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Utilities

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Technical Report

UTILITIES

TECHNICAL INFORMATION REPORT

Knoxville-Knox County

Metropolitan Planning Commission

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EXECUTIVE SUMMARY

The **Utilities Technical Information Report** provides an overview of public water, wastewater, electricity, and gas service in Knoxville and Knox County, Tennessee. The report is divided into six sections: **A Brief History of Public Utilities in Knoxville and Knox County, Water, Wastewater, Electricity, Natural Gas,** and **Issues, Goals, Objectives, and Strategies.**

The **History** section provides an overview of the growth of utility service locally. For the City of Knoxville, public water dates from the establishment of the Knoxville Water Company in 1882. Electricity was available from the Knoxville Schuyler Electric Light and Power Company (quickly absorbed by a division of National Power and Light) in 1885. A natural gas utility was established by William Churchwell and William Swann in 1854. These services were united under one public board, the Knoxville Utilities Board (KUB) in 1947.

The six public water systems in unincorporated Knox County were established during the 1950s and 1960s under the authority of 1937 State enabling legislation.

Seven utility agencies provide water to Knox County customers: First, West Knox, Hallsdale-Powell, Northeast Knox, Luttrell-Blaine-Corryton and Knox Chapman Utility Districts and KUB. Details of public drinking water services provided by these agencies in Knoxville and Knox County are presented in the **Water** section. This includes an overview of standards for water quality, quantity, and delivery systems.

The utilities rely on springs, streams, and rivers for a supply of raw water, which is treated at 12 treatment plants and distributed over 2,000 miles of water mains to 120,000 customers. These utilities meet suggested standards for water quality and quantity (average demand). Additional capacity may be needed to meet future peak and emergency demand.

The **Wastewater** section presents details of the existing public wastewater collection and treatment system. This includes standards for handling wastewater, for collection system design, and for quality of treated water, which must be met by all utility systems.

Six utilities provide wastewater service: First, West Knox, Hallsdale-Powell, Northeast Knox, Knox Chapman, and KUB. Together, these systems serve over 70,000 customers via almost 2,000 miles of lines. Collected wastewater is treated at 11 treatment plants in the county and then discharged into rivers and major streams. Treatment capacity is sufficient to meet existing demand. However, population growth may create a need for additional investment in plant capacity.

The **Electricity** section is an examination of the electric utilities which serve Knoxville and Knox County. As in the two previous chapters, a brief introduction to applicable standards is presented. Specifically, this includes standards for power quality, reliability, and distribution system design. The Inventory section summarizes the electric systems operated by the Knoxville Utilities Board, Lenoir City Utilities Board, and Clinton Utilities Board. Together, these three systems serve 151,075 residential and commercial customers through a network of infeed stations, substations, and distribution lines. All electricity is purchased from the Tennessee Valley Authority.

Natural Gas is provided by the Knoxville Utilities Board to customers in Knoxville and Knox County. In 1988, KUB served 24,713 customers via approximately 900 miles of gas lines.

The **Issues, Goals, Objectives, and Strategies** are the result of the deliberations of the Utilities Working Committee. The Committee included representatives of the utility districts, developers, economic development agencies, and the fire department. This Committee identified seven issues facing the community:

1. The need for better cooperation between local utilities and economic development agencies.

2. Fire hydrants and water pressure.

3. Efficiency and cost of utility services.

4. Inadequate consideration given to costs of utilities in public projects.

5. Drinking water quality.

6. Power quality and reliability.

7. Cooperation among utility districts.

Tied to each issue are a goal, objectives, and strategies for handling the issue. The strategies can be used by local governments and utility providers to guide future decisions and plans.

INTRODUCTION

Public utilities provide a framework for the growth of the community. Utilities influence where and how land is developed, the standard of public health and safety, and environmental quality.

The **Utilities Technical Information Report** is designed to provide decision makers with the information they need to understand and guide the development of utility systems in the future. In this report, "public utilities" refers to public water, wastewater, natural gas, and electric services. These services are provided by public or semi-public bodies chartered by the State of Tennessee. To assist in the development of the report, representatives from each of the public utilities which serve Knox County, along with representatives of the development and economic recruitment community, were invited to serve on a Working Committee. This report would not have been possible without their assistance.

This report is divided into six sections. Part I provides a brief introduction to the history of public utilities in Knoxville and Knox County. Parts II, III, IV, and V discuss water, wastewater, electric, and gas services respectively. These chapters include standards, an inventory of existing resources, and an analysis of conditions and problems.
Part VI is a presentation of the issues, goals, objectives, and strategies developed by the Utilities Working Committee.

I. HISTORY

I. A BRIEF HISTORY OF PUBLIC UTILITIES IN KNOX COUNTY

The earliest public water system in the Knoxville area dates from 1809, when a pipeline of hollowed logs brought water into town from McCampbell's Springs. During most of the 19th century, Knoxville residents relied on springs, well water, and water from the area's abundant rivers to supply the growing city's needs. During this period there was no municipal water utility in operation (1).

By the late 19th century, increased population and health concerns made a public water supply necessary. After municipal attempts to establish a water system failed, a private firm, the Knoxville Water Company, was granted a contract on July 1, 1882. Two reservoirs, on Reservoir Hill and Mabry Hill, were constructed to provide water. Other early communities in the area, including North Knoxville and West Knoxville, also established water service during the final years of the 19th century (1).

Private water service experienced many problems in turn of the century Knoxville. Pricing, water quality, quantities available, fire service, and reliability were subject to many complaints. In response to these problems, the city purchased the waterworks from the Knoxville Water Company in 1909 (1).

The first electric service dates back to the Knoxville Schuyler Electric Light and Power Company of 1885. Promising light with "No Hissing, No Flickering," the company's lamps soon illuminated Gay Street and nearby neighborhoods. The company was eventually absorbed by the Tennessee Public Service Company, a division of the National Power and Light Company (1).

As with water, citizens complained about rates, quality of service, and reliability of electric service. By the 1930s, sentiment in favor of public ownership of utilities had grown (1). In addition, local business leaders were interested in purchasing inexpensive power from the new Tennessee Valley Authority (TVA). TVA required all utilities receiving power from its network to be municipally-owned. After a period of difficult negotiations, the City of Knoxville purchased the Tennessee Public Service Company's power distribution system in 1938 (1). In west Knox County and Loudon County, similar factors inspired the formation of the Lenoir City Utilities Board (LCUB) in the same year. LCUB has since provided electricity to west Knox County residents and businesses (2).

Gas service began with a contract granted to William M. Churchwell and William G. Swann in 1854. The Knoxville Gas Light Company was granted an exclusive right to provide natural gas for street lighting and private consumption. In 1945, the

private gas utility was purchased by the City (1). In 1947, municipal water, electricity, and gas service agencies were officially combined into a new body, the Knoxville Utilities Board (KUB). KUB absorbed Knoxville's public wastewater collection system in 1987, thus consolidating the city's major utility services under one authority (1).

To extend service to rural Tennesseans, the 1937 State Legislature enabled rural communities to establish independent utility districts. A utility district was defined as a subdivision of the state, a "municipality" empowered to supply water, sewer, gas, garbage collection, or other public services. All utility district rates and services are subject to customer appeal.

In Knox County, utility districts were established in the 1950s. First Utility District, which serves much of southwest Knox County, was chartered in April, 1954. In 1966, the county judge authorized the District to develop a sewer system. The District now provides both water and sewer service to customers in southwest Knox County. West Knox Utility District was established in the late 1950s to provide water service to west Knox County. In 1971, the District began operation of a sewer system (3).

Hallsdale-Powell Utility District was established to provide water service to customers in north Knox County. It was the first utility district to recognize the growing need for central wastewater collection and treatment. In 1963, the District was authorized to develop a sanitary sewer system in the Halls community. Service was authorized for Powell in 1965, and, in 1968, the District's sewer authority was expanded throughout its water boundaries. Today, Hallsdale-Powell is the largest local utility district in terms of customers and service area (3).

Northeast Knox Utility District was established in the 1950s to provide water service to northeastern Knox County. The District has recently developed a sewer system. The Knox Chapman Utility District was established in the 1950s to provide water service to south Knox County. The District has contracted with the City of Maryville to treat wastewater from the District's small sewer system along Maryville Pike and Alcoa Highway (3). In 1989, Knox-Chapman entered into a joint agreement with Knox County to develop an extensive sewer network in other areas of south Knox County (4).

East Knox Utility District was established to provide water service to residents in eastern Knox County. In 1987, the Knoxville Utilities Board absorbed the operations of East Knox Utility District, including the utility's wastewater treatment and collection system.

II. WATER

A. STANDARDS FOR PUBLIC WATER SUPPLIES

1. Water Quality

The Safe Drinking Water Act of 1977 requires all public water systems to meet standards for pollutants, suspended solids, and natural contaminants. The Tennessee Department of Health and Environment, Division of Water Supply, is responsible for enforcing the Act in the State. The Department has developed detailed standards which govern treatment methodology, water quality, and testing requirements. Water quality standards are listed in Table 1.

