, clean water remains unchanged.

Wastewater Recycle/Reuse Systems

These systems provide for the collection and processing of all household wastewater or of fractions produced by certain activities, for subsequent reuse. A system which has received a majority of development efforts includes recycling bathing and laundry wastewater for flushing water-carriage toilets or for outside irrigation.

Other Water Conservation Measures

Another possible method for reduction of sewage flow is the adjustment of the price of water to control consumption. This method normally is used to reduce water demand in areas with water shortages. It probably would not be effective in reducing sanitary sewer flows because much of its impact is usually on luxury water usage, such as lawn sprinkling or car washing. None of these luxury uses imposes a load on a sanitary sewerage system or on onsite systems. Therefore, use of price controls in this study area probably would not be effective in significantly reducing wastewater flows. In addition, because many residents in the study area obtain water from individual wells, the only cost savings associated with reduced water use would be as a result of lower power costs for pumping and less chemical use for conditioning or treatment of the water by the individual homeowner.

Other measures include educational campaigns on water conservation in everyday living, and installation of pressure-reduction valves in areas where water pressure is excessive (greater than 60 pounds per square inch). Educational campaigns usually take the form of spot television and radio commercials, and distribution of leaflets with water and sewer bills. Water saving devices must continue to be used and maintained for flow reduction to be effective.

Results of Water Conservation Measures

Wastewater flows on the order of 15 to 30 gpcd can be achieved by installation of combinations of the following devices and systems:

- Replace standard toilets with dual cycle or low volume toilets
- Reduce shower water use by installing thermostatic mixing valves and flow control shower heads. Use of showers rather than baths should be encouraged whenever possible
- Replace older clotheswashing machines with those equipped with water-level controls or with front-loading machines
- Eliminate water-carried toilet wastes by use of in-house composting toilets
- Use recycled bath and laundry wastewaters for lawn irrigation during the summer
- Recycle bath and laundry wastewaters for toilet flushing. Filtration and disinfection of bath and laundry wastes for this purpose has been shown to be feasible and aesthetically acceptable in pilot studies (Cohen and Wallman 1974; McLaughlin 1968). This is an alternative to in-house composting toilets that could achieve the same level of wastewater flow reduction
- Use of commercially available air-assisted toilets and shower heads, using a common air compressor of small horsepower could reduce sewage volume from these two largest household sources up to 90%.

Impacts of Water Conservation Measures on Wastewater Treatment Systems

Methods that reduce wastewater flow or pollutant loads may provide the following benefits to a wastewater program:

- Reduce the sizes and capital costs of new sewage collection and treatment facilities
- Delay the time when future expansion or replacement facilities will be needed
- Reduce operation costs of pumping and treatment
- Mitigate sludge and effluent disposal impacts
- Extend the life of existing soils absorption system(s) that currently are functioning satisfactorily
- May reduce wastewater loads sufficiently to remedy failing soil absorption systems in which effluent is surfacing or causing backups
- Reduce the size of the soil disposal field required for new onsite systems.

The I/I reports conducted for this project analyzed the residential contribution to the total wastewater flow for each RSSA based on water supply records. These records indicated that, for the permanent population, the per capita residential flow contribution (average daily base flow - ADBF) is approximately 48 gpcd for Lake Geneva, 40 gpcd for Walworth, 85 gpcd for Fontana, and 55 gpcd for Williams Bay. USEPA guidelines indicate that water conservation and flow reduction measures must be considered where the ADBF is greater than 70 gpcd, unless the current population is less than 10,000 (USEPA 1981b). Based on this criteria, implementation of water conservation measures will not be required for Lake Geneva, Walworth or Williams Bay, because the ADBF is less than 70 gpcd for these communities. The ADBF for Fontana is greater than 70 gpcd, but its population (permanent plus seasonal) is less than 10,000. Based on these analyses, implementation of water conservation measures will not be mandatory in the sewered areas of the RSSAs.

The water conservation measures described herein should be considered for implementation on an individual, voluntary basis, particularly for the unsewered areas. Application of these measures will enhance the operation of existing, upgraded, and future onsite systems. Where appropriate, some of these measures are included in the preliminary design and costing of onsite portions of the wastewater management alternatives evaluated later in this document. Additional potential benefits of flow reduction to the community, as well as the usefulness of methods, analysis procedures, and examples are provided in a document entitled Flow Reduction (USEPA 1981a).

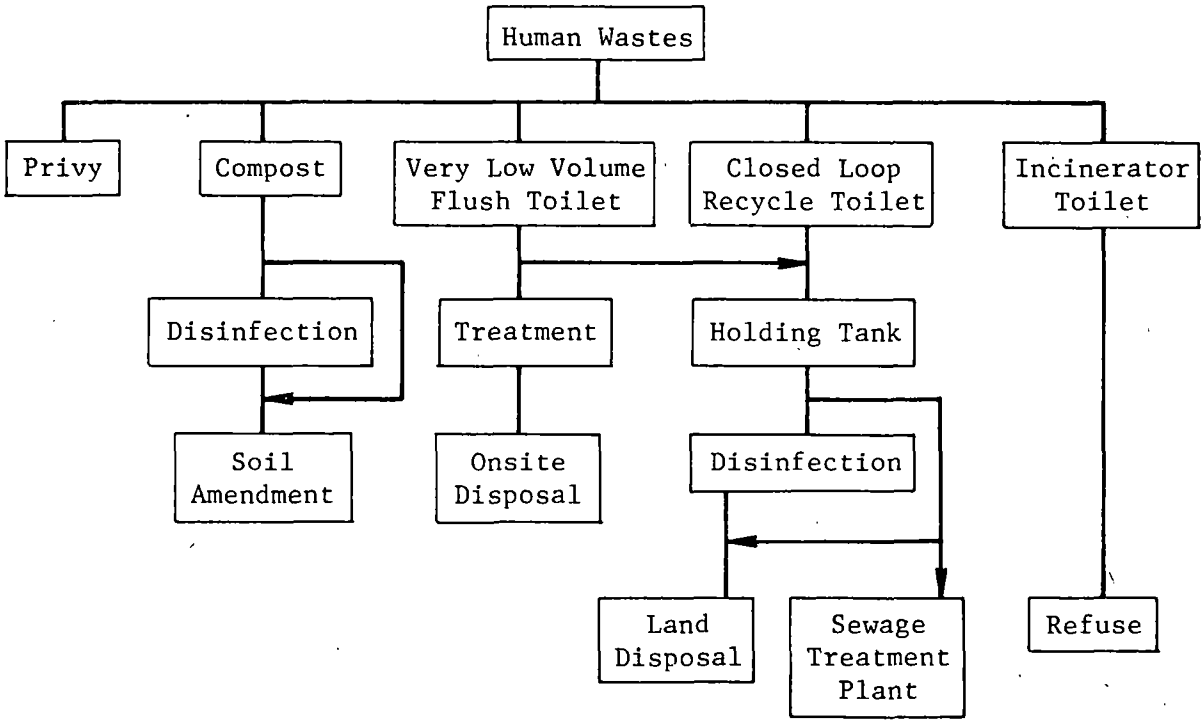
Waste Segregation

Various other methods for wastewater flow and wasteload reduction involve separation of toilet wastes from other liquid waste. Several toilet systems can be used to provide for segregation and separate handling of human excreta (often referred to as blackwater), and, in some cases, garbage wastes. Removal of human excreta from wastewater serves to eliminate significant quantities of pollutants, particularly suspended solids, nitrogen, and pathogenic organisms (USEPA 1980).

Wastewater generated by fixtures other than toilets often is referred to as graywater. Characterization studies have demonstrated that typical graywater contains appreciable quantities of organic matter, suspended solids, phosphorus, and grease. Organic materials in graywater appear to degrade at a rate not significantly different from those in combined residential wastewater. Microbiological studies have demonstrated that significant concentrations of pathogenic organisms, such as total and fecal coliforms typically are found in graywater (USEPA 1980).

Although residential graywater does contain pollutants and must be properly managed, graywater may be more simple to manage than total residential wastewater due to a reduced flow volume. A number of potential strategies for management of segregated human excreta (blackwater) and graywater are presented in Figure 2-10. Since implementation of wasteload reduction measures is not mandatory for the RSSAs (as explained previously), use of waste segregation measures will not be considered further in the development of alternatives for the RSSAs. However, the municipalities and individual onsite system owners in the RSSAs are encouraged to consider and utilize waste segregation facilities on an individual, voluntary basis.

SEGREGATED HUMAN WASTE MANAGEMENT



GRAYWATER MANAGEMENT

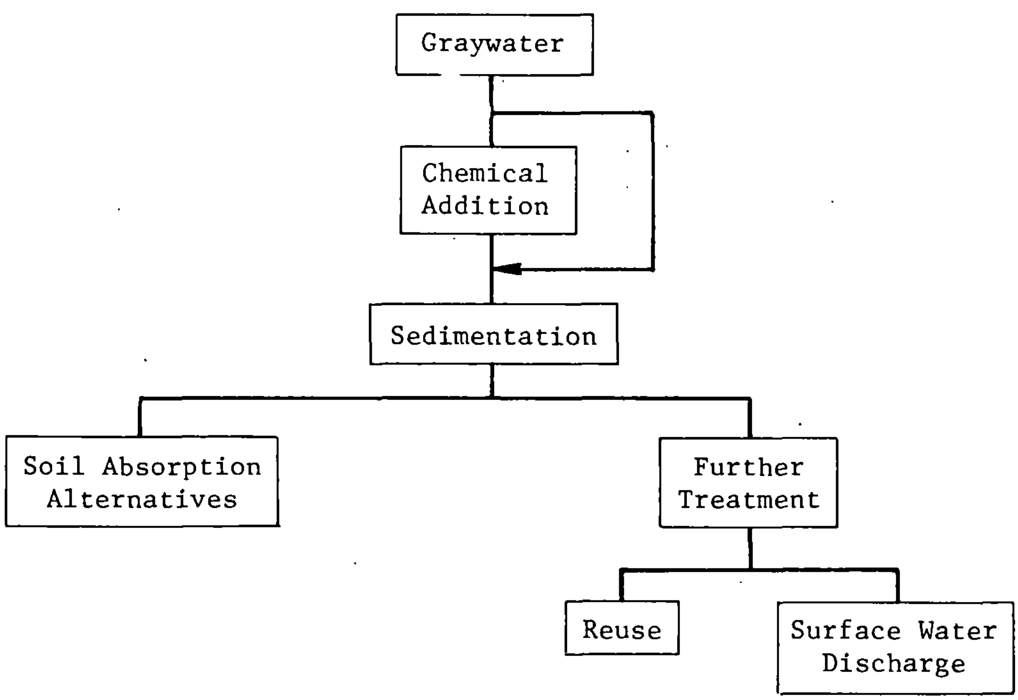


Figure 2-10. Example strategies for management of segregated human wastes and residential graywater.

Wisconsin Ban on Phosphorus

Phosphorus frequently is the nutrient that controls algal growth in surface waters, and therefore has an important influence on lake or stream eutrophication. Enrichment of lake waters with nutrients encourages the growth of algae and other microscopic plant life. Decay of plants increases biochemical oxygen demand (BOD) and lowers the amount of dissolved oxygen (DO) in water. Substantial drops in DO levels subsequently can result in loss of aquatic life (e.g., fish kills). The addition of nutrients into lake waters also encourages higher forms of plant life, thereby hastening the aging process by which a lake evolves into a bog or marsh. Normally, eutrophication is a natural process that proceeds slowly over time. However, human activity can greatly accelerate the eutrophication process. Phosphorus, nitrogen, and other nutrients contributed to surface waters by human wastes, laundry detergents, and agricultural runoff often result in over-fertilization, over-productivity of plant matter, and "choking" of a body of water within a few years.

To reduce phosphorus concentrations in wastewater, the Wisconsin legislature previously banned the use and sale of domestic laundry detergents containing more than 0.5% phosphorus by weight. The original ban, which expired in July 1982, was reintroduced and passed in the 1983 Legislative Session and became effective in January 1984. The original ban appears to have had a positive impact on surface water quality in the Great Lakes Basin, primarily by reducing phosphorus levels and algae in tributary and near-shore waters (Hartig and Horvath 1982). The preliminary assessment of the effect of the original ban concluded that:

- Based on a survey of 58 major wastewater treatment plants in Michigan, influent and effluent total phosphorus concentrations decreased by 23% and 25%, respectively
- The phosphorus detergent ban resulted in a 20% reduction in total phosphorus loadings to the Great Lakes.

A phosphorus ban does not increase or decrease the cost of onsite wastewater treatment systems. It is possible (although not confirmed or quantified by previous research), that a reduction in phosphorus discharged to soil absorption systems results in a considerable reduction in the amount of phosphorus transported to the groundwater from soil disposal systems. Since a phosphorus ban has been imposed by the State, further consideration of phosphorus bans by the municipalities in the RSSAs is not required.

2.3.1.3. Flow and Wasteload Characteristics

Once population projections, and flow and wasteload control strategies had been developed and/or evaluated, a summary of existing conditions (existing WWTP flows, per capita flows, and WWTP capacities) was made (Table 2-20) so that this information could be analyzed and reasonable flow and wasteload characteristics selected for application to projected conditions.

Design criteria were selected based upon information presented in various facilities planning documents and standard engineering design references (Table 2-21). The design factors for flows and loadings basically are the same as used by the facilities planner, with the exception of the per capita flows for Fontana and Williams Bay. Whereas the facilities planners used values of 99 gpcd and 80 gpcd for the theoretical average daily base flow (not including I/I) for permanent residents for Fontana and Williams Bay, respectively, the EIS design criteria used approximately 81 and 55 gpcd, respectively (Table 2-21 and Tables E-7 and E-8 Appendix E of the Draft EIS). These values were developed from water use records from the respective communities.

The design criteria were applied to projected conditions to arrive at design flows and loadings for the year 2005. The design flows developed for use in the EIS evaluations are listed in Table 2-22. Design information used by the facilities planners are listed in Table 2-23 for comparison.

Existing WWTP capacities were compared to projected wastewater flows from currently sewered portions of the RSSAs to determine if the existing WWTPs were adequate to serve future needs (Table 2-24). The Lake Geneva

Table 2-20. Estimated existing flow and WWTP capacities for Lake Geneva, Walworth, Fontana, and Williams Bay (Adapted from Donohue and Assoc., Inc. 1976, 1978b, 1978c, 1978d, and 1980a).

Item	Units	Lake Geneva I/I	Walworth I/I	Fontana I/I	Fontana SSES	Williams Bay I/I
Theoretical Wastewater Flow[a]						
Permanent residents						
Population		5469	1662[b]	1885		1700
Flow rate	gpcd	48	40	85		55
Flow	mgd	0.261	0.067	0.155		0.093
Other						
Seasonal residents	mgd	0.140	-	0.233		0.021
Commercial[c]	mgd	0.362	0.029	0.227		0.071
Industrial	mgd	0.023	0.010	-		-
Public[c]	mgd	0.060	0.011	-		0.012
Subtotal	mgd	0.585	0.050	0.460		0.104
Total summer average	mgd	0.846	0.117	0.615	0.615	0.208
I/I total						
Average annual	mgd	0.120	0.0	0.291	0.432	0.217
Maximum	mgd	1.650	0.0	1.444	1.843	1.200
Total						
Summer seasonal average	mgd	0.966	0.117	0.906	1.047	0.425
Maximum	mgd	2.495	0.117	2.059	2.458	1.408
Existing WWTP capacity						
Average annual design	mgd	1.1	0.150	0.9	0.9	0.786
Maximum hydraulic	mgd	3.0[d]	0.300	1.8	1.8	-

[a]Estimated from water pumping records from 1976 (except for Walworth 1974-1975).

[b]"Average" annual population.

[c]Summer flow. Winter flow less for some communities.

[d]Raw water pumping capacity.

Table 2-21. Summary of wastewater flow and organic loading design factors used in this EIS for the Geneva Lake-Lake Como RSSAs.

Item	Unit	Residential Perm.	Residential Seasonal[b]	Residential Transient[b]	Comm.	Indust.	Public
Wastewater Flows[a]							
Lake Geneva	gpcd	50	40	35	45	10	5
Fontana[c]	gpcd	81.3	40	35[d]	18.0	-	3.9
Walworth	gpcd	44.0	40	35	26.4	7.2	4.1
Williams Bay	gpcd	54.7	40	35	31.1	-	7.2
Organic Loading[e]							
Lake Geneva and Walworth							
BOD	lb/c/d	0.17	0.14	0.12	-	-	
SS	lb/c/d	0.20	0.16	0.14	-	-	-
TKN	lb/c/d	0.034	0.026	0.022	-	-	-
NH_3-N	lb/c/d	0.020	0.016	0.014	-	-	-
P	lb/c/d	0.0074	0.0059	0.0052	-	-	-
Fontana							
BOD	lb/c/d	0.24	0.19	0.17	-	-	-
SS	lb/c/d	0.23	0.18	0.16	-	-	-
Williams Bay							
TKN	lb/c/d	0.064	0.051	0.045	-	-	-
P	lb/c/d	0.024	0.019	0.017	-	-	-

[a] Average Daily Base Flow based on analyses of water records presented in facilities planning documents. Peak factors (from analyses of water records) Lake Geneva - 1.95, Fontana - 2.25, Walworth - 3.5, and Williams Bay - 1.3 (Donohue 1982b, 1983).

[b] Organic loadings for seasonal and transient residents are estimated to be 80% and 70% respectively of permanent resident loadings. Wastewater flow for seasonal and transient residents are estimated to be 80% and 70% of the Lake Geneva permanent residential flow. From Donohue & Assoc., Inc. (1982b, 1983), USEPA (1977), and Section NR 110.09(2) of the Wisconsin Administrative Code which suggests that seasonal "visitors are equivalent to 50 to 80% of full-time residents.

[c] The design factors are the same for the Facilities Plan recommended alternative except for the unit wastewater flows for Fontana (permanent residential - 99, commercial - 76, public - 11 gpcd) and Williams Bay (no design factors presented in the Facilities Plan.)

[d] Abbey Resort 146.5 gpcd.

[e] Based on factors/guidelines contained in Section NR 110.15(6) of the Wis. Adm. Cd., USEPA (1977), and Donohue & Assoc., Inc. (1982b, 1983a). See Appendix E of the Draft EIS.

Table 2-22. Summary of wastewater flows and organic loadings (using EIS design factors) projected for the sewered portions of the RSSAs for the year 2005[a]. **

ITEM	Flow (mgd)				Organic Loadings (lb/day)				
	Average Daily Base	I/I	Total Average	Maximum Day	BOD	SS	TKN	NH_3-N	P
Lake Geneva WWTP									
Winter	1.148	0.460	1.608	4.385	1,776	2,090	355	209	77
Summer	1.277	0.460	1.737	4.636	2,221	2,605	447	261	96
Walworth/Fontana WWTP									
Winter									
Walworth	0.206	0.066	0.272	0.853	430	506	86	51	19
Fontana	0.316	0.325	0.641	1.483	662	633	93	55	20
Total	0.522	0.391	0.913	2.336					
Summer									
Walworth	0.212	0.066	0.278	0.874	449	527	89	53	20
Fontana	0.490	0.325	0.815	1.876	1,321	1,255	181	111	41
Total	0.702	0.391	1.093	2.750	1,770	1,752	270	164	61
Williams Bay WWTP									
Winter	0.279	0.279	0.558	2.163	510	600	192	60	72
Summer	0.413	0.279	0.692	2.337	977	1139	364	119	136

[a]See Appendix E of the Draft EIS for design population and design flow computations.

**This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

Table 2-23. Summary of wastewater flows and organic loadings projected by the facilities planners for the RSSAs for the year 2005[a]. **

ITEM	Flow (mgd)				Organic Loadings (lb/day)				
	Average Daily Base	I/I	Total Average	Maximum Day	BOD	SS	TKN	NH_3-N	P
Lake Geneva WWTP[b]									
Annual Average	1.138	0.460	1.838	5.200	2,300	2,700	500	300	110
Summer	1.669	0.460	2.129	5.200	3,200	3,750	640	380	140
Walworth/Fontana WWTP[c,d]									
Average									
Walworth	0.172	0.066	0.238	0.475[e]	357	NA[f]	NA	NA	NA
Fontana	0.428	0.334	0.762	1.362[e]	628	NA	NA	NA	NA
Total	0.600	0.400	1.000	1.837	985	NA	NA	NA	NA
Summer									
Walworth	NA	NA	0.238	0.475[e]	357	NA	NA	NA	NA
Fontana	NA	NA	0.920	1.631[e]	858	NA	NA	NA	NA
Total	NA	NA	1.158	1.836	1,214	NA	NA	NA	NA
Williams Bay WWTP									
Average	NA	NA	0.726	2.829[e]	1,145	NA	NA	NA	NA
Summer	NA	NA	0.874	2.829[e]	1,573	NA	NA	NA	NA

[a] Includes projected sewer service area for entire RSSA.
[b] Donohue (1982b).
[c] By telephone, F. Wintheiser, Donohue & Assoc., Inc. to WAPORA, Inc. 11 May 1983.
[d] Donohue (1983a).
[e] Peak hour flows.
[f] NA - Not available in facilities planning documents.
**This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

and Walworth WWTPs will not have the capacity to properly treat projected average daily design flows in year 2005, and the Lake Geneva, Williams Bay, and Walworth WWTPs will not have the hydraulic capacity to handle projected peak design flows in year 2005. Therefore, new or expanded WWTPs will be required to provide proper wastewater management within currently sewered portions of the RSSAs. To provide centralized collection and treatment services to currently unsewered areas, larger treatment facilities would be required. The following section concerning WWTP effluent limitations describes additional reasons why new or expanded treatment facilities potentially will be needed.

Table 2-24. Comparison of existing WWTP capacities (year 1980) and projected flows (year 2005) for sewered portions of the RSSAs. **

RSSA	Existing WWTP Capacity (mgd) Average	Existing WWTP Capacity (mgd) Peak	Projected Flows (mgd) Wettest 30-Day	Projected Flows (mgd) Maximum Day
Lake Geneva	1.10	3.00	1.74	4.64
Williams Bay	0.79	1.41	0.69	2.34
Fontana	0.90	2.46	0.82	1.88
Walworth	0.15	0.30	0.28	0.87

[a] Projected flow were determined using EIS design factors (Table 2-23 and Appendix E of the Draft EIS).

** This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

2.3.1.4. Effluent Requirements

The WWTPs currently operating in the RSSAs must achieve a certain level or degree of treatment as specified by the WDNR. The WDNR establishes effluent limitations and issues permits for WWTPs which discharge effluent to surface streams (the State of Wisconsin does not allow discharge of WWTP effluent directly to lakes). Effluent limitations currently applicable to the Lake Geneva WWTP discharge to the the White River, as described in Table 2-25, are considered limitations for secondary treatment;

although the effluent currently required (BOD/TSS of 45/45) is not as stringent as the USEPA secondary treatment requirements (BOD/TSS of 30/30). However, beginning in 1985, WWTPs that discharge to the White River must achieve advanced treatment. Advanced treatment also will be required for any WWTPs on the west side of Geneva Lake that discharge to Piscasaw Creek. Effluent limits proposed by WDNR for discharge of municipal wastewater from a new or expanded Lake Geneva WWTP to the White River and from a new Walworth/Fontana WWTP to Piscasaw Creek are presented in Table 2-25 and Table 2-26, respectively.

Table 2-25. WDNR (1981b) proposed effluent limits for discharge to the White River (effective 1 January 1986).

	Concentration		
Effluent Parameter	Minimum	Average	Maximum
Winter (November through April)			
BOD_5 (weekly)	-	10 mg/l	-
Suspended solids (weekly)	-	10 mg/l	-
pH	6.0	-	9.0
Residual chlorine (daily maximum)	-	-	0.15 mg/l
Fecal coliform (#/100 ml)	-	NL[a]	-
Ammonia nitrogen (NH_3-N) (weekly)	-	4.0 mg/l	-
Dissolved oxygen (daily)	6.0 mg/l	-	-
Phosphorus - total, (as P) (monthly)	-	1.0 mg/l	-
Summer (May through October)			
BOD_5 (weekly)	-	10 mg/l	-
Suspended solids (weekly)	-	10 mg/l	-
pH	6.0	-	7.5
Residual chlorine (daily maximum)	-	-	0.15 mg/l
Fecal coliform (#/100 ml)	-	#/100 ml	-
Ammonia nitrogen (NH_3-N) (weekly)	-	2.0 mg/l	-
Dissolved oxygen (daily)	6.0 mg/l	-	-
Phosphorus - total (as P) (monthly)	-	1.0 mg/l	-

[a] No limits set. Reporting only.

Table 2-26. WDNR proposed permit effluent limits for discharge to Piscasaw Creek (WDNR 1981a).

Effluent Parameters	Summer (mg/l)		Winter (mg/l)	
BOD_5 (weekly)	10	10	10	10
Suspended solids (weekly)	10	10	10	10
Ammonia nitrogen (NH_3-N) (weekly)	2[a]	5[b]	4[a]	9[b]
pH range	6-7.6	6-7.2	6-8.1	6-7.6
Dissolved oxygen (minimum daily)	6	6	6	6

[a] The NH_3-N limits cannot be more stringent than these limits.
[b] Alternative NH_3-N and pH limits are listed to offer optional levels.

Effluent limits also have been established by WDNR for discharge of municipal wastewater to land application sites. WWTP effluent must not exceed BOD_5 limits of 50 mg/l in 80% of samples taken.

Existing WWTPs in the RSSAs currently do not discharge effluents of advanced treatment quality. Therefore, new or expanded facilities will be required in order to produce effluents of the quality required by WDNR.

2.3.1.5. Economic Factors

One item which is always of interest to the public and for which information must be given is the cost associated with various treatment facilities. Comparisons of costs for various treatment alternatives are usually made. However, comparisons always must be made on a common basis. Therefore, standard economic cost criteria to be applied to all alternatives were developed for use in this EIS. The economic cost criteria used in this document are presented in Table 2-27. All costs are indexed to third quarter 1982 (September 1982). Costs derived from the facilities planning documents have been updated to this point using appropriate cost indices.

Costs of project alternatives are compared on a total present worth cost basis with an amortization or planning period of 20 years (1985 to 2005) and an interest rate of 7.625%. Service lives and salvage values for equipment, structures, and sewerage facilities also are presented in Table 2-27. Salvage values were estimated using straight-line depreciation for items that could be used at the end of the 20-year planning period. Appreciation of land values was assumed to be zero over the project period (Donohue & Assoc., Inc. 1982b, 1983a). Operation and maintenance (O&M) costs include labor, materials, and utilities (power). Costs associated with the treatment works, pumping stations, solids handling and disposal processes, conveyance facilities, and onsite systems are based on current prevailing rates.

Table 2-27. Economic cost criteria (September 1982).

Item	Units	Value
Amortization period	years	20
Interest (discount) rate	%	7-5/8 (7.625)
Cost indices - 3rd Quarter 1982		
USEPA indices		
WWTP construction (Green Bay WI)	-	194
WWTP O&M	-	4.58
Sewer construction (Milwaukee WI)	-	187
Sewer O&M	-	1.606
Pump station O&M	-	239.0
ENR construction cost index (September 1982)	-	3,902
Service Life		
WWTPs and Pumping Stations:		
Structures	years	40
Mechanical equipment		
heavy duty - large pumps, clarifiers, HVAC, etc.	years	20
Medium duty - small pumps, mech. bars screens, etc.	years	15[a]
Light duty - blowers, etc.	years	10[a]
Process piping	years	30
Interceptors and sewers[c]	years	40
Land	years	Permanent
Onsite systems and cluster drainfields:		
Structures	years	50
Equipment	years	20
Salvage Value		
WWTPs and Pumping Stations:[c]		
Structures	%	50
Mechanical equipment		
Heavy duty	%	0
Medium duty	%	67[b]
Light duty	%	0
Process piping	%	33
Interceptors and sewers[c]	%	50
Land[c]	%	100
Onsite systems and cluster drainfields:		
Structures	%	60
Equipment	%	0

[a] One replacement required within planning period.
[b] Salvage value of 15th year replacement.
[c] From Donohue & Assoc., Inc. (1982b, 1983a).

Total capital cost includes the initial construction cost plus a service factor. The service factor includes costs for engineering, contingencies, legal and administrative, and financing fees. Service factors used in both the facilities planning documents and in this EIS for each project alternative and alternative components are summarized in Table 2-28.

2.3.2. Identification of Alternative Components

Once standard planning and design information applicable to all alternatives was developed (as described in Section 2.3.1.), various components of complete treatment systems were identified and evaluated. Once adequate system components are identified, they then can be put together in various combinations to form alternatives for wastewater management in the facilities planning area. Components identified as being potentially applicable to the Geneva Lake facilities planning area included wastewater collection, wastewater treatment, effluent discharge, sludge treatment and disposal, and onsite treatment and disposal.

2.3.2.1. Wastewater Collection Systems

Wastewater management systems that utilize centralized WWTPs collect wastewater from individual homes and transport it to the WWTPs through interceptor systems. The Facilities Plan for the East End evaluated the following alternative collection systems:

- Conventional gravity sewers - designed to collect raw sewage and transport it by gravity flow to a WWTP, interceptor sewer, or pumping station

- Small diameter gravity sewers - designed to collect septic tank effluent (which contains less solids than raw sewage) and to transport it by gravity flow to a WWTP, interceptor sewer, or pumping station

- Low pressure sewers - consisting of a pump at each connection pumping wastewater through a small diameter pressure main to a WWTP, interceptor sewer, or pumping station. Low pressure sewers can be designed to pump raw sewage (grinder pump system) or septic tank effluent.

Table 2-28. Service factors, excluding interest during construction, applied to construction cost to compute capital costs.

	Percent Of Initial Construction Cost				
	Contingencies	Legal and Engineering	Administrative	Financing	Total
Facilities planning[b]					
Lake Geneva WWTP	15.0	15.0	-[a]	-	30.0
Walworth/Fontana WWTP	10.0	15.0	-	-	25.0
Walworth/Fontana Inteceptors	10.0	15.0	-	-	25.0
Williams Bay WWTP	15.0	15.0	-	-	30.0
Interceptors (Others) / Collection sewers	0.0	0.0	-	-	0.0
EIS planning					
Conventional sewers, interceptors and WWTPs	10.0	10.0	3.0	4.0	27.0[c]
Non-conventional sewers, cluster drainfields, and onsite systems	13.0	15.0	3.0	4.0	35.0

[a] Included in legal and engineering costs.

[b] From Donohue & Assoc., Inc. (1982b, 1983a).

[c] EIS assumed figure of midpoint between Walworth/Fontana and Lake Geneva totals under FPRA

Another collection system type, vacuum sewers, are available but were not selected for evaluation because they are still a new technology, are subject to frequent malfunctions, and typically are not cost-effective when compared with similar-sized pressure sewer systems.

Interceptor sewers collect and transport wastewater from a number of discrete areas to a WWTP through trunk gravity sewers, pumping stations, and force mains. Principal conditions and factors necessitating the use of pumping stations in the sewage collection or interceptor system are as follows:

- The elevation of the area to be served is too low to be drained by gravity flows to existing or proposed trunk sewers
- Service is required for areas that are outside the natural drainage area, but within the sewage or drainage district
- Omission of pumping, although possible, would require excessive construction costs because of deep cuts required for installation of a trunk sewer to drain the area.

The pumping station pumps wastewater under pressure through a pipeline referred to as a force main. For the sake of economy, force main profiles generally conform to existing ground elevations.

2.3.2.2. Wastewater Treatment Technologies

A variety of wastewater treatment technologies were considered in the various facilities planning documents. In general, wastewater treatment options include conventional physical, biological, and chemical processes and land treatment. Conventional options utilize preliminary treatment, primary sedimentation, secondary treatment, filtration, phosphorus removal, pH adjustment, and effluent aeration. These unit processes are followed by disinfection prior to effluent disposal. Land treatment processes include slow-rate infiltration or irrigation, overland flow, and rapid infiltration.

The degree of treatment required and the treatment processes best suited for utilization often are dependent on the effluent disposal option selected. Wastewater treatment processes evaluated in the facilities planning documents are outlined in the following sections. Where disposal of treated wastewater is by effluent discharged to surface waters, effluent quality limitations determined by WDNR establish the required level of treatment.

2.3.2.3. Effluent Disposal Methods

Effluent disposal options available for use in the Geneva Lake area are: discharge to surface waters, disposal on land, and reuse.

Surface Water Discharge

WDNR will permit effluent discharge to the White River and to Piscasaw Creek from WWTPs meeting the State's designated effluent limitations (refer to Section 2.3.1.4.). Treatment processes considered in the facilities planning documents for WWTPs discharging to surface waters included physical/chemical treatment and a number of physical/biological treatment systems.

Physical/chemical treatment (typically involving preliminary treatment, flocculation - sedimentation with lime, recarbonation, filtration, carbon absorption, and disinfection) is best suited to larger facilities than those under consideration because of the high capital and operating costs involved. Therefore, physical/chemical treatment was considered not feasible for the Geneva Lake area and was not evaluated further.

Physical/biological treatment processes considered included preliminary treatment, primary sedimentation, secondary treatment with nitrification, secondary sedimentation, phosphorus removal, filtration, pH adjustment, disinfection and effluent aeration. Processes evaluated to provide secondary treatment and nitrification were: extended aeration activated sludge, trickling filter followed by activated sludge, rotating biological contactors (RBC), and a two-stage activated sludge process.

Land Application

Land application or land treatment of wastewater utilizes natural physical, chemical, and biological processes in vegetation, soils, and underlying formations to renovate and dispose of domestic wastewater. Land application methods have been practiced in the United States for more than 100 years, and presently are being used by hundreds of communities throughout the nation (Pound and Crites 1973).

In addition to wastewater treatment, benefits of land application may include nutrient recycling, timely water applications (e.g., crop irrigation), groundwater recharge, and soil improvement. These benefits accrue to a greater extent in arid and semi-arid areas, but also are applicable to humid areas. Secondary benefits include preservation of open space and summer augmentation of streamflow for land application systems which include winter storage.

Components of a land application system typically include a centralized collection and conveyance system, some level of primary treatment, secondary treatment to achieve BOD concentrations of 50 mg/l or less, possible storage, and the land application site and equipment. In addition, collection of treated wastewater may be included in the system design, along with discharge or resue of the treated wastewater. Additional components may be necessary to meet state requirements or to make the system operate properly.

Land application of municipal wastewater encompases a wide variety of possible treatment processes or methods of application. The three principal processes utilized in land treatment of wastewater are:

- Overland flow
- Slow-rate or crop irrigation
- Rapid infiltration.

In the overland flow process, wastewater is allowed to flow over a sloping surface and is collected at the bottom. The wastewater is treated as it flows across the land, and the collected effluent typically is discharged to a stream. Overland flow generally results in an effluent with an average phosphorus concentration of 4 mg/l. Phosphorus removals usually range from 40% to 60% on a concentration basis (USEPA 1981b).

In slow-rate irrigation systems, partially treated wastewater is applied to the land, usually with spray irrigation equipment, to enhance the growth of vegetation (e.g., crops and grasses). The crops perform a major role in removing nutrients through vegetative metabolic growth. Wastewater is applied at rates that may range from 0.8 to 3.1 inches per week. The upper 2 to 4 feet of soil is where major removals of organic matter, nutrients, and pathogens occur. Some treatment processes which occur are filtration, chemical precipitation, and adsorption by soil particles. Applied wastewater is either lost to the atmosphere by evapotranspiration, taken up by the growing vegetation, or percolates to the water table. The water table must be naturally low, or must be maintained at a reasonable depth by wells or tile drainage. Surface soil must be kept aerobic (by alternating irrigation and drying cycles) for optimum removal conditions to occur.

Rapid infiltration involves high rates (4 to 120 inches per week) of wastewater application to highly permeable soils, such as sands and loamy sands. Although vegetative cover may be present, it is not an integral part of the treatment system. Wastewater treatment occurs within the first few feet of soil by filtration, adsorption, precipitation, and other geochemical reactions. In most cases, SS, BOD, and fecal coliforms are removed almost completely. Phosphorus removal can range from 70% to 99%, depending on the physical and chemical properties of the soils. Nitrogen removal, however, generally is less efficient. Ammonia-nitrogen (NH_3-N) present in wastewater is almost completely converted to nitrates (NO_3) by a rapid infiltration system. Nitrates percolating into groundwater used for drinking, however, can cause health problems. Both ammonia-nitrogen and nitrates can be removed from wastewater by conventional nitrification/denitrification treatment processes prior to application to a rapid infiltration system. Denitrification, removal of nitrates by microbial reduction can be partially accomplished (approximately 50% removal) by adjusting application cycles, supplying an additional carbon source, using vegetated basins, collecting and recycling the rapid infiltration effluent with underdrains or collection wells, and/or reducing application rates (USEPA 1981c). If denitrification is not achieved prior to rapid infiltration or by other special measures, then effluent reaching groundwater potentially will contain nitrates ranging from 10 to 15 mg/l.

In rapid infiltration systems, little or no consumptive use of wastewater by plants and only minor evaporation occurs. Because most of the wastewater infiltrates into the soil, groundwater quality may be affected. To minimize the potential for groundwater contamination, the WDNR requires a minimum unsaturated zone below the system of 4 ft. during operation. Due to the rapid rates of application, the permeability of the underlying aquifer must be high to insure that the water table will not mound significantly and limit the long-term usefulness of the site.

Treatment Prior to Land Application

Limitations on discharges to land disposal systems are given in WDNR's WPDES permit policy documents. The applicable discharge limitations are summarized as follows:

- There shall be no discharge to a land disposal system except after treatment in a sewage treatment system that includes a secondary treatment process
- The BOD_5 concentration in the discharge to the land disposal system shall not exceed 50 mg/l in more than 20% of the monitoring samples that are required during a calendar quarter
- The discharge shall be alternately distributed to individual sections of the disposal system in a manner to allow sufficient resting periods to maintain infiltrative capacity of the soil.

Wastewater treatment processes evaluated in the Facilities Plan for use prior to land application systems consisted of preliminary treatment (bar screen, grit removal, and, for some alternatives, primary sedimentation), a number of secondary treatment alternatives, and disinfection. Secondary treatment processes evaluated were oxidation ditch, trickling filter, aerated lagoon, and RBCs.

Several people who testified at the public hearing on the DEIS requested that WDNR institute a moratorium on the construction of seepage cells in the state. WDNR does not intend to issue such a moratorium. The request for the moratorium appears to arise from the misconceptions that a significant number of seepage cells in Wisconsin have experienced hydraulic failure, and that serious groundwater contamination will occur below and downgradient from seepage cell sites.

On 2 December 1983, the WDNR issued a white paper which discusses seepage cell problems encountered by 10 communities in Wisconsin. This document is possibly being interpreted to mean that these 10 communities represent a significant fraction of the operating seepage cells in the State. Rather, these 10 communities represent a small portion of all municipal seepage systems in the State. Of the approximately 150 municipal seepage cells presently operating in the State, less than 10 have experienced hydraulic failure.

As a consequence of the White Paper investigation, WDNR has initiated more rigorous reviews of proposed seepage cell systems. Extensive and detailed site investigations are required to be performed in the facilities planning process. These data are analyzed for each system to determine whether the proposed system will have adequate hydraulic capacity, will not significantly degrade groundwater, and will be cost-effective. This more stringent review procedure has resulted in the rejection of land treatment options at Stanley, Owen-Withee, Saint Cloud, Crystal Lake Sanitary District No. 1, and Baldwin.

For Owen-Withee, the WDNR had approved the facilities plan and was reviewing the engineering plans and specifications when the site was rejected. For the Crystal Lake Sanitary District, the system was under construction when the WDNR became concerned with the suitability of the site. Then, WDNR demanded a surface water discharge. Saint Cloud, Baldwin, and Stanley would have been approved had the reviews occurred prior to 1982.

The concern that disposal of treated municipal wastewaters on land would cause serious groundwater contamination is unsupported by data from existing systems. The WDNR has never documented a situation where the operation of a municipal seepage cell system has rendered the groundwater unsuitable for its intended use. Groundwater monitoring data from municipal systems over recent years indicate that the characteristics of the groundwater will be altered and, for several systems, the chemical changes (increased ammonia and/or nitrate concentrations, and the dissolved solids) are approaching unacceptably high levels so that increased monitoring of the groundwater has been warranted. However, the operation of municipal seepage cells in the state appear to be having minimal effects on groundwater quality. Nationally, and in Wisconsin, a number of cases have been documented of severe groundwater contamination resulting from improper disposal of industrial or other toxic wastes. These problems should not be compared with the disposal of treated municipal wastewater via seepage cells.

In summary, the WDNR does not feel that a moratorium on the construction of seepage cells for treated municipal wastewater is warranted at the present time.

Land Suitability

The suitability of a soil for land application is largely dependent on the depth of the soil, its permeability, the depth to the water table, and the type of land application system to be utilized. Overland flow treatment is generally suited to soils of limited infiltration rate (i.e., very low permeability), but requires moderately large amounts of land. Few soils in the vicinity have the requisite limited permeability for overland flow. Slow-rate irrigation utilizes soils that have moderate infiltration rates and sufficient horizontal permeability so that an efficient underdrainage system can be installed, if necessary. Extensive areas, particularly southwest of Walworth, appear well suited for slow-rate irrigation. However, due to low application rates, large amounts of land are required for slow-rate irrigation systems. Rapid infiltration utilizes moderately coarse to coarse textured soils that are unsaturated to a considerable depth. A number of locations in the planning area potentially are well suited for rapid infiltration.

A site screening analysis was conducted by Donohue & Assoc., Inc. (1981a, 1983a). Criteria used for evaluating slow-rate irrigation sites for both the east and west planning areas included:

- Provision of secondary treatment and disinfection
- Application rate of approximately two inches per week
- Minimum storage capacity of six months
- Seventy-five percent of the total acreage which is usable
- Provision of a buffer zone of 500 feet for storage lagoon and 1,000 feet for irrigation area.

Land within a four-mile radius of potential treatment plant locations was evaluated for suitability of irrigation of cropland. For the east planning area, no large tracts of suitable soils were identified, and thus slow-rate irrigation was eliminated from further consideration (Donohue & Assoc., Inc. 1981a).

For the west planning area, considerable acreage has soils suitable for slow-rate irrigation. However, negative public comment during preparation of the Volume 1 Facilities Plan and the previous areawide Regional Water Quality Management Plan (prepared by the SEWRPC) ruled out any further consideration of effluent irrigation for the west planning area. Primary objections to use of slow-rate irrigation were potential groundwater pollution and municipal control of nearly 900 acres of agricultural land (Donohue & Assoc., Inc. 1983a).

Rapid infiltration was considered for both the east and the west planning areas. Planning criteria used for preliminary site identification is as follows:

- Provision of secondary treatment
- Application rate of approximately 26 inches per week

- Minimum storage capacity of two days
- Provision of a buffer zone of 500 feet for the storage lagoon and seepage cells
- Provision of multiple cells for adequate dosing and resting cycles.

Land within a four-mile radius of existing treatment plant locations (Lake Geneva on the east and Walworth on the west) was evaluated for suitability for rapid infiltration. Preference was given to sites near these existing treatment plants.

For the east planning area, a site at the southeast corner of U.S. Routes 12 and 50 was initially selected for further investigation. No other potential sites were identified in Volume 2: Treatment Alternatives, East Planning Area (Donohue & Assoc., Inc. 1981a). For the west planning area, the E 1/2, NW 1/4 of Section 28 (Rambow Site) was selected for further analysis. Other sites were not identified in Volume 2: Treatment Alternatives, West Planning Area (Donohue & Assoc., Inc. 1983a). The existing Fontana seepage basin site was screened out because the WDNR believed the Fontana system was not working well, and thus had stated the Fontana seepage system would only be allowed to continue on an interim basis.

Extensive testing of soils and groundwater conditions at these sites was conducted to determine if these sites were suitable for rapid infiltration. Groundwater contamination concerns were important issues for both sites and had to be adequately addressed by hydrogeological reports.

The east planning area site had soil borings and observation wells installed (By letter, Patrick D. Reuteman, Giles Engineering Assoc., Inc., to Tom Gapinske, Donohue & Assoc., Inc., 11 May 1982). Field testing of soil permeability and laboratory testing of grain-size distribution and permeability was then conducted. The report on soil testing (Giles Engineering Assoc., Inc. 1983) also included estimates of soil permeability obtained from grain-size distribution curves and logs from soil borings. The general hydrogeologic conditions, surrounding land use, geologic cross-sections, observation well water levels, and a preliminary site layout are contained in a seepage cell investigation report (By letter, Paul Wintheiser, Donohue & Assoc., Inc., to Mark B. Williams, WDNR, 14 July 1982). The proposed land application system layout, preliminary design, and environmental assessment are provided in Volume 2 - Process Specific Addendum East Planning Area (Donohue & Assoc., Inc. 1982b). The site borings indicated that the depth to a limiting soil layer varies from approximately 10 feet on the south property line to 45 feet in the middle of the site. The aquatard appears to slope from the west to the east. At one point near the northwest corner of the property the aquatard depth is at 23 feet depth (11 feet after proposed construction). The easterly line of soil borings encountered silty and clayey soil material at approximately 860 feet msl (the proposed bottom elevation of the lagoons is 885 feet).

Permeability of soils at the site range from 2.0 x 10^{-4} cm/sec to 9.76 x 10^{-3} cm/sec as determined by the falling-head field percolation test, the estimated rate based on the amount passing the No. 200 sieve, and the falling-head method on recompacted laboratory samples.

Groundwater flow in the area appears to be toward the northeast (Borman 1976). Groundwater elevations appear to slope from the level of Geneva Lake (864 feet) toward groundwater discharge locations, the White River and its tributaries. A drainage channel near the east boundary of the east site appears to be the major groundwater discharge location. Elevation of the drainageway is approximately 830 feet at the Route 50 culvert. Groundwater elevations measured in observation wells the piezometers at the east site were at about 845 feet, and sloped to the northeast.

Private wells to the north of Route 50 were identified as likely to be affected by effluent application at the proposed east end rapid infiltration site. Three wells are located directly north of the site (one is located at an abandoned service station and the other two are located further to the northeast). Information on what elevation and geologic strata groundwater is obtained was not available. The drainageway to the east will likely prevent groundwater movement farther east. Movement of infiltrated effluent to the west would depend on the extent of groundwater mounding under the site. The Golf Hills Subdivision is located about 3,000 feet west, and the groundwater elevation within the subdivision was determined by field investigations conducted by Donahue and Associates to be approximately 880 feet. Thus, in order for groundwater to flow from the rapid infiltration site to the subdivision, groundwater under the rapid infiltration site would have to mound above an elevation of 880 feet msl.

Application of effluent at the east rapid infiltration site potentially would cause mounding of the groundwater. An analysis performed by the Wisconsin Department of Natural Resources indicated that the expected groundwater mounding may range from as small as to be nonexistent on a day-to-day operational basis, to greater than several hundred feet assuming constant and uniform wastewater application over the entire seepage area during the 20 year design period. It should be noted that any mounding greater than 30 feet would mean hydraulic failure for the seepage cells. Based on expected conditions the groundwater mounding should not exceed 10 to 15 feet under the seepage cells. This mounding would raise the elevation of the groundwater under the seepage cell site to approximately 860 ft. above mean sea level. Most infiltrated effluent likely would flow to the northeast, the current flow direction. As previously indicated, soil borings indicate silty and clayey soil layers exist at an elevation of approximately 860 feet msl along the eastern side of the site. The clayey soil material potentially could retard flow sufficiently so that groundwater is forced to flow north, east, and west. Concern has been expressed by local citizens that the site is not suitable for land application and that use of the site may adversely affect groundwater in the area. An analysis using the Hantush (Hantush, 1967) groundwater model was performed by WDNR to determine the increase in groundwater depth at locations 500 ft. from the seepage cells. The assumptions used predicted a maximum long-term mound under the seepage cells of about 15 feet. At 500 ft. from the cell, however, there is no predictable rise in the existing groundwater elevation. Therefore, flooding of adjacent lands due to groundwater mounding is not anticipated. This analysis is applicable in any direction relative to the seepage cell site: this would include the stream and wetland area located approximately 500 ft. west of the site, the residences located between 500 and 700 ft. north of the site and the Golf Hills Subdivision located approximately 3000 ft. west of the site.

Analyses of groundwater monitoring are, however, based upon parameters such as soil hydraulic conductivity, depth to water table, time and rate of application, and related hydrogeological factors which can vary considerably across the site. The geology of the area is not homogeneous and therefore an accurate prediction of actual mounding can only be determined by further modeling after extensive geological investigation of the site.

The west planning area land application site had soil borings conducted on it in May 1983 (By letter, Michael G. Nielsen, Giles Engineering Assoc., Inc., to Marie Robinson, Donohue & Assoc., Inc., 18 May 1983). In July, test pits were excavated and infiltrometer tests were conducted (By letter, Douglas L. Weinkauf, Giles Engineering Assoc., Inc., to Robert Zook, Donohue & Assoc., Inc., 18 July 1983). Grain-size distribution curves were constructed on soil samples from both field investigations. Estimates of permeability calculated from the grain-size distribution curves and an initial evaluation of the site were provided in an initial subsurface report (By letter, Alan L. Berg, Donohue & Assoc., Inc., to Mark B. Williams, WDNR, 6 June 1983). These analyses were subsequently published in the Addendum No. 1 to Volume 2, West Planning Area - Walworth/ Fontana (Donohue & Assoc., Inc., 1983b). A final site investigations report was not prepared because local opposition to land application resulted in a more in-depth evaluation of an oxidation ditch alternative.

The soil borings and the test pits indicated that from the surface, 8 feet of soil material (approximately), is clayey silt to sand silt. Below this surface material is sand and gravel outwash with occasional cobbles. This material was encountered at approximately the same depth in three soil borings and two test pits; thus, it appears to be consistent laterally over the site. The deepest boring was extended to 30 feet and, at that depth, had not encountered any layers of restricted permeability.

The hydraulic conductivity of the surface soils material was determined empirically and was estimated to be approximately 5 x 10^{-9} cm per second. The infiltrometer tests indicated that the surface soils had an infiltration rate of less than 1 inch per hour. Below 8 feet the empirical hydraulic conductivity ranged from 5 x 10^{-7} to 5 x10^{-6} cm per second. The infiltration rates below 8 feet ranged from 10 to 26 inches per hour. Donohue & Assoc., Inc. (1983b) estimated that the soil material below 8 feet could be designed wth an application rate of 20 inches per week.

Groundwater was encountered in one boring at 26.5 feet below the ground surface (972 msl). The water table in the area is relatively level (Borman 1976) and may slope to the north or to the west under the selected site. The groundwater flow direction is either toward Pottawatomie Creek to the northeast or to Piscasaw Creek to the west. The complex geology of the area makes it difficult to conclude what direction the groundwater actually flows. Piscasaw Creek is at elevation 920 feet near the State line and is approximately 2.5 miles west of the selected site. The land surface slopes 20 feet per mile and the groundwater table slopes 8 feet per mile toward Piscasaw Creek.

The nearest private wells are ¼ mile west of the site and other private wells are located at ½ mile on the north, east, and south. No information was reported on these wells.

Movement of infiltrated effluent from seepage cells on this site would likely be to the north, to Pottawatomie Creek, and to the west, to Piscasaw Creek. No analysis of potential mounding of groundwater and its flow paths has been provided. If the surface soils to a depth of 8 feet were to be removed, the existing groundwater table would be 18.5 feet below the seepage cells. It is unlikely that the mounding would be sufficiently great so as to result in violations of the regulations with respect to the minimum depth to groundwater (4 feet at an operating site).

Reuse

Wastewater management techniques included under the category of treated effluent reuse may be identified as:

- Public water supply
- Groundwater recharge
- Industrial process uses or cooling tower makeup
- Energy production
- Recreational turf irrigation
- Fish and wildlife enhancement.

Reuse of treatment plant effluent as a public water supply or for groundwater recharge could present potential public health concerns. No major industries in the area require cooling water. The availability of good quality surface water and groundwater and abundant rainfall limit the demand for the use of treated wastewater for recreational turf irrigation. Direct reuse would require very costly treatment beyond stringent effluent limits and a sufficient economic incentive is not available to justify the expense. Thus, reuse of treated effluent currently is not a feasible management technique for the study area.

2.3.2.4. Sludge Treatment and Disposal

All of the wastewater treatment processes considered will generate sludge, although the amount of sludge generated will vary considerably depending on the process. Wastewater sludge is largely organic, but significant amounts of inert chemicals are present if phosphorus removal is performed. A typical sludge management program would involve interrelated processes for reducing the volume of the sludge (which is mostly water) and final disposal.

Volume reduction involves both the water and organic content of sludge. Organic material can be reduced through digestion, incineration, or wet-oxidation processes. Moisture reduction is attainable through concentration, conditioning, dewatering, and/or drying processes. The mode of final disposal selected determines the processes that are required.

Sludge disposal methods considered in the facilities planning documents were land disposal of liquid or dewatered sludge. Current disposal methods include landfilling of liquid sludge, landspreading of liquid sludge on farms, distribution of dried sludge to residents for private use, and use of dried sludge as a fertilizer on public land.

Proposed sludge treatment processes considered in the facilities planning documents (Donohue & Assoc., Inc. 1978a, 1980b, 1981a, 1981b) include thickening, digestion, and dewatering. Gravity thickening will result in a sludge with a solids concentration of about 3%. Aerobic digestion will produce a stabilized sludge with a 4% solids concentration, and anaerobic digestion will produce stabilized sludge with a 6% solids concentration.

For disposal options involving land disposal of dried sludge, sludge dewatering may be required. Sludge dewatering can be accomplished with drying beds or mechanical equipment including belt filters, vacuum filters, and filter presses. The facilities planning documents considered the use of belt filters, which will produce sludge cake (dried sludge) with a 20-40% solids concentration.

For disposal options involving land disposal of liquid sludge, sludge storage facilities are required. For the Lake Geneva WWTP, the Facilities Plan for the East End considered an earthen lagoon with a 180 day storage capacity (Donohue & Assoc., Inc. 1981a).

The cost-effectiveness analysis of liquid and dried sludge disposal by land application presented for the Lake Geneva WWTP in the Facilities Plan (Donohue & Assoc., Inc. 1981a) concluded that land application of liquid sludge was most cost-effective. The facilities planner's recommended sludge treatment processes for the Lake Geneva WWTP are gravity thickening, anaerobic digestion, lagoon storage, and land application of liquid sludge. Lake Geneva has applied for WDNR permits to dispose of liquid sludge on six sites with a total suitable disposal area of 622 acres

(Donohue & Assoc., Inc. 1982b). Based on laboratory analysis of the sludge and general soil conditions in the area, the average annual application rate allowed under WDNR and USEPA guidelines is 2.4 tons per acre based on nitrogen loadings, 110 tons per acre based on cadmium loadings, and 60 tons per acre based on zinc loadings (Donohue & Assoc., Inc. 1982b). Using an average annual application rate of 2.4 tons per acre, the east planning area served by the Lake Geneva WWTP would require approximately 288 acres for annual sludge disposal if the entire Lake Geneva RSSA and the Lake Como RSSA were sewered (Donohue & Assoc., Inc. 1982b). Thus, there appears to be sufficient suitable land to dispose of sludge by land spreading for sludge generated in the east end of the planning area.

Sludge disposal options considered for the west end WWTPs varied according to the alternative treatment processes considered. For the aerated lagoon treatment option, small amounts of decomposed sludge would accumulate in the lagoons and disposal would not be required during the 20-year design period. For treatment alternatives including RBC trickling filters, and anaerobic digestion, sludge disposal would involve liquid sludge storage and disposal. For the extended aeration and oxidation ditch treatment alternatives, solids handling facilities would include liquid sludge storage, belt presses for sludge dewatering, and truck hauling dried sludge to the final disposal site.

The Facilities Plan initially recommended an aerated lagoon treatment system for the west end to serve Walworth/Fontana. Sludge disposal was not a consideration since sludge would not be withdrawn from this plant during the design period. However, the facilities planner has recently evaluated utilization of a new oxidation ditch treatment system to serve Walworth/Fontana. Sludge from this system would be collected in a storage facility, pumped in liquid form into a haul truck, and transported to agricultural areas for disposal by land spreading.

2.3.2.5. Onsite Treatment Systems

Onsite systems which are feasible for use in the study area are largely those that are being utilized at the present time. Some modifications of existing designs are suggested to improve operation of the onsite systems.

Septic tanks presently being installed in the area are considered adequate both in terms of construction and capacity. The continued use of 750-gallon tanks for small residences and 1,000- and 1,500-gallon tanks for larger residences are recommended. Septic tanks should have an exposed manhole or inspection port to monitor the contents of the tank. If, during pumpouts and inspections, certain septic tanks are found to be faulty or seriously undersized, these tanks would then be repaired or replaced.

Seepage beds and seepage trenches (Figure 2-11) currently being installed in the County have a 20-year design life, although they would likely function satisfactorily for a considerably longer period. The seepage beds commonly installed range in size from 630 square feet (sf) to 1,245 sf for a new single family residence. The size is dictated by the Wisconsin Administrative Code based on the number of bedrooms and water using appliances in the residence, and on soil permeability. No changes in design procedures are anticipated as necessary to provide adequate sewage treatment. At the present time no reduction in the area of the seepage bed is allowed by the Wis. Adm. Cd. even though water conservation appliances may be installed. Existing residences that have failing soil absorption systems may receive a permit for an addition to an existing soil absorption system if the system is then sized according to the Wis. Adm. Cd.

Mound soil absorption systems (Figure 2-12) are constructed according to detailed design standards given in the Wis. Adm. Cd. to overcome limitations of primarily shallow water table but also limited permeability. Mound systems have pressure distribution systems pressurized by effluent pumps. The number of mound systems allowed at new residences is limited to 3% of the total number of onsite systems permitted, but is not limited for existing residences.

A variation of the conventional seepage bed and mound is the in-ground pressure distribution system (ILHR 83.14). This system is applicable to coarse-textured soils on small parcels because a reduction in bed area is

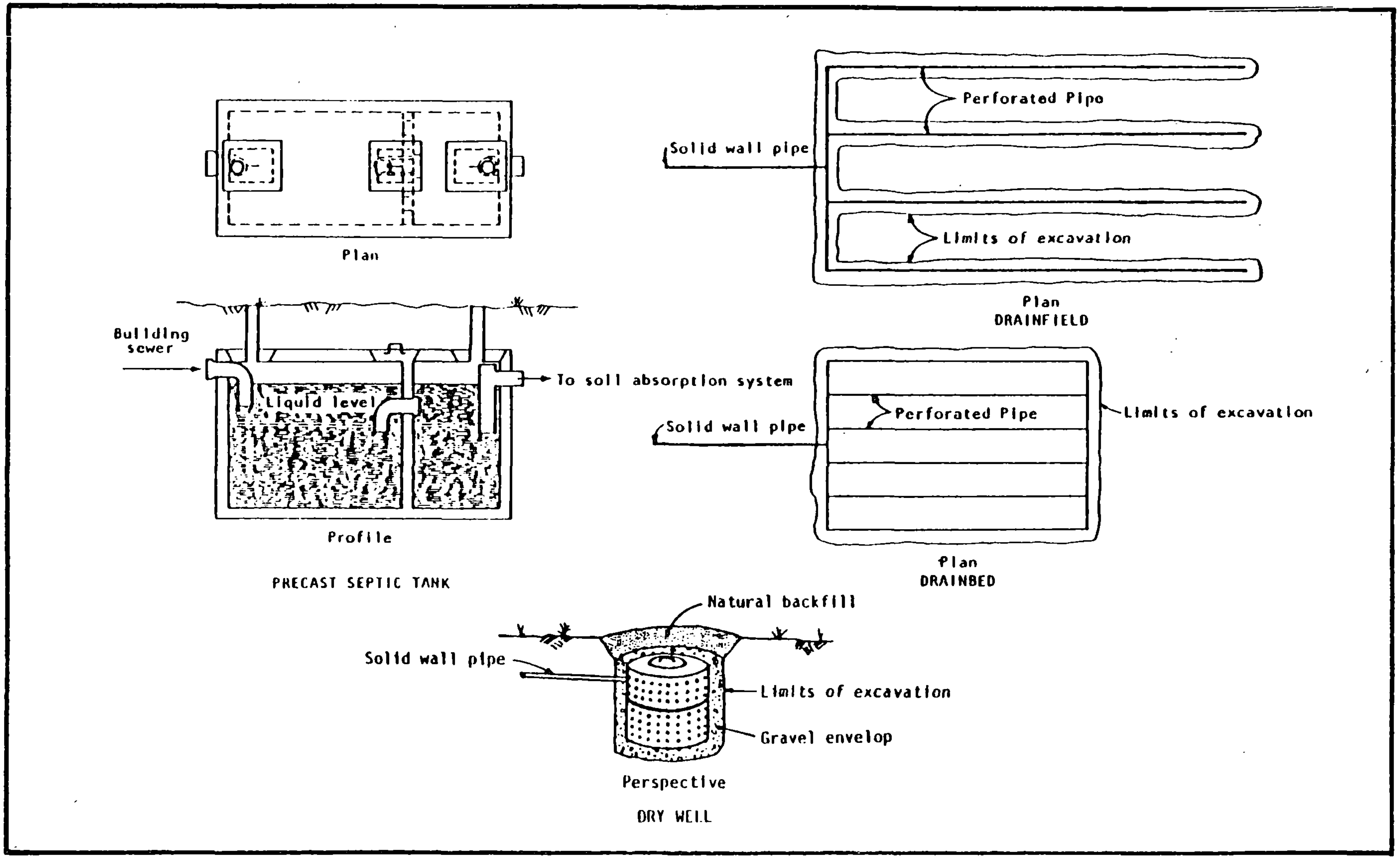


Figure 2-11. Septic tank/soil absorption system.

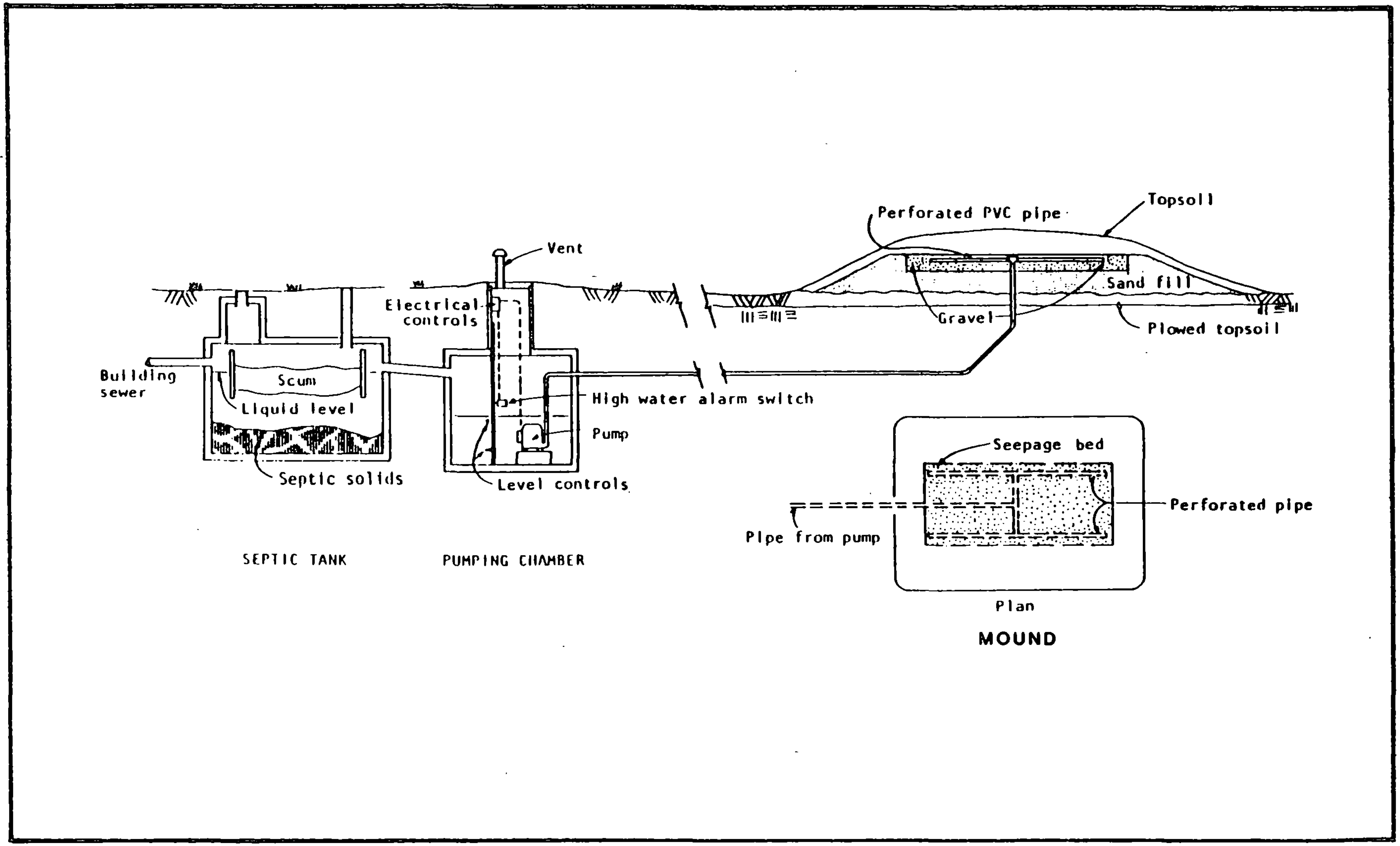


Figure 2-12. Septic tank/pumping chamber mound.

allowed compared to the conventional seepage bed. The in-ground system is similar in design to a mound system which includes the septic tank, the pump tank and pump, and the pressurized distribution piping which is located in a gravel bed built in natural soil. In soils of 0 to 10 minutes per inch percolation rate, a conventional seepage bed is sized based on 205 square feet per bedroom, while the bed of an in-ground pressure distribution system is based on 125 square feet per bedroom. This results in a considerable savings in the disposal area required.

Dry well soil absorption systems currently in use for some structures would have limited application for some parcels. A total of 17 dry wells have been installed in selected subdivisions within the RSSAs over the past 12 years. Depth of unsaturated permeable material must be sufficiently great so as to provide separation from the water table. Dry wells may be installed only where insufficient area is available for a seepage bed. Diameters of dry wells range from 3 to 13 feet, and the sidewall length is controlled by the required area.

Blackwater holding tanks may be appropriate for existing residences whose soil absorption systems fail because the absorption beds lack sufficient area. Components of the system include a low-flow toilet (0.8 gallons per flush), a holding tank for toilet wastes only, and the existing or upgraded septic tank-soil absorption system for the remainder of the wastes. When the toilet wastes are diverted from the septic tank-soil absorption system, that system has an opportunity to function properly. Significant reductions of organic loads (a 20 to 40% reduction in phosphorus loadings and an 80% reduction in nitrogen loadings) to the septic tank-soil absorption system occur when toilet wastes are excluded. Blackwater holding tanks are recommended if a lot has insufficient area for any other soil absorption system, and would be utilized in place of holding tanks. The Wisc. Ad. Code has no regular provision for blackwater tanks, thus approval must be obtained from the Department of Industry, Labor and Human Relations (ILHR 63.09[2][b]). With a 1,000 gallon tank, pumping may be necessary following every fourth month of occupancy.

Curtain drains are not strictly a wastewater treatment device, but can improve the operation of an existing system. The Wis. Ad. Cd. (IHLR 83.09) has a paragraph on monitoring groundwater levels where artificial drainage is existing, but does not address artificial drainage for improving operation of existing systems. In soils with limited vertical permeability or where upslope drainage is a problem, curtain drains have been very effective (Personal interview, Steve Martin, Ohio Environmental Protection Agency, 16 September 1983). The Wisconsin Administrative Code specifies that there be documentation on the drainage system design and on the maintenance responsibility of existing drainage tile. Curtain drains are installed a short distance away from and slightly below the bottom of the soil absorption system.

The cluster system designates a common soil absorption system and the treatment and collection facilities for a group of residences. The common soil absorption system is used because the individual lots are unsuitable for onsite soil absorption systems. An area of soils unsuitable for a common soil absorption system must be available in order to consider this option. Where offsite treatment is required, cluster soil absorption systems may be feasible.

The existing septic tanks, with some replacements, are assumed to be adequate for pretreatment. Septic tank effluent could be conveyed by small-diameter gravity sewers or pressure sewers to the soil absorption system sites. A cost-effectiveness analysis could establish which collection system to use for a particular area. A dosing system is typically required on large drainfields in order to achieve good distribution in the field. Where the collection system uses pressure sewers, a separate accumulator tank and lift station is required. The wet well and lift station on the septic tank effluent gravity sewers can perform that function.

Cluster soil absorption systems are usually designed as three or more seepage beds, trenches, or mounds. One would be rested for a one-year period while the others would be dosed alternately. The soil absorption systems must be designed based on the requirements of the Wis. Ad. Code. The trench bottom or bed area requirements are sized in a manner comparable to single family residences.

Although the present soils information and topography indicate that cluster soil absorption systems may be feasible in a large number of areas, further field investigations would be needed before final designs could proceed. The depth of permeable material must be determined in order to show that groundwater mounding into the soil absorption system would not occur.

The operation and maintenance requirements of the system are minimal. Periodic inspections of the lift stations and the soil absorption systems are essentially all that is necessary. The septic tanks and the lift station wet wells would require occasional pumping of solids. Maintenance of the collection piping is expected to be minimal (Otis 1979). Once a year, the rested soil absorption system would be rotated back into use and another one rested. Blockages of the collection systems should occur only rarely because of the use of clarified effuent. Lift stations are entirely dependent on a reliable power supply. Thus, only community power outages will affect operation of the system. Since wastewater generation is also dependent on power for pumping well water, the potential for serious environmental effects are somewhat mitigated.

Holding tanks do not strictly constitute onsite treatment because the treatment of the wastes still must occur away from the site. Holding tanks are utilized where soil absorption systems cannot be installed because of site limitations. Since holding tanks for seasonal residences often are pumped three or fewer times per year, they can be the most cost-effective onsite system. Holding tanks must have capacity to store the design volume of sewage produced at a residence in five days. For typical residences, the required volume is about 2,000 gallons. Holding tanks are equipped with pumping connections and high water alarms.

2.3.2.6. Septage and Holding Tank Waste Disposal

Use of a septic system requires periodic maintenance (every 1 to 5 years) that includes pumping out accumulated scum and sludge, called septage. Septage is a highly variable anaerobic slurry that contains large quantities of grit and grease; a highly offensive odor; the ability to foam; poor settling and dewatering characteristics; high solids and organic content; and a minor accumulation of heavy metals. Typical concentration values for constituents of septage are as follows (USEPA 1980b):

Total solids	38,800 mg/l
BOD_5	5,000 mg/l
COD	42,900 mg/l
TKN	680 mg/l
NH_3	160 mg/l
Total P	250 mg/l

Holding tank wastes are relatively dilute as compared to septage, but are about twice as concentrated as raw sewage. Extended detention times cause holding tank wastes to become anaerobic and odorous. Assuming that holding tank wastes have double the concentration of raw sewage, typical concentration values would be as follows:

Total solids	625 mg/l
BOD_5	540 mg/l
COD	1,500 mg/l
TKN	160 mg/l
NO_3	90 mg/l
Total P	35 mg/l

Septage and holding tank wastes disposal regulations have been established mainly in states with large concentrations of septic tanks. Wisconsin has established rules regarding disposal of liquid septage and holding tank wastes particularly concerning waste disposal on land. General methods of septage and holding tank wastes disposal include:

- Land disposal
- Biological and physical treatment
- Chemical treatment
- Treatment in a wastewater treatment plant.

Land Disposal

Two basic types of land disposal utilized for septage and holding tank wastes are:

- Methods which optimize nutrient recovery, such as application of liquid wastes to cropland and pastures

- Methods of land application in which there is no concern for recovery of nutrients in the liquid wastes, such as landfilling.

Septage can be considered a fertilizer because of its nutrient value when applied to soil. Nitrogen, phosphorus, and micronutrients are contained in septage. The septage application rate usually is dependent upon the amount of nitrogen available to the crop. The die-off of pathogens (harmful bacteria and viruses) in septage which is surface spread is quicker than that of pathogens in septage injected into the soil. Where septage is incorporated into the top three inches of soil, generally 99% of all pathogens will die off within one month (Brown and White 1977).

Advantages of direct cropland application of septage and holding tank wastes are: the recycling of nitrogen and phosphorus; the low technology, maintenance, and cost of the system; and the rapid destruction of pathogenic organisms. Disadvantages include possible odor and water quality problems if the wastes are not spread properly, and the difficulty (and possible inability) to apply wastes when the ground is very wet.

Spreading septage and holding tank wastes on the land surface should be accomplished according to the requirements of the State of Wisconsin. The amount applied should be dependent on the type of waste (septage or holding tank) disposed because the concentrations of constituents in septage are about five times those of holding tank wastes. Nuisance conditions attributed to surface spreading can be minimized by subsurface injection. The WDNR regulations concerning surface spreading of liquid wastes on soils include:

- Depth to bedrock or high groundwater must be at least 36 inches
- Disposal is not permitted on land used during the current growing season for pasturing livestock or for vegetables intended for human consumption, or on land used for growing forage crops during the eight weeks preceding harvest
- Disposal is not permitted on land with greater than 12% slopes

- Disposal on land with 6 to 12% slopes is limited to areas greater than 500 feet upgrade from a drainageway

- Disposal on land with 0 to 6% slopes is limited to areas greater than 200 feet upgrade from a drainageway

- Disposal is limited to areas greater than 50 feet from any property line

- Disposal is limited to areas greater than 200 feet from a potable water well or reservoir

- Disposal is limited to areas greater than 1,000 feet from a residence or area frequented by the public (500 feet if written permission is obtained from the owner)

- The rate of disposal shall not exceed 30 gallons per 100 square feet per day.

