INTERIM REPORT Office Copy ENGINEERING/FINANCIAL

FT. LUPTON, COLORADO

PLAN FOR WASTEWATER TREATMENT WORKS

Water Quality Management Plan

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
LOVELAND, COLORADO

PREPARED BY BRISCOE, MAPHIS, MURRAY & LAMONT, INC.
BOULDER, COLORADO
AND TOUPS CORPORATION
LOVELAND, COLORADO MAY, 1977

7

208 AREAWIDE WATER QUALITY MANAGEMENT PLAN

TECHNICAL PLANNING REPORT
WASTEWATER TREATMENT WORKS
FORT LUPTON, COLORADO

Prepared For:

Larimer-Weld Regional
Council of Governments

201 East Fourth Street
Loveland, Colorado 80537

F. A. Eidsness, Jr., 208 Program Director
Terrence L. Trembly, Assistant Director

Technical Planning By:

W. Tom Pitts, P.E., Project Director
W. R. Everest, P.E., Project Manager

TOUPS CORPORATION
Loveland, Colorado

Financial Planning By:

James Murray, Ph.D.
E. W. Lewan, P.E.

BRISCOE, MAPHIS, MURRAY, AND LAMONT, INC.
Boulder, Colorado

May 1977

The preparation of this report was financed in part through a Water Quality Management Technical Assistance Planning Grant from the Environmental Protection Agency under the provisions of Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500).

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES CONT.

LIST OF FIGURES

1.0 SUMMARY AND RECOMMENDATIONS

1.1 TECHNICAL PLANNING SUMMARY

The wastewater treatment facilities of the City of Fort Lupton are both hydraulically and biologically overloaded. As a result, the effluent from the plant frequently is not in compliance with limitations stipulated in the NPDES permit. Further, there is a partial connection ban on the sewerage system as a result of these problems.

In this Technical Plan, wastewater treatment and disposal options available to the city have been reanalyzed. It is recommended that the city proceed with implementation of the following components of the overall project:

- Upgrading and expansion of the treatment facilities utilizing aerated lagoons and polishing ponds;
- Improvements to the existing influent pumping station;
- Reclaimed water distribution facilities for irrigation of the proposed community park;
- Facilities to overcome collection system deficiencies.

Total estimated project costs for the above components are approximately $510,000. Future costs for expansion of the sewage collection system amount to an additional $250,000. Considering grant contributions from the State of Colorado, local costs for the present program are approximately $385,000.

Construction of a reclaimed water distribution system is a very cost-effective plan for irrigation of the proposed community park adjacent to the treatment plant. Implementation of such a program is not hindered by either water rights or water quality factors.

1.2 FINANCIAL PLANNING SUMMARY

Fort Lupton's financial condition is relatively strong, but in light of other needs, the Town does not appear capable of paying the entire cost of $385,000 to $510,000 for sewer system improvements. Outside financial assistance will be necessary.

Problems that will arise as the Town attempts to garner the necessary financing for its wastewater system will demand much attention from the existing residents. However, care should be exercised not to overlook the broader problem at

hand which is how a growing wastewater system should be managed in the best long-run interests of the citizens. Management policies regarding the utility service area, extensions, and utility operations are equally as important, and closely related to, financial policies on new hookup and service charges. Policies in these areas should be discussed early to gain citizen understanding and to set the stage for the purely financial decisions. To assist in these areas, the Town should obtain a copy of the Utility Management Handbook (1977) available from the LWRCOG.

The most critical financial variable for financing the expansion is the requirement that may be placed on the Town to increase its local effort by raising the annual user charge. Even if an increase is not necessary to obtain grant funds, some rate hike will probably be required simply in order to maintain the expanded system and to retire existing debt. Although plant investment fee (PIF) revenue might be used to meet some of these costs, the result could be that funds would not be available to finance future expansion or modernization to serve new growth.

At a rate level of approximately $82, and assuming no growth, the Town should not have difficulty in affording the system operating costs. If recent growth continues, this cost per tap will decline as more users share these costs.

Thus, the Town's major concern will be in locating sources to assist with a share of the $385,000 to $510,000 in capital costs. The financial analysis suggests that no more than $300,000 should be borrowed by the Town, and even so annual charges of $120 would be required. This could be somewhat less if rapid growth continues, though eventually additional investment in plant will be necessary.

Of utmost importance is that Fort Lupton is sure of its residents' acceptance of an upgraded system, and their understanding of, and willingness to bear the associated costs. If there is agreement to proceed, the management policies should be discussed and sources for outside financial assistance contacted.

2.0 INTRODUCTION

2.1 AREAWIDE WATER QUALITY MANAGEMENT PLANNING PROCESS

This Technical Planning Report has been prepared as part of an overall Areawide Water Quality Management Plan (208) for the Larimer-Weld region being developed by Toups Corporation and Briscoe, Maphis, Murray, and Lamont, Inc., for the Larimer-Weld Regional Council of Governments (LWRCOG). The purpose of the Technical Planning component of the 208 plan is to assist the various communities in the Larimer-Weld region in solving particular wastewater management problems by developing the best alternative project for waste treatment and disposal.

This Technical Planning Report has been prepared to provide near-term guidance for the City of Fort Lupton. This report (along with appropriate modifications) will be incorporated into the LWRCOG Areawide Waste Treatment Management Plan following review and approval by all governmental agencies involved.

2.2 PURPOSE AND SCOPE OF TECHNICAL PLAN

The wastewater treatment facilities of the City of Fort Lupton are both hydraulically and biologically overloaded. As a result, the effluent from the plant frequently is not in compliance with limitations stipulated in the NPDES permit. That permit also limits additional sewerage system connections to an average of 20 per year, and not to exceed 25 in any one year, until adequate system capacity is provided.