Table 1
Public Water System Standards in Tennessee (5)

Primary Maximum Chemical Contaminant Levels

Contaminant	Level (mg/L)
Arsenic	0.0500
Barium	1.0000
Cadmium	0.0100
Chromium	0.0500
Fluoride	2.0000
Lead	0.0500
Mercury	0.0020
Nitrate	10.0000
Selenium	0.0100
Silver	0.0500
Chlorinated hydrocarbons	
Endrin	0.0002
Lindane	0.0040
Methoxychlor	0.1000
Toxaphene	0.0050
Chlorophenoxyls	
2,4,D	0.1000
2,4,5, TP Silvex	0.0100

Secondary Standards for Aesthetic Quality

Chloride	250.0000
Color	15 color units
Copper	1.0000
Methyl blue	0.5000
Iron	0.3000
Manganese	0.0500
Odor	3 threshold odor number
pH	6.5 to 8.5
Sulfate	250.0000
Total dissolved solids	500.0000
Zinc	5.0000

The State also requires utility systems to meet health standards for bacterial contamination. E. coli (coliform), a common, easily identified bacteria found in human intestines, is used as an indicator for other, more dangerous organisms. All utility systems are required to frequently test for the presence of this bacteria species. The frequency of testing varies according to the size of the utility and past contamination problems.

2. Water Quantity

Determining the quantity of water available to consumers involves an examination of the amount of raw water available and the capacity of treatment plants. East Tennessee is normally a water-rich region. Knoxville and Knox County can draw upon abundant local rivers for drinking water, irrigation, and industrial processes. However, these rivers must support a variety of uses in addition to water supply. These uses include navigation, recreation, power production, and fisheries. During dry years, conflicts can develop between water users. Thus, careful planning is needed to ensure that water supplies meet future demand. State law requires all public utilities to develop a "drought management plan" and have a back-up water supply.

Water treatment plants are expensive, complex facilities which must meet federal, state, and local standards. These plants have limited capacities and must be able to supply adequate quantities of water to meet a variety of needs. It is, therefore, important to quantify future water demand.

One method to project future water demand is through the use of formulae which relate water demand to future population. Water demand has three components: average demand, peak demand, and emergency demand. Average demand is normal, daily water usage. Peak demand occurs when usage of water is unusually high. For example, hot summer droughts often cause an increase in water demand. Emergency demand is the level of supply needed to serve in emergency situations, such as major fires. A standard method for calculating average, peak, and emergency demand is summarized in the **Appendix**.

3. Water Delivery Systems

Water delivery systems include water mains, smaller distribution lines, pump stations, and storage tanks. Because the construction and maintenance of such systems is expensive, it is important that certain principles be followed in facility design and location. These are based on generally accepted planning and engineering principles. In addition, local,

state, and federal regulations require certain standards be met.

a. Generally, planning experts agree that public water service should be reliable and flexible. Two patterns are typically used in water system design (8). The "tree system" is the simplest and least expensive (Figure 1). However, tree systems are less flexible and more subject to service interruption. If a main pipe is blocked or broken in one location, the entire system below that point may be shut down. Normal maintenance may also require interruption of service for downline customers.

   The "grid pattern," while more costly, is more flexible and reliable (Figure 2). A single blockage or break can be bypassed. Normal pipe maintenance can occur without interrupting service to all nearby customers. The grid system also eliminates dead ends where stagnant water can collect.

b. In general, public water systems should select locations for their facilities that minimize damage from natural forces and reduce conflicts with other utilities. State and local regulations prohibit construction of water treatment facilities at locations prone to earthquakes, flooding, or fire damage. Only water intake valves can be located in the 100-year floodplain. Local regulations require water lines and pump stations in floodplains to be designed to withstand flood conditions without leaking (5).

   The University of Tennessee's Municipal Technical Advisory Service (MTAS) has examined conflicts between public water lines and nearby sewers. MTAS suggests a ten foot horizontal separation between water supply pipes and sewer lines. If local conditions prevent this, the water mains should be at least 18 inches above the top of the sewer line or the sewer should be constructed of especially strong materials and tested prior to service (7).

c. New water mains should include excess capacity. This will allow for future expansion of the system. In addition, the community should encourage compact, contiguous, and infill development. Such development reduces the length

of piping which must be installed and uses existing capacity more efficiently (9).

d. The water distribution system should provide adequate water pressure for firefighting. Generally, fire hydrants require at least a six inch line for adequate pressure.

e. Water distribution systems should not lose excessive amounts of water to leaks. The American Waterworks Association recommends that leakage not exceed 3,000 gallons per day per mile of water main. Generally, Knox County utilities lose 8 to 20 percent of their total water to leakage and line breaks. This figure is considered reasonable by local engineers (10).

FIGURE 1
The Tree System

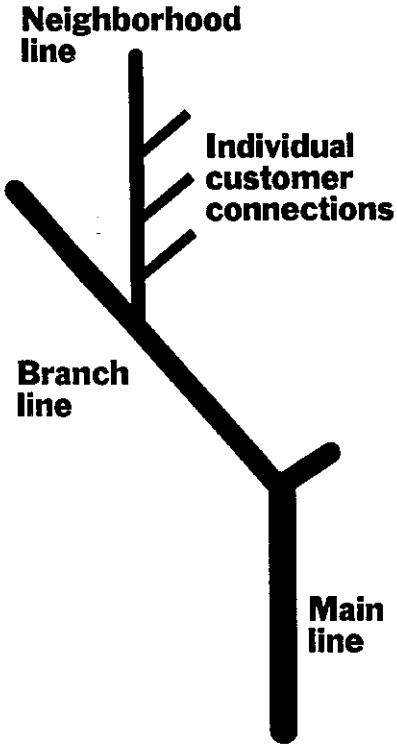
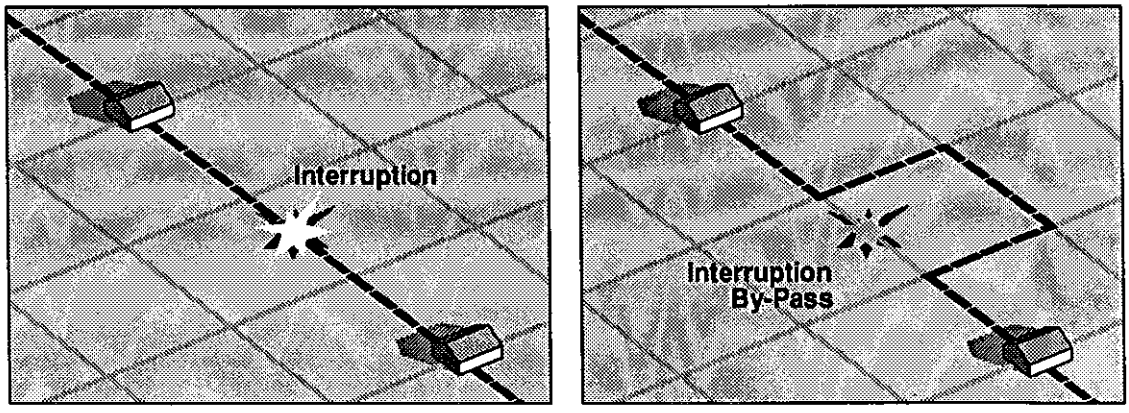


FIGURE 2
The Grid Pattern



B. INVENTORY OF WATER SYSTEMS

Seven utilities provide water in Knox County: Knoxville Utilities Board (KUB), First Utility District, West Knox Utility District, Hallsdale-Powell Utility District, Knox Chapman Utility District, Northeast Knox Utility District, and Luttrell-Blaine-Corryton Utility District (Map 1). The following is an inventory of water sources, treatment facilities, and distribution systems managed by these agencies.

1. Water Sources

Knox County's seven utility systems draw water from four major rivers and several springs. Table 2 lists the sources for each of the utility systems.