The regulations are slightly different if liquid wastes are immediately plowed or knifed in. Distances from a residence then may be 500 feet, and distances from a drainageway may be 100 feet (on land with 0 to 6% slopes).

Extensive acreage in Walworth County is suitable for application of septage and holding tank wastes. During certain periods of the year, though, field access may be limited by heavy rainfall, deep snow cover, or frozen ground. Graveled access road can be and are used during these periods, though runoff of wastes to streams during these times is likely.

Biological and Physical Treatment of Septage

Septage may be treated biologically in anaerobic lagoons, aerobic lagoons, or digesters. Some advantages of aerobic treatment are the reduction of the offensive odor of septage; production of a sludge with good dewatering characteristics; and production of a supernatant with a lower BOD_5 than anaerobic supernatants. The major disadvantage of aerobic treatment compared to anaerobic treatment is the higher operation and maintenance cost. Advantages of anaerobic treatment systems are stabilization of organic solids from waste material; relatively low operating and maintenance costs. A disadvantage of anaerobic treatment is the high BOD_5 of the effluent and the potential for creating nuisance odors.

Chemical Treatment of Septage

Treatment of septage by adding chemicals is used to improve dewaterability, reduce odors, or kill pathogens. Chemical treatment processes include addition of coagulants, rapid chemical oxidation, and lime stabilization.

Some advantages associated with chemical treatment of septage are:

- A good reduction in the concentration of pollutants can be achieved
- Dewaterability of septage is improved so the waste can be dewatered on sand beds
- Effective control of pathogenic organisms is possible.

Disadvantages of chemical treatment of septage are:

- High costs are usually associated with chemical treatment, and in many instances these alternatives are only feasible where relatively large quantities of septage are produced
- Large quantities of chemicals are needed
- A relatively high level of technology is needed.

Wastewater Treatment Plant

Holding tank wastes can be disposed of in any kind of sewage treatment plant since the characteristics of the wastewaters are similar. Special care must be exercised during discharge of holding tank wastes into the treatment plant, because holding tank wastes are anaerobic and odorous.

Septage can be adequately treated at a properly operated WWTP. Both activated sludge or fixed media-type plants (trickling filters or RBCs) are used to treat septage. Septage can be discharged into the liquid stream or sludge stream. Since septage is handled as a slurry, possible addition points at a WWTP are the upstream sewer, the bar screen, the grit chamber, the primary settling tank, or the aeration tank. Discharge into the upstream sewer allows solids to settle out of the sewer, particularly at periods of low flow.

Septage can be treated easily at WWTPs that feature long detention times, such as facultative lagoons, aerated lagoons, or oxidation ditches. These plants are less susceptible to upsets from shock loadings, and can easily accommodate septage as long as the additional organic load was included in the plant design.

Points where septage can be added to sludge handling processes include the aerobic and anaerobic digester, the sludge conditioning process, or sand drying beds. Septage added to a WWTP at 2% or less of the total flow will have little impact on the treatment processes.

The advantages of treating septage in a WWTP are:

- Septage is diluted with wastewater and treated
- Few aesthetic problems are assocated with this type of septage handling
- Skilled personnel are present at the plant site.

The disadvantages of septage disposal at a WWTP are:

- A shock effect can occur in the unit processes of the WWTP if septage is not properly introduced into the wastewater flow
- Additional equipment and facilities prior to treatment are required for separation, degritting, and equalization of the wastes.

Septage disposal alternatives adequate for this study area probably are limited to land application, because the potential of upsetting sewage or sludge treatment processes within a treatment plant is considerable. Holding tank wastes, on the other hand, can safely be treated within a sewage treatment plant. Thus, the option of treating holding tank wastes at various sewage treatment plants should be investigated further.

2.3.3. Development and Screening of Preliminary Alternatives

A number of wastewater management alternatives were explored in the Facilities Planning documents. These in turn were based on alternatives developed by SEWRPC in the 1978 Regional Sanitary Sewerage Plan for Southeastern Wisconsin. The alternatives presented in SEWRPC (1978) consisted of combinations of sub-regional centralized collection and treatment systems designed to serve the entire 1990 population within the SEWRPC service area. No consideration was given to continued use of existing onsite systems. A summary of the SEWRPC regional alternatives is presented in Table 2-29.

Table 2-29. Sources of regional WWTP alternatives presented in SEWRPC (1978).

SEWRPC Alternative	WWTPs No.	WWTPs Location	Total Present Worth Cost Ranking[a]
East End			
1	2	Lake Geneva, Como	1[b]
2	1	Lake Geneva	2
West End			
1	3	Fontana, Walworth, Williams Bay	1
2	2	Walworth, Williams Bay	2
3	1	Walworth	3[b]

Notes:
[a]Including construction and O&M costs for WWTPs and interceptors (including pumping stations) only. Does not include collector costs which would be the same for each alternative.
[b]Recommended SEWRPC alternative.

Volume 1 of the Facilities Plan (Donohue & Assoc., Inc. 1978a) includes an evaluation of regional wastewater management alternatives for the SEWRPC service area. Alternatives were developed based on the assumption that all present and future wastewater flows, except for the Playboy Resort (now Americana) and Kikkoman Foods, both of which have their own WWTPs, would be treated at the proposed regional WWTPs. Continued use of onsite systems was not considered.

The alternatives consisted of combinations of upgrading and expansion of existing WWTPs or construction of new WWTPs located at Lake Geneva, Fontana, Walworth, and Williams Bay. A summary of the alternatives including the sub-regional service area of each WWTP and a ranking of the

Table 2-30. Summary of regional WWTP alternatives presented in Facilities Plan Volume 1 (Donohue & Assoc., Inc. 1978a).

Alternative	WWTP Location	WWTP Construction	WWTP Discharge	Service Area [a]	Total Present Worth Cost Ranking [b]
I	Lake Geneva	None	White River	City of Lake Geneva	N/A
(No Action)	Fontana	None	Seepage lagoon	Vil. of Fontana	
	Walworth	None	Piscasaw Creek	Vil. of Walworth	
	Williams Bay	None	Seepage lagoon	Vil. of Williams Bay	
	Interlaken	None	Soil absorption	Interlaken	
II	Lake Geneva	Upgrade/expand	White River	C Lake Geneva, SE Shore Geneva Lake	6
	Como	New	Como Creek	N&S Shores, Lake Como, Interlaken	
	Fontana	Upgrade/expand	Land application	V Fontana, Fontana S Shore	
	Walworth	New	Piscasaw Creek	V Walworth	
	Williams Bay	Upgrade/expand	Seepage lagoon	V Williams Bay, E Williams Bay	
II-A	Lake Geneva	Upgrade/expand	White River	C Lake Geneva, SE Shore Geneva Lake, N&S Shore Lake Como, Interlaken	3
	Fontana	Upgrade/expand	Land Application	V Fontana, Fontana S Shore	
	Walworth	New	Piscasaw Creek	V Walworth	
	Williams Bay	Upgrade/expand	Seepage lagoon	V Williams Bay, E. Williams Bay	
II-B	Lake Geneva	Upgrade/expand	White River	C Lake Geneva, SE Shore Geneva Lake	2
	Fontana	Upgrade/expand	Land Application	V Fontana, Fontana S Shore	
	Walworth	New	Piscasaw Creek	V Walworth	
	Williams Bay	Upgrade/expand	Seepage lagoon	V Williams Bay, E. Williams Bay, N&S Shores, Lake Como, Interlaken	
II-C	Lake Geneva	Upgrade/expand	White River	C Lake Geneva, SE Shore Geneva Lake, N&S Shores Lake Como, Interlaken	5
	Fontana	Upgrade/expand	Shore Seepage	V Fontana, Fontana S Shore	
	Williams Bay	Upgrade/expand	lagoon	V Williams Bay, E Williams Bay	
	Walworth	New	Piscasaw Creek	V Walworth	
III	Lake Geneva	Upgrade/expand	White River	C Lake Geneva, SE Shore Geneva Lake, N&S Shores Lake Como, Interlaken	4
	Walworth/Fontana	New	Piscasaw Creek	V Walworth, V Fontana, Fontana S Shore	
	Williams Bay	Upgrade/expand	Seepage lagoon	V Williams Bay, E Williams Bay	

Table 2-30 (Continued)

III-A	Lake Geneva	Upgrade/expand	White River	C Lake Geneva, SE Shore Geneva Lake, NYS Shores Como Lake, Interlaken	1
	Walworth	New	Piscasaw Creek	V Walworth, V Fontana, V Williams Bay, E Williams Bay, Fontana S Shore	
III-B	Lake Geneva	Upgrade/expand	White River	Entire service area	7

Notes:

[a] See Table 2-31 for subdivisions included in subregional service areas.

[b] Total present worth cost (initial and future capital costs, O&M costs, minus salvage value) ranking includes costs for WWTP and interceptors only. Collector sewers are not included because they are the same for each Alternative.

total present worth costs are presented in Table 2-30. A breakdown of the subdivisions included in each sub-regional service area is presented in Table 2-31.

These alternatives were evaluated based on cost-effectiveness, environmental impacts, flexibility, and implementability. Alternative III-A was the recommended alternative and includes upgrading and expansion of the existing Lake Geneva WWTP to serve the east end of the service area, and a new WWTP at Walworth to serve the west end of the service area.

In Volume 2 of the Facilities Plan, WWTP design and effluent disposal alternatives were evaluated for the regional WWTPs proposed in Volume 1. The discussion is presented in two documents: one for the east end (Donohue & Assoc., Inc. 1981a), and another for the west end (Donohue & Assoc., Inc. 1981b, 1983a). The Volume 2 documents also included a discussion of the existing onsite systems in the planning area, and presented an evaluation of the costs to upgrade the onsite systems or construct cluster systems for these areas as alternatives to centralized collection and treatment at WWTPs. The analyses also includes a comparison of small diameter gravity, and pressure sewers as alternatives to conventional gravity collector sewers in the unsewered area. Alternatives developed for the Lake Como Beach Area were used as a "case study" to screen out high cost onsite and collection alternatives. The ranking of the total present worth costs for the alternatives evaluated for the unsewered areas are presented in Table 2-32.

The results of the evaluation indicate that upgrading of onsite systems 10 years old or older with new septic tanks and soil absorption systems or mounds for 60% of existing residence (a very conservative design assumption) is the most cost-effective alternative for wastewater management for all the unsewered areas except the south shore of Lake Como. However, upgrading of onsite systems was rejected for a number of unsewered areas because general site conditions in the area were deemed not suitable for onsite systems due to unquantified factors, such as: steep slopes, poor soils, numerous problems with existing onsite systems, high groundwater, and small lots. For these areas the wastewater management alterna-

Table 2-31. Breakdown of sub-regional service areas and general areas by subdivision (Donohue & Assoc., Inc. 1978a)

City of Lake Geneva
Village of Fontana
Village of Williams Bay
Village of Walworth

SE Shore Geneva Lake

(Sub-regional Service Area)

- Southeast Shore Area
  - Lake Geneva Beach
  - Trinke Estates
  - Robinsons
  - Robinsons Hillside
- Birches-Genevista Area
  - Genevista
  - Lake Geneva Terrace
  - Lawrence's Addition
  - Lakeview Park
  - The Birches
- Edgewater Terrace Area
  - Edgewater Terrace
  - Lake Geneva Highlands

East Williams Bay

(Sub-regional Service Area)

- Cisco Beach Area
  - Cisco Beach
  - Ara Glen
  - Rowena Park
  - Sylvan Trail Estates
- Sunset Hills Area
  - Sunset Hills
  - Sunset Hills Shores
  - Elgin Club
  - Odden Park
  - S. B. Chapin
  - Lake Geneva Knoll

Fontana South Shore

(Sub-regional Service Area)

- Shore Haven - Camp Sybil Area
  - Camp Sybil
  - Shore Haven
  - Oak Shores
  - Chicago Club
  - Lake Geneva Club
- Academy Estates Area
  - Northwestern Academy
  - Academy Estates
- Maple Hills Area
  - Maple Hills

N Shore Lake Como

(Sub-regional Service Area)

- Lake Como Beach Area
  - Lake Como Beach

S Shore Lake Como

(Sub-regional Service Area)

- Consumers Company Area
  - Consumers Company

Table 2-32. Facilities Plan ranking of total present worth costs for wastewater management alternatives serving currently unsewered areas. (Donohue & Assoc., Inc. 1983a)

General Area [a]	Alternatives	Ranking of Present Worth Costs [b]
Lake Como Beach Area	Individual ST-SAS[c]	1
	Individual mound	2
	Individual holding tanks	3
	Conventional gravity sewers	4
	Small diameter gravity sewers	5
	Grinder pump low pressure sewers	6
	Septic tank effluent pump low pressure sewers	7
	Cluster mound	8
	Cluster holding tanks	9
Southeast Shore Area	Individual ST-SAS	1
	Conventional gravity sewers	2
	Individual mounds	3
	Cluster mound	4
	Individual holding tanks	5
Birches - Genevista Area	Individual mounds	1
	Individual holding tanks	2
	Conventional gravity sewers	3
	Cluster mound	4
Edgewater Terrace Area	Individual mounds	1
	Conventional gravity sewers	2
	Individual holding tanks	3
	Cluster mound	4
Shóre Haven - Camp Sybil Area	Individual mounds	1
	Conventional gravity sewers	2
	Cluster mound	3
	Individual holding tanks	4
South Shore Lake Como	Conventional gravity sewers	1
	Individual mounds	2
	Cluster mound	3
	Individual holding tanks	4
Cisco Beach Area	Individual mounds	1
	Conventional gravity sewers	2
	Individual holding tanks	3
	Cluster mound	4
Sunset Hills Area	Individual mounds	1
	Individual holding tanks	2
	Conventional gravity sewers	3
	Cluster mound	4

[a]See Table 2-31 for subdivisions in each general area.

[b]Ranking of total present worth costs over 20 years. Including initial capital, future construction, and O&M costs minus salvage value.

[c]ST-SAS: Septic tank soil absorption system.

tive was selected based on a comparison of the total present worth costs of cluster systems and centralized collection with treatment at a WWTP.

Only conventional gravity sewers were considered in the analysis based on the results of the Lake Como Beach Area "case study" which indicated that this was the most cost-effective collection alternative.

The Facilities Plan recommended wastewater management alternatives for the unsewered areas within the SEWRPC Service Area are presented in Table 2-33. Upgraded individual onsite systems or cluster mounds were recommended for a number of areas previously identified for service with centralized collection and treatment in the SEWRPC and Facilities Plan Volume 1 documents. Based on this evaluation, a revised sewer service area (RSSA) was delineated which includes the areas presently sewered and the areas recommended for sewering in the Facilities Plan Volume 2 documents (Figure 1-3). The areas within the SEWRPC sewer service area (SSA) but outside the RSSA were excluded from further planning considerations in facilities planning and this EIS.

After publication of the preliminary Draft of Volume 2 for the west end of the planning area (Donohue & Assoc., Inc. 1981b), the Village of Williams Bay rejected the regional WWTP concept recommended in the Volume 1 document because it would significantly increase their annual cost over operation of their existing WWTP. Addendum 1 to Volume 2 - for the Lake Geneva West Planning Area (Donohue & Assoc., Inc. 1983b) reevaluated the cost of upgrading the existing Williams Bay WWTP and a new Walworth/ Fontana WWTP compared to the Volume 1 regional WWTP. Based on this analysis, the sub-regional concept providing two WWTPs for the west end (upgrading the existing Williams Bay WWTP and construction of a new sub-regional WWTP to serve Walworth/Fontana) was recommended in the final Draft of West End Volume 2 (Donohue & Assoc., Inc. 1983a).

This document also included a reevaluation of the cost-effectiveness of maintaining separate wastewater treatment facilities for the Interlaken Resort, Kikkoman Foods, and the Christian League for the Handicapped. In all three cases, it was originally recommended that these facilities main-

Table 2-33. Facilities Plan Volume 2 recommended wastewater management alternative for unsewered areas. (Donohue & Assoc., Inc. 1983a)

Sub-regional Area/ General Area [a]	Facilities Plan Recommended Alternative
SE Shore Geneva Lake	
Southeast Shore Area	Conventional gravity sewers[b]
Birches - Genevista Area	Cluster mounds
Edgewater Terrace Area	Cluster mounds
SW Shore Geneva Lake (Fontana South Shore)	
Shore Haven - Camp Sybil Area	Conventional gravity sewers[b]
Academy Estates Area	Conventional gravity sewers
Maple Hill Area	Individual mounds
NW Shore Geneva Lake (East Williams Bay)	
Cisco Beach Area	Conventional gravity sewers[b]
Sunset Hills Area	Individual mounds or small cluster mounds
N Shore Lake Como	
Lake Como Beach Area	Conventional gravity sewers[b]
S Shore Lake Como	
Consumers Company Area	Individual mounds or small cluster mounds

[a] See Table 2-31 for breakdown of subdivision included in each area.

[b] Includes treatment at regional WWTP.

tain their own individual wastewater treatment facilities for the 20 year planning period. The Facilities Plan has now been revised to conclude that the Interlaken Resort and the Christian League should maintain their own facilities. Kikkoman Foods will discharge its sanitary and process wastewaters to the Walworth/Fontana Treatment System.

The wastewater treatment processes and disposal alternatives evaluated for the new east end WWTP, located at Lake Geneva, and the new west end WWTP, located at Walworth/Fontana, included a number of secondary processes with surface water and land disposal. The WWTP alternatives were evaluated and the ranking of the total present worth costs are presented in Table 2-34. The recommended WWTP alternatives were:

- Lake Geneva Regional WWTP - upgrade and expand existing trickling filter WWTP with land disposal at new seepage cell site
- Walworth/Fontana WWTP - construct new aerated lagoon WWTP with land disposal at new seepage cell site
- Williams Bay WWTP - upgrade and expand existing activated sludge WWTP with land disposal at existing seepage cell sites.

The upgrade and expansion of the existing trickling filter WWTP was recommended over the lower cost new aerated lagoon WWTP for the Lake Geneva plant because the costs were very close (within 1%); the upgrade alternative has a lower annual operation and maintenance cost, making it less susceptible to inflation; and future expansion of the aerated lagoon would require purchase of additional land.

2.4. Description of Final Alternatives

Three system alternatives for providing wastewater treatment for the RSSAs are described in this section. The alternatives include: No Action; the Facilities Plan Recommended Alternative (FPRA), which consists of providing centralized collection and treatment for all portions of the RSSAs; and the EIS Alternative, which consists of providing management of onsite systems for currently unsewered portions of the RSSAs and centralized collection and treatment for portions of the RSSAs currently sewered.

These alternatives and their associated costs are described in the following sections. All costs are based on third-quarter (September) 1982 costs.

Table 2-34. Alternative treatment processes, disposal methods and ranking of total present worth costs for Facilities Plan Volume 2 WWTP alternatives.

Alternatives	Treatment Process[d]	Effluent Disposal	Ranking of Total Present Worth Costs
Lake Geneva Regional WWTP[a]			
I	Extended aeration	White River	4
II	Rotating biological contactor	White River	6
III	Two-stage activated sludge	White River	5
IV	Trickling filter/activated sludge	White River	3
V	Trickling filter	Land application	2
VI	New aerated lagoon	Land application	1
Walworth-Fontana WWTP[b]			
I	Extended aeration	Piscasaw Creek	5
II	Trickling filter/activated sludge	Piscasaw Creek	6
III	Oxidation ditch	Land application	3
IV	Trickling filter	Land application	2
V	Aerated lagoon	Land application	1
VI	Rotating biological contactor	Land application	4
Williams Bay WWTP[c]			
-	Activated sludge	Land application	-

[a]Upgrade/expand existing Lake Geneva WWTP Alternatives I-V (Donohue & Assoc., Inc. 1981a). Now WWTP for Alternative VI (Donohue & Assoc., Inc. 1982b).
[b]New WWTP (Donohue & Assoc., Inc. 1983b).
[c]Upgrade/expand existing WWTP (Donahue & Assoc., Inc. 1983b).

2.4.1. No Action Alternative

The no action alternative implies that neither USEPA or WDNR (except on an individual basis through the Wisconsin fund where eligible individual onsite systems can be funded through NR 128.30) would provide funds to build, upgrade, or expand existing wastewater treatment systems.

Wastewater would continue to be treated by existing WWTPs and existing onsite systems. Each individual community would be responsible for improving operations and for making any necessary non-structural process adjustments to maintain permitted treatment levels throughout the 20-year design period. County sanitarians would continue to be responsible for permitting and regulating existing onsite systems, and would continue to require replacement or repair of obviously failing systems in unsewered areas. A description of the no action alternative for each WWTP and for the unsewered areas is presented below.

Lake Geneva WWTP

As described previously, the existing Lake Geneva WWTP has an average design capacity of 1.1 mgd and generally is in satisfactory operating condition. However, it regularly fails to meet effluent limitions for total phosphorus under current (interim) permit requirements. The projected year 2005 average daily (summer) design wastewater flow for the existing Lake Geneva WWTP service area is 1.737 mgd. With no action, the existing facilities would not be able to provide treatment to meet final (1986) WPDES permit requirements. Without Federal or State funding, construction of new and/or upgraded facilities potentially would place a financial burden on the local community. Therefore, the community probably would continue to operate the existing WWTP for several years without major improvements. At some point prior to year 2005, increased flows would overload the plant, potentially causing backups and overflows of sewage both in the collection system and at the WWTP site. The WWTP would continue to discharge, with increasing frequency, an effluent of lower quality that would not meet permit requirements into the White River. Ultimately, WDNR would take enforcement action forcing the Village to upgrade their existing facilities or construct new facilities as necessary to meet WPDES permit requirements.

Williams Bay WWTP

The existing Williams Bay WWTP has an average hydraulic design capacity of 0.786 mgd. Some portions of the plant are in poor structural condition and the plant has experienced hydraulic problems. The existing plant generally meets the BOD effluent requirements for land application, but has exceeded the limit on occasion. Hydraulic problems reportedly cause the plant to overflow and discharge partially treated sewage to Southwick Creek (which flows to Geneva Lake) in violation of the WPDES permit.

The projected year 2005 average daily (summer) design wastewater flow for the existing service area is 0.692 mgd, which is less than the existing WWTP design capacity. However, because of hydraulic limitations at the plant, it is likely that overflows would continue occasionally in violation of the WPDES permit. In addition, the aging condition of the WWTP structures and equipment make it likely that the plant would require a major renovation and, perhaps, that additional seepage lagoon area would be required to adequately serve the wastewater treatment needs of the existing service area over the 20-year design period. If USEPA or WDNR do not provide funding, the Village eventually may be required to undertake the rehabilitation and expansion on its own.

Fontana WWTP

The existing Fontana WWTP has an average daily design capacity of 0.9 mgd and a peak daily capacity of 1.8 mgd. The WWTP currently is operating satisfactorily, but portions of the WWTP are 25 years old. A new seepage lagoon at the WWTP appears to be operational, but the old lagoon has experienced problems. The projected year 2005 average daily (summer) design wastewater flow for the existing service area is 0.815 mgd, which is less than the existing WWTP design capacity. If the facilities were new, they probably would operate satisfactorily over the design period. However, with no action taken it is likely that the older portions of the WWTP would require major structural and mechanical renovation and that additional seepage lagoon area would be required to adequately serve the wastewater treatment needs of the service area over the 20-year design period. If USEPA or WDNR does not provide funding, the Village may be required to finance WWTP improvements on its own.

Walworth WWTP

The existing Walworth WWTP has an average daily design capacity of 0.15 mgd. Flow to the WWTP currently exceeds its design capacity, and some portions of the WWTP are in poor structural condition. The projected year 2005 average daily (summer) design wastewater flow for the existing service area is 0.278 mgd. The WWTP and polishing lagoon system currently is discharging an effluent of a quality consistent with its design, but it will not be able to meet future effluent requirements without major structural improvements. If the no action alternatives were implemented by USEPA and/or the WDNR, these needed improvements would have to be financed solely by the Village of Walworth.

Onsite Systems

Wastewater would be treated by existing onsite systems, and no new onsite facilities would be built except to replace obviously failed systems. This EIS assumes, however, that County sanitarians would continue responsibility for ensuring that failing existing systems are upgraded according to DILHR standards. The need for improved wastewater management around Geneva Lake and Como Lake is not well documented. The number of onsite systems experiencing serious or recurrent malfunctions is small.

Under the no action alternative, local health authorities will continue to have inadequate information with which to identify failing systems and to design onsite system repairs appropriate to the problems and their causes. They are unlikely to have the time, personnel, or monitoring capabilities necessary to be able to specify innovative attempts to solve all problems. The result will be an increasing number of holding tanks on small lots and on lots with high groundwater. If no action is taken, existing onsite systems in the study area potentially would continue to be used in their present condition. Although some replacement systems would be funded by WDNR, new and some replacement systems would be financed solely by their individual owners.

2.4.2. Facilities Plan Recommended Alternative

The Facilities Plan recommended alternative (FPRA) includes construction of collection sewers and interceptors in nearly all currently unsewered areas within the RSSAs, upgrading of the Lake Geneva WWTP to serve the east end of the planning area, upgrading of the Williams Bay WWTP, and construction of a new WWTP at Walworth to serve the west end planning area communities of Walworth and Fontana. The existing Fontana WWTP and Walworth WWTP would be abandoned. Location of the proposed collection and treatment facilities for the FPRA are presented in Figure 2-13. The facilities proposed for construction as the FPRA are described in the following paragraphs.

Collectors and Interceptors

For the FPRA, conventional gravity collection sewers are proposed, but not costed, for collection of wastewater in the unsewered areas of the RSSAs. Conventional gravity sewers were selected based on cost-effectiveness analyses presented in the facilities planning documents. Gravity collection sewers and interceptors consisting of gravity sewers, pumping stations and force mains are proposed. The interceptors were sized by the facilities planner for a 50-year design period. The estimated cost of constructing and operating collection sewers for certain subdivisions within the RSSAs as proposed in the FPRA (Table 2-35) is listed in Table 2-36.

Table 2-35. Subdivisions to be served by centralized wastewater collection and treatment facilities in the FPRA.

Lake Geneva WWTP	Walworth/Fontana WWTP	Williams Bay WWTP
City of Lake Geneva	Village of Walworth	Village of Williams Bay
Lake Como Beach Sub.	Village of Fontana	Northwest shore
		Cisco Beach Sub.
Southeast shore	Southwest shore	Ara Glen Sub.
Lake Geneva Beach Sub.	Camp Sybil Sub.	Rowena Park Sub.
Trinke Estates Sub.	Shore Haven Sub.	Sylvan Trail Estates Sub.
Robinson's Sub.	Oak Shores Sub.	
Robinson Hillside Sub.	Chicago Club Sub.	
	Lake Geneva Club Sub.	
	Northwestern Academy	
	Academy Estates Sub.	
	Maple Hills Sub.	

The cost to the individual homeowner to construct the connection to the system (approximately $1,000) is not included in the costs. The use of onsite wastewater treatment systems would be discontinued in the subdivisions served by sewers. All future residences in the RSSAs would be served by the central gravity collection systems.

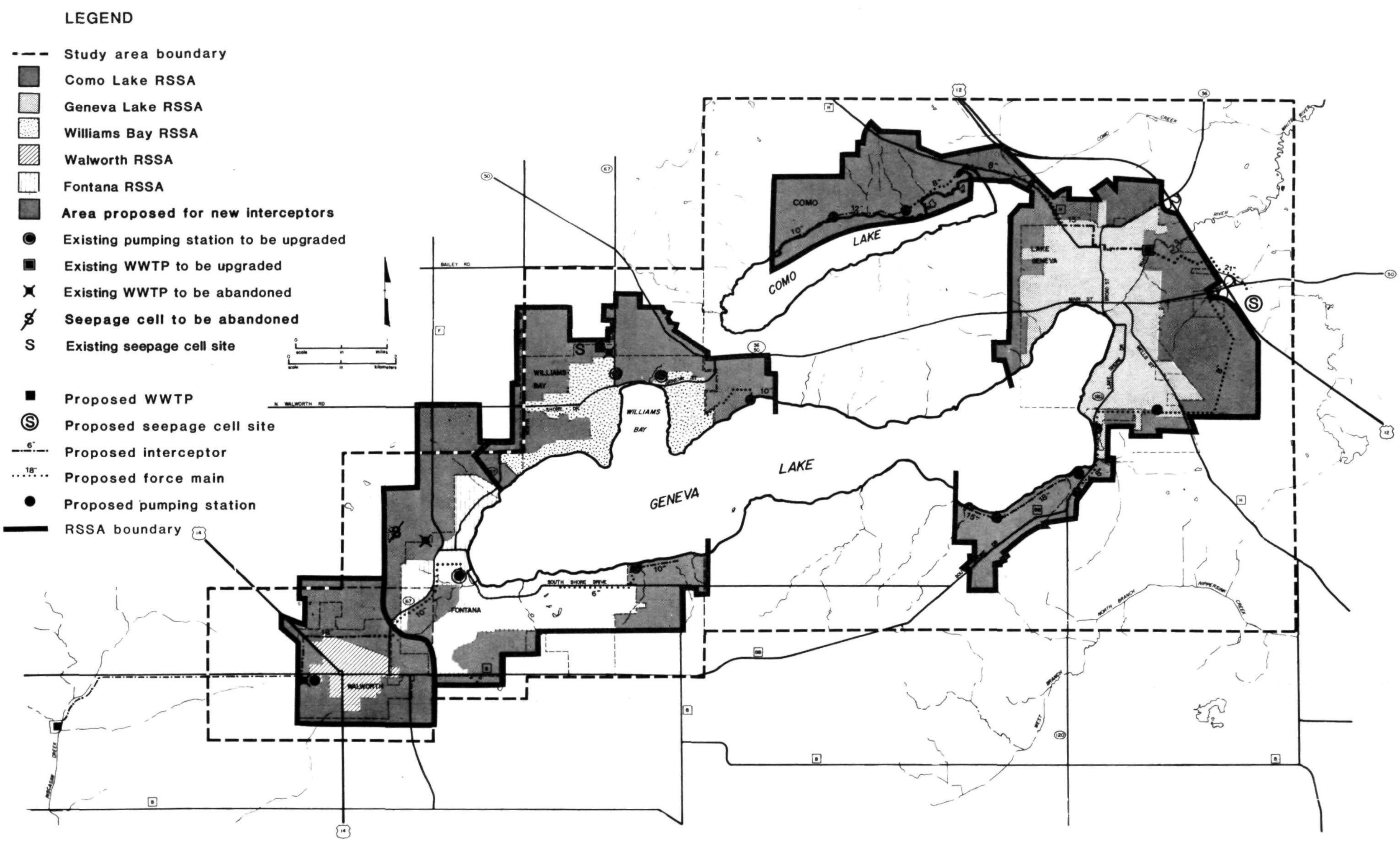


Figure 2-13. Location of wastewater collection and treatment facilities for the Facilities Plan Recommended Alternative.

Lake Geneva WWTP

The FPRA proposes to serve the City of Lake Geneva, the Lake Como Beach Subdivision, and the southeast shore of Geneva Lake. The WWTP would be designed to handle an average daily (summer) flow of 2.13 mgd, and a peak daily flow of 5.2 mgd.

Table 2-36. Estimated cost of collection sewers and interceptors for certain subdivisions within the RSSAs, as proposed in the FPRA (see Appendix F of the Draft EIS)

Item	Initial Capital	Annual O&M	Construction 10th Yr.	Salvage Value
Collection Sewers[b]				
Lake Como (Geneva Town)[c]	$9,272,500	$13,000	$151,300	$4,749,750
Southeast Shore (Linn Town)[c]	1,313,300	6,300	812,500	1,266,000
Southwest Shore (Linn Town)[d]	679,750	3,600	-	339,900
Northwest Shore (Linn Town)[e]	723,300	4,200	67,500	412,300
Interceptor				
Lake Como Beach[c]	2,031,250	440	-	1,216,690
Southeast Shore[c]	1,463,710	3,290	-	876,220
Southwest Shore[d]	640,850	290	-	385,530
Northwest Shore[e]	552,370	860	-	330,460
Total	$16,677,030	$31,980	$1,031,300	$9,576,850

[a]Updated to the third quarter 1982 (see Table F-5, Appendix F of the Draft EIS).

[b]See Table 2-35 for a list of subdivisions proposed for collector sewers.

[c]To Lake Geneva WWTP.

[d]To Walworth/Fontana WWTP.

[e]To Williams Bay WWTP.

For the upgraded WWTP, approximately 50 feet of existing interceptor sewer will be relaid to accommodate a new raw wastewater pump station (Figure 2-14). Wastewater will flow by gravity through a new mechanical bar screen, and a manual bar screen also will be provided for backup. A new grit chamber will separate heavier grit from lighter organic matter. Grit accumulating in the bottom of the grit chamber will be pumped out periodically and transported by truck to a sanitary landfill.

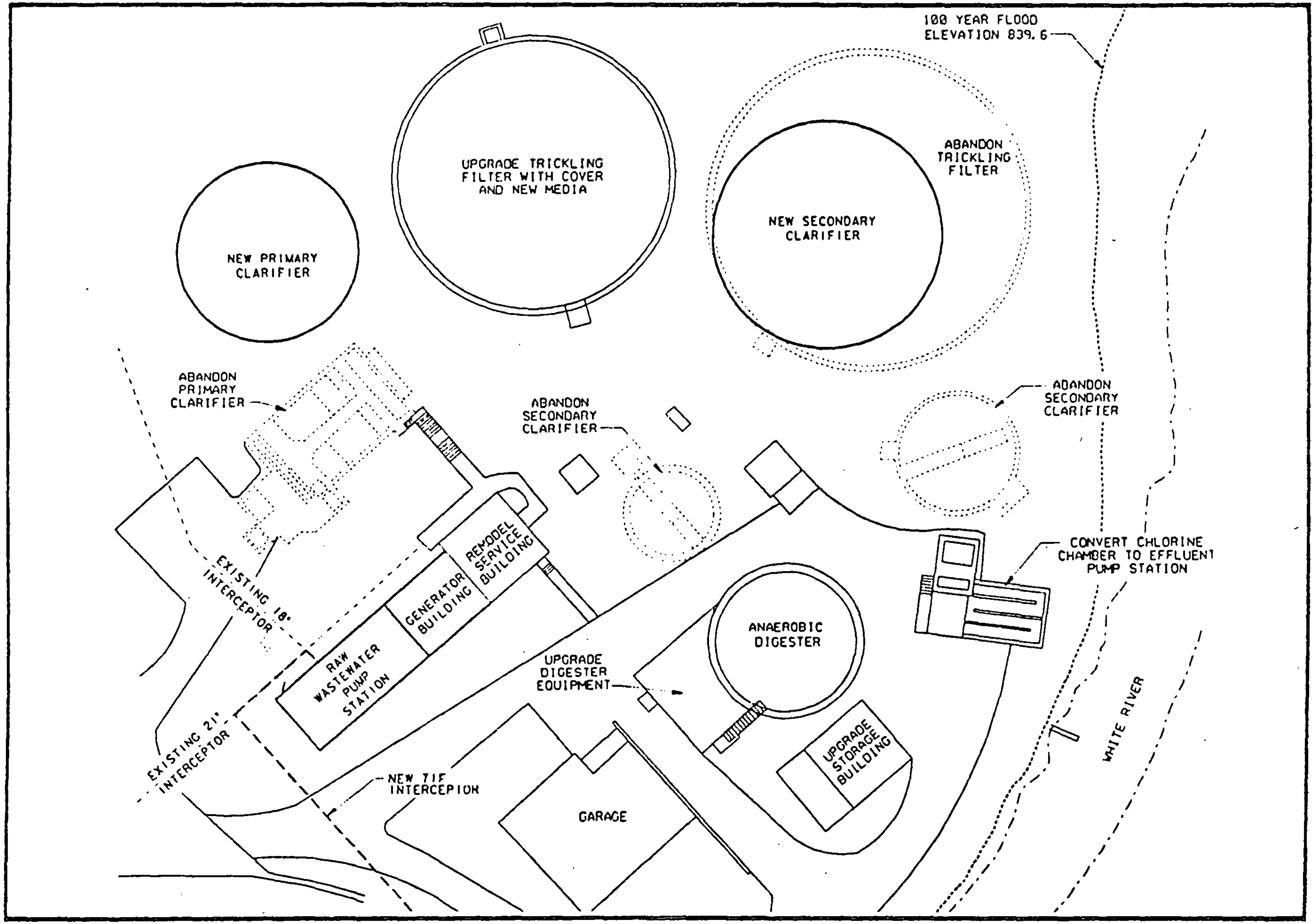


Figure 2-14. Expanded facilities for the Geneva Lake WWTP as proposed in the FPRA (Donohue & Assoc., Inc. 1982b).

Following grit removal, wastewater will flow by gravity to a new raw wastewater pumping station. Six constant speed, submersible pumps will handle the anticipated flow. The wastewater will be metered using a magnetic flow meter and then transported to a new 55-foot diameter primary clarifier.

Primary effluent will then flow by gravity to a renovated 88-foot diameter trickling filter. A fiberglass domed cover will be used to enhance treatment efficiencies during cold weather. A new distribution arm and larger piping will increase hydraulic capacity of the filter. The trickling filter will utilize 6-foot deep plastic media instead of the existing rock media.

Trickling filter effluent will flow by gravity to a new secondary clarifier. The existing raw wastewater pump station will be used to recycle trickling filter effluent back to the filter influent, which will maintain optimum hydraulic loadings to the filter, enhance treatment, and meet NR 110 code requirements.

One 70-foot diameter secondary clarifier will replace two existing clarifiers, because the existing units are too small and shallow and have mechanical and structural problems. Clarified secondary effluent will flow by gravity to the existing chlorine contact chamber, which will be converted into an effluent pump station. Four vertical turbine pumps will transport effluent to a 2.8 million gallon dosing lagoon at the rapid infiltration site through a 21-inch diameter, 7,250-foot force main.

The rapid infiltration system will be located near the STH 50 and US 12 interchange. The infiltration system will consist of eight seepage cells (Figure 2-15). Multiple cells will allow for resting other cells to extend their life, and to provide better treatment. Resting will allow nitrification and denitrification to occur, which will minimize the impact of nitrates on groundwater. The average design dosing rate will be approximately 23 inches per week.

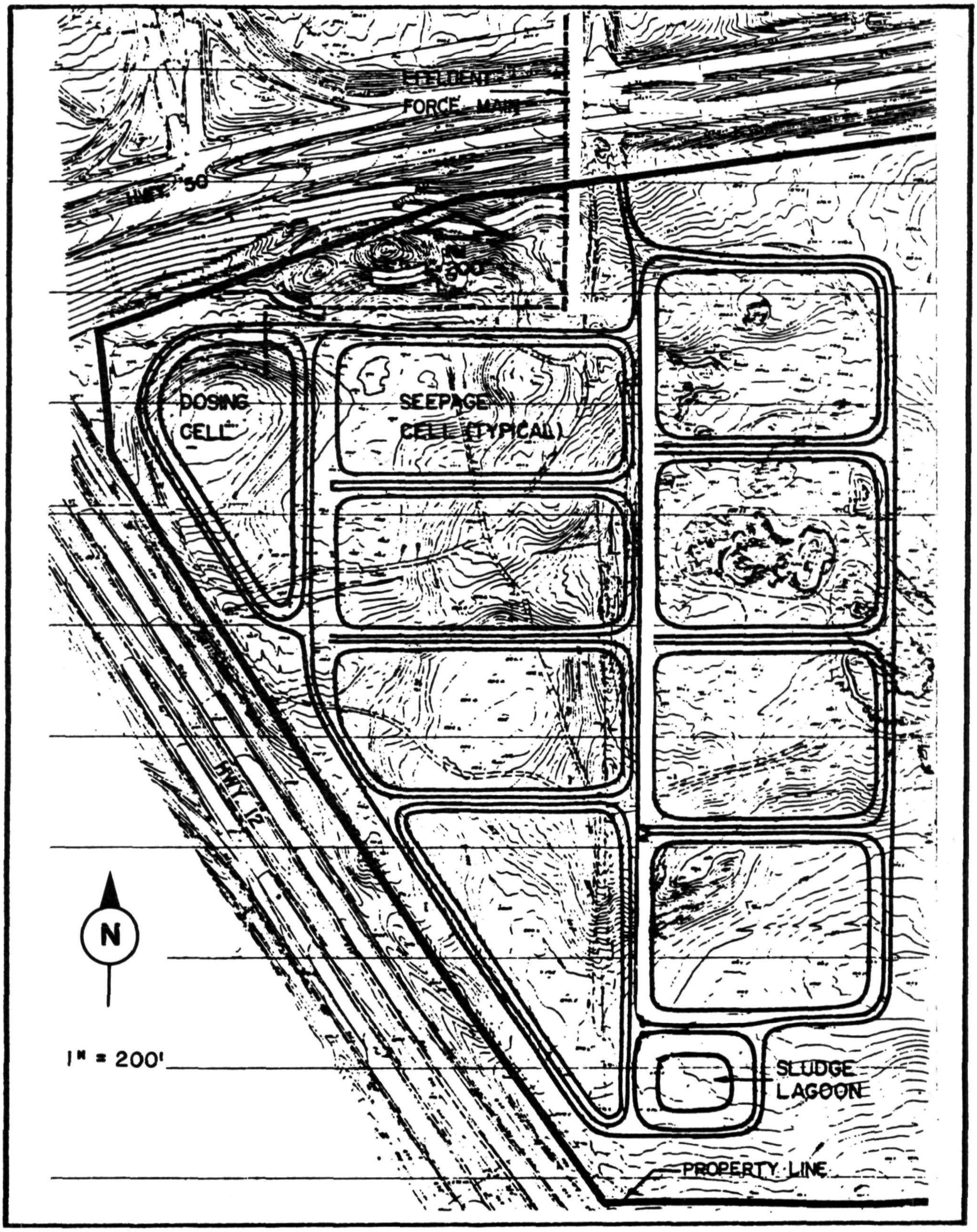


Figure 2-15. Layout of the rapid infiltration system proposed in the FPRA (Donohue & Assoc., Inc. 1982b).

Discharge from a dosing cell to the seepage cells will be by gravity through a 36-inch diameter pipe. The discharge will be controlled by several valves which can be automatically or manually operated. The bottom of the dosing lagoon will be located a minimum of eight feet above that of the seepage cells to facilitate gravity flow. The dosing lagoon will have a synthetic liner to prevent leakage, since no onsite soils are suitable for that purpose. One seepage cell will contain a centrally located underdrain. The underdrain will terminate in a standpipe to ensure a direct means of collecting leachate from the system for analysis. Several new groundwater monitoring wells will be required around the rapid infiltration site due to the proposed layout, and to conform to the construction requirements of NR 110.25(5).

Sludge treatment and disposal will consist of upgrading the City's existing system. Primary and secondary sludge will be pumped to the existing 45-foot diameter anaerobic digester. Digester equipment and sludge pumps will be upgraded or replaced as necessary. Digested sludge will be transported by truck to a new sludge storage lagoon.

A 2.1 million gallon sludge storage lagoon is proposed at the rapid infiltration site. Approximately 180 days storage will be provided. Liquid haul of digested sludge will be accomplished using an existing 2,800 gallon sludge truck, plus one new sludge application vehicle consisting of a farm tractor and a 3,000 gallon trailer. Soil incorporation of the sludge will be used to take advantage of the sludge's nutrient value. The City currently is obtaining licensed sludge application sites in the vicinity of the sludge lagoon in order to minimize travel expense.

Besides the above mentioned process additions, the existing Lake Geneva WWTP will be upgraded in the areas of office and laboratory facilities; an existing service building will be remodeled, standby power will be provided, and floodproofing the site will be accomplished by earth filling around some existing structures. Estimated costs for the expanded Lake Geneva WWTP and new rapid infiltration system, as proposed by the FPRA, are listed in Table 2-37. A disaggregation of costs among the major service areas in the Lake Como - Lake Geneva RSSAs also is included in Table 2-38.

Table 2-37. Estimated cost of the upgraded Lake Geneva WWTP (2.13 mgd) and new rapid infiltration system, as proposed in the FPRA (Adapted from Donohue and Assoc., Inc., 1982b).

WASTEWATER TREATMENT PLANT SITE	Initial Cost	Service Life (Years)	Future 15th Year Cost	Salvage Value 20th Year
General Construction				
Raw Wastewater Pump Station	$ 110,000	40		$ 55,000
Grit Removal	65,000	40		32,200
Primary Clarifier	40,000	40		20,000
Trickling Filter Modifications	8,000	20		
Trickling Filter Cover	67,000	40		33,500
Secondary Clarifier	165,000	40		82,500
Digester Modifications	5,000	20		
Sitework	14,000	20		
Demolition	20,000	--		
Generator Building	20,000	40		10,000
Effluent Pump Station	15,000	20		
Remodel Service Building	30,000	20		
Mechanical Equipment				
Mechanical Bar Screen	70,000	15	$ 70,000	52,500
Grit Handling	49,000	15	49,00	36,800
Raw Wastewater Pumps	105,000	15	105,000	78,800
Primary Clarifier	64,000	20		
T.F. Media	218,000	20		
T.F. Distributor Arm	54,000	20		
T.F. Underdrain Rehabilitation	15,000	20		
Effluent Pumps	46,000	15	46,000	34,500
T.F. Recirculating Pump Modifications	6,000	15	6,000	4,500
Anaerobic Digester	146,000	20		
Sludge Pumps	10,000	15	10,000	7,500
Standby Generator	96,000	20		
Metering and Sampling	58,000	20		
Secondary Clarifier	67,000	20		
Process Piping	204,000	30		67,900
Laboratory and Office Equipment	10,000	20		
Sludge Vehicle	105,000	15	105,000	78,800
Plumbing	30,000	20		
HVAC	40,000	20		
Electrical	190,000	20		
Subtotal - WWTP Site	$2,142,000		$391,000	$594,500

Table 2-37. (Continued)

	Initial Cost	Service Life (Years)	Future 15th Year Cost	Salvage Value 20th Year
LAND APPLICATION SITE				
Sitework	$ 286,000	20		
Process Piping	257,000	30		$ 85,600
Roadways	38,000	20		
Fencing	13,000	20		
Percolate Monitoring System	7,000	20		
Observation Wells	4,000	20		
Control Structures	30,000	20		
Sludge Lagoon	50,000	20		
Land Purchase	445,000	--		
AT&T Cable Relay	150,000	--		
Subtotal - Land Application Site	$1,280,000		$ 0	$ 85,600
CONVEYANCE PIPING				
Effluent Force Main	$ 290,000	30		$ 96,600
Sludge Transport	65,000	30		21,600
Subtotal - Conveyance Piping	$ 355,000		$ 0	$118,200
TOTAL CONSTRUCTION COST	$3,777,000		$391,000	$798,300
Engineering, Legal, Adm. (15%)	$ 560,000			
Contingencies (15%)	$ 573,000			
ESTIMATED INITIAL CAPITAL COST	$4,910,000			

Table 2-37. (Continued).

ANNUAL O&M Item	Collection Sewer O&M	WWTP	Total O&M
Sewage Disposal Salary	$ 4,000.00	$78,006.37	$ 82,006.37
Social Security	300.00	5,108.00	5,408.00
Retirement	500.00	8,586.00	9,086.00
Health and Life Insurance	700.00	6,512.47	7,212.47
Car Allowance	600.00	600.00	1,210.00
Electricity	2,000.00	37,500.00*	39,500.00
Water	2,600.00	2,600.00	5,200.00
Telephone	220.00	500.00	720.00
Fuel - Digester	---	5,800.00	5,800.00
Fuel - Office	---	1,925.00	1,925.00
Repairs - Equipment	---	4,800.00	4,800.00
Repairs - Sewer	8,000.00	---	8,000.00
Repairs - Lift Stations	3,000.00	---	3,000.00
Maintenance - Equipment	---	1,500.00	1,500.00
Maintenance - Sewers	2,000.00	---	2,000.00
Maintenance - Lift Stations	2,500.00	---	2,500.00
Survey of Sewers	15,000.00	---	15,000.00
Engineering	5,000.00	5,000.00	10,000.00
Chemicals	---	2,000.00	2,000.00
Sludge Removal	---	7,000.00	7,000.00
Building - Maintenance	400.00	400.00	800.00
Testing	---	2,800.00	2,800.00
Vehicle - Maintenance	2,000.00	1,000.00	3,000.00
Alarm Circuits	450.00	---	450.00
Emergency Power	500.00	---	500.00
Insurance	600.00	5,770.00	6,370.00
Travel and School	500.00	800.00	1,300.00
Miscellaneous	2,000.00	---	2,000.00
Billing Expense	5,000.00	10,000.00	15,000.00
Debt Service	10,000.00	43,448.45	53,448.45
Outlay	5,000.00	20,000.00	25,000.00
TOTAL	$72,870.00	$251,656.29	$366,526.29

Table 2-38. Disaggregation of costs of the Lake Geneva collection sytem and WWTP among major service areas of the Geneva Lake-Lake Como RSSA, based upon population served:[a]

Area	Base-year Population	Cost Share
Lake Como	2,723	25%
Lake Geneva	7,480	67%
Southeast Shore	898	8%
Total	11,101	100%

Area	Capital Cost	Future 15th Yr. Cost	Annual O&M	Salvage Value
Lake Como	$1,227,500	$ 97,750	$ 91,625	$199,575
Lake Geneva	3,289,700	261,970	245,555	534,861
Southeast Shore	392,800	31,280	29,320	63,864
Total	$4,910,000	$391,000	$366,500	$798,300

[a]Cost disaggregation computed by WAPORA, Inc.

The proposed WWTP facilities as described above involve upgrading and expanding the existing City of Lake Geneva trickling filter WWTP and land disposal of effluent at a new seepage cell site. Proposed upgrading of the existing WWTP was selected by the facilities planners based on a cost-effectiveness analysis comparing that option with the option of constructing a new aerated lagoon WWTP. The cost-effectiveness analysis concluded that the total present worth costs of both options were within one percent of each other. The upgrade and expand option was selected because the aerated lagoon would require utilization of an additional 14 acres of land suitable for future seepage cells, and because the lagoon had a higher energy consumption and therefore was more vulnerable to escalation of energy costs (Donohue & Assoc., Inc. 1982b).

Walworth/Fontana WWTP

The Walworth/Fontana WWTP proposed for the FPRA would replace the existing Walworth WWTP, Fontana WWTP and Kikkoman Foods WWTP. The proposed WWTP would serve the Village of Walworth, Village of Fontana, and subdivisions along the southwest shore of Geneva Lake (Table 2-35). The design capacity of the proposed WWTP would be 1.70 mgd.

A new oxidation ditch treatment system for Walworth and Fontana will comprise a new subregional treatment facility on the existing Walworth polishing lagoon site adjacent to Piscasaw Creek. Conveyance facilities will include upgrading the Fontana pump station; construction of a new force main conveying Fontana wastewater out of the Geneva Lake drainage basin; construction of an interceptor to convey Fontana wastewater from the drainage basin divide to the existing Walworth treatment plant site; replacement of Walworth's existing treatment facility with a metering station; and construction of an additional gravity interceptor paralleling Walworth's existing gravity outfall to convey combined Walworth and Fontana flows from the existing Walworth WWTP site to the new oxidation ditch WWTP site.

Preliminary treatment of wastewater entering the oxidation ditch treatment facility first will involve mechanical bar screening and flow metering facilities. Preliminary treated wastewater then will flow into a wet well where it will be lifted by submersible pumps to grit removal units. Vortex separation with grit washing will be used for grit removal due to less odors being generated because of the grit washing operation.

Secondary treatment will be accomplished by dual oxidation ditch channels. Aeration will be accomplished using conventional surface rotors. Mixed liquor/suspended solids from oxidation ditch will be settled in large flocculating final clarifies. The design engineer has suggested that the flocculating clarifiers will produce effluent consistent with the required limitations. Therefore, the communities have proposed not to install tertiary filtration equipment. The WDNR is evaluating this proposal and tertiary filters will be added if necessary. Settled effluent will be disinfected with chlorine and dechlorinated prior to discharge.

Sludge disposal will be by application of liquid sludge to approximately 40 acres of agricultural lands. Studies by the facilities planner indicate that nitrogen will be the limiting parameter for annual application. Sludge will be applied at the rate of 4.14 dry tons per acre, or actually 67,000 gallons per acre since it will be in liquid form. Copper is the limiting parameter regarding life of the site; however, the site will be adequate for 22 years, which is longer than the 20-year design life of the system. An exact site for sludge disposal currently has not been selected.

Cost estimates for the proposed new Walworth/Fontana WWTP as described for the FPRA are presented in Table 2-39. A disaggregation of costs among the major service areas in the Walworth/Fontana RSSAs is contained in Table 2-40.

Williams Bay WWTP

Initial facilities planning documents proposed a Walworth/Fontana regional WWTP that also would serve Williams Bay. A re-evaluation of this concept however, determined that it would be more cost-effective to serve Williams Bay separately from the proposed Walworth/Fontana system. Once it

Table 2-39. Estimated cost of the Walworth/Fontana WWTP (1.16 mgd) proposed for the FPRA (Adapted from Donohue & Assoc., Inc. 1983d). **

	Initial Cost ($)	Service Life (Yrs)	Future 10th Yr. ($)	Future 15th Yr. ($)	Salvage Value ($)
CONVEYANCE FACILITIES					
Fontana Pump Sta. -					
Modifications Mechanical	245,000	15	--	$245,000	$163,500
Walworth Metering Site					
Structural	15,000	40	--	--	7,500
Mechanical	25,000	40	--	--	--
Piping					
Fontana to Walworth	553,000	40	--	--	276,500
Walworth to WWTP Site	475,000	40	--	--	237,500
CONSTRUCTION COST - CONVEYANCE FACILITIES	1,313,000				
Engineering (15%)	195,000				
Contingencies (10%)	130,000				
CAPITAL COST - CONVEYANCE FACILITIES	1,638,000		-0-	245,000	685,000
TREATMENT FACILITY					
Influent Lift Sta.					
Mechanical	25,000	15	--	25,000	16,500
Structural	30,000	40	--	--	15,000
Screening/Flow Metering					
Mechanical	48,000	20	--	--	--
Structural	32,000	40	--	--	16,000
Grit Removal					
Mechanical	50,000	20	--	--	--
Structural	25,000	40	--	--	12,500
Oxidation Ditch					
Mechanical	220,000	20	--	--	--
Structural	610,000	40	--	--	305,000
Tertiary Sand Filtration					
Mechanical	220,000	20	--	--	--
Structural	80,000	40	--	--	40,000
UV Disinfection/pH Adjustment					
Mechanical	105,000	20	--	--	--
Structural	30,000	40	--	--	15,000
Cascade Post Aeration/Outfall					
Structural	20,000	40	--	--	10,000
Sludge/Decant/Holding Tank					
Mechanical	40,000	20	--	--	--
Structural	48,000	40	--	--	24,000
Other					
Sludge Vehicle	100,000	10	100,000	--	--
Service Building	50,000	40	--	--	25,000
Lab & Office Equipment	30,000	20			
Metering & Sampling	25,000	20			
Control Structures	10,000	40	--	--	5,000
Landscaping/Roads	25,000	20			
Fencing	10,000	20			
Land	60,000	Infinite			60,000

Table 2-39. (Concluded)

CONVEYANCE FACILITIES	Initial Cost ($)	Service Life (Yrs)	Future 10th Yr. ($)	Future 15th Yr. ($)	Salvage Value ($)
Well/Plumbing	30,000	20			
HVAC	60,000	20			
Process Piping	200,000	20			
Electrical	220,000	20			
CONSTRUCTION COST - TREATMENT FACILITY	2,403,000				
Engineering (15%)	360,000				
Contingencies (10%)	240,000				
CAPITAL COST - TREATMENT FACILITY	3,003,000		100,000	25,000	544,000
SUBREGIONAL FACILITIES	4,641,000		100,000	270,000	1,229,000

O&M COST ESTIMATE

CONVEYANCE FACILITIES	Annual Cost
Fontana Pump Sta.	$20,000
Walworth Pump Sta.	500
ANNUAL O&M COST - CONVEYANCE FACILITIES	20,500
TREATMENT FACILITY	
Labor	60,000
Electric Power	44,600
Natural Gas and Fuel	7,000
Parts and Maintenance Supplies	13,000
Chemicals	600
ANNUAL O&M COST - TREATMENT FACILITY	125,000

EXISTING COLLECTION SYSTEM[a]	Walworth	Fontana
Sewer System O&M	$10,000	$23,000
Administrative/Billing	11,000	6,500
ANNUAL O&M COST - EXISTING COLLECTION SYSTEM	$21,000	$29,500

[a] Costs were taken from Appendix M of Addendum No. 1 to Volume 2: West Planning Area (Donohue & Asoc., Inc. 1983b).

** This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

Table 2-39A. Estimated cost of the Walworth/Fontana WWTP (1.70 mgd) proposed for the FPRA (Adapted from Donohue & Assoc., Inc. 1983d). **

CONVEYANCE FACILITIES	Initial Cost ($)	Service Life (Yrs)	Future 10th Yr. ($)	Future 15th Yr. ($)	Salvage Value ($)
Fontana Pump Sta. -					
Modifications Mechanical	245,000	15	--	$245,000	$163,500
Walworth Metering Site					
Structural	15,000	40	--	--	7,500
Mechanical	25,000	40	--	--	--
Piping					
Fontana to Walworth	553,000	40	--	--	276,500
Walworth to WWTP Site	475,000	40	--	--	237,500
Kikkoman	120,000	40			60,000
CONSTRUCTION COST - CONVEYANCE FACILITIES	1,469,000				
Engineering (15%)	200,200				
Contingencies (10%)	146,800				
CAPITAL COST - CONVEYANCE FACILITIES	1,836,000		-0-	245,000	$750,500
TREATMENT FACILITY					
Influent Lift Sta.					
Mechanical	84,000	15	--	84,000	56,000
Structural	108,000	40	--	--	54,000
Preliminary Treatment					
Mechanical	68,000	20	--	--	--
Oxidation Ditch					
Mechanical	190,000	20	--	--	--
Structural	523,000	40	--	--	261,500
Clarification					
Mechanical	169,000	20	--	--	--
Structural	507,000	40	--	--	253,500
Disinfection/pH Adjustment					
Mechanical	30,000	20	--	--	--
Structural	137,000	40	--	--	68,500
Cascade Post Aeration/Outfall					
Structural	25,000	40	--	--	12,500
Sludge Handling					
Mechanical	40,000	20	--	--	--
Structural	153,000	40	--	--	76,500
Sludge Vehicle	100,000	10	100,000	--	--
Other					
Service Building	60,000	40	--	--	30,000
Lab & Office Equipment	30,000	20			
Metering & Sampling	25,000	20			
Control Structures	10,000	40	--	--	5,000
Landscaping/Roads	25,000	20			
Fencing	10,000	20			
Land	60,000	Infinite			60,000

Table 2-39A. (Concluded)

CONVEYANCE FACILITIES	Initial Cost ($)	Service Life (Yrs)	Future 10th Yr. ($)	Future 15th Yr. ($)	Salvage Value ($)
Well/Plumbing	30,000	20			
HVAC	60,000	20			
Process Piping	273,000	20			
Electrical	274,000	20			
CONSTRUCTION COST - TREATMENT FACILITY	2,991,000				
Engineering (15%)	450,000				
Contingencies (10%)	299,000				
CAPITAL COST - TREATMENT FACILITY	$3,740,000		100,000	84,000	877,500
SUBREGIONAL FACILITIES	$5,576,000		100,000	329,000	1,628,000

O&M COST ESTIMATE

CONVEYANCE FACILITIES	Annual Cost
Fontana Pump Sta.	$20,000
Walworth Pump Sta.	500
ANNUAL O&M COST - CONVEYANCE FACILITIES	20,500
TREATMENT FACILITY	
Labor	80,000
Electric Power	84,000
Natural Gas and Fuel	7,000
Parts and Maintenance Supplies	13,000
Chemicals	600
ANNUAL O&M COST - TREATMENT FACILITY	$184,600

Footnote: Costs generated by WDNR from information developed by Strand Associates, Madison, Design Consultants for Walworth/Fontana. Capacity and Costs account for discharge from Kikkoman Foods.

** This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

Table 2-40. Disaggregation of costs for the FPRA among major service areas of the Walworth/Fontana RSSAs, based on annual daily average wastewater flows.[a] **

Area	Design Flow	Capital Cost Share	Base Year Flow	O&M Cost Share
Walworth	235,000 gpd	23.5%	190,000 gpd	20.9%
Fontana	765,000	76.5%	718,000	79.1%
Currently sewered area	677,000	88.5%	650,000	90.5%
Southwest shore	88,000	11.5%	68,000	9.5%
Total	1,000,000	100.0%	908,000	100.0%

Area	Capital Cost	Future 10th Yr. Cost	Future 15th Yr. Cost	Annual O&M	Salvage Value
Fontana:					
Sewer System O&M	-	-	-	$ 23,000	-
Administrative	-	-	-	6,500	-
Pump Station	$ 306,000	-	$245,000	20,000	$163,500
Piping	1,145,400	-	-	-	458,200
WWTP	2,297,300	76,500	19,100	105,500	416,200
Subtotal (Fontana)	$3,748,700	$76,500	$264,100	$155,000	$1,037,900
Southwest shore	431,000	8,800	30,400	14,700	119,300
Currently sewered area	3,317,700	67,700	233,700	147,300	918,600
Walworth:					
Sewer System O&M	-	-	-	$ 10,000	-
Administrative	-	-	-	11,000	-
Metering Station	50,000	-	-	500	7,500
Piping	139,400	-	-	-	55,800
WWTP	705,700	23,500	5,900	7,500	127,800
Subtotal (Walworth)	$895,100	$23,500	$5,900	$29,000	$191,100
Total	$4,641,000	$100,000	$270,000	$184,000	$1,229,000

[a] Cost disaggregation computed by WAPORA, Inc.

** This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

was determined that Williams Bay would be served with separate facilities, the Village of Williams Bay withdrew from the Geneva Lake facilities planning effort, with the intent of submitting independent facilities planning documents at a later time. However, since Williams Bay is in the planning area for this project, preliminary information developed by the Village's consultants (Robers and Boyd) and supplemented by the facilities planner (Donohue & Assoc., Inc., 1983c) concerning construction of a new aerated lagoon WWTP for Williams Bay has been included in this EIS.

For this alternative, Williams Bay would construct a new 0.9 mgd aerated lagoon WWTP, with effluent disposal by rapid infiltration at the Village's existing seepage lagoons, which will be upgraded and expanded. Items to be constructed and/or expanded include: a new aeration lagoon with a liner, yard piping, a service building and laboratory, aeration equipment and structures, and miscellaneous electrical, mechanical, plumbing, and ventilation services. A preliminary cost estimate of the proposed Williams Bay facilities is given in Table 2-41. A disaggregation of costs among the major service areas in the Williams Bay RSSA also is contained in Table 2-42. A summary of the total estimated costs associated with the FPRA is listed in Table 2-43.

2.4.3. EIS Alternative

Evidence demonstrating an excessive number of failures of onsite systems and the resulting adverse effects of such failures within the planning area has not been presented. Contrary to this, the needs documentation information (Section 2.2.) indicated that the number of failing onsite systems within the RSSAs is low, and documented evidence of surface water and groundwater pollution resulting from failing onsite systems is minimal. As a result, a third alternative (herein referred to as the EIS Alternative) has been developed for evaluation.

The EIS Alternative includes upgrading existing onsite systems with obvious and potential problems identified in the needs documentation process, and improved management of existing and future onsite systems in the areas of the RSSAs not currently served by sewers; upgrading the Lake

Table 2-41. Estimated cost of the Williams Bay WWTP (0.9 mgd) proposed for the FPRA (Adapted from letter, Alan L. Berg, Donohue & Assoc., Inc., to Mark B. Williams, WDNR, 14 October 1983).

TREATMENT FACILITY	Initial Cost ($)	Service Life (Yrs)	Future 10th Yr. ($)	Future 15th Yr. ($)	Salvage Value ($)
New Wastewater Pumping	87,000	15	---	87,000	58,000
Mechanical	18,000	40	---	---	9,000
Force Main	242,000	20	---	---	---
Earthwork	101,000	20	---	---	---
Lagoon Liner	261,000	30	---	---	87,000
Process Piping	45,000	20	---	---	---
Aeration Blowers	28,000	20	---	---	---
Aeration Piping	79,000	20	---	---	---
Aerators	25,000	40	---	---	---
Blower Building	12,000	20	---	---	---
Roadways	18,000	20	---	---	---
Landscaping	5,000	20	---	---	---
Fencing	5,000	20	---	---	---
Observation Wells	15,000	20	---	---	---
Control Sructures	23,000	20	---	---	---
Metering & Sampling	16,000	20	---	---	---
Electrical	29,000	20	---	---	---
CONSTRUCTION COST - TREATMENT FACILITY	1,040,000				
Engineering (15%)	150,000				
Contingencies (15%)	150,000				
CAPITAL COST - TREATMENT FACILITY	1,304,000	20	-0-	87,000	166,000

ANNUAL O&M COST - TREATMENT FACILITY	Annual Cost
Labor	$34,000
Electric Power	39,000
Natural Gas and Fuel	3,000
Parts and Maintenance Supplies	4,000
Total for Treatment Facility	80,000
EXISTING COLLECTION SYSTEM[a]	
Total for Sewer System	100,000
TOTAL ANNUAL O&M	180,000

[a] Cost was taken from Apendix CC of Volume 2: Treatment Alternatives, West Planning Area (Donohue & Assoc., Inc. 1983a).

Table 2-42. Disaggregation of costs among major service areas of the Williams Bay RSSA, based upon population served.

Area	Base-Year Population	Cost Share
Williams Bay	3,670	87%
Northwest Shore	543	13%
Total:	4,213	100%

Area	Capital Cost	Future 15th Yr. Cost	Annual O&M	Salvage Value
Williams Bay	$3,134,000	$76,000	$156,400	$144,400
Northwest Shore	170,000	11,000	23,600	21,600
Total	$1,304,000	$87,000	$180,000	$166,000

[a]Cost disaggregation computed by WAPORA, Inc.

Table 2-43. Summary of estimated costs for the FPRA for major service areas within the Geneva Lake-Lake Como RSSAs.

Area	Initial Capital	Annual O&M	Future 10th Yr. Cost	Future 15th Yr. Cost	Salvage Value	Present Worth[a] O&M (10.0983)	Present Worth[a] 10th Yr. (0.4796)	Present Worth[a] 15th Yr. (0.3321)	Present Worth[a] Salvage (0.2300)	Total Present Worth
Lake Geneva-Lake Como RSSAs										
Lake Como Beach										
Collection	$9,272,500	$13,000	$151,300	$ -	$4,749,750					
Interceptor	2,031,250	440	-	-	1,216,690					
WWTP	1,227,500	91,625	-	97,750	199,575					
Total	12,531,250	105,065	151,300	97,750	6,166,015	1,060,978	72,563	32,463	(1,418,184)	12,279,070
Lake Geneva										
Collection and WWTP	3,289,700	245,555	-	261,970	534,861	2,479,688	-	87,000	(123,018)	5,733,370
Southeast Shore										
Collection	1,313,300	6,300	812,500	-	1,266,000					
Interceptor	1,463,710	3,290	-	-	876,220					
WWTP	392,800	29,320	-	31,280	63,864					
Total:	3,169,810	38,910	812,500	31,280	2,206,084	392,925	389,675	10,388	507,399	3,455,399
Total	18,990,760	389,530	963,800	391,000	8,906,960	3,933,591	462,238	129,851	2,048,601	21,467,839
Walworth/Fontana RSSAs										
Walworth										
Collection and WWTP	895,100	29,000	23,500	5,900	191,100	292,851	11,271	1,959	43,953	1,157,228
Fontana										
Collection and WWTP	3,317,700	147,300	67,700	233,700	918,600	1,487,480	32,469	77,612	211,278	4,703,983
Southwest Shore										
Collection	679,750	3,600	-	-	339,900					
Interceptor	640,850	290	-	-	385,530					
WWTP	431,000	14,700	8,800	30,400	119,300	187,727	4,220	10,096	194,288	1,759,355
Total	1,751,600	18,590	8,800	30,400	844,730					
Total	5,964,400	194,890	100,000	270,000	1,954,430	1,968,058	47,960	89,667	449,519	7,620,566
Williams Bay RSSA										
Williams Bay										
Collection and WWTP	1,134,000	156,400	-	76,000	144,400	1,579,374	-	25,240	33,212	2,705,402
Northwest Shore										
Collection	723,300	4,200	67,500	-	412,300					
Interceptor	552,370	860	-	-	330,460					
WWTP	170,000	23,600	-	11,000	21,600					
Total	1,445,670	28,660	67,500	11,000	764,360	289,417	32,373	3,653	175,803	1,595,310
Total	2,579,670	185,060	67,500	87,000	908,760	1,868,791	32,373	28,893	209,015	4,300,712
TOTAL FOR FPRA:	$27,534,840	$769,480	$1,131,300	$748,000	$11,770,150	$7,770,440	$542,571	$248,411	$2,707,135	$33,389,117

[a] Present worth calculated at 7 5/8% for 20 years.

**This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

Geneva WWTP; construction of a new WWTP to serve Williams Bay; and construction of a new WWTP to serve the Villages of Walworth and Fontana. The service areas of the proposed WWTPs would include the year 2005 population expected for currently sewered portions of these communities only, and would not include expansion of sewers into currently unsewered areas. The extent of the RSSAs to remain unsewered and the location of proposed interceptor and treatment facilities for the EIS Alternative are presented in Figure 2-17. Facilities proposed for construction for the EIS Alternative are described in the following paragraphs.

Onsite Systems

Under the EIS Alternative, existing unsewered areas within the RSSAs would remain on onsite systems. Management districts would be formed to administer funds, inspect, design, and construct upgraded systems; ensure proper operation and maintenance of the systems; and monitor performance of systems (Section 2.7.4.). The management districts would likely use State funding for completing the necessary facilities planning and design work for a construction grant application under NR 128.08. During this phase, the local district and the State agencies would have to agree on the components that would be utilized in upgrading existing systems. The EIS Alternative feasibility analysis and costs presented in this EIS are based on using a variety of sub-code systems, a number of which are described in Section 2.4.5. The sub-code systems are justified within a management district because the district would have the resources to monitor performance of the systems and would have the authority to establish special rules concerning operations. Also, numerous sub-code systems have been operating satisfactorily, especially for seasonal residences within the planning area without any demonstrably harmful effect on the environment.

The district would arrange for the inspection, design, and construction of upgraded systems. Individual upgrades would be made in consultation with the property owner and the system design would be selected from a range of technical options. The first choice of an upgrade would be a septic tank-seepage bed in compliance with the Wis. Adm.Cd. Other soil absorption systems, dry wells or mounds, would be considered where parcel area is limited and the water table is deep, or where the water table is shallow and the parcel is large. Small parcels with permeable soils would receive a septic tank and in-ground pressure distribution system installation. Curtain drains around the soil absorption system may be appropriate for certain parcels that have a seasonally high water table due to upslope drainage or limited permeability soils, and that have a suitable drain outlet nearby.

Another option that would be implemented is installation of flow reduction devices (Section 2.3.2.) in household plumbing. The types and numbers of devices would be limited by the existing plumbing design and acceptability to the homeowner. One aspect of flow reduction that would be considered is removal of garbage grinders and laundry facilities from residences with failing or marginally failing systems. If none of these options could be implemented for a particular residence, then more drastic flow and waste reduction measures or off-site treatment would be considerd. Principal among these is the low-flow toilet and blackwater holding tank for toilet wastes and the existing or upgraded system for the remaining (graywater) wastes. Any of the options enumerated previously would be satisfactory for graywater treatment. DILHR will approve extreme flow reduction options only after all off-lot or cluster system options have been thoroughly investigated (By letter, James Sargent, DIHLR, to Harlan D. Hirt, USEPA, 30 March 1984).

A holding tank for the entire waste flow is not a preferred option, but may be required for certain residences or businesses. For seasonal residences, the costs of disposal are reasonable but, for permanent residences, the costs are prohibitively expensive. In that situation, or where a number of adjacent parcels would require holding tanks, constructing a cluster soil absorption system would have cost and environmental advantages over holding tanks. No area was identified where a concentration of permanent residences required off-site treatment, therefore, no cluster systems were currently recommended or costed in the EIS Alternative. Upon further inspection and investigation, though, cluster soil absorption systems may be justified.

The onsite portion of the EIS Alternative was costed by estimating the types and number of upgrades that would likely be necessary in each of the subdivisions. Past upgrades, currently failed or likely to fail systems, and site limitations were evaluated to arrive at the estimates. If there was no evidence to the contrary, the assumption was made that the systems were functioning satisfactorily. Estimates of the number of system components to be upgraded initially are presented in Tables D-1 to D-7 in Appendix D of the Draft EIS. The summary of upgrade technologies initially selected for the 1,725 onsite systems within the RSSAs is:

- 191 septic tank replacements
- 140 seepage bed replacements
- 78 pump tanks and mounds
- 137 blackwater holding tanks
- 1,179 system need no upgrade.

During the planning period, it is anticipated that a number of systems will require replacement because of change of occupancy, overloading of the system, or decline in the infiltration rate of the soil. The management district would identify these by the annual inspection of the system, by the septic tank pumping contractor, or by information supplied by homeowners. For costing purposes, the number of these future upgrades was estimated based on an approximation of replacements that have been installed within the past ten years. These estimates are presented in Tables D-8 to D-14 in Appendix D of the Draft EIS and are summarized as follows:

- 87 septic tanks replacements
- 115 seepage bed replacements
- 67 pump tank and mounds
- 100 blackwater holding tanks
- 28 holding tanks.