2.2.1 Purpose

The purpose of this Technical Plan is to reanalyze all wastewater treatment and disposal options available to the City of Fort Lupton, recommend the best alternative project, and be assured that the city's wastewater problems will be solved in a cost-effective manner.

2.2.2 Scope

The scope of this Technical Plan includes the following phases:

- Describe the planning area characteristics;
- Determine wastewater characteristics;
- Analyze waste treatment and discharge requirements;
- Analyze existing facilities;

- Develop, analyze, and screen alternative plans;
- Prepare a detailed description of the best alternative project, including engineering, financial, and institutional programs;
- Prepare a Technical Planning Report presenting all data, and outlining a wastewater management program for the 20-year planning period.
- Assessment of current financial capabilities;
- Development of a procedure for establishing a financial program;
- Analysis of the ability (and risks involved) in financing the proposed wastewater treatment program.

3.0 PLANNING AREA CHARACTERISTICS

The City of Fort Lupton is located in the southern part of Weld County approximately twenty miles northeast of Denver at the intersection of U.S. Highway 85 and State Highway 52. The South Platte River flows immediately to the west of the town. Fort Lupton was originally founded in 1846 as a fur trading post and was incorporated in 1890. From its time of incorporation until the late 1940's, Fort Lupton served as a major agricultural service center and agricultural manufacturing area. However, the national decline of agricultural business and the trend towards larger farms caused a decline in Fort Lupton's economy. Today, Fort Lupton is primarily a residential community supplying housing opportunities to people working in the Denver, Boulder, Longmont, and Greeley areas. However, there is still limited industrial and commercial activity within the city, and there is excellent potential for further light industrial development. The location and present city boundary of Fort Lupton is shown on Figure 3.0-A, together with the location of the existing wastewater treatment facilities.

3.1 EXISTING AND PROJECTED POPULATION

The population of Fort Lupton at the time of the 1970 Census was 2,489 people. The present population in the city is estimated to be approximately 3,500. Due to its proximity to Denver, the population projections for Fort Lupton vary significantly. Table 3.1-A shows various projections previously developed for the city. [South Platte River Basin 303 Plan, Regional Planning Commission, NHPQ]. Also shown is the estimated future population if the city attracts the same percentage of growth that occurred in the Larimer-Weld region as it did during 1970-1975 (projected percentage rate). All these projections are also shown graphically on Figure 3.1-A.

Population projections for Fort Lupton that are used in this report are:

1983 ------- 5,000

2000 ------- 9,000

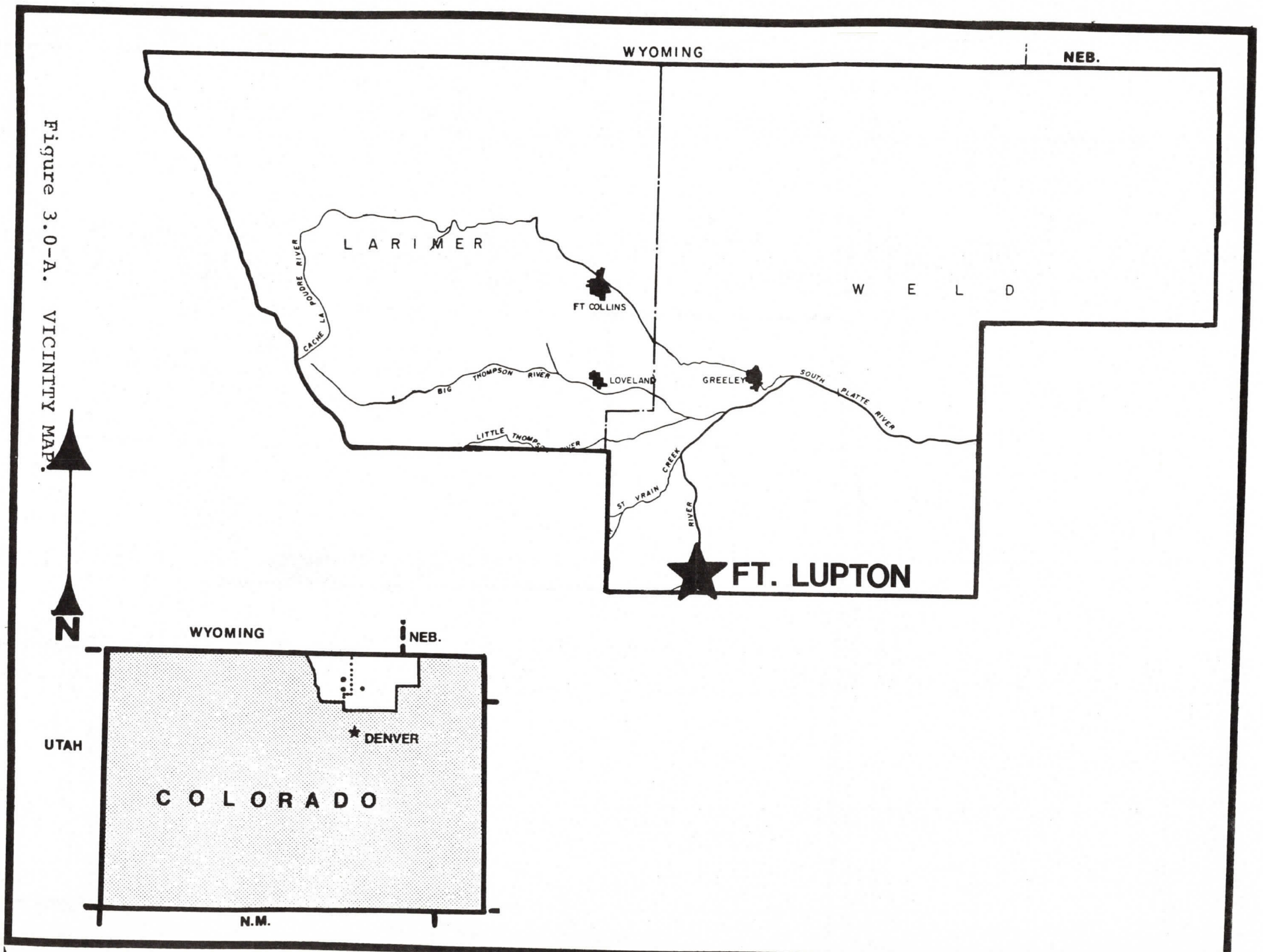

Figure 3.0-A. VICINITY MAP.