Table 2
Water Sources for Utility Systems

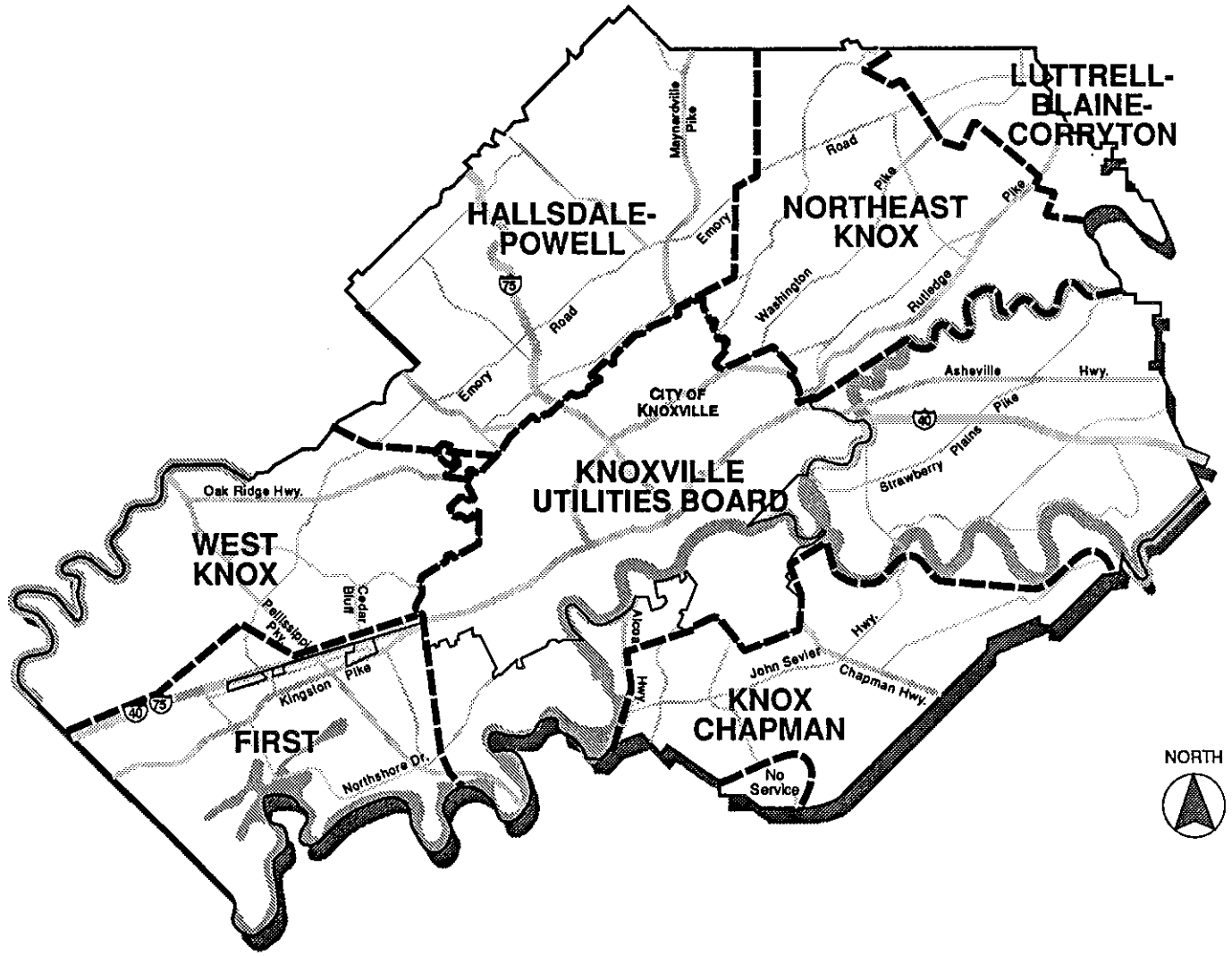
Utility System	Water Source
Knoxville Utilities Board	Fort Loudoun Reservoir Holston River French Broad River
Luttrell-Blaine-Corryton	natural springs
Hallsdale-Powell	Melton Hill Lake Fowler Springs
First Utility District	Fort Loudoun Reservoir
Northeast Knox	Holston River
Knox Chapman	French Broad River
West Knox	Melton Hill Lake

Source: KUB and Utility Districts, Fall 1989.

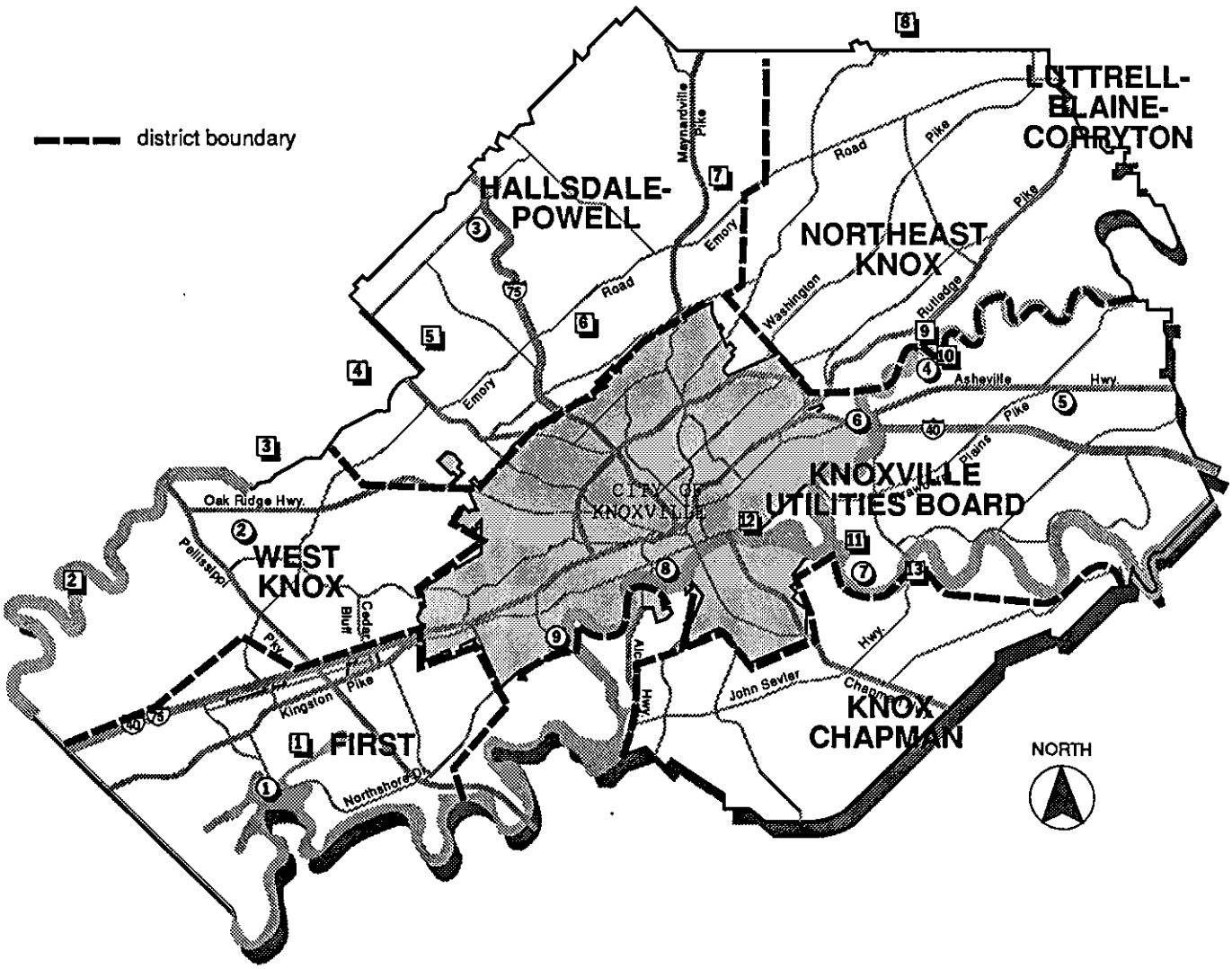
2. Treatment Plants

Treatment technology varies greatly, depending on the quality of the water supply and the size of the demand. All treatment plants must meet Tennessee Department of Health and Environment standards as discussed earlier. Knox County's 13 water treatment plants are listed in Table 3 and shown on Map 2.

MAP 1
Water Service Districts



MAP 2
City and County Water
and Sewage Treatment Plants



WASTEWATER TREATMENT PLANTS (X)

1. Concord Road
2. Karns
3. Raccoon Valley
4. Eastwood
5. Carter School Road
6. Love's Creek
7. Forks of the River
8. Third Creek (Kuwahee)
9. Fourth Creek

WATER TREATMENT PLANTS [X]

1. Jenkins Lane
2. Plant A
3. Plant B (WK)
4. Melton-Hill (H-P)
5. Fowler Springs
6. Dry Gap Pike
7. Granny Bright
8. Wallop Hollow Rd. (L-B-C)
9. Ellistown Rd.
10. Wooddale
11. Forks of the River
12. Mark B. Whitaker
13. John Sevier

Table 3
Knox County Water Treatment Plants

Utility	Plant Name	Capacity (mgd)*
KUB	Whitaker	60.0
	Forks of River	2.2
	Wooddale	1.2
L-B-C	Wallop Hollow	0.4
Hall.-Pow.	Dry Gap Road	4.5
	Fowler Springs	0.4
First	Jenkins Lane	14.0
	Walker Springs	0.4
Northeast	Ellistown Road	2.3
		4.6
Knox Chapman	John Sevier	2.9
West Knox	Plant A	6.0
	Plant B	2.5

* Where mgd is million gallons per day.

Source: KUB and Utility Districts, Fall 1989.

3. Water Distribution Systems

Once treated, water must be moved from the plant to the customers. The typical distribution system includes main lines, pumping stations, storage tanks, and smaller lines. Presented in Table 4 is a summary of pipeline mileage and number of customers for each local provider.

Table 4
Water System Lines and Customers
1989

Utility	Line Mileage (mains)	Customers
KUB	1,100	61,800
L-B-C	50	1,170
Hallsdale-Powell	500	15,495
First	372	15,200
Northeast	140	4,410
Knox Chapman	178	6,810
West Knox	300	10,168

Source: KUB and Utility Districts, Fall 1989.

Because it is the most expensive element in the distribution system, the placement of water mains can greatly influence the location of future development. Once water mains have been extended to an area, public water service is readily available for new customers. Smaller distributor pipes and individual water connections can be easily installed.

Distribution lines generally vary from 2 inch galvanized steel pipe to 24 inch pipe. Within the Knoxville Utilities Board service area, most lines are 6 inches in diameter. All of the utility districts have programs in progress to replace the 2 inch lines.

To ensure adequate water pressure along the lines, Knox County utilities use pumping stations to move water to large storage tanks on ridge crests. These storage tanks then use gravity to provide the needed pressure.