Systems for new residences would be constructed according to current Wis. Adm. Cd. requirements; therefore, the systems would be limited to conventional septic tanks and soil abosorption systems. Based on population projection disaggregations prepared by SEWRPC and modified by Donohue & Assoc., Inc., and WAPORA, Inc., the estimated numbers of future systems also is presented in Tables D-8 through D-14 in Appendix D of the Draft EIS and are summarized as follows:

- 380 septic tank and seepage beds
- 16 septic tank and dry wells
- 119 septic tank, pump tank, and mounds.

Estimated costs of constructing and operating the needed onsite systems (both immediate and future) for major service areas within the Geneva Lake RSSAs are shown in Table 2-44.

Lake Geneva WWTP

The EIS Alternative proposed WWTP facilities to serve the Lake Geneva RSSA are based on the documented need for a design capacity of 1.7 mgd. The WWTP facilities would be similar to those proposed for the FPRA, and would consist of upgrading the existing trickling filter facilities plus construction of new seepage cell facilities and a sludge storage lagoon at a new site located southeast of the STH 50 and U.S. 12 interchange. Where manufacturers standard equipment lines permit, treatment units would be proportionately smaller than those proposed for the FPRA since 1.7 mgd of wastewater would be treated (daily average) instead of 2.1 mgd. Cost estimates for the Lake Geneva WWTP as proposed for the EIS Alternative, based upon revisions to the FPRA costs (due to reduced design flow) are listed in Table 2-45.

Walworth/Fontana WWTP

During conduct of the facilities planning efforts, the facilities planner investigated a second alternative for Walworth/Fontana, consisting of a new site identified by the FP for the lagoon WWTP followed by a rapid infiltration disposal system. The site identified by the FP for the new WWTP would be at the Donald Rambow farm on the southwest border of the Village of Walworth. Total present worth of the aerated lagoon-rapid infiltration system was estimated by the facilities planner to be $4,750,000 (about 20% less than the oxidation ditch treatment system recommended in FPRA). The oxidation ditch alternative was selected by the facilities planner in part because of strong public sentiment against the concept of devoting 80 acres of prime farmland to wastewater treatment.

Table 2-44. Estimated costs for onsite system in major service areas within the Geneva Lake-Lake Como RSSAs.

Area	Capital Cost	Annual O&M	Salvage Value
Lake Geneva-Lake Como RSSAs			
Lake Como Beach			
Administration	$221,544	$60,273	$ 0
Initial (Permanent)	$461,795	$34,650	$38,082
Initial (Seasonal)	526,376	15,468	49,956
Future Annual[a]	63,651	1,175	160,470
Lake Geneva Golf Hills[b]			
Administration	19,584	5,328	0
Initial (Permanent)	74,996	5,378	6,666
Initial (Seasonal)	0	0	0
Future Annual[a]	7,667	207	23,043
Geneva Bay Est. and Forest Rest			
Administrtation	6,936	1,887	0
Initial (Permanent)	3,510	600	0
Initial (Seasonal)	1,755	180	0
Future Annual[a]	1,336	13	3,699
Southeast Shore			
Administration	60,345	16,539	0
Initial (Permanent)	95,895	3,860	7,011
Initial (Seasonal)	144,616	4,078	11,877
Future Annual[a]	15,900	394	55,182
Fontana RSSA			
Section 11			
Administration	2,856	777	0
Initial (Permanent)	1,404	160	0
Initial (Seasonal)	702	72	0
Future Annual[a]	4,230	97	9,864
Southwest Shore			
Administration	46,104	12,543	0
Initial (Permanent)	54,783	3,402	4,375
Initial (Seasonal)	119,408	4,030	16,146
Future Annual[a]	15,495	324	50,973
Williams Bay RSSA			
Northwest Shore			
Administration	50,184	13,653	0
Initial (Permanent)	27,682	1,684	1,737
Initial (Seasonal)	79,383	3,140	6,948
Future Annual[a]	17,073	195	49,707

[a]Costs listed for future annual are for future annual construction, annual gradient O&M, and total salvage value, respectively.

[b]Lake Geneva Golf Hills Subdivision lies within the existing Lake Geneva service area and a sewage collection system is being developed for the Subdivision.

Table 2-45. Estimated cost of the upgraded Lake Geneva WWTP (1.74 mgd) and new rapid-infiltration system, as proposed in the EIS Alternative.

Item	Construction Cost	Design Life(yrs)	15th Yr. Cost	Salvage Value
WASTEWATER TREATMENT PLANT SITE				
General Construction				
Raw WW Pump Station	$97,900	40	--	$49,000
Grit Removal	57,900	40	--	29,000
Primary Clarifier	35,600	40	--	19,800
Trickling Filter Mod.	8,000	20	--	--
Trickling Filter Cover	67,000	40	--	33,500
Secondary Clarifier	147,000	40	--	73,500
Digester Mod.	5,000	20	--	--
Sitework	14,000	20	--	--
Demolition	20,000	--	--	--
Generator Building	20,000	40	--	10,000
Effluent Pump Station	13,000	20	--	--
Remodel Service Bldg.	30,000	20	--	--
Mechanical Equipment				
Mechanical Bar Screen	62,300	15	$62,300	41,500
Grit Handling	44,000	15	44,000	29,300
Raw WW Pumps	93,500	15	93,500	62,300
Primary Clarifier	57,000	20	--	--
T.F. Media	218,000	20	--	--
T.F. Distribution Arm	54,000	20	--	--
T.F. Underdrain Rehab.	15,000	20	--	--
Effluent Pumps	41,000	15	41,000	27,300
T.F. Recirculating Pump Mod.	6,000	15	6,000	4,000
Anaerobic Digestor	129,900	20	--	--
Sludge Pumps	9,000	15	9,000	6,000
Standby Generator	96,000	20	--	--
Metering and Sampling	58,000	20	--	--
Secondary Clarifier	60,000	20	--	--
Process Piping	182,000	30	--	60,700
Laboratory/Office Equip.	10,000	20	--	--
Sludge Vehicle	105,00	15	105,00	70,000
Plumbing	30,000	20	--	--
HVAC	40,000	20	--	--
Electrical	190,000	20	--	--
Subtotal - WWTP Site	$2,016,100		$360,800	$513,900

Table 2-45. (Concluded).

Annual O&M

Item	Sewer O&M	WWTP O&M	Total O&M
Sewage Disposal Salary	$4,000	$18,006	$82,006
Social Security	300	5,108	5,408
Retirement	500	8,586	9,086
Health and Life Insurance	700	6,512	7,212
Car Allowance	600	600	1,200
Electricity	2,000	37,500	39,500
Water	2,600	2,600	5,200
Telephone	220	500	720
Fuel - Digester	--	5,200	5,200
Fuel - Office	--	1,700	1,700
Repairs - Equipment	--	4,300	4,300
Repairs - Sewer	7,100	--	7,100
Repairs - Lift Stations	2,700	--	2,700
Maintenance - Equipment	--	1,300	1,300
Maintenance - Sewers	1,800	--	1,800
Maintenance - Lift Stations	2,200	--	2,200
Survey of Sewers	15,000	--	15,000
Engineering	5,000	5,000	10,000
Chemicals	--	1,800	1,800
Sludge Removal	--	6,200	6,200
Building - Maintenance	400	400	800
Testing	--	2,800	2,800
Vehicle - Maintenance	2,000	1,000	3,000
Alarm Circuits	450	--	450
Emergency Power	500	--	500
Insurance	600	5,770	6,370
Travel and School	500	800	1,300
Miscellaneous	2,000	--	2,000
Billing Expense	5,000	10,000	15,000
Debt Service	10,000	43,448	53,448
Outlay	5,000	20,000	25,000
Subtotal	$71,170	$249,130	$320,300
Replacement Fund	--	41,500	41,500
TOTAL O&M	$71,170	$290,630	$361,800

Table 2-45. (Continued).

Item	Construction Cost	Design Life(yrs)	Future 15th Yr. Cost	Salvage Value
LAND APPLICATION SITE				
Sitework	$254,500	20	--	--
Process Piping	228,700	30	--	$76,200
Roadways	38,000	20	--	--
Fencing	13,000	20	--	--
Percolate Monitoring	7,000	20	--	--
Observation Wells	4,000	20	--	--
Control Structures	26,700	20	--	--
Sludge Lagoon	50,000	20	--	--
Land Purchase	396,000	Perm.	--	--
AT&T Cable Relay	150,000	--	--	--
Subtotal - Land Application Site	$1,167,900		$ 0	$76,200
CONVEYANCE PIPING				
Effluent Force Main	$258,000	30	--	$86,000
Sludge Transport	57,900	30	--	19,300
Subtotal - Piping	$315,900		$ 0	$105,300
TOTAL CONSTRUCTION	$3,499,900		$360,800	$695,400
Service Factor (27%)	945,000			
TOTAL CAPITAL COST	$4,444,900			

provided. The raw wastewater pump station would discharge to a 12-inch diameter force main, which would convey raw sewage to the aerated lagoon system.

The aerated lagoon system would consist of three cells designed to remove 80% of the influent BOD. Oxygen transfer within the aerated lagoon would be provided by positive displacement blowers and static tube aerators designed to deliver a minimum of 1.5 pounds of oxygen per pound of BOD removed, as required by Section NR 110.24(6) of the Wis. Adm. Cd. A third, quiescent cell would be provided for effluent polishing. The quiescent cell also would serve as the dosing cell for the land application system. The aerated lagoons would be designed to produce an effluent containing less than 50 mg/l BOD.

All flow through the WWTP from the force main discharge to the seepage cells would be by gravity. Liquid piping would be designed to allow by-passing of individual cells for resting or maintenance. Eight seepage cells would be provided, to allow for alternate dosing and resting. This would enhance treatment and prolong the life of the system. Dosing and resting seepage cells would alternately saturate and drain the soil, creating anaerobic and aerobic conditions, respectively. This would allow both nitrification and denitrification to occur, which would minimize the effect of nitrates on groundwater.

A system of observation wells also would be installed around the perimeter of the seepage cell system, to monitor groundwater quality. In addition, a new administration and maintenance building would be provided. This building would include a laboratory, offices, aeration equipment, lavatory facilities, the stand-by generator, a workshop, and vehicle storage space.

The aerated lagoon-rapid infiltration wastewater treatment system will rely, in part, upon the physical, chemical, and biological purification of wastewater within subsurface soil materials of the site selected. For this final purification method to be practical, cost-effective, and environmentally acceptable subsurface soil materials at the site selected must

In reviewing the progress of facilities planning efforts during conduct of this EIS, two items of interest were noted:

- The aerated lagoon - rapid infiltration treatment was found to be the lowest cost treatment concept
- Additional areas with soils similar to those found at the Rambow site (e.g., permeable sands and sandy loam) are located in and around the Village of Walworth.

For these reasons, the EIS Alternative includes an aerated lagoon-rapid infiltration treatment system near Walworth to serve the Villages of Fontana and Walworth.

For this system, new pumps would be installed in the main pump station in Fontana. A comminutor would be provided to protect the pumps from large solids. Pumps would be designed to handle the peak flow rate with the largest unit out of service and would include flow monitoring equipment. A stand-by electric generator also would be provided. The Fontana pump station would discharge through a force main to a gravity interceptor constructed to convey wastewater from Fontana to the Walworth WWTP site.

At the existing Walworth WWTP site a new metering station would be constructed for Walworth. The Fontana and Walworth flows would be combined at that site and would flow by gravity to the regional land application site.

This intermunicipal conveyance system would discharge to a new raw wastewater pump station, located at the land application site. A comminutor would be provided to protect the pumps from large solids. Pumps would be able to handle the peak flow rate with the largest unit out of service. Flow monitoring equipment and a stand-by electric generator also would be provided. The raw wastewater pump station would discharge to a 12-inch diameter force main, which would convey raw sewage to the aerated lagoon system.

The aerated lagoon system would consist of three cells designed to remove 80% of the influent BOD. Oxygen transfer within the aerated lagoon would be provided by positive displacement blowers and static tube aerators designed to deliver a minimum of 1.5 pounds of oxygen per pound of BOD removed, as required by Section NR 110.24(6) of the Wis. Adm. Cd. A third, quiescent cell would be provided for effluent polishing. The quiescent cell also would serve as the dosing cell for the land application system. The aerated lagoons would be designed to produce an effluent containing less than 50 mg/l BOD.

All flow through the WWTP from the forcemain discharge to the seepage cells would be by gravity. Liquid piping would be designed to allow by-passing of individual cells for resting or maintenance. Eight seepage cells would be provided, to allow for alternate dosing and resting. This would enhance treatment and prolong the life of the system. Dosing and resting seepage cells would alternately saturate and drain the soil, creating anaerobic and aerobic conditions, respectively. This would allow both nitrification and denitrification to occur, which would minimize the effect of nitrates on groundwater.

A system of observation wells also would be installed around the perimeter of the seepage cell system, to monitor groundwater quality. In addition, a new administration and maintenance building would be provided. This building would include a laboratory, offices, aeration equipment, lavatory facilities, the stand-by generator, a workshop, and vehicle storage space.

The aerated lagoon-rapid infiltration wastewater treatment system will rely, in part, upon the physical, chemical, and biological purification of wastewater within subsurface soil materials of the site selected. For this final purification method to be practical, cost-effective, and environmentally acceptable subsurface soil materials at the site selected must possess the capability of accepting and conducting applied wastewater at reasonable hydraulic rates. The site also must possess an adequate depth of subsurface material to ensure adequate treatment of wastewater prior to reaching groundwater. In addition to its physical suitability, the site also must be attainable with appropriate zoning to be implementable.

For the EIS Alternative, the site evaluated in detail by the facilities planner consists of 80 acres of the Donald Rambow farm, legally described as the E ½ of the NW ¼ of Section 28, TIN, R16E, Walworth County, Wisconsin. The location of the site is shown on Figure 2-17.

The facilities planner conducted limited soil testing to determine the hydraulic conductivity rate and depth to groundwater. The three borings indicated laterally uniform underlying soils and a groundwater depth of approximately 26 feet. Theoretical hydraulic conductivities calculated by the facilities planner based upon grain size analyses, however, indicated potentially low hydraulic loading rates might be required. Onsite infiltration testing to measure permeability was conducted by the facilities planner. This latter infiltration testing identified increasing infiltration rates with depth below the ground surface. Preliminary indications were that, upon removal of the top eight feet of low-permeability surface material, an application rate of 20 inches per week could be utilized.

According to the facilities planner, another good indication of the feasibility of the site is the fact that detailed logging of the test pit walls, like the first three borings, did not find any silt or clay seams that would impede infiltration from the bottom of the cells, as has occurred at some other facilities within the State (Donohue and Assoc., Inc., 1983b).

Estimated costs for the Walworth/Fontana aerated lagoon-rapid infiltration system for the EIS Alternative, as derived from detailed costs prepared by the facilities planner for the Facilities Plan aerated lagoon alternatives, are listed in Table 2-46. A disaggregation of costs between sewered portions of the Walworth/Fontana RSSAs is shown in Table 2-47.

The Rambow site was retained as a suggested site only for costing purposes; i.e., if facilities at the Rambow site have lower costs then facilities located in another site near the Village potentially would be lower cost. If an aerated lagoon system does prove to have lower cost, then further site evaluations could be undertaken to find an acceptable site near or within the Village.

Table 2-46. Estimated costs for the Walworth/Fontana WWTP (1.09 mgd) as proposed in the EIS Alternative. **

CONVEYANCE FACILITIES	Initial Cost ($)	Service Life (Yrs)	Future 10th Yr. ($)	Future 15th Yr. ($)	Salvage Value ($)
Fontana Pump Station					
Structural	--	--	--	--	--
Mechanical	245,000	15	--	245,000	163,500
Walworth Metering Site					
Structural	15,000	40	--	--	7,500
Mechanical	25,000	40	--	--	--
Piping					
Fontana to Walworth	553,000	40	--	--	276,500
Walworth to Rambow Site	172,000	40	--	--	86,000
CONSTRUCTION COST - CONVEYANCE FACILITIES	1,010,000				
Service Factor (27%)	272,200				
CAPITAL COST - CONVEYANCE FACILITIES	1,282,700		-0-	$245,000	$533,500
TREATMENT FACILITY					
Earthwork	466,000	20	--	--	--
Lagoon Liner	218,000	20	--	--	--
Process Piping	195,000	40	--	--	65,000
Aeration Blowers	45,000	20	--	--	--
Aerators	80,000	20	--	--	--
Service Building	166,000	40	--	--	83,000
Land	500,000	Infinite	--	--	500,000
Roadways	20,000	20	-- --	--	--
Landscaping	15,000	20	--	--	--
Fencing	13,000	20	--	--	--
Water Well	7,000	20	--	--	--
Observation Wells	4,000	20	--	--	--
Control Structures	23,000	20	--	--	--
Metering and Sampling	16,000	20	--	--	--
Tractor and Mower	16,000	10	16,000	--	--
Lab & Office Equipment	30,000	20	--	--	--
Electrical	37,000	20	--	--	--
Raw Wastewater Pumping					
Structural	75,000	40	--	--	37,500
Mechanical	50,000	15	--	50,000	16,500
Force Main	5,000	40	--	--	2,500
CONSTRUCTION COST - TREATMENT FACILITY	2,009,000				
Service Factor (27%)	542,400				
CAPITAL COST - TREATMENT FACILITY	2,551,400		$16,000	$50,000	$704,500
CAPITAL COST - SUBREGIONAL FACILITIES	3,834,100		$16,000	$295,000	$1,238,000

Table 2-46 (Concluded).

	Annual Cost ($/Yr)	
ANNUAL O&M COST - CONVEYANCE FACILITIES		
CONVEYANCE FACILITIES		
Fontana Pump Sta.	$20,000	
Walworth Pump Sta.	500	
ANNUAL O&M COST - CONVEYANCE FACILITIES	20,500	
ANNUAL O&M COST - TREATMENT FACILITY		
Labor	30,000	
Electric Power	38,000	
Natural Gas and Fuel	2,000	
Parts and Maintenance Supplies	2,500	
Chemicals	300	
ANNUAL O&M COST - TREATMENT FACILITY	73,000	
ANNUAL O&M COST - SUBREGIONAL FACILITIES	$93,500	

ANNUAL O&M COST - EXISTING SEWER O&M[a]	Walworth	Fontana
Existing Sewer System O&M	$10,000	$23,000
Administrative/Billing Cost	11,000	6,500
ANNUAL O&M COST - EXISTING SEWER O&M	$21,000	$29,500

[a]Annual O&M costs for existing sewers and administrative costs is taken from Appendix L of Addendum No. 1 to Volume 2: West Planning Area (Donohue & Assoc., Inc. 1983b).
**This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

Williams Bay WWTP

For the EIS Alternative, a new Williams Bay aerated lagoon - rapid infiltration WWTP would be constructed, as proposed in the FPRA. The only difference is that a 0.7 mgd WWTP (average daily summer flow) would be built instead of a 0.9 mgd WWTP, due to the reduced flow from a smaller service area. Estimated costs for the 0.7 mgd Williams Bay WWTP are listed in Table 2-48. A summary of the costs associated with the complete EIS Alternative is given in Table 2-49.

Table 2-47. Disaggregation of costs between sewered portions of Walworth/Fontana RSSAs, based on annual daily average wastewater flows.[a] **

Area	Design Flow	Capital Cost Share	Base Year Flow	O&M Cost Share
Walworth	278,000 gpd	25.4%	190,000 gpd	22.6%
Fontana	815,000	74.6%	650,000	77.4%
Total:	1,093,000	100.0%	840,000	100.0%

Area	Capital Cost	Future 10th Yr. Cost	Future 15th Yr. Cost	Annual O&M	Salvage Value
Fontana:					
Administrative	-	-	-	$6,500	-
Existing Sewer O&M	-	-	-	23,000	-
Pump Station	$311,200	-	$245,000	20,000	$163,500
Piping	869,214	-	-	-	340,656
WWTP	1,903,300	11,900	37,300	56,700	525,600
Subtotal (Fontana)	$3,083,700	$11,900	$282,300	106,200	$1,029,756
Walworth:					
Administrative	-	-	-	10,000	-
Existing Sewer O&M	-	-	-	11,000	-
Metering Station	50,900	-	-	500	7,500
Piping	55,474	-	-	-	21,844
WWTP	648,000	4,100	12,700	16,500	178,900
Subtotal (Walworth)	$754,400	$4,100	$12,700	$38,000	$208,244
Total	$3,834,100	$16,000	$295,000	$144,200	$1,238,000

[a] Cost disaggregation computed by WAPORA, Inc.

**This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

Table 2-48. Estimated cost of the Williams Bay WWTP (0.7 mgd) proposed for the EIS Alternative (Scaled from FPRA by WAPORA, Inc.).

TREATMENT FACILITY	Initial Cost ($)	Service Life (Yrs)	Future 15th Yr. ($)	Salvage Value ($)
Raw Wastewater Pumping				
Mechanical	75,700	15	75,700	50,500
Force Main	15,700	40	--	7,900
Earthwork	210,500	20	--	--
Lagoon Liner	87,900	20	--	--
Process Piping	227,00	30	--	75,700
Aeration Blowers	39,200	20	--	--
Aerators	29,400	20	--	--
Blower Building	68,700	20	--	--
Roadways	25,000	40	--	--
Landscaping	12,000	20	--	--
Fencing	18,000	20	--	--
Observation Wells	5,000	20	--	--
Control Structures	20,000	20	--	--
Metering and Sampling	16,000	20	--	--
Electrical	25,200	20	--	--
CONSTRUCTION COST - TREATMENT FACILITY	885,300		$75,700	$134,100
Service Factor (27%)	239,000			
CAPITAL COST - TREATMENT FACILITY	1,124,300			

ANNUAL O&M COST	Annual Cost
ANNUAL O&M COST - TREATMENT FACILITY	
Labor	$30,000
Electric Power	34,000
Natural Gas and Fuel	2,600
Parts and Maintenance Supplies	3,500
ANNUAL O&M COST - TREATMENT FACILITY	70,100
EXISTING COLLECTION SYSTEM[a]	
Existing Sewer System O&M	100,000
TOTAL ANNUAL O&M COST	170,100

[a] Cost was taken from Appendix W of Volume 2: Treatment Alternatives, West Planning Area (Donohue & Assoc., Inc. 1983a).

Table 2-49. Summary of estimated costs for the EIS Alternative for major service areas within the Geneva Lake-Lake Como RSSAs.**

Area	Capital	Annual O&M	Future 10th Yr. Cost	Future 15th Yr. Cost	Salvage Value	Present Worth[a] Capital	Present Worth[a] O&M (10.0983)	Present Worth[a] 10th Yr. (0.4796)	Present Worth[a] 15th Yr. (0.3321)	Present Worth[a] Salvage (0.2300)	Total Present Worth
Lake Geneva-Lake Como RSSAs											
Lake Como (Onsite):											
Administration	$221,544	$60,273	--	--	$ 0	$221,544	$608,655	--	--	$ 0	
Initial (Permanent)	$461,795	$34,650	--	--	$38,082	$461,795	$349,906	--	--	$8,759	
Initial (Seasonal)	526,376	15,468	--	--	44,956	526,376	156,201	--	--	11,490	
Future Annual[b]	63,651	1,175	--	--	160,470	642,767	84,726	--	--	36,908	
Total[c]	$1,209,715	$110,391			$83,038	$1,852,482	$1,199,488			57,157	$2,994,813
Lake Geneva Golf Hills (Onsite)											
Administration	19,584	5,328	--	--	0	19,584	53,804	--	--	0	
Initial (Permanent)	74,966	5,378	--	--	6,666	74,966	54,309	--	--	1,533	
Initial (Seasonal)	0	0	--	--	0	0	0	--	--	0	
Future Annual[b]	7,667	207	--	--	23,043	77,424	14,926	--	--	5,300	
Total[c]	94,550	10,706			6,666	171,974	123,039			6,833	288,180
Geneva Bay Est. & Forest Rest (Onsite)											
Administration	6,936	1,887	--	--	0	6,936	19,055	--	--	0	
Initial (Permanent)	3,510	600	--	--	0	3,510	6,059	--	--	0	
Initial (Seasonal)	1,755	180	--	--	0	1,755	1,818	--	--	0	
Future Annual[b]	1,336	13			3,699	13,491	937			851	
Total	12,201	2,667			0	25,692	27,869			851	52,710
Southeast Shore (Onsite)											
Administration	60,345	16,539	--	--	0	60,345	167,016	--	--	0	
Initial (Permanent)	95,895	3,860	--	--	7,011	95,895	38,979	--	--	1,613	
Initial (Seasonal)	144,616	4,078	--	--	11,877	144,616	41,181	--	--	2,732	
Future Annual[b]	15,900	394	--	--	55,182	160,563	28,410	--	--	12,692	
Total	300,856	24,477			18,888	461,419	275,586			719,968	
Lake Geneva											
Collection and WWTP	4,444,900	361,800	--	360,800	695,400	4,444,900	3,653,565		119,822	159,942	8,058,345
Totals	6,062,222	510,041		360,800	803,992	6,956,467	5,279,457	0	119,822	241,820	12,114,016

Table 2-49. (Continued.)

Area	Capital	Annual O&M	Future 10th Yr. Cost	Future 15th Yr. Cost	Salvage Value	Present Worth[a] Capital	Present Worth[a] O&M (10.0983)	Present Worth[a] 10th Yr. (0.4796)	Present Worth[a] 15th Yr. (0.3321)	Present Worth[a] Salvage (0.2300)	Total Present Worth
Walworth/Fontana RSSAs											
Walworth											
Collection and WWTP	754,400	38,000	4,100	12,700	208,244	754,400	383,735	1,966	4,218	47,896	1,096,423
Fontana											
Collection and WWTP	3,083,700	106,200	11,900	282,300	1,029,756	3,083,700	1,072,439	5,707	93,752	236,844	4,018,754
Fontana (Onsite):											
Section 11											
Administration	2,856	777	--	--	0	2,856	7,846	--	--	0	
Initial (Permanent)	1,404	160	--	--	0	1,404	1,616	--	--	0	
Initial (Seasonal)	702	72	--	--	0	702	727	--	--	0	
Future Annual[b]	4,230	47	--	--	9,864	42,716	3,389	--	--	2,269	
Total[c]	4,962	1,009	--	--	0	47,678	13,578	--	--	2,269	58,987
Southwest Shore (Onsite)											
Aminstration	46,104	12,543	--	--	0	46,104	126,662	--	--	0	
Initial (Permanent)	54,783	3,402	--	--	4,375	54,783	34,354	--	--	1,006	
Initial (Seasonal)	119,408	4,030	--	--	16,146	119,408	40,696	--	--	3,714	
Future Annual[b]	15,495	324	--	--	50,973	156,473	23,363	--	--	11,724	
Total[c]	220,295	19,975			20,521	376,768	225,076			16,444	585,400
Total for Fontana RSSA	3,308,957	127,184	11,900	282,300	1,050,277	3,508,146	1,311,093	5,707	93,752	255,557	4,663,141
Williams Bay RSSA											
Williams Bay											
Collection and WWTP	1,124,300	170,100	--	75,700	134,100	1,124,300	1,717,721	--	25,140	30,843	2,836,318

Table 2-49. (Concluded.)

Area	Capital	Annual O&M	Future 10th Yr. Cost	Future 15th Yr. Cost	Salvage Value	Present Worth[a] Capital	Present Worth[a] O&M (10.0983)	Present Worth[a] 10th Yr. (0.4796)	Present Worth[a] 15th Yr. (0.3321)	Present Worth[a] Salvage (0.2300)	Total Present Worth
Northwest Shore (Onsite)											
Administration	50,184	13,653	--	--	0	50,184	137,872	--	--	0	
Initial (Permanent)	27,682	1,684	--	--	1,737	27,682	17,006	--	--	400	
Initial (Seasonal)	79,383	3,140	--	--	6,948	79,383	31,709	--	--	1,598	
Future Annual[b]	17,073	195	--	--	49,707	172,408	14,061	--	--	11,433	
Total	157,249	18,477	--	--	8,685	329,657	200,648	--	--	13,431	516,874
Total	1,281,549	188,577	--	75,700	142,785	1,453,957	1,918,369	--	25,140	44,274	3,353,192
TOTAL FOR EIS ALTERNATIVE:	$11,407,128	$863,802	$16,000	$731,500	$2,205,298	$12,672,970	$8,892,744	$7,673	$242,931	$589,547	$21,226,772

[a] Present worth calculated at 7 5/8% for 20 years.

[b] Present worth factors for future annual onsite systems are:
- Present worth of annual capital = 10.0983
- Present worth of annual incremented O&M = 72.1075
- Present worth of total salvage value = 0.2300

[c] The totals for capital and annual O&M include only initial costs.

**This table was developed from Facilities Planning information prior to the decision of Kikkoman Foods to discharge industrial process and sanitary wastewater to the proposed Walworth/Fontana Sewerage System. The information contained in this table does not include the costs and capacities related to the Kikkoman discharge.

2.5. Cost-Effectiveness Analysis of the Final Alternatives

This section evaluates the cost-effectiveness of the FPRA and the EIS Alternative. Section 2.5.1. evaluates monetary costs and anticipated user charges of the alternatives, while Sections 2.5.2. through 2.5.4. evaluate the flexibility and reliability of the alternatives and discuss how they could be implemented.

2.5.1. Cost-effectiveness Analysis

The previous section of this EIS presented information concerning the anticipated costs of constructing the final alternatives (construction cost); the total project costs including engineering, contingency, and administrative fees which would be incurred (capital cost); the estimated yearly cost of operating and maintaining the facilities (annual O&M); and the value treatment equipment and/or structures would have at the end of the 20-year planning period (salvage value).

Capital costs are given in terms of total dollars required to finance the project in one lump sum payment. Operation and maintenance costs, however, are given as an annual cost to be spent each year during the 20-year planning period. If one alternative has a high capital cost but a low O&M costs, while a second alternative has a low capital cost but high annual O&M costs, it is difficult to compare the two alternatives to tell which one really would be least expensive over-all. In order to enable a meaningful comparison to be made, a total present worth analysis must be conducted.

The total present worth analysis presents all cost information in terms of present worth at the beginning of the planning period. Capital cost, present worth of the annual O&M, and present worth of the salvage value at the end of the planning period are summed to obtain the total present worth of each alternative (salvage cost is a negative value). The results of the cost-effectiveness analysis of the final alternatives for the Geneva Lake RSSAs are presented by the total present worth cost estimates listed in Tables 2-43 and 2-49. As listed in these tables, the total present worth of the FPRA is $33,389,100, whereas the total present worth of the EIS Alternative is $21,226,800 (approximately 63% of the FPRA estimated cost). Therefore, the EIS Alternative has less total present worth than the FPRA.

A comparison of present worth costs which are associated with providing wastewater management services to specific RSSAs, or service areas within certain RSSAs, also can be made by comparing the total present worth values listed in Tables 2-43 and 2-49 for the various areas. For example, for the Lake Como area, the total present worth of the centralized sewage collection and treatment system proposed by the FPRA is $12,279,070. For the same Lake Como area, the total present worth of the onsite management system proposed by the EIS Alternative is $2,994,800 (approximately 25% of the FPRA estimated cost). In general the EIS Alternative that serves currently unsewered areas of the RSSAs with onsite management systems has lower total percent worth costs than the FPRA that proposes construction of sewers in currently unsewered areas.

For currently sewered areas, the estimated costs for providing centralized wastewater collection and treatment, as proposed by both the FPRA and EIS Alternative, are similar. For Lake Geneva, the cost of the EIS Alternative is greater than for the FPRA, because the WWTP costs are borne entirely by the City and are not shared with citizens in Lake Como and the southeast shore area. Exactly what these various costs will mean to the citizens paying for wastewater services will depend, in part, on what kind of State and/or Federal grants (if any) are awarded for the project.

It should be noted that the EIS Alternative provides for wastewater treatment (either centralized or onsite) for nearly all residences in the RSSAs. The FPRA proposes sewers in all areas, but cost estimates currently have been provided by the facilities planner for the larger subdivisions only. If collection sewers are actually constructed to serve all residences within the RSSAs, the total cost for collection sewers of the FPRA could actually be substantially higher than those listed in Table 2-36.

The USEPA construction grants program, although administered by the WDNR, is a Federal Program which makes Federal grants available for construction of wastewater treatment facilities. For grants awarded prior to 1 October 1984, the Federal grant would equal 75 percent of all grant eligible capital costs. On or after 1 October 1984, the Federal share would be 55% of all grant eligible capital costs. USEPA participation in cost for reserve capacity after 1 October 1984 has been reduced from 20 years to the capacity needed at the time of grant award. Grants are not awarded for annual operation and maintenance expenditures.

For innovative/alternative components such as land disposal systems (e.g., rapid infiltration) and resource recovery systems (e.g., sludge landspreading), grants of up to 85% of the grant eligible capital costs of the innovative/alternative systems can be awarded prior to 1 October 1984. On or after 1 October 1984, innovative/alternative systems may receive grants for up to 75% of the grant eligible capital costs.

The Wisconsin fund grant program makes 60% grants for the construction cost of eligible systems for which Federal monies are not available. Engineering fees, legal and administration fees, and annual operation and maintenance costs are not eligible for state funding. A priority list uses several criteria to determine eligibility under both the Federal and state grant programs. The project schedule for the Geneva Lake study area indicates that construction grants will be requested, and potentially awarded, prior to 1 October 1984. Because of the respective rankings of these projects on the WDNR priority list, the Lake Geneva WWTP likely will receive Federal funding. The facilities proposed for Williams Bay, Walworth, and Fontana likely will not receive any Federal funding. However, it does appear that the west end projects (Walworth, Fontana, and Williams Bay) likely will receive grants from the Wisconsin Fund in the amount of 60% of all grant eligible costs. In addition, it appears that collection sewers, interceptors and associated lift stations, and initial onsite system upgrades for permanent residences potentially would receive Wisconsin fund grants if requested and attached to a WWTP project. Initial upgrades of onsite systems for seasonal residents, and all future upgrades and new systems potentially would not be grant eligible.

Approximate user costs were developed for the FPRA and EIS alternatives, based on the following assumptions:

- The Lake Geneva WWTP will receive a Federal grant for 75% of the capital cost of the WWTP upgrade, and 85% of the capital cost of the rapid infiltration basins and sludge facilities
- Wastewater collection and conveyance lines will receive a State grant for 60% of their construction costs
- The Walworth, Fontana, and Williams Bay WWTPs will receive a WDNR grant for 60% of their construction costs
- Onsite systems for permanent residents will receive a State grant for 60% of their construction costs
- Onsite systems for seasonal and future residences will receive no grant assistance.

Estimated user costs for various areas in the RSSAs for the FPRA and the EIS Alternative are presented in Tables 2-50 and 2-51, respectively. If collection sewers are built in all subdivisions in the RSSAs and the homeowner's connecting sewer costs were included, user costs for the FPRA may be substantially higher than those shown in Table 2-50. The user cost presented in this EIS are included only to allow a meaningful comparison of alternatives. Actual user charges assessed by the villages, cities, and/or sewage management districts will depend on actual funding provided (if any) at the time of construction, bond rates at the time of bond issuance, and other factors. If these projects are built in phases, then actual user charges also will vary periodically due to additional bond sales and bond retirement during each phase of construction.

2.5.2. Flexibility

Flexibility measures the ability of a system to accommodate future growth and depends on the ease with which an existing system can be upgraded or modified. System alternatives considered in this report include centralized collection sewer systems, wastewater treatment plants, and various onsite systems. The following evaluation is generally applicable to most of the alternatives unless otherwise stated in the discussion.

Table 2-50. Estimated annual user cost per existing connection for the FPRA for the various service areas within the Geneva Lake-Lake Como RSSAs.

Area	Local Share[a]	Annual Equivalent (0.0990)	Annual O&M	Annual Cost	Number of Connections	Estimated User Cost Per Connection
Lake Como Beach	$6,217,915	$615,574	$105,065	$720,639	984	732
Lake Geneva	682,110	67,529	245,555	313,084	3,028	103
Southeast Shore	1,546,486	153,102	38,910	192,012	300	640
Fontana	1,750,283	173,278	147,300	320,578	1,582	203
Walworth	472,218	46,750	29,000	75,750	649	117
Southwest Shore	924,072	91,483	14,700	106,183	290	366
Williams Bay	598,252	59,227	156,400	215,627	1,346	160
Northwest Shore	762,676	75,505	28,660	104,165	191	545

[a]See Appendix F for calculation of local share.

Table 2-51. Estimated annual user cost per connection for the EIS Alternative for various service areas within the Geneva Lake-Lake Como RSSAs.

Area	Local Share[a]	Annual Equivalent (0.0990)	Total Annual O&M	Annual Cost	Number of Connections	Estimated User Cost Per Connection
Lake Como	$1,004,473	$99,443	$110,391	$209,834	984	213
Lake Geneva Golf Hills	61,232	6,062	10,706	16,768	83	202
Geneva Bay Est. and Forest Rest	10,641	1,053	2,667	3,720	30	124
Southeast Shore	263,457	26,082	24,477	50,559	300	169
Lake Geneva	923,931	91,469	361,800	453,269	3,028	150
Walworth	397,990	39,401	38,000	77,401	649	119
Fontana	1,626,834	161,057	106,200	267,257	1,582	170
Section 11 Fontana	4,338	429	1,009	1,438	12	120
Southwest Shore	195,947	19,399	19,975	39,374	290	136
Williams Bay	593,135	58,720	170,100	228,820	1,346	170
Northwest Shore	144,945	14,350	18,477	32,826	191	172

[a]See Appendix F of the Draft EIS for calculation of local share.

For gravity sewer systems, flexibility to handle future increases in flows greater than the original design flow is generally low. Interceptor sewers are generally designed for capacity beyond the planning period. To provide an increase in capacity of existing collector sewers is a somewhat expensive process. Also, the layout of the system depends upon the location of the treatment facility. Expansion of a sewer system is generally easy with the addition of new sewers, but is expensive.

The ability to expand a conventional WWTP depends largely upon the processes being used, the layout of the facilities, and the availability of additional land for expansion. The expansion or upgrading of most of the treatment processes considered in the proposed WWTPs is relatively easy. With proper design of process components of the treatment plant and proper planning of the facility layout, the cost and effort required for expansion may be relatively small. Most conventional treatment processes also have good operational flexibility because operators can, to some extent, vary treatment parameters. This is definitely true for the trickling filter, oxidation ditch, and aerated lagoon WWTPs evaluated in this EIS.

Onsite systems are extremely flexible in that they are generally designed for each user and they only are put where they are needed. As long as spatial and environmental parameters are met, the type of system can be chosen according to individual requirements. Existing septic systems can be easily expanded by adding tank and drainfield capacity, if suitable land is available. Flow can then be distributed to an added system with little disturbance of the existing one. In the case of mound systems, future expansion may be difficult or impossible.

Because of these reasons, WWTPs proposed for the FPRA will be flexible. However, the flexibility of the proposed expanded collection system may be somewhat limited, particularly if growth beyond that projected occurs in an area where existing collection lines are small.

With the EIS alternative, all growth in unsewered areas will be handled by onsite systems to maintain maximum flexibility. Since new sewer lines will not be continually connecting onto existing lines, the life and flexibility of the existing collection system also will be extended. The onsite systems and the centralized WWTPs proposed by the EIS alternative both have excellent flexibility for expansion. However, onsite systems are dependent upon the presence of favorable soil and water table conditions. If they fail, replacement may be difficult, decreasing flexibility.

2.5.3. Reliability

Reliability measures the ability of a system or system component to operate without failure at its designed level of efficiency. It is particularly important to have dependable operation in situations where adverse environmental or economic impacts may result from failure of the system.

A gravity sewer is highly reliable when designed properly. Such systems require little maintenance, consume no energy, and have no mechanical components to malfunction. Gravity sewer problems can include clogged pipes that result in sewer backups; infiltration/inflow which increases the volume of flow beyond the design level; and broken or misaligned pipes. Major contributors to these problems are improperly jointed pipes and damage to manholes, especially where they are not located in paved roads.

Pump stations and force mains increase operation and maintenance requirements and decrease system reliability. Backup pumps are installed in order to provide service in case one pump fails. A backup power source is usually provided, consisting of either dual power lines or stationary or portable emergency generators. Force mains are generally reliable; excessive solids deposition and ruptured pipes occur rarely. Leaking joints occur more frequently and can cause environmental damage.

Federal Guidelines for Design, Operation, and Maintenance of Wastewater Treatment Facilities (Federal Water Quality Administration 1970) require that:

> All water pollution control facilities should be planned and designed so as to provide for maximum reliability at all times. The facilities should be capable of operating satisfactorily during power failures, flooding, peak loads, equipment failure, and maintenance shutdowns.

The wastewater control systems being evaluated for the study area should consider the following types of factors to insure system reliability:

- Duplicate sources of electric power
- Standby power for essential plant elements
- Multiple units and equipment to provide maximum flexibility in operation
- Replacement parts readily available
- Holding tanks or basins to provide for emergency storage of overflow and adequate pump-back facilities
- Flexibility of piping and pumping facilities to permit rerouting of flows under emergency conditions
- Provision for emergency storage or disposal of sludge
- Dual chlorination units
- Automatic controls to regulate and record chlorine residuals
- Automatic alarm systems to warn of high water, power failure, or equipment malfunction
- No treatment plant bypasses or collection system bypasses
- Design of interceptor sewers to permit emergency storage without causing backups
- Enforcement of pretreatment regulations to avoid industrial waste-induced treatment upsets
- Floodproofing of treatment plants
- Plant Operations and Maintenance Manuals with a section on emergency operation procedures
- Use of qualified plant operators.

Centralized collection and treatment alternatives will be highly reliable if these measures are incorporated. Collection systems will be less reliable where pump stations are required. If dual power lines from separate substations can be extended to every pump station (an expensive proposition), a reasonable level of reliability can be attained. Supplying auxiliary power units for each pump station may not be feasible. A failure of a pump station would likely result in raw sewage or effluent being discharged to surface waters.

Onsite systems are generally a reliable means of treating and disposing of wastewater. Except with certain systems, they operate with no power inputs and little attention. When failures do occur, the impact to the environment is small and diffuse. Total failures rarely occur in which no treatment at all takes place.

Septic tanks provide reliable treatment when they are properly designed and maintained. The principal maintenance requirement is periodic pumping of the tank, usually every three to five years. The treatment process can be harmed if large quantities of strong chemicals are flushed into the tank.

Soil absorption systems generally provide excellent treatment if design and installation are accomplished properly and soil conditions are suitable. Other key factors in the successful operation of soil absorption systems are proper functioning of the septic tank or other treatment unit and observance of reasonable water conservation practices consistent with the design flows. Soil absorption systems can malfunction when extended wet weather results in saturation of the soil, when solids carryover plugs the seepage bed, and when compaction of the soil surface results in restricted permeability. Mound soil absorption systems are more reliable than conventional seepage bed systems where water tables are high, beacuse potential groundwater problems are minimized. They do require an effluent pump, however, and rely on a dependable power supply. Septic tanks and pump chambers generally can hold approximately 1.5 days of storage, which is probably longer than the average power outage. A malfunctioning pump can be replaced readily if onsite units are standardized.

For these reasons, WWTPs and sewage lift stations proposed by the FPRA will have moderate reliability, subject to failures during periods of power outage. The reliability of simple trickling filter, oxidation ditch, and aerated lagoon WWTPs is better than for other complex treatment technologies. The simple WWTPs are also able to handle shock loads well.

For the EIS alternative, reliability of the WWTPs will be the same as for the FPRA, as discussed above. Onsite systems will provide maximum reliability in unsewered areas.

2.5.4. Implementability

The means by which the selected wastewater management plan is implemnted for each community depends upon whether the selected alternative relies primarily upon centralized or decentralized facilities. Because most sanitary districts have in the past been organized around centralized collection and treatment of wastewater, there is a great deal of information about the implementation of such systems. Decentralized collection and treatment, including onsite systems and cluster systems with subsurface disposal, is relatively new and there is less management experience on which to draw.

In this section the term "management district" referes to the authority responsible for managing the systems. A management district need not be an autonomous organization, devoted solely to the management of these systems. It may in fact be charged with other duties, and may share systems management responsibility through agreements with other agencies.

The value of small waste flows systems as a long-term rather than short-term alternative to centralized collection and treatment only began to be recognized in the 1970s. As a result, communities preparing facilities plans after 30 September 1978 were required to provide an analysis of the use of innovative and alternative wastewater processes and techniques that could solve a community's wastewater needs (PRM 78-9, USEPA 1978a). Included as alternative processes are individual onsite wastewater treatment systems with subsurface soil disposal systems.

The 1977 Clean Water Act amendments recognized the need for continual supervision of the operation and maintenance of onsite systems. USEPA Construction Grant Regulations (USEPA 1978a, USEPA 1979b) which implement that act, require an applicant to meet a number of preconditions before a construction grant for private wastewater systems may be made. They include:

- Certifying that a public body will be responsible for the proper installation, operation, and maintenance of the funded systems
- Establishing a comprehensive program for the regulation and inspection of onsite systems that will include periodic testing of existing potable water wells and, where a substantial number of onsite systems exists, more extensive monitoring of aquifers
- Obtaining assurance of unlimited access to each individual system at all reasonable times for inspection, monitoring, construction, maintenance, rehabilitation, and replacement.

Program Requirements Memorandum 79-8 extended these requirements to grants for publicly owned systems. These policies are continued in recent regulations and guidelines implementing the Clean Water Act (40 CFR 35.2206 and 40 CFR 35.2100).

The WDNR requirements for funding onsite system improvements through NR 128 of the Wis. Adm. Code are proposed for the Lake Geneva area. The onsite improvements would be grant-eligible subject to the following conditions:

- Sanitary districts would need to be formed to encompass the area where improvements will be constructed
- The districts should apply for a Step 1 Advance of Allowance. To be eligible for this they would have to be under 3,500 in population and the septic problem would need to be documented. If they were 3,500 in population, they could apply for a Wisconsin Fund Step 1
- In facility planning the septic problems have to be fairly well documented for anything to be grant eligible. If these systems could be corrected by routine maintenance and replacement, they may have failed due to age or poor maintenance and replacement would not be eligible. At any rate, the onsite improvements have to be demonstrated as cost-effective in facility planning.

WDNR is preparing a policy to address the eligibility of alternative systems and onsite replacement. The systems would have to be maintained and operated by a community management agency (sanitary district). Publicity owned systems (outright ownership or life-of-project lease or easement) for permanent residences are grant-eligible while the policy for privately owned systems serving permanent residences is under development. Any capacity for future growth or units for seasonal residences are not grant-eligible.

Regardless of whether the selected alternative for a community is primarily centralized or decentralized, four aspects of the implementation program must be addressed:

- There must be legal authority for the managing agency to exist and financial authority for it to operate
- The agency must manage construction, ownership, and operation of the sanitary district
- A choice must be made between the several types of long-term financing that are generally required in paying for capital expenditures associated with the project
- A system of user charges to retire capital debts, to cover expenditures for operation and maintenance, and to provide a reserve for contingencies must be established.

Centralized System

The City of Lake Geneva and Villages of Walworth, Fontana, and Williams Bay have the institutional ability to implement and finance wastewater disposal facilities within their respective corporate limits. They have the legal ability to apply for the USEPA Construction Grants, Wisconsin Funds, and other sources of funding for design and construction; to finance the operating costs and local share of the construction costs; and to generate revenues through user charges. Management of wastewater disposal facilities outside the Village limits, as required for a portion of each of the Revised Sewer Service Areas under the FPRA can be accomplished through contractual arrangements to provide service.

Capital expenses associated with a project may be financed by several techniques (discussed in detail in Chapter 4.0.). User charges are set at a level that will provide for repayment of long-term debt and cover operation and maintenance expenses. The user charges for the different alternatives are discussed in Section 2.7. In addition, prudent management agencies frequently add an extra charge to provide a contingency fund for extraordinary expenses and equipment replacement.

Decentralized Systems

Regulation of onsite wastewater treatment systems has evolved to the point where most new facilities are designed, permitted, and inspected by county health departments or other agencies. After installation, the local district has no further responsibility for these systems other than recording septic tank pumpage reports until malfunctions become evident. In such cases the local district may inspect and issue permits for repair of the systems. The primary basis for governmental regulation in this field has been its obligation to protect public health.

Rarely have governmental obligations been interpreted more broadly to include monitoring and control of other effects of onsite system use or misuse. The general absence of information concerning septic system impacts on groundwater and surface water quality has been coupled with a lack of knowledge of the operation of onsite systems.

Wisconsin statutes provide that communities such as the Town of Linn or Geneva can form sanitary districts to implement an onsite wastewater management alternative. A sanitary district may be formed by petition from residents or by WDNR under State Statutes (Chapter 6330). Commissioners of the district are either appointed by the Town Board or elected to their positions. They have the legal power to issue bonds, borrow money, and plan and construct wastewater facilities. The sanitary district is responsible for levying user charges, operating and maintaining the systems, and keeping records as required by WDNR. The existing sanitary district serving the Town of Linn would need to expand its authority to include wastewater management in the unsewered portions of the RSSA designated in this document. A sanitary district would have to be formed in the Town of Geneva to include the portions of the RSSA in the north shore of Lake Como.

The purpose of a decentralized wastewater management district would be to balance the costs of management with the needs of public health and environmental quality. Management of such a district would imply formation of a management district and of onsite wastewater management policies. The concept of a management district is new. The concept of community management of private onsite wastewater treatment facilities has been well developed in the Final Generic Environmental Impact Statement on Wastewater Management in Rural Lake Areas (USEPA 1983). That document presents four community management models which are summarized in Table 2-52.

A status quo model is possible in areas with low density residential development, few problems with onsite systems, and interest in the regulation of onsite systems is low. An owner, volunter assistance model would be appropriate where a higher density of onsite systems and number of identified system failures occurs and potential for more widespread well contamination exists. A compulsory community management would be appropriate with higher onsite system density, greater population of risk, identified onsite system failures, documented groundwater problems, and interest in the regulation of individual onsite systems. All homeowners with individual onsite systems would be required to participate in a community management program. The homeowner would retain ownership and liability for their onsite systems but the community would assume greater responsibility for insuring that they are properly maintained and operated. A comprehensive water quality management model would include aspects of the compulsory model but would also address all sources of pollution affecting a major water resource such as Geneva Lake. The decision of which model to adopt would be up to each community.

Another product of the Generic Rural Lake Areas EIS is a six step method for developing a management program. Many of the issues associated with the development of a management district are presented in this EIS, however, they are presented in much greater detail in the Technical Reference Document of the Generic Rural Lake Areas EIS. The process leading to the development of a management district program involves six major steps:

- Inventorying factors affecting the design process
- Making decisions on system ownership and liability

Table 2-52. Management models for community management of private onsite wastewater facilities.

Model Characteristics of of Planning Areas	Ownership/Liability	Functions Needed	Responsibility for Functions
Status Quo			
Onsite systems; low density and failure rate	Homeowner/homeowner	Permitting	County Health Department
Good soils		Inspection of systems	County Health Department
No sensitive water resources		Routine O&M	Homeowners
No Community interests in regulation		Complaints investigated	County Health Department
Available expertise			
Owner Volunteer			
Onsite systems; high density and moderate failure rate	Homeowner/homeowner	Permitting	County Health Department
Impacted water resources		Inspection of systems	County Health Department
Limited funding for water/ wastewater improvements		Complaints investigated	County Health Department
Community interest in regulating systems		Water sampling/analysis	County or State Health Departments
Available expertise		Sanitary surveys	County Health Department
		Construction Grants Administration	County Health Department
Compulsory			
Large number of systems; high density and moderate failure rate	Homeowner/homeowner	Permitting	County Health Department
Impacted groundwater resources		Inspection of systems	County Health Department
High community interest in regulating systems		Routine O&M	Homeowners
Limited funds		Complaints investigated	County Health Department
Available expertise		Water sampling/analysis	County or State Health Departments
		Sanitary surveys	County Health Department
		Construction Grants Administration	County Health Department
Comprehensive			
Large population on onsite systems; great number of failures around a clean lake	Homeowner/county	Permitting	County Health Department
Very sensitive water resources		Inspection of systems	County Health Department
High community interest in regulation of systems and pollution control		Routine O&M	Town
Some off-site systems		Complaints investigated	County Health Department
Limited funds		Water sampling/analysis	Town/County/State Health Departments
Available expertise		Sanitary surveys	County Health Department
		Construction Grants Administration	County Health Department

- Identifying services to be provided
- Determining how selected services will be performed
- Determining who will be responsible for providing services
- Implementing the management program.

The measures projected as necessary to upgrade the onsite systems in the unsewered portions of the RSSAs were outlined in Section 2.4.3. These upgraded systems as well as those that do not require immediate improvements will require monitoring and maintenance services over the project planning period. Providing these services is one of the major objectives of the management program.

Whenever possible, failing onsite systems would be replaced with a standard septic tank - soil absorption system designed according to State standard. However, it must be recognized that conventional seepage beds will not correct all problems. To avoid the very high cost of installing and maintaining holding tanks on lots with severe limitations, full consideration of unconventional systems is an integral part of the EIS Alternative. However, reliance on unconventional solutions to wastewater problems creates the need for a higher level of expertise to select the appropriate system for the given site conditions and to install and maintain them properly.

Unconventional systems recommended include such technologies as toilet water/wash water separation, reduced size absorption systems with maximum water conservation, reduced size mounds, and other "sub-code" systems. These types of systems are currently not permitted for construction of new onsite systems serving new dwelling units under State Regulations. These systems are not proposed for new development under the EIS alternative. However, for existing systems State regulations do make provisions for a variance procedure whereby sub-code onsite systems are permitted where lot limitations prohibit more standard forms of technology (ILHR Chapter H 83.09 Section 2b). This procedure has recently been applied, to the greatest extent, to the separation distances between lot lines, wells, and onsite treatment systems. The use of this procedure would need to be expanded to encompass the type of systems proposed under the EIS alternative.

This procedure would also depend heavily on a higher level of expertise at the local and County level to ensure that unconventional systems are properly selected, based upon site conditions.

As previously mentioned, the Town of Linn Sanitary District has the appropriate authority to implement the management program within their jurisdictional boundaries. However, essential expertise is lacking. This expertise does exist at the County level with the Walworth County Office of Planning, Zoning, and Sanitation for a considerable portion of the skills necessary. A new district would have to be formed for the Town of Geneva. In addition, the Geneva Lake Watershed Environmental Agency is available to provide water quality management expertise necessary for proper operation in the management district. An interagency agreement to coordinate the appropriate expertise could be formulated to ensure that the appropriate expertise is brought to bear. All costs could be recovered through the legal authority of the district at the Town level through a system of user charges that would provide for repayment of long-term debt as well as operation and maintenance expenses.

Onsite wastewater treatment facilities may be owned by the individual owner, by a community management district, or by a private organization. Liability involves acceptance of the responsibility for consequences of the failure of an onsite system. Historically, communities have accepted all liability for the failure of centralized collection and treatment systems, with exception of house connections and plumbing blockages. The liability for individual system failures has traditionally rested with the system owner. With community management of onsite wastewater systems, there may be advantages to reassignment of the liability for system failure. The assignment of liability to either a public or private agency is a matter of choice for the communities and their residents.

The range of services that a management agency could perform in managing onsite systems varies greatly. Services chosen should be those needed to fulfill community obligations without superfluous regulation, manpower, or capital investment. Administrative, technical, and planning services that a community might select are listed in Table 2-53.

Table 2-53. Potential program services for wastewater management systems

Administrative

- Staffing
- Financial
- Permits
- Bonding
- Certification programs
- Service contract supervision
- Accept public management for privately installed facilities
- Interagency coordination
- Training programs
- Public education
- Enforcement
- Property/access acquisition

Technical

- System design
- Plan review
- Soils investigations
- System installation
- Routine inspection and maintenance
- Septage collection and disposal
- Pilot studies
- Flow reduction program
- Water quality monitoring

Site investigations and design review of onsite systems for new buildings remains the responsibility of the Walworth County Office of Planning, Zoning, and Sanitation. However, any combination of the following three groups could provide the necessary services:

- The Town Sanitary District (including assistance from County and State organizations)
- Property owners or occupants
- Private organizations such as contractors, consultants, licensed plumbers, private utilities, and private homeowner associations.

Communities may control services by providing them directly or they may provide those services that only the designated regulatory body can provide (such as permit issuance and enforcement), supervising the services assigned to owners or private organizations. Assignment of service responsibilities should account for the skills and regulatory authority needed to successfully provide the service as well as the costs for different parties to provide them and the risks attendant on poor performance. The determination of who will be responsible for providing these services will be a decision each community will have to make.

The last step in the design process would be implementation of the management program. The specifics of this step would vary depending on decisions made in the design process. Examples of the necessary implementation procedures are:

- Drafting and adopting appropriate municipal ordinance establishing the agency or providing it with needed authorities
- Hiring new personnel as needed
- Notifying potential contractors and consultants of performance criteria and contract requirements for operating within the management district
- Drafting and adopting interagency agreements
- Creating sanitary review board
- Informing property owners about their responsibilities for specific services.

Advantages and disadvantages are attendant to each type of management option. Complete control by a municipal wastewater management agency comes closest to guaranteeing that the systems would operate at optimal levels but represents the most costly approach. The least costly approach would be to keep the homeowner responsible for all maintenance activities and costs. The homeowner then would be more inclined to utilize water-saving measures and other methods to minimize maintenance costs. However, as is currently the case, environmental protection is more likely to suffer when the homeowner is responsible for maintenance.

Onsite systems can be funded under Section NR 128.08, which requires that the individual systems be maintained and operated by a management agency or that access be granted at all reasonable times through an easement or under Section NR 128.30 which funds individual, private systems for existing permanent residences. In a manner similar to centralized systems, only a certain portion of the total capital costs are eligible for funding. Grants under Section NR 128.30 pay up to 60% of the eligible costs and have a limit of $3,000 per residence or business individual system. It is anticipated that the onsite systems will likely be funded under Section NR 128.08 and that the onsite systems will be owned, constructed, operated, and maintained by the management agency. The local costs for the construction, operation, and maintenance of the decentralized systems can be assessed to each user equally by a variety of means (Section 4.1.3.). A Town management district would thus have the necessary authority to apply for funds, finance, and implement a decentralized wastewater management approach.

3.0. AFFECTED ENVIRONMENT

3.1. Natural Environment

3.1.1. Atmosphere

3.1.1.1. Climate

The Greater Rockford Airport at Rockford, Illinois, approximately 35 miles southwest of Lake Geneva, is the repository of complete meteorological data representative of the Geneva Lake-Lake Como study area. The study area is characterized by climate of the continental type, moderated somewhat by nearby Lake Michigan. The area experiences large annual temperature ranges and frequent short-term fluctuations. Monthly temperatures average 48.1°F (NOAA 1979). The highest temperature recorded at Rockford was 103° in July 1955, and the record low of -24°F occurred in January 1979.

The average monthly precipitation in the study area is 36.72 inches (NOAA 1979). Thirty-four percent of the average annual precipitation falls in June and July, and 64% of the average yearly total occurs from April through September. However, every month averages at least 4% of the total average annual rainfall. Most of the snow falls from November through March. A maximum monthly snowfall of 26.1 inches occurred in January 1979, and the maximum snowfall in a 24-hour period was 10.9 inches in February 1960.

Winds are predominantly from the west-northwest, except during June through October, when they are from the south-southwest (NOAA 1979). Wind speeds average 9.9 mph.

Upper air data for the Geneva Lake-Lake Como study area have been used to derive a statistical picture of the occurrence and characteristics of elevated inversions (Holzworth 1972). These inversions trap pollutants in ground-based mixing layers, and may result in air pollution episodes. The lower the inversion layer, or the shallower the mixing layer, the more concentrated the pollutants are likely to be. The mean annual afternoon mixing height in the study area has been determined to be approximately 1190 meters (m); the mean afternoon mixing height ranges from about 630 m in winter to 1580 m in the summer. Mixing heights in combination with wind speeds can be employed to evaluate atmospheric dispersion conditions.

3.1.1.2. Air Quality

The study area is located in the USEPA Southeastern Wisconsin Air Quality Control Region (AQCR). Air quality standards applicable to the study area are the Wisconsin Ambient Air Quality Standards, which are identical to the National Ambient Air Quality Standards (NAAQS). New or modified wastewater treatment facilities must not cause violations of the standards, and must meet the New Source Performance Standards for Sewage Sludge Incinerators (USEPA 40 CFR, Part 60). Such facilities also are subject to state air quality regulations.

Based on regional air quality data and information on sources of atmospheric emissions, the Geneva Lake-Lake Como study area has been classified as an air attainment area for sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), hydrocarbons (HC), and ozone (O_3). An attainment area is one in which pollution concentrations do not exceed the primary or secondary NAAQS. The study area is presently unclassified for total suspended particulates (TSP) (By telephone, Tom Mateer, USEPA Region V, 29 October 1980).

The WDNR monitored TSP levels at Lake Geneva from 1971 through 30 June 1977, when it dismantled its station. TSP levels were in compliance with both annual and maximum 24-hour primary ambient air quality standards (health-related), although violations of the maximum 24-hour secondary standard (welfare-related) occurred. The maximum 24-hour TSP value achieved in the 6-year monitoring period was 196 ug/m^3, which was well below the primary standard of 260 ug/m^3.

There are no Prevention of Significant Deterioration (PSD) Class I areas in the Geneva Lake-Lake Como study area (By telephone, Tom Mickelson, WDNR, 29 October 1980). A PSD Class I designation is given to an area that is in attainment with the NAAQS, which allows minimal, if any, industrial growth. Class II areas allow moderate industrial growth to occur, and all areas not designated Class I in the US are Class II.

There are no significant odor problems in the Geneva Lake-Lake Como study area. The WDNR has never received complaints of odors in Walworth County (By telephone, Robert Redovich, WDNR, Southeast District, Bureau of Air Management, 2 October 1978). New or modified wastewater treatment facilities must be carefully located, designed, and maintained to avoid potential odor problems.

3.1.1.3. Noise

There are no major noise sources in the Geneva Lake-Lake Como study area with the exception of highway noises and those related to water recreation, such as motorboats. The location, design, and operation of wastewater facilities must be considered to avoid exposing the surrounding community to excessive noise.

3.1.2. Land

3.1.2.1. Physiography and Topography

The Geneva Lake-Lake Como study area is located in a topographically high area just south of the Kettle Moraine area. The topography of the study area is characterized by steep, hummocky, morainic ridges, which trend northeast-southwest and reflect glacial deposition over a preglacial bedrock valley. Elevations range from less than 830 ft msl in a wetland area in the northeast corner of the study area to over 1,130 ft msl in the south-central part of the study area.

The majority of the study area is situated in the Fox River Basin (Section 3.1.3.). Lake Como and Geneva Lake are the two major bodies of surface water in the area and are drained to the northeast by Como Creek and the White River, respectively. These lakes roughly parallel morainic ridges and are fed by numerous small perennial and intermittent streams. Wetlands occur south of the Village of Fontana, around Lake Como, and in the northeastern and southeastern parts of the study area.

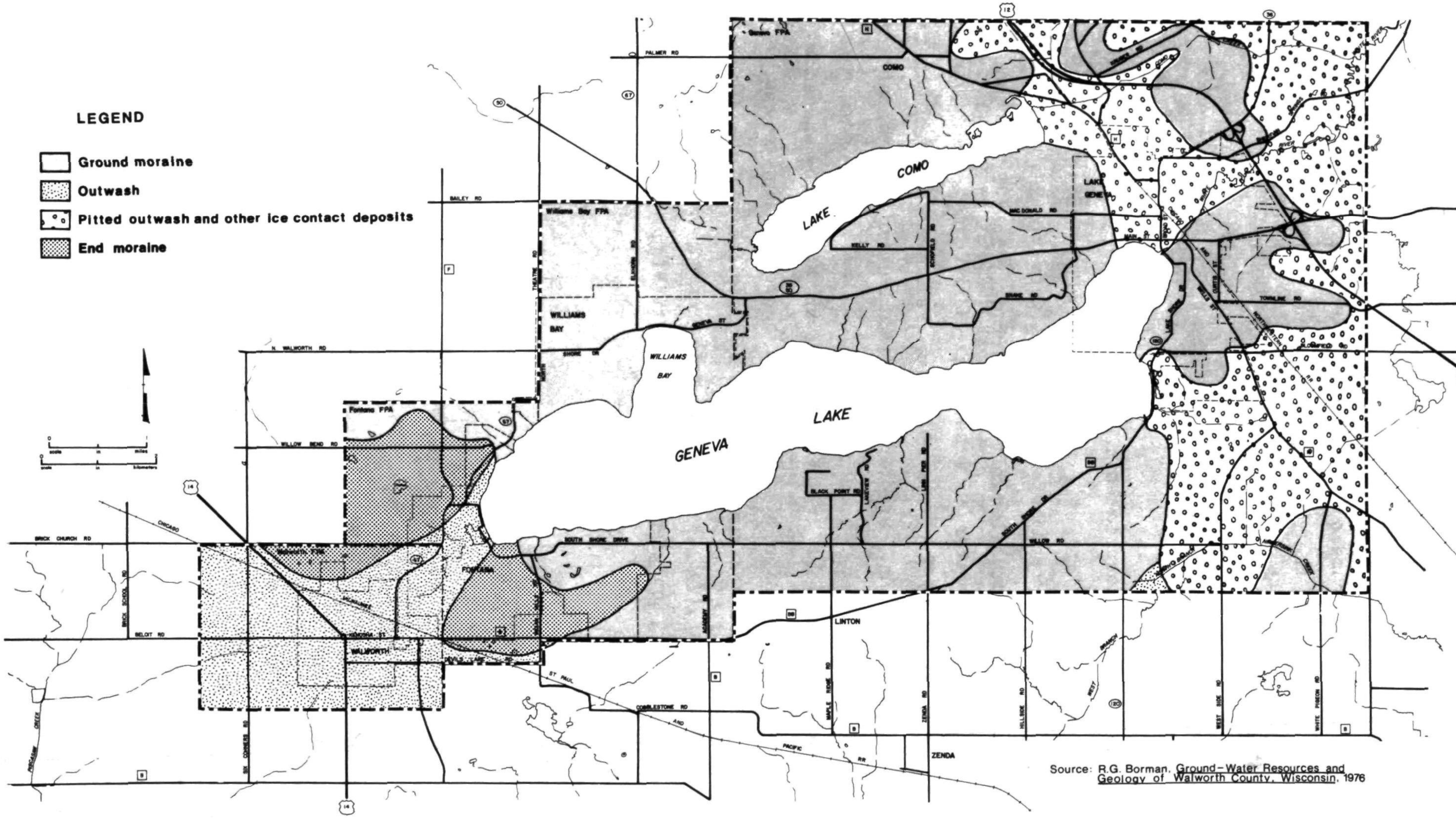
3.1.2.2. Bedrock Geology

The study area is located on the western flank of the Michigan Basin. The bedrock geology consists of Precambrian crystalline rocks overlain by Paleozoic strata. The Precambrian surface slopes to the east throughout Walworth County. The elevation of this surface ranges from -100 ft mean sea level (msl) at Whitewater to less than -1600 ft msl along the eastern county line (Borman 1976). The overlying Paleozoic strata consist of easterly dipping Cambrian, Ordovician, and Silurian sedimentary rocks.

The bedrock surface of the Rock-Fox River Basin was shaped by pre-glacial and glacial erosion of the exposed bedrock. Due to the regional easterly dip of the bedrock strata, increasingly older rocks are exposed to the west (Cotter et al 1969). This regional pattern, however, is distorted by an uneven bedrock topography. The most striking features are bedrock valleys, which were formed by the removal of the less resistant Maquoketa Shale.

3.1.2.3. Surficial Geology

The unconsolidated sediments in the study area are predominantly glacial sediments of Quaternary age. These sediments include end moraine, ground moraine, and outwash material deposited by the Delavan lobe of the Lake Michigan glacier during the Wisconsinan Stage of glaciation. The combined thickness of unconsolidated materials (i.e., alluvium, marsh deposits, lacustrine sediment, and glacial drift) in the study area ranges from approximately 100 ft in the northeast corner to over 500 ft in an area between Geneva Lake and the southern border of the study area (Borman 1976). Thicknesses tend to be greatest where glacial deposits fill bedrock valleys and in topographically high regions. Figure 3-1 illustrates the



Source: R.G. Borman, Ground-Water Resources and Geology of Walworth County, Wisconsin, 1976

Figure 3-1. Surficial geology.

uppermost deposits in the study area. Other unconsolidated materials may underlie these deposits. Buried deposits, particularly those within bedrock valleys, constitute important aquifers in the study area.

End moraines mark the position of a glacier during a halt or minor re-advance, and are composed of glacial till that was deposited along the edge of a relatively stagnant ice sheet. Moraine topography is generally characterized by belts of sharply rolling to hummocky land. Because glacial ice was responsible for most of the deposition, materials consist predominantly of unsorted, unstratified mixtures of clay, silt, sand, gravel, and boulders. However, localized deposits of stratified sand and gravel may have been formed from glaciofluvial action of associated meltwaters.

Ground moraines consist of glacial till that was deposited directly by glacial ice advancing over bedrock or older glacial deposits. Sediments comprise unsorted, unstratified mixtures of clay, silt, sand, gravel, and boulders. Topography is typically gently rolling. Ground moraines in the study area, however, are unusually rough, possibly due to the uneven bedrock surface.

Outwash plains consists of irregularly stratified drift deposited by meltwaters emerging from a stagnant or retreating ice front. Sediment particle size ranges from gravel to clay and tends to decrease with distance from the source. Topography associated with outwash plains is generally level to gently sloping.

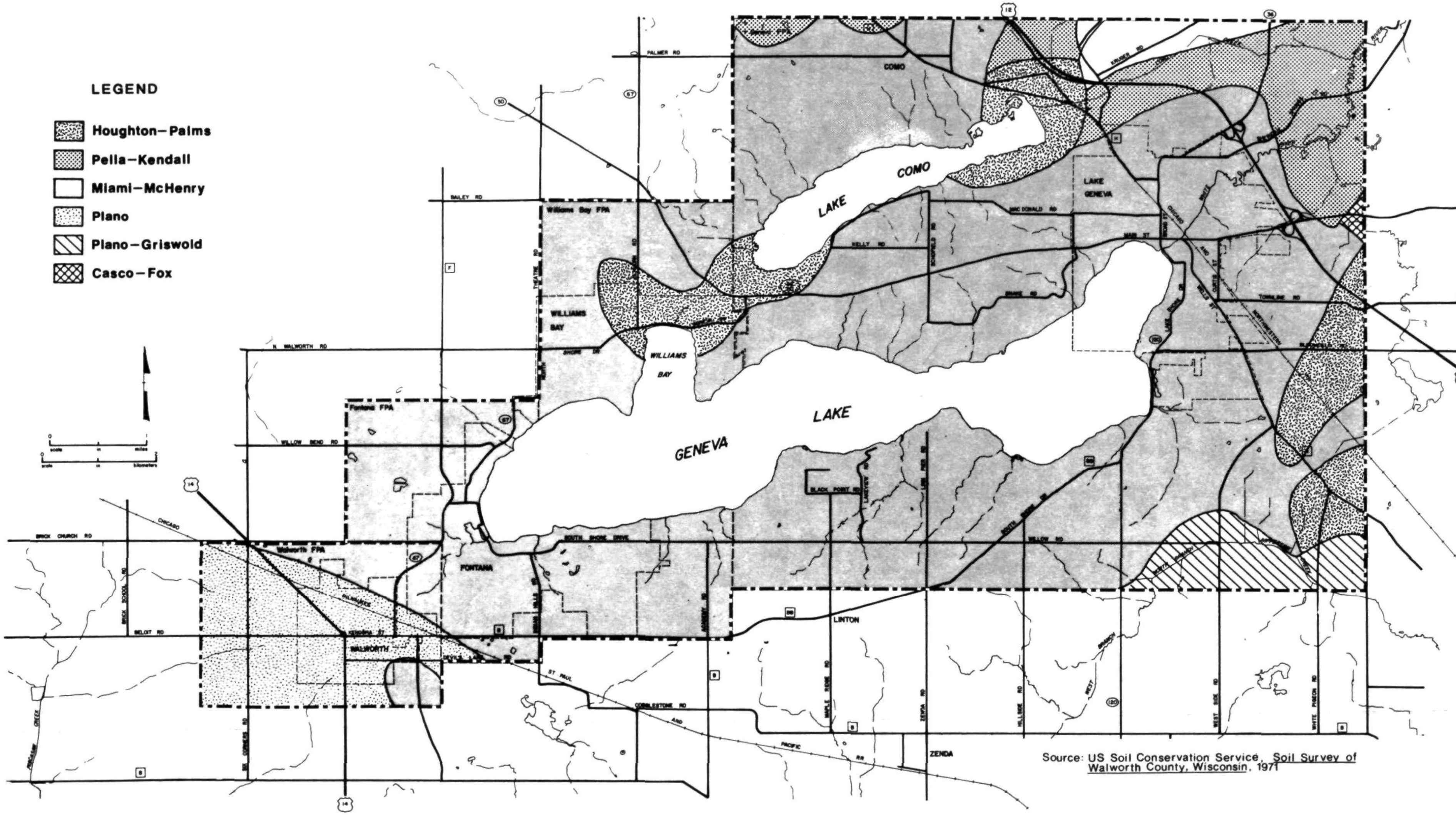
3.1.2.4. Soils

Sewage disposal in rural areas most often depends on soil-based systems. Whether they function properly or not depends on proper design, construction, and maintenance of the system. One approach to selection of design criteria is to generalize soils into similar groupings based on pertinent physical characteristics. The US Department of Agriculture Soil Conservation Service (SCS) in cooperation with the Soil Department of the Wisconsin Geological and Natural History Survey, and the Wisconsin Agricultural Experiment Station of the University of Wisconsin, have selected design criteria for this project, based on pertinent physical/chemical soil properties of the area, detailed in the Soil Survey of Walworth County (SCS 1971).