LOCATION MAP - LARIMER-WELD REGION

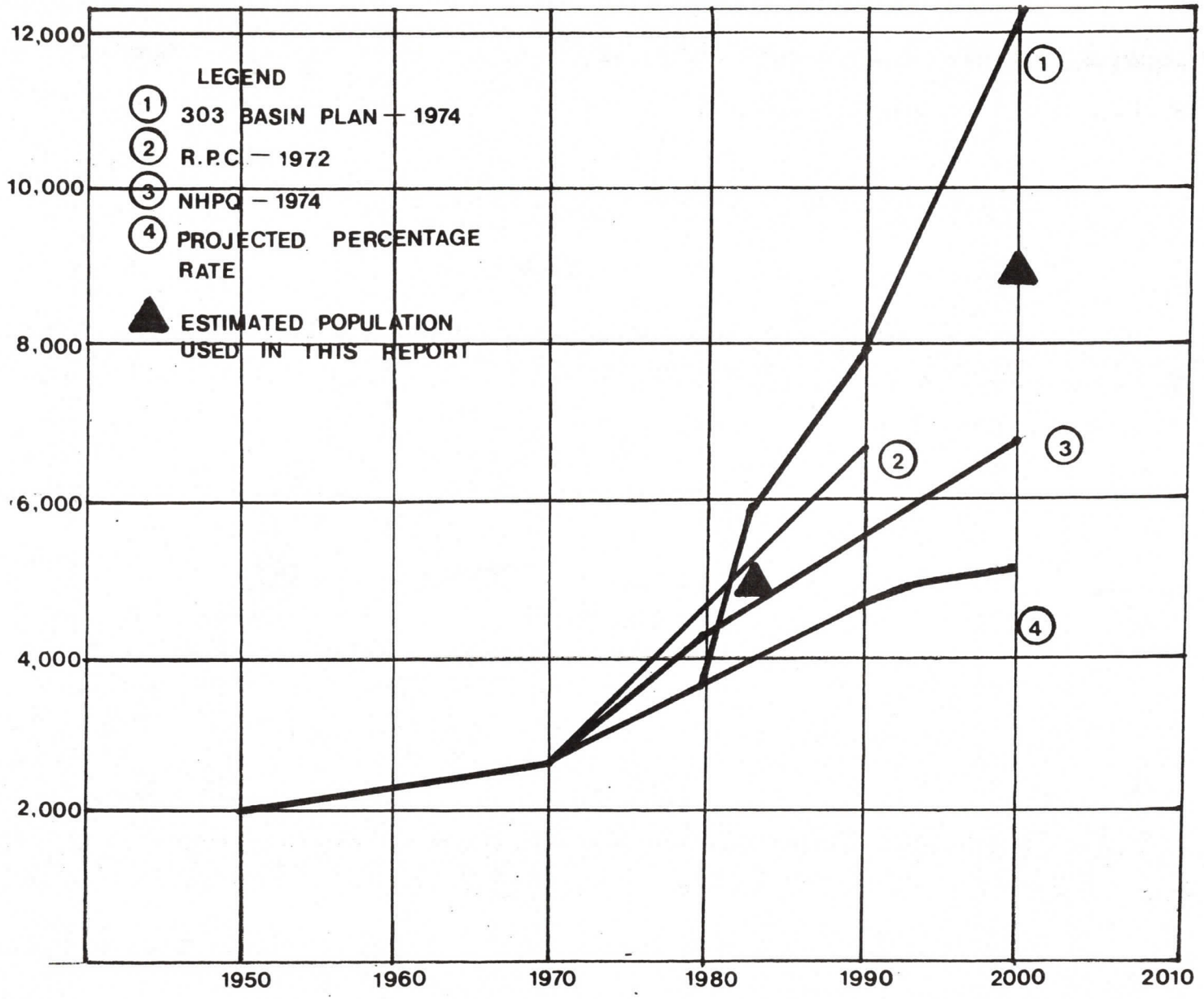

FIG. 3.1-A - POPULATION PROJECTIONS - CITY OF FORT LUPTON

TABLE 3.1-A. POPULATION PROJECTIONS - CITY OF FORT LUPTON

DATA SOURCE	ESTIMATED POPULATION						
	1950	1960	1970	1980	1983	1990	2000
U.S. Bureau of the Census	1907	2194	2489	--	--	--	--
South Platte River Basin 303 Plan - 1974				3750	5800	7700	12,200
Regional Planning Commission Study - 1972				4500	5100	6500	--
NHPQ - 1974				4200	4560	5400	6700
Projected Percentage Rate				3500	4000	4600	5000
Estimated Population Used in this Report					5000		9000

3.2 INDUSTRIAL DEVELOPMENT

The City of Fort Lupton provides wastewater treatment service to the Fort Lupton Canning Company (FLCC). Proposals for other industrial development have been considered by the city. For planning purposes, it is estimated that the level of industrial activity at FLCC will increase at the same rate as the projected municipal growth. Because no other significant industrial development is presently being finalized, no industrial wastewater other than from FLCC is considered in this report. The impact of any future such development on the city sewerage facilities should be evaluated in detail as part of a city analysis of such development.