C. ANALYSIS OF INVENTORY DATA

1. Quality and Quantity

At present, Knox County utilities meet state and federal standards for drinking water quality. However, compliance with increasingly stringent standards will be more difficult if

water quality in local rivers and streams deteriorates (11). Poor raw water quality will require increasingly expensive investment in new treatment technology.

Continued growth and prosperity depends on a water supply large enough to meet demand. As discussed earlier, demand has three components: average demand, peak demand, and emergency demand. Table 5 compares present utility system capacities with estimated peak, average, and emergency demand. As shown in the table, all of Knox County's utilities have adequate capacity for average and peak demand. Four of the seven utilities have adequate capacity to meet the MPC emergency standards. The three other utilities almost meet the standard.

Table 5
Plant Capacity (mgd) versus Demand, 1989

Utility	Capacity	Ave. Dem.	Peak Dem.	Emer. Dem.
KUB	63.40	33.00	42.00	63.00
L-B-C	0.43	0.26	0.39	0.59
Hall.-Pow.	6.50	3.50	4.50	6.75
First	14.00	5.50	9.00	13.50
Northeast	2.30	1.04	1.48	2.22
Knox Chapman	2.90	1.80	2.00	3.00
West Knox	9.00	3.43	3.94	5.91

Source: KUB and Utility Districts, Fall 1989.

Future demand must also be considered. The U.S. Bureau of Economic Analysis projects Knox County population to increase by 9.9 percent between 1990 and 2000 and by 10.5 percent between 2000 and 2010 (3). These estimates are significantly higher than estimates from sources such as the State Planning Office, but they can be used to estimate the maximum increase in demand for water and sewer which will probably occur. Much of the growth will occur in the North, Northwest, and Southwest County Sectors.

By 2010, the North County Sector, served largely by the Hallsdale-Powell Utility District, is projected to add 14,664 people to its 1990 population of 34,429, an increase of 42.6 percent. As shown in Table 5 above, Hallsdale-Powell has adequate capacity to meet present average and peak demand. If demand for water increases at the same rate as population growth, then existing capacity will be able to meet peak and average demand (Table 6). However, the treatment plant will be operating at capacity under peak demand. Therefore, emergency

demand will not be met (3).

The Northwest County Sector is projected to experience the most growth, expanding from 46,488 in 1990 to 72,680 in 2010. Almost all of the Northwest Sector is served by the West Knox Utility District. Given projected growth in demand, the District will have the capacity to support peak and average demand and nearly meet emergency demand standards (3)(Table 6).

The Southwest County Sector will also experience significant growth, adding 19,553 people to its 1990 population of 32,213. This sector is served by First Utility District and Knoxville Utilities Board. Present capacity of the Jenkins Lane Plant of the First Utility District will support average and peak demand. This should hold true if the City of Knoxville continues to annex territory in the Southwest County Sector. According to an agreement between KUB and County utility districts, annexed areas will generally be served by KUB, thus reducing the demand which must be met by the First Utility District. Because the City Sectors and East County Sectors are relatively slow-growing, KUB has substantial reserve capacity available at the Mark B. Whitaker Water Plant to support growth in demand in Southwest Knox County. However, neither utility will have the suggested emergency reserve capacity (3)(Table 6).

It should be recognized that local utility agencies have active planning processes, and capacities can be expanded to meet future growth in a timely and cost effective manner.

Table 6
Projected Demands for Major Growth Areas
2010

Utility Service	Projected Demands (mgd) Average	Peak	Emergency
Hallsdale-Powell	4.99	6.42	9.63
First	8.84	14.46	24.15
West Knox	5.35	6.15	9.22

It should be noted that these demand projections are based on population projections which may be overstated. However, the projections do suggest that several of the utilities will be required to expand treatment facility capacities. Water

conservation measures can limit the increase in demand, reducing some of the need for additional capacity.

2. Water Distribution Systems

As noted in the **STANDARDS** section, water distribution systems should meet standards for safety, efficiency, and cost effectiveness. In Knox County, cost is a primary factor in deciding where and when utility services will be provided. There are no strong policies in effect to guide development into compact, efficient patterns which could reduce service costs.

Water distribution lines also affect the delivery of fire protection services. Adequate water pressure for firefighting requires sufficient line size. Most areas in rural Knox County were originally developed with small lines which often leak as they age. Replacement of inadequate lines is a costly process, but as noted earlier, all of the utility districts have an ongoing program to replace such lines. Problems of inadequate water pressure due to leakage and line size are most notable in eastern portions of Knox County.

Fire hydrant installation and maintenance is an additional concern. It is the responsibility of the utility organizations to test and maintain the hydrants. However, there is some controversy over the routine use of these hydrants by local fire departments. More cooperation between fire departments and county utility districts would reduce these problems.

III. WASTEWATER

A. STANDARDS FOR WASTEWATER SYSTEMS

1. Quantity

To ensure adequate sewage treatment capacity, it is necessary to predict the quantity of wastewater which will be produced in a system. There are several methods which can be used to project demand for sewer services. If water usage is known or can be projected, a good rule of thumb is that 60 to 80 percent of water used will require treatment as wastewater.

Alternatively, an examination of land uses can be used to estimate wastewater. Different uses produce different amounts of waste. Table 7 lists average wastewater flows for various land uses.

Table 7
Wastewater Flows By Land Use (6)

Land Use	Flow (gallons/acre/day)
Hotels, Retail Stores, and Office Space	60,000
Warehouse and Wholesale Establishments	15,000
Light Industrial	14,000

A third method of predicting wastewater quantity is the use of an accepted per capita standard. The Environmental Protection Agency estimates that each person in this country produces 100 gallons of wastewater per day. The Tennessee Department of Health and Environment requires the use of this standard when actual waste production figures are unavailable.

In estimating wastewater quantities, it is important that infiltration and inflow be considered in the totals. Infiltration occurs when natural groundwater and stormwater runoff enters sewer systems through cracks and minor breaks. Inflow is the result of illegal connections to the public sewers. Connected storm drains are one of the most common sources of inflow. Infiltration and inflow can overload sewage treatment systems during storms. Overloaded plants can release large amounts of untreated, contaminated water into local rivers and streams. Typically, most utilities try to prevent infiltration and inflow from doubling the average flow. In an older sewer system, this standard is difficult to meet (10).

2. Collection Systems

The State of Tennessee has detailed standards for the design of public wastewater systems. These standards regulate pipe materials, bedding, pipe size, manholes, and treatment facility capacity. To guide local governments in providing high quality wastewater collection systems, MTAS has also published detailed engineering standards (7).

As with water systems, wastewater collection systems are most efficient when they serve compact patterns of development. Compact growth can reduce capital expenditures for new mains and pump stations. Infill development is also desirable. Communities should encourage development which uses existing utility capacity (9).

Wastewater collection systems should be designed for reliability. As noted in the **WATER** section, a grid pattern is more reliable because other paths are available whenever a single pipe is blocked. However, the grid pattern is also much more costly to construct.

3. Treatment and Disposal

Three kinds of wastewater treatment are used: primary, secondary, and tertiary. Primary treatment systems use mechanical means to remove the coarser solids in the waste stream. Secondary treatment adds more extensive filtering, settling basins, and chemical treatment. Tertiary treatment uses activated charcoal and mechanical filters, advanced chemical treatment, and other methods aimed at removing nearly all biological wastes and organic chemicals.

Once treated, wastewater is discharged into rivers and streams. To do so, sewage treatment plants must have National Pollution Discharge Elimination Permits (NPDES), which are granted by the Tennessee Department of Health and Environment, Division of Water Pollution Control. The NPDES permits require the discharger to meet certain standards for biochemical oxygen demand, suspended solids, chemical contaminants, and fecal coliform bacteria. All municipal sewage treatment plants are required to complete periodic reports about discharges into the State's waters.

One by-product of the sewage treatment process is a residue of semi-liquid "sludge." Knox County utilities use landfills and land application to dispose of their sludge. Landfills receiving municipal sludge must comply with several performance requirements. (These are discussed in more detail in the **Natural Environment Technical Information Report.**)

Land application is the spreading of sludge on open land or farmland. The sludge must not be toxic, and the land chosen must have soils which limit contamination of groundwater from sludge runoff. Sewage treatment plant sludge can be quite valuable as a natural fertilizer for farm use. If the sludge was further purified, dried, and composted to remove all odors, it would make a suitable home garden fertilizer.

B. INVENTORY OF WASTEWATER SYSTEMS

Six Knox County utility systems provide wastewater collection and treatment: Knoxville Utilities Board, Hallsdale-Powell Utility District, First Utility District, West Knox Utility District, Knox Chapman Utility District, and Northeast Knox Utility District. District boundaries and areas presently served by sewers are shown on Map 3.

Three elements in wastewater systems are examined in this inventory: 1) collection systems, 2) treatment plants, and 3) water bodies that receive the treated wastes.