The soil associations found in the Geneva Lake-Lake Como study area are described below. The term "soil association" refers to a distinctive proportional pattern of soils that normally consists of one or more major soils (which give the association its name) and at least one minor soil (SCS 1971). The association map presented in Figure 3-2 provides general information on the soils of the study area. For detailed information on the soils of a specific parcel, the Soil Survey of Walworth County (SCS 1971) must be consulted.

The Houghton-Palms Association is characterized as very poorly drained organic soils that occur near lakes and drainageways in depressions and on bottom lands. The association is found at the eastern and western ends of Lake Como, and at the eastern end of the study area. The soil material is composed of muck and peat, with mineral soils material underlying the organic material. These areas frequently are flooded with the water table at or near the surface throughout the year. No structures or onsite sewage disposal systems can be constructed successfully in these areas without extensive soil modification.

The Miami-McHenry Association is the most extensive in the study area and is characterized by well-drained soils in gently rolling to steep uplands surrounding the lakes. The soils are formed in loess and underlying sandy loam to loam glacial till associated with the till plains and terminal moraines. Small areas where this association occurs are steeply sloping or level, have high water tables, or consist of organic soil material. Because of the slopes, surface runoff is rapid, and ponding generally does not occur. Onsite sewage disposal systems that utilize this type of soil generally operate well if they are designed, constructed, and maintained properly.



Source: US Soil Conservation Service, Soil Survey of Walworth County, Wisconsin, 1971

Figure 3-2. Soils association.

The Plano, gravelly substratum-Warsaw Association is characterized as well-drained soils with nearly level to gently undulating slopes found on outwash plains and stream terraces in the southwestern corner of the study area around Walworth. The soil material is silty clay loam over sand and gravel outwash in most areas. Surface runoff is slow, but the relatively high permeability of the soil, and the deep water table in these areas effectively reduce ponding to very short durations. Soil-based onsite sewage disposal systems operate well on these soils, but inadequate treatment of septic tank effluent may occur if drainfields are located in the underlying sand and gravel.

3.1.2.5. Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing row crops. The SCS has defined prime farmlands as lands having "an adequate and dependable moisture supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt or sodium content, and few or no rocks." Prime farmlands are also characterized as lands that are not excessively erodible or saturated with water for long periods of time, and which either do not flood or are protected from flooding (SCS 1977).

Prime farmlands, farmlands of statewide importance, and farmlands of local importance have been identified and mapped in the study area by the SCS (See Figure 3-3). Prime farmland accounts for 245,790 acres in Walworth County and includes all farmland on Class I and II soils. Farmland of statewide importance is land with good potential for growing hay or for growing hay and row crops in rotation. Conservation practices such as contour stripping may be required on these Class III lands. Farmlands of local importance are any lands that are considered important on a local basis by the SCS.

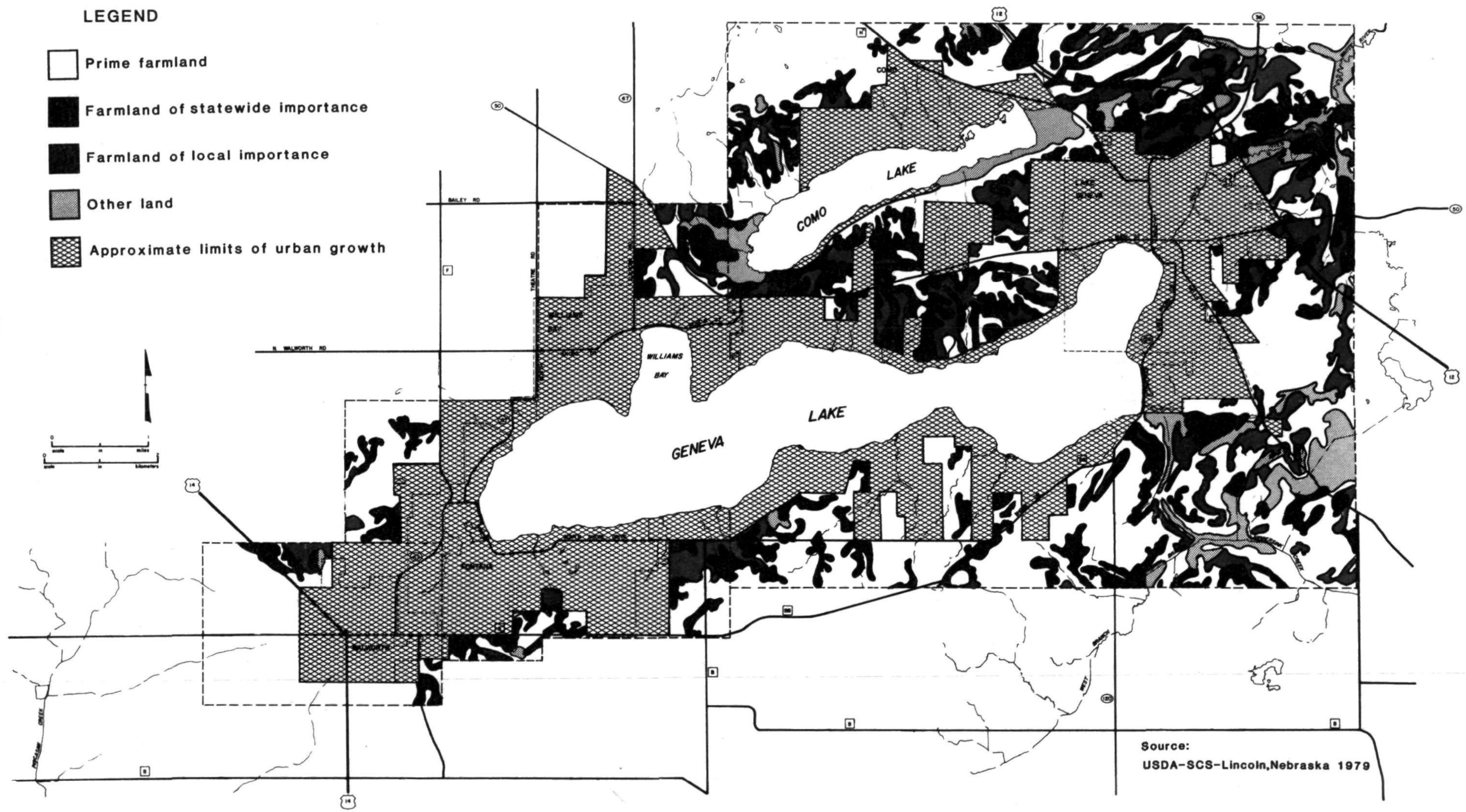


Figure 3-3. Prime farmland.

3.1.3. Water Resources and Water Quality

3.1.3.1. Groundwater

Groundwater Resources

Groundwater in the Geneva Lake-Lake Como study area is an important resource for residential, industrial, commercial, and municipal users. Groundwater currently supplies 100% of the area's drinking water. The total groundwater withdrawal for Walworth County in 1971 was 6.6 mgd (Borman 1976) (Table 3-1).

Table 3-1. Amount of water used daily in 1971 for residential, commercial, industrial, and municipal purposes in Walworth County, Wisconsin (Borman 1976).

Water Use	Amount Used MGD	Amount Used Percent
Residential (public supply)	1.56	23
Residential (private supply)	1.1	17
Commercial (public and private supply)	1.2	18
Industrial (public and private supply)	1.3	20
Institutional (private supply)	0.2	3
Municipal	1.27	19
Total	6.63	100

The groundwater aquifers in the study area are located in sandstone, in unconsolidated sand and gravel glacier deposits, in the Niagaran Formation, and in the Galena-Decorah-Platteville Formation.

The sand-gravel and sandstone aquifers in the area supplied approximately 94% of the 1971 pumpage for Walworth County (Table 3-2). The sand-gravel aquifer, which is the major source of water, occurs both at the surface and buried below relatively impermeable materials. Wells at the surface yield between 500 gpm and 5,000 gpm, and wells below relatively impermeable materials yield between 10 gpm and 500 gpm (Cotter et al 1969). Because water is found in the interconnected pore spaces between grains, well yields are also dependent upon the grain size and sorting of the sediment, and the thickness and lateral extent of the permeable deposit. The saturated thickness of the aquifer in the study area ranges from zero to about 300 feet; it is greatest in Fontana and Walworth, where glacial deposits fill bedrock valleys and the topography is higher.

In areas where permeable glacial deposits are thin or absent, wells penetrate the three bedrock aquifers. In many instances, bedrock wells rather than glacial drift wells are preferred because bedrock wells do not have to be screened and therefore are less expensive to construct.

Table 3-2. Total pumpage from aquifers in Walworth County in 1971 (Borman 1976).

Aquifer	Pumpage MGD	Pumpage Percent
Sand-and-gravel	3.5	53
Niagara	0.2	3
Galena-Platteville	0.2	3
Sandstone	2.7	41
Total	6.6	100

The sandstone aquifer underlies the entire study area. It is the major source of water for municipal and industrial supplies, but is not generally tapped for private water supply (Borman 1976). The sandstone aquifer includes all sandstone bedrock below the Maquoketa shale. Yields from most wells tapping this aquifer are directly proportional to the thickness of the sandstone penetrated. Because of the thickness (up to 3,000 feet) and total head, well yields of up to 2000 gpm are possible (Cotter et al 1969).

Although the Niagaran dolomite aquifer system supplies water for only 11% of the private uses in Walworth County, it is an important source of water in parts of the study area where the sand-and-gravel aquifer is absent. The Niagaran dolomite aquifer can be as thick as 450 feet, and wells tapping it have yielded up to 1,500 gpm (Cotter et al 1969).

The Galena-Platteville aquifer provides water in areas where the sand-and-gravel aquifer and Niagaran aquifer are absent. This aquifer system is used for residential and agricultural purposes. The thickness of the aquifer ranges from 0 feet to 400 feet, and yields from 10 gpm to 100 gpm (Cotter et al 1969).

Groundwater Quality

Groundwater within the study area is generally suitable for drinking in terms of meeting drinking water standards. However, some residents in the Lake Como area have mentioned that the taste renders the water unsuitable for drinking. A spring used for drinking water purposes was closed for most of the summer of 1982 in Lake Como. Coliform bacteria counts were found above drinking water standards. The groundwater, in most locations in the study area, is considered to be very hard (Borman 1976).

3.1.3.2. Streams

The streams and rivers in the study area that are of concern include the White River, Piscasaw Creek, and Como Creek.

Stream Characteristics

The White River flows northeast out of Geneva Lake and joins the Fox River near Burlington, Wisconsin, about 12 miles from the study area. Low flows typically occur in late summer or autumn and high flows occur during the spring. A summary of flow records is presented in Table 3-3. The 7-day, 10-year low flow is used to determine the amount of wastewater a stream can assimilate and still be used for recreational or other purposes. The 7-day, 10-year low flow for the White River at the Lake Geneva Wastewater Treatment Plant is reported as 0.89 cfs by the USGS (1979), whereas SEWRPC (1974) reported a value of 0.10 cfs at the same site.

The White River watershed has a history of minor floods. Major flooding is prevented by the storage of water in Geneva Lake attenuating the runoff peak following precipitation and snowmelt. The two most significant floods in the area occurred in March-April 1960 and July 1938 (Donohue & Assoc., Inc. 1978a).

Piscasaw Creek originates in southwestern Walworth County, Wisconsin, and flows south for approximately 30 miles, where it joins the Kishwaukee River near Belvidere, Illinois. The Kishwaukee River eventually flows into the Rock River. Hydrologic data on Piscasaw Creek are limited. Available

Table 3-3. Summary of flow data for the White River (water years 1958-64 and 1967-79; USGS 1980). Flow measurements were taken at a gaging station 3 meters downstream from the bridge on State Highway 36, about 0.5 miles NE of the City of Lake Geneva.

	Average Flow (cfs)	
Discharge (water years 1974-79)	90.5	
Extremes for the period of record:		
Maximum Discharge	1,960	18 July 1969
Minimum Discharge	2.3	4 July 1965
Extremes for the water year 1978-79:		
Maximum Discharge	671	19 March
Minimum Discharge	21	12 November

low-flow data are for the Village of Walworth sewage treatment plant. The value for the 7-day, 10-year low flow was recorded as 1.30 cfs by the USGS (1979), as 4.73 cfs by SEWRPC (1978), and as 0.70 cfs by WDNR (Donohue & Assoc., Inc. 1983a).

Como Creek leaves Lake Como flowing in a northeasterly direction for about 1.8 miles before entering the White River northeast of Lake Geneva in Lyons Township. The 7-day, 10-year low flow is estimated to range from 0.3 cfs to 0.53 cfs (By telephone, Steven Skavroneck, WDNR, 19 October 1978).

Stream Water Quality

The quality of the surface water in the study area is regulated by the WDNR through Chapter 144 of the Wisconsin Statutes and Chapters 102 and 104 of the Wisconsin Administrative Code. These standards apply to individual surface waters according to their use and location. They are divided into four categories: general standards, standards for fish and aquatic life, standards for recreational use, and standards for water supply.

White River

The White River near Lake Geneva has been classified as "effluent limited" (i.e., the stream is capable of meeting water quality goals with application of best practicable treatment technology). No routine water quality monitoring stations are located on the White River that provide sufficient data to accurately assess the water quality of the river. Limited data (Table 3-4), however, indicate that concentrations measured met water quality standards or were within recommended concentrations to protect water uses (USEPA 1976).

Table 3-4. Summary of water quality data (mg/l) for the White River at Lake Geneva (June - November 1972; USEPA 1978).

Parameter	No. of Samples	Range	Mean
Ammonia Nitrogen	14	0.315 - 0.009	0.069
Total Kjeldahl Nitrogen	14	1.80 - 0.390	0.935
NO_2 -N and NO_3 -N	14	0.168 - 0.010	0.044
Phosphorus - Dissolved	14	0.039 - 0.005	0.010
Phosphorus - Total	12	0.060 - 0.015	0.025

There are two point sources that discharge into the White River. The WWTP for the City of Lake Geneva, which has an average design capacity of 1.1 mgd, currently discharges an average of 0.6 mgd. The other discharge is the Americana Hotel WWTP.

Piscasaw Creek

Piscasaw Creek also has been classified as "effluent limited." No water quality data, however, are available to assess the stream's water quality in the study area. The only point source discharging to Piscasaw

Creek in the study area is the Village of Walworth WWTP. It has an average design capacity of 0.15 mgd and a peak hydraulic design capacity of 0.3 mgd.

Como Creek

Como Creek has been classified as "effluent limited." There are no water quality monitoring stations on the creek, and the 1972 National Eutrophication Study of Lake Como is the only source of water quality data for Como Creek (Table 3-5). At the time of the survey, the concentrations measured met water quality standards or were within recommended concentrations to protect water uses. There are no known point sources discharging into Como Creek.

Table 3-5. Summary of water quality data (mg/l) for Como Creek (June - November 1972; USEPA 1976).

Parameter	No. of Samples	Range	Mean
Ammonia - Nitrogen	14	0.710 - 0.012	0.108
Total Kjeldahl Nitrogen	13	2.30 - 0.780	1.14
NO_2 -N and NO_3 -N	13	0.310 - 0.021	0.091
Phosphorus - Dissolved	14	0.075 - 0.005	0.020
Phosphorus - Total	13	0.195 - 0.020	0.078

3.1.3.3. Lakes

Lake Characteristics

The two lakes of concern in the study area are Geneva Lake and Lake Como. Geneva Lake, a deep glacial lake, has no major stream inflows. Recharge is through 130 acres of wetland drainage, groundwater, direct precipitation, and numerous small perennial and intermittent streams. A dam at the outlet for Geneva Lake (constructed in 1836) maintains the lake at 10 feet above its natural level. Lake Como is a shallow, impounded wetland lake. The lake level is artificially maintained at 3 feet by an earthen dike at the far eastern shore. Most of the lake bottom is composed of muck and peat. The morphologic and hydrographic characteristics of Geneva Lake and Lake Como are presented in Table 3-6.

Table 3-6. Morphologic and hydrographic characteristics of Geneva Lake and Lake Como (Aqua-Tech 1978).

	Geneva Lake	Lake Como
Drainage area	13,184 acres	4,244 acres
Lake area	5,262 acres	946 acres
Volume	320,984 acre-feet	4,033 acre-feet
Mean hydraulic retention time[a]	30 years	1.1 years
Shore length	20.2 miles	8.4 miles
Depth mean	61 feet	4.3 feet[b]
maximum	135 feet	9.0 feet
Length	7.6 miles	3.4 miles
Width maximum	2.1 miles	0.6 miles
minimum	0.5 miles	
Watershed area: lake area	3.5:1	5.5:1
Lake bottom composition	80% silt and mud top 4 feet sand and gravel	muck and silt
Percent of area less than 3 feet deep	1%	18%
Percent of area greater than 20 feet deep	77%	0%

[a]Time required for exchange of total volume of a body of water.
[b]Only 65 acres have a depth over 6 feet deep.

Geneva Lake Water Quality

The water quality of Geneva Lake has been a concern of the residents of the area since its establishment as a resort and recreation center. This early concern was demonstrated by the adoption in 1893 of a State statute that specifically prohibited the discharge of sewage effluents into the lake. These historic efforts to divert sewage effluent, the small size of the watershed, and the large volume of the lake, are factors attributed to the water quality of Geneva Lake which has remained relatively good over the years. In recent years, however, algal blooms have occurred in a few shoreline areas, and herbicides were used annually in attempts to control these occurrences. During the period from 1971 to 1976, between 11.5 and 62.0 acres of lake per year were chemically treated for algae (GLWEA 1977).

The major water quality problem presently facing Geneva Lake is the potential for accelerated eutrophication, in which the lake becomes increasingly over-nourished and over productive of plant life. Eutrophication is caused by an increase in the input of plant nutrients (e.g., nitrogen and phosphorus) to a lake. The opposite of an eutrophic lake is an oligotrophic lake, which is a clear lake containing little organic matter and with low nutrient supplies. Lakes that are in an intermediate condition are termed "mesotrophic."

A number of surveys conducted in the last 15 years have classified Geneva Lake as mesotrophic. The USEPA's National Eutrophication Survey, conducted in 1972, classified the lake as mesotrophic based on water quality data (Table 3-7). WDNR also classified Geneva Lake as mesotrophic based on data the agency collected from 1975 to 1978 (Table 3-8). The nutrient concentrations found were in compliance with State standards and most were within recommended levels to protect water quality (USEPA 1976). In addition, an ongoing comprehensive water quality sampling program has been conducted by GLWEA, which has regularly collected and analyzed water quality data from 1976 through 1982. This most recent information corroborates the USEPA and WDNR classifications of Geneva Lake as mesotrophic (Table 3-7).

For an overview of lake dynamics, data from a sampling station in the center of Fontana Bay serve as representative data for the lake. The temperature profile for Fontana Bay in summer indicates that the lake stratifies and that the thermocline (the region of rapidly decreasing temperatures and poor circulation) extends to fairly deep levels in the lake (between 29 and 56 feet). The dissolved oxygen (DO) profile in winter indicates that DO concentrations are above 5.0 mg/l to a depth of 132 feet. During the summer stratification period, however, the DO is depleted in the hypolimnion (i.e., the lower, cold, non-circulating region). All lake

Table 3-7. Summary of National Eutrophication Survey water quality data for Geneva Lake, June - November 1972 (USEPA 1975a).[a]

Parameter	No. of Samples	Maximum	Minimum	Mean	Standard Deviation
Temperature (°C)	53	22.5	6.1	11.8	5.4
Dissolved Oxygen (mg/l)	44	11.0	0.6[b]	8.6	1.6
Conductivity (umhos/cm)	50	415	340	386	21.7
pH	50	8.60	7.50	8.15	0.26
Alkalinity (mg/l as $CaCo_3$)	50	190	162	178	7.4
Phosphorus - Total (mg/l)	50	0.047	0.009	0.015	0.006
Phosphorus - Dissolved (mg/l)	50	0.039	0.005	0.008	0.005
NO_2 -N and NO_3 - N (mg/l)	50	0.190	0.010	0.050	0.039
Ammonia Nitrogen (mg/l)	50	0.090	0.020	0.044	0.014
Secchi disc (inches)	8	144	105	126	11.8
Chlorophyll a (ug/l)[c]	9	13.4	2.0	5.8	4.0

[a] Data include measurements conducted at three stations and at various depths.

[b] The minimum value was recorded at a depth of 8 feet during November.

[c] Values were reported to be in error by plus or minus 20%.

Table 3-8. Summary of WDNR water quality data for Geneva Lake November 1975 to April 1978 (WDNR 1978).

Parameter	No. of Samples[a]	Maximum (0 ft)	Maximum (At Other Depth)	Minimum (0 ft)	Minimum (At Other Depth)	Mean (0 ft)	Standard Deviation
Temperature (°C)	9	23.5	--	0.0	--	7.9	8.2
Dissolved Oxygen (mg/l)	9	13.4	--	7.5	1.8 (90 ft)	11.1	1.6
pH	8	8.3	--	7.9	7.6 (140 ft)	8.1	0.2
Conductivity (umhos/cm)	8	447.0	518 (70 ft)	347.0	--	409.0	31.0
Alkalinity (mg/l as $CaCO_3$)	9	237.0	238 (134 ft)	172.0	--	186.0	21.0
Nitrite Nitrogen (mg/l)	9	0.013	0.016 (140 ft)	0.0002	0.001 (45 ft)	0.004	0.004
Nitrate Nitrogen (mg/l)	9	0.13	0.29 (140 ft)	0.02	--	0.085	0.04
Ammonia Nitrogen (mg/l)	9	0.11	0.13 (130 ft)	0.04	0.03 (134 ft)	0.076	0.03
Total Nitrogen (mg/l)	9	0.76	0.95 (40 ft)	0.32	0.07 (75 ft)	0.53	0.13
Total Phosphorus (mg/l)	9	0.12	0.14 (140 ft)	0.02	0.01 (45 ft)	0.04	0.03
Turbidity (Jtu)	7	5.1	--	0.9	0.6 (134 ft)	2.1	1.3

[a] All samples summarized were taken at 0 ft (surface); additional samples were taken at various depths and do not lend themselves to tabular form.

water below 121 feet was completely devoid of oxygen, and the water below 46 feet had less than 5.0 mg/l of oxygen. Similar DO levels were found in Williams Bay and Geneva Bay at the same depths sampled in Fontana Bay. DO reached a level of 3.0 mg/l or less below 52 feet in both bays. Sampling results show that DO concentrations down to 46 feet in mid-summer have not decreased since 1966 (the first year data are available for comparison). This fact indicates that the regime in the epilimnion is sufficient to sustain aquatic life.

The phosphorus and nitrogen concentrations in the lake, particularly during the spring and summer seasons, indicate that the nutrient enrichment problem is not as severe in Geneva Lake as it is in many of the other lakes in southeastern Wisconsin (USEPA 1975a). However, concentrations of total phosphorus during the growing season (May - October) are close to or slightly in excess of the threshold concentration of 0.025 mg/l recommended for lakes to prevent the development of biological nuisance (USEPA 1976). In addition, phytoplankton data from the 1976-77 period (GLWEA 1977) indicate that blue-green algae increase in abundance during summer stratification until October, when they constitute approximately 99% of the plankton population. The low diversity of the phytoplankton population in late summer, coupled with the presence of pollution-tolerant zooplankton (GLWEA 1977), provide evidence that the trophic status of Geneva Lake changes from mesotrophic conditions in winter to slightly eutrophic conditions during late summer. The reduction of nutrients, particularly phosphorus, could contribute to slowing down the eutrophication process and maintaining the quality of Geneva Lake.

GLWEA has estimated nutrient loadings to Geneva Lake from various sources (Table 3-9). Atmospheric dustfall and precipitation were estimated to account for 58.7% of the total N load and 42.9% of total P load to the lake. The next largest source was perennial streams, which contributed 32.5% of the N and 38.6% of the P. Intermittent streams, storm sewers, and groundwater seepage were minor contributors (8.8% N and 12.2% P). Most of the phosphorus contributed by the perennial streams was from Buena Vista Creek. This stream contributed 80.3% of the dissolved P and 71.8% of the total P from the perennial streams. Seepage and overflow from the infiltration ponds of the Fontana WWTP appeared to be responsible for the high P concentrations in Buena Vista Creek. The contribution from Buena Vista Creek is important, because much of the P is in the soluble form (93%), which is readily available for aquatic plant and algae growth. This phosphorus source is the single largest manageable source affecting Lake Geneva.

Table 3-9. Estimated nutrient balance for Geneva Lake for various sources and for losses via the White River (GLWEA 1977).

Source	Total Nitrogen lbs/yr	Total Nitrogen % total	Dissolved Phosphorus lbs/yr	Dissolved Phosphorus % total	Total Phosphorus lbs/yr	Total Phosphorus % total
Perennial streams	39,676	32.5	3,160	59.6	3,749	38.6
Intermittent streams	1,314	1.1	219	4.1	252	2.6
Atmosphere	71,757	58.7	1,570	29.6	4,777	49.2
Groundwater seepage	8,719	7.1	224	4.2	672	6.9
Storm sewers	768	0.6	132	2.5	267	2.7
Totals	122,234	100.0	5,305	100	9,717	100
Losses (White River outflow)	11,232	9.2	241	4.5	600	6.1

Other data collected by GLWEA indicate that the organic matter present in Geneva Lake waters is not excessive (i.e., BOD_5 concentrations are low; Table 3-10). In addition, the results of bacterial surveys of various swimming areas and in the mixing zones of perennial streams indicate that Geneva Lake is generally safe for all recreational uses (Table 3-11). Fecal coliform counts in the beach areas have exceeded the permissible state levels (200/100 ml) a few times, although counts frequently exceeded standards for recreational uses within the mixing zone of Hillside and Harris Creeks. The fecal coliform/fecal streptococcus (FC/FS) ratios for tributary streams indicate that occurrences of bacteria were mainly of animal origin (GLWEA 1977). Only a small proportion of the samples demonstrated a predominance of human fecal contamination. The results of a bacteriological monitoring survey conducted in 1979 corroborate this finding (Table 3-12) (K-V Assoc., Inc. 1979).

Table 3-10. Water quality data for various seasons at Fontana Bay, Geneva Lake (GLWEA 1977).

Parameter	Winter (Jan-Feb)	Spring (April-June)	Summer (July-Sept)	Fall (Oct-Dec)
pH	8.2	8.2	8.0	8.1
Chloride (mg/l)	14.4	13.0	13.8	13.9
Specific conductivity (umhos/cm)	379	429	420	410
BOD_5 (mg/l)	1.6	1.2	1.1	1.3
Secchi Disc (ft)	18.0	11.0	9.6	9.8

Lake Como Water Quality

Lake Como water quality was monitored in 1972 as part of the National Eutrophication Survey (USEPA 1975b). Based on that survey, on field observations, and on past studies, USEPA classified Lake Como as eutrophic. The Lake Como management study (Aqua-Tech 1978) also classified the lake as eutrophic based on the Carlson Trophic Status Index (TSI). The median values of Secchi disc transparency, phosphorus, and chlorophyll a had TSIs of 85, 73, and 68, respectively. Generally, values over 50 indicate eutrophic conditions.

The average total phosphorus concentration was high at 0.118 mg/l. Concentrations ranged from 0.04 mg/l to 0.221 mg/l, with the lower phosphorus concentrations occurring in late fall and winter, and the higher concentrations occurring during the summer months. Total nitrogen concentrations were also high, but not atypical for a shallow productive lake ranging from 2 mg/l to 4 mg/l. The high concentrations of phosphorus and nitrogen result in excessive algal growth in the summer months as indicated by the chlorophyll a concentrations, which averaged 50 mg/m^3 in the spring through fall months.

Table 3-11. Monthly average fecal coliform counts at various swimming beaches on Geneva Lake and in the mixing zones of perennial streams (summers of 1975-1977; GLWEA 1977).

Sites	Counts in Colonies/100 ml								
	1975			1976			1977		
	June	July	Aug.	June	July	Aug.	June	July	Aug.
City of Lake Geneva									
East end of beach	20	22	38	10	30	38	28	10	10
Swim pier	14	80	18	20	13	38	10	12	10
West end of beach	14	16	18	18	245	27	12	26	12
Village of Fontana									
North end of beach	432	16	15	12	10	22	65	54	75
Swim pier	16	26	16	16	10	75	176	202	34
South end of beach	12	28	10	14	28	43	58	98	28
Village of Williams Bay									
East end of beach	10	10	10	92	16	10	18	10	10
Swim pier	20	12	14	18	10	10	100	90	10
Harris Creek mixing zone	108	204	30	708	155	210	30	468	62
West end of beach	--	--	--	18	32	10	--	--	13
Linn Township									
Hillside Creek mixing zone	1,308	7,730	7,350	828	1,824	908	594	314	506
Swim area	42	10	10	46	42	113	424	90	12
Swim pier	12	52	24	26	13	23	34	88	106

NOTE: Criteria for Public Swim Beaches as established by the Wisconsin Division of Health: the average of not less than five samples taken within 30 days shall not exceed 200 colonies per 100 ml. Underlined values represent averages that exceeded the criteria for Public Swim Beaches.

Table 3-12. Bacterial content of shoreline water samples of Geneva Lake and Lake Como, Wisconsin (K-V Assoc., Inc. 1979).

Lake	Station	Fecal Coliform (#/100 ml)	Location
Geneva Lake	B1	6	Stream, west shore of Geneva Bay
	B2	700	Stream, northeast shore
	B3	16	Harris Creek, Williams Bay
	B4	2,100	Southwick Creek, Williams Bay
	B5	120	Stormdrain, west side Williams Bay
	B6	1	Stream, Conference Point Camp
	B7	6	Stream, Norman Barr Camp
	B8	1	The Gardens Stream
	B9	93	Buena Vista Creek
	B10	33	Stream, end of road to lake
	B11	1	Abbey Springs Creek
	B12	3	Stream, Dock #519
	B13	81	N.M. & N. Academy Stream
	B14	2	Grunow Rd. Stream, east of Dock #567
	B15	23	Stream, east of Dock #620
	B16	6	Light Body's Creek (Birches)
	B17	3	Stream, east of golf course
	B18	5	Trinke Estates, inside harbor
	B19	1	Drainpipe, west of Dock #780
	B20	600	Stream, west of Dock #793
Lake Como	B21	1	Pipe, House #9, Mars Resort
	B22	10	Stream, House #9, Mars Resort
	B23	1	Stream, A.W. Stack, House #245-7
	B24	1	Drainpipe
	B25	77,000	Drainpipe #800
	B26	1	Stream, east of Dock #91
	B27	1	4 ft conduit, Interlaken property
	B28	1	Marshy area, last house S.E. shore
	B29	240	Como Creek
	B30	3	Drainpipe, between Oak & Pine Rd.
	B31	1	Drainpipe, end of Acacia Rd.
	B32	1	Drainpipe, end of Cherry Rd.
	B33	10	Drainpipe, end of Poplar Rd.
	B34	70	Drainpipe, Como Vista Motel
	B35	1	Ditch, Tamarack Rd.
	B36	120	Stream, Uranus Road
	B37	50	Ditch, between Apricot & Willow Rd.

During summer months the water clarity of Lake Como is very low. Secchi disc measurements in 1976 were only 5 to 9 inches (Aqua-Tech 1978). The turbidity of the lake is attributed to high concentrations of algae and to the suspension of bottom sediments into the water column. The DO concentrations measured during the 1976-77 monitoring program were found to be near saturation level throughout the spring and summer months. These high DO levels result from oxygen generation by plants (photosynthesis) and the continuous mixing of the water column by wind. The DO, however, was depleted in winter, caused by the retardation of air mixing with the water body and the oxygen demand from decaying plant material.

The phosphorus budget for Lake Como that was computed on the basis of the hydrologic and water quality data collected during 1976-77 indicates that surface drainage (runoff) and precipitation/atmospheric fallout contributed 59% and 31% of the phosphorus loading, respectively (WDNR 1977). Small streams flowing into Lake Como were found to have total phosphorus concentrations that ranged as high as 0.987 mg/l, with an average concentration of 0.110 mg/l. Groundwater was estimated to supply only 10% of the phosphorus load, although it is the major source of water into the lake. Test wells located around the lake recorded low levels of phosphorus with average concentrations of 0.035 mg/l in all samples, including those from the Como Beach Subdivision.

In addition to the sources of phosphorus in runoff, the layer of soft sediments 0.7 to 20.25 feet in thickness at the bottom of Lake Como also appears to be a significant contributor of phosphorus. When the lake is not frozen over, these organic bottom sediments are in a constant state of disturbance because of the shallowness of the lake.

In summary, the major water quality problems in Lake Como are excessive algal growth, periodic low DO levels, and turbidity. These conditions are detrimental to the recreational value and fishery resources of the lake. The water quality problems can be attributed to the lake's physical characteristics, excessive amounts of soft sediments at the bottom of the lake, and nutrient loadings from the watershed.

3.1.3.4. Floodplains

The Federal Insurance Agency of the US Department of Housing and Urban Development administers the National Flood Insurance Program in the study area. There are no 100-year floodplains of significance in the study area. Areas identified on a preliminary basis from USGS mapping data as floodplains are limited to lands immediately bordering Como Creek and the White River (US Department of Housing and Urban Development 1977). Revised flood hazard boundary maps (Federal Insurance Rate Maps), prepared from more detailed hydrologic studies, are used by both municipality and county governments to prepare their respective zoning ordinances. Walworth County ordinances for floodplain management were approved in August 1983 (By telephone, Carol Meadows, Walworth County, Department of Planning, Zoning and Sanitation, 9 April 1984). The City of Lake Geneva has updated their ordinances from the Federal Insurance Rate Maps. The city's wastewater treatment plant, located near the White River, does not fall within the boundaries of a designated 100-year floodplain (By telephone, City Clerk's office, City of Lake Geneva, 23 May 1983). Based on the current revised maps, floodplain management provisions are not required for the approval of Federal funds in future treatment plant improvements.

3.1.4. Terrestrial and Aquatic Biota

3.1.4.1. Terrestrial Communities

The Geneva Lake-Lake Como study area occurs in the Maple-Basswood and Oak Savanna Section of the Eastern Deciduous Forest Province (Bailey 1980). This extensive temperate deciduous forest area is dominated by broadleaf trees and is generally characterized by a poorly developed understory. Most deviations from this forest community pattern are the result of man-induced alterations to the landscape.

Vegetation. Eight terrestrial land-cover types were delineated in the Geneva Lake-Lake Como study area from aerial photographs and field surveys conducted during August 1979 (Figure 3-4). The most extensive cover types were agricultural lands, deciduous forests, and wetlands. The following

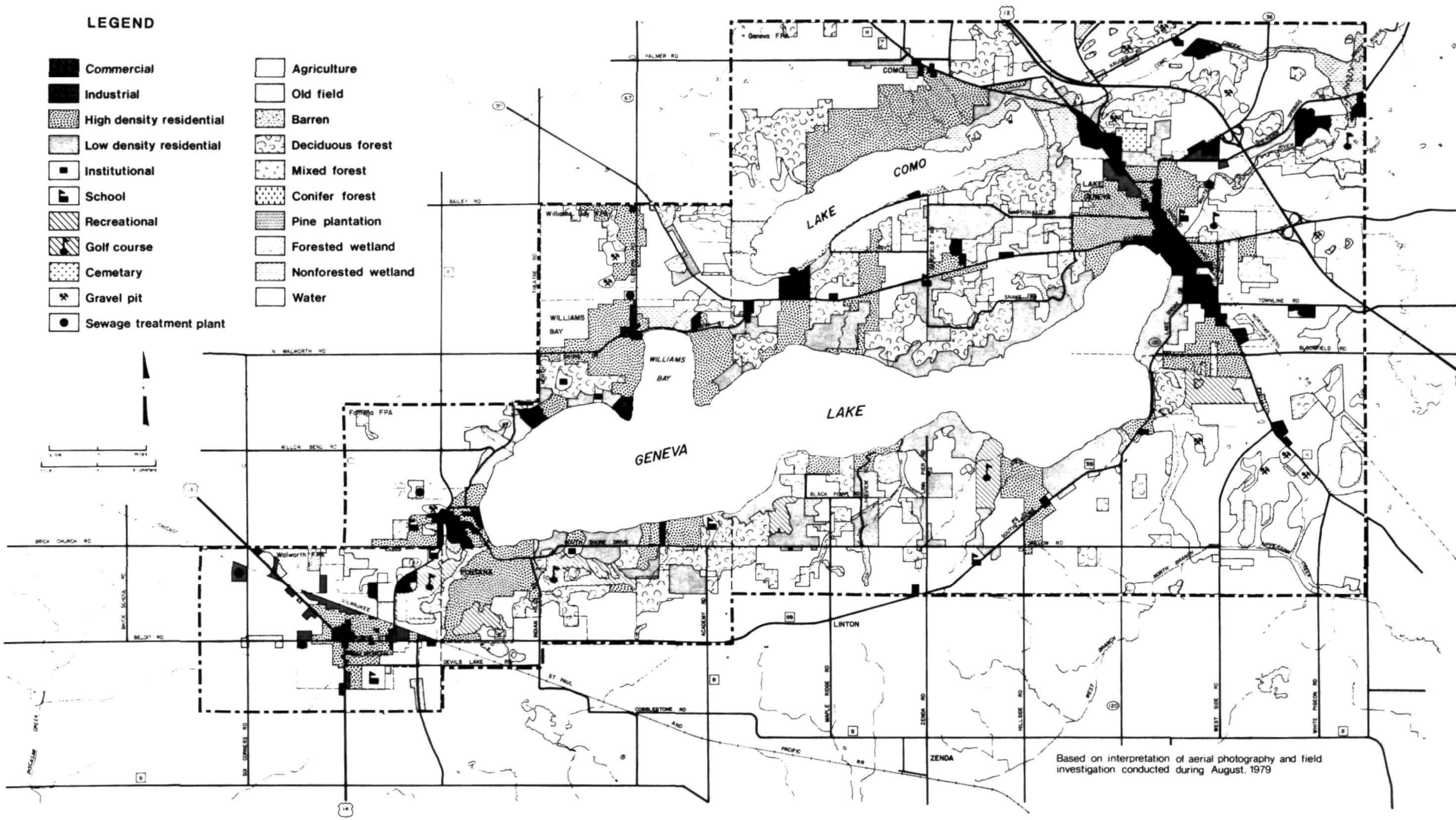


Figure 3-4. Land use/land cover.

narrative contains a brief description of each land-cover type. Since wetlands are important in the study area, they are discussed in greater detail in Section 3.1.4.3.

The two agricultural types, cultivated and noncultivated (old field), comprise approximately 50% of the terrestrial land cover in the study area. Corn (Zea mays) is the predominant crop grown in the study area on cultivated lands. The old-field type is comprised primarily of grasses, weeds, and low shrubs. Both types provide habitat for a variety of ground-inhabiting species of wildlife, and are especially important to the ring-necked pheasant (Phasianus colchicus) and the eastern cottontail rabbit (Sylvilagus floridanus).

Five forested cover types including deciduous (predominantly upland), coniferous, mixed, forested wetland, and pine plantation were delineated in the study area. The deciduous forest type was by far the most extensive (Figure 3-4). Typical overstory species in more upland areas of the deciduous forest included silver maple (Acer saccharinum), sugar maple (A. saccharum), white oak (Quercus alba), northern red oak (Q. rubra), bur oak (Q. macrocarpa), black oak (Q. velutina), shagbark hickory (Carya ovata), basswood (Tilia americana), and white ash (Fraxinus americana). At lower elevations, the maples are still prevalent, but species such as box elder (Acer negundo), green ash (Fraxinus pennsylvanica), American elm (Ulmus americana), cottonwood (Populus deltoides), and black willow (Salix nigra) replace some of the more upland species.

At the lowest elevations, the latter species form the overstory of the forested wetland (lowland forest). Several small stands (generally less than 10 acres) of eastern larch (Larix laricina), also known as tamarack swamps, were the only other forested wetlands in the study area.

Minimal acreages of the remaining forested types occurred in the study area. Several small plantations of coniferous species such as red pine (Pinus resinosa), Norway spruce (Picea abies), and blue spruce (P. pungens) were planted in the study area. Mixed deciduous-coniferous stands were limited.

The major non-forested wetlands in the study area include sedge meadows, fresh (wet) meadows, shrub-carr, and some shallow marshes and fens (SEWRPC 1981, SEWRPC 1983). Sedge meadows are stable communities, provided that water levels remain constant. Sedges (Carex spp.), and Canadian bluejoint grass (Calamagrostis canadensis) are the characteristic species of this wetland type. Sedge meadows that are drained or disturbed to some extent typically succeed to shrub-carr wetlands. Shrub-carr wetlands contain willows (Salix spp.) and red-osier dogwood (Cornus stolonifera) in addition to the sedges and grasses found in the sedge meadows. In extremely disturbed shrub-carr wetlands, the willows, dogwoods, and sedges are replaced by exotic plants such as honeysuckle (Lonicera sp.), buckthorn (Rhamnus sp.), and reed canary grass (Phalaris arundinacea).

Fresh meadows are lowland grass meadows dominated by forbs (broad-leaved flowering plants) such as marsh aster (Aster simplex), red-stem aster (A. puniceus), New England aster (A. novae-angliae), and giant goldenrod (Solidago gigantea).

Several small calcareous fen communities occur within the wetland complexes located in the Village of Fontana and north of the Village of Williams Bay. Fens are specialized plant communities growing on waterlogged organic soils associated with alkaline springs and seepages. Characteristic plants include shrubby cinquefoil (Potentilla fruiticosa), Riddell's goldenrod, grass of Parnassus, white lady's-slipper orchid (Cypripedium candidum), and ladies' tresses orchids (Spiraathes spp.).

The springs associated with the wetland complexes on the west end of Geneva Lake and north of the Village of Williams Bay, are trout spawning springs. To maintain the high quality water in these springs, it is essential that the associated wetlands be maintained in an undisturbed condition (SEWRPC 1981).

Wildlife. All four groups of terrestrial wildlife (amphibians, reptiles, birds, and mammals) are well represented in the study area. Each species is associated with a particular vegetation cover type or land cover, and one or a combination of cover types comprises a given species habitat.

Some 17 species of amphibians and 25 species of reptiles have ranges that include the study area. Typical species include the spotted salamander (Ambystoma maculatum), wood frog (Rana sylvatica), eastern milksnake (Lampropeltis triangulum), and northern redbellied snake (Storeria occipitomaculata).

There have been 107 species of birds sighted in the area around Geneva Lake (WDNR 1973, Ledger 1974). The highest numbers of species were observed in forested vegetation areas. Geneva Lake has a large population of diving ducks in autumn, including the canvasback (Aythya valisineria), and the common goldeneye (Bucephala clangula). Both Geneva Lake and Lake Como provide good nesting areas for the mallard (Anas platyrhynchos), blue-winged teal (A. discors), and marginally, for the wood duck (Aix sponsa) (By telephone, John Wetzel, WDNR, 10 November 1978). The marsh fringes around both lakes, particularly south of Geneva Lake, are good ring-necked pheasant habitat, as are nearby cornfields. The Geneva Lake area has been listed as one of the 90 favorite locations for birding in Wisconsin.

There are 47 species of mammals (including bats) that potentially could occur in the study area (Hamilton and Whitaker 1979). Common species include the opossum (Didelphis virginiana), eastern cottontail rabbit, fox squirrel (Sciurus niger), gray squirrel (S. carolinensis), raccoon (Procyon lotor), muskrat (Ondatra zibethicus), and striped skunk (Mephitis mephitis) (By telephone, John Wetzel, WDNR, 10 November 1978).

Important Wildlife Habitat. Wildlife habitat locations were initally delineated for southeastern Wisconsin in 1963, and were subsequently updated in 1970 for SEWRPC by the Wisconsin Department of Natural Resources. Wildlife habitats considered to be of high value are those that contain a good diversity of wildlife species, are adequate in size to meet all of the habitat requirements for the species concerned, and are generally located in close proximity to other wildlife habitat areas. Wildlife habitat areas of medium value generally lack one of the three aforementioned criteria. Certain low-value habitats may be important if they are located in close proximity to other medium- or high-value wildlife habitat areas, if they provide corridors linking higher value habitat areas, or if they provide the only available habitat in an area. The major factors considered in assigning value ratings to wildlife habitat are diversity, territorial requirements, vegetative composition and structure, proximity to other wildlife habitat areas, and degree of disturbance.

Wildlife habitats were classified further by SEWRPC as deer, pheasant, waterfowl, muskrat-mink, songbirds, squirrel, or mixed habitat. These designations were applied to assist in identifying wildlife habitats according to the extent to which they meet requirements of particular species, and do not imply that the named species is the most important or dominant species in the particular habitat. For example, an area designated as a deer habitat, provides habitat for other wildlife also.

The following areas (vegetation cover/habitat) in the Geneva Lake drainage area were rated for their value by SEWRPC in May 1981 (Figure 3-5). Of the 2,416 acres of wildlife habitat rated, the upland deciduous forest situated in the northeast and southeast portions of the Geneva Lake drainage area was rated as high-quality squirrel and white-tailed deer (*Odocoileus virginianus*) habitat. Other forested areas scattered throughout the drainage basin were considered medium- to low-quality habitat for squirrel, deer, and ring-necked pheasant. Large wetland complexes along the eastern boundary of the drainage basin, north of Williams Bay and west of Walworth, provide high- and medium-quality habitat for ring-necked pheasant, muskrat, and waterfowl.

3.1.4.2. Aquatic Communities

Both lotic (moving water) and lentic (standing water) aquatic communities occur in the study area. Lotic communities, although numerous, are small in size and comprise a small percentage of the overall aquatic habitat. In contrast, lentic communities, primarily Geneva Lake and Lake Como, comprise a large percentage (approximately 30%) of the aquatic habitat in the study area. Data on aquatic biota are available primarily for Geneva Lake and Lake Como.

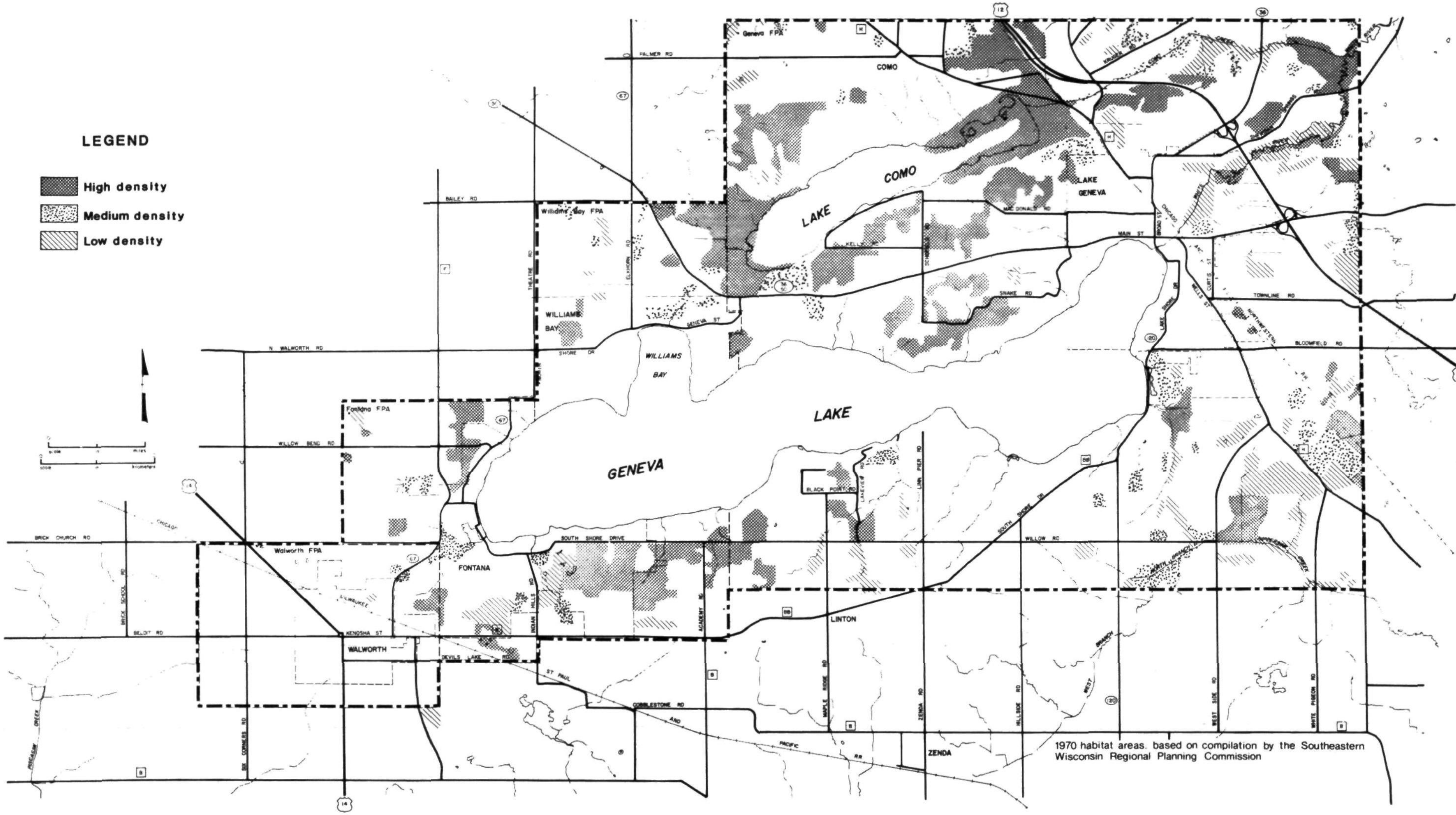


Figure 3-5. Wildlife habitat value.

Aquatic Flora. Phytoplankton are the producers that constitute the primary level in the food chain in virtually all aquatic systems. These predominantly microscopic organisms are food for higher forms such as zooplankton, microinvertebrates, macroinvertebrates, and ultimately fish. Certain phytoplankton, the blue-green algae that include Anabaena spp. and Nostoc spp., were present in particularly high numbers in Geneva Lake. Of the 37 phytoplankton taxa collected from Geneva Lake, 14 species were blue-green algae, 12 were green algae, 10 were diatoms, and 1 was a dinoflagellate.

The shoreline of Geneva Lake is completely developed and was found to be devoid of emergent or floating aquatic vegetation. Among the rooted aquatic species, muskgrass (Chara sp.), was observed in abundance at depths of up to 26 feet during 1967 studies conducted by Belonger (1969). Spiked water milfoil (Myriophyllum exalbescens) was abundant at medium depths, and eel grass (Vallisneria americana) was common in shallows. Other species such as pondweed (Potamogeton spp.) and Naiad (Najas spp.) were observed less frequently.

Lake Como is a shallow body of water (generally less than 8 feet in depth) characterized by an abundance of aquatic plants. The shore zone, in the areas where it is vegetated, is characterized by emergent species such as narrow-leaved cattail (Typha angustifolia) and common rush (Juncus effusus) (WDNR 1975). Offshore areas typically included such species as yellow pond lily (Nuphar variegatum), white water lily (Nymphaea tuberosa), spiked water milfoil, and muskgrass (Aqua-Tech 1978, Belonger 1969). Other species occurring less commonly included coontail (Ceratophyllum demersum) and several species of Potamogeton.

Aquatic Fauna. Zooplankton feed on phytoplankton, and in turn are food for most higher aquatic animals, including fish. Zooplankton data for the study area were available only for Geneva Lake. Some 22 species of zooplankton were collected in the period from May 1976 to May 1977 (GLWEA 1977, Aqua-Tech 1978). The most common groups included copepods and water fleas.

Some 16 species of macroinvertebrates, predominantly bottom-dwelling organisms, were collected from Geneva Lake from May 1976 to May 1977. The groups collected included worms, leeches, insects, snails, and clams. Although snails and clams were the most commonly collected macroinvertebrates, most of the shells collected were empty. The animals that occupied the shells may have been killed by the periodic treatment of the lake with chemicals used to control a waterfowl parasite that causes swimmer's itch.

Because Lake Como is a shallow lake, it is subject to winterkills. Consequently, the fishery in past years has consisted principally of the smaller sizes of sunfish and catfish. In recent years, northern pike (Esox lucius) and yellow perch (Perca flavescens) appear to be growing and reproducing in the lake. Some 20 species of fish are known to occur in Lake Como.

Geneva Lake, because of its size, depth, and good water quality and clarity, supports a high diversity of fish species. Thirty-eight species of fish have been collected. Panfish such as bluegill (Lepomis machrochirus), black crappie (Pomoxis nigromaculatus), white bass (Monrone americana), and rock bass (Ambloplites rupestris) are abundant and receive heavy fishing pressure.

One small river and several creeks occur in the study area. Both Southwick Creek and Harris Creek are considered trout spawning streams by the Wisconsin Department of Natural Resources. These two creeks and Van Sykes Creek are considered the last remaining tributary trout streams to Geneva Lake. Other creeks in the area, such as Bloomfield, Como, Piscasaw, and Williams Bay Creek, do not normally contain game fish, and consequently are managed for forage fish only. The White River is managed for channel catfish (Ictalurus punctatus), northern pike (Esox lucius), and smallmouth bass (Micropterus dolomieui).

The survey of Wisconsin trout streams (Kmiotek 1973) does not list any of the above streams. However, Williams Bay Creek apparently did support trout population in the past.

3.1.4.3. Wetlands

The wetlands discussed in this section are those that have been classified and mapped by the Wisconsin Department of Natural Resources, Bureau of Planning (1979a). The term "wetlands" is used to indicate an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation, and which has soils indicative of wet conditions.

Wetlands have been identified by the Wisconsin DNR and by Wisconsin state law as significant resources requiring protection (WDNR 1980). Each county has been charged with adopting zoning and subdivision regulations for protection of shorelands in unincorporated areas, to include wetlands as identified in the Wisconsin Wetland Inventory (WDNR 1979a).

Five basic classes of wetlands occur in the study area (Figure 3-6). The emergent/wet meadow class, which occurs primarily as emergent macrophytes, sedge meadows, fresh wet meadows, and shallow marshes, is by far the most extensive 60-70%. Wetlands in this class occur primarily in the south-central portion of the study area, west of Lake Petite, at the east end of Geneva Lake and at the east and west ends of Lake Como. Scrub/shrub wetlands (predominantly shrub-carr wetlands) comprise approximtely 20-25% of the wetlands in the study area. The most extensive scrub/shrub wetlands occur at the west end of Lake Como.

Most of the remainder of the wetlands in the study area (approximately 10-15%) are forested. The most extensive forested wetlands occur just north and east of Williams Bay on Geneva Lake, and along the southeast shoreline of Lake Como.

3.1.4.4. Threatened and Endangered Species

No plants or animals that are included on the Federal endangered or threatened species list (50 CFR 17) are known to occur in the study area. Fifteen species that are included on the State list occur, or could occur in the study area (Table 3-13).

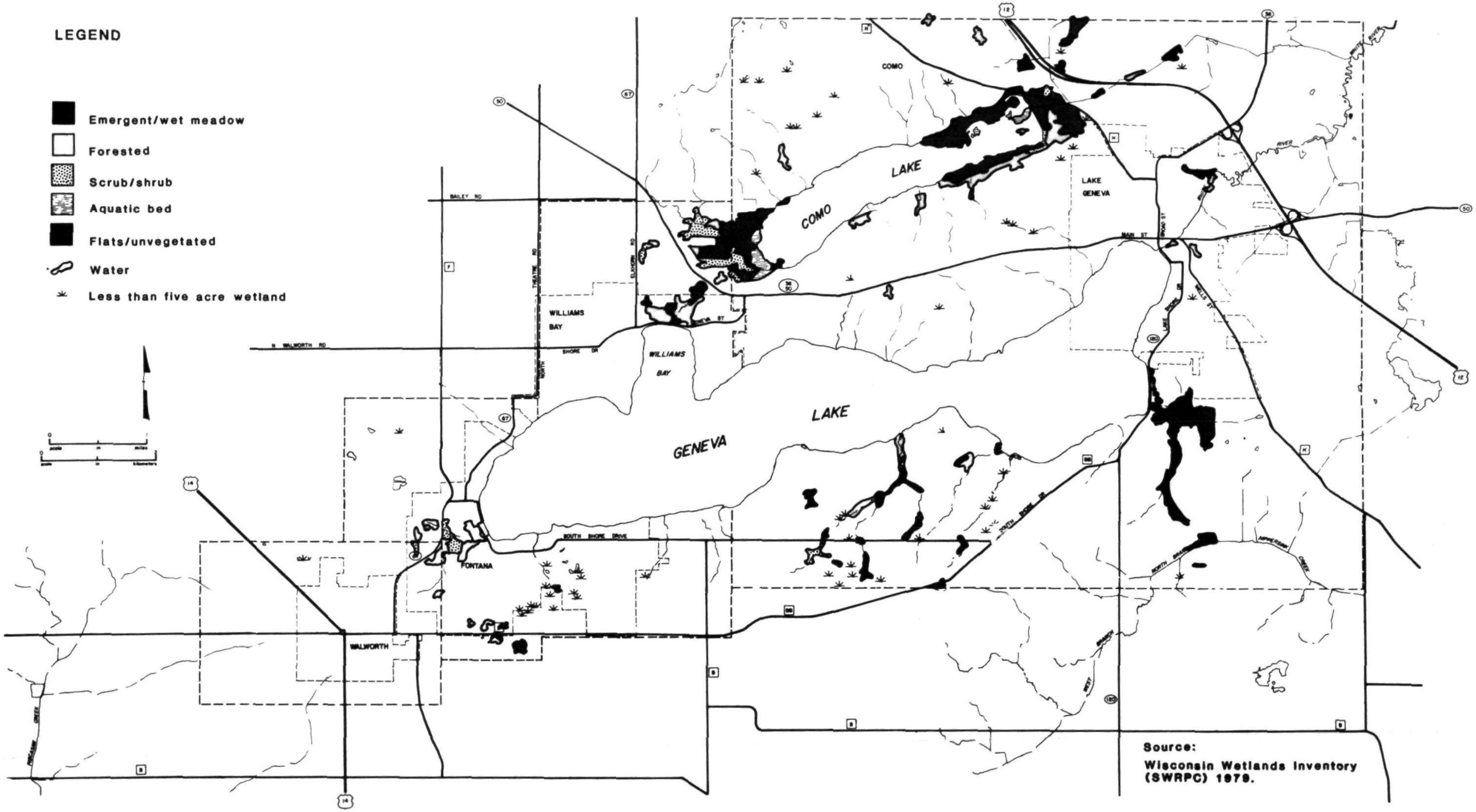


Figure 3-6. Wetlands.

Table 3-13. Plant and bird species listed as threatened or endangered by the State of Wisconsin, and that potentially could occur in the Geneva Lake-Lake Como study area (Wisconsin Statutes, Section 29.415).

Status[a]	Common Name	Scientific Name	Habitat
	PLANTS		
E	Hemlock-parsley	*Conioselinum chinesnse*	Marsh
T	Prairie-parsley	*Polytaenia nuttallii*	Prairie
T	Prairie White-fringed Orchid	*Habenaria leucophaea*	Prairie
E	Spike-rush	*Eleocharis quadrangulata*	Aquatic
E	Stoneroot	*Collinsonia canadensis*	Upland Forest
T	Tuberculed Orchid	*Habenaria flava herbiola*	Prairie
T	White Lady's Slipper Orchid	*Cypripedium candidum*	Marsh, Prairie
T	Purple Coneflower	*Echinacea pauida*	Forested Wetland
T	False Asphodel	*Tofieldia glutinosa*	Fresh Meadow
	BIRDS		
T	Cooper's Hawk	*Accipiter cooperii*	
E	Forster's Tern	*Sterna forsteri*	
E	Common Tern	*Sterna hirundo*	
T	Great Egret	*Casmerodius albus*	
	AMPHIBIANS AND REPTILES		
T	Slender Glass Lizard	*Ophisaurus attenuatus*	
E	Eastern Massasauga	*Sistrurus catenatus*	
T	Spotted Salamander	*Ambystoma maculatum*	
E	Queen Snake	*Regina septemvittata*	
T	Blanding's Turtle	*Emydoidea blandingi*	

[a]E: endangered.
T: threatened.

Four species of plants classified by the State as endangered, and four species classified by the State as threatened (Wisconsin Department of Natural Resources 1976) have ranges that include Walworth County. The white lady's slipper (Cypridium candium) has been collected in the area on the northeastern side of Williams Bay (By telephone, Donald Reed, SEWRPC, 11 September 1979).

Of the 10 species of fish listed by the State as threatened and 7 listed as endangered (WDNR 1979b), none have been collected from Geneva Lake or Lake Como.

Thirteen species of birds (8 endangered and 5 threatened) are listed by the State of Wisconsin (WDNR 1979b). Of these, the four bird species listed in Table 3-13 have been sighted recently in the study area.

Twelve species of amphibians and reptiles are listed by the State as threatened or endangered (WDNR 1979b). Six of these species have ranges that include the study area. The eastern massasauga (Sistrurus catenatus), which is known to occur in the area (By interview, George Knudson, WDNR, 22 December 1978), and the queen snake (Regina septemvittata) are both listed as endangered (WDNR 1979b). The Blandings turtle (Emydoidea blandingi) is likely to occur in the study area (By letter, Donald Reed, SEWPRC, 1981).

The three species of mammals listed by the State as endangered (WDNR 1979b) do not occur in the Geneva Lake-Lake Como study area.

On the basis of known distribution of aquatic animals, one of the species listed by the State is known to occur in the study area. The longear sunfish (Lepomis megalotis), a threatened specie, has been identified in Lake Geneva Town, Section 36 (By letter, Howard S. Druckenmiller, WDNR, to Harlan D. Hirt, USEPA, 16 March 1984).

3.1.4.5. Significant Natural Areas

Significant natural areas were inventoried in several counties in Wisconsin, including Walworth County (Read 1976, Germain et al 1977).

Candidate sites were evaluated on the basis of the following criteria:

- Diversity of plant and animal species and plant communities
- Expected natural area community structure and integrity
- Relative commonness of comparable community types within the inventory area
- Educational value
- Size.

In the above inventory, significant natural areas were classified according to the following system (Read 1976):

1a - Of State Scientific Area quality, not designated

1b - Of State Scientific Area quality, designated

2a - Natural Areas, unprotected; of less natural area significance than state scientific areas because of suspected sustained disturbance factors, excessively small size, etc.

2b - Natural areas, protected; same as 2a but under some assured preservation status

3 - Natural History Areas; areas possessing value as educational areas but with a sufficient history as to preclude special preservation efforts.

Four sites in or near the study area that meet these criteria were designated as significant natural areas (Table 3-14).

Table 3-14. Significant natural areas in or near the Geneva Lake-Lake Como study area (Read 1976a).

Township	Natural Area	Classification	Description
Linn	Wychwood Sanctuary	1a	80+ acres of relatively undisturbed sugar maple - basswood-oak forest
Bloomfield	Tamarack and meadow	3	300+ acres of tamarack bog and shrub-carr; it has been ditched
Lyons	Moelter Marsh	3	Somewhat degraded sedge meadow containing some fen species; portions tending to shrub-carr
Geneva	Warbler Trail Sanctuary	2b (3)	Hiking trail (east shore of Lake Como) thru marshland, shrub-carr

3.2. Man-made Environment

3.2.1. Land Use

3.2.1.1. Existing Land Use

The Geneva Lake-Lake Como study area is composed of approximately 44 square miles (28,201 acres) of land area, of which only a small portion (30%) is developed. The undeveloped land (20,133 acres) is composed mainly of cropland, forest, and wetland (Table 3-15). While the majority of this land is in agricultural production (Figure 3-3), the area also is considered a valuable recreational resource.

Developed land comprises approximately 8,000 acres (28.4%) of the study area, with residential uses predominating in 22% of the study area. Most of this development has been concentrated in the City of Lake Geneva, the Villages of Fontana, Walworth, and Williams Bay, and along the more than 28 miles of lake shoreline. Much of the lakeside residential growth since the turn of the century has occurred as a result of subdividing large lakeside estates into more dense single-family developments. Commercial land uses are concentrated primarily in the City of Lake Geneva and the

Table 3-15. Land use/land cover in the Geneva Lake-Lake Como study area (based on 1979 aerial photographs; SEWRPC).

Land Cover/Land Use	Acres	Percent of Total
Undeveloped Land		
Agriculture	13,393	47.5%
Forest[a]	3,204	11.4%
Wetland[b]	2,045	7.3%
Oldfield	1,063	3.8%
Barren[c]	322	1.1%
Water	104	0.4%
Developed Land		
High-density Residential	3,382	12.0%
Low-density Residential	2,842	10.1%
Commercial	743	2.6%
Golf Courses	716	2.5%
Industrial	230	0.8%
Institutions	111	0.4%
Total Land	28,201	100.0%

[a] Includes pine plantations, deciduous forest, coniferous forest and mixed forest.

[b] Includes forested and non-forested wetlands.

[c] Includes gravel pits.

village centers. Most of the commercial land use in the study area is recreation-related (e.g., restaurants, antique shops, and gift shops). Small industrial developments are located in Lake Geneva and in Walworth adjacent to railroad lines.

3.2.1.2. Development Controls

Development in Walworth County is governed by regulations and ordinances enacted at the County and municipal levels. The Walworth County Zoning Ordinance (1971) regulates development in the unincorporated areas of the County. An important feature of this zoning ordinance is the minimum lot size allowed for new and existing development. For existing developments, a minimum lot size of 10,000 square feet is required for areas not served by sewers and 5,000 square feet for areas that are sewered. For new developments, sewered lots must be at least 15,000 square feet and unsewered lots must be at least 20,000 square feet. Unsewered lot sizes smaller than these will not be eligible for septic system permits.

A shoreline ordinance was enacted by the County in 1974 to control development along the shoreline of unincorporated areas. The ordinance defines "shoreline" as "land within 1,000 feet of the high-water levels of lakes, ponds, and flowages and within 300 feet of navigable streams." The ordinance governs shoreline land use, water and air quality, and structural development, and authorizes the creation of:

- Agricultural Districts
- Conservation Districts
- Park Districts
- Residential Districts
- Business Districts and
- Industrial Districts.

The Walworth County Board of Supervisors approved an Agricultural Preservation Plan in 1978 to implement plans and policies regarding the use of farmland and open-space in the County. To enforce this plan, the County amended its zoning ordinance in 1974 to include an A-1 exclusive agricultural-use zoning district. Agricultural preservation also is encouraged under a state tax incentive program, which allows 60% of the agricultural real estate taxes to be deducted from the Wisconsin State Tax.

Lake Geneva, Fontana, and Williams Bay have adopted individual development ordinances in addition to zoning ordinances. The Village of Williams Bay also adopted a lakefront master plan and a land use ordinance. The land use ordinance was designed to regulate excavation and the removal of vegetation that may cause erosion and increased sedimentation to surface waters.

The Village of Fontana has adopted an estate zoning ordinance. This ordinance restricts the subdivision of lakefront property in order to prevent higher density use that cannot be accommodated by existing infrastructures. Many of the subdivisions located in the study area were once large estates.

3.2.1.3. Future Land Use Trends

Future development activity in the study area will most likely be composed primarily of residential, and to a lesser extent, commercial land uses. Although residential development is currently occurring at a very slow pace, the potential exists for increases in the rate of development, since the area is well known as a recreational and retirement site. The natural increase in the permanent population of the study area will also create additional demand for residential development.

Future commercial development, primarily in service-related businesses, can be expected as the population of the study area grows. This commercial development will likely remain concentrated in the incorporated areas and along the major access roads. Additional commercial resort developments may be anticipated, although such development would not be expected in the short term.

Industrial land use will continue to be minor in the study area. The three industrial parks that presently exist there should be able to accommodate any additional industrial development.

3.2.2. Population

The demographic and economic analyses conducted for this EIS describe three geographic delineations: the sewer service areas (SSA), the revised sewer service areas (RSSA), and the socioeconomic area. SEWRPC population data and population projections have been analyzed and are presented for the SSAs and RSSAs. US Census data on population trends, demographic characteristics, housing, and economic and fiscal parameters have been analyzed and are presented for the socioeconomic area. The SSA and RSSA boundaries are described in Section 1.1. (Figure 1-2). The socioeconomic area includes the SSAs and RSSAs and all of the seven minor civil divisions (MCDs) which they encompass (the City of Lake Geneva, the Villages of Fontana, Walworth, and Williams Bay, and the Towns of Geneva, Linn, and Walworth). Census data are not available at the SSA and RSSA level because they are composed of portions of one or more of the MCDs.

The Geneva Lake-Lake Como study area is an established recreational area with a population that is composed of permanent residents, seasonal residents, and transient residents. The US Bureau of the Census collects data on the year-round or permanent residents only. Seasonal residents are those who maintain second homes in the area and reside there for only a portion of the year (usually summer). An additional segment, transients, includes tourists who stay for a brief period at the area's many camps, resorts, motels, and campgrounds. Seasonal and transient residents are not counted by the census and must, therefore, be estimated using techniques described below.

3.2.2.1. Population Trends

Permanent Population

The present-day demography of the Geneva Lake-Lake Como area has been heavily influenced by the settlement patterns which evolved during the 1870s. In 1870, when the population of the area was approximately 1,000, the first lakeshore residents began surveying the area for homesites (Wolfmeyer and Gage 1976). In July 1871 the first direct train from Chicago arrived, bringing hundreds of seasonal summer visitors. During the hundred-year period from 1870 to 1970, the permanent population growth of the area varied widely, but generally was more rapid than in the state and nation (Appendix G of the Draft EIS). Much of this growth reflected the rapid expansion of the local economy in response to the demand for recreation-related faciliities and services. During the period from 1940 to 1970, population growth in the study area was consistently more rapid than in the state and nation. A comparison of the percentage increase in the Socioeconomic area (84.9%) to the increases in the state (40.8%) and nation (53.8%) indicates that this growth occurred at an accelerated rate. This rapid growth contrasted markedly with statistics for rural areas nationwide, in which the population declined by 5.9%. This contrast reflects the growing local economy and diverse employment opportunities between 1940 and 1970, and the fact that, because the study area is within commuting distance of six major employment centers, it became a "residential extension" of these areas. In addition, the area was and continues to be a popular resort and retirement area.

The socioeconomic area, Walworth County, and the State of Wisconsin have exhibited declining growth rates since 1950, and population growth continued to moderate during the decade from 1970 to 1980. During this period, the socioeconomic area grew by only 11.4%. This moderate overall growth does not reflect the rapid growth that occurred in Fontana (20.5%) nor the population decline that occurred in the Village of Walworth (-1.8%). The population increases in Lake Geneva, Williams Bay, and Geneva, Linn, and Walworth Towns were 14.7%, 13.4%, 12.7%, 7.5%, and 5.3%, respectively.

The current (1980) permanent population of the Socioeconomic Area is 18,170. The largest incorporated area is the City of Lake Geneva, which has a population of 5,607 people. Each of the three villages has a population of under 2,000 persons. Geneva Town had a 1980 population of 3,933 persons while Linn and Walworth Towns had 2,053 and 1,443 residents, respectively.

Seasonal Population

Data on past trends in the area's seasonal population are not available. Local officials, however, estimate that between 100,000 and 110,000 visitors come to the Geneva Lake vicinity on an annual basis (By telephone, George Hennerly, Director, Lake Geneva Hotel/Motel Assn., 6 November 1980). During June, July, and August, approximately 78,000 people visit the area. The influx of visitors reaches a peak during the 4th of July weekend.

3.2.2.2. Base-Year Population

Base-year 1980 permanent and seasonal population estimates have been prepared for each of the SSAs and for the sewered and unsewered portions of the RSSAs. These estimates are based on 1980 census data compiled by SEWRPC by quarter section for the SSAs. The SEWRPC/Census data only provide information on the number of permanent residents and housing units by type and occupancy status. Therefore, 1980 seasonal population estimates have been prepared by WAPORA from SEWRPC disaggregations of 1980 seasonal dwelling unit counts. A list of the sections enumerated by WAPORA by RSSA, and the methodology used to derive these population estimates, are presented in Appendix G of the Draft EIS.

Permanent Population

In 1980 the permanent population residing in the five RSSAs was 13,338 (Table 3-16). The population residing in the sewered and unsewered portions of the RSSAs was 11,051 (83%) and 2,287 (17%), respectively. Sixty percent of the population residing in the unsewered portions was located in the Lake Como RSSA (where there currently are no sewers). Overall, the RSSAs contain 89% of the permanent population residing in the SEWRPC-delineated SSAs and 17% of the Walworth County population. The Lake Geneva RSSA has the largest permanent population (6,395) followed by Williams Bay, Fontana, Walworth, and Lake Como.

Table 3-16. Base-year population estimates for the RSSAs in the Geneva Lake-Lake Como study area (See Appendix G of the Draft EIS for methodology).

Area	Base-Year 1980: Permanent: Housing Units	Permanent: Population	Seasonal: Housing Units	Seasonal: Population	Peak: Population	Peak: Percentage Permanent	Peak: Percentage Seasonal
063 Fontana							
SSA	724	1,953	1,136	3,408	5,361	36%	64%
RSSA	718	1,920	1,114	3,342	5,262	36	64
Sewered	630	1,688	952	2,856	4,544	37	63
Unsewered	88	232	162	486	718	34	66
066 Walworth							
SSA	659	1,693	30	90	1,783	95%	5%
RSSA	659	1,693	30	90	1,783	95	5
Sewered	621	1,555	28	84	1,639	95	5
Unsewered	38	138	2	6	144	96	4
067 Williams Bay							
SSA	995	2,407	934	2,802	5,209	46%	54%
RSSA	783	1,951	754	2,262	4,213	46	54
Sewered	709	1,759	637	1,911	3,670	48	52
Unsewered	74	192	117	351	543	45	65

Table 3-16. Base-year population estimates for the RSSAs in the Geneva Lake-Lake Como Study area (See Appendix G of the Draft EIS for methodology) (concluded).