FLCC processes peas and green or waxed beans from mid-June to mid-September each year. Sauerkraut is also batch-processed at various times throughout the year. Recent production data for FLCC is presented in Table 3.2-A.

TABLE 3.2-A. FORT LUPTON CANNING COMPANY PRODUCTION

COMMODITY	AVERAGE CASES/SEASON (a)	CASES/ DAY (b)	PERCENT OF AVERAGE PACK
Beans	271,000	4,500	78
Peas	66,000	1,100	18
Sauerkraut	25,000	400	7
TOTAL	362,000	6,000	100

(a) Source: Mr. Ben Counter, FLCC.

(b) Based on 60 canning days per season.

3.3 FINANCIAL CAPABILITIES

The financial capabilities of the City of Fort Lupton were analyzed by Briscoe, Maphis, Murray and Lamont, Institutional/Financial consultants to the LWRCOG. This portion of the Technical Plan is presented in Chapter 10.0.

4.0 WASTEWATER CHARACTERISTICS

The characteristics of Fort Lupton wastewater will be estimated based on historical data, results of a regional wastewater quality sampling program recently conducted by Toups Corporaion, and on recommended design criteria published by the Colorado Department of Health (CDH). Wasteload projections will be developed based on waste characteristics and population projections.

4.1 MUNICIPAL WASTEWATER CHARACTERISTICS

In analyzing wastewater characteristics, it is necessary to investigate components affecting both the amount of wastewater and its strength and composition.

4.1.1 Flow

Unit average municipal wastewater flows for Fort Lupton were previously determined as 133 gallons per capita per day (gcd) [NHPQ-1974]. This value indicates that some inflow or infiltration (I/I) is probably entering the Fort Lupton sewerage system. However, it has been concluded that existing I/I is not "excessive" [NHPQ-1974]. This means that it is more economical to continue to treat and dispose of I/I entering the system than to physically rehabilitate the system to eliminate the I/I flows at the source (i.e., breaks in pipelines, dislocated manholes, roof drain connections, etc.).

It is assumed that future development in the city will be served by well designed and constructed sewer systems. For projected flows, a unit average flow of 100 gallons per capita per day (gcd) is a realistic value for design purposes and will be utilized in this report. This value represents typical domestic waste, including residential and normal commercial contributions, together with infiltration/inflow (I/I) expected from even well designed and constructed sewerage systems. Peak flow will be calculated based on data presented in the 303 Basin Plan [Toups-1974]. Based on recent flow measurements conducted by the city, existing municipal flows are about 0.45 mgd. Average municipal wastewater flow is projected to be 0.60 mgd in 1983 and 1.0 mgd in the year 2000.

Unit industrial wastewater flow amounts to 33 gallons per case processed.

Industrial wastewater from the FLCC is estimated to increase from the present .20 mgd average flow to .28 mgd in 1983 and .46 mgd in 2000. Projected municipal and industrial wastewater flows are shown graphically in Figure 4.1.1-A for average and peak conditions.

4.1.2 Composition

Wastewater strength is generally measured in terms of biochemical oxygen demand (BOD_5) and suspended solids (SS). Evaluation of other constituents such as chemical oxygen demand (COD), ammonia (NH_3), temperature and pH are necessary in particular situations.

As part of a sampling program conducted in the Technical Planning component of the LWRCOG 208 Plan, samples of influent and effluent wastewater were collected from the Fort Lupton treatment facilities and analyzed for various constituents. The results of these analyses, together with a summary of historical wastewater composition data is shown in Table 4.1.2-A. Comparison of values for BOD, suspended solids, and fecal coliforms with limitations in the existing Fort Lupton NPDES permit (Appendix B) indicates that the existing facilities must be upgraded to meet State and Federal requirements.

A knowledge of chemical parameters is essential for determining the potential for wastewater reuse, which will be evaluated in a later section. Table 4.1.2-B shows the quality of the Fort Lupton water supply and wastewater in terms of various chemical constituents.

Existing municipal wastewater has a BOD_5 of approximately 190 mg/l, and a SS of 130 mg/l. Based on the existing unit flow of 133 gcd, the unit strength is 0.21 pounds per capita per day (pcd) and 0.145 pcd SS. Assuming that future residential construction will characteristically include garbage grinders, projected SS composition will be greater than present levels. A projected unit SS of 0.18 pcd is appropriate for design purposes.