1. Collection Systems

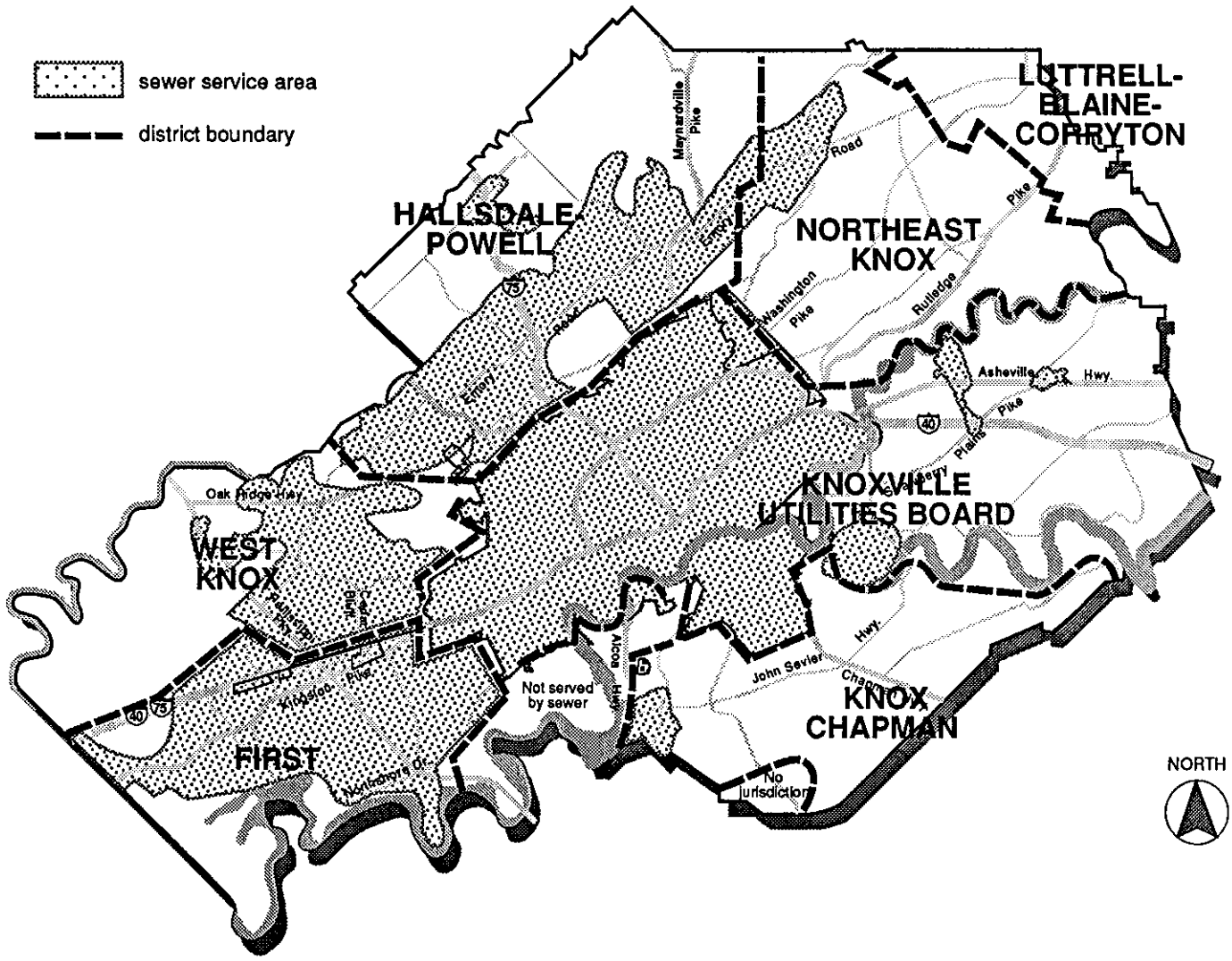
Individual household and business wastes must be collected throughout utility service areas. Collection systems consist of sewers, mains, and pump stations. Knox County utilities operate many miles of sewer lines (Table 8). These range in size from 6 inch service lines to a 76 inch main which carries much of Knoxville's sewage into the Third Creek treatment plant. Most local systems are structured in a "tree pattern," as discussed in the **WATER** section of this report.

Table 8
Sewer System Lines and Customers
1989

Utility	Line Mileage (mains)	Customers
KUB	1,200	51,709
Hallsdale-Powell	230	8,743
First	210	11,200
Knox Chapman	12	202
West	150	6,519

Source: KUB and Utility Districts, Fall 1989.

MAP 3
Areas Served by Sewers



Most Knoxville and Knox County sewers are "gravity lines." Gravity sewers use the force of gravity to ensure a steady flow of sewage through the collection system. This reduces the need for expensive pump stations. Most gravity sewer systems operate within individual drainage basins where the terrain allows fluids to collect at specific points. Utilities then pump the collected wastes across drainage basins into mains leading to treatment plants.

2. Treatment Plants

Once collected, raw sewage must be treated to reduce its impact on the environment. Table 9 lists treatment plants and the bodies of water receiving treatment plant discharge in Knoxville and Knox County. The Tennessee Department of Health and Environment, Division of Water Pollution Control, monitors these discharges. Sewage treatment plant locations are shown on Map 2 in the **WATER** section of this report.

3. Water Outfall

All Knox County rivers and streams have been assigned official "uses" by the State of Tennessee. These include fishing, swimming, wildlife habitat, public drinking water sources, recreation, industrial water supply, and animal water supply.

As shown in Table 9, most of the local utility districts discharge treated wastewater into major rivers. These rivers can usually dilute the normal pollutant loads without serious harm to water quality. However, problems can develop when treatment plants are overloaded during major rain storms. Problems also arise when a smaller stream is used as the receiving stream. A smaller creek can be heavily damaged by municipal sewage treatment plant discharges.

Local waterways can also be damaged by wastewater leakages. Wastewater collection systems must, therefore, be designed to minimize environmentally destructive leaks and malfunctions. Leaking sewers are a source of contamination which can limit the ability of streams and rivers to support desired uses. One indicator of leaking sewers is the presence of high levels of fecal coliform bacteria. Streams which support all designated uses must have fecal coliform levels below 200 bacteria per 100 milliliters of water. In Knox County, First Creek, Second Creek, Third Creek, and Goose Creek violate this standard (12). The Tennessee Department of Health and Environment requires a posting of warning signs along these streams.

Table 9
Wastewater Treatment Plants and Water Outfall

Utility	Treatment Plant	Capacity	Water Outfall
KUB	Kuwahee Plant	40.00 mgd	Tennessee River
	Fourth Creek	10.80 mgd	Tennessee River
	Loves Creek	5.00 mgd	Holston River
	Forks of River	1.00 mgd	French Broad
	Eastwood Plant	0.10 mgd	Holston River
	Carter Plant	0.09 mgd	Lyons Creek
Hall-Pow	Beaver Creek	5.50 mgd	Beaver Creek
	Raccoon Valley	0.15 mgd	Bullrun Creek
W. Knox	Karns Plant	4.00 mgd	Beaver Creek
First	Concord Road	5.00 mgd	Turkey Creek
K. Chapman	* Treated by City of Maryville		
NE Knox	* Data not available		

Source: KUB and Utility Districts, Fall 1989.

C. ANALYSIS OF INVENTORY DATA

Public wastewater systems can most efficiently serve compact, contiguous, relatively high density development. Such development is generally not predominant in Knox County. The promotion of compact development can be achieved through the use of utility extension policies. Local government and utility providers can discourage new utility system extensions far outside existing service areas. Where infill or contiguous development is desired, speculative improvements in utility capacity can be put in place to encourage this development.

However, Knox County governments and utility districts have not implemented such policies. If a developer wishes to be served at a site quite distant from existing development or utility service, utility districts will generally provide such service at a cost to the developer. In addition, utility providers are revenue-maximizing entities prohibited by law from engaging in speculative extensions of service.

Wastewater treatment plant capacity can be a limiter of community growth. In general, the utility districts in Knox County can meet demands for service. However, KUB, Hallsdale-

Powell, and First Utility District presently lack a desirable margin of safety above peak demand. These agencies experience overloads during major storms as water infiltrates their collection systems. Resulting bypasses of treatment plants can damage the receiving streams. Table 10 compares 1989 capacities to demand for treatment of wastewater.

Table 10
Plant Capacity (mgd) versus Demand

Utility	Capacity	Ave. Demand	Peak Demand
KUB	56.99	30.00	55.00
Hall.-Pow.	5.65	3.20	5.00
First	5.00	3.30	5.00
Knox Chapman	1.01	0.02	0.03
West Knox	4.00	1.03	1.72
NE Knox	n/a	n/a	n/a

Source: KUB and Utility Districts, Fall 1989.

It is also important to consider future demand. As discussed above, Knoxville and Knox County will experience significant growth during the 1990s and 2000s (3). Three county sectors will experience the greatest growth: North, Northwest, and Southwest. These sectors are served by Hallsdale-Powell Utility District (North), First Utility District, KUB (Southwest), and West Knox Utility District (Northwest). KUB also treats wastewater from a small portion of the Northwest Sector.

As indicated in Tables 10 and 11, significant new capital investment may be needed in the near future to handle new demands generated by a growing population. In the high growth sectors, West Knox Utility District is best suited to handle the increased population. Hallsdale-Powell Utility District has the capacity to meet average demand. First Utility District will require significant new near-term investment to meet projected demands (3). In addition, if growth in the number of customers continues in the sections of Northwest Knox County served by KUB, expansion may be necessary in the Third Creek facility.

As discussed in the **WATER** section of this report, each of the local utility providers evaluates needs for future services. Plans are prepared for timely and cost effective expansion of their wastewater plants.