	Base-Year 1980						
	Permanent		Seasonal		Peak		
						Percentage	
Area	Housing Units	Population	Housing Units	Population	Population	Permanent	Seasonal
908 Lake Como							
SSA	536	1,379	448	1,344	2,723	51%	49%
RSSA	536	1,379	448	1,344	2,723	51	49
Sewered	0	0	0	0	0	0	0
Unsewered	536	1,379	448	1,344	2,723	51	49
059 Lake Geneva							
SSA	3,093	7,586	1,386	4,158	11,744	65%	35%
RSSA	2,667	6,395	661	1,983	8,378	76	24
Sewered	2,551	6,049	477	1,431	7,480	81	19
Unsewered	116	346	184	552	898	39	61
Combined Total							
SSA	5,967	15,018	3,934	11,802	26,820	56%	44%
RSSA	5,363	13,338	3,007	9,021	22,359	60	40
Sewered	4,511	11,051	2,094	6,282	17,333	64	36
Unsewered	852	2,287	913	2,739	5,026	46	54

Seasonal Population

The 1980 estimated seasonal population residing in the five RSSAs is 9,021 (Table 3-16). Approximately 6,282 persons or 70% of the seasonal population, reside in the sewered portions of the RSSAs and 2,739 or 30% resides in the unsewered portions. Overall, the RSSAs contain 76% of the estimated seasonal population residing in the SSAs. The Fontana RSSA has the largest seasonal population (3,342), followed by Williams Bay, Lake Geneva, Lake Como, and Walworth.

Transient Population

The population analysis for the Geneva Lake-Lake Como study area must include the seasonal transient population: visitors staying in hotels, motels, camps, and campgrounds. In 1980, this seasonal transient population was estimated to be 4869 persons within the RSSA boundaries. The present EIS estimates that this number will not increase significantly during the planning period. This assumption is based on the fact that no new facilities have been constructed recently within the RSSAs, and no plans for the development of such facilities in the future are known.

Table 3-17. Estimated seasonal transient population in the Revised Sewer Service Areas for 1980.

Revised Sewer Service Area	Resort, Hotel, Motel[a]	Camps, Campgrounds[b]
Lake Como (908)	NA	0
Lake Geneva (059)	907	1138
Williams Bay (067)	92	1570
Fontana (063)	858	254
Walworth (066)	42	50
Total	1907	2962

NA - Not Available

[a] Data on the number of units collected by telephone interviews with resort owners during August 1979. An occupancy rate of 2.51 persons per unit was used to determine population.

[b] Maximum accommodations obtained by telephone interviews with campground officials during August 1979.

Peak Population

The 1980 estimated peak population residing in the five RSSAs is 22,359 (Table 3-16). The peak population represents the combined permanent and seasonal populations. The population residing in the sewered and unsewered portions is 17,333 (78%) and 5,026 (22%), respectively. Overall, 60% of the peak population resides in the RSSAs on a permanent basis, and 40% on a seasonal basis. However, this permanent/seasonal split is skewed because of the large permanent population in the Lake Geneva RSSA. The permanent/seasonal population by RSSA is shown below:

RSSA	Percent Permanent	Percent Seasonal
Walworth	95	5
Lake Geneva	76	24
Lake Como	51	49
Williams Bay	46	54
Fontana	36	64
Overall	60	40

The Lake Geneva RSSA has the largest peak population, followed by Fontana, Williams Bay, Lake Como, and Walworth.

3.2.2.3. Population Projections

Accuracy in the development of population projections is directly related to the size of the base population, the time period for which the projections are made, and the availability of data from which trends can be analyzed. Population projections for small populations over long periods of time are generally less accurate than for larger populations over the same period of time. Attitudinal or technological changes can significantly affect small communities, whereas larger communities are better able to absorb such changes.

Both permanent and seasonal population projections have been prepared for the Geneva Lake-Lake Como Revised Sewer Service Areas for the year 2005. The following sections indicate the future population levels projected for these areas and explain the methodology used to develop the projections.

Design-Year (2005) Population Projections

SEWRPC has prepared official population projections for each of the five Geneva Lake-Lake Como Sewer Service Areas for 1985 and 2000. The SEWRPC projections are based in part upon adopted areawide land use development objectives. The projections are actually, therefore, recommended population levels (population allocations) that are controlled at the County level. According to SEWRPC officials, "The ultimate reliability of such normative population allocations is dependent, in part, upon the degree to which local units and private developers choose to implement regional plan recommendations." (By letter, Thomas D. Patterson, Chief, Planning Research Division, SEWRPC 1 April 1981). A description of the methodology used by SEWRPC to allocate population growth to subareas is contained in Appendix G of the Draft EIS. Importantly, the population allocations were not developed by means of a quantitative methodology (e.g., component or noncomponent), but rather by using a land-holding-capacity type of analysis. The result is that population is allocated to all of the developable land regardless of its year-round or seasonal occupancy status. In addition, SEWRPC subtracted the area covered by existing urban development as of 1975, and used US Census data to determine the base population. Because the US Census enumerates permanent population only, the seasonal population was not counted as part of the base population. The SEWRPC population allocations thus account for future levels of both permanent and seasonal population, but do not account for the existing seasonal population.

Because RSSAs that will receive sewer service are smaller geographically than the SSAs (for which SEWRPC developed future population levels), projections of population size within the RSSAs had to be prepared. The basic methodology utilized to prepare the year 2005 population projections involved using the ratio of 1980 SSA population to 1980 RSSA population, applying that ratio to the year 2000 population projections, and then extrapolating to the year 2005. This method was not used to project the population within the boundaries of the Villages of Fontana, Walworth, and Williams Bay, however. Officials of these Villages were concerned that the SEWRPC projections were too high, and therefore the Village Boards of the respective municipalities decided that population increases of 500 persons over the 1980 census population for Walworth and Fontana, and of 1,000 persons over the 1980 census population of Williams Bay, would be used for the year 2005 projections. These Villages have applied to SEWRPC to amend the 208 Plan to reflect these changes. In addition, the 1980 existing seasonal population was added to the projected population level to yield a design-year, peak population level.

The estimated design-year, peak population level developed during the course of this EIS is 31,229 (Table 3-18). (No attempt has been made to differentiate between permanent and seasonal population). The net increase in population over the 25-year period from 1980 to 2005 is 8,870, a 38.8% increase. The average annual increase is 347, or 1.5%. The sewered portions of the RSSAs are projected to increase by 40.9% and the unsewered portions are projected to increase by 31.9%. However, these figures are skewed by the large population base in the Lake Geneva RSSA, where sewered areas are projected to increase 58.8% and unsewered areas are projected to increase by only 27.9%. The reverse situation occurs in the four other RSSAs. The Lake Geneva RSSA is projected to remain the most populated, and also to experience the most rapid growth (55.5% over the planning period). The Lake Geneva RSSA will account for 53.5% of the new growth in the RSSAs. The Walworth RSSA also is projected to experience rapid population growth, 46.8%, although it will remain the smallest RSSA. The Lake Como RSSA is projected to increase from 2,723 to 3,374. This net increase of 651 is the smallest projected increase of the five RSSAs. The Fontana RSSA is projected to experience an increase of 1,084, or 20.6%. The Williams Bay RSSA is projected to experience an increase of 1,649, or 39.1%. Overall, the projected increase in the RSSAs is slightly higher than past trends would indicate (especially given that population growth in the area has slowed since 1950). It is also higher than the national average annual increase of 0.9% projected for the same period (By telephone, Information Specialist, US Bureau of the Census, 11 July 1983).

Donohue & Associates, the facilities planner, also developed population projections for the RSSAs through the year 2005 and for the SSAs through the year 2030. These projections are also based on SEWRPC data which have been extrapolated by means of straight-line projection. These projections are shown in Table 3-19.

Table 3-18. Design-year population estimates for the RSSAs in the Geneva Lake-Lake Como study area (See Appendix G of the Draft EIS for methodology).

Area	Design-Year 2005		Population Change 1980-2005	
	Housing Units	Population	Net	Percentage
063 Fontana				
SSA	2,853	8,045	2,684	50.1
RSSA	2,238	6,346	1,084	20.6
Sewered	1,867	5,309	765	16.8
Unsewered	371	1,037	319	44.4
066 Walworth				
SSA	1,570	4,048	2,265	127.0
RSSA	1,017	2,618	835	46.8
Sewered	919	2,320	681	41.5
Unsewered	98	298	154	106.9
067 Williams Bay				
SSA	3,026	8,075	2,866	55.0
RSSA	2,139	5,862	1,649	39.1
Sewered	1,861	4,909	1,239	33.8
Unsewered	278	953	410	75.5
908 Lake Como				
SSA	1,238	3,374	651	23.9
RSSA	1,238	3,374	651	23.9
Sewered	0	0	0	0
Unsewered	1,238	3,374	651	23.9
059 Lake Geneva				
SSA	6,734	17,261	5,517	47.0
RSSA	5,326	13,029	4,651	55.5
Sewered	4,942	11,880	4,400	58.8
Unsewered	384	1,149	251	27.9
Totals				
SSA	15,421	40,803	13,983	34.3
RSSA	11,958	31,229	8,870	38.8
Sewered	9,589	24,418	7,085	40.9
Unsewered	2,369	6,811	1,785	31.9

Table 3-19. Population projections for 2005 and 2030 (Appendix I; Donohue & Associates, Inc. 1983).

Area	2005 Population		2030 Permanent Population
	Permanent	Seasonal[a]	
063 Fontana			
SSA	2,541	3,944	6,800
RSSA	2,300	3,570	NA[b]
066 Walworth			
SSA	2,246	2,246	4,850
RSSA	2,207	2,207	NA
067 Williams Bay			
SSA	4,305	7,461	7,375
RSSA	3,420	5,927	NA
908 Lake Como			
SSA	1,970	3,365	2,190
RSSA	1,970	3,365	NA
059 Lake Geneva			
SSA	12,483	19,218	15,600
RSSA	11,530	17,750	NA

[a] Although Donohue lists this figure as seasonal, this is actually the peak population.

[b] NA - Not Available.

3.2.3. Socioeconomic Characteristics

3.2.3.1. Demographic Characteristics

The 1980 demographic characteristics of the socioeconomic area's population are described in this section in terms of age, race, and household size. These data are compared to similar data from 1970, and with the overall characteristics of Walworth County and Wisconsin (Table 3-20). In general, the population of the socioeconomic area is older, has fewer persons per household, and is characterized by fewer racial minorities than that of Walworth County and Wisconsin.

Table 3-20. Selected demographic characteristics, 1970 and 1980 (US Bureau of the Census 1973, 1982a).

	Population		Percentage Change	% Non-White		Median Age		% 18 Years of Age		% 65 + Year		Persons Per Household	
	1970	1980	1970-1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
Fontana	1,464	1,764	20.5	0.3	0.9	33.4	35.0	34.0	26.0	13.2	13.8	3.03	2.68
Lake Geneva	4,890	5,607	14.7	0.2	3.7	32.5	32.9	30.9	23.3	15.0	16.5	2.81	2.36
Walworth	1,637	1,607	-1.8	0.1	2.2	31.9	33.2	33.4	25.2	13.8	17.1	3.02	2.51
Williams Bay	1,554	1,763	13.4	0.2	0.9	32.6	35.3	32.0	24.4	16.1	17.8	2.89	2.49
Geneva Town	3,490	3,933	12.7	1.6	2.2	34.5	37.2	29.9	24.7	19.3	20.1	3.15	3.32
Linn Town	1,910	2,053	7.5	0.4	1.3	32.3	34.1	33.4	28.7	11.9	14.9	3.07	2.78
Walworth Town	1,370	1,443	5.3	0.3	0.7	28.1	31.7	36.1	29.9	7.2	10.7	3.43	3.38
Walworth County	63,444	71,507	12.7	2.7	2.3	26.4	29.6	33.1	26.0	11.7	12.8		2.88
Wisconsin	4,417,731	4,705,767	6.5	3.6	5.6	27.2	29.4	35.8	28.9	10.7	7.0	3.22	2.54

Age

Median age is an index of the overall age of a population. The median age of the population of each MCD in the socioeconomic area, as well as in Walworth County and in Wisconsin, increased from 1970 to 1980. This increase in median age follows a nationwide trend resulting from declining fertility rates since the mid 1960s. Overall, the median age of the Socioeconomic Area population is much higher (2 to 5 years) than those of the County and State.

Another measure of the age characteristics of the population is the percentage that is less than 18 years old and 65 years old or more. Since 1970, the percentage of the population that is less than 18 has declined and the percentage over 65 has increased in the socioeconomic area. This trend is also reflected in the age characteristics of Walworth County. At the State level, however, the percentage of persons 65 or older decreased from 1970 to 1980. In combination, these two age groups are referred to as the "dependent population," because they generally are dependent on the earnings of persons aged 18 to 64 years. The dependent population in each of the MCDs in the socioeconomic area is larger (proportionately) than in Walworth County and the State.

Generally, the population of the socioeconomic area can be described as one that is maturing at a rate greater than those of Walworth County and the State. This trend may be attributed in part to a lack of job opportunities for younger residents, and the growing number of retired residents in the area. This trend is particularly significant in the Geneva Lake-Lake Como area, because persons 65 years and older are generally on fixed incomes, and may therefore have difficulty financing their share of improved wastewater treatment facilities or other community improvement projects.

Race

Non-white individuals in the socioeconomic area, Walworth County, and Wisconsin, represent only a small portion of the population. Although the number of non-white residents increased during the 1970s, the socioeconomic area still has a lower proportion of residents in this group than do either the County or the State. In general, non-whites account for less than 3% of the total population of the socioeconomic area.

Household Size

Following the national trends in smaller household size, the number of persons per household in the MCDs in the socioeconomic area has also declined. With the exception of Geneva and Walworth Towns, household size is smaller than County and State averages. This decline in household size also coincides with the more mature average age of the population.

3.2.3.2. Housing

In 1980, a total of 8,694 year-round housing units were counted by the Bureau of the Census in the socioeconomic area (Table 3-21). This represents an increase of approximately 500 units since 1970. Units occupied on a year-round basis account for 77% (6,735) of the total units. Of the remaining units 1353 (15%) were classified as held for occasional use, and 606 units as vacant for sale or rent. Most of the units that were occupied on a year-round basis were owned by the occupants, and only 31% of these units were occupied by renters.

The predominant type of housing unit in the socioeconomic area is the single-family detached dwelling, although condominiums, multi-family units, and mobile home units are present. The 1980 Census counted 755 condominium units in the Socioeconomic area primarily in Fontana (248), Lake Geneva (116), and Williams Bay (90). Single-family dwellings comprise 77% of the housing units occupied on a year-round basis. Approximately 22% of the units occupied year-round occur in multi-family dwellings, and less than 1% are mobile home units.

The number of persons per occupied dwelling unit in the socioeconomic area has decreased from 3.16 in 1970 to 2.71 in 1980. This decrease follows the national trend of fewer children per family and larger numbers of

Table 3-21. Characteristics of the housing stock in the socioeconomic area, 1980 (US Bureau of the Census 1982b).

	Total Year-Round Units	Occupied Units	Type of Year-Round			Persons/ Unit	Median Value of Noncondominium Owner-Occupied Units
			Single-Family	Multi-Family	Mobile Home		
Fontana	958	657	702	256	0	2.68	$66,600
Lake Geneva	2,558	2,380	1,600	948	10	2.34	52,900
Walworth	664	640	491	173	0	2.51	47,000
Williams Bay	1,157	707	897	259	1	2.45	58,400
Geneva Town	1,309	1,185	1,148	126	35	2.83	50,600
Linn Town	1,602	739	1,450	147	5	2.76	64,000
Walworth Town	446	427	398	36	14	3.10	60,600
Total	8,694	6,735	6,686	1,945	65	2.71	NA
1970 Total	8,196	5,163	5,553	NA	NA	3.16	NA

NA - Not available.

older persons. This trend may also be indicative of an increased population of retired persons within the socioeconomic area.

The median value of owner-occupied noncondominium housing units in the socioeconomic area ranged from $47,000 in Walworth to $66,000 in Fontana. The State and County values were exceeded in each of the MCDs except Walworth and Geneva Town.

Most of the new housing unit construction during the past decade has involved single-family homes and condominiums. Between 1971 and 1978, an average of 60 housing unit construction permits were issued annually in the socioeconomic area (Table 3-22). However, a sharp decline in housing construction began in 1979 and continues to the present. This decrease in housing construction has been caused in part by the high interest rates for mortgages and by high gasoline prices, which could serve to deter potential seasonal homeowners.

Another trend in housing in the socioeconomic area has been the conversion of seasonal homes to permanent residences. Seasonal homeowners often purchase their second home with the intention of living in it permanently after retirement. Many second homes have been weatherized to make them habitable on a year-round basis (By letter, M. Hollisters, Bob Keefe and Associates, 7 December 1978).

3.2.4. Economics

Employment data for the period 1971 to 1976 are available for Walworth County and Wisconsin from the Regional Economic Information System of the U.S. Bureau of Economic Analysis. County-level employment data are useful for the study of trends that affect the study area, since they include the 20-mile to 25-mile radius within which most commuting to work occurs. Employment data have been analyzed also for the seven MCDs in the socioeconomic area in 1979. These data have proved useful for the study of local economic characteristics.

Table 3-22. Single family housing construction permits issued in revised sewer service areas 1970-1982.

Town	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979[a]	1980[a]	1981	1982[b]
Geneva	14	37	30	26	16	22	19	24	30	12	7	4	2
Linn	5	27	19	28	18	22	23	44	31	20	9	7	8
Walworth	10	12	8	14	10	12	7	7	10	4	2	1	0
Total	29	76	57	68	44	56	49	75	61	36	18	12	10

[a]May include permits not in RSSAs.

[b]Through September.

3.2.4.1. Employment Trends in Walworth County

Employment data for Walworth County indicate that moderate growth occurred from 1971 to 1976 (Table 3-23). The increase of 6.1% in total employment was below the statewide increase of 10.4%. The moderate growth in total employment reflects decreased employment in manufacturing (-0.6%), farming (-7.4%), and construction (-0.2%), which offset employment increases in wholesale trade (126.8%), retail trade (13.2%); finance, insurance, and real estate (30.2%), agriculture (10.3%), government (7.4%), and hospitality-recreation-tourism (7.1%). Growth in the wholesale trade, retail trade, and government categories accounted for 79% of the total employment growth in the County.

Sector Analysis

Employment can be divided between two economic sectors: the basic sector and the non-basic, or service sector. The basic sector produces goods and services for export to other areas. The specific components of the basic sector may vary with locale, but usually include employment in agriculture, mining, and manufacturing. Although tourism services are not exported, they are considered basic in this analysis because local consumption is attributed to non-residents. The income generated by the basic sector circulates within the local economy and supports service sector industries that provide goods and services for local consumption.

Economic and population trends are directly related to employment opportunities in the basic sector. The ratio of total employment (basic and service sector employment) to basic employment, usually referred to as a multiplier, quantitatively describes this relationship. Specifically, the ratio indicates the total number of jobs generated by each job in the basic sector.

Basic Sector

In 1976, the manufacturing industries accounted for 46% of the employment in the basic sector. The manufacture of durable goods, including

Table 3-23. Walworth County employment trends, by sector, in 1971 and 1976 (US Bureau of Economic Analysis 1978).

Category	1971	1976	Percentage Change 1971-1976
Total employment	25,833	27,413	6.1
Farm proprietors	1,566	1,450	-7.4
Non-farm proprietors	2,134	2,256	5.7
Wage and salary	22,133	23,707	7.1
Basic			
Agriculture[a]	2,473	2,727	10.3
Mining[b]	--	20	--
Manufacturing	5,632	5,596	-0.6
Hospitality-Recreation-Tourism[c]	3,448	3,692	7.1
Non-basic (service)	14,280	15,378	7.6
Multipliers			
Basic Service[d]	1.2	1.3	
Basic Total[e]	2.2	2.3	
Basic Population[f]	5.5	5.5	
Labor force	27,700[g]	31,100	12.3
Employed	26,600	29,500	10.9
Unemployed	1,040	1,600	53.8
Unemployment rate	3.8%	5.2%	

[a]Includes farm proprietors, farm wage and salary employers, agricultural services, forestry, fisheries, and other.

[b]Mining employment was not disclosed in 1971.

[c]Hospitality-Recreation-Tourism consists of 47.6% of employment in retail trade, and 38.0% of employment in services (Cooper and Beier 1979a,b).

[d]Indicates number of service jobs generated by 1 basic job.

[e]Indicates number of total jobs generated by 1 basic job.

[f]Indicates number of people supported by 1 basic job.

[g]Apparent error due to rounding.

stainless steel and alloy tubing, farm equipment, and musical instruments, accounted for approximately 75% of the manufacturing employment in the County. Despite the employment loss that occurred between 1971 and 1976, which reflected the nationwide recession during 1974 and 1975, future expansion in this sector is expected (SEWRPC 1978).

The agricultural sector employed 2,727 people in 1976, which represented 23% of the basic employment sector. Dairy farming is the traditional form of agriculture in Walworth County, although the cultivation of row crops appears to be increasing (Wisconsin Department of Business Development n.d.). Although Walworth County is one of the richest farming counties in the State, employment in this sector is expected to decline by 2000. (SEWRPC 1978). This parallels national trends.

In 1976 there were 20 persons employed in mining in Walworth County, which was limited to the extraction of sand, gravel and stone.

The hospitality-recreation-tourism industry is the second largest basic industry, and the third largest industry, in Walworth County. This industry is especially important in the Geneva Lake-Lake Como area where it has been a major component of the local economy for nearly a century. The industry directly employed 3,692 people in 1976. This figure, however, does not include employment in recreation-sensitive industries, such as food and retail sales, or transportation-oriented businesses. Thus, the size of this industry may be underestimated (Cooper and Beier 1979a,b).

In 1977 the hospitality-recreation-tourism industry generated over $74.6 million in gross sales by restaurants; taverns; hotels, motels, and resorts; trailer parks and camping grounds; sporting goods stores; and amusement and recreation establishments equaling to 15% of the total sales in Walworth County. The 1977 sales volume represented a 15.9% increase over 1976 sales, a figure which, because the rate of inflation for the same period was 5.9%, indicated a real growth of 10.0%. Statewide, the sector grew at a rate of 5.7%. These figures, when combined with the 1977 recreation-sensitive sales of retail and service establishments such as department, food, drug, and liquor stores, vending machines, and gasoline stations, resulted in gross sales of nearly $214 million. This represents approximately 43% of the total business sales in the County. Despite a decrease in the number of restaurants, hotels, motels, resorts, and sporting goods stores reporting, these categories exhibited significant growth over 1976.

Service Sector

Employment in the service sector accounted for 56% of the employment in Walworth County in 1976. Employment in the service sector is concentrated in government enterprises (35%), services (17%), and retail trade (15%) (Table 3-24). However, there is relatively little government employment in the Geneva Lake-Lake Como area. The high levels of employment in

Table 3-24. Employment by industry in Geneva, Linn, Lyons, Walworth and Bloomfield Townships, 1975 (SEWRPC n.d.).

Industry	Employment	Percent of Total
Agriculture, Forestry, and Fisheries	520	7.2
Mining, Construction	238	3.3
Manufacturing	1,081	14.9
Transportation, Communications Utilities and Wholesale Trade	142	2.0
Finance, Insurance, Real Estate	192	2.6
Services	2,000	27.6
Education and Public Administration	1,400	19.3
Total	7,253	100.0

the service and retail trade sectors reflect the resort and recreation attributes of the County. Between 1971 and 1976, the employment in the service sector in Walworth County increased 7.7%. This was below the statewide increase of 12.0%. Although the slow growth of the service sector in Walworth County does not parallel state and national trends, it is important to observe that the wholesale trade and the finance, insurance, and real estate industries did experience rapid growth. The rapid growth of these two tertiary industries indicates that the local economic base is becoming increasingly sophisticated. Estimates of planned employment for Walworth County for the year 2000 indicate that all of the service sector industries are likely to experience growth (SEWRPC 1978).

Employment and Population Multipliers

In both 1971 and 1976, each basic job generated one service and two total jobs, and supported almost six people. This indicates that population growth and economic growth closely paralleled one another over the 5-year period. These multipliers are lower than the multipliers for Wisconsin. The lower multipliers in Walworth County may indicate one of two things. First, basic sector wages in Walworth County may be lower than basic sector wages in Wisconsin. Therefore, fewer service sector jobs are generated, or alternatively, most of the basic sector wages are spent outside of Walworth County, generating service sector employment in other areas.

County Labor Trends

In 1976, Walworth County had a resident labor force of 31,100-which constituted 47% of the total population. This ratio of resident labor force to total population, called the labor force participation rate, was the same at both the county and state levels.

Unemployment

The unemployment rate for Walworth County was below the state and national rates in 1970, 1976, 1979, and August 1980 (Table 3-25). The relatively low unemployment rate indicates that the Walworth County economy is stable and has been expanding in response to new population growth.

Table 3-25. Unemployment rates in Walworth County, Wisconsin, and the US (By telephone, John Golliher, Wisconsin Bureau of Research and Statistics, 20 October 1980).

	1971	1976	1979	August 1980
Walworth County	3.8%	5.2%	3.4%	5.2%
Wisconsin	4.5%	5.6%	4.5%	6.8%
US	5.9%	7.7%	5.8%	7.5%

3.2.4.2. Local Employment Trends

The socioeconomic area had a 1980 civilian labor force of 9,018 workers (Table 3-26). The number of unemployed workers totalled 476, and accounted for 5.3% of the civilian labor force. Unemployment ranged from only 4.1% of the labor force in Geneva Town to 7.9% in Walworth Town.

The U.S. Bureau of the Census describes employment by twelve industry categories (Appendix G of the Draft EIS). The manufacturing category employed the greatest number of workers in 1980. Almost one-quarter of the workers were employed in a manufacturing job. The professional services category, which includes health, education, and other types of professional services, accounted for 19.0% of the jobs in the socioeconomic area. The third largest employment category in the socioeconomic area was the retail category which employed

Table 3-26. Employment of civilian labor force in the socioeconomic area, 1980 (USBOC 1982b).

	Civilian Labor Force	No. Unemployed	% Unemployment
Fontana	891	47	5.3
Lake Geneva	2934	153	5.2
Walworth	856	40	4.8
Williams Bay	920	62	6.7
Geneva Twp.	1764	72	4.1
Linn Twp.	683	54	7.9
Study Area	9018	476	5.3

almost 15% of the labor force. The personal, entertainment, and recreation services category accounted for 9.3% of the jobs in the socioeconomic area, while the construction category employed 7.3% of the employed persons.

3.2.4.3. Income

The 1979 income characteristics of permanent residents of the socioeconomic area are reported by the U.S. Bureau of the Census. Three descriptions are used to characterize local income levels: median household income, median family income, and per capita income (Table 3-27). Median household income and median family income differ in that the family income statistics account for the total income in households with two or more related individuals, and the household income statistics account for the income of all households (e.g., single persons and families).

Income levels in the MCDs in the socioeconomic area varied widely in 1979 (Table 3-27). Because of this variability, it is difficult to make general statements regarding the income levels in the Geneva Lake-Lake Como area. Overall, however, the levels of income in the socioeconomic area were not unusually high or low.

Table 3-27. Income characteristics of socioeconomic area, 1979 (US Bureau of the Census 1982b).

	Median Household Income	Median Family Income	Per Capita Income	Percent of Population Below Poverty Level
Fontana	20,366	22,656	9,556	6.95
Lake Geneva	15,493	19,304	7,881	7.1
Walworth	16,195	19,604	7,161	6.6
Williams Bay	15,706	20,127	7,623	8.0
Geneva Town	20,687	22,315	6,310	6.95
Linn Town	17,424	19,754	9,421	7.9
Walworth Town	19,695	21,343	6,679	8.9
Walworth Co.	17,457	20,796	7,123	7.8
Wisconsin	17,687	20,422	7,256	8.5

In terms of median household income and median family income, Fontana, Geneva Town, and Walworth Town each had income levels at about the County and State levels. Income in the remaining four MCDs fell below the county and state levels. The range in median household income was from $15,493 to $20,687. The range in median family income was from $19,304 to $22,656. The income levels in the City of Lake Geneva were at the low end of both ranges.

The per-capita income distribution did not follow a similar pattern. Per-capita income in Fontana, Lake Geneva, Williams Bay, and Linn Town exceeded the County and State levels. This indicates that the income range in Lake Geneva, Williams Bay and Linn Town were greater than the income range in Geneva and Walworth Towns.

Another indicator of income is the proportion of population below the poverty level. In Wisconsin in 1979, 8.5% of the population was below the poverty level, while 7.8% of the population of Walworth County was below the poverty level. Overall, this represents a low incidence of poverty in the socioeconomic area. In 1979, 7.3% of the socioeconomic area population was below poverty level. Walworth Town and Williams Bay had the largest proportion of their residents classified as below the poverty level (Table 3-27), while Walworth had the smallest portion of the population below poverty level.

3.2.5. Municipal Finances

A variety of community services and facilities are available to the residents of the socioeconomic area, including education, transportation facilities, full-time police and fire protection, library and recreation facilities, garbage collection and disposal, water supply, and in Lake Geneva, Fontana, Walworth, and Williams Bay, wastewater collection and treatment. The ability to maintain or improve these services and facilities is dependent on the continued ability of area residents to finance them.

3.2.5.1. Revenues and Expenditures

Data on the revenues and expenditures of the jurisdictions in the socioeconomic area were collected for the general operations fund only. Data on trust funds, capital projects, special assessment funds and detailed data on enterprises were not obtained. Local property taxes, intergovernmental revenues, and charges for the use of property and money were the major sources of revenue collected by the jurisdictions in the study area for general operations during 1980. Other sources included tax credits, regulation and compliance fees, public charges for services and enterprises (e.g., parking utility or sewer utility). Charges for sanitation services (sanitary sewers and treatment plants, refuse collection and landfill operations) are included in the latter two categories. The total revenues per capita collected for general operations during 1980 ranged from $114 in the Town of Geneva to $695 in the Village of Williams Bay (Wisconsin Department of Revenue 1981). The revenues collected, by source and by jurisdiction, are shown in Table 3-28.

The major expenditures for general operations by the jurisdictions in the socioeconomic area in 1980 were for public safety, transportation, debt service (where applicable), and general administration. The towns of Geneva, Linn and Walworth spent from 39.6% to 61.0% of their resources on transportation (highway maintenance, traffic control, street lighting, bicycle trails, parking lot meters and ramps, mass transit, airports, and docks and harbors). Public safety expenditures accounted for 25% or more of the general operations expenditures in each of the jurisdictions except the Village of Williams Bay and the Town of Walworth. Expenditures for sanitation (as defined above) ranged from 1.0% of the general operations expenditures in the Town of Linn. Per capita expenditures for sanitation ranged from $1 in the Town of Walworth to $22 in the Village of Fontana. Total expenditures per capita for general operations ranged from $108 in the Town of Geneva to $724 in the Village of Williams Bay (Wisconsin Department of Revenue 1981). The expenditures by category and by jurisdiction are shown in Table 3-29.

Table 3-28. Sources of revenue for general operations produced by the jurisdiction in the Geneva Lake-Lake Como socioeconomic area 1980 (Wisconsin Department of Revenue 1981).

Jurisdiction	Net Local Property Taxes	Tax Credits	Other Taxes	Inter-governmental Revenues	Regulation and Compliance	Public Charges for Services	Use of Money and Property	Inter-governmental charges for Services	Total Revenues for General Operations	Enterprises
City of Lake Geneva										
($1,000)	799.4	126.6	97.2	537.8	168.4	135.3	544.0	0	2408.8	610.1
Percent	33.2	5.3	4.0	22.3	7.0	5.6	22.6	0	100	NA
Per Capita	151	24	18	101	32	26	103	0	454	115
Village of Fontana										
($1,000)	450.9	42.2	98.9	202.1	49.8	46.9	207.8	0	1098.6	330.6
Percent	41.0	3.8	9.0	18.4	4.5	4.3	18.9	0	100	NA
Per Capita	251	23	55	112	28	26	116	0	611	184
Village of Walworth										
($1000)	120.0	24.1	2.2	161.5	15.8	0.8	20.4	10.3	355.1	152.7
Percent	33.8	6.8	0.6	45.5	4.4	0.2	5.7	2.9	100	NA
Per Capita	82	17	2	111	11	1	14	7	244	105
Village of Williams										
Bay ($1,000)	232.7	27.9	33.3	165.7	51.2	44.2	616.4	0	1171.2	282.3
Percent	19.9	2.4	2.8	14.1	4.4	3.8	52.6	0	100	NA
Per Capita	138	17	20	98	30	26	365	0	694	167
Town of Geneva ($1,000)	69.8	4.9	59.4	221.2	36.6	2.3	19.7	4.3	418.2	0
Percent	16.7	1.2	14.2	52.9	8.7	0.5	4.7	1.0	100	NA
Per Capita	19	1	16	60	10	1	5	1	114	0
Town of Linn ($1,000)	201.0	13.0	0	168.1	3.6	13.4	18.0	0	417.2	0
Percent	48.2	3.1	0	40.3	0.9	3.2	4.3	0	100	NA
Per Capita	122	8	0	102	2	8	11	0	253	0
Town of Walworth	26.9	3.1	0	112.7	2.0	0	39.3	0	184.0	0
Percent	14.6	1.7	0	61.2	1.1	0	21.4	0	100	NA
Per Capita	19	2	0	80	1	0	28	0	130	0

Table 3-29. Resources expended for general operations by the jurisdictions in the Geneva Lake-Lake Como socioeconomic area, 1980 (Wisconsin Department of Revenue 1981).

Jurisdiction	General Administration	Public Safety	Health and Social Services	Transportation	Sanitation	Conservation and Leisure	Capital Projects-Direct Appropriations	Principal and Interest	Other	Total Expenditures for General Operation	Enterprises
City of Lake Geneva ($1,000)	250.0	607.0	3.5	347.1	77.5	522.6	0	468.1	168.1	2443.9	569.6
Percent	10.2	24.8	0.1	14.2	3.2	21.4	0	19.2	6.9	100	NA
Per Capita	47	114	1	65	15	99	0	88	32	461	107
Village of Fontana	119.6	296.3	2.5	233.2	38.7	78.1	18.9	291.1	83.6	1161.8	311.8
Percent	10.3	25.5	0.2	20.1	3.3	6.7	1.6	25.1	7.2	100	NA
Per Capita	66	165	1	130	22	43	11	162	46	646	173
Village of Walworth	39.7	141.9	0.2	34.0	16.9	25.5	0	61.5	33.8	353.5	167.4
Percent	11.2	40.1	0.1	9.6	4.8	7.2	0	17.4	9.6	100	NA
Per Capita	27	97	.0	23	12	17	0	42	23	243	115
Village of Williams Bay	100.5	180.1	0.5	110.4	28.9	79.1	43.2	240.6	439.4	1222.7	383.7
Percent	8.2	14.7	0	9.0	2.4	6.5	3.5	19.7	35.6	100	NA
Per Capita	60	107	0	65	17	47	26	143	260	724	227
Town of Geneva	38.4	127.9	0	170.7	7.0	9.5	0	0	42.9	396.3	0
Percent	9.7	32.3	0	43.1	1.8	2.4	0	0	10.8	100	NA
Per Capita	10	35	0	46	2	3	0	0	12	108	0
Town of Linn ($1,000)	37.1	116.6	0.1	166.3	30.9	23.2	15.3	0	30.6	420.1	0
Percent	8.8	27.7	0	39.6	7.4	5.5	3.6	0	7.3	100	NA
Per Capita	23	71	0	101	19	14	9	0	19	255	0
Town of Walworth	14.2	8.1	0.1	112.1	1.8	0.9	0	9.9	36.9	183.8	0
Percent	7.7	4.4	0	61.0	1.0	0.5	0	5.4	20.0	100	NA
Per Capita	10	6	0	79	1	1	0	7	26	130	0

3.2.5.2. User Costs

The 1983 annual sewer service user costs for residences in Fontana, Lake Geneva, Walworth, and Williams Bay are $162 ($182 without water service), $85, $88, and $179, respectively. These user costs all fall below USEPA's recommended upper limits (Table 3-30).

Table 3-30. Current user costs for wastewater treatment in the socioeconomic area communities (By telephone, E. Lemmen, Superintendent, City of Lake Geneva Water and Sewer Department; Grabow, Asst. Clerk and Treasurer, Village of Fontana; L. Czaja, Clerk-Treasurer, Village of Walworth; and Pat Stevenson, Chairperson Village of Williams Bay Water and Sewer Department, 22 June 1983).

Community	1979 Median Household Income	Current Annual User Costs	Annual User Costs as a Percentage of Income
Fontana	$20,366	$162 (with water) $182 (without water)	0.8%
Lake Geneva	15,493	85	0.5
Walworth	16,195	85	0.5
Williams Bay	15,706	179	1.1
Geneva Town	20,687	NA	NA
Linn Town	17,424	NA	NA
Walworth Town	19,695	NA	NA

NA - Not Available

USEPA (19782) recommended upper limits for annual user costs as a percentage of median household income:

1.0% when income is less than $10,000
1.5% when income is between $10,000 and $17,000
1.75% when income is greater than $17,000

(USEPA. 1982. Construction Grants 1982).

3.2.5.3. Tax Assessments

The property tax rates in the socioeconomic area jurisdictions generally are similar to the tax rates in Walworth County and other areas of the state (Wisconsin Department of Revenue 1982). The town tax rates are lower than the Village and City rates, as is usually the case. The general property tax full value rate ranged from $15.38 per $1,000 of full equalized value in the Town of Geneva to $23.46 per $1,000 of full equalized value in the Village of Walworth. School districts accounted for approximately 50% of the tax level in the jurisdictions in the study area (Table 3-31). The state tax rate is $.20 per $1,000 of full value. The county tax rate is $3.36 per $1,000 of full value (except in the city of Lake Geneva where it is $3.34 per $1,000 of full value). The local tax rates in the City of Lake Geneva and Village range from $4.16 to $7.17 per $1,000 of full value, but in the towns the local tax rates range from only $0.50 to $1.87 per $1,000 of full value. The taxes per capita vary widely between the jurisdictions in the study area (Table 3-31). The range is from $562 in the City of Lake Geneva and the Town of Geneva to $1,595 in the Village of Fontana. The taxes per capita in the Village of Williams Bay and the Town of Linn also exceed $1,000. The tax distribution in the study area reflects both the large seasonal population and the extent of agricultural land. (i.e., the taxes per capita was computed with permanent population data only).

3.2.5.4. Municipal Indebtedness

The financial condition of the socioeconomic area was analyzed by means of 1981 data. The study area contains seven municipalities, eleven school districts, one vocational school, two sanitary districts, and a public inland lake protection and rehabilitation district. All of these jurisdictions appear to be financially sound and not overburdened with debt. The long-term debt of the municipalities and overlapping districts ranged from $530,583 in the Town of Walworth to $4,352,366 in the City of Lake Geneva. The Villages of Fontana, Walworth and Williams Bay each had self-supporting debt. Only the Village of Williams Bay had short-term debt in 1981. The short-term debt can vary widely from year to year. The statutory debt limits of the municipalities and four of the benchmarks used by the credit industry are presented in Table 3-32. All of the municipalities fall well below the upper limits set. Thus each municipality should be able to support additional debt for its share of wastewater treatment facilities, without undue financial strain.

Table 3-31. Tax rates in 1981 for the jurisdictions in the Geneva Lake-Lake Como socioeconomic area (Wisconsin Department of Revenue 1982).

Jurisdiction	Tax Full Value Rate $1,000	Full Value Tax Rates				Taxes Per Capita
		State	County	Local	School	
City of Lake Geneva	20.80	.20	3.34	5.36	11.90	$ 562
Village of Fontana	17.05	.20	3.36	4.16	9.32	1,595
Village of Walworth	23.46	.20	3.36	7.16	12.74	785
Village of Williams Bay	19.30	.20	3.36	6.01	9.73	1,079
Town of Geneva	15.38	.20	3.36	.56	11.25	562
Town of Linn	15.49	.20	3.36	1.87	10.04	1,559
Town of Walworth	15.58	.20	3.36	0.50	11.52	618
County average	18.01	.20	3.35	2.93	11.53	
State average	21.61	.20	3.66	4.76	12.99	

Table 3-32. Statutory debt limits, credit industry benchmarks, and comparative statistics for the jurisdictions in the Geneva Lake-Lake Como study area (Groves 1980; By telephone, Darrell Frankie, Wisconsin Department of Revenue, 15 September 1981; By telephone, Fera Weigen, Wisconsin Department of Revenue, 15 December 1982.

Jurisdiction	Benchmark Overall debt[a] exceeding 100% of full value	Benchmark Overall debt exceeding $1,200 per capita	Benchmark Level of overall debt exceeding 90% of statutory limit	Benchmark Overall debt per capita exceeding 15% of per capita personnal income	
	Statistic	Statistic	Statistic	Statistic	
	Overall debt as percent of full value	Debt per capita	Level of overall debt as a percent of statutory limit	Overall per capita debt as a percent of per capita personal income	Statutory Debt Limit ($)[c]
City of Lake Geneva	2.1%	$780.27	42.1%	7.6%	10,329,880
Village of Fontana	2.1	366.90	41.3	4.0	8,169,975
Village of Walworth	3.3	172.26	66.0	2.1	2,122,590
Village of Williams Bay	2.3	278.82	45.1	3.5	4,940,850
Town of Geneva	0.4	117.52	7.8	2.4	7,354,625
Town of Linn	0.4	109.13	8.6	1.3	10,399,545
Town of Walworth	0.7	358.99	14.2	5.4	3,723,950

[a] Overall debt is the total long-term debt of municipalities and overlapping districts for which tax revenues have been pledge. In this case overall debt includes municipal county and school district debt.

[b] This index was developed by Standard and Poor's bond rating firm. It is also known as the "S&P Index".

[c] The State of Wisconsin limits long-term indebtedness in the form of general obligation bonds, long term rates, state trust fund loans, and installment contracts to 5% of the full equalized value of general property, except as noted in Appendix G of the Draft EIS.

3.2.6. Transportation Facilities

Transportation facilities, both public and private, have significant effects on the permanent population, seasonal population, recreational usage, and to a lesser degree the local employment structure of the study area. The number of individuals visiting an area, and the number of commuters residing in it is dependent on the ease with which they can travel. Transportation facilities are also one of the locational factors used by manufacturers and other potential employers.

The study area is located within 30 to 75 miles of six metropolitan areas in Illinois and Wisconsin. There are four modes of transportation available in the study area: private automobile, railroad, airplane, and bus.

Roadways

The Geneva Lake-Lake Como area is well served by state and Federal highway systems. US 12 and US 14 constitute the major traffic corridors linking the study area with Chicago, Illinois; Janesville, Wisconsin; and Madison, Wisconsin. Access to the study area from the cities of Rockford, Illinois and Beloit, Wisconsin to the west, and Milwaukee, Wisconsin to the north is provided by the I90-Wisconsin 15 highway. Both US 12 and I-90-Wisconsin 15 are four-lane, limited access highways. Additional access is provided by Illinois 47 (which becomes Wisconsin 120) and Wisconsin 50 from Kenosha, Wisconsin. Each of these highways is a full-access, two-lane road. Traffic counts on STH 120, US Route 12, and US Route 14 in the immediate vicinity of the Illinois-Wisconsin state line are made by the Wisconsin Department of Transportation (WISDOT) approximately every three years. Annual average 24-hour two-way traffic count data collected in 1975 and 1978 indicate that during the three-year period, traffic increased significantly on US Route 12, increased moderately on US Route 14, and decreased on STH 120.

Data on the ratio of roadway volume to roadway capacity for selected roadway segments in the study area vicinity indicate that roadway congestion occurs in the study area (Table 3-33). At the present time Wisconsin STH 50 is heavily congested on summer weekends. Trucks currently are banned in Lake Geneva on weekends (By telephone, William Sills, Commissioner, Geneva Lake Area Joint Transportation Commission, 10 December 1979).

The Illinois Department of Transportation (IDOT) is currently preparing environmental impact statements on plans for the construction of two freeways affecting the study area. Under the current six-year transportation improvement plan prepared by WISDOT, two road improvement projects are scheduled in the vicinity of the study area. They are:

- Resurfacing, shoulder work, and minor alignment improvements on STH 120 between the Illinois-Wisconsin state line and Lake Geneva. The projected construction start-up date is 1983.

Table 3-33. Ratios of roadway volume to roadway capacity on selected road segments in the Geneva-Lake Como study area (By telephone, Bob Roszkowski, WISDOT, 20 November 1980).

Roadway Segment	Ratio of Volume to Capacity	Actual Volume to Capacity
STH 120 between the Illinois-Wisconsin state line and the City of Lake Geneva	0.58	418:721
STH 50 between STH 83 and US Route 12	0.64	474:740
STH 50 between US Route 12 and the City of Lake Geneva	1.84	1,297:705
STH 50 between Williams Bay and STH 15	1.22	806:661

[a] Considers 2-way traffic at the 100th hourly volume at service level C.

NOTE: A ratio of 1 indicates that volume is equal to capacity.

- Replacing the present traffic barriers with concrete median barriers on I-94 from the Illinois-Wisconsin state line north 6 miles. The projected construction start-up date is 1984.

These recommended improvements are subject to financing availability (By telephone, Tom Winkle, WISDOT, 3 November 1980). In addition, SEWRPC has recommended that the segment of Wisconsin 50 between Lake Geneva and I-94 be upgraded to four lanes between 1981 and 1985 (By telephone, Bob Beglinger, SEWRPC, 3 November 1980). WISDOT, however, has not approved this recommendation.

Railroads

Railroad service is provided to and from the study area by the Geneva Lake Area Joint Transportation Commission (GLA). Under the provisions of the Wisconsin State Rail Preservation Act, the GLA has received funding for the purchase of the abandoned Chicago and Northwestern (C&NW) line between Lake Geneva and Ringwood, Illinois. The State of Wisconsin will provide funds also to purchase abandoned depots and parking facilities (By telephone, William Sills, Commissioner, GLA, 23 October 1980).

The GLA-administered railroad will provide rail service for commercial freight hauling, for commuters, and for tourist excursions. Freight service which is currently in operation, was a major factor in restoring rail operations to the area. It primarily serves local industries such as the Burlington Consumers Cooperative at Genoa City, Wisconsin.

Bus

Three companies, the GLA, Greyhound Bus Lines, and Wisconsin Coach Lines, provide intercity and interstate bus service to the study area.

Airports

There are two privately-owned airports open to the public in the study area: the airport owned by Marriott, Inc., at the Americana Resort in Lake Geneva and the Big Foot Airport, which is located in Walworth.

3.2.7. Recreation

The Geneva Lake-Lake Como area is one of the prime recreational resort areas in the State of Wisconsin. Approximately 110,000 tourists visit the area annually. (By telephone, George Hennerly, Director, Lake Geneva Area Hotel Association, 28 October 1980). The area's principal recreational resources are its many lakes and streams, where swimming, boating, and fishing are the major activities.

Recreational Facilities

The economic data for Walworth County reflect the importance of the hospitality-recreation-tourism (HRT) industry in the study area, although no data specific to the study area are available. HRT sales in Walworth County are important indicators of the economic welfare both of the State and of local communities. In 1976 and 1977, Walworth County recorded the seventh highest level of gross HRT sales in the State of Wisconsin. Walworth County ranked tenth when the impact of the HRT industry on local income was measured.

Over 70 publicly and privately owned recreational facilities are located in the study area (Donohue & Assoc., Inc. 1978a). The Big Foot Beach State Park is the largest publicly owned facility in the study area. In 1977, over 108,000 people, including 24,600 campers, visited the park (WDNR 1977). Numerous resorts and motels, restaurants, golf courses, beaches, and boating facilities, are also found in the area.

Geneva Lake and Lake Como are used for boating and fishing. Because of Geneva Lake's size, depth, and good water quality, boat activity is heavier than it is on Lake Como (WDNR 1969a,b). A boating census, conducted in July 1977, counted 4,172 boats on Geneva Lake. No similar count has been taken on Lake Como (GLWEA 1977). There are little recent data on fishing pressures in the Geneva Lake-Lake Como study area. Conservative estimates by the operators of boat launching and livery services indicate that approximately 160 fishing boats are launched daily on weekends and holidays, and 120 boats are launched daily during the week (GLWEA 1977).

Geneva Lake receives an estimated 25 person-hours of fishing per acre of water each year, with a fish harvest of approximately 23 fish per acre (WDNR 1969a).

3.2.8. Cultural Resources

Prehistoric Sites

Early investigations of archaeological resources in the study area were documented by Charles Brown, the former director of the Wisconsin State Historical Society, who identifed eleven Indian trails, four villages, thirty campsites, five planting grounds, two sugar bushes, three caches, three cemeteries, three single burials, two mound groups, three single mounds, and one shrine. Three mounds of the twelve-mound groups were effigy mounds (Brown 1930). Subsequent verification of these findings was not established because of inaccurate mapping at the time of recording and later site destruction by urban development and by amateur archaeologists and collectors.

The State Historical Society has acknowledged the presence of 92 known archaeological sites in the study area. Further information on these sites is not currently available, since no systematic archaeological survey of the study area has been undertaken (By letter, Richard A. Erney, State Historical Society of Wisconsin, 21 July 1977). However, the State Historical Society has indicated that there is a strong likelihood that other such sites exist within the study area, based on the area's abundance of natural resources.

Around 18,000 B.P., the Great Lakes Region was covered by the Wisconsin Ice Sheet. The boreal forest remaining after the glacial retreat supported large mammals that were hunted by Paleo-Indian bands at the end of the Pleistocene, circa 11,500 B.P. There is, however, no evidence to date of the presences of Paleo Indian-groups in the Geneva Lake area. Among the known archaeological sites in the study area, some are believed to be multi-component. Through typological comparison with excavated archaeological sites in Wisconsin and Illinois, it is possible to assume that a similar pattern of prehistoric settlement and subsistence existed between tribes of these neighboring areas.

The first evidence of occupation in the study area has been estimated at 6,000 B.C., based on the discovery of projectile points of the type manufactured by Archaic Indians. These people maintained a subsistence economy based on shellfish gathering and small game hunting. This economic shift was due to climatic changes and the resulting replacement of the boreal forests with pine, spruce, and birch, which affected the types of wildlife that could be sustained.

Adaptation to the environment continued, marked by the introduction of plant cultivation around 2,500 B.C. and the subsequent development of a corn-based agricultural economy (Chomko and Crawford 1978). These events distinguished the economic pattern of the Woodland period. Regional cultural variations increased, as exemplified by the variations that appeared in the local methods of burial. The Woodland culture was characterized by burial cults and mounds. Groups in Wisconsin constructed large mounds which resembled animals and birds, but which contained few artifacts to aid later investigators in unraveling this little-understood culture. Effigy mound construction occurred primarily between 500 and 1000 A.D., but it is believed that regional construction of such mounds continued as late as the mid-16th century.

The infusion of Potowatomi Indians into the Geneva Lake area altered the cultural complexion of the region. Three Indian villages, with an estimated total population of 500, flourished in the study area at the time of the arrival of the first white settlers in 1831 (Rossmuller 1959).

Historic Sites

The first visit by white settlers to the Geneva Lake area was recorded by the John Kinzie party in 1831 (Jenkins 1922). However, indirect evidence supports the belief that French fur traders had prior access to the area in the 17th century.

In 1883, township and section lines were marked out under the provisions of a government contract prior to the granting of statehood in 1846. In 1836, Christopher Payne obtained a land claim and erected a sawmill, which he followed with a second mill that he operated for seven years. The settlers had peacefully coexisted with the Potowatomi band, led by Chief Big Foot. However, in the 1840's the Potowatomi were removed to a reservation in Council Bluffs, Iowa, freeing the land for increased white expansion.

The first permanent settlements outside Geneva Lake were established in 1836 at Williams Bay by Captain Israel Williams and at Fontana by James Van Slyke. At that time, Williams Bay was primarily farmland. It remained as such until after the turn of the century, when connection with the railway brought increasing numbers of people and increasing development to the area. In the same year, James Van Slyke built his home at Fontana, which developed into the principal mill site for the area. The first general store serving the area was built in 1837, followed by a school house in 1838. Ferguson's Owl Tavern in Geneva was the first travelers' inn.

The town of Geneva was established in 1839 and incorporated in 1844. The first railway line to Lake Geneva was built in 1856, but was only operational for a period of four years. It was replaced in 1871 by the Chicago and Northwest Railway, which began transporting a large seasonal population. The completion of the railway line coincided with the Chicago fire of 1871, and provided access to Lake Geneva as a refuge for Chicago families whose homes were destroyed. Keyes Park, the first resort hotel in the area, opened in the same year.

Since then, the Geneva Lake-Lake Como area has become a well-known resort area, attracting many wealthy Chicago families, which established summer homes there during the "Newport" period, from 1870 to 1920. Many of these homes, as well as the simple log houses, barns, and outbuildings of the early settlers, are still visible today in the study area. The structures in the study area that are included in the National Register of Historic places are listed in Table 3-34. For additional information on

Table 3-34. Study area structures included in the National Register of Historic Places (US Dept. of Interior 1982).

Site	Location	Date of Registration
Lake Geneva Chicago and Northwestern Railroad Depot (1891)	Broad Street	07-31-78
Longlands (1899-1901)	880 Lake Shore Dr.	09-18-78
Lanamoor (1900)	774 So. Lake Shore Dr.	01-15-80

The following site is under consideration for inclusion in the National Register: Yerkes Observatory (HD) Observatory Place

historic and archaeologic resources in the study area, see Appendix H of the Draft EIS.

3.2.9. Energy Consumption

In 1977, the study area consumed approximately 27% of the estimated energy used in Walworth County (Table 3-35). Natural gas, which is readily available in the study area, provided most of the energy used in homes and

Table 3-35. Energy consumption in Walworth County and the Geneva Lake-Lake Como Area, 1977 (Aigner et al 1977).

	Consumption[a] (in Million Btu)	
Fuel	Walworth County	Lake Geneva-Lake Como
Natural Gas	6,140	1,800
Liquified Petroleum	280	50
Gas Fuel Oil	1,010	240
Wood	280	0
Coal	290	100
Gasoline	2,800	732
Electricity	1,670	430
Total	12,470	3,352 (27%)

[a]Consumption was determined on the basis of total Wisconsin energy consumption allocated to the sub-areas by housing units. These are considered to be very generalized figures.

business. No restrictions in natural gas connections are anticipated for residential and small commercial customers, although schools, and large non-residential customers (manufacturing and commercial users) may use up to 5,000 cubic feet per hour (By telephone, Bud McEwan, Wisconsin Southern Gas Company, 2 January 1979).

4.0. ENVIRONMENTAL CONSEQUENCES

The potential environmental consequences of the wastewater management alternatives (Section 2.4.) are discussed in the following sections. The impacts resulting from the construction and operation of the alternatives for each of the communities may be beneficial or adverse, and may vary in duration (either short-term or long-term) and significance. The important impacts of the alternatives on the study area are indexed by environmental resource in Table 4-1.

Environmental effects are classified as either primary or secondary impacts. Primary impacts result directly from the construction and/or operation of the proposed project. Short-term primary impacts generally occur during construction. Long-term primary impacts occur throughout the life of the project and generally result from the operation of the proposed project.

Secondary impacts are the indirect effects of the project and occur because the project causes changes that in turn induce other actions or effects that would not have taken place in the absence of the project. Because the project creates change in the affected area, associated impacts can result. For example, improved or expanded wastewater treatment systems can open up land for urban development that otherwise would not have experienced such development because of the lack of this capability. This residential, commercial, or industrial development could create an increased demand for other public facilities and services; increase development pressure on agricultural lands, woodlands, or other environmentally sensitive areas; increase ambient noise levels; lead to air and water pollution; or displace low and moderate income families. Secondary impacts also may be either short-term or long-term. Short-term secondary impacts, for example, include the disruption of the environment that occurs during the construction of the development that is induced by the proposed project. An example of a long-term secondary impact would be the urban runoff that occurs indefinitely after the induced development of agricultural land or open space areas.

Table 4-1. Index of important impacts for the construction and operation of the wastewater management alternatives in the Geneva Lake-Lake Como study area.

Environmental Resource	Primary Impact	Operational Impact	Secondary Impact
Atmosphere	4.1.1.1.	4.1.2.1.	--
Soils	4.1.1.2.	4.1.2.2.	--
Surface water	4.1.1.3.	4.1.2.3.	4.2.3.
Groundwater	4.1.1.4	4.1.2.4	--
Vegetation	4.1.1.5.	4.1.2.5.	4.2.6.
Wildlife	4.1.1.5.	4.1.2.5.	4.2.6.
Wetlands	4.1.1.6.	4.1.2.6.	4.2.6.
Land Use	4.1.1.7.	4.1.2.7.	4.2.2.
Demography	4.1.1.8.	4.1.2.8.	4.2.1.
Prime Farmland	4.1.1.9.	--	4.2.6.
Economics	4.1.1.10	4.1.2.9.	4.2.5.
Recreation and Tourism	4.1.1.11.	4.1.2.10.	4.2.4.
Transportation	4.1.1.12.	4.1.2.11.	--
Energy Resources	4.1.1.13.	--	--
Cultural Resources	4.1.1.14.	--	4.2.6.
Fiscal Impacts	--	4.1.3.	--

Most adverse impacts can be mitigated, and many should be of short duration. The possible mitigative measures outlined in the following sections include planning activities and the utilization of construction techniques that reduce the severity of both primary and secondary adverse impacts. Construction plans and specifications, developed by facilities planners for the communities and reviewed by the WDNR, must include these mitigative measures if Federal monies are used to assist in financing the proposed project.

4.1. Primary Impacts

4.1.1. Construction Impacts

Both the FPRA and the EIS Alternative require some construction. The EIS Alternative includes the construction of some new municipal wastewater treatment systems and the upgrading of individual onsite treatment systems throughout the life of the project. The construction impacts associated with centralized collection and treatment systems proposed under the FPRA and under the EIS Alternative are addressed in the following subsections for each of the major categories of the natural and man-made environment.

4.1.1.1. Atmosphere

The construction activities associated with the FPRA and the EIS Alternative, including placement of conveyance lines and land clearing for WWTPs, will produce short-term adverse impacts to local air quality. Clearing, grading, excavating, backfilling, and related construction activities will generate fugitive dust, noise, and odors. Emission of fumes and noise from construction equipment will be a temporary nuisance to residents living near the construction sites. However, the EIS Alternative requires less construction than does the FPRA. Construction in currently unsewered areas will be limited to those residences with failing onsite systems and would not include extensive excavation for collection lines as proposed under the FPRA (See Figure 2-13).

4.1.1.2. Soil Erosion and Sedimentation

Soils exposed during construction activity will be subjected to accelerated erosion until the soil surface is protected by revegetation or other means. Conveyance lines typically are laid within road right-of-ways and runoff from construction activities tends to concentrate in roadside drainageways. The FPRA involves laying considerable lengths of sewers and force mains and can be expected to result in the greatest erosion and subsequent sedimentation. The adverse impacts resulting from construction related erosion and sedimentation include nutrient and other pollutant inputs to the lakes, possible siltation, clogging of road culverts, localized flooding where drainageways are filled with sediment, and damage to structures, roads, and ditches.

4.1.1.3. Surface Water

Increased sedimentation resulting from the construction of collection sewers could result in surface water quality degradation, as noted above. The impacts associated with the construction of sewer lines - increased nutrient inputs, increased turbidity, possible siltation - would occur under the centralized collection and treatment alternatives as proposed in the FPRA. The construction impacts would vary in intensity and duration depending on the length of the sewer lines, their placement in relation to drainageways, and the mitigative measures used to reduce sedimentation. These factors will influence the amount of sediment that reaches the lakes, and ultimately, the severity of the construction impacts.

The FPRA includes an effluent discharge to a farm drainage ditch approximately 500 feet upstream of the confluence of the ditch and Piscasaw Creek. The effluent discharge will have additional impacts associated with the construction activities for the effluent discharge. The construction activities would temporarily increase turbidity levels, increase nutrient concentrations, possibly affect temperature and dissolved oxygen (DO) concentrations, and disrupt the aquatic community. The adaptability of the fish and other biota to habitat disturbance will be a primary factor in the severity of the impacts.

4.1.1.4. Groundwater

Groundwater may be impacted by construction activities in localized areas. Construction dewatering may cause some local failures of shallow wells, especially where collection lines and pump stations are to be constructed under the FPRA. A potential change in water quality would likely occur where organic soils are disturbed either directly, or by altering the water table. Changes in groundwater quality might occur from construction of collection lines extending to Lake Como under the FPRA. Organics may leach out of these areas and affect the taste of water in nearby wells. Spilled fuel and other construction materials could pass through the soils to contaminate the groundwater.

4.1.1.5. Terrestrial Biota

Construction activities associated with various components of the proposed alternatives would result in impacts to wildlife and vegetation to various degrees. Collection sewers and upgraded onsite systems would be placed on residential lots; temporary loss of grassed areas and the removal or death of trees would result from construction of these facilities. Disruption of backyard vegetation and the presence of construction equipment and noise would cause temporary displacement of most vertebrate species and mortality of a few (probably small mammal) species, but replacement of vegetation and cessation of construction activities would allow the reestablishment of animals to the areas. More likely the animals commonly associated with human habitation (e.g., eastern cottontail rabbits, house sparrows, European starlings) that would be displaced, would move to suitable neighboring habitat and induce no density-related stress upon neighboring habitats.

Proposed conveyance lines for the FPRA generally parallel and are contiguous to existing road rights-of-way. A strip of approximately 20 feet of roadside vegetation would be removed during construction along County road rights-of-way, and a strip of approximately 20 to 40 feet would be disrupted for placement of force mains. This could disrupt hedge row vegetation in both residential and agricultural portions of the study area.

The primary land uses and land cover along the proposed lines include low density residential, agricultural cropland, and wetlands. Small woodlots border the routes at scattered locations; second-growth roadside shrubbery would likely be destroyed. Birds, mammals, reptiles, and amphibians that reside on or near the proposed routes would migrate from disturbed areas during construction. Small mammals and reptiles would incur some mortality from construction. Displacement of most animals would be temporary, however, coinciding with the duration of construction.

Under the FPRA and the EIS Alternative, a new land application facility is proposed in Sections 31 and 32, Town of Lyons, that would require approximately 80 acres of oldfield, agricultural land, and gravel extraction area. Construction would result in the permanent displacement or mortality of various animals commonly associated with oldfield areas. A diverse vertebrate population is associated with this habitat, so losses would noticeably reduce resident vertebrate populations. A portion of the wildlife communities may reoccupy strip areas of the site that are not mowed after construction is completed.

Under the EIS Alternative, a new land application site is proposed in Section 28, Town of Walworth, and that would require 80 acres of agricultural land. Construction of the proposed land application facility at this site would result in the permanent displacement or mortality of various animals commonly associated with cultivated fields. This habitat does not support a highly diverse vertebrate population, however, so losses would not be expected to noticeably reduce resident vertebrate populations. Following completion of construction, areas adjacent to the proposed facility would probably be reoccupied by wildlife communities similar in composition to preconstruction communities.

Construction activities associated with the proposed WWTPs for Walworth/Fontana for the FPRA and for Lake Geneva under both the FPRA and the EIS Alternative probably would not destroy any extensive stands of native vegetation. No significant impacts to terrestrial wildlife would be expected. The kinds of disruption of the existing communities would be similar to that expected in Section 28.

The impacts on terrestrial biota that would result from upgrading the existing systems under the EIS Alternative would be insignificant because a relatively small amount of construction on developed land would be required to complete the project.

4.1.1.6. Wetlands

Environmental impacts associated with the construction of a wastewater collection system to Lake Como under the FPRA would include construction in the right-of-way of Highway H adjacent to a large wetland area. This could result in loss of wildlife habitat and erosion and possible sedimentation of the wetland. The rate and direction of groundwater flow in the wetland also may be disrupted unless care is taken in the construction process. Adverse impacts could be minimized with the careful use of erosion and sedimentation control practices. Construction activity during spring and early summer should be avoided to reduce disruption of wildlife reproductive cycles.

4.1.1.7. Land Use

The construction and upgrading of WWTPs at Lake Geneva and Walworth under both the FPRA and the EIS Alternative would require the conversion of a gravel extraction facility and agricultural land uses, respectively, to developed land uses. The aerated lagoons and land application sites that are proposed as treatment alternatives for the west end communities of Walworth and Fontana would require a land area of approximately 25 to 30 acres out of an 80 acre site proposed for condemnation. The Lake Geneva facilities are estimated to require approximately 45 acres. The oxidation ditch treatment facility proposed for Walworth/Fontana under the FPRA, would require 6 acres of land currently owned by the Village of Walworth and used as a wastewater treatment site plus an additional three acres currently in agricultural land use.

In general, the only land uses that are compatible with the construction and operation of WWTPs include agricultural, small woodlot, open space, or similar land uses. Developed land uses, i.e., residential, commercial or institutional land uses, typically are incompatible with

WWTPs. In addition, the construction of sewer systems under the FPRA could temporarily disrupt activities along the rights-of-way. The magnitude of these impacts is not anticipated to be significant in much of the study area because most of the sewer systems would follow existing road rights-of-way. However, the installation of collection and transmission lines to the Walworth/Fontana WWTP as proposed under the FPRA or the EIS Alternative could disrupt existing farm operations by damaging drain tiles, by changing water table elevations (FPRA only), and by compacting soils during construction and backfill activities.

4.1.1.8. Demography

Temporary jobs created by the construction of wastewater collection and treatment facilities are not likely to attract any new permanent residents to the study area. These positions probably would be filled by workers from the Geneva Lake-Lake Como study area or from adjacent communities. Construction activities taking place on or adjacent to the property of seasonal residents could result in the temporary reduction of use of the seasonal dwellings. No significant demographic impacts are anticipated during the construction of wastewater facilities.

4.1.1.9. Prime and Unique Farmlands

The construction of WWTPs and rapid infiltration systems would irreversibly convert prime farmland to developed land use. The WWTPs proposed for the study area would require approximately 125 acres. Of this acreage, the facilities in Lake Geneva and Williams Bay are not anticipated to affect any prime agricultural land. However on the west end, the 80 acres planned for rapid infiltration lagoons for Walworth/Fontana at the Rambow site are listed as prime agricultural land. The construction of an infiltration facility on this site would remove 80 acres of actively farmed, prime agricultural land on Class I-1 soils. These soils represent less than 1% of the most valuable soils in the State of Wisconsin. This farm is located in an A-1 exclusive agricultural use zoning district and the owners are participating in the state preferential tax assessment program that offsets their property tax for maintaining the property in agricultural use.

Wisconsin statutes (Section 32.035) require the preparation of an agricultural impact statement (AIS) if a proposed project involves the actual or potential exercise of the powers of eminent domain in the acquisition of an interest in more than 5 acres of land from any one farm operation. The AIS is prepared by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) and describes the potential effects of the project on farm operations and agricultural resource. The AIS is intended to reflect the general objectives and policy concerns of the DATCP of conserving important agricultural resources and maintaining a healthy rural economy. The DATCP recognizes, however, that final project decisions must consider a number of factors including, but not limited to, potential agricultural impacts. The State has prepared an AIS on this project (Appendix B). The AIS concludes that while the loss of the 80 acres of farmland would not have a significant effect on the national, state, or local economy or farmland resource base, the loss of this acreage would contribute to the widespread erosion of this resource.

In July 1982, the Soil Conservation Service published proposed rules for implementing the Farmland Protection Policy Act (48 CFR 134) which require the identification and consideration of the effects of Federal programs on the conversion of farmland to non-agricultural uses. The proposed rules contain a numerical weighting system for assessing the effects of a proposal action against a site's importance as farmland. When applying data from the AIS to the 80 acre site proposed for land application in Walworth, the site scored 115 out of a possible 160 points (Appendix B) indicating that the site is highly suitable for protection as farmland.

Factors for determining whether a Federal project significantly effects a resource are contained in the Final Regulations for the Implementation of Procedural Provisions of the National Environmental Policy Act (43 CFR 23, Section 1508.27; 29 November 1978). These Regulations require consideration of both context and intensity in determining if a project significantly affects any aspect of the "Human Environment." Concerning context, the Regulations state: "In the case of a site specific action, (such as construction of a rapid infiltration facility) significance would usually depend upon the effects in the locale rather than the world as a whole." Intensity refers to the degree of impact, the effects on public health, unique characteristics of the geographic area (such as prime farmlands), the degree to which the effects may be highly controversial, whether the action is related to other actions that are cumulatively significant, as well as others. With due consideration of both the context and intensity of the impacts resulting from the use of the 80 acre site for land application of wastewater, this action would represent a significant, long term, adverse impact. However, there are mitigative measures that could be taken that would in large part reduce the significance of these impacts. These are discussed in Section 4.3.

4.1.1.10. Economics

The construction activities associated with both of the alternatives would create a limited number of short-term construction jobs. Most jobs would be filled by persons living within the study area or within a reasonable commuting distance of the area.

The purchase of construction materials from merchants within the study area would benefit the local economy. However, few firms offering the necessary building materials are present within the study area. Most construction materials would be imported from outside the area, probably from the greater Milwaukee or Chicago areas. Purchases made by construction workers within the study area also would benefit the local economy. These benefits would be offset, though, by the reduced patronage that businesses along the sewer lines would experience as a result of the temporary disruptions caused by construction activities under the FPRA.

4.1.1.11. Recreation and Tourism

Any increase or decrease in tourism, or the use of recreational facilities within the study area attributable to the construction of wastewater collection and treatment facilities is dependent upon construction activities which detract from the recreational amenities of the study area. Most recreational activities within the study area are water related and take place on or along the perimeters of Geneva Lake and Lake Como. No major air, water, noise, or traffic impacts are expected to occur near Geneva Lake or Lake Como which would significantly disrupt tourism and recreation activities. The disruption of traffic flows in the downtown areas of the study area communities could cause a temporary displacement of tourists, particularly if construction took place in these areas during the summer. Access to some recreational facilities, interrupted by construction activities, may curtail some recreation and tourist activities along the shoreline areas of both lakes under the FPRA.

4.1.1.12. Transportation

Increased truck traffic during the construction of centralized wastewater collection and treatment systems would increase traffic congestion and disrupt traffic flows, particularly in the downtown areas of the study area communities. Vehicular traffic also would be inconvenienced by excavating, grading, backfilling, and temporary road closures during the construction of conveyance lines along roadways, as proposed under the FPRA. The temporary closure of some roads would inconvenience permanent residents and tourists and result in increased traffic congestion on adjacent roadways.

4.1.1.13. Energy Resources

Residential, commercial, and industrial energy requirements are not likely to be affected during the construction of wastewater collection and treatment facilities. Trucks and construction equipment used for the construction of wastewater treatment facilities would increase demand for local supplies of gasoline and diesel fuel. The increased demands resulting from construction activities are not anticipated to have a significant impact on the availability of fossil fuels in the study area.

4.1.1.14. Cultural Resources

Archaeological data for the study area indicates the presence of 92 sites. Information on many of the locations, however, are not readily available (Section 3.2.8.). Three structures in the study area are listed on the National Register of Historic Places. Approximately 200 additional sites of architectural significance were identified by WAPORA personnel in 1979 (Section 3.2.8.). It is difficult to assess adverse impacts attributable to construction of wastewater collection and treatment facilities which may affect historic, archaeological, and architectural sites, because final collection routings under the FPRA and WWTP sites for both the FPRA and the EIS Alternative have not been selected. However, construction of wastewater collection facilities in previously undisturbed routes in currently unsewered areas has greater potential for disrupting these resources than upgrading onsite treatment systems under the EIS Alternative. All routes and sites should be presented to the SHPO for assessment before construction activities begin. Construction excavations could uncover significant cultural resources which otherwise might not be found. To provide adequate consideration of impacts on these resources, an archaeological survey of specific sites should be conducted following the selection of an alternative. The State of Wisconsin requires that this investigation be completed prior to a Step 3 award, or before construction begins, to insure that all necessary steps are taken to protect cultural resources.

4.1.2. Operation Impacts

Each of the alternatives, including the No Action Alternative, include operations that will continue through the 20-year project planning period. Included in the definition of operations are upgrading failing onsite systems under the EIS Alternative, constructing centralized wastewater collection systems under the FPRA, and under both the FPRA and the EIS Alternative, renovating or constructing wastewater treatment systems. Operation impacts associated with the alternatives for the study area communities are addressed for each of the major categories of the natural and man-made environments.

4.1.2.1. Atmosphere

The potential emissions from the operation of the wastewater management alternatives include aerosols, hazardous gases, and odors. The emissions could pose a public health risk or be a nuisance.

Aerosols are defined as solid or liquid particles, ranging in size from 0.01 to 50 micrometers that are suspended in the air. These particles are produced at wastewater treatment facilities during various treatment processes. Some of the constituents of aerosols have the potential of being pathogenic and could cause respiratory and gastrointestinal infections, however, concentrations of bacteria or viruses in aerosols are generally insignificant (Hickey and Reist 1975). The vast majority of the microorganisms in aerosols are destroyed by solar radiation, desiccation (drying out), and other environmental phenomena. There are no records of disease outbreaks resulting from pathogens present in aerosols. Therefore, no adverse impacts are expected from aerosol emissions for any of the alternatives.