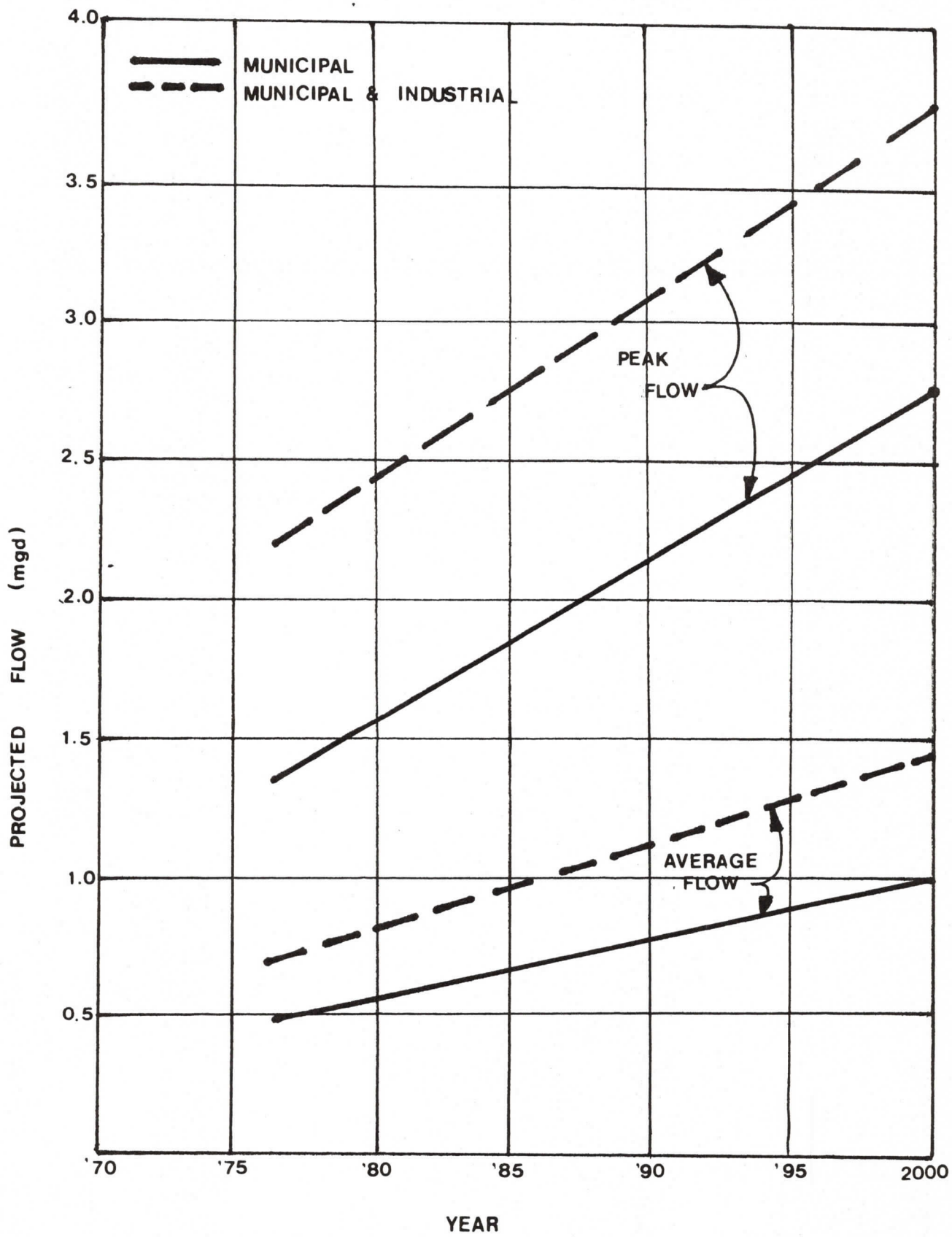

FIG. 4.1.1-A - PROJECTED WASTEWATER FLOWS

TABLE 4.1.2-A

WASTEWATER CHARACTERISTICS - FORT LUPTON (a)

CONSTITUENT (a)	SAMPLING PROGRAM RESULTS (b)		HISTORICAL EFFLUENT DATA (e)
	INFLUENT (c)	EFFLUENT (d)	
BOD_5 (unfiltered)	na	23	39
BOD_5 (soluble)	190	19	na (f)
COD	360	132	na
Suspended Solids	94	92	66 (g)
Fecal Coliform (MPN/100 ml)	na	6100	15,900
Ammonia	10.0	1.2	6.6
Nitrate	na	0.01	na
Phosphate	na	2.6	na
Sulfate	na	304	na
Sodium	na	337	na
Total Alkalinity	na	286	na
TDS	1512	1364	na
pH	7.8	8.6	8.4
Temperacture (°C)	25	19	Varies
D.O.	na	6.2	9.0
Elect. Cond. (umho/cm)	na	1840	na
Chlorine Residual	na	0	na

(a) mg/l unless otherwise indicated

(b) Grab samples collected on 9-3-76 & 9-9-76; analysis by M&I

(c) Influent to lift station

(d) Discharge from south lagoon

(e) Average of 30 samples from north and south lagoons

(f) Influent = 186 mg/l

(g) Effluent = 128 mg/l

na = Data not available

TABLE 4.1.2-B

CHEMICAL CHARACTERISTICS OF WATER SUPPLY AND WASTEWATER

CONSTITUENT	WATER SUPPLY (a)	PROJECTED WASTEWATER (b)	ACTUAL WASTEWATER (c)
CATIONS			
Calcium (Ca)	357	380	na
Magnesium (Mg)	40	60	na
Sodium (Na)	185	250	337
ANIONS			
Sulfate (SOu)	372	400	304
Nitrate (NO_3)	59	60	.01
Phosphate (PO_4)	0.40	10	2.6 (P as P)
Chloride (Cl)	157	230	na
Boron	0.1	0.5	na
Fluoride	1.4	2.1	na
Total Hardness	521	650	na
Total Dissolved Solids (TDS)	1249	1550	1512
Electrical Conductivity (umho/cm)	1650	2050	2000 (d)
Silica	21	na	na
Total Alkalinity	316	na	286
Iron	0.10	na	na

na = Data not available

(a) Average of 6 wells sampled on 5-6-75

(b) Based on normal increment from domestic use

(c) Sampled 9-3-76 and 9-9-76

(d) Adjusted

A literature search was conducted to determine the best estimate of industrial wastewater composition for the FLCC. Based on an evaluation of numerous references [Rudolfs-1953; Eckenfelder-1967; Nemerow-1971; EPA-197,1975], and considering the unit water use at the cannery, the values shown in Table 4.1.2-C are appropriate for FLCC industrial wastewater.

TABLE 4.1.2-C. ESTIMATED WASTEWATER CHARACTERISTICS - FORT LUPTON CANNING COMPANY

COMMODITY	BOD (a) (mg/l)	SS (a) (mg/l)
Beans	430	120
Peas	650	360
Sauerkraut	1500	60
Average Pack (b)	450	150

(a) Based on water use of 33 gallons/case.
(b) Based on pro-rated pack of beans and peas only.