Table 11
Projected Demands in Major Growth Areas
2010

Utility Service	Projected Demands (mgd) Average	Peak
Hallsdale-Powell	4.56	7.12
First	5.30	8.03
West Knox	1.61	2.69

IV. ELECTRICITY

A. STANDARDS FOR ELECTRICITY SYSTEMS

Electric utilities should meet certain standards for service. Many of these standards address technical matters such as equipment design, generating capacity, and power quality and are the responsibility of the electric utilities themselves. Rather than concentrating on technical matters, attention here is placed on three general principles which should be followed for the provision of electricity services:

First, electricity distribution systems should be designed to minimize service interruptions. As with water and sewer utilities, grid networks with built-in redundancy provide the most reliable service. Reliability can also be improved through careful maintenance of system equipment (8).

Second, power supplies should be clean, or relatively free of transient voltage spikes and noise. Many users of electric service have sensitive electronic equipment which can be damaged by frequent interruptions and "static." Some utility systems provide a range of power qualities to customers who need such alternative service. Equipment designed to improve power quality and reliability can be provided to customers with special needs.

Third, rights-of-way for utility lines should be sensitively designed and located. Where possible, local distribution lines should be buried. Burying utility lines improves the appearance of neighborhoods, improves power service reliability, and eliminates the dangers associated with downed power lines. Where burial is not possible, the utility right-of-way should respect the landscape and minimize the need to clear vegetation and trees.

KUB has specific standards for burial of power lines and treatment of utility rights-of-way. Ideally, insulated power cables should be buried 45 to 48 inches. If soil conditions do not allow this depth, special conduits or concrete casings should be used to protect the buried cable. KUB requires a cleared, 20-foot right-of-way for local distribution lines and 50 feet for high-tension lines (13).

B. INVENTORY OF ELECTRICITY SYSTEMS

Three utility systems provide electricity service in Knox County. All three purchase their power from the Tennessee Valley Authority, which operates a system of hydro-electric dams, coal- and gas-fired plants, and nuclear generating stations. The Knoxville Utilities Board supplies power to the City of Knoxville, east Knox County, south Knox County, a majority of north Knox County, and half of unincorporated west

Knox County. KUB electricity service also extends into portions of Grainger, Jefferson, Sevier, and Union Counties. The Lenoir City Utilities Board (LCUB) supplies the rest of west Knox County, including the Town of Farragut and the Pellissippi Technology Corridor. The Clinton Utilities Board (CUB) provides power to Raccoon Valley and Bullrun Valley (Map 4). Presented below is a summary of systems data for each of the three local providers of electricity.

1. KUB Bureau of Power

KUB provides electricity to 144,984 customers in its 5 county service area. Of that number, 128,447 are residential customers, 16,436 are commercial and industrial customers, and 101 connections are for outdoor lighting. In 1988, KUB purchased 4,467,079 MWH (thousand kilowatt hours) from TVA to serve those customers (15).

The KUB electricity grid had a total capacity of 1,423 mega volt amperes (MVA) in 1989. The system will be upgraded to a capacity of 1,703 MVA by November 1990 (15). This power is fed into the KUB system at three infeed stations: a) Lonsdale Substation on Concord Street, b) Knox Substation near Loves Creek Road, and c) North Knox Substation near Callahan Road. A fourth infeed station under construction on Nixon Road will provide 250 MW of power after July of 1991. From the infeed stations, electricity is distributed through 120 power transformers at 50 secondary substations. The system is an interlocked grid that allows for continuous service even during partial shut-downs (16).

During 1988, residential customers used 1,983,895 MWH of electricity, small commercial and industrial customers used 411,032 MWH, large commercial and industrial customers used 1,794,260 MWH, and outdoor lighting connections required 53,277 MWH of electricity. The peak winter daily demand was 1,170 mega watts and the peak summer daily demand was 774 mega watts (15).

2. Lenoir City Utilities Board

Although its primary service district is Loudon County, the Lenoir City Utilities Board provides some electricity service in west Knox County. LCUB provided electricity service to 22,228 customers in Knox County in 1988. Of that number, 19,235 were residential and 2,903 were commercial and industrial customers (17).

TVA power is delivered to the Knox County portion of the LCUB system at two infeed stations: a) Solway Substation on Hardin Valley Road at Pellissippi Parkway, and b) Ebenezer Substation

on Peters Road at George Williams Road. The Solway Substation has a capacity of 150 mega watts, and the Ebenezer Substation has a capacity of 200 mega watts. Power is then distributed through the Knox County portion of the system from 5 secondary substations. The peak daily demand for electricity in 1988 was 222.8 mega watts (17).

3. Clinton Utilities Board

The Clinton Utilities Board provides a small amount of electricity service in northwest Knox County. It serves 400 Knox County customers, 397 of which are residential customers. The remaining three are small commercial customers. CUB operates no infeed stations or secondary substations in Knox County. Local customers are served from the Andersonville Substation located in Anderson County. It operates with a 25 mega watt capacity. In 1988, peak daily demands for CUB electricity reached 3.6 mega watts (18).

Standard Voltages

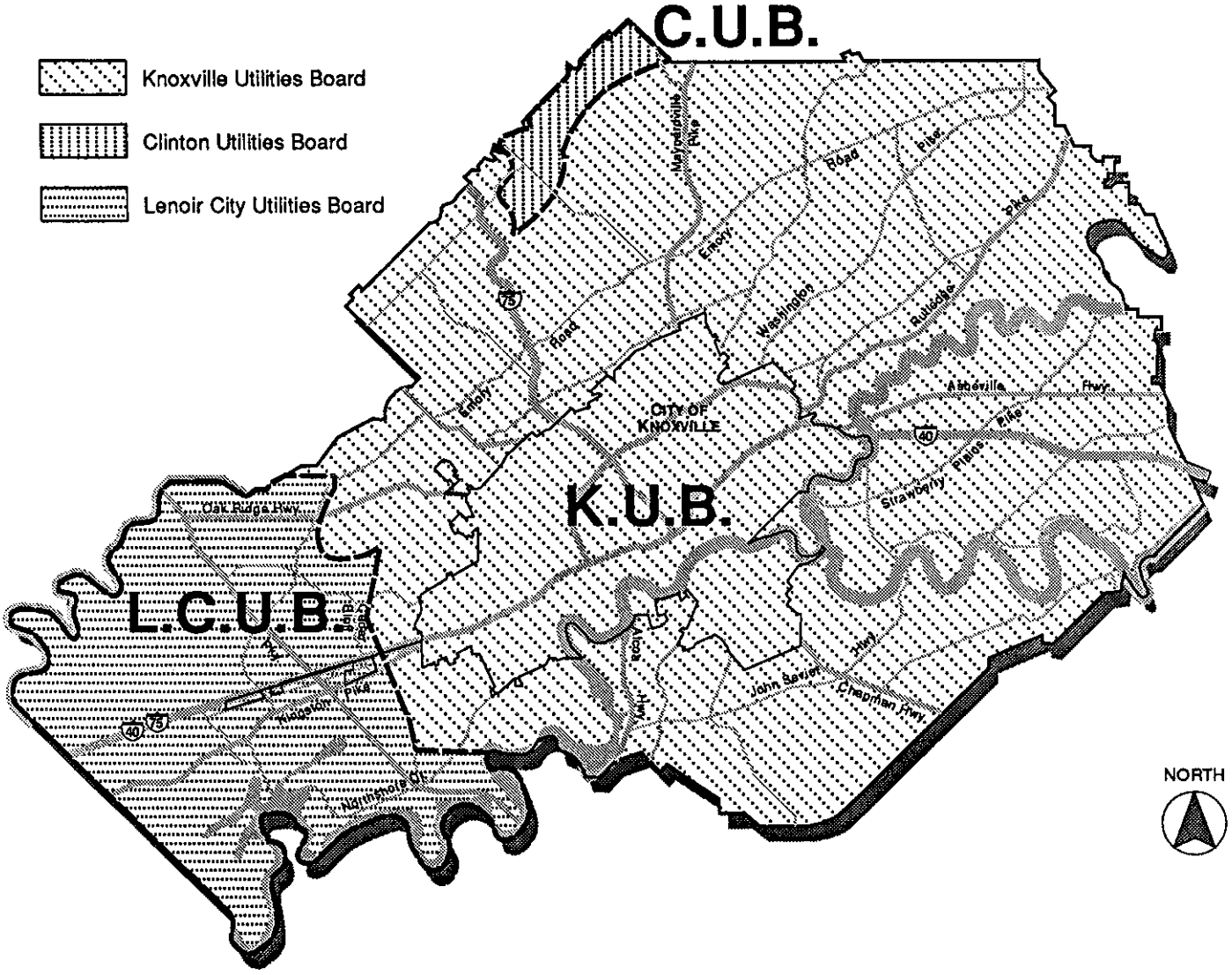
KUB offers customers six standard voltages, with additional voltages available upon special request. The Lenoir City Utilities Board offers five standard voltages. Table 12 lists these voltages.