Discharges of hazardous gases could have adverse affects on public health and the environment. Explosive, toxic, noxious, lachrymose (causing tears), and asphyxiating gases can be produced at wastewater treatment facilities. These gases include chlorine, methane, ammonia, hydrogen sulfide, carbon monoxide, nitrogen oxides, sulfur, and phosphorus. The knowledge of the possibility that such gases can escape from the facilities or into work areas in dangerous or nuisance concentrations might affect the operation of the facilities and the adjacent land uses. Gaseous emissions, however, can be controlled by proper design, operation, and maintenance procedures.

Odor is a property of a substance that affects the sense of smell. Organic material that contains sulfur or nitrogen may be partially oxidized anaerobically and result in the emission of byproducts that may be malodorous. Common emissions, such as hydrogen sulfide and ammonia, are often referred to as sewer gases and have odors of rotten eggs and concentrated urine, respectively. Some organic acids, aldehydes, mercaptans, skatoles, indoles, and amines also may be odorous, either individually or in combination with other compounds. Sources of wastewater related odors include:

- Fresh, septic, or incompletely treated wastewater
- Screenings, grit, and skimmings containing septic or putrescible matter

- Oil, grease, fats, and soaps from food handling enterprises, home, and surface runoff
- Gaseous emissions from treatment processes, manholes, wet wells, pumping stations, leaking containers, turbulent flow areas, and outfall areas
- Raw or incompletely stabilized sludge or septage.

Wastewater treatment lagoons typically emit considerable odors when the ice cover goes out in the spring. These odors are likely to be noticeable for at least one-half mile down wind. Effluent odors may escape from lift stations where turbulent flows occur unless proper design steps are taken to minimize odors. The occasional failure of an onsite system may release some odors. Septage haulers using inadequate or improperly maintained equipment may also create odor nuisances.

4.1.2.2. Soils

The operation of the land application sites for wastewater treatment would alter the soils of these sites over the life of the project. The potential changes depend on the existing chemical and hydraulic properties of the soil, and on the chemical characteristics and application rates of the effluent. The pH, cation exchange capacity, and phosphorus retention capacity should be adequate to ensure that most constituents in the effluent will be removed effectively at the proposed application rates. Organic constituents in the applied water would be oxidized by natural biological processes within the top few feet of soil (USEPA 1981b). The volatile solids are biologically oxidized and inorganic solids become part of the soil matrix (USEPA 1981b).

Phosphorus would be present in the lagoon, oxidation ditch or septic tank effluent in an inorganic form as orthophosphate (primarily HPO_4^{-2}), as polyphosphates (or condensed phosphates), and as organic phosphate compounds. Because the pH of wastewater is alkaline, the predominant form usually is orthophosphate (USEPA 1976). Polyphosphate is converted quickly to orthophosphate in conventional wastewater treatment, in soil, or in water. Dissolved organic phosphorus is converted more slowly (day to weeks) to orthophosphate.

When effluent is applied to soils, dissolved inorganic phosphorus (orthophosphate) may be absorbed by iron, aluminum, or calcium compounds, or may be precipitated through reactions with soluble iron, aluminum, and calcium. Because it is difficult to distinguish between adsorption and precipitation reactions, the term "sorption" is utilized to refer to the removal of phosphorus by both processes (USEPA 1981b). The degree to which wastewater phosphorus is sorbed in soil depends on its concentration, soil pH, temperature, time, total loading, and the concentration of other wastewater constituents that directly react with phosphorus, or that affect soil pH and oxidation-reduction reactions (USEPA 1981b).

The phosphorus in the adsorbed phase in soil exists in equilibrium with the concentration of dissolved soil phosphorus (USEPA 1981b). As an increasing amount of existing adsorptive capacity is used, such as when wastewater enriched with phosphorus is applied, the dissolved phosphorus concentration similarly will be increased. This may result in an increased concentration of phosphorus in the percolate, and thus, in the groundwater or in the recovered underdrainage water.

Adsorbed phosphorus is eventually transformed into a crystalline-mineral state, re-establishing the adsorptive capacity of the soil. This transformation occurs slowly, requiring from months to years. Work by various researchers indicates that as much as 100% of the original adsorptive capacity may be recovered in as little as three months. However, in some instances it may take years for the adsorptive capacity to fully recover because the active cations may become increasingly bound in the crystalline form.

Dissolved organic phosphorus in applied effluent can move quickly through the soil and enter the groundwater. Adequate retention of the effluent in the unsaturated soil zone is necessary to allow enough time for the organic phosphorus to be hydrolized by microorganisms to the orthophosphate form. It then can be adsorbed in the orthophosphate form.

The study area soils should have adequate sorption capacity for phosphorus where onsite seepage beds and rapid infiltration beds of current design are constructed to standard (Ellis and Erickson 1969). Water quality sampling results appear to verify this conclusion (See Section 2.2.2.5. and Appendix C).

Nitrogen loadings in the wastewater are of greatest concern. Nitrogen would be present in applied wastewater principally in the form of ammonium (NH_4), nitrates (NO_3), and organic nitrogen. When wastewater is applied to soils, the natural supply of soil nitrogen is increased. As in natural processes, most added organic nitrogen slowly is converted to ionized ammonia by microbial action in the soil. This form of nitrogen, and any ionized ammonia in the effluent, is adsorbed by soil particles.

Soil microbes utilize ammonium directly. Microbes oxidize ammonium to nitrite (NO_2) that is quickly converted to the nitrate (NO_3) form through nitrification. Nitrate is highly soluble and can be leached from the soil into the groundwater. This may elevate nitrate concentrations in groundwater but should not exceed drinking water standards of 10 mg/l. Under anaerobic conditions (in the absence of oxygen), soil nitrate can be reduced by soil microbes to gaseous nitrogen forms (denitrification). These gaseous forms move upward through the soil atmosphere and are dissipated into the air. Denitrification depends on organic carbon for an energy source; thus, the interface between natural soil and gravel fill in a seepage bed or mound has both requisite characteristics for denitrification.

Unlike phosphorus, nitrogen is not stored in soils except in organic matter. Increases in organic matter within the soils would result from increased microbial action and from decreased oxidation. The increased organic matter improves the soil workability, water holding capacity, and capability of retaining plant nutrients.

4.1.2.3. Surface Waters

Piscasaw Creek

Piscasaw Creek flows south along the western township of the Town of Walworth. At this point it is a headwater stream flowing discontinuously

(USGS 1971). Piscasaw Creek is channelized and almost completely straightened from the point where the existing Walworth wastewater treatment lagoon discharges to the Illinois border, 2 miles to the south.

The quality of Piscasaw Creek has probably been reduced as a result of this channel straightening. Channelization tends to decrease the duration of higher-than-base flows by moving water out of the watershed faster than would occur under more natural stream conditions. The result is that less water is available to dilute wastewater effluent. This rapid loss of streamflow is somewhat mitigated by two other hydrologic circumstances. First, a small amount of tributary flow is introduced to the Creek at a point approximately 1.9 miles downstream from the Walworth WWTP lagoon. Second, a significant amount of groundwater discharges into Piscasaw Creek downstream from the WWTP (WDNR 1981a). The groundwater discharging to Piscasaw Creek probably originates from recharge areas in the steeper uplands to the west. As a result of these hydrologic factors, changes in streamflow characteristics and water quality occur as the stream flows southward.

In waste load allocation studies conducted for Piscasaw Creek, WDNR reported that the 7-day, 10-year low-flow, just upstream of the Walworth WWTP lagoons, is approximately 0.70 cfs. Existing effluent discharges from the lagoons total approximately 0.22 cfs (WDNR 1981a). Therefore, Piscasaw Creek currently has about 24% of its volume as WWTP effluent in the effluent mixing zone below the lagoons. At a point 0.88 miles downstream of the Walworth WWTP lagoons, the 7-day, 10-year low-flow is estimated to be 1.3 cfs (WDNR 1981a). Thus, no more than 14.5% of the streamflow would be partially assimilated WWTP effluent.

Based on the preceding information, it appears that the stream segment adversely impacted by WWTP effluent is from the mixing zone, downstream to the confluence with the small tributary. However, field survey crews sampling Piscasaw Creek during the waste load allocation study (WDNR 1981a) reported very high photosynthetic activity immediately downstream of the WWTP lagoons during daylight hours. This is probably due to the growth-inducing effect that WWTP effluent nutrients have on aquatic macrophytes and benthic algae. Few trees line the stream bank in this area and, as a result, a great deal of oxygen can be produced during daylight hours by the abundant aquatic plants. During darkness, though, respiration of these aquatic macrophytes and benthic algae and sediment oxygen demand significantly lower the instream DO below the water quality necessary to meet full fish and aquatic life (WDNR 1981a).

Under the FPRA, treatment of the combined wastewater flows of Walworth and Fontana with an oxidation ditch WWTP would increase the effluent discharge rate to approximately 1.72 cfs. The proposed FPRA facilities would be located at the existing Walworth WWTP lagoons. However, the FPRA proposed rate of effluent discharge would be greater than the estimated 7-day, 10-year low-flow for all points on Piscasaw Creek prior to its crossing the state line. During the critical, low-flow (7-day, 10-year) condition, the proposed treatment facilities would result in a streamflow which is primarily effluent.

Waste load allocation studies conducted by WDNR have recommended that the effluent limits indicated in Table 4-2 would not be sufficient to protect the water quality of Piscasaw Creek under the critical, low-flow conditions (WDNR 1981a). This means that dissolved oxygen concentration would fall below 5.0 mg/l during darkness and when streamflows are approaching the 7-day, low-flow level. This level of oxygen is generally insufficient to sustain full fish and aquatic life standards.

Table 4-2. Waste load allocation effluent limits for combined Fontana and Walworth WWTP facilities (WDNR 1981a).

Effluent Parameters	Summer (mg/l)		Winter (mg/l)	
BOD_5 (mg/l) weekly	10	10	10	10
TSS (mg/l) weekly	10	10	10	10
NH_3-N (mg/l) weekly	2[a]	5[b]	4[a]	9[b]
pH range (s.u.)	6-7.6	6-7.2	6-8.1	6-7.6
DO minimum (mg/l) (daily)	6	6	6	6

[a]The NH_3-N limits cannot be more stringent than these limits.

[b]Alternative NH_3-N and pH limits are listed to offer optional levels.

The EIS Alternative for Fontana and Walworth proposes the use of rapid infiltration beds, thereby ceasing all effluent discharges to Piscasaw Creek. Elimination of the effluent would produce a decrease in nutrients and suspended solids in the creek as well as a decrease in temperature. This would substantially improve the water quality and clarity. Flow would decrease by about 25%. In response to these changes aqautic plant productivity would decrease. Over the short term, the nuisance growth of attached algae and aquatic macrophytes would decline. Watercress, characteristic of cleaner water and found above the effluent, would be expected to become established in the area. Aquatic fauna adapted to effluent enrichment would be reduced in number. A more diverse but less numerous community would be established made up of species now present in the area and other, less pollution-tolerant species from upstream.

The EIS Alternative would also preclude any change of slug loads of poorly-treated wastewater adversely affecting the stream. In summary, the EIS Alternative would produce substantial beneficial water quality impacts for Piscasaw Creek. These would occur primarily as a result of the reduction of nutrient inputs; increased dissolved oxygen due to the decrease in water temperature and nightly consumption of dissolved oxygen by decaying plant material; and the elimination of the change of slug loads due to system failures.

White River

From its headwater source in Geneva Lake, the White River flows in a northeasterly direction, through the City and past the WWTP. The original stream channel has been straightened from the dam on the Geneva Lake outlet to a point approximately one-eighth mile downstream of the treatment plant, after which the stream course becomes more sinuous. The White River traverses a large floodplain marsh located about 1.5 miles downstream from the WWTP.

Below the WWTP, the 7-day, 10-year low-flow is estimated to be 0.89 cfs (WDNR 1981b). The existing design flow of the treatment plant is 1.7 cfs, so that under low-flow conditions approximately 65% of the streamflow is effluent. It is evident that when water from Lake Geneva is not being released through the dam spillway gates, (a common late summer occurrence) the White River downstream from the WWTP is being strongly influenced by effluent. However, when summer rainstorms occur, the streamflow below the dam may be briefly augmented by storm sewer discharges from the City of Lake Geneva (WDNR 1981b). Groundwater influx is another source of streamflow augmentation. During waste load allocation field studies, WDNR estimated that groundwater added 0.38 cfs of streamflow to the White River over each mile of stream course.

Based on the potential impacts from the urban storm sewers combined with the WWTP effluent, the effluent mixing zone area below the City WWTP appears to be the segment most vulnerable to water quality degradation. WDNR, however, has classified all of the White River downstream of Lake Geneva as capable of supporting a full fish and aquatic life community (WDNR 1981b). The waste load allocation field survey reports (WDNR 1981b) indicate that the WWTP effluent enriches the White River sufficiently to produce luxuriant amounts of aquatic macrophytes and benthic algae. The modeling contained an inconsistency with respect to the diurnal DO curve analysis. The segment immediately downstream from the outfall should have experienced significant sedimentation and a large respiration (R) value. Rather, the respiration value was small (possibly inhibited by chlorine) and downstream respiration values were larger (WDNR 1981b). Thus, the DO levels were larger immediately downstream from the outfall than expected.

However, computer modeling of waste load allocations made by WDNR predicts that, under critical low-flow conditions, the White River would not sustain levels of dissolved oxygen greater than 5.0 mg/l at all times even if no WWTP effluent were being discharged. Presumably, then, the existing WWTP effluent discharges are now capable of causing violations of State dissolved oxygen standards in the White River. WDNR has recognized the natural limitations of the White River's assimilative capacity in recommending effluent limits for the City of Lake Geneva that would help to minimize violations of state standards under all but the most critical stress flow conditions.

The FPRA for the City of Lake Geneva would result in a removal of effluent previously discharged to the White River (See also Section 2.4.2.). This would eliminate any adverse impacts of wastewater effluent on the White River. However, any action alternative is expected to result in increased amounts of impervious surface areas such as roads, driveways, and roofs, as a result of future commercial and residential growth (90% population increase; Section 4.2.2.). Therefore, secondary water quality impacts may occur in the White River and in Geneva Lake with the increased discharge of urban storm water pollutants to these waters. These secondary impacts cannot readily be quantified and therefore are not evaluated in detail.

However, the types of secondary (storm runoff) impacts expected include increased sedimentation in the stream bed, reduced water clarity, and increased delivery of nutrients to the River and to Geneva Lake.

The EIS Alternative also proposes upgrading the existing municipal wastewater treatment facilities in Lake Geneva with a new system of interceptor mains and a new rapid infiltration treatment system (Section 2.4.3.). The existing Lake Geneva WWTP discharge to the White River would thus be abandoned under both the EIS Alternative and the FPRA. Both the EIS Alternative and the FPRA would be beneficial for the White River. Future violations of dissolved oxygen standards would be less frequent and less severe, and the amounts of nutrients discharged would be reduced. The State standard violations for the existing discharge would be eliminated. However, both alternatives would have a short term adverse impact on the White River due to the sudden removal of an existing source of nutrient enrichment and a long term adverse impact due to the loss of the streamflow contribution made by the WWTP effluent. These adverse impacts would be similar in nature to those described for the impacts on the aquatic plant community of Piscasaw Creek.

4.1.2.4. Groundwater

Long-term impacts that could be encountered in the operational phase of the alternatives concern the following types of pollutants: bacteria and viruses, organics and suspended solids; phosphorus; and nitrate-nitrogen. Movement to groundwater of other wastewater constituents or of soil chemicals would occur, but are not expected to restrict any of the uses of the groundwater.

Bacteria and dissolved organics are readily removed by filtration and adsorption onto soil particles. Two feet of soil material is generally adequate for bacterial removal, except in very coarse-grained, highly permeable soil material. Contamination of drinking water wells or surface water with bacteria and dissolved organics in the study area is unlikely under any of the alternatives.

Phosphorus can be significant in groundwater if its dicharges to a sensitive surface water because it can contribute to the excessive eutrophication of lakes. Section 4.1.2.2. contains a discussion of phosphorus absorption in soils and supports the conclusion that phosphorus contributions to the groundwater from any of the alternatives would be minimal.

The ability to predict phosphorus concentrations in percolate waters from soil treatment systems has not yet been demonstrated (Enfield 1978). Models that have been developed for this purpose have not yet been evaluated under field conditions. Field studies have shown that most soils, even medium sands, typically remove in excess of 95% of phosphates at relatively short distances from effluent sources (Jones and Lee 1977).

One potential source of phosphorus input to groundwater is the soil absorption systems included in the No Action Alternative and the EIS Alternative. The groundwater quality analyses performed in conjunction with the Septic Leachate Detector survey showed that a very limited amount of phosphorus is reaching the lakes by way of groundwater. The majority of groundwater plumes sampled, however, had phosphorus concentrations less than 1.0 mg/l, although one plume did have a concentration of 9.05 mg/l. The contribution of phosphorus to the lakes from onsite systems has not been quantified from the sampling data, but from theoretical data. Thus, onsite systems may be contributing to algal growth in localized areas where effluent plumes emerge, but their contribution to eutrophication is not quantifiable. The greatest quantity of phosphorus would be contributed to groundwater under the No Action Alternative. A slight amount of phosphorus would be contributed to the groundwater under the EIS Alternative, which continues to rely on onsite systems. The FPRA would remove almost all phosphorus from groundwater entering the lake by installing collection lines to all currently unsewered areas and transmitting all effluent to the proposed WWTPs.

The EIS Alternative and the FPRA, which incorporate land application by rapid infiltration of biologically treated effluent, are not expected to increase the phosphorus concentration in the groundwater. Application of wastewater onto the soil results in utilization of the soil for sorption of phosphorus. Phosphorus in groundwater under a land application site is of concern only when surface waters are affected. Groundwater from the Walworth/Fontana site would likely flow to the west into Piscasaw Creek and the Fox River Basin. The Williams Bay site would flow towards Williams Bay in Geneva Lake and the City of Lake Geneva site would flow to the east into the White River drainage. However, phosphorus from these land application facilities is not expected to have any impact on these water resources.

Nitrates in groundwater are of greatest concern at concentrations of more than 10 mg/l as nitrogen because they may cause methemoglobinemia in infants who ingest liquids prepared with such waters. The limit was set in the National Interim Primary Drinking Water Regulations (40 CFR 141) of the Safe Drinking Water Act (PL 93-523). A general discussion of nitrogen in soils is presented in Section 4.1.2.2.

The concentration of soil absorption systems in a particular area is reported to be the most important parameter influencing pollution levels of nitrates in groundwater (Scalf and Dunlap 1977). That source also notes, however, that currently available "information has neither been sufficiently definitive nor quantitative to provide a basis for density criteria." The potential for high nitrate concentrations in groundwaters is greater in areas of higher density residential developments. Depending on the groundwater flow direction and pumping rates of wells, nitrate contributions from soil absorption systems may become cumulative in multi-tier developments. Thus, separation distances are critical for new construction and maximum density codes are crucial for new subdivisions.

The groundwater sampling results (Section 2.2.2.5.) from wells show that no elevated nitrates (greater than 4 mg/l as nitrogen) occurred in the wells that were sampled. Only two wells in Lake Como Beach had nitrates greater than 2.0 mg/l. One was from a shallow well that also showed high fecal coliforms indicating site problems. The other value may indicate direct pollution from the surface or anomalous sampling error because the well is 125 feet deep.

These slightly elevated levels of nitrate would continue under the No Action Alternative, and violations of the drinking water quality standard may occur, but are not likely. The EIS Alternative that includes continued use of onsite systems may not necessarily result in declines in concentrations of nitrates in the groundwater. Wells that continue to have elevated nitrate concentrations may need to be deepened so that a hydraulically limiting layer is penetrated.

Sampling data from the existing rapid infiltration facilities in the Geneva Lake area indicate that these facilities may cause minor changes in localized concentration of nitrates in the groundwater. However, these changes are relatively minor in degree and are well below drinking water standards. In addition, there is an abundance of groundwater in the Geneva Lake area. This, coupled with fairly rapid rates of movement through coarse glacial deposits, is expected to result in dilution of the nitrate concentration to near background levels after short travel distances from infiltration basins. Maintaining appropriate distances from watersupply wells will reduce the potential for contamination from rapid infiltration facilities.

Data from a lysimeter under the infiltration lagoon and a potable well on the Fontana treatment plant site show no nitrate concentrations above 1 mg/l (Appendix C of the Draft EIS). Data from two downgradient wells at the Interlaken Resort show nitrate concentrations ranging from 0.5 to 6.81 mg/l, which are relatively high but still well below drinking water standards of 10 mg/l. However, an upgradient well, not influenced by wastewater effluent, shows background concentrations as high as 1.9 mg/l. The high nitrate sampling events also correspond to periods when the sewage treatment is producing effluent nitrate concentrations of 9.83 to 19.5 mg/l. Lake Como sampling results at Interlaken do not reflect these high concentrations indicating adequate mixing and dilution by the time it reaches the lake.

Groundwater data for Williams Bay is minimal (Appendix C of the Draft EIS) and was prepared for assessing the performance of seepage lagoon No. 2 (Warzyn Engineering, Inc. 1982). The water quality data from the two monitoring wells along the east side of the seepage lagoon indicated that nitrates are not a problem under the lagoon. The concentrations on one sampling date (8 July 1982) were 4.47 and 5.44 mgl/N. A well 180 feet to the west of the seepage lagoon and upgradient had a measured nitrate concentration of 11.0 mgl/N. The concentration was inexplicable (Warzyn Engineering, Inc. 1982), and may reflect agricultural sources, or sources other than wastewater.

The specific prediction of groundwater impacts of a seepage cell system requires consideration of the following:

- Known and expected wastewater characteristics
- Type of treatment process used before the disposal system
- Known and expected wastewater effluent characteristics
- Application rates, soil characteristics, and depth to groundwater
- Direction of groundwater flow, recharge or discharge conditions, and existing groundwater quality
- Depth to bedrock and the geographic land configuration adjacent to the disposal site
- Downstream uses of the groundwater.

Because the Villages of Walworth and Fontana elected to construct the oxidation ditch system with a surface water discharge, the information necessary to predict groundwater impacts was not gathered. Therefore, the potential impacts of a seepage cell system at the Village of Walworth cannot be determined beyond a general discussion.

Recently, Kikkoman Industries has requested that the Villages of Walworth and Fontana allow the industry to discharge its process wastewater to the proposed municipal treatment system. This wastewater contains high concentrations of chlorides. Chlorides are not a specific health problem but high concentrations affect the potability of the groundwater. The WDNR had expressed reservations over a seepage cell system that would serve Walworth and Fontana if the Kikkoman wastewaters are discharged to the municipal system because of the possibility of increasing chloride levels in the groundwater above acceptable concentrations.

The City of Lake Geneva proposes to construct seepage cells on a site that is located at the southeast corner of the intersection of US 12 and STH 50 in the Town of Lyons. The WDNR required that the city perform an extensive evaluation of the proposed seepage cell site. Furthermore, the city and its consultant have completed an additional evaluation of this site to confirm and supplement original data, and conclusions. The WDN has reviewed and commented on all information submitted by Donohue Assoc., Inc.

Several persons commented that the proposed seepage cell site has bee extensively mined for sand and gravel subsequent to the initial sit investigation. The WDNR required a second field investigation subsequen to the gravel mining activities. The requested report was completed durin the spring of 1983.

A specific discussion of the factors that were evaluated in assessin the feasibility of the proposed disposal site for the City of Lake Genev follows.

The characteristics of the wastewater generated in the city wer assumed to be typical domestic wastes, and as such, do not contain an specific characteristic that would cause undue concern in designing a seepage cell system. The available records of wastewater characteristics for the city validates this assumption. The wastewater biochemical oxygen demand and suspended solids concentrations reported on the monthly discharge monitoring forms are at the low end of the range expected for typical domestic wastewaters. Donohue & Assoc., Inc. performed an industrial survey in the City of Lake Geneva in 1979. This survey identified 17 industries in the community. It was found, however, that none of the wastewater discharged from these industries displayed characteristics which would raise concern in the design and operation of the seepage cell system. Of the 17 industries identified only one is required under the revisions of NR 101, Wis. Adm. Code, to report wastewater characteristics to the WDNR. The 1981 waste characteristics from this industry as reported to the WDNR are shown in Table 4-3.

The soils of the proposed site have been the subject of two investigations, the first was completed in September 1982 and the second in March 1983. The sand and gravel mining at the proposed site occurred during early December 1982. The upper 10 to 20 feet of soil (present conditions) consists of a fairly homogeneous mixture of well graded sand, silty sand,

Table 4-3. Industrial wastewater characteristics for the City of Lake Geneva.[a]

Constituent	Average Loadings lbs/day	mg/l
BOD	35.9	71
Suspended Solids	55.6	110
Oil & Grease	88.9	176
Nitrate & Nitrate Nitrogen	1.6	3.1
Total Nitrogen	1.3	2.6
Phosphorus	2.2	4.3
Sulfate	20.2	40
Chloride	55.6	110
Zinc	1.8	3.5
Phenols	0.1	0.19

[a]Waste composition: process-88.1%, cooling-0%, and sanitary-11.9% for average flows of 68,794 gpd and maximum flows of 101,000 gpd.

and poorly graded gravel. The underlying soils are silty sands to silty clays. The fraction of fine material (that passing the No. 200 sieve) in the sand and gravel ranges from approximately 5% to 26% by weights.

Table 4-4. Sludge characteristics for the City of Lake Geneva.

Parameter	1982				1983			
	3/03	6/07	9/17	12/07	3/02	6/08	9/12	12/07
Total Solids (%)	3.0	3.1	2.5	1.7	2.3	2.7	2.3	2.7
Total Nitrogen (%)	5.27	3.87	2.88	4.00	4.00	3.19	4.61	2.70
Ammonia N (%)	0.90	1.68	2.12	2.76	1.96	1.22	1.91	1.48
Total Phosphorus (%)	5.33	2.19	3.8	4.17	4.00	3.33	4.13	3.70
Total Potassium (%)	0.14	.22	.20	.253	.198	.204	.213	.144
Arsenic (mg/kg)	10.3	.16	1.2	.29	6.52	2.93	.83	5.56
Cadmium (mg/kg)	9.0	9.03	9.2	9.1	9.57	8.52	9.13	6.67
Chromium (mg/kg)	133	103	100	94	130	92.6	69.6	74.1
Copper (mg/kg)	700	158	1,120	882	739	704	783	741
Lead (mg/kg)	187	277	200	194	161	167	213	204
Mercury (mg/kg)	1.8	2.32	3.36	2.4	2.87	2.11	.09	3.52
Nickel (mg/kg)	70	58.1	52	41	100	55.6	56.5	48.1
Zinc (mg/kg)	6,670	7,420	8,400	7,647	7,830	7,410	6,960	8,520
pH	6.8	6.8	7.1	6.9	6.7	6.7	705	6.75

The groundwater elevation at the proposed disposal site varies from approximately 847 feet above mean sea level (msl) at the eastern edge of the site boundaries to approximately 855 feet above mean sea level at the western boundary of the site. Correspondingly, the existing ground elevations on the site vary from approximately 870 feet to 905 feet. The minimum separation from existing ground surface levels to existing groundwater elevations is 15 feet. Information published by the University of Wisconsin - Extension in conjunction with the United States Department of the Interior Geological Survey (Borman, 1976) indicates that the general groundwater groundwater movement in the area of the proposed seepage cells is to the northeast. Measurements taken during the site investigation by Donohue & Associates (Donohue & Assoc., Inc. 1982c) show that the groundwater movement under the seepage cell site is more to the east than to the northeast and has a gradient of approximately 0.004 feet per foot.

The surrounding topography is important for assessing the feasibility of a seepage cell site. Approximately 500 east of the proposed site is a small drainage stream that runs from south to north. The water surface elevation of the stream is estimated from USGS topographic maps as approximately 845 to 840 feet msl. The water surface elevation at the stream culvert at STH 50 was approximately 829 feet on 13 January 1984 and 23 March 1984 (By telephone, Don Zenz, Donohue & Assoc., Inc., to Mark Williams, WDNR, 25 March 1984). Another stream is located approximately 700 to 800 feet north of the proposed seepage cell site. This stream flows from the southwest to the northeast and its elevation is approximately 845 to 840 feet msl as estimated from the USGS topographic map.

The prediction of pollutant movement in the groundwater from the seepage cell site is dependent upon detailed investigation of the geologic and hydrogeologic configuration of the area. Based upon information gathered by Donohue and Associates, the Wisconsin Department of Natural Resources performed a brief analysis of groundwater mounding to evaluate the potential for pollutant movement from the site. Although the site geology is variable and the analysis was based on limited field data, the WDNR analysis concluded that existing groundwater at distances greater than 500 feet from the site. The analysis further stated that the additional flow from seepage cell discharge was not anticipated to appreciably change the flow depth or stream characteristics for tributaries to the White River.

The primary substances of concern in evaluating the potential groundwater impacts associated with the disposal of treated wastewater via seepage cells are: nitrates, phosphorus, heavy metals, total dissolved solids, microorganisms, and organic chemicals. The following is a specific discussion of the anticipated groundwater impacts of these specific groups that may result from the operation of the seepage cell system at the City of Lake Geneva.

Typically, domestic wastewater contains approximately 50 mg/l of the total nitrogen that is about 30 mg/l ammonia nitrogen and 20 mg/l organic nitrogen. Nitrate concentrations in raw wastewater typically are very low. Biological treatment processes, of the type serving the city will remove 10-30% of the influent nitrogen (Metcalf & Eddy, Inc. 1979). The forms of nitrogen in the trickling filter effluent will be ammonia, organic, and nitrate. The expected removal of nitrogen through a seepage cell system will range from 30 to 80%. The expected total nitrogen in the groundwater under the seepage cells will range from 7 mg/l to a 24.5 mgl N as nitrates. Thus, the operation of seepage cells at the City of Lake Geneva has the potential of increasing the nitrate concentration in the groundwater above the drinking water standard of 10 mg/l nitrate nitrogen.

The proposed seepage cell design includes construction of 8 individual seepage cells that will be dosed and rested on a weekly basis. The dose-rest cycle, coupled with the pH of Lake Geneva's wastewater (7.0 - 7.5), promotes quite high nitrogen removal rates. A slight reduction in the nitrate concentration can be expected from dilution with natural groundwater. Several design features will be incorporated into the system such that the city will be able to identify impending nitrate contamination of the groundwater. A lysimeter below one seepage cell but above the groundwater will enable the city to collect samples as the wastewater percolates through the soil and to determine the level of treatment taking place in the soil. Also, WDNR will require upgradient and downgradient monitoring wells. Analysis of samples taken from the lysimeters and the monitoring wells will allow the city to monitor the levels of pollutants and to track the movement of these pollutants in the groundwater. If high levels of nitrates are measured in the lysimeter samples, the city can change the operation to reduce the amount of total nitrogen applied to the site. If necessary, additional treatment units designed specifically to remove nitrogen can be constructed in the future.

From a public health standpoint, phosphorus contamination of the groundwater is generally not a concern. Phosphorus is not toxic and does not affect the potability of water. Also, the soil readily adsorbs and removes phosphorus as it percolates downward.

Certain metal ions, designated as "heavy metals" (zinc, nickel, mercury, lead, copper, chromium, and cadmium) are of concern in the groundwater. The soil can remove these from the percolating wastewater by adsorption and precipitation reactions. The Lake Geneva wastewater generally has low metal concentrations, therefore, heavy metals in the groundwater will also be low and will not hinder groundwater use. Additionally, the ability of soils to remove heavy metals is enhanced at pH levels greater than 7.0. As previously noted, the wastewater pH ranges bewteen 7.0 and 7.5; therefore, soil pH will be maintained at sufficiently high levels for efficient removal of heavy metals.

Total dissolved soilds (TDS) consist of those elements (including but not limited to sodium, calcium, maganese, magnesium, iron, chloride, and sulfates) that contribute to the hardness, alkalinity, and salinity of the groundwater. High TDS does not generally pose a health hazard but will affect the potability. Typically, the concentrations of TDS in groundwater will be increased by 200 mg/l to 600 mg/l, depending on the TDS in the water supply. The WDNR does not require sampling and reporting of TDS on a routine basis. Therefore, no consistent record of existing TDS concentrations in the groundwater are available. The city reported TDS concentrations of 400 mg/l in 1972. Groundwater samples from the proposed site had TDS concentrations ranging from 388 mg/l to 618 mg/l (Donohue & Assoc., Inc. 1982). The TDS in the samples taken from 3 of the private wells north of the proposed site range from 690 mg/l to 1,010 mg/l.

The anticipated change in the TDS at the proposed site cannot be predicted accurately but the concentrations could be increased by as much as 500 mg/l. The total TDS concentrations would then be near or greater than 1,000 mg/l. The secondary public water standard is 500 mg/l, as specified in NR 109.60 of the Wis. Adm. Code.

Pathogenic bacteria and viruses are the microorganisms of concern in groundwater. Pathogenic bacteria experience rapid die off through wastewater treatment facilities and in soil. Therefore, the contamination of the groundwater under the seepage cell site at Lake Geneva by pathogenic bacteria is not a concern. Removal of viruses by soil reaction may not be immediate. However, it is generally reported (USEPA 1981c) that the maximum travel of viruses through the soil is limited to several hundred meters. It is felt that the location of the seepage cells at Lake Geneva relative to private water supply wells and surface water bodies is sufficient to prevent transmission of viruses.

The threat to groundwater contamination by organic chemicals only occurs when the concentration of organic chemicals is high. This is not a situation expected at the City of Lake Geneva. As noted earlier, there are no significant industrial waste discharges to the city system. Insecticides, pesticides or solvents from the residential and commercial areas of the city may be present in the municipal sewerage system. These organic chemicals will be effectively removed or altered in the treatment process and through the seepage cell system.

Four or five private water supply wells are located north and northeast of the proposed site at distances ranging from 500 feet to 750 feet. A potential exists that these wells could be adversely affected by the operation of the seepage cells. Based on the previous discussion, the likelihood of adverse health-related impacts are not likely. Nevertheless, these resident have expressed a reasonable concern over the safety of their water supply and have requested that the responsibility for replacing their wells should the well water become contaminated or nonpotable be clearly delineated. Chapter 144 of the Wisconsin State Statutes provides authority to WDNR to order the owner of any regulated disposal system to correct any problems that operation of the disposal system causes. Futhermore, current legislation being considered by the Wisconsin legislature will provide for the replacement of wells from the general tax funds for any private water supply well that becomes nonpotable for any reason.

Nitrates in the groundwater below the rapid infiltration site at Walworth/Fontana probably would average less than the drinking water quality standard of 10 mgl/N. Improvements in the facilities at Williams Bay could permit operation of the system to maximize denitrification. A new system at Walworth/Fontana would have the operational flexibility to maximize denitrification. Short-term, localized increases in nitrate concentrations above background concentrations are anticipated, but average concentrations above the drinking water quality standard of 10 mgl/N are not anticipated. The higher nitrate concentrations are not expected to restrict current uses of the groundwater. The surface waters to which the groundwater would discharge would not be significantly affected because most surface waters are phosphorus, rather than nitrate, limited for biological growth.

Seepage from the wastewater treatment lagoons at Walworth/Fontana could result in elevated nitrate levels in the groundwater below the lagoons. Clay liners are not impermeable and plastic liners can be punctured or experience deterioration. On medium- to coarse-textured soils, the quality of the liner is of utmost concern for protection of groundwater quality. Monitoring wells would be installed and sampled on a regular basis. The sampling program would identify problems before neighboring residents would be affected.

Changes in groundwater levels would occur with the centralized alternatives. Export of water from the locally recharged lakeshore area to the wastewater treatment systems would change the groundwater levels slightly. The greatest change in groundwater levels would occur in the vicinity of the land application sites. Inadequate data have been assembled to accurately predict the water table rise. The water table rise would only affect the land application site, and the immediately surrounding area. Appropriate application rates at the land application sites would prevent the water table from rising to nuisance levels.

4.1.2.5. Terrestrial Biota

The land application sites proposed in Section 38 for Walworth/Fontana under the EIS Alternative, and Sections 1 and 30 for Williams Bay and the City of Lake Geneva under the FPRA would affect the terrestrial biota during plant operation. No significant, adverse long-term effects would be expected during normal plant operating conditions. Wildlife, especially waterfowl, may be attracted to the lagoons but there is little evidence that they would be adversely affected.

4.1.2.6. Wetlands

None of the existing or proposed wastewater treatment facilities are anticipated to impact significantly upon wetlands within the study area. The existing Lake Geneva WWTP is contiguous to a wetland characterized as forested to the north and emergent to the south. Under both the FPRA and the EIS Alternative, the effluent discharge from this plant would be removed from the White River and applied to infiltration basins at a rapid infiltration site Southeast of the intersection of Routes 12 and 50. Groundwater mounding projections by WDNR indicate that mounding will not influence wetland groundwater or surface water levels.

4.1.2.7. Land Use

Land use under the easement of sewage conveyance lines proposed under the FPRA would be intermittently affected when maintenance or repairs were performed on sections of the lines. Periodic excavating and filling would disturb vegetation and soil along conveyance lines. The release of low level odors and aerosols from WWTPs and the knowledge that hazardous gases could potentially be released from those plants may affect land use adjacent to the plants. Improper maintenance of onsite systems may create malodorous conditions which would adversely affect adjacent land uses.

4.1.2.8. Demographics

The operation and maintenance of wastewater facilities proposed under either of the alternatives will not have a significant impact on the demography of the study area. A limited number of long-term jobs created by the operation and maintenance of these facilities likely will be filled by persons living in and around the study area. It can be assumed that new residents would not be attrated to the study area for the limited number of positions.

4.1.2.9. Economics

The operation of wastewater facilities under the centralized collection and treatment component of the FPRA would create a few long-term jobs. These jobs could be filled by persons residing in the study area.

No new jobs are anticipated to be created under the EIS Alternative. Existing contractors are expected to satisfy local demand for construction and maintenance services of onsite systems. No significant economic impacts are expected to occur during the operation of wastewater treatment facilities under any of the alternatives.

4.1.2.10 Recreation and Tourism

The operation of wastewater facilities under any of the alternatives could affect tourist and recreational activities in the study area if a malfunction of those facilities occurred. A failure in the system components of the WWTPs could cause untreated or partially treated waste to be discharged into Lake Geneva, Lake Como, Piscasaw Creek, or the White River. This phenomenon would result in short-term water quality degradation and a reduction in the recreational use of these bodies of water. Odors emanating from malfunctioning onsite systems may curtail outdoor recreational activities in the near vicinity.

4.1.2.11. Transportation

Impacts arising during the construction of collection and conveyance lines under the FPRA would reoccur when maintenance or repairs are made on those lines. Occasionally some roads may be closed on a temporary basis. Truck traffic to and from the proposed treatment facilities under the FPRA and the EIS Alternative will be associated with supply deliveries.

4.1.3. Fiscal Impact

The costs of implementing a wastewater collection and treatment project in the study area would be apportioned between USEPA, the State of Wisconsin and local residents. Apportionment of the costs is made on the basis of what costs are eligible to be funded by the State of Wisconsin or USEPA. The costs for each alternative are presented in Sections 2.5.2. and 2.5.3. A description of the portion of the costs that would be funded by USEPA and by the State, and the portion of the costs that represents the local share is contained in Section 2.5.1.

Wastewater treatment facilities can create significant financial impacts on communities and users who are responsible for the capital, operation, maintenance and debt costs associated with sewage treatment facilities. Guidelines for determining the magnitude of the fiscal impacts associated with wastewater collection and treatment alternatives include:

- overall debt as a percentage of full value (Table 4-5)
- overall debt as a percentage of the statutory debt limit (Table 4-6)
- ratio of the average annual user charge to median household income (Table 4-7).

In Wisconsin, long-term municipal indebtedness is limited to 5% of the full equalized value of general property. As Table 4-5 indicates, none of the communities would exceed the statutory debt limit, under either the

Table 4-5. Estimated debt as a percentage of full equalized value (all figures x 1,000).

Area	Existing Debt	+	Local Share: FPRA	Local Share: EIS Alternative	=	Total Debt	÷	Full Value	=	Debt-to-Value (%)
		+	6,218		=	6,806			=	4.6
Lake Como (Geneva Town)	588						÷	147,093		
		+		1,004	=	1,592			=	1.1
		+	682		=	5,031			=	2.4
Lake Geneva	4,349						÷	206,598		
		+		924	=	5,273			=	2.6
		+	472		=	913			=	2.2
Walworth[b]	1,041						÷	42,452		
	-600	+		398	=	839			=	2.0
		+	1,750		=	5,124			=	3.1
Fontana	3,374						÷	163,400		
		+		1,627	=	5,001			=	3.1
		+	598		=	2,871			=	2.9
Williams Bay	2,273						÷	98,817		
		+		593	=	2,866			=	2.9
		+	3,164		=	3,996			=	1.9
Linn Town[a]	832						÷	207,991		
		+		937	=	1,769			=	0.9

[a] Includes southeast shore, southwest shore and northwest shore collection and treatment alternatives.
[b] Walworth has $600,000 in an account balance for construction of a new WWTP.

Table 4-6. Estimated debt as a percentage of the statutory debt limit (all figures x 1,000).

Area	Total Debt		Statutory Debt Limit	Overall Debt as a % of Statutory Limit	
	FPRA	EIS Alternative		FPRA	EIS Alternative
Lake Como (Geneva Town)	6,806	1,592	7,355	92.5	21.6
Lake Geneva	5,031	5,273	10,330	48.7	51.0
Walworth	913	839	2,123	71.3	67.8
Fontana	5,124	5,001	8,170	43.0	39.5
Williams Bay	2,871	2,866	4,941	58.1	58.0
Linn Town[a]	3,996	1,769	10,400	38.1	17.0

[a]Includes southeast shore, southwest shore and northwest shore collection and treatment alternatives.

Table 4-7. Estimated average annual user costs as a percentage of median household income.

Area	Annual User Costs		Median Household Income (1980)	User Cost/ Median Household Income Ratio	
	FPRA	EIS Alternative		FPRA	EIS Alternative
Lake Como (Geneva Town)	$732	213	20,687	3.5%	1.0%
Lake Geneva	103	202	15,493	0.7	1.3
Southeast Shore (Linn Town)	640	169	17,424	3.7	1.0
Walworth	117	119	16,195	0.7	0.7
Fontana	203	170	20,366	1.0	0.8
Southwest Shore (Linn Town)	366	136	17,424	2.1	0.8
Williams Bay	160	170	15,706	1.0	1.1
Northwest Shore (Linn Town)	545	172	17,424	3.1	1.0

FPRA or EIS Alternative. Geneva Town would approach the 5% limitation, under the FPRA, however, with an estimated debt-to-value ratio of 4.6%.

Another index for estimating the potential fiscal impacts of a capital improvement project is the level of overall debt (existing debt combined with capital costs of the project) as a percentage of the statutory debt limit. In general, if a community's overall debt exceeds 90% of the statutory debt limit, its ability to undertake other capital improvement projects in the near future could be jeopardized. Communities financing projects that would cause the overall debt to exceed this 90% guideline can generally expect to pay a greater interest rate on general obligation or revenue bonds that are sold to finance the project.

As Table 4-6 indicates, the 90% guideline would be exceeded by Geneva Town and would be approached by Walworth under the FPRA and EIS Alternative. Thus, implementation of the FPRA in Geneva Town and either the FPRA or EIS alternative in Walworth could limit the Town's ability to implement other capital improvement projects until a portion of the outstanding debt is retired.

The USEPA considers projects to be expensive and as having an adverse impact on the finances of the users when average annual user changes are:

- o 1.0% of median household incomes less than $10,000
- o 1.5% of median household incomes between $10,000 and $7,000
- o 1.75% of median household incomes greater than $17,000.

Information on median household income in the study area communities, in 1980, is presented in Table 4-7 along with the ratio of average annual user costs to median household income. As Table 4-7 indicates, implementation of the FPRA in the Lake Como, southeast shore, southwest shore and northwest shore service areas would impose a significant financial burden on residents of these service areas. High user costs are associated with these alternatives because of the costs of installing collection systems in currently unsewered areas. The estimated user costs presented in Table 4-7 do not, however, consider the effect of connection policies. The actual annual user costs probably would be lower as a result of revenues raised by the respective communities or utility districts from connection fees or benefit assessments. However, regardless of whether residents of currently unsewered areas that are proposed to be sewered under the FPRA are charged a connection fee or a benefit assessment, or are faced with substantially higher ad valorem taxes, the costs of constructing collection systems will represent a substantial financial impact on residents of these areas. Thus, although the estimated average annual user charges presented in Table 4-7 may be somewhat inflated, because they do not consider connection policies, it also is apparent that implementing the FPRA in currently unsewered areas will require a substantial commitment from residents of these areas to finance the proposed systems. The fiscal impacts associated with the FPRA would be most acute for residents with fixed incomes, however, an analysis of average income levels indicates a low percentage of families in the study area have incomes at or below the poverty level, and therefore it is expected that only few displacement of low income residents may occur.

4.2. Secondary Impacts

Each of the alternatives will have effects that extend beyond primary or operational impacts. These indirect, or secondary impacts are likely to occur when improvements in wastewater treatment capacity and capability lead to changes in the study area that, in turn, induce or stimulate other developments which would not have taken place in the absence of a project. The categories that may experience significant secondary impacts are described in the following sections.

4.2.1. Demographics

Population growth and land development have always been dependent on factors such as transportation access, employment opportunities, physical setting and land values. One of the more significant factors influencing the development potential of an area is the presence or absence of centralized wastewater collection and treatment systems. Onsite wastewater treatment facilities often limit development to areas with suitable soil and site characteristics, while centralized sewer systems allow greater locational independence because soil, slope, and drainage are less constraining design parameters. The construction of sewers in an unsewered area often increases the supply of buildable land, and local municipal ordinances usually allow development at greater densities in sewered areas than in unsewered areas.

In some situations, improvements in wastewater treatment capacity and capability can induce, or stimulate, growth that would not have occurred without the improvements. Typically, such induced growth occurs in areas where there is significant demand for residential development, but that demand is constrained by the lack of adequate wastewater treatment capacity or capability. In other words, there can be a direct correlation between the development potential of an area and the capacity and capability of available wastewater treatment. Although the availability of sewers can influence the development potential of an area, other factors such as site and locational amenities, land values, employment opportunities, transportation access, and related factors are also important factors in defining an area's development potential. The dynamics of these factors obviously vary according to the characteristics of the locality.

It is not clear at this time whether the development potential of the study area is directly related to the presence or absence of centralized wastewater collection and treatment systems, i.e., the effect of sewers as opposed to onsite systems on population growth rates. The FPRA estimates a year 2005 population for the combined RSSAs (including permanent and seasonal residents) of 32,819. Based on an estimated 1980 population in the EIS of 22,359, this represents a projected increase of 46.8% in the combined RSSAs. The population of the East Planning area under the FPRA (which encompasses the Lake Como and Lake Geneva RSSAs) is projected to increase by 90.2% between 1980 and 2005, from 11,101 to 21,115 a rate significantly greater than the past rate. The West Planning area (which includes the Fontana, Williams Bay, and Walworth RSSAs) is projected to increase under the FPRA from 9,279 to 11,704 by the year 2005. This small increase under the FPRA is attributable to population projections selected by the individual communities and a smaller 1980 base seasonal population than that which is esimated in the EIS for the communities of Fontana and

Williams Bay. The growth rates that are reflected in the FPRA projections indicate that the facilities planners assume that existing growth rates will continue in the future, and further, that the existing development potential of the East Planning area is currently constrained by the lack of centralized collection and treatment capability and capacity. That is, the development of sewers in unsewered areas will "unleash" the development potential of the area; a development potential that at present cannot be realized because of the absence of sewers in prime development areas.

The population analysis developed for the EIS, however, (Section 3.2.2.3.) differs substantially from the FPRA, particularly for the East Planning area. For the West Planning area, the EIS estimates a population increase of 31.7% between 1980 and 2005, from 11,258 to 14,826. For the East Planning area, the EIS projects a population increase of 47.8%, from 11,101 to 16,405. The EIS estimates for the West Planning area are based on a larger 1980 seasonal base population than the FPRA. However, they accommodate only the amount of growth planned for by the respective communities between the years 1980 and 2005.

The EIS population projection is based on growth projected by each community for the sewered area and on the SEWRPC projections for the unsewered areas within the RSSAs. This projection is greater than the FPRA projection because the 1980 estimated population was greater in the EIS analysis and the SEWRPC growth was included in the projections. The projected annual average growth rate of 1.3% for the west end communities appeared to be reasonable when compared to other areas with similar characteristics. Further, the communities in the West Planning area should be able to accommodate this increased population without stressing other public facilities and services (e.g., police and fire protection, schools, etc.) and the environmental quality and "amenity value" of the area are not expected to be impacted by this level of population growth.

The FPRA population projections for the East Planning area (21,115) are considerably higher (22%) than the EIS projections (16,405). In this situation, it appears that the FPRA projections assume that improvements in treatment capacity and capability will result in a substantially higher population growth, and that these growth rates will be maintained into the future. The EIS projections are based on the SEWRPC projections for the City of Lake Geneva and the SEWRPC projections for the areas that lie within the RSSAS. If facilities are designed for the larger population, however, there is a very real possibility that the availability of wastewater collection and treatment facilities may induce more growth than anticipated. It should also be noted that creating an onsite waste water management district and providing upgraded onsite systems technology may expedite permit approvals for land development in currently unsewered areas. However, it is questionable if the amount or rate of development and population growth will meet or surpass that projected in the EIS.

A recent study (Ragatz 1980) has presented evidence that the attractiveness of a recreational area results from the combination of a number of factors. These include people's perceptions about the area; the quality of recreational opportunities that are available; land values; and proximity to metropolitan areas. There is evidence that when a recreational lake area reaches a certain level of development, additional development takes place very slowly, then virtually ceases. Even though vacant, buildable land may be available, additional development may not occur if the factors that originally made the area attractive - spaciousness, "rustic" settings, quiet surroundings and high quality recreational opportunities - are no longer perceived to be present. Thus the ability of a recreational area to attract recreational users may be diminished by a perception on the part of the public that the area has lost some of its desirable characteristics. The number of people who are attracted to the area for recreation may not be the same as the number of people who choose to become seasonal or permanent residents. Recent USEPA EIS's for other recreational lake areas (e.g., Moose Lake, Minnesota and Indian Lake-Sister Lakes, Michigan) have made similar predictions of the effects of increased population density.

If the population in the east planning area becomes large enough, the saturation point could be reached and these effects could occur. The problem arises in that the "saturation point" is undefinable quantity and, as such, the necessary population density to reach the "saturation point" is also undefinable. Both the FPRA and EIS Alternative allow for population growth through the 20 year planning period which will move the East Planning Area toward the "saturation point." The FPRA does provide for a larger and faster population growth than the EIS Alternative, and the "saturation point" could be reached sooner under the FPRA. It should be noted, however, that it is not possible to predict whether the "saturation point" will be reached during the planning period.

The most apparent impact of reaching the "saturation point" would be stress on existing recreational areas and opportunities. If a perception developed that the quality of the area's recreational opportunities had declined because of overcrowding, other less developed recreational areas could attract those dissatisfied with conditions in the Planning Area. If this occurred, land values in the area could diminish because of the reduced attractiveness of the area. It is not possible to predict what the "saturation point" may be and when it might be reached. However, given existing development and recreational use characteristics, it appears that the area can only absorb a limited amount of additional population before the amenity values of the area could begin to diminish.

In addition, a 90% increase in the population of the East Planning area would require major improvements in other public facilities and services. For these improvements to be made, a substantial commitment of the community's financial resources would be required. Although not quantifiable at this time, the increased costs associated with necessary improvements in other public facilities and services could lead to increased taxes and user fees that could severely impact some segments of the population. That is, a wastewater collection and treatment system designed to accommodate an additional 10,014 people implies a commitment to finance the capital and O&M costs associated with the improvements, an understanding and endorsement of the changes that these improvements will bring about in the community, and a similar commitment to improve other public facilities and services as a result of the population growth.

4.2.2. Land Use

The land use impacts associated with the wastewater management alternatives are primarily related to induced population increases and the resultant demand for residential land. While the potential for additional commercial and industrial development may exist with the availability of wastewater treatment facilities, it is likely that this type of nonresidential development will not be significant.

The introduction of new wastewater collection and upgraded treatment facilities in the study area would increase population and, in turn, produce changes in land use. Should the population grow in the RSSA according to the FPRA projections, the most significant impact would occur in the East Planning area. Demands for land would be substantial should a 90% net increase in population (11,101 persons [Table 3-16] to 21,115 persons [Table 3-19]) be realized in the East Planning Area. To accommodate this change, approximately 4,179 additional dwelling units (approximately 2.4 person/d.u.) on a minimum lot size of, roughly, 10,000 sq. ft. for sewered areas would be required. This increase would necessitate the transformation of approximately 920 acres of vacant buildable land into residentially developed lands. Under the EIS population projections, a 47.8% net increase in population (11,101 persons to 16,403 persons [Tables 3-16 and 3-18]) would require approximately 570 acres of buildable land in the East Planning area. This land would provide 2120 additional dwelling units with 2.5 persons/d.u. On a per dwelling unit basis, the permitted residential densities are approximately 2 units per acre for unsewered areas while sewered areas allow approximately 4 units per acre.

The pattern of land use is not expected to change significiantly because of proposed wastewater facilities. The greatest change in land use patterns would result if 1,143 acres of land were taken from forest, agricultural, and other lands, and opened for residential development under the FPRA. Although this represents approximately 4% of land in the planning area and 5.7% of undeveloped land, it is a substantial portion of developable land in the planning area. The EIS projections for the total study area would require approximately 933 acres, mainly because the density of development would be less than under the FPRA. Land required for sewered residential developments is 604 acres and land for unsewered development is 329 acres. The total EIS land requirement is about 3% of the land area in the total planning area and approximately 4.5% of developable land. Localized impacts may occur in the southeast shore and Lake Geneva RSSA if the FPRA extends collection lines with the capacity proposed. A large amount of new development in this area could drastically alter the density and character of development and thus alter land use patterns.

4.2.3. Surface Water

Lake Geneva

Lake Geneva has been classified as mesotrophic, or moderately "enriched," in three independent research investigations. These investigations indicated that dissolved oxygen depletion in the deeper (hypolimnetic) waters has not worsened measurably since 1966. In general, Lake Geneva does not appear to have changed in overall trophic status as a result of increased residential development in its watershed. However, the GLWEA has recently presented symptomatic evidence of worsening water quality in late summer, leading to concerns that the lake may become eutrophic in years to come. For example, nuisance blooms of blue-green algae have been frequently documented in shallow embayments of Lake Geneva. Fecal coliform counts and nutrient analyses made of samples taken from tributary streams entering the Lake also indicate that runoff from summer storms may be yielding significant amounts of pollution and causing localized algal bloom problems.

The primary reason that Lake Geneva has not developed the whole-lake symptoms of eutrophication evidenced by many southern Wisconsin lakes is that it is sufficiently deep to remain stratified throughout the summer. Because of Geneva Lake's great depth (mean of 61 feet), much of the pollutant load delivered in spring and early summer runoff settles out and is trapped in the sediments. After stratification becomes strong during June, the nutrients suspended below the thermocline or settled in the sediments are isolated from productive upper waters, where algal blooms take place.

(See Section 3.1.3.3. for detailed data on Geneva Lake's limnological characteristics.)

Protection of the existing quality of Geneva Lake would mean abating the nutrient pollution which promotes the summer algal blooms and aquatic macrophyte growth now observed in back bays, near stream discharge points and the mouths of ditches, and throughout the littoral zone. The GLWEA has concluded that perennial streams represent the single largest source of "controllable" pollutants such as nutrients, sediment, and fecal coliform organisms (GLWEA 1977). Therefore, whenever runoff water enters the Lake during summer, especially in stream courses, culverts, and ditches, pollution abatement is desirable. Based on this conclusion, prevention or abatement of problems with algal blooms can be best accomplished by addressing land management practices which contribute the most nutrients and sediments to runoff channels.

Both the FPRA and the EIS Alternative will result in increased residential development with the attendant future additions in impervious surface area, storm sewers and drainage ditches to support the development. The degree of water quality impact will vary between these alternatives based on the amount of development supported, or "induced," and where that development is principally concentrated. Development clustered along the near lakeshore area or on hillsides bordering perennial streams can potentially have a much more adverse water quality impact than would the same amount of development scattered throughout the watershed. This is because the longer it takes runoff to enter the lake, the greater the opportunity for sediments to settle out, for dissolved nutrients to become soil-bound, and for fecal coliform organisms and pathogens to die off.

A review of acreage available for development, platted lot locations, and sewer service area maps was made for the RSSAs. Assuming that developable sewered lots average 10,000 sq. ft and unsewered lots average 20,000 sq. ft, projections were made of the growth in acreage devoted to residential land use throughout the RSSA. Substantial increases in developed acreages were projected to occur in the Lake Geneva RSSA, whereas no substantial concentration of developed acreages were projected to result in the west end RSSAs or in the Lake Como RSSA under the FPRA. Moderate increases of developed acreage were projected for the Williams Bay RSSA under the FPRA. Examples of the projected increases are presented in Table 4-8.

As indicated in Table 4-8, a large concentration of residential growth will occur in the Lake Geneva RSSA under the FPRA, which includes the southeast shore of Geneva Lake. The water quality impact of this future growth is anticipated to be substantial. The new growth would be concentrated closer to the lake at higher residential density permitted on sewered lots and would introduce biologically available nutrients to the lake. Nutrient loads to Geneva Lake will be increased by the addition of lawn fertilizer, construction erosion, roof drain diversions onto driveways and roadway ditches, build up of litter and trash in drainageways and increased deposition of fecal material from domestic pets. Under the EIS Alternative, the amount of development expected to occur would be measurably less than that anticipated under the FPRA. In the southeast shore area, the density of development would be half that of the FPRA and would not result in runoff volumes as great as the FPRA. The amount of nutrients and pathogens delivered to the lake would thus be measurably reduced.

Table 4-8. Projected increases in developed residential acreage from 1980 to the year 2005 for Williams Bay & Lake Geneva RSSAs.

Increases in Residential Acreage 1980-2005

RSSA	FPRA	Total	EIS (sewered)	EIS (unsewered)
Williams Bay	157	189	114	75
Lake Geneva (including Lake Como)	920	570	404	166

Lake Como

Lake Como has been classified as highly eutrophic in two independent trophic status investigations (See Section 3.1.3.3.). The principal nutrient source for Lake Como is reported to be surface runoff from agricultural land (GLWEA 1977). Therefore, improvements in water quality of Lake Como would result from either the FPRA or the EIS Alternative. Neither alternative proposes abatement of non-point source pollution and significant increases in development would not result from either alternative.

4.2.4. Recreation and Tourism

Any increase or decrease of tourism and recreational activities within the study area attributable to the operation of new, expanded wastewater facilities would occur if a major change in water quality were to occur. No significant improvement or degradation of water quality is anticipated from the construction and operation of the proposed wastewater facilities. Improved wastewater treatment will not result in a significant improvement in the water quality of either Geneva Lake or Lake Como. Increased development under any alternative would result in increased pollutants associated with urban runoff that may affect the water quality of Geneva Lake over the long term.

Also, a significant increase in population and land development could have a negative impact on recreation and tourism. This would occur should the physical and cultural amenities, which are highly important to the recreation and tourist trade, diminish. This may, in part, result from the transformation of agricultural, forest, and other buildable lands to residential developments. A major population increase could also result in crowding of recreational activities. Tourists may be sensitive to this and decide on other locations.

4.2.5. Economics

Economic growth should continue with population growth and development anticipated in the study area. The availability of centralized collection and treatment systems within the RSSAs could result in additional commercial development related to the tourist and recreation industry such as hotels, motels, and restaurants. This additional development would depend as much on ancillary economic factors such as costs, the tourist potential of the area, the limits of market saturation, etc., as on the availability of sewer service. If additional commercial development did occur as a result of the construction of sewers and WWTPs, the local economy would benefit from the increased tax revenues and employment opportunities. These potential benefits are not quantifiable, however.

Available data indicates that the permanent population of the study area is basically characterized as middle class, whose median family income approximated $20,000 in 1980 (US Bureau of the Census, 1982). Another indicator of income is the portion of the population that is below poverty level. While 8.5% of the population in the State of Wisconsin is below the poverty level, an approximate average of 7.5% of the study area's permanent population is below poverty level. Thus, it would be expected that few people with fixed incomes would be displaced from the study area for failure to pay user fees associated with wastewater facilities.

The seasonal population could be expected to have a somewhat higher income than the permanent population. Homes they purchase are usually second homes which is usually indicative of a moderately high to higher income class. These people benefit the community when money is circulated within the local economy and supports service sector industries.

4.2.6. Sensitive Environmental Resources

Floodplains

No 100-year floodplain area would come under pressure for secondary development under the alternatives. Local and County ordinances effectively limit most forms of development in floodplains in the study area.

Wetlands

Wetlands found in the study area are shown in Figure 3-6. Construction of wastewater collection and treatment facilities or upgrading onsite systems will not likely lead to any residential development pressures on wetland resources in the study area. In addition, local, County, and State ordinances effectively limit filling of wetlands for residential development. Wetlands and other sensitive environmental resources are protected through classification as primary environmental corridors. In accordance with NR 121, WDNR does not generally approve sewer extensions into areas with potential for development in wetlands adjacent to navigable waters.

Threatened and Endangered Species

The few species of plants and animals included on the threatened or endangered species list that are known to inhabit in the study area are found in wetland or lake environments. Consequently no direct threat to these species are anticipated from construction or operation of wastewater collection or treatment facilities. Any activity that threatens their environment, such as sediment from adjacent construction sites, could thereafter the viability of that species in the local area.

Cultural Resources

Significant cultural resources exist in the study area and more may be uncovered during construction of centralized wastewater collection facilities under the FPRA. If the FPRA extends sewers along the southeast shore of Lake Geneva with the capacity proposed, a significant amount of new residential development may take place in the vicinity of Big Foot Beach State Park and on the lake side of South Shore Drive. This development could impact known and previously uncovered archaeological resources. In addition, development pressure may be permitted through provision of centralized wastewater collection systems under the FPRA that could result in subdivision and development of large historically and architecturally noteworthy estates along the lakeshore. This development would occur at higher densities than are permitted under the provision of onsite systems as envisioned under the EIS Alternative.

Prime Agricultural Land

The Agricultural Impact Statement prepared by DATCP notes that secondary development effects could occur by providing wastewater collection facilities to portions of the Revised Sewer Service Area. The west end RSSA does include some prime farmland and farmland of statewide significance, as well as land zoned for exclusive agricultural use. The AIS concludes that the provision of wastewater collection facilities under the FPRA could facilitate the conversion of several hundred acres of productive farmland in the RSSA into residential or other non-farm uses. The EIS Alternative will lead to a more scattered development pattern than the FPRA, however, development pressure on prime agricultural land would not be as intense under the EIS Alternative.

4.3. Mitigation of Adverse Impacts

As previously discussed, various adverse impacts would be associated with the proposed alternatives. Many of these adverse impacts could be reduced moderately by the application of mitigative measures. These mitigative measures consist of a variety of legal requirements, planning measures, and design practices. The extent to which these measures are applied will determine the ultimate impact of the particular action. Potential measures for alleviating construction, operation, and secondary effects presented in Sections 4.1 and 4.2 are discussed in the following sections.

4.3.1. Mitigation of Construction Impacts

The construction related impacts presented in Section 4.1. primarily are short-term effects resulting from construction activities at WWTP sites or along the route of proposed sewer systems. Proper design should minimize the potential impacts and the plans and specifications should incorporate mitigative measures consistent with the following discussion.

Noise

The impact of noise from construction of wastewater collection lines, rennovating wastewater treatment plants, and upgrading onsite systems could be minimized by appropriate scheduling and public notification of the time, location, and extent of the work.

Atmosphere

Fugitive dust from the excavation and backfilling operations for the sewers, force mains, and treatment plants could be minimized by various techniques. Frequent street sweeping of dirt from construction activites would reduce the major source of dust. Prompt repaving of roads disturbed by construction also could reduce dust effectively. Construction site, spoil piles, and unpaved access roads should be wetted periodically to minimize dust. Soil stockpiles and backfilled trenches should be seeded with a temporary or permanent seeding or covered with mulch to reduce susceptibility to wind erosion.

Street cleaning at sites where trucks and equipment gain access to construction sites and of roads along which a sewer or force main would be constructed would reduce loose dirt that otherwise would generate dust, create unsafe driving conditions, or be washed into roadside ditches or storm drains.

Exhaust emission and noise from construction equipment could be minimized by proper equipment maintenance. The resident engineer should have and should exercise the authority to ban from the site all poorly maintained equipment. Soil borings along the proposed force main rights-of-way conducted during system design, would identify organic soils that have the potential to release odors when excavated. These areas could be bypassed by rerouting the force main if, depending on the location, a significant impact might be expected.

Spoil disposal sites should be identified during the project design stage to ensure that adequate sites are available and that disposal site impacts are minimized. Landscaping and restoration of vegetation should be conducted immediately after disposal is completed to prevent impacts from dust generation and unsightly conditions.

Areas disturbed by trenching and grading at the WWTP sites should be revegetated as soon as possible to prevent erosion and dust generation. Native plants and grasses should be used. This also will facilitate the re-establishment of wildlife habitat.

Soil Erosion and Sedimentation

Erosion and sedimentation must be minimized at all construction sites. USEPA Program Requirements Memorandum 78-1 established recommendations for control of erosion and runoff from construction activites. Adherence to these requirements would serve to mitigate potential problems:

- Construction site selection should consider potential occurrence of erosion and sediment losses
- The project plan and layout should be designed to fit the local topography and soil conditions
- When appropriate, land grading and excavating should be kept at a minimum to reduce the possibility of creating runoff and erosion problems which require extensive control measures
- Whenever possible, topsoil should be removed and stockpiled before grading begins
- Land exposure should be minimized in terms of area and time
- Exposed areas subject to erosion should be covered as quickly as possible by mean of mulching or vegetation
- Natural vegetation should be retained whenever feasible
- Appropriate structural or agronomic practices to control runoff and sedimentation should be provided during and after construction
- Early completion of stabilized drainage systems (temporary and permanent systems) will substantially reduce erosion potential
- Access roadways should be paved or otherwise stabilized as soon as feasible
- Clearing and grading should not be started until a firm construction schedule is known and can be effectively coordinated with the grading and clearing activities.

In addition, WDNR anticipates that no disposal of spoil materials from construction sites will occur without authorization and concurrence on a disposal plan with the WDNR district office.

Transportation

Route planning for the transportation of heavy construction equipment and materials should ensure that surface load restrictions are considered. In this way, damage to streets and roadways would be avoided. Trucks hauling excavation spoil to disposal sites or fill material to the WWTP sites should be routed along primary arterials to minimize the threat to public safety and to reduce disturbance along residential streets.

Prime Agricultural Land

Section 4.1.1.8. indicates that construction of a rapid infiltration facility on the selected 80 acre parcel southwest of the Village of Walworth would constitute a significant, long term adverse impact under the EIS Alternative. However, the total present worth analysis presented in Section 2.5. demonstrates that land application is the lowest cost alternative, and as discussed in Section 4.1. it may be an environmentally sound wastewater management alternative for the west end communities.

In order to mitigate the anticipated impact, the possibility of maintaining independent wastewater management at each of the Villages with two separate WWTPs and land application facilities was investigated. USEPA has stated that separate treatment facilities for Walworth and Fontana has merit but, because funding assistance will come from the State rather than the Federal government, EPA has deferred decisions about the alternative to be funded to the WDNR. Because separate Walworth and Fontana seepage cells would be sited in areas with protected agriculture uses, less land would need to be purchased for buffer areas. In that case, the Walworth site could be limited to a 25-acre site, either within the Village or nearby. The additional land purchase required for Fontana could be limited to 40 acres and located where some land of statewide importance, rather than prime, would be included. The Wisconsin Department of Natural Resources has, however, already imposed restrictions on the Village of Fontana and therefore the mitigation potential is minimized because the alternative is not implementable.

During the facilities planning process, the facilities planner investigated a new WWTP and rapid-infiltration treatment system, located at the Donald Rambow farm on the southwest border of the Village of Walworth. In reviewing facilities planning information during conduct of this EIS, several items of interest were noted:

- Aerated lagoon - rapid infiltration treatment was found to be the lowest cost treatment system

- The existing Fontana WWTP has a design capacity of 0.9 mgd, and in 1982 produced a 13/11 (BOD/TSS) effluent. Projected year 2005 flows for Fontana (based upon the EIS design criteria and reduced service area) is 0.641 mgd

- Additional areas with soils similar to those found at the Rambow site (e.g., permeable sands and sandy loam) are located around Walworth.

Because of the above listed facts, it appears that, from an engineering standpoint, facilities to serve only the Walworth RSSA may be feasible. Separate facilities for Walworth and Fontana also would save the cost of pumping all of Fontana's flow to a Walworth/Fontana facility. Facilities at Walworth would consist of the lagoon and seepage cells to treat 0.3 mgd (average daily summer flow), a lagoon liner, process piping, aeration equipment, observation wells, miscellaneous concrete structures, a service building and laboratory, various electrical, mechanical, and plumbing facilities, and new and upgraded conveyance facilities. Approximate costs for the proposed Walworth facilities, as derived from detailed costs prepared by the facilities planner for the Facilities Plan aerated lagoon alternative, are listed in Table 4-9.

Table 4-9. Estimated costs for a separate Walworth aerated lagoon WWTP proposed as a mitigative measure.

Item	Capital Costs	Annual O&M	Salvage Value
Conveyance Piping	$ 175,500	$12,300	$ 87,750
Aerated Lagoon and Seepage Basins WWTP	1,140,000	32,900	320,100
TOTALS:	$1,315,500	$45.200	$407,850

The existing Fontana WWTP has a design capacity of 0.9 mgd, and produces a 13/11 (BOD/TSS) effluent, which is very good. The WDNR requires BOD_5 concentrations to be reduced only to 50 mg/l prior to application to a land application system (e.g., rapid infiltration). Projected year 2005 flow (average summer day) is 0.641 mgd. A lysimeter was installed eight feet below the surface of the new seepage lagoon at the time of construction to monitor wastewater effluent percolating through the soil. Since monitoring begain in 1979, NPDWS drinking water limits for the parameters measured have never been exceeded (Appendix C of the Draft EIS). However, sodium concentrations, total dissolved solids concentrations, and conductivity are elevated above background levels.

Operational procedures practiced at the plant are currently not in compliance with WDNR policies governing rapid infiltration facilities. Site hydraulic limitations and lagoon design prevent a dose/rest cycle as required by the WDNR. The dose/rest cycle is promoted to maintain an aerobic/anaerobic environment in the soil which facilitates nitrification and denitrification. The lagoons currently are operated with a minimum of two feet of standing water at any time, however, effluent from the lagoons does not cause any surface water, groundwater, or public health violations. A drainage system might be installed to drain one lagoon into a new lagoon to promote the necessary application cycle.

In order to continue operations, Fontana would need to moderately upgrade its existing WWTP, and expand the seepage basins by adding a new 15 to 20 acre cell. The existing WWTP upgrades would primarily include repair of structural and mechanical problems, plus provision of additional support services (repair minor plant equipment, laboratory supplies, etc.). New units should not be needed at the secondary treatment facilities, because the trickling filter portion of the WWTP will be able to handle periodic I/I flows for short periods following rainfall events. Some coarse gravel pits and the Village's municipal water supply well are located to the south of the existing WWTP, thus land north of the existing seepage basins could be considered for utilization for the additional rapid infiltration cell. Cost estimates for these recommended facilities are listed in Table 4-10.

Table 4-10. Estimated costs for a separate upgraded and expanded Fontana WWTP proposed as a mitigative measure.

Item	Capital Costs	Annual O&M	Salvage Value
Upgraded existing WWTP	$350,000	$32,100	0
New 10-acre Seepage Cell	327,000	35,200	59,500
Land Purchase	20,000	0	20,000
TOTALS:	$697,000	$67,300	$79,500

The Village of Fontana treatment facility appears to be operating effectively at its current flow and loading and is projected in this EIS as being able to do so with some upgrading for the duration of the 20-year planning period. Sufficient land exists contiguous to the plant with apparently similar geohydrologic conditions that would be suitable for additional infiltration lagoon construction. If higher than existing summer flows were projected to occur, additional effluent application capacity could be provided by spray irrigating effluent on lands contiguous to the existing plant.

If the Fontana effluent were not transmitted to a Walworth WWTP, the areal requirements of a land application facility there would be reduced to 25 acres. The current 80-acre site is situated in an area where the soil series is classified as Plano silt loam on nearly level land. This soil series is found extensively throughout the western half of the Village of Walworth as well as contiguous areas of the Town of Walworth. Given the reduced areal needs of a Walworth WWTP and infiltration facility, alternative sites with geohydrologic characteristics similar to the 80-acre site probably exist within a reasonable transmission distance of the current plant. In order to demonstrate the effectiveness of potentially suitable alternative sites, however, additional field investigations would be required.

Cultural Resources

The Natural Historic Preservation Act of 1966, Executive Order 11593 (1971), the Archaeological and Historic Preservation Act of 1974, and the 1973 Procedures of the Advisory Council on Historic Preservation require that care must be taken early in the planning process to identify cultural resources and minimize adverse effects on them. The State Historic Preservation Officer must have an opportunity to determine that the requirements have been satisfied.

Known archaeological sites should be avoided. After an alternative is selected and design work begins, a thorough pedestrian archaeological survey may be required for those areas affected by proposed facilities. In addition to the information already collected and consultation with the State Historic Preservation Officer and other knowledgeable informants, a controlled surface collection of discovered sites and minor subsurface testing should be conducted. A similar survey would be required of historic structures, sites, properties, and objects in and adjacent to the construction areas, if they might be affected by the construction or operation of the project.