4.1.3 Design Factors

A summary of unit design factors for sizing various components of the wastewater system is presented in Table 4.1.3-A.

TABLE 4.1.3-A. UNIT DESIGN FACTORS

ITEM	FACTOR	
	EXISTING	FUTURE
Wastewater Flow		
Municipal flow		
Average flow (gcd)	133	100(a)
Peak flow (% of average)	(b)	(b)
Industrial flow (c)		
Average flow (gal/case)	33	33
Peak flow (% of average)	(b)	(b)
Wastewater Composition		
Municipal flow		
BOD_5 (pcd)	.21	.21
SS (pcd)	.145	.18
Industrial flow (c)		
BOD_5 (mg/l)	450	450
SS (mg/l)	150	150

gcd = gallons per capita per day
pcd = pounds per capita per day
(a) Includes minimum I/I contributions
(b) See Figure 4.1.1-A
(c) Fort Lupton Canning Company

4.2 WASTELOAD PROJECTIONS

Wasteload projections have been developed by applying the unit design factors shown in Table 4.1.3-A to the projected population shown in Table 3.1-A, and projected production at FLCC.

Table 4.2-A presents a compilation of municipal wastewater loadings in terms of flow, BOD and SS for various future periods. Corresponding data for industrial wastewater from FLCC is shown in Table 4.2-B. A summary of all projected wastewater loads is documented in Table 4.2-C. Total municipal and industrial flows increase to approximately 1.5 mgd in the year 2000. Total BOD load is about 3600 pounds per day, with approximately equal contributions from municipal and industrial sources. Total SS load is about 2000 pounds per day.

TABLE 4.2-A

MUNICIPAL WASTEWATER LOADINGS

	AVERAGE DRY WEATHER FLOW (ADWF)		BOD_5		SUSPENDED SOLIDS	
	UNIT (gcd)	TOTAL (mgd)	CONCENTRATION (mg/l) (c)	LOADING (#/day)	CONCENTRATION (mg/l)	LOADING (#/day)
1976	133	.45	190	750	130 (d)	500
1976-1983	100 (a)	.15	250	350	200 (e)	280
Subtotal - 1983	122 (b)	.60	215	1100	155	800
1983-2000	100 (a)	.40	250	850	200	650
Total - 2000	112 (b)	1.00	230	1950	170	1450

gcd = gallons per capita per day
mg/l = milligrams per liter
pcd = pounds per capita per day

(a) Lower because of reduced I/I as a result of future sewer system integrity
(b) Assumes existing I/I is not excessive
(c) Based on a unit load = 0.21 pcd
(d) Based on a unit load = 0.145 pcd
(e) Based on a future unit load = 0.18 pcd

TABLE 4.2-B

INDUSTRIAL WASTEWATER LOADING - FORT LUPTON CANNING COMPANY

	AVERAGE DRY WEATHER FLOW (ADWF) (mgd) (a)	LOADING		
		BOD_5 (#/day) (b)	SS (E/day) (c)	PE (d)
1976	.20	750	250	3500
1983	.28	1050	350	5000
2000	.46	1700	600	8000

(a) Mid-June through mid-September only
(b) Based on a concentration of 450 mg/l
(c) Based on a concentration of 150 mg/l
(d) Population equivalent, based on BOD

TABLE 4.2-C

SUMMARY OF PROJECTED WASTEWATER LOADINGS

SOURCE	1983			2000		
	ADWF (mgd)	LOADING (#/day)		ADWF (mgd)	LOADING (#/day)	
		BOD_5	SS		BOD_5	SS
Municipal	.60	1100	800	1.00	1950	1450
Industrial (a)	.28	1050	350	.46	1700	600
Total (a)	.88	2150	1150	1.46	3650	2050

(a) Mid-June through mid-September only

5.0 DISCHARGE AND TREATMENT REQUIREMENTS

Wastewater must be disposed of in a manner which will protect the public health, maintain receiving water quality consistant with its beneficial uses, and prevent nuisance at the site of disposal. These conditions, along with economic considerations, determine the degree and type of wastewater treatment necessary prior to disposal or reuse. In this section, discharge standards are delineated, treatment requirements are outlined, an overview of alternative treatment processes are presented, and an evaluation of irrigation reuse potential is given.

5.1 WASTE DISCHARGE STANDARDS

Standards promulgated by the U.S. Environmental Protection Agency (EPA) and the Colorado Water Quality Control Commission (WQCC) for the discharge of wastes to receiving waters have been extensively discussed in the South Platte River Water Quality Management Plan [Toups-1974]. Current standards have been refined, and further changes are presently being proposed.

5.1.1 Existing Requirements

As a minimum, planning of publically-owned wastewater treatment facilities must provide for secondary treatment by 1977 or as soon as possible thereafter, and for application of Best Practicable Waste Treatment Technology (BPWTT) prior to 1983. The levels of BPWTT and various waste management techniques available to meet those levels have been defined [EPA-1975]. Secondary treatment and BPWTT requirements apply to discharges to all surface waters of the State. The WQCC has ruled that these standards also apply to discharges to privately-owned irrigation supply waters. More stringent standards apply to discharges to water quality limited segments of State receiving waters; however, no such segments are located in the vicinity of the City of Fort Lupton. Current EPA secondary treatment requirements as promulgated under the Federal Water Pollution Control Act Amendments (PL 92-500), together with current standards of the Colorado WQCC, have been incorporated into the NPDES permit for the City of Fort Lupton (Appendix B), and are summarized in Table 5.1.1-A.