Table 12
Standard Voltages Available in Knox County

KUB	LCUB
120/240 volts, 1-phase, 3-wire	120/240 volts, 1-phase
120/208 volts, 3-phase, 4-wire	120/240 volts, 3-phase
277/480 volts, 3-phase, 4-wire	120/208 volts, 3-phase
7,620/13,200 volts, 3-phase, 4-wire	270/480 volts, 3-phase
69,000 volts, 3-phase, 3-wire	480/480 volts, 3-phase
161,000 volts, 3-phase, 3-wire	

Source: KUB, Summer 1989.

MAP 4
Electricity Service Districts



C. ANALYSIS OF INVENTORY DATA

All areas of Knoxville and Knox County receive adequate electricity services. Unlike services for water and wastewater, all local residents can be readily connected to the electricity system.

Both KUB and LCUB use a grid distribution network to provide reliable electric service in Knox County. For customers that need greater reliability, KUB will give priority to restoring service and even provide backup distribution lines. Customers which require a level of service beyond that are encouraged to purchase emergency generators.

Industrial and commercial users of electricity are provided adequate electric service. However, some users require electricity beyond the "normal" types and levels of service. The special needs of these users can be met, but the user is responsible for the purchase of any equipment necessary to upgrade the level of service.

Many developers now bury utilities in new subdivisions. KUB requires the developer to excavate the trench and furnish conduit and transformer pads. Developers often construct a single trench for all utilities and cable television. As noted above, underground utilities improved appearance of residential neighborhoods.

V. NATURAL GAS

Natural gas is supplied in Knox County by the Knoxville Utilities Board Bureau of Gas (Map 5). Because it is often used as an alternative energy source, the provision of this service plays a limited role in the growth and development of Knoxville and Knox County. For this reason, only a brief summary of natural gas service in Knox County is presented.

A. SYSTEMS DATA

The Knoxville Utilities Board is the only provider of natural gas in Knoxville and Knox County. Gas is purchased by KUB from the East Tennessee Natural Gas Company. In 1988, gas purchases amounted to 7,975,000 MCF (thousand cubic feet) (19).

In 1988, KUB had 24,713 customers for natural gas. Of that number, 20,160 were residential customers, 4,422 were commercial customers, and 131 were industrial customers. In 1989, the total number of customers increased to 30,895. Approximately 900 miles of gas mains serve these customers, with an average annual residential consumption of 80 MCF. The peak daily pressure in 1988 was 56,223 MCF (15).

B. GENERAL ANALYSIS

Most standards which apply to gas utilities are highly technical in nature and are not appropriate in this report. However, the following general principles for gas service used by KUB demonstrate the role of natural gas provision locally:

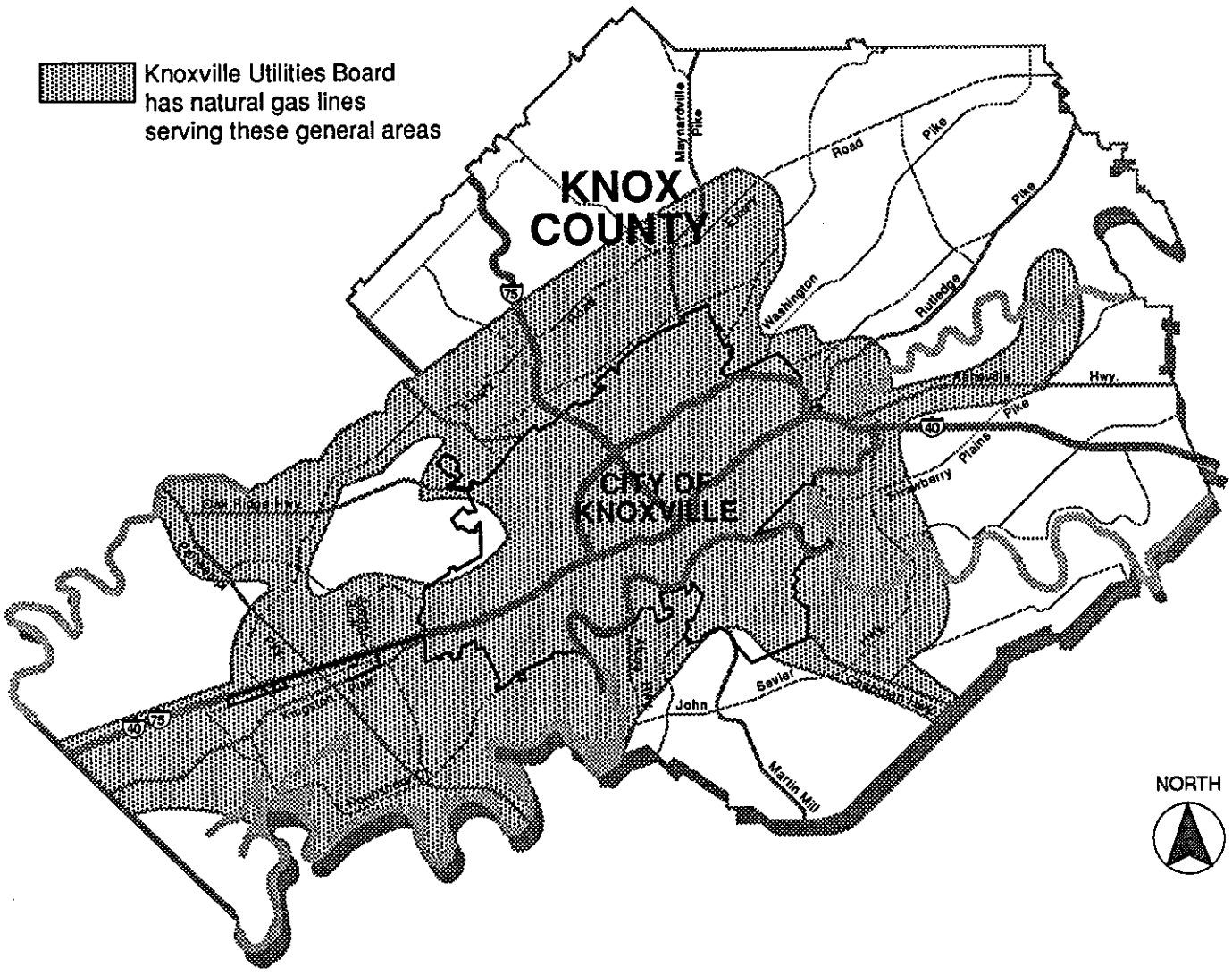
First, KUB purchases gas on daily contracts from pipeline sources. Although KUB itself does not maintain reserves, it does have supplemental suppliers which can be tapped to cover shortfalls caused by severe weather conditions or other excess demands for service.

Second, KUB uses statistical techniques to forecast gas needs. Factors such as building activity, climatological projections, and population trends are examined to estimate supply requirements.

Third, a grid system allows individual sections of the network to be isolated for repairs and maintenance. This reduces the number of service disruptions to customers and allows for regularly scheduled maintenance programs (8).

Finally, developers must pay for gas service extension prior to construction. Once construction is complete, KUB reimburses the developer $330 for each new customer brought on line (20).

MAP 5
Areas Served by Natural Gas



VI. ISSUES, GOALS, OBJECTIVES, AND STRATEGIES

This section summarizes issues, goals, objectives, policies, and actions developed by MPC staff and the Utilities Working Committee. The Committee, comprised of representatives from local utility districts, development agencies, and local industry, provided the expertise and advice needed to complete this chapter.

The Working Committee identified goals and objectives for each issue. **Goals** are general statements of intent, ideals toward which the community should strive. **Objectives** are more specific, measurable intentions. Typically, objectives identify those responsible for meeting the objective and when the desired state will be reached. To meet each goal and objective, the Working Committee developed a number of strategies. These **strategies** can be divided into two broad categories: 1) policies, and 2) actions. **Policies** are general rules which guide local decision-making. **Actions** are specific activities which are to be accomplished by local institutions. In many cases, these two categories will overlap. Where possible, several potential strategies have been identified. These strategies are usually complementary and provide a range of options for decision-makers.

ISSUE 1: BETTER COOPERATION BETWEEN LOCAL UTILITY DISTRICTS AND ECONOMIC DEVELOPMENT AGENCIES

Working committee members agreed that economic recruitment efforts can be hampered by poor coordination among the seven utility districts and local economic development agencies. Poor communication, conflicts between potential service suppliers, and a lack of understanding of the needs of participants can influence a prospect to look elsewhere. Poor coordination and a multiplicity of utilities plagues major projects and planned growth areas such as the Technology Corridor. As noted in the **Technology Corridor Zoning Assessment**, "some technology-based enterprises have reportedly shown concern about the multiplicity of utility institutions providing various services within the zone."

Goal

Improve the coordination of local utility districts with economic development efforts.

Objective: Facilitate communication and understanding among local utility districts and economic development agencies.

Strategic Component:

Policy: A representative of the utility districts should be involved from the beginning in economic development and recruitment efforts.

Policy: Economic development officials should be represented at the periodic utility district meetings. This will improve the understanding of utility district operation by economic recruiters.

Action: Institute a permanent economic development council, including representatives of the Chamber of Commerce, the Tennessee Technology Foundation, local economic development agencies, and local utility districts.

Action: Provide information and assistance to potential investors seeking opportunities in Knox County.

Action: Utility districts can extend speculative lines if they are guaranteed a revenue base. Knox County should develop a program to guarantee utility districts the necessary revenues.