In consultation with the State Historic Preservation Officer, it would be determined if any of the resources identified by the surveys appears to be eligible for the National Register of Historic Places. Subsequently, an evaluation would be made of the probable effects of the project on these resources and the mitigation procedures that are necessary.

A recent and supplemental archaeological survey performed along the proposed force-main/interceptor route to the new Walworth/Fontana Treatment Plant Site and of land immediately west of the Walworth Treatment Plant Site indicates the construction of the wastewater treatment facilities will impact on archaeological artifacts. The archaeological survey report recommends several measures to mitigate the impacts on these archaeological features. The design engineer has stated that the recommendations contained in the report will be complied with.

4.3.2. Mitigation of Operation Impacts

The potential adverse operational impacts of the WWTP alternatives relate primarily to potential adverse impacts on groundwater and possible health risks. For the land application alternative, the most significant adverse impact is the potential for nitrate contamination of groundwater. Adverse impacts associated with the operation of onsite systems are primarily related to potential contamination of idividual well water supplies. Measures to minimize these and other operation phase impacts from all the alternatives are discussed below.

Atmosphere

Adverse impacts related to the operation of the proposed sewer systems and treatment facilities would be minimal if the facilities are properly designed, operated, and maintained. Aerosols, gaseous emissions, and odors from the various treatment processes could be controlled to a large extent. Above-ground pumps would be enclosed and installed to minimize sound impacts. The effluent quality of any WWTP is specified by the WDNR and must be monitored. Proper and regular maintenance of onsite systems also would maximize the efficiency of these systems and minimize odors released from malfunctioning systems.

Groundwater

Both onsite waste treatment and land application by rapid infiltration have the potential to elevate nitrate concentration in groundwater above background levels. At present, the densities of onsite systems and soil properties have limited the impact of these systems on groundwater. Appropriate design and upgrading of onsite systems as well as formation of a management district should prevent any further degradation of groundwater quality. Section 4.1.2.4. presented groundwater data indicating that rapid infiltration facilities can elevate nitrate concentrations but not to a level that would restrict any groundwater uses. Appropriate operation and maintenance of pretreatment facilities prior to land application would limit the potential for nitrate contamination of groundwater.

4.3.3. Mitigation of Secondary Impacts

As discussed in Section 4.2; secondary impacts as a result of construction of wastewater collection and treatment facilities for the East Planning Area under the FPRA are expected to occur. These impacts arise from induced population growth and attendant residential development, and the effects this would have on water quality and the agricultural resource base. Adequate zoning, health, and water quality regulation and enforcement would minimize these impacts. Local growth management planning would assist in regulating the general location, density, and type of growth that might occur.

It is EPA's position that the principal mitigative measure that would effectively minimize the anticipated impacts would be to limit the construction of new wastewater collection and treatment facilities to the size and scale identified in Chapter 2 under the EIS Alternative. The EIS Alternative would not extend collection lines into unsewered areas with the potential of inducing growth in sensitive environmental areas. The treatment plant would be sized according to the amount of growth anticipated by municipal policies, growth management planning and in accordance with the capabilities of public services.

4.4. Unavoidable Adverse Impacts

Some impacts associated with the implementation of any of the alternatives cannot be avoided. The centralized collection and treatment alternatives would have the following adverse impacts:

- Considerable short-term construction dust, noise, and traffic nuisance
- Short-term alteration of vegetation and wildlife habitat along the sewer and force main corridors and long-term alteration at the WWTP sites
- Considerable erosion and siltation during construction
- Alteration and destruction of wildlife habitat at the rapid infiltration sites

- Conversion of prime farmland to WWTP sites for some alternatives.

The dencentralized alternatives that primarily include continued use of existing and upgraded onsite systems and holding tanks for critical areas would have the following adverse impacts:

- Some short-term construction dust, noise, and traffic nuisance
- Some erosion and siltation during construction
- Discharge of percolate with elevated levels of nitrates and chlorides from soil absorption systems to the groundwater
- Occasional short-lived odors associated with pumping septic tanks and holding tanks and trucking it to disposal sites
- User fees for management and operation of wastewater treatment services for the residents within the RSSAs.

4.5. Irretrievable and Irreversible Resource Commitments

The major type and amounts of resources that would be committed through the implementation of any of the alternatives are presented in Sections 4.1. and 4.2. Each of the alternatives would include some or all of the following resource commitments:

- Fossil fuel, electrical energy, and human labor for facilities construction and operation
- Chemicals, especially chlorine, for WWTP operation
- Tax dollars for construction and operation
- Some unsalvageable construction materials.

For each alternative involving a WWTP, there is a significant consumption of these resources with no feasible means of recovery. Thus, nonrecoverable resources would be foregone for the provision of the proposed wastewater control system.

Accidents which could occur from system construction and operation could cause irreversible bodily damage or death, and damage or destroy equipment and other resources.

The potential accidental destruction of undiscovered archaeological sites through excavation activities is not reversible. This would represent permanent loss of the site.

5.0. RESPONSES TO COMMENTS ON THE DRAFT EIS

Comments on the Draft Environmental Impact Statement (DEIS) were received at the public hearing held February 9, 1984 at the Big Foot High School, Walworth, Wisconsin and also were received by mail. Comments and questions received at the public hearing were documented in a hearing transcript and responses to those comments are provided in this chapter. Responses to Public Hearing Comments are presented in Section 5.1. Written comments on the DEIS were received from a total of twelve public agencies and four private citizens (Appendix A). Responses to written comments are presented in Section 5.2., 5.3., and 5.4. An index to comments is presented in Section 5.5.

Comments on the Draft EIS are generally grouped into nine topics:

- Removing prime agricultural land from crop production use
- EIS recommendation of seepage cells and opposing documentation on seepage cell technology
- Seepage cell groundwater impacts at Walworth
- Treatment capacity to be provided at Lake Geneva WWTP
- Seepage cell groundwater impacts at Lake Geneva
- Property value impacts in the Town of Lyons
- Redefinition of Lake Geneva sewer service area
- Groundwater mounding potential and impacts at Lake Geneva
- Wetland impacts

Comments and responses are presented in the following paragraphs. The index to comments identifies each author or speaker, the topic number from the above list, and the page upon which the comment and response is presented.

5.1. Response to Comments From the Public Hearing

<u>Mr. Robert Biebel</u>:

(1) The Southeastern Wisconsin Regional Planning Commission staff believes that the Walworth/Fontana wastewater treatment plant should provide for surface discharge to Piscasaw Creek rather than utilize land application due to prime agricultural lands impacts; that the Lake Geneva wastewater treatment facility should provide treatment capacity for the entire Lake Geneva Revised Sewer Service Area and that the extension of sewers throughout the entire Revised Sewer Service Areas be reevaluated by the local units of governments.

The Final EIS concurs that, based upon public input, and the WDNR position not to allow further use of the existing Fontana site, the Walworth/Fontana wastewater treatment facility should be a surface discharge treatment plant as presented in the FPRA.

With respect to treatment capacity at the Lake Geneva wastewater treatment facility, the U.S. Environmental Protection Agency has concluded that there is insufficient documentation of need, i.e. adverse health or water quality impacts, to warrant such additional capacity, and accordingly recommends funding construction of only that proportionate amount of treatment capacity recommended by the EIS.

Similarly, USEPA has concluded that sufficient information has been gathered to demonstrate that extension of sewers into all the unsewered areas with the RSSAs is not cost-effective irrespective of when the interceptors and collection systems would be constructed. If the sewers were to be constructed some time in the future, a specific date must be selected for cost-effectiveness analysis and, in the time interval, costs of constructing and maintaining onsite systems would accrue nevertheless. Because extension of sewers into unsewered areas is not cost-effective with respect to monetary and non-monetary costs, USEPA is bound by its regulations to provide funding only for the capacity that can be justified. The community does have the option of constructing a larger WWTP at local expense.

USEPA does regard the use of onsite sewerage disposal systems as a permanent solution for sanitary waste disposal. Systems rarely fail in the Lake Geneva area, based on replacement records, field investigations, and interviews with residents in areas suspected as having concentrations of failing systems. The DILHR will permit variances for reduced size systems where water conservation devices are installed and practices are followed. The EPA recommends that an onsite management agency be set up in the respective areas to ensure that onsite systems are maintained properly and are upgraded when failures occur. Duplicate sewage treatment facilities for the same area (onsite management and collection and treatment) cannot be approved by USEPA.

New urban growth should be orderly and adjacent to existing urban development. Treatment plant capacity is available at Lake Geneva for a 56% population growth from the existing service area and unsewered areas during the project period under the EIS Alternative. Extension of sewers into unsewered areas must occur in order to accommodate that population growth.

The communities at the west end of Lake Geneva dictated the population growth for the planning period that would be used in the flow projections. The Villages of Williams Bay and Fontana have excessive infiltration and inflow in the collection systems and are an evaluation and rehabilitation programs to reduce the excess flows. Sufficient capacity for the planned growth will be available if the rehabilitation programs are as successful as projected by Donohue & Assoc., Inc.

Mr. Chuck Holman:

(2) Representative Holman requested that officials of the Environmental Protection Agency and Wisconsin Department of Natural Resources consider the public desires and the purpose of public input equally with technical and cost considerations when developing final recommendations.

Comment noted. EPA and DNR have evaluated all alternatives with recognition of the public concerns and desires expressed through the public participation elements of the EIS process. EPA and WDNR concurrence with public input is exemplified by the decision to utilize a surface discharge for the Walworth/Fontana WWTP.

Mr. Frank Dammeir

(3) Wastewater treatment capacity at the Lake Geneva treatment facility cannot be readily downsized as suggested by the EIS Alternative due to standard sizes of single treatment units and equipment items. Cost savings for down-sizing treatment capacity would be little, if any.

Comment noted. The Environmental Protection Agency's position on funding treatment capacity is presented in the response to Comment (1). The EPA recommends funding construction of only that proportionate amount of treatment capacity recommended by the EIS.

Mr. J. T. Forrester:

(4) The Walworth treatment facility should be the FPRA oxidation ditch.

Comment noted. USEPA concurs with the WDNR to approve the FPRA surface discharge to Piscasaw Creek.

Mr. William Meudt:

(5) Seepage cells should not be used because of a high occurrence of failure in similar systems.

The State of Wisconsin has approximately 150 operating municipal seepage systems of which less than 10 have experienced hydraulic failure. The incidence of failure is not high enough to issue a moratorium on seepage cell construction.

Mr. Allen Morrison:

(6) The Walworth County Park and Planning Commission does not agree with the EIS Alternative for on-site systems on the east end and further disagrees with the EIS Alternative for the Walworth/Fontana treatment facility based upon the need for preservation of prime farm land.

Comment noted. These issues are addressed in the response to Comment (1).

Mr. Jerry Palzkill:

(7) The EIS Alternative for use of the Rambow site should be abandoned based upon agricultural land use considerations.

Comment noted. USEPA and WDNR concur with the FPRA for Walworth/Fontana.

Mr. Ted Peters:

(8) Although sewers are not cost effective in unsewered areas and secondary impacts of sewer construction could cause additional problems, the Geneva Lake Watershed Environmental Agency disagrees that on-site systems are a long-term solution and suggests no changes to the Revised Sewer Service Areas to enable future consideration of sewer service in presently unsewered areas.

Comment noted. Response to the issue is addressed in the response to Comment (1).

Ms. Carolyn Rambow:

(9) The EIS Alternative utilizing seepage cells in the Walworth/Fontana system should not be permitted based upon failures of similar systems and non-acceptance in other States.

Comment noted. The Final EIS concurs with WDNR recommendations of the FPRA surface discharge to Piscasaw Creek.

Mr. Fred Ruekert:

(10) Ruekert and Mielke Engineers of Waukesha, representing Williams Bay, concurs with the EIS Alternative for Williams Bay.

Comment noted.

Mr. John Disabato:

(11) Debt service costs for the Village of Walworth should not be included since Walworth passed a bond issue in 1972 and revenues have been held in trust earning interest. Also, even if the FPRA oxidation ditch system is more costly, the people should have it, if that is what they want.

Comments noted. The financial impacts have been changed to reflect the current funds. Final EIS concurs with the FPRA for Walworth/Fontana.

Mr. Gilbert Schultz:

(12) Groundwater quality may be adversely impacted by Lake Geneva seepage cells and if contaminated, poses a threat to local wells.

The State of Wisconsin has concluded that the potential for damage to local wells is minimal due to (a) wastewater characteristics, (b) soils types, (c) depth to groundwater and (d) surface drainage systems [see page 4-26]. Additionally, groundwater monitors will be employed for groundwater quality assurance.

Mr. Milton Voss:

(13) The EIS should address the groundwater impacts from discharge of high chloride waste streams from Kikkoman Industries to seepage cells and the Walworth/Fontana system should discharge to Piscasaw Creek.

Kikkoman Foods has decided to utilize the existing seepage beds only for non-contact cooling water discharge, and will discharge all sanitary and process wastewaters to the Walworth/Fontana Treatment System.

Mrs. Maxine Wartgow:

(14) The Fontana Utility Department disagrees with the EIS Alternative of seepage cells in favor of the FPRA oxidation ditch.

Comment noted. The Final EIS concurs with the FPRA.

Mr. Art Zabierek:

(15) a] Homeowners in the Town of Lyons are concerned about loss of property values due to the presence of seepage lagoons; b] Groundwater quality deterioration may threaten wells; c] Groundwater mounding potential and impacts should be thoroughly evaluated; d] Prime agricultural land should not be used for the Walworth/Fontana treatment facility; e] Impacts upon wetland area should be further evaluated.

a. The impact of sludge application to land upon adjacent property values was evaluated in a 1982 study entitled "An Assessment of Land Values for

Properties Adjacent to and Removed From Land Application of Sludge Sites," which was conducted by USEPA Region V. Property values in twelve counties within Region V were evaluated. Within each county, property adjacent to the sludge application sites was compared to property removed from such facilities. The study concluded that there were no statistically significant differences between the rates of increase of property values within each county.

The conclusions of this study are expected to apply equally to effluent disposal systems because the esthetic impacts, i.e. odor and visual blight, of living next to effluent land disposal facilities are less than or equal to the same key impacts for sludge sites.

b. Groundwater quality impacts were addressed in the response to Comment(12).

c. Groundwater mounding impacts are being further evaluated by WDNR and Donohue & Assoc., Inc.

d. The Walworth/Fontana treatment facility will utilize the FPRA.

e. Wetland impacts have been reviewed in further detail. Additional comments on wetland impacts are provided in Chapter 4, paragraph 4.1.2.6.

5.2. Correspondence from Federal Agencies

U.S. Department of Interior, Office of Environmental Project Review: (5 March 1984)

(16) The EIS should quantitatively describe the probable amount of groundwater mounding at land application sites. Additionally, the EIS should provide additional assessment of primary and secondary impacts on wetlands in the planning area.

Groundwater mounding impacts are being further evaluated by WDNR and Donahue & Assoc., Inc. Additional discussion is provided in Chapter 4.

U.S. Department of Commerce, NOAA: (14 February 1984)

(17) The National Ocean Service (NOS) requires 90 days notification of geodetic control survey mounuments located with the project area which may require relocation.

Comment noted.

U.S. Department of Transportation, US Coast Guard: (6 March 1984)

(18) The discussion of the project's impacts on the local highway transportation network is considered to be adequate.

Comment noted.

5.3. Correspondence from State and Local Agencies

State of Wisconsin, Dept. of Agriculture, Trade and Consumer Protection: (15 February 1984)

(19) The irreversible conversion of the Rambow site from prime farmland to non-farm use for public projects is not in the public's long-term interest. Additionally, the Agricultural Impact Statement (AIS) should be included in the EIS.

The Rambow site will continue in agricultural use since Walworth/Fontana will use the FPRA surface discharge. The AIS is included as Appendix B.

State of Wisconsin, Department of Transportation: (1 March 1984)

(20) The proposed project will not have significant adverse impacts upon transportation interests or concerns.

State of Wisconsin, Department of Industry, Labor and Human Relations: (30 March 1984)

(21) The Department concurs that where site and soil conditions preclude installation of replacement septic systems, variances can be granted for alternative onsite systems. Approval of reduced size systems based upon water conservation and/or wastewater segregation would be dependent upon the non-availability of off-lot or cluster type solutions. Oversight of alternative systems by a management district further justifies this alternative treatment process.

Comments noted. Off-lot and cluster type solutions would be investigated where there is significant need and where land is available.

Southeastern Wisconsin Regional Planning Commission: (6 February 1984)

(22) The Commission believes the EIS land application alternative for Walworth/Fontana is less favorable than the FPRA with discharge to Piscasaw Creek. Further, EIS delineated sewer service areas are in direct conflict with recommendations in the Regional Water Quality Management Plan. EIS provisions for a reduction in wastewater treatment capacity in Lake Geneva based upon reduced sewer service areas is considered unsound.

The Walworth/Fontana treatment facility will be in accordance with the FPRA. The Final EIS position on sewer service areas and treatment capacity is provided in the response to Comment (1).

Walworth County, Park and Planning Commission: (6 February 1984)

(23) The Commission disagrees with the sewer service areas depicted in the EIS, and expressed concern over the loss of prime farmland if the Rambow site were to be used for wastewater treatment.

The Rambow site will remain in agricultural use; Walworth/Fontana will utilize the FPRA. The sewer service areas are unchanged due to a lack of documented need and the results of the cost-effectiveness analysis.

Town of Lyons: (12 January 1984)

(24) The Town of Lyons presented a petition of 111 residents expressing their concern over the impacts of wastewater treatment facilities upon property values and groundwater quality.

Response to concerns for property values were addressed in response to Comment (15). Groundwater quality is addressed in response to Comment (12).

Town of Walworth: (31 January 1984)

(25) The Town Board is opposed to the use of surface impoundments for wastewater treatment. The Board expressed concern for loss of farmland and potential groundwater quality deterioration due to use of seepage lagoons at the Rambow site.

Walworth/Fontana wastewater treatment will be the FPRA.

Village of Walworth: (23 January 1984)

(26) By resolution of the Village Board of Trustees, the Village expressed opposition to the EIS alternative in favor of the FPRA due to loss of prime farmland and potential deterioration of groundwater quality from seepage lagoons.

Walworth/Fontana wastewater treatment will be the FPRA.

Geneva Lake Environmental Agency: (21 February 1984)

(27) The Agency agrees that the extension of sewers into areas along the southeastern shore of Geneva Lake is not cost-effective and may cause extensive adverse secondary impacts, but the Agency recommends this area to be included in the sewer service area so that sewer extension programs could be implemented if on-site systems experience failure.

Comment noted. These comments were also read at the Public Hearing, Comment (8). Response to the issue of capacity and sewer service area boundaries is addressed in the response to Comment (1).

Committee to Save Geneva Lake: (20 February 1984)

(28) The Committee expressed concern that extension of sewers through areas zoned Conservancy and Agriculture will cause secondary impacts of pressure for additional residential development, which would increase residential density and decrease the "quality of life."

Comment noted. The EIS concurs in this opinion. Primary environmental designation of conservancy areas would prevent sewered developments.

5.4. Correspondence from Private Citizens

Mrs. George F. Knowles: (21 February 1984)

(29) Mrs. Knowles objected to the proposed use of seepage cells for Lake Geneva, suggesting that there are several similar systems in Wisconsin which have operating problems.

The seepage cell facilities are viable, cost-effective wastewater treatment units. WDNR has stated that only about 10 similar systems of the 150 operating systems in Wisconsin have experienced operationl problems.

The Rambow Family: (21 February 1984)

(30) The Rambows expressed opposition to the EIS alternative for Walworth/Fontana wastewater treatment.

The Walworth/Fontana facility will be the FPRA.

Mr. Stanley Sokoloski: (20 January 1984)

(31) Mr. Sokoloski requests that sewers be extended to Como subdivision.

Comment noted. Sewers are not cost-effective. However, local government may extend sewers if they feel there is a need.

Mrs. Eunice G. Sanderson: (22 February 1984)

(32) Mrs. Sanderson opposed the EIS alternative for wastewater treatment at the Rambow site on the basis of loss of prime agricultural land.

The Walworth/Fontana facility will be the FPRA.

Petition of Residents of the Town of Lyons: (9 February 1984)

(33) Property owners of Lyons oppose the use of seepage lagoons for wastewater treatment at the intersection of Highways 12 and 50 based upon the potential impacts of such facility on adjacent property values and upon groundwater quality.

USEPA Region V, conducted a study in 1982 evaluating the impact of municipal sludge land application sites upon adjacent property values compared to similar parcels not adjacent to land application sites. The study concluded that there were no statistically significant property value differences due to the adjacent land application site. The conclusions of this study are expected to apply equally to effluent disposal sites since the esthetic annoyances of odor and visual disturbances are less with effluent disposal systems than for sludge disposal systems. The WDNR has concluded that the potential for adverse impacts upon groundwater quality is minimal due to local hydrogeological characteristics.

Eleanora Wickstrom: (Transcript of Recorded Testimony received 9 February 1984)

(34) Ms. Wickstrom is opposed to the use of Big Foot Prairie land for wastewater treatment, citing high groundwater and the citizens' desire to construct a treatment plant with discharge to Piscasaw Creek.

The Walworth/Fontana treatment facility will be the FPRA.

5.5. Index to Comments

6.0. LIST OF PREPARERS

The Draft Final Environmental Statement (DES and FES) were prepared by the Chicago Regional Office of WAPORA, Inc., under contract to USEPA Region V. USEPA and WDNR prepared the DES and published it as a Draft EIS and has prepared the FES and published it as a Final EIS and has prepared the FES and publishes it as a Final EIS. The USEPA and WDNR Project Officers and the WAPORA staff involved in the preparation of the DEIS and FEIS included:

USEPA

Jack Kratzmeyer	Project Officer (former)
Marilyn Sabadaszka	Project Officer (former)
Ted Rockwell	Project Officer (former)
Greg Vanderlaan	Project Officer (former)

WDNR

Steve Ugoretz	Bureau of Environmental Impact
Debra Howard	Bureau of Environmental Impact (former)
Mark Williams	Municipal Wastewater Section
Charles Pape	Southeast District Office

WAPORA, Inc.

Keith Whitenight	Project Administrator
Robert France	Project Administrator (former)
John Johnson	Project Administrator (former)
E. Clark Boli	Project Administrator (former)
Ross Pilling	Project Manager, Senior Planner and Principal Author (former)
Phil Phillips	Project Manager (former)
J.P. Singh	Project Engineer (former)
Gerald Lenssen	Project Engineer and Principal Author
James Varnell	Project Engineer and Principal Author
Ellen Renzas	Socioeconomist
Mark Cameron	Socioeconomist

WAPORA, Inc.,cont.

Ross Sweeny	Project Engineer
Roy Greer	Biologist
John Laumer	Water Quality Scientist
Steve McComas	Environmental Scientist
Linda Gawthrop	Land Use Planner
Gregg Larson	Demographer
Andrew Freeman	Demographer
Judy Dwyer	Geographer
Lauren Rader	Cultural Resources
Sharon Knight	Cultural Resources and Cartographer
Peter Woods	Graphics Specialist
Phil Pekron	Environmental Scientist
Kent Peterson	Geologist
Rhoda Granat	Editor
Zear Meriweather	Production Specialist
Delores Jackson-Hope	Production Specialist
Donna Madras	Production Specialist

In addition, several subcontractors and others assisted in the preparation of this document. These, along with their areas of expertise, are listed below:

- Aerial Survey
  USEPA
  Vint Hill Farms VA
- Septic Leachate Analysis
  K-V Associates
  Falmouth MA

7.0. GLOSSARY OF TECHNICAL TERMS

Activated sludge process. A method of secondary wastewater treatment in which a suspended microbiological culture is maintained inside an aerated treatment basin. The microbial organisms oxidize the complex organic matter in the wastewater to carbon dioxide, water, and energy.

Advanced secondary treatment. Wastewater treatment more stringent than secondary treatment but not to advanced waste treatment levels.

Advanced waste treatment. Wastewater treatment to treatment levels that provide for maximum monthly average BOD_5 and SS concentrations less than 10 mg/l and/or total nitrogen removal of greater than 50% (total nitrogen removal = TKN + nitrite and nitrate).

Aeration. To circulate oxygen through a substance, as in wastewater treatment, where it aids in purification.

Aerobic. Refers to life or processes that occur only in the presence of oxygen.

Aerosol. A suspension of liquid or solid particles in a gas.

Algae. Simple rootless plants that grow in bodies of water in relative proportion to the amounts of nutrients available. Algal blooms, or sudden growth spurts, can affect water quality adversely.

Algal bloom. A proliferation of one species of algae in lakes, streams or ponds to the exclusion of other algal species.

Alluvial. Pertaining to material that has been carried by a stream.

Ambient air. Any unconfined portion of the atmosphere: open air.

Ammonia-nitrogen. Nitrogen in the form of ammonia (NH_3) that is produced in nature when nitrogen-containing organic material is biologically decomposed.

Anaerobic. Refers to life or processes that occur in the absence of oxygen.

Anoxia. Condition where oxygen is deficient or absent.

Aquifer. A geologic stratum or unit that contains water and will allow it to pass through. The water may reside in and travel through innumerable spaces between rock grains in a sand or gravel aquifer, small or cavernous openings formed by solution in a limestone aquifer, or fissures, cracks, and rubble in harder rocks such as shale.

Artesian (adj.). Refers to groundwater that is under sufficient pressure to flow to the surface without being pumped.

Artesian well. A well that normally gives a continuous flow because of hydrostatic pressure, created when the outlet of the well is below the level of the water source.

Bar screen. In wastewater treatment, a screen that removes large floating and suspended solids.

Base flow. The rate of movement of water in a stream channel that occurs typically during rainless periods, when stream flow is maintained largely or entirely by discharges of groundwater.

Bed Rock. The solid rock beneath the soil and subsoil.

Biochemical oxygen demand (BOD). A bioassay-type procedure in which the weight of oxygen utilized by microorganisms to oxidize and assimilate the organic matter present per liter of water is determined. It is common to note the number of days during which a test was conducted as a subscript to the abbreviated name. For example, BOD_5 indicates that the results are based on a five-day long (120-hour) test. The BOD value is a relative measure of the amount (load) of living and dead oxidizable organic matter in water. A high demand may deplete the supply of oxygen in the water, temporarily or for a prolonged time, to the degree that many or all kinds of aquatic organisms are killed. Determinations of BOD are useful in the evaluation of the impact of wastewater on receiving waters.

Biota. The plants and animals of an area.

CFS. Cubic Feet per second

Chlorination. The application of chlorine to drinking water, sewage or industrial waste for disinfection or oxidation of undesirable compounds.

Circulation period. The interval of time in which the density stratification of a lake is destroyed by the equalization of temperature, as a result of which the entire water mass becomes mixed.

Clay. The smallest mineral particles in soil, less than .004 mm in diameter; soil that contains at least 40% clay particles, less than 45% sand, and less than 40% silt.

Coliform bacteria. Members of a large group of bacteria that flourish in the feces and/or intestines of warm-blooded animals, including man. Fecal coliform bacteria, particularly _Escherichia coli_ (_E. coli_), enter water mostly in fecal matter, such as sewage or feedlot runnoff. Coliforms apparently do not cause serious human diseases, but these organisms are abundant in polluted waters and they are fairly easy to detect. The abundance of coliforms in water, therefore, is used as an index to the probability of the occurrence of such disease-producing organisms (pathogens) as _Salmonella_, _Shigella_, and enteric viruses which are otherwise relatively difficult to detect.

Community. The plants and animals in a particular area that are closely related through food chains and other interactions.

Cultural resources Fragile and nonrenewable sites, districts, buildings, structures, or objects representative of our heritage. Cultural resources are divided into three categories: historical, architectural, or archaeological. Cultural resources of special significance may be eligible for listing on the National Register of Historic Places.

Decibel (dB). A unit of measurement used to express the relative intensity of sound. For environmental assessment, it is common to use a frequency-rated scale (A scale) on which the units (dBA) are correlated with responses of the human ear. On the A scale, 0 dBA represents the average least perceptible sound (rustling leaves, gentle breathing), and 140 dBA represents the intensity at which the eardrum may rupture (jet engine at open throttle). Intermediate values generally are: 20 dBA, faint (whisper at 5 feet, classroom, private office); 60 dBA, loud (average restaurant or living room, playground); 80 DBA, very loud (impossible to use a telephone, noise made by food blender or portable standing machine; hearing impairment may result from prolonged exposure); 100 dBA, deafening noise (thunder, car horn at 3 feet, loud motorcycle, loud power lawn mower).

Demographic. Pertaining to the science of vital and special statistics, especially with regard to population density and capacity for expansion or decline.

Detention time. Average time required to flow through a basin. Also called retention time.

Digestion. In wastewater treatment a closed tank, sometimes heated to 95°F where sludge is subjected to intensified bacterial action.

Disinfection. Effective killing by chemical or physical processes of all organisms capable of causing infectious disease. Chlorination is the disinfection method commonly employed in sewage treatment processes.

Dissolved oxygen (DO). Oxygen gas (O_2) in water. It is utilized in respiration by fish and other aquatic organisms, and those organisms may be injured or killed when the concentration is low. Because much oxygen diffuses into water from the air, the concentration of DO is greater, other conditions being equal, at sea level than at high elevations, during periods of high atmospheric pressure than during periods of low pressure, and when the water is turbulent (during rainfall, in rapids, and waterfalls) rather than when it is placid. Because cool water can absorb more oxygen than warm water, the concentration tends to be greater at low temperatures than at high temperatures. Dissolved oxygen is depleted by the oxidation of organic matter and of various inorganic chemicals. Should depletion be extreme, the water may become anaerobic and could stagnate and stink.

Drainage Basin. A geographical area or region which is so sloped and contoured that surface runoff from streams and other natural water-courses is carried away by a single drainage system by gravity to a common outlet or outlets; also referred to as a watershed or drainage area.

Drift. Rock material picked up and transported by a glacier and deposited elsewhere.

Effluent. Wastewater or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or part thereof.

EIS. Enviornmental Impact Statement.

Endangered species. Any species of animal or plant that is in known danger of extinction throughout all or a significant part of its range.

Epilimnion. The turbulent superficial layer of a lake lying above the metalimnion which does not have a permanent thermal stratification.

Eutrophication. The progressive enrichment of surface waters particularly non-flowing bodies of water such as lakes and ponds, with dissolved nutrients, such as phosphorous and nitrogen compounds, which accelerate the growth of algae and higher forms of plant life and result in the utilization of the useable oxygen content of the waters at the expense of other aquatic life forms.

Fauna. The total animal life of a particular geographic area or habitat.

Fecal coliform bacteria. See coliform bacteria.

Floodplain. Belt of low, flat ground bordering a stream channel subject to periodic inundation.

Floodway. The portion of the floodplain which carries moving water during a flood event.

Flood fringe. The part of the floodplain which serves as a storage area during a flood event.

Flora. The total plant life of a particular geographic area or habitat.

Flowmeter. A guage that indicates the amount of flow of wastewater moving through a treatment plant.

Forbs. Non woody low vegetation species such as composites or legumes.

Force main. A pipe designed to carry wastewater under pressure.

FPRA. Facilities Plan Recommended Alternative.

Gravity system. A system of conduits (open or closed) in which no liquid pumping is required.

Gravity sewer. A sewer in which wastewater flows naturally down-gradient by the force of gravity.

Groundwater. All subsurface water, especially that part in the zone of saturation.

Holding Tank. Enclosed tank, usually of fiberglass, steel or concrete, for the storage of wastewater prior to removal or disposal at another location.

Hypolimnion. The deep layer of a lake lying below the epilimnion and the metalimnion and removed from surface influences.

Infiltration. The water entering a sewer system and service connections from the ground through such means as, but not limited to, defective pipes, pipe joints, improper connections, or manhole walls. Infiltration does not include, and is distinguished from, inflow.

Inflow. The water discharged into a wastewater collection system and service connections from such sources as, but not limited to, roof leaders, cellars, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross-connections from storm sewers and combined sewers, catch basins, storm waters, surface runoff, street wash waters or drainage. Inflow does not include, and is distinguished from, infiltration.

Influent. Water, wastewater, or other liquid flowing into a reservoir, basin, or treatment facility, or any unit thereof.

Interceptor sewer. A sewer designed and installed to collect sewage from a series of trunk sewers and to convey it to a sewage treatment plant.

Innovative Technology. A technology whose use has not been widely documented by experience and is not a variant of conventional biological or physical/chemical treatment.

Lagoon. In wastewater treatment, a shallow pond, usually man-made, in which sunlight, algal and bacterial action and oxygen interact to restore the wastewater to a reasonable state of purity.

Land Treatment. A method of treatment in which the soil, air, vegetation, bacteria, and fungi are employed to remove pollutants from wastewater. In its most simple form, the method includes three steps: (1) pretreatment to screen out large solids; (2) secondary treatment and chlorination; and (3) spraying over cropland, pasture, or natural vegetation to allow plants and soil microorganisms to remove additional pollutants. Much of the sprayed water evaporates, and the remainder may be allowed to percolate to the water table, discharged through drain tiles, or reclaimed by wells.

Leachate. Solution formed when water percolates through solid wastes, soil or other materials and extracts soluble or suspendable substances from material.

Lift station. A facility in a collector sewer system, consisting of a receiving chamber, pumping equipment, and associated drive and control devices, that collects wastewater from a low-lying district at some convenient point, from which it is lifted to another portion of the collector system.

Littoral. The shoreward region of a body of water.

Loam. The textural class name for soil having a moderate amount of sand, silt, and clay. Loam soils contain 7 to 27% of clay, 28 to 50% of silt, and less than 52% of sand.

Loess. Wind transported sedments derived from fine glacial outwash materials.

Macroinvertebrates. Invertebrates that are visible to the unaided eye (those retained by a standard No. 30 sieve, which has 28 meshes per inch or 0.595 mm openings); generally connotates bottom-dwelling aquatic animals (benthos).

Macrophyte. A large (not microscopic) plant, usually in an aquatic habitat.

Mesotrophic. Waters with a moderate supply of nutrients and no significant production of organic matter.

Metalimnion. The layer of water in a lake between the epilimnion and hypolimnion in which the temperature exhibits the greatest difference in a vertical direction.

Milligram per liter (mg/l). A concentration of 1/1000 gram of a substance in 1 liter of water. Because 1 liter of pure water weighs 1,000 grams, the concentration also can be stated as 1 ppm (part per million, by weight). Used to measure and report the concentrations of most substances that commonly occur in natural and polluted waters.

Moraine. A mound, ridge, or other distinctive accumulation of sediment deposited by a glacier.

National Register of Historic Places. Official listing of the cultural resources of the Nation that are worthy of preservation. Listing on the National Register makes property owners eligible to be considered for Federal grants-in-aid for historic preservation through state programs. Listing also provides protection through comment by the Advisory Council on Historic Preservation on the effect of Federally financed, assisted, or licensed undertakings on historic properties.

Nitrate-nitrogen. Nitrogen in the form of nitrate (NO_3). It is the most oxidized phase in the nitrogen cycle in nature and occurs in high concentrations in the final stages of biological oxidation. It can serve as a nutrient for the growth of algae and other aquatic plants.

Nitrite-nitrogen. Nitrogen in the form of nitrite (NO_2). It is an intermediate stage in the nitrogen cycle in nature. Nitrite normally is found in low concentrations and represents a transient stage in the biological oxidation of organic materials.

Nonpoint source. Any area, in contrast to a pipe or other structure, from which pollutants flow into a body of water. Common pollutants from nonpoint sources are sediments from construction sites and fertilizers and sediments from agricultural soils.

NPDWS. National Primary Drinking Water Standard.

Nutrients. Elements or compounds essential as raw materials for the growth and development of an organism; e.g., carbon, oxygen, nitrogen, and phosphorus.

Outwash. Sand and gravel transported away from a glacier by streams of meltwater and either deposited as a floodplain along a preexisting valley bottom or broadcast over a preexisting plain in a form similar to an alluvial fan.

Oligotrophic. Waters with a small supply of nutrients and hence an insignificant production of organic matter.

Ordinance. A municipal or county regulation.

Outwash. Drift carried by melt water from a glacier and deposited beyond the marginal moraine.

Outwash Plain. A plain formed by material deposited by melt water from a glacier flowing over a more or less flat surface of large area. Deposits of this origin are usually distinguishable from odinary river deposits by the fact that they often grade into moraines and their constituents bear evidence of glacial origin. Also called frontal apron.

Oxidation lagoon (pond). A holding area where organic wastes are broken down by aerobic bacteria.

Percolation. The downward movement of water through pore spaces or larger voids in soil or rock.

pH. A measure of the acidity or alkalinity of a material, liquid or solid. pH is represented on a scale of 0 to 14 with 7 being a neutral state; 0, most acid; and 14, most alkaline.

Piezometric level. An imaginary point that represents the static head of groundwater and is defined by the level to which water will rise.

Plankton. Minute plants (phytoplankton) and animals (zooplankton) that float or swim weakly in rivers, ponds, lakes, estuaries, or seas.

Point source. In regard to water, any pipe, ditch, channel, conduit, tunnel, well, discrete operation, vessel or other floating craft, or other confined and discrete conveyance from which a substance considered to be a pollutant is, or may be, discharged into a body of water.

Pressure sewer system. A wastewater collection system in which household wastes are collected in the building drain and conveyed therein to the pretreatment and/or pressurization facility. The system consists of two major elements, the on-site or pressurization facility, and the primary conductor pressurized sewer main.

Primary treatment. The first stage in wastewater treatment, in which substantially all floating or settleable solids are mechanically removed by screening and sedimentation.

Prime farmland. Agricultural lands, designated Class I or Class II, having little or no limitations to profitable crop production.

Pumping station. A facility within a sewer system that pumps sewage/effluent against the force of gravity.

Runoff. Water from rain, snow melt, or irrigation that flows over the ground surface and returns to streams. It can collect pollutants from air or land and carry them to the receiving waters.

RSSA. Revised Sewer Service Area.

Sanitary sewer. Underground pipes that carry only domestic or commercial wastewater, not stormwater.

Screening. Use of racks of screens to remove coarse floating and suspended solids from sewage.

Secchi Disk. A disk, painted in four quadrants of alternating black and white, which is lowered into a body of water. The measured depth at which the disk is no longer visible from the surface is a measure of relative transparency.

Secondary treatment. The second stage in the treatment of wastewater in which bacteria are utilized to decompose the organic matter in sewage. This step is accomplished by introducing the sewage into a trickling filter or an activated sludge process. Effective secondary treatment processes remove virtually all floating solids and settleable solids, as well as 90% of the BOD and suspended solids. USEPA regulations define secondary treatment as 30 mg/1 BOD, 30 mg/1 SS, or 85% removal of these substances.

Sedimentation. The process of subsidence and deposition of suspended matter carried by water, sewage, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point where it can transport the suspended material.

Seepage. Water that flows through the soil.

Seepage cells. Unlined wastewater lagoons designed so that all or part of wastewater percolates into the underlying soil.

Septic snooper. Trademark for the ENDECO (Environmental Devices Corporation) Type 2100 Septic Leachate Detector. This instrument consists of an underwater probe, a water intake system, an analyzer control unit and a graphic recorder. Water drawn through the instrument is continuously analyzed for specific fluorescence and conductivity. When calibrated against typical effluents, the instrument can detect and profile effluent-like substances and thereby locate septic tank leachate or other sources of domestic sewage entering lakes and streams.

Septic tank. An underground tank used for the collection of domestic wastes. Bacteria in the wastes decompose the organic matter, and the sludge settles to the bottom. The effluent flows through drains into the ground. Sludge is pumped out at regular intervals.

Septic tank effluent pump (STEP). Pump designed to transfer settled wastewater from a septic tank to a sewer.

Septic tank soil absorption system (STAS). A system of wastewater disposal in which large solids are retained in a tank; fine solids and liquids are dispersed into the surrounding soil by a system of pipes.

SSA. Sewer Service Area.

Settling tank. A holding area for wastewater, where heavier particles sink to the bottom and can be siphoned off.

Sewer, Interceptor. See Interceptor Sewer.

Sewer, lateral. A sewer designed and installed to collect sewage from a limited number of individual properties and conduct it to a trunk sewer. Also known as a street sewer or collecting sewer.

Sewer, sanitary. See Sanitary Sewer.

Sewer, storm. A conduit that collects and transports storm-water runoff. In many sewerage systems, storm sewers are separate from those carrying sanitary or industrial wastewater.

Sewer, trunk. A sewer designed and installed to collect sewage from a number of lateral sewers and conduct it to an interceptor sewer or, in some cases, to a sewage treatment plant.

Sinking fund. A fund established by periodic installments to provide for the retirement of the principal of term bonds.

Slope. The incline of the surface of the land. It is usually expressed as a percent (%) of slope that equals the number of feet of fall per 100 feet in horizontal distance.

Sludge. The accumulated solids that have been separated from liquids such as as wastewater.

Soil association. General term used to describe taxonomic units of soils, relative proportions, and pattern of occurrence.

Soil textural class. The classification of soil material according to the proportions of sand, silt, and clay. The principal textural classes in soil, in increasing order of the amount of silt and clay, are as follows: sand, loamy sand, sandy loam, loam, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. These class names are modified to indicate the size of the sand fraction or the presence of gravel, sandy loam, gravelly loam, stony clay, and cobbly loam, and are used on detailed soil maps. These terms apply only to individual soil horizons or to the surface layer of a soil type.

State equalized valuation (SEV). A measure employed within a State to adjust actual assessed valuation upward to approximate true market value. Thus it is possible to relate debt burden to the full value of taxable property in each community within that State.

Stratification. The condition of a body of water when the water is divided into layers of differing density. Climatic changes over the course of the seasons cause a lake to divide into a bottom layer and surface layer, with a boundary layer (thermocline) between them. Stratification generally occurs during the summer and again during periods of ice cover in the winter. Overturns, or periods of mixing, generally occur once in the spring and once in the autumn. This "dimictic" condition is most common in lakes located in middle latitudes. A lake which stratifies and mixes more than twice per year is defined as "polymictic".

Threatened species. Any species of animal or plant that is likely to become endangered within the foreseeable future throughout all or a significant part of its range.

Till. Unsorted and unstratified drift, consisting of a heterogeneous mixture of clay, sand, gravel, and boulders, that is deposited by and underneath a glacier.

Trickling filter process. A method of secondary wastewater treatment in which the biological growth is attached to a fixed medium, over which wastewater is sprayed. The filter organisms biochemically oxidize the complex organic matter in the wastewater to carbon dioxide, water, and energy.

Topography. The configuration of a surface area including its relief, or relative evaluations, and the position of its natural and manmade features.

Unique farmland. Land, which is unsuitable for crop production in its natural state, that has been made productive by drainage, irrigation, or fertilization practices.

Wastewater. Water carrying dissolved or suspended solids from homes, farms, businesses, and industries.

Water quality. The relative condition of a body of water, as judged by a comparison between contemporary values and certain more or less objective standard values for biological, chemical, and/or physical parameters. The standard values usually are based on a specific series of intended uses, and may vary as the intended uses vary.

Watershed. The region drained by or contributing water to a stream, lake, or other body of water.

Water table. The upper level of groundwater that is not confined by an upper impermeable layer and is under atmospheric pressure. The upper surface of the substrate that is wholly saturated with groundwater.

WDNR. Wisconsin Department of Natural Resources.

Wetlands. Those areas that are inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

WWTP. Wastewater Treatment Plant.

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APPENDIX A

CORRESPONDENCE RECEIVED PERTAINING TO DRAFT ENVIRONMENTAL IMPACT STATEMENT GENEVA LAKE AREA, WALWORTH COUNTY, WISCONSIN

United States Department of the Interior

OFFICE OF ENVIRONMENTAL PROJECT REVIEW
175 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

ER-84/50

March 5, 1984

Mr. Valdas V. Adamkus
Regional Administrator
U.S. Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Adamkus:

The Department of the Interior has reviewed the draft environmental statement on the wastewater treatment facilities, Geneva Lake Area, Walworth County, Wisconsin.

General Comments

Known mineral resources in the study area are limited to sand and gravel. Figure 3-4 shows 12 gravel pits within the planning area. Both construction alternatives would require the conversion of one gravel pit to developed land use. Owing to the number of gravel pits identified in this area, the loss of one pit probably would not adversely impact gravel availability.

The statement should evaluate in a more quantitative manner the probable amount of mounding that would occur under the land application sites and the probable offsite ground-water impacts. Perching effects of low-permeability layers that are currently above the water table should be included in the analysis. Both vertical and horizontal permeabilities should be used and the probable directions of resultant ground-water gradients should be determined.

The Geneva Lake-Lake Como study area includes four outdoor recreation areas that were acquired and/or developed with Land and Water Conservation Fund (LWCF) assistance. These are:

Big Foot Beach State Park (Project No. 55-00052)
Stone Tract, Lake Como (Project No. 55-00432)
Woelky Tract, Lake Como (Project No. 55-01478)
Cobb Park, City of Lake Geneva (Project No. 55-00915)

Development of new wastewater treatment facilities or modification of currently existing facilities which might adversely affect these areas should be avoided. If the proposed project will use any land from these recreation areas, compliance with Section 4(f) of the Department of Transportation Act and with Section 6(f) of the LWCF Act, as amended, must be accomplished.

Section 6(f) provides that no property acquired or developed with assistance under this section shall, without the approval of the Secretary of the

Interior, be converted to other than public outdoor recreation uses. It also requires the substitution of converted lands with other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location.

The National Park Service is designated by the Secretary of the Interior to consider approval of Section 6(f) conversion requests upon submission through the State Liaison Officer for Outdoor Recreation. In Wisconsin this official is Mr. Paul N. Guthrie, Jr., Director, Office of Intergovernmental Programs, Wisconsin Department of Natural Resources, Box 7921, Madison, Wisconsin 53707.

We believe the draft statement generally presents an adequate discussion of alternatives and project related environmental effects. However, we believe the final statement could be strengthened relative to the assessment of primary and secondary effects on wetlands in the planning area. The following specific comments detail those areas in need of strengthening.

Specific Comments

Pages 4-6 The draft statement indicates that a loss of wetland wildlife habitat may occur from wastewater collection system construction in the right-of-way along Highway H. The final statement should include more detailed information on habitat to be lost including; wetland type; presence of state rare or threatened plant species; and need for a Federal Section 404 permit. Specific mitigative measures to be proposed for the system construction should be addressed in Section 4.3.1.

Pages 4-43 The discussion of wetland resources lacks specific information to support the statement that ". . . Local, County, and State ordinances effectively limit filling of wetlands for residential development." We believe this needs to be validated by discussing in detail the various approaches to be utilized. In addition, there is no mention, throughout the draft statement, of the Section 404 permit program. The Section 404 program generally protects wetlands above the ordinary high water mark, where state and local regulations, historically, have been weak or non-existent. Since the "EIS Alternative" would also allow for small management districts to address the wastewater issue (Executive Summary, xiii), the specific wetland management ordinances for guiding wastewater planning and managing onsite wastewater systems in the unsewered portions of the revised sewer service areas should be addressed fully. In our view, this is important given the high degree of overlap between unsewered areas (Figure 2-6) and wetlands (Figure 3-6) within the planning area.

We appreciate the opportunity to provide these comments.

Sincerely yours,

Sheila Minor Huff

Sheila Minor Huff
Regional Environmental Officer

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE ADMINISTRATOR

February 14, 1984

Mr. Valdas V. Adamkus
Regional Administrator
Environmental Protection Agency
Region V
230 South Dearborn St.
Chicago, Illinois 60604

Dear Mr. Adamkus:

This is in reference to your draft environmental impact statement on the wastewater treatment facilities for the Geneva Lake area, Walworth County, Wisconsin. Enclosed are comments from the National Oceanic and Atmospheric Administration.

Thank you for giving us an opportunity to provide comments which we hope will be of assistance to you. We would appreciate receiving four copies of the final environmental impact statement.

Sincerely,

Joyce M. Wood

Joyce M. Wood
Chief, Ecology and
Conservation Division

Enclosure

JMW:das

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Washington, D.C. 20230

February 8, 1984 N/MB2x5:VLS

TO: PP2 - Joyce Wood

FROM: N - Paul M. Wolff

SUBJECT: DEIS 8401.06 - Wastewater Treatment Facilities for the Geneva Lake Area, Walworth County, Wisconsin

The subject statement has been reviewed within the areas of the National Ocean Service's (NOS) responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

Geodetic control survey monuments may be located in the proposed project area. If there is any planned activity which will disturb or destroy these monuments, NOS requires not less than 90 days' notification in advance of such activity in order to plan for their relocation. NOS recommends that funding for this project include the cost of any relocation required for NOS monuments. For further information about these monuments, please contact Mr. John Spencer, Chief, National Geodetic Information Branch (N/CG17), or Mr. Charles Novak, Chief, Network Maintenance Section (N/CG162), at 6001 Executive Boulevard, Rockville, Maryland 20852.

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

Washington, DC 20593
Staff Symbol: G-WP-1
Phone: (202) 426-9584

07

6 MAR 1984

Mr. Harlan D. Hirt
Chief, Environmental Impact Section
5 WFI-12
Region V
U.S. Environmental Protection Agency
230 South Dearborn St.
Chicago, Illinois 60604

Dear Mr. Hirt:

The concerned operating administrations and staff of the Department of Transportation have reviewed the EIS for EPA Wastewater Treatment Facilities, Geneva Lake Area, Walworth Co., Wisconsin.

The Federal Highway Administration offered the following comments:

> "On page 3-78 the STH 120 work referenced is now scheduled to start in 1984. On page 3-79, it should be noted the installation of the concrete median barrier and resurfacing of I-94 in Kenosha County was completed in 1983. Also, the preparation of a draft EIS for the upgrading of STH 50 between Lake Geneva and I-49 is currently underway.
>
> The discussion on the project's impacts on the local highway transportation network is considered to be adequate".

The opportunity to review this Environmental Impact Statement is appreciated.

Sincerely,

W. R. RIEDEL
Chief, Planning and Evaluation Staff
By direction of Commandant

State of Wisconsin
DEPARTMENT OF AGRICULTURE, TRADE & CONSUMER PROTECTION

February 15, 1984

La Verne Ausman
Secretary

801 West Badger Road
P.O. Box 8911
Madison, Wisconsin 53708
608 266-1721

Mr. Harlan D. Hirt, Chief
Environmental Impact Section
US-EPA, Region V
230 S. Dearborn Street
Chicago, IL 60604

Re: Draft Environmental Impact Statement
Wastewater Treatment Facilities
For the Geneva Lake Area
Walworth County, Wisconsin

Dear Mr. Hirt:

The following comments are offered on behalf of the DATCP concerning the DEIS for the Geneva Lake Area wastewater treatment facilities:

1. Department staff agree with the conclusion on page 4-9 that the loss of the Rambow site "would represent a significant, long-term, adverse impact," but are skeptical that the mitigative measures proposed in section 4.3 would "in large part reduce the significance of these impacts," as suggested in the text. The areas of Plano silt loam soils located in and adjacent to Walworth which are large enough to accommodate the proposed, reduced-size seepage lagoon facility are all rated as capability class I, prime farmland. Within the Village of Walworth, these sites are actively farmed. Outside the Village of Walworth these sites are zoned for exclusive agricultural use. So long as a seepage lagoon system is proposed on Plano silt loam soils, the precedent of permanently removing prime farmland from agricultural use remains.

   For all those reasons stated in the Agricultural Impact Statement for this project, it is believed that the irreversible conversion of prime farmland to nonfarm use for public projects is not in the public's long-term best interests if feasible alternatives to the use of prime farmland exist. The department is all the more concerned when the land in question is class I, actively farmed, and zoned or designated for exclusive agricultural use.

   EPA staff are reminded of EPA policy to protect environmentally significant agricultural lands, established in 1978. In a letter from Douglas M. Costle to EPA assistant administrators, regional administrators and office directors, dated September 8, 1978, it is stated:

   > EPA declares its policy to protect, through the administration and implementation of its programs and regulations, the Nation's environmentally significant agricultural lands from irreversible conversion to uses which result in their loss as an environmental or essential food production resource. (page 5)

> Specific project decisions involved in the planning, design and construction of sewer interceptors and treatment facilities shall consider farmland protection. They shall ensure farmland protection unless no technically or economically feasible alternatives of lesser environmental consequences can be implemented. (page 6)

We believe this to be a responsible EPA policy which should be enforced with respect to this project.

2. References to site owners' participation in the Wisconsin Farmland Preservation Program are accurate, but descriptions of the program on pages xxi, 3-43 and 4-8 are inaccurate.

3. The statement is made on pages xxi and 4-8 that the class I-1 soils on the Rambow site "represent less than 1% of the most valuable soils in the State of Wisconsin." It would be more accurately stated that capability class I soils have the fewest limitations for farming of any soils in the nation, and represent less than 1% of the state's land area.

4. The department understands the circumstances which resulted in the AIS being printed as a separate addendum to the DEIS. We are concerned, however, that there was no mention made in the DEIS that the AIS is a part of that document. Furthermore, the AIS addendum was not distributed with the main text of the DEIS at the public hearing in Walworth. We trust that the AIS <u>will</u> be incorporated into the final EIS, possibly as an appendix.

Thank you for the opportunity to comment.

Sincerely,

Carol S. Olson

Carol S. Olson
Agricultural Impact Analyst
Bureau of Land Resources
AGRICULTURAL RESOURCE MANAGEMENT DIV.

Sincerely,

James A. Johnson

James A. Johnson
Director
Bureau of Land Resources
AGRICULTURAL RESOURCE MANAGEMENT DIV.

CSO/JAJ/T3/2/D4

State of Wisconsin \ DEPARTMENT OF TRANSPORTATION

March 1, 1984

BUREAU OF ENVIRONMENTAL
AND DATA ANALYSIS
4802 Sheboygan Avenue
P.O. Box 7916
Madison, WI 53707-7916

Mr. Harlan D. Hirt, Chief
Environmental Impact Section
U.S. Environmental Protection
Agency, Region V
230 South Dearborn Street
Chicago, IL 60604

Attn: 5WFI-12

Mr. Harlan:

We have reviewed the Draft Environmental Impact Statement on the Wastewater Treatement Facilities for the Geneva Lake Area of Walworth County, Wisconsin. It is our determination that the proposed project would not have significant adverse effects upon our transportation interests or concerns. We recommend, however, that you coordinate your activities which would be in or across State Trunk Highway right of way with:

H. Shebesta, Director
Division of Transportation Districts
P.O. Box 149
141 N.W. Barstow Street
Waukesha, WI 53187
(414) 548-5902

Whenever your activities would be in or cross the right of way of municipal, township or county transportation facilities, you should coordinate with the appropriate officials in those levels of government.

Thank you for the opportunity to review and comment on this Draft Environmental Impact Statement.

CAMorehouse

Cynthia A. Morehouse
Director

JBN: 50301841
cc: H. S. Druckenmiller, DNR
Trans. Dist. #2

State of Wisconsin \ Department of Industry, Labor and Human Relations

March 30, 1984

SAFETY & BUILDINGS DIVISION

Bureau of Plumbing
201 East Washington Avenue
P.O. Box 7969
Madison, Wisconsin 53707

Mr. Harlan D. Hirt, Chief
Environmental Impact Section
5WFI-12, USEPA Region V
230 South Dearborn St.
Chicago, IL 60604

Plan Identification No. 84-00960

Dear Mr. Hirt:

Re: Draft Environmental Impact Statement
Wastewater Treatment Facilities
Geneva Lake Area, Walworth County, WI

Please be informed that we have reviewed the pertinent subject matter and have the following comments.

We concur that where site and soil conditions preclude installation of replacement septic systems that are code complying, certain variances can be granted to allow use of the best available solution, in order to avoid more widespread use of holding tanks. We also agree that a relatively high level of expertise is needed to determine these best available solutions, and that oversight by a management district would further justify this alternative. However, prior to allowing reduced sizing based on maximum water conservation and/or wastewater segregation, we would need rigorous assurance that off-lot or cluster type solutions are not available.

In reference to the 21 failing systems that have been identified to date, all interested parties should be aware that section ILHR 83.03 (3) of the Wisconsin Administrative Code allows a maximum time period of one year for correction. Other references to H 63 in the Statement should read ILHR 83. The reference on page 2-113 to a 3% limit on mounds for new construction should read 30 per county to reflect the 1982 revision to s. 145.022 (3) of the Wisconsin Statutes. We are unable to locate Section 2.7.4., as referenced on page 2-158, and the reference on that page to Section 2.4.5 should read 2.5.4.

Sincerely,

James Sargent
Director

JS:ks

cc: Mark Williams, DNR

DILHR-SBD-6423 (N. 04/81)

KWB/RPB/ib 310-100
H0106-B
2/6/84

STATEMENT FOR PUBLIC HEARING
ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR WASTEWATER
TREATMENT FACILITIES IN THE GENEVA LAKE AREA

Big Foot High School
Village of Walworth
7:30 p.m.

MY NAME IS ROBERT P. BIEBEL AND I AM THE CHIEF ENVIRONMENTAL ENGINEER FOR THE SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION. I AM APPEARING ON BEHALF OF THE COMMISSION TO COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR WASTEWATER TREATMENT FACILITIES IN THE GENEVA LAKE AREA.

IN 1979, THE REGIONAL PLANNING COMMISSION COMPLETED A REGIONAL WATER QUALITY MANAGEMENT PLAN WHICH HAS SUBSEQUENTLY BEEN ADOPTED BY THE COMMISSION, THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES, AND THE U.S. ENVIRONMENTAL PROTECTION AGENCY. THAT PLAN, WHICH CONSIDERED THE BEST MEANS OF PROVIDING FOR THE ABATEMENT OF BOTH POINT SOURCES AND NONPOINT SOURCES OF SURFACE WATER POLLUTION IN SOUTHEASTERN WISCONSIN AND TO THE EXTENT PRACTICABLE PROVIDE "FISHABLE AND SWIMMABLE" SURFACE WATERS, INCLUDES SPECIFIC RECOMMENDATIONS FOR SEWAGE TREATMENT FACILITIES AND FOR AREAS TO BE PROVIDED WITH PUBLIC SANITARY SEWER SERVICE IN THE GENEVA LAKE AREA.

THE COMMISSION STAFF HAS REVIEWED THE SUBJECT ENVIRONMENTAL IMPACT STATEMENT WITHIN THE CONTEXT OF THE REGIONAL WATER QUALITY MANAGEMENT PLAN AND WITH REGARD TO THE SEWAGE TREATMENT FACILITY PLANNING WHICH HAS BEEN ONGOING BY THE LOCAL UNITS OF GOVERNMENT FOR THE LAST SEVEN YEARS. BASED UPON THAT REVIEW, THE COMMISSION STAFF HAS TWO CONCERNS WHICH WE WISH TO ADDRESS HERE TODAY.

THE FIRST CONCERN FOCUSES ON THE TYPE OF TREATMENT PROCESS WHICH IS TO BE INCLUDED IN THE NEW FACILITY TO SERVE THE VILLAGES OF WALWORTH AND FONTANA. THE REGIONAL PLAN SPECIFICALLY STATES THAT THE PROPOSED WALWORTH/FONTANA PLANT MAY INCLUDE EITHER A LAND APPLICATION TREATMENT PROCESS FACILITY, SUCH AS INCLUDED IN THE ENVIRONMENTAL IMPACT STATEMENT ALTERNATIVE, OR A PROCESS PROVIDING ADEQUATE TREATMENT PRIOR TO DISCHARGE TO PISCASAW CREEK AS RECOMMENDED IN THE LOCAL FACILITY PLANS. THE REGIONAL PLAN FURTHER RECOMMENDS THAT PHOSPHORUS REMOVAL BE PROVIDED IN THE PLANT DESIGN SHOULD THE PISCASAW CREEK DISCHARGE ALTERNATIVE BE CHOSEN. WHILE THE REGIONAL PLAN PROVIDES FOR EITHER OF THESE TWO TREATMENT ALTERNATIVES, THE COMMISSION STAFF BELIEVES THAT A REVIEW OF THE PUBLIC PARTICIPATION ELEMENT OF THE LOCAL FACILITY PLANNING PROCESS, AS WELL AS THE PRIME AGRICULTURAL LAND IMPACTS AND IMPLEMENTATION CONSIDERATIONS CLEARLY INDICATE THAT THE LAND APPLICATION ALTERNATIVE IS LESS FAVORABLE THAN THE ALTERNATIVE WHICH PROVIDES FOR DISCHARGE TO PISCASAW CREEK. LOCAL OFFICIALS EVALUATED ALL OF THE APPROPRIATE FACTORS, INCLUDING MONETARY COSTS, IN ARRIVING AT THEIR DECISION TO RECOMMEND A PLANT WHICH DISCHARGES TO PISCASAW CREEK. THE COMMISSION STAFF BELIEVES THAT DECISION WAS A SOUND ONE. IT IS ACCORDINGLY RECOMMENDED THAT THE ENVIRONMENTAL IMPACT STATEMENT BE REVISED TO MORE FULLY REFLECT THE PUBLIC PARTICIPATION ELEMENT OF THE LOCAL FACILITY PLANNING AS WELL AS THE IMPLEMENTABILITY PROBLEMS WHICH SURELY WOULD OCCUR SHOULD THE LOCAL UNITS OF GOVERNMENT BE REQUIRED TO ADOPT THE LAND APPLICATION ALTERNATIVE.

THE SECOND CONCERN WHICH THE COMMISSION STAFF WISHES TO RAISE RELATES TO THE APPARENT INDICATION IN THE ENVIRONMENTAL IMPACT STATEMENT THAT THE EXTENT OF THE PUBLIC SANITARY SEWER SERVICE AREA SHOULD ESSENTIALLY BE LIMITED TO THE AREAS PRESENTLY SEWERED. THE ALTERNATIVE SET FORTH IN THE EIS AS MOST COST EFFECTIVE PROVIDES FOR CONTINUED LONG TERM RELIANCE ON ONSITE SEWAGE DISPOSAL

SYSTEMS FOR ALL OF THE PRESENTLY UNSEWERED AREAS WITHIN THE GENEVA LAKE AREA. THE EIS ALTERNATIVE ALSO PROVIDES FOR A REDUCTION IN SEWAGE TREATMENT PLANT CAPACITIES DUE TO THIS REDUCTION IN SERVICE AREA. THE EIS ALTERNATIVE IS BASED UPON THE CONCLUSION THAT A COMBINATION OF CONVENTIONAL SEPTIC SYSTEMS, MOUND SYSTEMS, AND HOLDING TANKS CAN BE USED TO ECONOMICALLY SERVE ALL OF THE UNSEWERED AREAS OVER THE NEXT 20 YEARS. THE COMMISSION STAFF HAS CONCLUDED THAT IMPLEMENTATION OF THIS ALTERNATIVE WOULD BE UNSOUND FOR THE FOLLOWING REASONS:

1. THE EIS CONCLUSIONS WITH REGARD TO THE EXISTING PROBLEMS AND LONG TERM VIABILITY OF ONSITE SYSTEMS APPEAR TO BE OVERLY OPTIMISTIC. BASED UPON THE COMMISSION STAFF'S REVIEW OF THE MATERIAL IN THE LOCAL FACILITY PLANS AND THE EIS, THE POTENTIAL PROBLEMS APPEAR TO BE MORE SEVERE THAN THE EIS HAS INDICATED. THERE ARE AREAS WHERE, AS PROBLEMS DO DEVELOP, NO ONSITE ALTERNATIVE EXCEPT A HOLDING TANK WILL BE VIABLE. ELIMINATING THE POTENTIAL TO PROVIDE PUBLIC SEWERS TO SOME AREAS COULD CREATE A SEVERE PUBLIC HEALTH HAZARD AND CONTRIBUTE TO THE DEVALUATION OF PROPERTY. IN THIS REGARD, IT IS IMPORTANT TO CLARIFY IN THE EIS THE LIMITATIONS WHICH EXIST FOR UPGRADING OR REPLACING EXISTING SYSTEMS UNDER THE PRESENT STATE AND COUNTY REGULATIONS.

2. THE COMMISSION DOES NOT REGARD THE USE OF ONSITE SEWAGE DISPOSAL SYSTEMS AS A PERMANENT SOLUTION TO THE SANITARY WASTE DISPOSAL PROBLEMS ASSOCIATED WITH URBAN DEVELOPMENT. EVEN UNDER RELATIVELY GOOD SOIL CONDITIONS, SYSTEMS FAIL OVER TIME AND MUST BE REPLACED. IN MANY CASES--PARTICULARLY WHERE OLDER, SMALLER LOT SUBDIVISIONS ARE INVOLVED --ONSITE SOIL ABSORPTION SYSTEM REPLACEMENT IS PRECLUDED. ACCORDINGLY,

CENTRALIZED SANITARY SEWERS SHOULD NOT BE PRECLUDED AS A SOLUTION TO EXISTING ONSITE SEWAGE DISPOSAL PROBLEMS AND TO ACCOMMODATING NEW URBAN DEVELOPMENT.

3. THE EIS CONCLUSION THAT THE DEVELOPMENT OF PUBLIC SANITARY SEWERS COULD RESULT IN ADVERSE SECONDARY IMPACTS BY STIMULATING DEVELOPMENT IN AREAS UNSUITED FOR SUCH DEVELOPMENT IS NOT SOUND. IN SOUTHEASTERN WISCONSIN, ONCE A SOUND SANITARY SEWER SERVICE AREA REFINEMENT STUDY IS DONE--AS THE COMMISSION PROPOSES TO DO WORKING WITH THE LOCAL UNITS OF GOVERNMENT CONCERNED--THE POTENTIAL FOR SUCH ADVERSE IMPACTS IS NOT REAL SINCE ALL SEWER EXTENSIONS MUST BE REVIEWED FOR CONFORMANCE WITH A SOUND SEWER SERVICE AREA PLAN APPROVED BY THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES. IT IS OUR UNDERSTANDING THAT THE LAKE GENEVA COMMUNITIES ARE WILLING TO PREPARE SUCH PLANS WHICH WILL PRECISELY ESTABLISH THE LIMITS OF THE SERVICE AREAS AND PREVENT SIGNIFICANT UNPLANNED POPULATION GROWTH AND WHICH WILL PROVIDE FOR PROTECTION OF ALL ENVIRONMENTALLY SENSITIVE AREAS. ACCORDINGLY, SECONDARY ENVIRONMENTAL IMPACTS ARE NOT AN ISSUE.

4. THE COST FOR PROVIDING THE CAPACITY TO SEWER THE AREAS PROPOSED TO BE SEWERED IN THE LOCAL FACILITY PLANS IS ONLY MARGINALLY LARGER--ABOUT 7% --THAN THE COST TO PROVIDE THE CAPACITY NEEDED FOR ONLY THE EXISTING SERVICE AREA. THE TREATMENT FACILITY DESIGN CAPACITIES SET FORTH IN THE ENVIRONMENTAL IMPACT STATEMENT ALTERNATIVE DO NOT PROVIDE ANY FLEXIBILITY FOR GROWTH. IN SOME CASES THESE DESIGN FLOWS ARE ALREADY REACHED DURING PEAK SUMMER MONTHS.

5. THE EIS PLANNED SEWER SERVICE AREA DOES NOT REFLECT THE LOCAL COMMUNITY PLANS FOR URBAN DENSITY DEVELOPMENT. IN SOME CASES SEWERS ARE ALREADY DESIGNED BEYOND THE LIMITS OF THE EIS PLANNED SERVICE AREA.

6. THE COST ANALYSIS DEVELOPED IN THE EIS ALTERNATIVE SHOULD BE RECONSIDERED BY ASSUMING THAT THE TRUNK AND COLLECTION SEWERS NEEDED FOR SOLVING ONSITE SEWAGE DISPOSAL NEEDS WILL NOT BE CONSTRUCTED UNTIL SUCH TIME AS THE NEED ARISES. THUS, THE ONLY INITIAL COST DIFFERENCE BETWEEN THE EIS ALTERNATIVE AND THE FACILITY PLAN ALTERNATIVE IS A MODEST INCREMENTAL TREATMENT PLANT COST. THE DEVELOPMENT OF SEWERS FOR EACH UNSEWERED AREA WILL BE EVALUATED AS NEEDS ARISE.

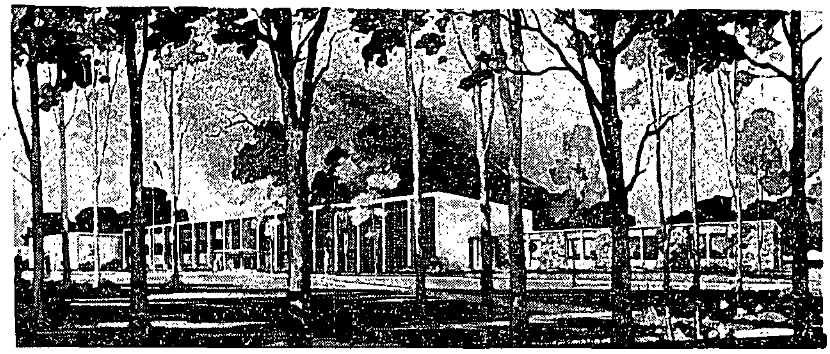
7. THE PLANNED SEWER SERVICE AREAS AS DELINEATED UNDER THE ENVIRONMENTAL IMPACT STATEMENT ALTERNATIVE ARE IN DIRECT CONFLICT WITH RECOMMENDATIONS CONTAINED IN THE ADOPTED REGIONAL WATER QUALITY MANAGEMENT PLAN.

IN VIEW OF THE ABOVE, THE COMMISSION STAFF RECOMMENDS THAT THE ENVIRONMENTAL IMPACT STATEMENT BE REVISED TO MORE FULLY CONSIDER THE ALTERNATIVE RECOMMENDED IN THE ADOPTED REGIONAL WATER QUALITY MANAGEMENT AND LOCAL FACILITY PLANS WITH REGARD TO SEWER SERVICE AREAS AND TREATMENT PLANT DESIGN CAPACITIES. IT SHOULD BE RECOGNIZED THAT THE SEWER SERVICE AREAS WOULD THEN BE REFINED BY THE LOCAL COMMUNITIES WORKING WITH THE COMMISSION IN DEVELOPING A PROPOSED SANITARY SEWER SERVICE AREA REFINEMENT THAT WOULD SPECIFICALLY IDENTIFY THE LANDS WHICH WOULD NOT BE SEWERED FOR ENVIRONMENTAL PROTECTION REASONS. IT WOULD THEN BE POSSIBLE TO PROVIDE SEWER SERVICE TO UNSEWERED AREAS AS NEEDS ARISE. THIS FLEXIBILITY IN MEETING THE PLANNED DEVELOPMENT AND POTENTIAL PROBLEMS WITH EXISTING DEVELOPMENT IS IMPORTANT.

IN CONCLUSION, THE COMMISSION RECOMMENDS THAT THE EIS BE REVISED TO MORE FULLY TAKE INTO ACCOUNT THE PUBLIC PARTICIPATION AND IMPLEMENTATION PROBLEMS REGARDING THE LAND APPLICATION ALTERNATIVE FOR THE WALWORTH/FONTANA SEWAGE TREATMENT PLANT. IN ADDITION, IT IS RECOMMENDED THAT THE EIS BE REVISED IN SUCH A MANNER AS TO NOT PRECLUDE THE EXTENSION OF PUBLIC SANITARY SEWERS TO EXISTING AND PROPOSED URBAN DEVELOPMENT IN THE GENEVA LAKE AREA WITHIN THOSE AREAS IDENTIFIED IN THE REGIONAL AND LOCAL PLANS FOR SUCH SERVICE. FINALLY, THE EIS SHOULD BE REVISED TO CALL FOR ADEQUATE TREATMENT CAPACITIES TO ACCOMMODATE THESE NEEDS.

THANK YOU FOR THE OPPORTUNITY TO COMMENT ON THIS ENVIRONMENTAL IMPACT STATEMENT.

Walworth County



Planning, Zoning and
Sanitation Office

Courthouse Annex - Box 1007
Elkhorn, Wisconsin 53121

TELEPHONE:
414/723-3344

Elkhorn, Wisconsin 53121

February 6, 1984

Mr. Harlan D. Hirt
Chief, Environmental Impact Section
U.S. Environmental Protection Agency
Region V
230 South Dearborn Street
Chicago, IL 60604

Dear Mr. Hirt:

The Walworth County Park and Planning Commission staff has reviewed the Draft Environmental Impact Statement completed by your agency and the Wisconsin Department of Natural Resources for the Lake Geneva area, Walworth County, Wisconsin in January of 1984 and at this time would like to make the following comments:

1. It appears that the Environmental Impact Statement (EIS) eliminates a number of large presently unsewered developments from the originally identified sewer service area for the entire Lake Geneva region. If this is the case it seems that future sewered development outside of existing municipal boundaries is unlikely. Also this seems to rule out future sewer extensions to large unsewered residential areas (i.e. Lake Como, the Robinson-Hillside, Academy Estates, and Trinke Estates subdivisions) all noted as having poor soils for on-site waste disposal systems. Even though new innovations in the area of on-site waste systems have made it possible to eliminate many septic system failures in the Lake Geneva area, for many homeowners near the lake area the best solution is still hooking up to a municipal sewage treatment system.

   It should be noted that even with the recent downturn in the nations economy the greater Lake Geneva area is still experiencing substantial pressure for development. This pressure is expected to increase in the future.

   Not to recognize these existing problems by so drastically scaling down future sewer service areas seems short sighted in our opinion.

2. The commission has gone on record as opposing the proposed subregional aerated lagoon for the Villages of Fontana, and Walworth, Wisconsin to be located on an 80 acre parcel of farmland owned by Donald and Faith Rambow located Southwest of the Village of Walworth in the east ½ of the northwest ¼ of section 28 in the Town of Walworth, Wisconsin.

   The parcel is part of a 280+ acre family farm operation and currently provides the principal means of support for three families. The Rambows grow corn, oats, soybeans and hay as cash crops and for livestock use and milk about 40 cows.