TABLE 5.1.1-A. CURRENT WASTE DISCHARGE REQUIREMENTS

PARAMETER	FEDERAL PL 92-500		STATE WQCC		
	30-DAY AVERAGE	7-DAY AVERAGE	30-DAY AVERAGE	7-DAY AVERAGE	SINGLE SAMPLE
BOD_5 (mg/l)	30(a)	45	ns	ns	ns
SS (mg/l)	30(a,d)	45(d)	ns	ns	ns
pH	ns	ns	ns	ns	(b)
Total Residual Chlorine (mg/l)	ns	ns	ns	ns	0.5
Fecal Coliform (MPN/100 ml)	ns	ns	6,000	12,000	ns
Oil and Grease (mg/l)	ns	ns	ns	ns	10(c)

ns = none specified
(a) Shall not exceed 15 percent of 30-day average influent concentration.
(b) Within the limits of 6.0 to 9.0 unless it can be demonstrated that: (1) inorganic chemicals are not added to the waste stream as part of the treatment process; and (2) contributions from industrial sources do not cause the pH to exceed the 6.0 to 9.0 limits (EPA requirements).
(c) Nor shall there be a visible sheen.
(d) Conditional relaxation of these standards now proposed by EPA for communities utilizing stabilization ponds systems with a design capacity of 1 mgd or less.

5.1.2 Proposed Requirements

EPA has recently proposed a relaxation of suspended solids limitations in discharge standards of communities which utilize stabilization pond systems. The proposed standards recognize the need to retain pond systems for many smaller communities because of their inherent economical and functional advantages. Adoption of the regulations would allow the EPA Regional Administrator or state agency to grant a variance with respect to suspended solids limitations of secondary treatment requirements defined in NPDES permits, providing the community can show that: (1) waste stabilization ponds are used as the process for secondary treatment; (2) the treatment facilities have a design capacity of 1 mgd or less; and (3) performance data indicates that the facilities cannot comply with present suspended solids limitations, even if properly operated, without the addition of treatment systems not historically considered as secondary treatment (i.e., filtration systems for algae removal).

Pond systems would still be required to meet an effluent quality achieveable by "best waste stabilization pond technology" (BWSPT). BWSPT is defined as a suspended solids value which is equal to the effluent concentration achieved 90 percent of the time within a state or appropriate contiguous geographical area, by waste stabilization ponds that are achieving the levels of effluent quality established for BOD (30/45 mg/l).

5.2 OVERVIEW OF ALTERNATIVE DISPOSAL OPTIONS

There are three general classes of disposal options available today: treatment and discharge, treatment and reuse (land treatment), and land disposal. The first two alternatives will be discussed in detail while the third--land disposal--will be discussed in general.

5.2.1 Treatment and Discharge

There are many methods of treating municipal wastewater to a quality at which it can be discharged. As indicated previously, the City of Fort Lupton is not situated on a water-quality limited receiving water segment. Therefore, discharge levels must only comply with secondary treatment and BPWTT requirements of EPA. A thorough analysis of the numerous treatment processes available to meet these standards is presented in a later section of this report.

5.2.2 Treatment and Reuse

Four factors prerequisite to wastewater reclamation for reuse of treated wastewater are: 1) the availability of a wastewater reuser (industry or irrigation operation located in close proximity to source of reclaimed water); 2) storage facilities or alternate disposal site for wastewater during periods of non-reuse; 3) capability of producing reclaimed water of required quality; and 4) legal ownership of the wastewater by the municipality.

The State of Colorado currently does not have water quality standards for reuse of wastewater for irrigation purposes. Assuming that the applicable standards will be no less stringent than the existing recommended Federal standards, it will be necessary for the plant to produce secondary effluent. Since this standard is identical with the quality requirements for discharge, no additional treatment facilities would be required for irrigation reuse than if the water were discharged directly to a receiving water. An exemption is probable higher levels of disinfection to insure the protection of public health at the reuse site. An identical discharge standard also eliminates the requirement for effluent storage during non-irrigation periods. If it is desired to maximize the amount of wastewater reuse, a reservoir would be required for seasonal storage of reclaimed water. This alternative will be further discussed later in the report.

5.2.3 Land Disposal

Percolation of wastewater through the soil provides additional treatment of the applied wastewater. Suspended solids, bacteria, BOD and phosphorous are all effectively removed by filtering and straining action of the soil [EPA-1975]. Nitrogen removal, however, is poor. In addition, EPA requirements for secondary treatment do not apply to this alternative. However, to control such things as odors, prudent engineering judgment requires that, as a minimum, secondary treatment as defined by EPA be achieved prior to land disposal.

If a crop is grown in conjunction with a land disposal operation, the project is effectively one of agricultural reuse. The factors which affect the cost of such a system most directly is the area of land required for the design flowrate of the community. Both the size of the application equipment and the land capital costs are directly related to the required area which is determined by the allowable hydraulic loading rate. The allowable hydraulic loading rate for a high-rate irrigation process is dependent only upon the soils' capacity for transmitting water and not on crop irrigation requirements. The maximum hydraulic loading rate is the sum of soil moisture depletion plus the quantity which can be transmitted through the root zone. The soil moisture depletion for the local climatic conditions is approximately 12 inches for the season while the soil transmission rate can range between 10 and 600 inches per year depending on soil type and surficial geology. Total hydraulic loading rates can therefore range between 22 and 612 inches per year which correspond to area requirements of 610 acres/million gallons and 20 acres/million gallons, respectively.

The suspended solids concentration of the water also affects the hydraulic loading rate by clogging the soil. The rates discussed above must be considered maximum. There is also a "buffer area" requirement which increases the necessary amount of land.

5.3 POTENTIAL FOR WASTEWATER RECLAMATION

Analysis indicates that irrigation is essentially the only potential method of reclamation within the Fort Lupton area. Wastewater from the city treatment facility is indirectly reuse for agricultural irrigation through downstream diversions. The City of Fort Lupton is also planning a large community park immediately south of the treatment plant. It appears that irrigation of this park with reclaimed water would be very cost-effective.