ISSUE 2: ADEQUATE FIRE HYDRANTS AND WATER PRESSURE TO ENSURE PUBLIC SAFETY

Some areas of Knox County do not have enough fire hydrants. This imposes difficulties on fire departments and increases the cost of fire insurance for local homeowners. In other areas of the county, water pressure is too low to adequately support the use of fire hydrants. This problem is largely due to inadequate line size, which contributes to pressure problems.

Goal

Ensure that all of areas of Knoxville and Knox County have adequate water supply for firefighting.

Objective 1: Improve compliance with established standards for fire hydrants in residential, commercial, and industrial areas.

Strategic Component:

Policy: Adequate fire fighting equipment should be available in all sections of Knox County with public water service.

Policy: Knox County government should provide funding for a regular program of fire hydrant maintenance and testing.

Policy: Fire departments operating in Knox County should pay for water and hydrant use.

Action: Local fire departments should complete a study of fire hydrant needs, identifying areas of deficiencies. In cooperation with local utilities, the departments should develop a hydrant improvement program to upgrade poorly served neighborhoods.

Action: Knox County governments should coordinate fire hydrant installation in conjunction with ongoing system upgrading.

Action: Constitute a joint utility district-fire department working committee to identify and solve major problems.

Objective 2: Provide adequate line size and water pressure to support needed fire hydrants.

Strategic Component:

Policy: Encourage development to locate in areas with adequate infrastructure.

Policy: Allow development in poorly-served areas if the developer will contribute to a share of the cost of upgrading inadequate lines.

Action: Utility districts should continue to replace inadequate pipes in areas with poor fire service.

Action: Coordinate fire hydrant installation by county governments with water line improvements.

Action: Knox County should allow or create special assessment districts to fund necessary improvements.

ISSUE 3: EFFICIENCY AND COST OF UTILITY SERVICE

Compact, contiguous development has many advantages for the provision of public services such as utilities. Such development makes extension of services less costly and allows more full use of existing facilities. By contrast, scattered development requires costly investment in new roads, schools, and other services while existing services are under-used.

Goal

Ensure efficient provision of adequate utility services for residential, commercial, and industrial uses.

Objective 1: Limit sewer service to the urbanized area. The urbanized area is defined in the **Land Use Element** of the **General Plan.**

Strategic Component:

Policy: Encourage development and redevelopment in neighborhoods with open land and unused utility capacity.

Policy: Encourage new projects to be located adjacent to or within existing service areas.

Policy: Require connection to central sewers for all developments within the Urban Growth Area.

Policy: To limit sprawl, coordinate utilities, highways, schools, employment, shopping, and recreation to encourage balanced, compact growth.

Action: Identify areas with open land and unused utility capacity and target those areas for development.

Objective 2: All water service customers with access to public sewers should be connected to the system.

Strategic Component:

Policy: Continue to enforce the state law which mandates payment for sewer service when it is available.

Policy: Within the Urban Service Area, denser development and development in areas with soils unsuitable for septic systems should have public sewers.

Action: The County and City governments should investigate cost sharing and subsidy options to help low-income households finance needed connections to public sewers.

Action: Work with the County Health Department to limit development on septic tanks in areas with or scheduled to receive sewer service.

Action: Investigate the means to provide wastewater service to balance growth in all areas of the county.

ISSUE 4: INADEQUATE CONSIDERATION GIVEN TO COSTS OF UTILITIES IN PUBLIC PROJECTS

Many committee members argued that local government projects have been developed without considering the cost to the utility districts of providing water and sewer service. Such projects also ignore the fact that the utilities cannot install utility lines on a speculative basis to make development areas more attractive to potential investors. They are obligated by law to provide service only when a customer is actually present.

Problems have arisen when the utilities cannot serve a new industrial park or area designated for industrial growth. For example, the Pellissippi Parkway Plan called for major investments in public services such as water and sewer. However, at present only two of the six water service improvements called for by the Technology Corridor's Five Year Plan (1985-1990) have been completed, while four of the six wastewater improvements have been completed.

Goal

Ensure that major County and City projects have a logical plan for financing necessary utility services.

Objective 1: Improve coordination between local utilities and economic development officials.

Objective 2: Develop a system to finance services to major new City and County projects.

Strategic Component:

Policy: Major projects should be located in easily serviceable sections of the county.

Policy: Local utility districts should be involved from the beginning in the planning of major projects and the industrial recruitment process.

Policy: City and County governments should recognize that it is their responsibility to pay for speculative utility lines. Refer to the **Economic Development Element** of the **General Plan.**

Action: A coordinating committee/task force should be convened for proposed public projects which require major utility investments.

Action: The City and County should evaluate the use of bond issues to finance speculative extension of utility lines.

Objective 3: Improve utility services to under-served projects such as the Technology Corridor and the County Industrial Park.

Strategic Component:

Policy: The City, County, Tennessee Technology Foundation and other economic development agencies should provide for utility service as soon as possible in project areas such as the Technology Corridor.

Action: The City, County, Tennessee Technology Foundation, and other economic development agencies should develop a funding source to assist the utilities in the completion of recommended improvements.

Action: The Tennessee Technology Foundation should be involved in the annual programming of available county and state funds to meet utility needs.

Action: Major economic development projects are facilitated by a single source of information on all utility services. Develop a utility coordinating body as outlined under **ISSUE 1.**

Action: The City and County should evaluate the use of bond issues to finance speculative extension of utility lines.

Action: Develop a method of packaging utility services so that they are included in the price of project land. This simplifies recruiters marketing efforts.

ISSUE 5: DRINKING WATER QUALITY

New federal regulations are being developed which will require utilities to meet more stringent standards for water quality. This issue has two elements: 1) the quality of the "raw" water supply from local sources, and 2) the expense of new treatment technology required under the legislation.

Goal

Ensure that all Knox County and Knoxville residents have drinking water which meets all standards and regulations while minimizing costs to the utilities.

Objective: Maintain a high quality drinking water supply for Knox County.

Strategic Component:

Policy: Monitor and limit point source pollution discharges upstream from all public water system intakes.

Policy: Reduce and control non-point source pollution, the source of 80 percent of the pollutants in Knox County streams. (This topic is discussed in greater detail in MPC's **Environmental Issues Facing Knoxville and Knox County in the 1990s**).

Action: Identify all illegal point source discharges near public water system intakes.

Action: Create standards based on size and type of streams for vegetation strips to filter out non-point source pollution before it enters the streams.

Action: Investigate methods to finance necessary improvements for public wastewater treatment plants. This should be done as a cooperative venture between the Department of Health, East Tennessee Development District, utility districts, and local governments.

ISSUE 6: POWER QUALITY AND RELIABILITY

Some high technology firms have complained that power reliability and quality is poor in west Knox County. This is a major problem for companies which use high-powered computers in their daily operations. Thus, potential employers might choose communities with more reliable electricity supplies. On the other hand, utility district policies state that for services beyond normal requirements, it is the responsibility of the user to meet that user's specific additional needs.

Goal

Ensure that all Knox County residents and industries have access to reliable and high quality electric power.

Objective 1: Ensure that critical electricity users have reliable, continuous power supplies.

Strategic Component:

Action: Examine alternative power distribution systems which help ensure uninterrupted power supplies.

Action: Identify and upgrade any distribution system deficiencies.

Objective 2: Help the customers identify the means to meet special power quality needs.

Strategic Component:

Action: Publicize the availability of equipment which can "purify" average quality electricity to meet special needs.

Action: Investigate the possibility for installing "special quality" power lines where the user is willing to pay the costs.

Action: Examine the potential for supplying special development areas with higher quality power (at cost).

ISSUE 7: COOPERATION AMONG UTILITY DISTRICTS

There are seven utility districts which provide service to Knox County residents. The County Executive has directed the utility districts to study utility district consolidation. Benefits might include elimination of duplicated facilities, economies of scale, better information sharing and planning, and improved industrial recruitment.

Goal

Operate an efficient, effective, and environmentally sound system of utility services.

Objective: Identify the choices facing the community to improve coordination of utility services.

Strategic Component:

Policy: Each drainage basin should have one utility agency provide both water and sewer services wherever possible.

Policy: Careful consideration should be given to all methods of improving the coordination of utility services, including consolidation and formalized working groups.

Action: Utilities should complete the study authorized by the County Executive on the potential for utility consolidation.

APPENDIX

Calculating Public Water Demand

Formula 1: Calculation of average residential demand

gal. of water used per capita	**X**	number of people per dwelling	**X**	number of dwellings

Similarly, commercial water needs can be projected by using Formula 2.

Formula 2: Calculation of average commercial demand

gal. of water per capita or per unit business	**X**	number of people or units per business	**X**	number of businesses

Formula 3: Calculation of average industrial demand

gal. per unit of product	**X**	number of units produced	**X**	number of industries

To project **peak demand**, replace the average per capita water demand with peak figures. Municipal Technical Advisory Service (MTAS) standards suggest utilities provide 150 percent of peak demand to meet emergency demand.

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This report is one in a series of technical reports. Each report details issues of concern to residents within Knox County. Reports are as follows:

Economic Development
Environment
Parks and Recreation
Education
Law Enforcement
Fire Protection/EMS
Urban Design
Food, Health, and Social Services
Utility Services
Housing

Separate summary reports of each of the above are also available at MPC in the City-County Building. For more information, please contact the MPC Library at 521-2500.

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