   The 80 acre parcel in question is well drained, prime farmland which is used exclusively as cropland. The loss of this 80 acres would be equivilent to the loss of the acreage needed to feed the Rambows' entire dairy herd. It would mean the loss of nearly 45% of the Rambows' owned land or 25% of their owned and rented land.

   It should be noted that in the past a number of these aerated type lagoon systems have failed. The most recent case would be an aerated lagoon type system constructed for Cambellsport, Wisconsin. Reliance on this yet unproven technology could result in possible groundwater contamination.

We would appreciate your consideration of these above mentioned objections.

Sincerely,

Allen Morrison

Allen Morrison, Chairman
WALWORTH COUNTY PARK
AND PLANNING COMMISSION

AM:jc

TOWN OF LYONS

OFFICE OF TOWN CLERK

Town of Lyons - - Lyons, Wisconsin 53148

January 12, 1984

Environmental Impact Section
230 South Dearborn St.
Chicago, Il. 60604

Gentlemen: Attention--Harlan D. Hirt, Chief

This is to advise you that the Town Board at its January 9th, 1984, Regular Town Board Meeting wishes to express its opposition to the establishment of a sewage treatment facility for the City of Lake Geneva in the NE 1/4 Sec. 31 and the NW 1/4 of Sec. 32 in the Town of Lyons or at any other place within the Town which will conflict with the already established residential, agricultural, and recreational uses of the Town.

Further, we have a petition that was filed with us on June 11, 1983, containing about seventy-five signatures which reads as follows: We believe it is the obligation of the Town Board and the Park and Planning Commission to preserve and maintain residential property values and water and air quality for the residents of the Town. If this project is to be considered further, it is then the obligation of the City of Lake Geneva to provide surrounding property owners and/or residents with an environmental impact statement showing the short and long range effects of this open pit sewage treatment facility on our drinking water, the air we breathe, the wildlife in the area, and the quality of life in the future.

Respectfully submitted,

TOWN OF LYONS

Richard Reich

Richard Reich, Chairman

Fred W. Ehlen

Fred W. Ehlen, Supervisor No. 1

Wm R. Mangold

William R. Mangold, Supervisor No. 2

Town of Walworth

Route 1

WALWORTH, WISCONSIN 53184

January 31, 1984

U.S. Environmental Protection Agency
Region V
230 South Dearborn St.
Chicago, IL 60604

Attn.: Harlan D. Hirt
Environmental Impact Section 5WFI-12

Dear Sir,

At the request of a local citizens group the Walworth Town Board at its regular monthly meeting restated their position as stated last June (1983) in regard to aerated lagoons, seepage beds, or sewer ponds in the Town of Walworth.

The Town Board is strongly opposed to such ponds. We feel that in addition to wasting irreplaceable farm land and damaging priceless good will between the communities involved, that there is sufficient controversy and disagreement among the so-called experts to cause this Board deep concern as to the actual safety of our underground water system. In regard to all of this we find it difficult to under stand why the continuing pursuit of this method by certain agencies when there are other options available.

Very truly yours,

James Van Dreser

James Van Dreser
Chairman
Town of Walworth

VILLAGE OF WALWORTH
WALWORTH COUNTY, WIS.

RESOLUTION 84-1

WHEREAS, the Village of Walworth Board of Trustees, as lead agency for a joint sewer study for a Step One Facility Plan, which has investigated several wastewater management alternatives for the Villages of Walworth, Fontana and Williams Bay on the west side of Lake Geneva, and the City of Lake Geneva and Lake Como on the east side of Lake Geneva, as well as the unsewered areas which surround Lake Geneva; and,

WHEREAS, Donohue and Associates, Inc., professional engineers, assisted in the preparation of all necessary scientific and engineering data required to properly evaluate the wastewater management alternatives which would be best suited to the area; and,

WHEREAS, Archeological Consulting and Services, archeological consultants, also assisted Donohue and Associates, Inc. in the preparation and investigation of all necessary scientific data required to properly evaluate several wastewater management alternatives; and,

WHEREAS, Donohue and Associates, Inc., engineers, did submit a final draft Geneva Lake Facilities Plan, Volume 2 Treatment Alternatives, West Planning Area 1983; and,

WHEREAS, the Villages of Walworth and Fontana have formed a joint subregional committee to explore the alternatives for wastewater management and review the final draft of the Geneva Lake Facilities Plan, Volume 2 Treatment Alternatives, West Planning Area 1983; and,

WHEREAS, the Villages of Walworth and Fontana, after extensive investigation on their own behalf, did unanimously adopt the Geneva Lake Facilities Plan, Volume 2 Treatment Alternatives, West Planning

Area 1983; and,

WHEREAS this final draft sets forth a recommended alternative for wastewater management which consists of treatment in an oxidation ditch, secondary treatment to a clarifier followed by sand filtration and ultraviolet disinfection and a final discharge of effluent to surface water, (Piscasaw Creek); and,

WHEREAS, as required by federal and state regulations, a draft Environmental Impact Statement (EIS) was prepared by the Environmental Protection Agency, assisted by WAPORA and the Wisconsin Department of Natural Resources, 1984; and,

WHEREAS, the Village of Walworth hereby stresses the importance of the adoption of the Facilities Plan Recommended Alternatives set forth in the EIS draft for the Wastewater Treatment Facilities for the Geneva Lake Area, Walworth County, Wisconsin, 1984; and,

WHEREAS, the Village of Walworth after extensive investigation which has included the examination of other high-rate soil absorption systems in the State of Wisconsin and the State of Minnesota, arrived at the following conclusions: many systems in both states are flawed and malfunctioning, a few have had complete failures, and the State of Minnesota is considering a temporary ban on any new soil absorption systems, which findings help the Village conclude that the EIS recommended alternative or any other alternative recommending soil absorption would be unacceptable for our community because of it's shortsightedness and possible long-term devastating consequences;

NOW, THEREFORE, BE IT RESOLVED, that the Village of Walworth Board of Trustees does hereby express unequivocably, it's opposition to the EIS alterantive and stresses the importance of the approval of the FPRA set forth in the EIS draft dated January, 1984, by EPA and WDNR, and wishes to set forth it's following objections to the EIS alternative:

1. Land application seepage cells which use high-rate soil absorption for effluent have been proven faulty in our area and remain suspect presently.

2. The loss of any prime agricultural land on the prairie remains as an unacceptable solution because it remains as a nonreplaceable commodity.

3. The risk of contamination to our pure drinking water, and also the service are consequences which could possibly cause irreverisble damage to our ground water.

4. Last, but not least, we cannot risk short-term advantages which claim to be cost effective but ultimately could become capital intensive if failure occurs due to the lack of a sufficient data base and known recent failures.

Adopted this 23rd day of January, 1984

Village President

Village Clerk

Geneva Lake Environmental Agency

FONTANA
LAKE GENEVA
LINN TOWNSHIP
WALWORTH TWP.
WILLIAMS BAY

HIGHWAY 67
P.O. BOX 190
FONTANA, WI. 53125
PHONE 1-414-275-6310

February 21, 1984

Mr. Harlan D. Hirt
Chief, Environmental Impact Section
REGION V, U.S. ENVIRONMENTAL PROTECTION AGENCY
230 S. Dearborn Street
Chicago, IL. 60604

RE: Comments pertaining to the draft EIS Wastewater Treatment Facilities for the Geneva Lake Area, Walworth County, Wisconsin, SWF1-12

Dear Mr. Hirt:

The Geneva Lake Environmental Agency was established over ten years ago to manage Geneva Lake and its watershed.

We have been involved in facilities study since the mid-1970's. Much of our water quality data was used in the facilities study as well as in the EIS. The Agency has reviewed the EIS and would like to comment on some of the recommendations presented in the EIS, specifically on the Sewer Service Area.

- We agree that, at this time, the extension of sewers into unsewered areas is perhaps not the best solution to existing problems in these areas.

- We agree that the cost-effectiveness of sewer extension into unsewered area may not be acceptable to the residents of these areas nor to the civil subdivision in which these areas are located.

- We also agree that the secondary impacts of extending sewers into these areas could, and probably will, result in more environmental damages than the sewer extension would in itself abate.

- However, we disagree with the EIS's assessment of the seriousness of the problem from failing on-site systems of Geneva Lake's South shore, specifically the Southeastern shore.

- We feel that the problem of failing septic systems and the resulting water quality degradation is greater than one is led to believe from reading the EIS.

We feel this way in view of the:

* groundwater quality data
* seasonal bacteria data
* seasonal stream water quality data
* age of systems
* type of data
* lot size

We also feel that, based upon those issues, the potential for future failure and water quality degradation is also greater than presented in the EIS.

- The seriousness of the problem may be relative only to Geneva Lake, yet it is one of the areas of most concern on Geneva Lake. We feel that an active stance on water pollution, rather than a reactive response by its residents, has retained this lake's high water quality over the years.
- We feel the problem is serious enough to do something now with visions toward the future. Alternative methods should be tried now with the most promising being one of the various innovative alternate systems for small communities and rural areas.
- These alternatives will still require a time and dollar commitment by the local units of government and the residents. It will also require a combined effort by both.
- Even though sewers for the Southeastern shore of Geneva Lake may not be the best solution for the problems found in that area at this time, we still feel that the area should be included in the Sewer Service Area. We feel this way because if, down the road 10-15 years, the alternative recommendations do not come to be or prove to be unsuccessful in abateing the water quality problems, the option of sewers will still exist. It will exist without having to deal with plant design, facilities study amendment and the associated time and money loss.

We thank you for your consideration.

Sincerely,

Theodore W. Peters
Director
GENEVA LAKE ENVIRONMENTAL AGENCY

TWP/hm
cc: Franklin Walsh

THE COMMITTEE TO
SAVE GENEVA LAKE
P.O. BOX 356 • FONTANA, WISCONSIN 53125 • PHONE 414/248-0328

February 20, 1984

Mr. Harlan D. Hirt
Chief, Environmental Impact Section
Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

RE: EIS STATEMENT

Dear Mr. Hirt:

With concern The Committee To Save Geneva Lake has followed the progress of the studies of the Wastewater Treatment Facilities for the Geneva Lake area.

The Committee has a number of concerns centered around this issue. Good water quality and the monitoring of it is an ongoing prime concern of ours as it is of the residents of this area. The quality of waters is affected naturally by the amounts of untreated discharge emitted into the ground water. These polluting particles are a part of nature as well as man made. Therefore the need to lower the numbers by controlling the man made pollutants is a necessary factor.

Extending sewer lines to area that have none, as you point out is one manner through which man tries to controll the quality of the waters. There are definitely good effects of properly controlled sewerage. However, too much of a good thing can have a bad effect. The Committee is concerned with the amount of mass sewerage proposed for this area.

It is realistic to have proper capacity built into the Waste Water Treatment Plants should onsite systems totally fail in the far future. However,to extend the lines to the areas now endangers the density figures that are now realistic for present land use.

Much of the lands now unsewered are zoned Conservancy and Agriculture. These are prime park and farm lands whose natural state enhances the beauty of the area. They are a continual reminder of the strong quality of life that land owners strive to maintain.

As pointed out in the studies, population could increase by the year 2005 upwards of 90% should mass extension of sewers go into affect. If there is excess capacity for future expansion built into this plan and no assurance that there will not be a push past boundaries set we then find a situation where the extension of sewer pipes to unsewered areas would have adverse effects on the area. Such extension of sewers will definitely affect residential density which will have a detrimental effect on the lake. As residential density increases it is generally noted that the "quality of life" decreases, which then affects the quality of the lake. With all of this in mind we feel there are realistic alternatives to this that can both help maintain the quality of the water and the level of density in the area.

In closing, this is a serious and delecate problem that must be looked at from all aspects before a final decission is made. Look at the immediate as well as the future. Look at the affects your decisions will have on the water, the land and the residents.

Sincerely,

Pam Carper

Pam Carper
Executive Director

RECEIVED
FEB 23 1984
EPA
OFFICE ... ADMIN ...

February 21, 1984

United States Environmental
Protection Agency
Region V (Water Division)
230 South Dearborn St.
Chicago, IL 60604

Reply Ref: 5FWI-12

Attn: Valdas V. Adamkus
Regional Administrator

RE: Wastewater Treatment Facilities for Geneva Lake Area, Walworth County, Wisconsin

Dear Mr. Adamkus:

After attending meetings, reading articles and reviewing the Draft Environmental Impact Statement for the above referenced project, I have come to one conclusion. It is not the environment or the health considerations that any of our governmental agencies from city, county, state to federal are concerned about, it's MONEY.

It was brought out at the public meeting on the Draft EIS that the wastewater treatment problem in the Geneva Lake area has been under study for some five to seven years.

Had proven methods of wastewater treatment been installed even three to four years ago, the cost would have been appreciably less due to inflation alone.

The costs of all the studies, site evaluations, Draft Environmental Impact Statement, D.N.R. participation, Local municipality engineering costs must be at an astronomical figure after all these years. These costs could have come to an end several years back and the DOLLARS put to constructive use in building efficient wastewater treatment plants.

Now, however, the prime consideration is "COST EFFECTIVENESS", no matter what the people want; the same people who will have to live with the facility and will have to pay for it.

Why is the U.S. Environmental Protection Agency and the Wisconsin Dept. of Natural Resources pushing the seepage cell concept when according to the article on Seepage Cell Failures in the Feb. 16, 1984 issue of the Lake Geneva Regional News, Minnesota, Michigan, Ohio, Indiana and Illinois do not allow new seepage cell construction.

We apparently already have many problems in Wisconsin with these systems; even in Fontana, a community covered in the subject Draft EIS.

O: WATER
cc: RF
RA
Leffin

February 21, 1984 Reply Attn: 5WFI-21

In my opinion, complete treatment at a wastewater treatment plant is the only sane solution and the only plan that is fair to future generation.

Let's hope the decisions that are made on the type of wastewater facilities to be constructed in the Geneva Lake area are based on sound proven treatment practices and not on real estate deals and "Cost Effective" considerations.

Yours very truly,

Mrs. George F. Knowles

Mrs. George F. Knowles
Rt. #3 Box 6035
Hwy 50 East
Lake Geneva, WI 53147

ek/

CC: Wisconsin Department of Natural Resources, Madison, WI
Editor - Lake Geneva Regional News, Lake Geneva, WI
Chuck Coleman, State Representative, Madison, WI

Save the Prairie
c/oRt. 1, Box 175
Walworth Wi 53184
Feb 21, 1984

Mr. Harlan Hirt
Chief, Environmental Impact Section, 5WFI-12
230 So. Dearborn St.
Chicago, Ill. 60604

Dear Mr. Hirt,

We thank you for the opportunity to address our thoughts about rapid infilltration disposal on the Big Foot Prairie.

Our serious concerns take this form. We wish to note:
1. A 34" crude oil pipeline transverses that parcel. Natural gas lines are in other parcels. We feel the crude oil pipeline poses a hazard to construction, complication to design and possible problem if groundwater mounding would occur no matter what easements are obtained.

2. Wisconsin as of Thurs., 2/23/84 has a Groundwater Bill that promises to apply stringent monitors to any groundwater contributors such as seepage cells. Also private wells will now be protected from contamination. Federal standards, we're told, will probably be adopted.

3. Rambow site and most other village-contiguous sites are within 1 mile of failing Kikkoman absorption ponds. Note enclosed data with chlorides in 860 mg/l, 720 mg/l area and nitrates of 16 m./l, 17 mg/l, etc.

4. Prime farmalnd should be be raped and destroyed this way. It is a nonrenewable jewel, like the lake and groundwater and should be nutured and given life. (I'm a city girl and I understand it and I'M sure many EPA people do, too.)

5. People and government do not want seepage cells. Note earlier petitions with 360 names and village government resolutions, and word of Township government, SEWRPC, DNR WW Rx Div.

6. Region 5 says no to seepage cells. See state data enclosed.

7. EPA calls it "failed technology" and will be studying rapid infilltration along with a few other problem "technologies." See enclosed.

8. DN R's White Paper and its getting ready to ban seepage cells as a failing system. Have you read it? Enclosed are some additional failures .

Sincerely yours,

Carolyn Rambow
Harold Rambow

Both John R (10)
(4)

Carolyn:

Attached is the page from the overall Water Division yearly workplan which relates to studying failed technologies. This will be an on-going effort in which all technologies will not be reviewed this year, but we will look at some of the likely candidates.

The most apparent ones at this time include:

- Rotating Biological Contactors (RBC)
- Rapid Infiltration
- Incinerators
- Hi-Tech Instrumentation

Others will emerge I'm sure as we go along.

The results of our findings will be distributed to the States in our region for use during their planning and design reviews. The idea is to feed-back the information for benefit at the front end of the facility development process.

If you have any more questions, please call.

JR Kelley

MINNESOTA
ILLINOIS
INDIANA
MICHIGAN
OHIO
WISCONSIN

JOHN R. KELLEY P.E.

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604
(312) 353-2146

As a result of the aforementioned concerns of cost-effectiveness, hydraulic failure and ground water impacts, we are deferring future action on all previously approved high rate soil absorption system facilities plans until a re-evaluation of ground water impacts, hydraulic suitability and cost-effectiveness has been completed.

All municipalities with previously approved high rate soil absorption system facilities plans should contact the Technical Review Section as soon as possible to re-evaluate the recommended alternative. To perform this review, in most cases soils and hydrogeological data will be required which may take several months to perform and may be constrained to a specific season of the year (such as spring high ground water).

In that extensive re-evaluation may be required with associated delay, previously approved high rate soil absorption system projects will not be placed on future construction grant project lists until this work is approved.

We understand the concern that this delay will cause to municipalities. However, we believe that the benefits of obtaining environmentally sound, cost-effective wastewater treatment systems dictates that this approach be followed.

If you have further questions concerning this, please contact John E. Hensel at 296-7213.

STUDY OF FINANCIAL AID OPTIONS COMPLETE

A report prepared for the MPCA has been completed by Peat, Marwick, Mitchell & Company in association with the Government Research Center of the Municipal Finance Officer Association, Donohue and Associates, and Briggs and Morgan Law Firm. The final report, dated October 1, 1983, is entitled "Evaluation of Alternative State Aid and Other Programs for Financing Construction of Municipal Wastewater Treatment Facilities".

The report analyzes the existing status of the construction needs in Minnesota, the fiscal health of Minnesota cities and identifies State financing program alternatives. Several options involving bond guarantees, loans and directed State grants were closely evaluated.

This information will be used by the Agency staff, the Agency Board Members and a Citizens Construction Grants Task Force to consider possible State financial aid programs for municipalities in order to comply with the July 1988 deadline for compliance with effluent quality standards.

This will obviously be a topic receiving attention by the 1984 Legislature as well as the realization of the reduced Federal share (from 75% to 55%) as the approaching 1988 deadline begins to come into focus. More on this topic will follow in future CGM editions.

UPDATE ON WPC 34

WPC 34 was finalized in October 1984. You may request copies from the office listed below. Indicate that you want a Session Law copy of 6 MCAR 4.8034, Rule for the Administration of the Minnesota State Water Pollution Control Fund and federal grant funds allotted to Minnesota, Chapters 115 and 116. There will be a nominal fee for the information.

Minnesota Department of Administration
State Register & Public Documents Div.
Central Services Bureau
117 University Ave.
St. Paul, Minnesota 55155
(612) 296-3000

1984 DRAFT MUNICIPAL PROJECT LIST

The Public Notice for the 1984 Draft Municipal Project List (MPL) was mailed on October 6, 1983.

Grantees that are currently on the draft list should review the dollar amounts associated with the project. If the amount is incorrect, promptly send written notifi-

Minnesota Pollution Control Agency

NOVEMBER 1983
Volume 42

CONSTRUCTION GRANTS MEMORANDUM

TO: CONSULTING ENGINEERS

FROM: CONSTRUCTION GRANTS PROGRAM MANAGER

TOPICS

HIGH RATE SOIL ABSORPTION SYSTEM FACILITIES PLAN APPROVAL

There is increasing concern about ground water impacts and hydraulic failure of large drainfields/mounds, rapid infiltration systems and other high rate disposal systems which discharge wastewater effluent to ground water.

Research and study by University, Federal and State officials have expressed concern in several areas:

1) Ability of high rate soil absorption systems to physically accept all water on a long term basis.

2) Possibility of ground water mounding from high discharge volumes which could interfere with system operation/ performance.

3) Possiblity of ground water and associated well contamination resulting from discharge of high volumes of such potential pollutants as nitrogen.

Soils and ground water studies have recently been required to evaluate soil and hydrogeological characteristics of these high rate soil absorption systems. In instances where adverse ground water impacts are anticipated, either a variance from WPC 22, "Classification of Underground Waters of the State and Standards for Waste Disposal" or water well replacement may be required.

When the environmental and cost impacts of high rate soil absorption systems are fully considered, other treatment alternatives such as stabilization ponds, spray irrigation or sand filtration may be cost-effective.

(over)

DIRECTORY
(612) 296 - Ext

TECHNICAL REVIEW SECTION
G. Wegwart, Chief
W. Sexauer, Operations/Training Unit

GRANTS SECTION
D. Anderson, Chief
S. Meyer, Admin. Review Unit

Perry T. Beaton
Assistant Director
7364

EDITOR
C Voigt, 7229

Minnesota Pollution Control Agency
Division of Water Quality
1935 West County Road B-2
Roseville, Minnesota 55113

Illinois Environmental Protection Agency 2200 Churchill Road, Springfield, IL 62706

217/782-0610

Seepage Lagoons

February 14, 1984

Carolyn Rambow
Route 1, Box 175
Walworth, Wisconsin 63184

Dear Ms. Rambow:

The following is a summary of our telephone conversation of January 31, 1984 and February 9, 1984.

The Agency does not normally allow seepage lagoons as a means of wastewater treatment within the State. Soil conditions in most areas of Illinois are not conducive to this type of treatment.

We have approved the use of this type of system as a rehabilitation project for unsuccessful conventional lagoon project, where the existing lagoons were leaking and no groundwater impact was noted.

If you have any questions concerning the above, please contact Mr. Liam McDonnell of my staff at the address or telephone number herein.

Very truly yours,

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:LM:dks/266d, 7

cc: Records

STATE of INDIANA

STATE BOARD OF HEALTH

AN EQUAL OPPORTUNITY EMPLOYER

INDIANAPOLIS

Address Reply to:
Indiana State Board of Health
1330 West Michigan Street
P. O. Box 1964
Indianapolis, IN 46206

February 3, 1984

Ms. Carolyn Rambow
Route 1, Box 175
Walworth, WI 53184

Dear Ms. Rambow:

Re: Ground Absorption Systems

This letter is to substantiate the information discussed with Chuck Flowers of my staff via a phone call February 2, 1984. The State of Indiana does not issue permits for the disposal of wastewaters via "ground absorption systems" if there is any danger of contaminants or toxics being present which would degrade groundwater supplies. This would prohibit most industrial and municipal use of such systems. Operational permits for such systems have been issued in the past and tentatively could be reissued but only for water known to be innocuous and free of pollution (such as noncontact cooling waters). Rule 4 of Regulation 330 IAC 3.1, a copy of which is enclosed, describes the criteria and procedures by which such permits are issued. If you have any questions, please contact Chuck Flowers at 317/633-0749.

Very truly yours,

Larry J. Kane

Larry J. Kane, Chief
Permits Section
Division of Water Pollution Control

ICF/jb
Enclosure

OhioEPA

February 10, 1984

Mrs. Carolyn Rambow
Route 1, Box 175
Walworth, Wisconsin 53184

Dear Mrs. Rambow:

Director Maynard has asked me to respond to your February 3, 1984, letter concerning the use of high adsorption ponds for the treatment of municipal sewage in Ohio.

A review of our records and discussions with knowledgeable agency personnel indicates that Ohio does not have any facilities of the type in which you are interested being used for municipal wastewater treatment.

The successful operation of a facility of this type, commonly called a rapid infiltration system, is dependent on many conditions. Some of these are: type of soil, percolation rate, depth to groundwater, movement and quality of groundwater, topography, and underlying geologic formations. In addition, the proximity to urban areas and land requirements can influence the selection of this type of treatment.

I believe that the unavailability of sites with proper combinations of the above condition has precluded the use of rapid infiltration systems in Ohio.

I trust this information will be useful to you.

Very truly yours,

Andrew Turner

Andrew Turner, Ph.D., P.E.
Chief
Division of Water Pollution Control

AT:tw
0003p/9

State of Ohio Environmental Protection Agency
361 E. Broad St., Columbus, Ohio 43216-1049, (614) 466-8565

Iowa department of water, air and waste management

February 1, 1984

Ms. Carolyn Rambow
Route 1, Box 175
Walworth, WI 53184

Dear Ms. Rambow:

This letter is in response to your recent inquiry regarding this agency's requirements for permitting infiltration basins or seepage cells for treatment and disposal of wastewater in the State of Iowa.

To my knowledge no such system has ever been approved in Iowa and we would view such a system with a great deal of apprehension. This position is based on Iowa's dependence on shallow aquifers as a major source of water supply for its population. The potential for contamination of these aquifers outweigh possible benefits of such treatment systems. This is especially true when there are other acceptable treatment and disposal alternatives available.

This agency's position in this matter should not be construed as a total condemnation of infiltration basins. Given local conditions, these systems may be acceptable. We just do not feel these conditions are present in Iowa.

If you should have any other questions regarding this matter please feel free to contact me at (515) 281-8911.

Sincerely,

FIELD SERVICES DIVISION

Timothy J. O'Connor, P.E.
Central Assistance Branch

TO:nsv/FS/W032Q02.01

cc: Wisconsin Department of Natural Resources

henry a. wallace building • 900 east grand • des moines, iowa 50319 • 515/281-8690

GBC
AQUASEARCH
110 EAST RYAN ROAD (414) 761-7005
OAK CREEK, WISCONSIN 53154 - 4599

RECEIVED

LABORATORY NUMBER	DATE	PAGE
83-5730	8/15/83	1

LABORATORY REPORT

KIKKOMAN FOODS INC.
P.O. BOX 69
WALWORTH, WI 53184

accepted fed. standard 250 mg/l chlorides

ATTN: MINORV NAGAOKI

DATE RECEIVED	DATE COLLECTED
7/29/83	7/28/83

SAMPLE NAME: WELL WATER (GRAB)

ACCOUNT NUMBER: #608

REFERENCE METHOD:

VERBAL

Nitrates 10 - infants, 100 adult

- [X] STANDARD METHODS, APHA, 15th EDITION, 1980.
- [X] METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTE, EPA, 1979.
- [ ] TEST METHODS FOR THE EVALUATION OF SOLID WASTE, PHYSICAL, CHEMICAL METHODS, EPA, 1980.

PARAMETER	*83-5730 WELL #1 SAMPLE	83-5731 WELL #2 SAMPLE	83-5732 WELL #3 SAMPLE	83-5733 WELL #4 SAMPLE	83-5734 WELL #5 SAMPLE
NITROGEN AMMONIA	-0.01	-0.01	-0.01	-0.01	-0.01
NITROGEN NITRITE-NITRATE	16	14	3.0	1.0	16
NITROGEN KJELDAHL	0.2	0.1	0.7	0.6	0.5
ORGANIC NITROGEN	0.2	0.1	0.7	0.6	0.5
B.O.D. 5-DAY	18	-4	-4	-4	-4
CHLORIDE	33	14	550	710	95
PH	6.8@17°C	6.8@17°C	7.0@17°C	6.9@17°C	6.9@17°C
TOTAL DISSOLVED SOLIDS	540	480	1,200	1,500	630
ALKALINITY	310	290	280	360	320

*LAB I.D. NUMBERS

A (-) SIGN DENOTES A 'LESS THAN' VALUE.

BG

* ALL UNITS ARE EXPRESSED AS:
- [X] MG/L
- [ ] PPM
- [ ] MG/KG

8/16/83
DATE

David Kollakowsky
LABORATORY SUPERVISOR

CBC
AQUASEARCH
140 EAST RY[illegible] ROAD (414) 764-7005
OAK CREEK, WISCONSIN 53154 - 4599

LABORATORY REPORT

LABORATORY NUMBER	DATE	PAGE
#83-4924- #83-4928	7/28/83	1

RECEIVED 8/1/83

KIKKOMAN FOODS INC.
P.O. BOX 69
WALWORTH, WI 53184

DATE RECEIVED	DATE COLLECTED
6/29/83	6/28/83
SAMPLE NAME	
WELL WATER	
ACCOUNT NUMBER	
#1221	

VERBAL

ATTN: MINO NAGAOKA

REFERENCE METHOD:

accepted standard 250/mg/l -chlorides
nitrate 10 infants & adults
~~t 20 adults~~

☒ STANDARD METHODS, APHA, 15th EDITION, 1980.
☒ METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTE, EPA, 1979.
☐ TEST METHODS FOR THE EVALUATION OF SOLID WASTE, PHYSICAL, CHEMICAL METHODS, EPA, 1980.

PARAMETER	#1 *83-4924	#2 *83-4925	#3 *83-4926	#4 *83-4927	#5 *83-4928
NITROGEN AMMONIA	0.09	-0.01	0.12	0.86	0.92
NITROGEN (NITRATE+ NITRITE)	15	12	1.5	1.3	13
NITROGEN KJELDAHL	-0.1	-0.1	1.5	1.8	0.93
ORGANIC NITROGEN	-0.1	-0.1	1.38	0.94	-0.1
B.O.D.-5-DAY	19	12	10	6.1	14
CHLORIDE	23	16	860	720	26
pH @ 24°C	6.6	6.8	6.9	6.9	7.0
TOTAL SOLIDS DISSOLVED	640	510	1700	1700	620
ALKALINITY	230	270	270	220	350

A (-) SIGN DENOTES A 'LESS THAN' VALUE.

(*) LAB I.D. NUMBER.

PW
* ALL UNITS ARE EXPRESSED AS:
☒ MG/L ☐ PPM
☐ MG/KG

7/29/83
DATE

[signature]
LABORATORY SUPERVISOR

CBC *AQUASEARCH*
140 EAST R[illegible]ROAD (414) 764-7005
OAK CREEK, WISCONSIN 53154 - 4599

LABORATORY REPORT

LABORATORY NUMBER	DATE	PAGE
#83-7010	9/22/83	1

KIKKOMAN FOODS INC.
P.O. BOX 69
WALWORTH, WI. 53184

accepted standard nitrates: [illegible] accepted standard chlorides: 250 mg/l -

ATTN: MINORU NAGAOKI

REFERENCE METHOD:

DATE RECEIVED	DATE COLLECTED
9/1/83	8/29/83
SAMPLE NAME	
WELLWATER (GRAB)	
ACCOUNT NUMBER	
#608	

VERBAL

☒ STANDARD METHODS, APHA, 15th EDITION, 1980.
☒ METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTE, EPA, 1979.
☐ TEST METHODS FOR THE EVALUATION OF SOLID WASTE, PHYSICAL, CHEMICAL METHODS, EPA, 1980.

PARAMETER	1 *#83-7010	2 *#83-7011	3 *#83-7012	4 *#83-7013	5 *#83-701
NITROGEN AMMONIA	-0.01	-0.01	-0.01	-0.01	-0.01
NITROGEN (NITRITE/ NITRATE)	17	16	1.1	0.91	15
NITROGEN KJELDAHL	0.34	0.57	0.81	1.1	-0.1
TOTAL ORGANIC NITROGEN	0.34	0.57	0.81	1.1	-0.1
B.O.D. - 5 DAY	-4	-4	-4	11	4.0
CHLORIDE	23	16	110	670	27
PH @ 10°C	7.2	7.2	7.2	7.2	7.3
TOTAL DISSOLVED SOLIDS	520	450	1200	1500	540
TOTAL ALKALINITY	300	280	240	340	320

*LAB ID REPORT NUMBERS

A (-) SIGN DENOTES A "LESS THAN" VALUE.

AC

* ALL UNITS ARE EXPRESSED AS:
☒ MG/L ☐ PPM
☐ MG/KG

9/23/83
DATE

[signature]
LABORATORY SUPERVISOR

1-20-84

Mr. Harlan D. Hirt

Dear Sir

I have read your article on sewers in Lake Geneva area. I would like to know what you can say about getting sewers in Como sub-division. I am for sewer's as soon as possible. I'm close to 80 yrs. of age. and we had out house in my early days. they were replaced by cesspools + septic tanks I think its time to have sewers in this day and age. Thank You Sir

Stanley Sokoloski
R.D. 5 BOX 122
Lake Geneva, Wis.
53147

Fontana, Wisconsin
February 22, 1984

Mr. Harlan Hirt
Environmental Impact - EPA

Dear Mr. Hirt:

I am writing in regard to the sewage treatment plant for Walworth and Fontana, Wisconsin.

It would be an awful mistake to take good, fertile farm land for this, or any, sewage treatment plant. At present, there is enough farm land, but the time will come when we need every acre.

Please listen to the local people and assist with an alternative plan.

Yours very truly,
Eunice G. Sanderson
(Mrs. John A. Sanderson)

P.O. BOX 315
373 N. SHORE DR.
FONTANA, WI 53125

FEB 24 1984

Fontana, Wisconsin
February 22, 1984

Mr C.D. Besadny
Department of Natural Resources
Madison, Wisconsin

Dear Sir:

I am concerned about the sewage treatment plant to be built for Walworth and Fontana.

Good, fertile farm land should never be taken for sewage treatment. The land is one of our greatest resources. Let us not pollute it. Surely, there is a better way to get rid of sewage. Even if it costs more, it will be worth it in the long run.

Very sincerely yours,
Eunice G. Sanderson
(Mrs. John A. Sanderson)

PETITION

We, the undersigned, being residents and/or property owners in the Town of Lyons, Walworth County, Wisconsin, hereby petition the Town Board of the Town of Lyons, the Park and Planning Commission for Walworth County, and the City Council of the City of Lake Geneva to take the necessary action to insure proper land use and development on lands now in the Town of Lyons.

Specifically, we oppose the establishment of a sewerage treatment facility for the City of Lake Geneva in the NE 1/4 of Sec. 31 and the NW 1/4 of Sec. 32 in the Town of Lyons or at any other place within the Town which will conflict with the already established residential, agricultural, and recreational uses of the Town.

Further, we believe it is the obligation of the Town Board and the Park and Planning Commission to preserve and maintain residential property values and water and air quality for the residents of the Town. If this project is to be considered further, it is then the obligation of the City of Lake Geneva to provide surrounding property owners and/or residents with an environmental impact statement showing the short and long range effects of this open pit sewerage treatment facility on our drinking water, the air we breathe, the wildlife in the area, and the quality of life in the future.

The above Petition was signed by 111 local residents. It was submitted as part of the testimony presented by Mr. Arthur M. Zabierek on behalf of himself and other property owners in Lyons Township at the Lake Geneva Draft Environmental Impact Statement public hearing held at Big Foot High School, Walworth, Wisconsin on February 9, 1984.

Recorded Testimony submitted at the Public Hearing

I am Eleanora Wickstrom, residing on Prairie View Road in Walworth Township. The farm where I live was acquired by my father in the fall of 1916. I have almost 70 years of relationship with this area. I have served as Walworth Township Assessor and know in detail the value of its land the improved property the economic persuits of the residents and the overall topography of the Town. Further, I have always been on top of the events as a local news correspondent for 3 dailies and a weekly newspaper.

Big Foot Prairie lies to a large degree in the south half of the Town, and in some degree in the west half. The prairie runs west from Highway 14 South to the Walworth/Sharon Town Line for 3 miles and about 3 1/2 miles north from the Illinois/Wisconsin State Line to Highway 14 northwest and occupies about 9 1/2 land sections, or about 6,100 acres. A soil survey of Walworth County by the United States Department of Agriculture and the University of Wisconsin in 1970 shows the soil types of land from the prairie. In most instances, the prevailing soil is a black silt-loam with a gravelly substrata. In 1976, a groundwater resources and geological study of Walworth County was made by the U.S. Department of the Interior in cooperation with the Wisconsin Geological and Natural History Survey. That report reveals the depth of soil from the surface to the sand and gravel aquifer from which prairie residents draw their water for domestic and livestock use. At the east end of the prairie the depth from soil surface to the aquifer is 30 feet. At the west end it is only 10 feet from the surface to the water table.

Over the year I have known when the water table at the west end of our farm has been at the surface. Aerated lagoons as contemplated to be built in the north half of Section 28 would have little soil for filtration before being a part of the sand and gravel aquifer, the source of water for residents for domestic and livestock use.

If you were to pick a prairie site for an aerated lagoon in picking Big Foot Prairie, you could not have been more dead wrong. It seems to me it would be ludicrous for you to spend your time on considering it as a site because you couldn't find the information before you proceeded to make any study. By the way, a prairie farmer living in the east half of Section 31 can't get a permit from the Walworth County Sanitation Consulting Office to relocate his underground septic system, but must build one above ground - a mound system. That ought to tell you something.

The question before us, then, is not a matter of whether prairie land will be removed from crop cultivation, but one of pollution of drinking water for tomorrow, the future, and infinity. How are you going to purify a sand and gravel aquifer that extends to some 100 feet or more in depth? Can the EPA (Environmental Protection Agency) and the Wisconsin Department of Natural Resources ever live down such a boo-boo after proceeding with your plans.

About 14 years ago, the Village of Walworth began the work to upgrade their sewage treatment plant. Blueprints were readied, legal work was finished and a bond issue was floated for a tertiary treatment plant at the headwaters of the Piscasaw Creek in the Town of Sharon. The location is 3 1/2 miles west of the Village of Walworth. President Richard Nixon put the damper on those plans when he ordered funding for municipal sewage stopped. Now the plans for the Village of Walworth to construct a new treatment plant has been bogged down because the plant must rescue Geneva Lake from pollution from Fontana's aerated lagoons. The underground springs feeding the west end of Lake Geneva are apparently polluted by the Fontana sewage treatment plant. It is interesting to note that part of this hearing tonight is on further extension of sewerage lines to the south shore and north shore of Geneva Lake and located in the Town of Linn. I gather the engineers are eager for another Delavan-Elkhorn-Walworth County Sanitary District.

Walworth Village is located on the divide between the Rock River and the Fox River systems in surface water drainage. The solution for control of pollution is to plan for sewering the Geneva Lake in its natural pattern, through the White River, and leave Walworth Village alone for use of the Piscasaw Creek. Remember, the State of Illinois is only 2 miles south of the Walworth Village pond site, and that creek would not be able to handle great volumes of effluent.

AGRICULTURAL IMPACT STATEMENT

Appendix "B" of:

U.S. Environmental Protection Agency and
Wisconsin Department of Natural Resources

FINAL ENVIRONMENTAL IMPACT STATEMENT ON WASTEWATER TREATMENT FACILITIES; GENEVA LAKE AREA WALWORTH COUNTY, WISCONSIN

May, 1984

Prepared by:

STATE OF WISCONSIN
DEPARTMENT OF AGRICULTURE, TRADE AND CONSUMER PROTECTION

Carol S. Olson
Agricultural Impact Analyst

Submitted by:

James A. Johnson
Director of Land Resources Bureau
Agricultural Resource Management Division
Department of Agriculture, Trade and Consumer Protection

Issued: May, 1984

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Agricultural Impact Statement

I. INTRODUCTION

This agricultural impact statement (AIS) was prepared by the Wisconsin Department of Agriculture, Trade and Consumer Protection in accordance with s. 32.035, Wis. Stats., and serves as "Appendix 'B'" of the Final Environmental Impact Statement (FEIS); Wastewater Treatment Facilities for the Geneva Lake Area; Walworth County, Wisconsin. The AIS analyzes the potential agricultural impacts associated with the wastewater treatment facilities alternatives considered in the FEIS.

The content of this AIS is substantially the same as the content of the draft AIS which was published with the Draft Environmental Impact Statement (DEIS) in January, 1984. The only noteworthy changes to the text were made with regard to the oxidation ditch - surface water discharge alternative (also known as the "facilities plan recommended alternative") for the communities of Walworth and Fontana. Subsequent to DEIS publication, the following modifications were made to this alternative proposal: (1) the force main - interceptor sewer route was altered; (2) it was decided that manhole structures would be installed totally below the ground surface in cropland areas; and (3) rather than acquire 25 acres of the Lundstrom property as a sludge application site, it was proposed that three acres be acquired from the Lundstroms adjacent to the existing Walworth polishing lagoon site for oxidation ditch construction. Voluntary sludge application agreements would then be worked out with local farmers. On the whole, these proposed changes are expected to reduce the potential adverse effects of this alternative on farm operations (see section III.B.2. of the text).

Information for this AIS was obtained from a number of sources, including the Department of Natural Resources; Donohue & Associates, Inc.; Wapora, Inc.; Strand Associates, Inc.; the Walworth County Planning, Zoning and Sanitation Department; the USDA Soil Conservation Service Soil Survey of Walworth County; the Walworth County Farmland Preservation Plan; the Wisconsin Agricultural Reporting Service; and some of the potentially affected farm operators.

II. THE AGRICULTURAL SETTING

Walworth County is a mostly rural county located in southeastern Wisconsin within 90 minutes drive of Chicago, Milwaukee, Madison, Janesville, Beloit, Kenosha and Racine. Although it has developed a diversified economy, it has maintained a strong agricultural sector.

Dairying and cash crop production are the major sources of farm income in the county, although income from meat and egg production is also significant. In 1980 the county ranked among the top ten Wisconsin counties in production of total field crops, corn for grain, soybeans, wheat, sweet corn, and eggs, and among the top twenty counties in the production of potatoes, green peas for processing, and hogs and pigs.[1] Roughly 76

[1] Wisconsin Agriculture Reporting Service, 1982 Wisconsin Agricultural Statistics.

percent of the county's land area is in farms, with an average farm size of about 237 acres.[2] Approximately 80 to 85 percent of the farm operations in the county are owner-operated.[3]

The county's high rate of agricultural productivity is made possible in large part by favorable climate, soils, and location with respect to markets. Roughly 70 percent of the county's land area is classified as prime farmland by the USDA Soil Conservation Service, with most of the remaining land area divided between urban development and farmland of statewide or local importance.[4] About 85 percent of the farmland in Walworth County is in Land Capability Classes I, II and III and can be farmed intensively if adequate conservation practices are followed.[5]

The county's proximity to large urban centers has been both a boon and a threat to the county's agricultural land. It has given farmers a competitive marketing advantage over many other Wisconsin counties but has also led to significant commuter, second home, and recreational development pressures, especially along highway corridors and near the county's many lakes and scenic attractions. The county's population increased at 1-1/2 times the rate of state population growth between 1950 and 1960, and at nearly twice the state's growth rate between 1960 and 1980.[6]

Recognizing the need to protect the county's best farmland from urban sprawl and unwise or premature, nonfarm development, the county amended its zoning ordinance in 1974 to include an A-1 exclusive agricultural-use zoning district. Permitted land use in this district is limited to agricultural use, with a minimum parcel size of 35 acres. Special exceptions and conditional uses are limited to "those agricultural-related, religious, other utility, institutional or governmental uses which do not conflict with agricultural use and are found to be necessary in light of the alternative locations available for such uses."[7] By 1977, all of the towns in Walworth County were making use of the new district. To date, the county has allowed few parcels to be rezoned for private nonagricultural development once they have been zoned for exclusive agricultural use. Those parcels that have been rezoned were allowed to be rezoned because they were no longer well suited to farming. The A-1 zoning district has therefore provided strong protection to blocks of the county's best remaining farmlands.

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[2] Ibid.

[3] 1978 Census of Agriculture

[4] U.S.D.A. Soil Conservation Service, Map of "Important Farmlands, Walworth County, Wisconsin."

[5] U.S.D.A. Soil Conservation Service, Soil Survey of Walworth County, Wisconsin, issued 1971.

[6] Census data, U.S. Department of Commerce, Bureau of the Census

[7] S. 91.75(5), Wis. Stats. The Walworth County exclusive agricultural zoning ordinance has been certified by the state as meeting the requirements set forth in Chapter 91 of the Wis. Stats., (Laws of 1977). This entitles farms in the district to tax credits, exemptions from special assessments (e.g., for water, sewer, lights and nonfarm drainage), and to special protection under Wisconsin's "right to farm" legislation (s. 823.08, Wis. Stats.).

Most of the land within the proposed East Geneva Lake and West Geneva Lake sewer service areas is already developed for nonfarm use or has been designated for eventual nonfarm use. As of June, 1983, only four of the unincorporated parcels within the proposed sewer service areas were zoned A-1 Exclusive Agricultural (all in the Town of Walworth). Most of the remaining farmland included within the proposed sewer service district boundaries is zoned A-3 "Transitional Farmland," with the understanding that this land will likely, and appropriately convert to nonfarm use if the Geneva Lake area community continues to grow.

Farmland outside the proposed sewer service areas in the towns of Walworth, Delavan and Linn is primarily prime farmland zoned for exclusive agricultural use (A-1). The area west and south of the Village of Walworth, known as the "Big Foot Prairie," contains one of the larger concentrations of Land Capability Unit I-1 soils in the state. Capability Unit I-1 soils are the best of the prime farmland soils; they have the fewest limitations for farming, are capable of producing the highest yields, are well suited to all general farm crops and many special crops, and are suited to intensive cropping practices. This area is especially valued as farmland because Capability Class I soils are found on less than 1% of the land area in the state.[8]

Geneva, Lyons and Bloomfield, the towns just northeast and east of Geneva Lake, also contain much prime and A-1 farmland, although here it is interspersed with nonfarmland and significant farmland acreages of statewide and local importance.

III. ANALYSIS OF POTENTIAL AGRICULTURAL IMPACT[9]

A. East Geneva Lake Alternatives

1. No Action (Status Quo) Alternative

The "no action" alternative would not result in any direct, adverse effects on farmland or agricultural production. No additional agricultural land would be acquired for the public treatment or disposal of locally generated sewage.

This alternative could, however, contribute to local "leap-frog" development patterns and the indirect loss of farmland outside the sewer service area if adequate sewer or septic system treatment is not available within the sewer service area. Land zoned for exclusive agricultural use would be protected from most such non-farm development, but other farmland (such as that zoned A-2 or A-3) may not be.

[8] According to the U.S. Soil Conservation Service, 1977 National Resources Inventory, Rev. 2/80, only 0.98% of the state's land area contains capability class I soils.

[9] See Chapter 2 of the FEIS for a description of proposed project alternatives.

The City of Lake Geneva is currently developing a land application program for sludge disposal, using landfilling as a backup disposal method. Therefore, it is expected that wastewater sludge will be disposed of through land application regardless of the wastewater treatment alternative chosen.

2. Trickling Filter - Land Application Alternative

This is the city of Lake Geneva's preferred alternative. It would involve upgrading the trickling filter facility at the existing site, constructing a new force main to the proposed land application site which is located southeast of the USH 12-STH 50 interchange east of Lake Geneva, and the construction of an effluent storage pond and seepage cells at the land application site. After treatment at the trickling filter facility, effluent would be piped via force main to the land application site for final treatment and disposal in the seepage cells. Discharge of treated wastewater would therefore be to groundwater rather than to the White River.

Upgrading of the trickling filter facility would not require any additional farmland. Force main construction is currently planned across nonfarmland and within existing highway right-of-way. If the force main route is altered to cross farmland, it could result in the temporary disruption of farm operations during construction and a longer term reduction in crop yields if soil mixing and soil compaction occur. The force main would be buried to a depth allowing the continuation of normal cropping practices in the easement area after installation has been completed.

The principal adverse agricultural impact associated with this alternative is the conversion of up to approximately 37 acres of cropland to nonagricultural use at the proposed land application site. The city is proposing to acquire a 140 acre parcel from the Southwest Dairy Corporation and may acquire a 12 acre parcel and an 11 acre parcel from D. Peller and J. Fazio, respectively, for the land application site.

The only acreage which is currently being farmed on this proposed site is 37 acres of cropland in the western portion of the S.W. Dairy Corp. parcel. This land is leased on a year-to-year basis to Gordon Polyock who has been cash cropping the land in corn. The loss of use of this acreage is expected to have a minor, but noticeable, effect on the Polyocks' farm operation. Mr. Polyock currently owns about 470 acres of farmland, rents about 800 acres and does custom work on additional acreage. The loss of use of 37 acres of rental land would result in a five percent reduction in the Polyocks' rented acreage. This is expected to slightly reduce the Polyocks' farm income and lower their rate of return on investments in existing farm equipment and storage facilities if suitable replacement acreage is not locally available. Mr. Polyock believes it would be difficult to find any additional rental farmland in the area. The Polyocks are also slightly affected by the uncertainty associated with the proposed project. Without knowing if and when the site will be acquired and cropping operations will have to cease, it is difficult to accurately plan ahead for seed and fertilizer needs and to decide what, if any, crop rotations should be used. The Polyocks' lease for the 1984 growing season is not expected to be broken. However, the lease might not be renewed for the 1985 growing season if the land is acquired by the spring of 1985 as expected.

According to the U.S. Soil Conservation Service (SCS) Soil Survey for Walworth County, Wisconsin, the principal soils on the SW Dairy Corp. property are Houghton muck (0-2% slopes), Miami loam (2-6% slopes), Casco soils (6-20% slopes) and McHenry silt loam (2-6% slopes). Houghton muck is a deep, poorly drained soil which requires surface or tile drainage measures if it is to be used for cultivated crops. According to SCS criteria for the classification of important farmlands, it is classified as farmland of statewide importance if it is drained and protected from frequent flooding. If not drained, it is classified as "other lands." The Miami loam and McHenry silt loam soils are classified as prime farmland (capability subclass II-e) and the Casco soils are classified as farmland of local significance. The 37 acres of cropland on the site consist of prime farmland and farmland of local importance. The Houghton soils are not currently drained or used for farming.

Soils on the Peller and Fazio parcels are classified as farmland of statewide and local importance. These parcels were farmed as part of a larger parcel before they were cut off from adjacent lands by highway construction. Today, their relatively small size and triangular shape limit their value as farmland.

The eastern 80 or so acres of the S.W. Dairy Corp. parcel (consisting largely of muck soils) is zoned C-1, Conservancy. Approximately 10 acres in the northwestern portion of the parcel is zoned M-3, Mineral Extraction, and includes a sand and gravel pit. The rest of the parcel is zoned A-2, Agricultural. The Peller and Fazio parcels are zoned B-4, Highway Business. There are no buildings or wells on any of the parcels.

The expanded treatment facility would result in the production of increased amounts of sludge. The city's proposal to dispose of sludge through land application on farm fields would both save landfill space and take advantage of the soil conditioning benefits of the sludge. Care would have to be taken to monitor the contents of the sludge and to regulate the timing and rate of its application in order to avoid exceeding acceptable levels of nitrogen, heavy metals and/or other potentially harmful substances which could build up in the soil or leach into the groundwater. When properly applied, wastewater sludge can benefit farmland as a soil conditioner and as a low analysis fertilizer providing varying amounts of nitrogen, phosphorus and potassium. During the winter months and other times when sludge cannot be applied to farmland, it would be stored in a sludge storage basin which would be constructed on the land application site, south of the seepage cells. If sludge application agreements can be worked out with area farmers on a voluntary basis, the proposed means of sludge disposal would likely benefit farmland and farm operations.

The proposed expansion of the sewer service area is not expected to adversely affect farmland in this area. On the contrary, it is expected that the proposed sewer service extensions may reduce the incentive for new "leap-frog" development across farmland by allowing for more compact development in the urban service area.[10] Sewer service is not proposed to be extended to any lands currently zoned for exclusive agricultural use in the East Geneva Lake area.

3. Mechanical Plant - Surface Water Discharge Alternatives

Any of the four mechanical plant wastewater treatment alternatives[11] considered by the city could be constructed at the existing treatment plant site and would not involve the acquisition of any additional farmland unless farmland is acquired for a sludge storage facility. It is expected that if one of these alternatives is selected, sludge would be applied to farmland as in the above described alternative and a sludge storage lagoon would be constructed on city-owned property in the southwest 1/4 of section 7 in the town of Bloomfield. Because no farmland would need to be acquired for these alternatives, they would each have a lesser effect on farmland and farm operations than would the city's preferred alternative described above.

B. West Geneva Lake Alternatives

1. No Action (Status Quo) Alternative

The "no action" alternative is not expected to result in any direct adverse effects on farmland or agricultural production unless existing local treatment systems fail and discharge inadequately treated effluent to land or waters used by neighboring farms. No additional agricultural land would be acquired for the public treatment or disposal of locally generated sewage.

This alternative could contribute to local "leap-frog" development patterns and the indirect loss of farmland outside the sewer service area if adequate sewer or septic system treatment is not

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[10]As pointed out in the main text of the DEIS, incentives for "leap-frog" development across farmland could also be reduced through proper onsite management of septic systems on a governmental (e.g. sanitary district) basis.

[11]The four mechanical plant alternatives considered were, (1) extended aeration, (2) rotating biological contactors, (3) two-stage activated sludge, and (4) trickling filter/activated sludge, all with discharge to the White River.

available within the sewer service area. Land zoned for exclusive agricultural use would be protected from most such non-farm development, but other farmland may not be.

Sludge produced at the Walworth and Fontana treatment plants is currently land applied. Walworth's sludge is removed by a commercial hauler and applied on local farmlands. Fontana's sludge is dewatered and made available to local residents for use on lawns and gardens. When properly applied, sludge has a beneficial effect on soil fertility and tilth.

2. Subregional Oxidation Ditch - Surface Water Discharge Alternative

This alternative was recommended in the Facilities Plan prepared by Donohue & Associates and is Walworth and Fontana's preferred alternative. Slight modifications have been made to this alternative since the time of DEIS publication. As currently proposed, approximately three acres of land would be acquired adjacent to the west boundary of the existing Walworth polishing lagoon site for construction of an oxidation ditch wastewater treatment facility. Untreated wastewater would be piped to the site via force main and interceptor sewer, and treated wastewater would be discharged to Piscasaw Creek.

Oxidation Ditch Site:

The three acres which would be acquired to accommodate the oxidation ditch facility are currently owned by Carl and John Lundstrom as part of a 194 acre parcel. Approximately 175 of the 194 acres are leased out for corn and soybean production; the remainder of the parcel is wooded. According to the owners, roughly half of the proposed three acre oxidation ditch site is cropped. Drainage tiles have been installed on the farm, but the Department was unable to ascertain whether any have been installed in the proposed acquisition area.

The acquisition of the three acre site is not expected to have a significant adverse effect on any farm operation. Owners of the parcel are concerned, however, that the increased volume of treated wastewater discharged to Piscasaw Creek as a result of combining the wastewater flows from Walworth, Fontana and the Kikkoman plant will exacerbate existing streambank flooding problems. The creekbed has not been kept free of debris and periodically overflows onto the Lundstroms' cropland east of the creek. According to the Lundstroms, the Village of Walworth's right to enter the Lundstrom property to keep the creek clear of debris, so effluent from the treatment plant is not impeded, has not been exercised.

Force Main - Interceptor Sewer:

Wastewater from the Kikkoman plant would be conveyed to the oxidation ditch site via force main. If the force main is constructed within public road right-of-way, as proposed, no farmland would be directly affected by force main construction.

New interceptor sewer easements would be acquired to convey wastewater to the treatment plant from the Walworth-Fontana area. Thirty-foot-wide permanent easements and thirty-foot-wide temporary construction easements would be obtained across farmland along the northern edge of the Village of Walworth Industrial Park and the eastern edge of the Edward and Leona Berlin farm and the Donald and Faith Rambow farm. The interceptor sewer would then follow Beloit Road right-of-way to a point just west of Piscasaw Creek. From there, a thirty-foot-wide permanent easement flanked by fifteen-foot-wide temporary construction easements would be acquired across farmland owned by John Ingalls to the proposed oxidation ditch site. In all, permanent easements would be acquired on about 8-1/2 acres of farmland for interceptor sewer construction, including 2.4 acres from the industrial park, 1.5 acres from the Berlins, 1.5 acres from the Rambows and three acres from John Ingalls. An equal amount of temporary construction easement would be acquired. Affected acreage consists mostly, if not entirely, of cropland.

The interceptor sewer would be buried below plow depth, permitting normal cropping operations and the installation of driveways in the easement area after sewer construction has been completed. Buildings would not be permitted in the sewer easement area, but would probably not be desired so close to property lines or to Piscasaw Creek anyway. Manholes would be installed every 400 to 600 feet along the interceptor sewer route. According to Strand Associates, Inc., these manholes would also be buried below plow depth in cropland areas.[12]

If appropriate preventive and corrective measures are not taken, interceptor sewer construction could result in reduced crop yields due to soil compaction, mixing of the soil horizons, soil settling and/or interference with subsurface drainage tiles. Soil compaction could result in noticeably reduced yields for a period of up to five years and is generally greatest where heavy equipment is allowed on wet or freshly plowed fields. Compaction is gradually alleviated over time through plowing and natural freeze-thaw cycles. Both soil compaction and soil mixing reduce yields by damaging soil structure and tilth. Air spaces and water infiltration is reduced, inhibiting root growth. Soil horizon mixing also reduces fertility and may bring stones, clay or gravel to the surface, thereby reducing tilth and increasing wear and tear on farm machinery.

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[12]See Draft Agricultural Impact Statement, p. 7, for an analysis of the potential adverse agricultural effects of extending manholes above plow depth in cropland areas.

Soil settling may occur in the trench area after sewer installation has been completed, resulting in the development of gullies or low spots in the field. Severe settling could lead to gully erosion or ponding in the easement area. Mounding of replacement soil in the easement area reduces, but does not always prevent, soil settling problems. Follow up inspection and corrective measures may be necessary.

Subsurface drainage tiles have been installed on the Ingalls farm. Any drainage tile lines severed or damaged during construction would require prompt and careful repair to avoid increasing the severity of any existing field drainage problems.

Due to the problems which could arise from sewer installation if appropriate preventive and corrective measures are not taken, farmers may feel compelled to monitor some of the installation work which is done on their farm. This could result in added costs to the farmer if installation occurs at a time of year when other important farm tasks would have to be foregone or delayed as a result of installation monitoring.

Overall, the adverse agricultural effects of the proposed sewer installation are expected to be slight if reasonable construction practices are followed and just compensation is provided. Concerns expressed in the DAIS with the originally proposed location of the interceptor sewer route on the Ingalls farm have been largely mitigated by revising the location of the route to the west side of Piscasaw Creek.

<u>Sludge Handling</u>: Wastewater sludge is proposed to be handled through land application to farmland. Voluntary sludge application agreements would be worked out with local farmers. Sludge holding facilities may be provided at the oxidation ditch site to store sludge during times of the year when land application is not feasible.

<u>Secondary Development Effects</u>: Secondary development effects on farmland could stem from defining the proposed sewer service area and sewage treatment capacity needs either too broadly or too narrowly. It is important that the proposed sewer service area and treatment capacity include sufficient room for expected urban growth to reduce the incentive for more scattered rural development in farmland areas.

On the other hand, if the sewer service area is defined too broadly and capacity needs are overestimated, the treatment plant system and facilities would be overbuilt, resulting in an economic incentive on the part of the sewerage district to actively promote the expansion of sewer services to recoup the costs of the fixed investment in the treatment plant facilities. The premature annexation and/or rezoning and conversion of productive farmlands are, therefore, a possible result of an overestimation of future sewer service needs.

The Department did not evaluate the projected sewage treatment capacity needs of the local area, although it did examine the existing zoning and farmland classification of farmlands proposed to be included in the sewer service area. Most of the land included in the Donohue and Associates proposed sewer service area for the West Geneva Lake area lies within existing village boundaries and is already developed or zoned for nonagricultural use. However, the proposed sewer service area does include some prime farmland and farmland of statewide significance, both within and outside existing village boundaries, including at least four parcels zoned for exclusive agricultural use and several parcels zoned as "transitional" farmland.[13]

Transitional farmlands are so zoned with the understanding that this land will likely, and appropriately, convert to nonagricultural use in the future if the Geneva Lake area community continues to grow. Land zoned for exclusive agricultural use, however, is so zoned with the understanding that this land would best be reserved for continued agricultural use. It is exempt from any new sewer assessments so long as the land does not make use of the sewer system improvements.

It is only in exceptional cases that farmland requires sewer service. The inclusion of farmlands, including land zoned A-1, exclusive agricultural, in the proposed sewer service area suggests, therefore, that either existing land use and town/county planning and zoning efforts were overlooked in sewer service area proposals, or that the included farmlands are intended to be developed within the planning period, regardless of existing zoning. If the latter is true, it means the proposed sewage treatment project would facilitate the conversion of several hundred acres of productive farmland included in the proposed sewer service area boundaries.

3. Subregional Aerated Lagoon - Land Application Alternative

This alternative would involve the construction of an aerated lagoon and seepage cells on 40 or more acres of land within, or adjacent to, the corporate boundaries of the village of Walworth. Discharge of treated wastewater would be to groundwater via the seepage cells. No significant amount of sludge would be produced. Secondary development impacts on farmland would be similar to those described under the oxidation ditch alternative.

The only site which has been officially proposed to accommodate this alternative, to date, is a 80 acre parcel of farmland located southwest of the village in the east 1/2 of the northwest 1/4 of

[13]Land included within the proposed sewer service area which is zoned for exclusive agricultural use includes 3 parcels adjacent to STH 67 in sections 2, 3 and 10 and a parcel in section 23, all in the town of Walworth, T. 1N. - R.16.

section 28 in the town of Walworth. The parcel is owned by Donald and Faith Rambow as part of a 280+ acre family farm operation. The farm is currently operated by Harold, Carolyn and Darwin Rambow and provides the principal means of support for three families. The Rambows grow corn, oats, soybeans and hay as cash crops and for livestock use, and milk about 40 cows.

Recent farm equipment purchases and farmland preservation program participation are indications of the family's long-term interest in farming. The family has recently purchased a new corn dryer which increased their corn drying capacity, and has spent roughly $76,000 on farm equipment since 1982. The farm is located in an A-1, exclusive agricultural use zoning district and the family has received state income tax credits as an offset to their property tax for maintaining their land in agricultural use. The fact that the Rambows are interested in expanding rather than reducing the size of their farm operation is evidenced by their recent farm equipment purchases and the fact that they are currently renting an additional 137 acres of cropland.

The 80 acre parcel in question is well drained, nearly level, prime farmland which is used exclusively as cropland. The loss of this 80 acres would be equivalent to the loss of the acreage needed to feed the Rambows' entire dairy herd. It would mean the loss of nearly 45 percent of the Rambows' owned land, or 25 percent of their owned and rented land. The smaller land base would result in less acreage to spread farm equipment payments over and lower returns to fixed investments in farm machinery, buildings, equipment and management in general.

These adverse agricultural impacts could be largely alleviated for the Rambows through appropriate compensation and assistance in locating suitable replacement farmland in the local area. Even if suitable replacement farmland is found, however, it is not likely to be as conveniently located as the 80 acre parcel which lies contiguous to the rest of the Rambows' farm holdings. In the short run, adverse agricultural impacts on the Rambow farm operation could be reduced or minimized by allowing the Rambows to farm unused portions of the 80 acre site, at least until replacement acreage is acquired. If the treatment facilities are contained within the southern 40 acres of the parcel, as proposed, this would leave the northern 40 acres available for crop use until future plant expansion is needed.

In addition to any adverse agricultural effects which this alternative would have on the Rambow farm operation are the adverse agricultural impacts accruing to the area and to society as a whole. While it's true that the loss of 80 acres of farmland in and of itself would not have a significant effect on the national, state or local economy or farmland resource base, it's also true that most farmland conversions occur on an incremental, parcel-by-parcel basis. it's only when the acreages of the individual parcels which were converted out of agricultural use are totalled up that the figures, impacts and projections become alarming. Whether one accepts the estimate that the nation is losing one million or three million acres of farmland each year to nonagricultural use,[14] it is clear that the land characteristics which are ideally suited to farming (deep, level, well drained, fertile soils) are also among the land characteristics sought for shopping mall, residential, landfill, wastewater land application system, industrial park, airport and highway developments.

As our best farmlands are converted to nonagricultural use, we must rely increasingly on less land or lands which are naturally less productive to meet our food and fiber production needs. This results in lower yields per acre or in increased dependency on an input and energy intensive agriculture as the use of fertilizers, irrigation, drainage tiles, erosion control structures and practices, and hydroponics is increasingly substituted for naturally productive farmland. As farmers become increasingly dependent on these means of augmenting yields, society becomes more vulnerable to food price inflation stemming from water shortages and/or increases in energy prices. High costs of food production resulting from reliance on the input intensive farming of marginal farmlands also make those farm products less competitive at the local, state and international level.

Most farmland conversion decisions are made at the local level by individuals and local units of government. At this level, the effects on the county, state or national economy are typically considered to be irrelevant, if considered at all. Yet, barring the imposition of federal or state regulations, this is the level at which farmland preservation decisions must be made if our best farmlands are to be preserved for agricultural use.

The 80 acre parcel in question is located on Plano silt loam soils in the Big Foot Prairie. It is capability unit I-1, prime farmland. This is the highest farmland designation there is. The U.S. Soil Conservation Service estimates that less than one percent of the land area in Wisconsin contains class I soils.[15] Recognizing the value and importance of maintaining this land in agricultural production, the county and town of Walworth have zoned the land into an A-1, exclusive agricultural use district and the state has paid tax credits to the owners as a further incentive to keep the land in agricultural use.

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[14]The U.S. Soil Conservation Service has estimated that 2.92 million acres of agricultural land were converted to nonagricultural uses each year between 1967 and 1975. The Natural Resources Economics Division of the Economics, Statistics and Cooperative Service at the U.S.D.A. has estimated the annual conversion rate to be about one million acres per year. Differences stem from definitions, assumptions and data collection sources and methods used.

[15]See footnote 8.

If the villages do acquire, annex and use this parcel for wastewater treatment plant purposes, it will not, in itself, significantly affect the local farm economy. What it will do is undermine state and local farmland preservation efforts and contribute to the overall trend of the incremental conversion of our best farmlands to nonagricultural use.

4. WalCoMet Regional Alternative

This alternative involves the transporting of wastewater effluent from the Walworth, Fontana and possibly Williams Bay area to the existing WalCoMet wastewater treatment facilities in Delavan. No agricultural land would be acquired for wastewater treatment plant purposes, however agricultural land would likely be affected by interceptor sewer and force main construction from the villages to the WalCoMet main lift station on C.T.H. "O" south of Delavan. The potential adverse agricultural effects of interceptor sewer/force main construction are expected to be similar in type to those described under the oxidation ditch alternative. Secondary development effects are also expected to be similar to those described under the oxidation ditch alternative.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. East Geneva Lake Alternatives

None of the alternatives described in this AIS for handling East Geneva Lake's wastewater treatment needs is expected to have large or unreasonable adverse effects on farmland or farm operations. The most significant adverse agricultural impacts would result from implementation of the trickling filter - land application alternative. Under this alternative, up to approximately 37 acres designated as prime farmland and farmland of local importance may be converted to nonagricultural use at the proposed land application site. The actual acreage affected will depend upon the final site layout selected. The potentially affected farmland is currently zoned A-2, agricultural, and is rented out on a year-to-year basis to a farmer who farms over 1200 acres of owned and rented farmland. The loss of use of this acreage is expected to have a slight, but noticeable adverse effect on the renter's farm operation.

The mechanical treatment plant alternatives would result in the least adverse effects on farmland and farm operations. No farmland would need to be acquired for treatment plant purposes. Secondary development effects are expected to be insignificant with any of the described East Geneva Lake alternatives due to the county/town implementation of exclusive agricultural use zoning and the exclusion of agriculturally zoned lands from the proposed sewer service area.

The following recommendations are offered as ways in which to reduce the potential adverse agricultural impacts associated with the proposed alternatives:

1. Once acquired, any significant acreage of unused cropland at the proposed land application site should be made available to the current renter or other local farmers for continued agricultural use.

2. The current renter of the cropland at the proposed land application site should be kept informed of the expected date by which he will have to cease farming on part or all of the site so that he can adjust his operations and plan accordingly.

3. Wastewater sludge should continue to be made available to local farmers and residents regardless of the alternatives chosen. Application guidelines and information on the potential health/crop risks associated with misuse should be distributed to anyone planning on land-applying locally generated sludge.

4. If the force main leading to the land application site is altered to cross farmland, it is recommended that the procedures described in recommendation 2 on page 16 be followed.

B. <u>West Geneva Lake Alternatives</u>

Only one of the West Geneva Lake wastewater treatment alternatives described in the AIS, the aerated lagoon - land treatment alternative, is considered to be highly objectionable from an agricultural point of view. The objection is based on the potentially severe agricultural impacts implementation of this alternative could have on the farm operation currently occupying the proposed treatment plant site, and on the facts that the 80-acre site in question is rated among the top one percent of farmland in the state and has been the target of combined state, county, town and landowner farmland preservation efforts.

As indicated in section III.B.3., the 80 acre parcel which would be acquired for treatment facility use is capability class I, prime farmland which is used exclusively as cropland by the parcel's owner-operators. The loss of this 80 acres would be equivalent to the loss of the acreage needed to feed the farm operation's 40-cow dairy herd. It would mean the loss of nearly 45 percent of the farm operation's owned farmland, or 25 percent of its owned and rented farmland. The smaller land base would result in less acreage to spread farm equipment payments over and lower returns to fixed investments in farm machinery, buildings, equipment and management. The affected dairy - cash crop farm operation currently provides the principal means of support for three families. It would be difficult for the farm operation to continue to support all three families if the farm's land base is so drastically reduced.

The affected site became the target of farmland preservation efforts long before it was ever considered for wastewater treatment facility use. In the mid-1970's, along with most of the rest of the undeveloped portions of the fertile Big Foot Prairie, the site was zoned for exclusive agricultural use through combined town and county efforts. After the Wisconsin Farmland Preservation Act was enacted in 1977, the site's owners applied for and received farmland preservation tax credits from the state as further encouragement to maintain the land in agricultural use. Due, in large part, to strong and effective landowner opposition to the proposed site, local and county resolve to preserve the site for continued agricultural use has redoubled since the site was proposed for wastewater treatment facility use.

As explained in the impact analysis section of this AIS, the loss of this farmland will not, in and of itself, significantly affect the local farm economy. However, because most farmland preservation/conversion decisions are made at the local level on a parcel-by-parcel basis, the decision to convert this farmland to wastewater treatment plant use is important in both a symbolic and precedent-setting sense. If the very best of the state's farmland cannot be preserved through combined state, county, town and landowner efforts when viable alternatives to the use of that farmland exist, then the prospects for preserving farmland elsewhere under lesser circumstances looks bleak. A decision to convert the Rambow site or any similar site to wastewater treatment plant use when other reasonable alternatives exist would both undermine state and local farmland preservation efforts and contribute to the overall trend of the incremental conversion of our best farmland to nonagricultural use.

The principal agricultural concerns associated with the oxidation ditch and WalCoMet alternatives stem from proposed force main/interceptor sewer construction. The poor routing and/or installation of force mains and interceptor sewers can result in unnecessarily severe soil compaction, drainage, erosion and soil mixing problems; all of which reduce potential crop yields. Increased discharge to Piscasaw Creek under the oxidation ditch alternative could exacerbate downstream flooding problems if mitigating measures, such as streambed clearing, are not taken.

A final concern with the West Geneva Lake wastewater treatment alternatives is that the proposed sewer service area boundaries may be too inclusive. Within the proposed boundaries are hundreds of acres of farmland, including farmland which is currently located outside village boundaries and zoned for agricultural use. Of particular concern is the inclusion of farmland which is currently zoned for exclusive agricultural use adjacent to STH 67 in sections 2, 3, 10 and 11 in the town of Walworth, north of the villages of Walworth and Fontana. The inclusion of this land in the sewer service area could encourage and facilitate strip development along STH 67 which would prematurely remove prime farmland from production and which could eventually necessitate the rerouting of STH 67 across farmland to the west to avoid congestion problems along the existing route.

The following recommendations are offered as ways in which to reduce the potential adverse agricultural impacts associated with the proposed West Geneva Lake alternatives:

1. The aerated lagoon - land treatment alternative should not be constructed on the Rambow site or on any similar site so long as viable alternatives exist. If another site is sought, special efforts should be made to avoid class I farmland and land zoned for exclusive agricultural use.

2. Where interceptor sewers or force mains are constructed across farmland, the following procedures are recommended:

    a. Topsoil should be removed, stored separately and replaced in the proper manner and sequence following sewer installation.

    b. To minimize soil compaction, the use of heavy construction equipment should be avoided on wet or freshly plowed fields where feasible. Construction equipment should be restricted to the immediate area of the work being performed and to specified access routes. Chisel plowing or subsoiling of construction areas is advised to help restore compacted soils after construction is completed.

    c. Appropriate measures should be taken to limit and correct for soil settling following soil replacement. Follow up inspections may be necessary.

    d. Care should be taken to avoid permanent drainage pattern alterations and the disruption of subsurface drainage tiles. Any damaged tiles should be promptly repaired or replaced.

    e. If manholes must extend above ground, they should be made highly visible and be placed along fence rows or field edges where possible.

3. Any significant acreage of farmland acquired but not needed for immediate treatment plant development should be made available to local farmers for continued agricultural use.

4. If treated wastewater is discharged to Piscasaw Creek, measures should be taken by the west-end communities to reduce the likelihood of the wastewater adding to existing downstream flooding problems.

5. Affected farm operators should be given advance notice of land acquisition, clearing and construction schedules so that farm operations can be adjusted accordingly.

6. All erosion control and soil conservation measures to be followed during construction should be clearly communicated to the contractor(s). County Land Conservation Committee staff should be contacted to discuss potential erosion, seeding, sedimentation and drainage problems as necessary.

7. The merits of including farmland zoned for exclusive agricultural use adjacent to STH 67 within proposed sewer service area boundaries should be re-evaluated in light of the potential facilitating effect this could have on highway strip development, traffic congestion and farmland conversion to nonagricultural use.

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