Additionally, agricultural interests in the general vicinity of the city plant may find it to their advantage to consider irrigation with reclaimed water. One restraint on any wastewater reclamation project in Colorado, and particularly Fort Lupton, is the impact of such a program on water rights. This will be discussed in more detail in a later section of the report.

5.3.1 Potential Irrigation Demand

Irrigation of landscape or agriculture with reclaimed water must consider both the annual and seasonal irrigation requirements of the area. As indicated on Figure 5.3.1-A, irrigation use is highly seasonal, with monthly rates varying from 0 to 350 percent of yearly average. In Fort Lupton, this is partially compensated by the fact that additional reclaimed water is available during the irrigation season because of industrial wastewater from FLCC.

Irrigation requirements for landscape irrigation (i.e., Fort Lupton community park), and overall agricultural irrigation are based on a unit factor of 19 inches per year (1.6 acre-feet/gross acre/year). Considering these rates and seasonal variations, there is sufficient wastewater production at the city treatment facility to irrigate all 65 acres of the proposed community park without the need of providing seasonal storage. Maximum daily reclaimed water demand would approximate 500 gpm to irrigate the 65-acre park. With increasing flows, and provisions for reclaimed water storage to meet peak irrigation demands, additional area could be irrigated with city reclaimed water. This is demonstrated by Figure 5.3.1-B.

5.3.2 Quality Requirements for Reuse

Probably the most important consideration in evaluating the reuse potential of wastewater for irrigation is the quality requirements for the irrigation water. Quality requirements are determined by bacteriological regulations for wastewater reclamation, plus evaluation of the possible adverse effects on the irrigated crop by individual constituents contained in the water. The specification of non-injurious chemical constituent concentrations is a difficult and involved task requiring an extensive review and evaluation of available literature and other data prepared and compiled by numerous agronomists.

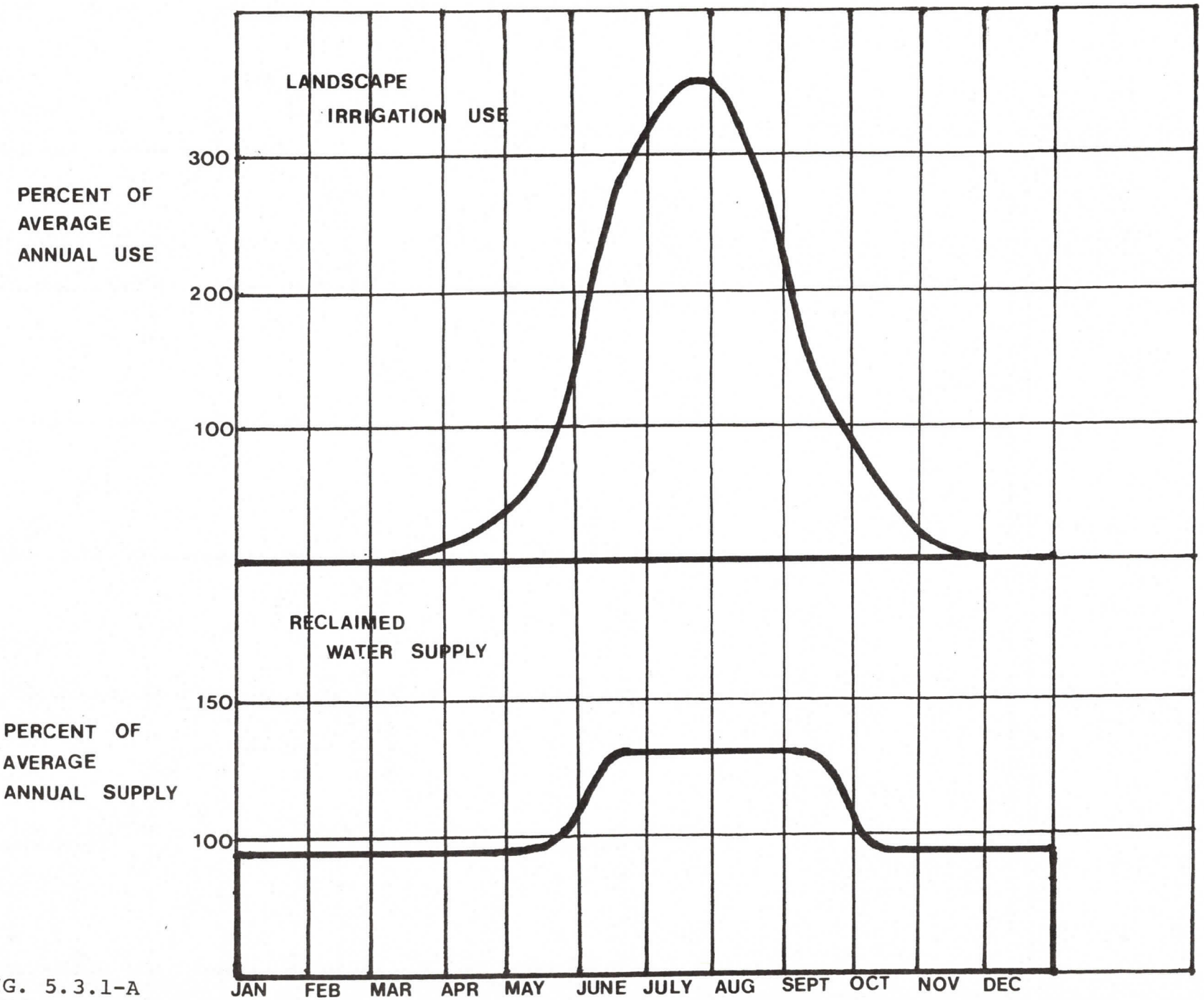

FIG. 5.3.1-A

SEASONAL VARIATIONS OF IRRIGATION USE AND RECLAIMED WATER SUPPLY

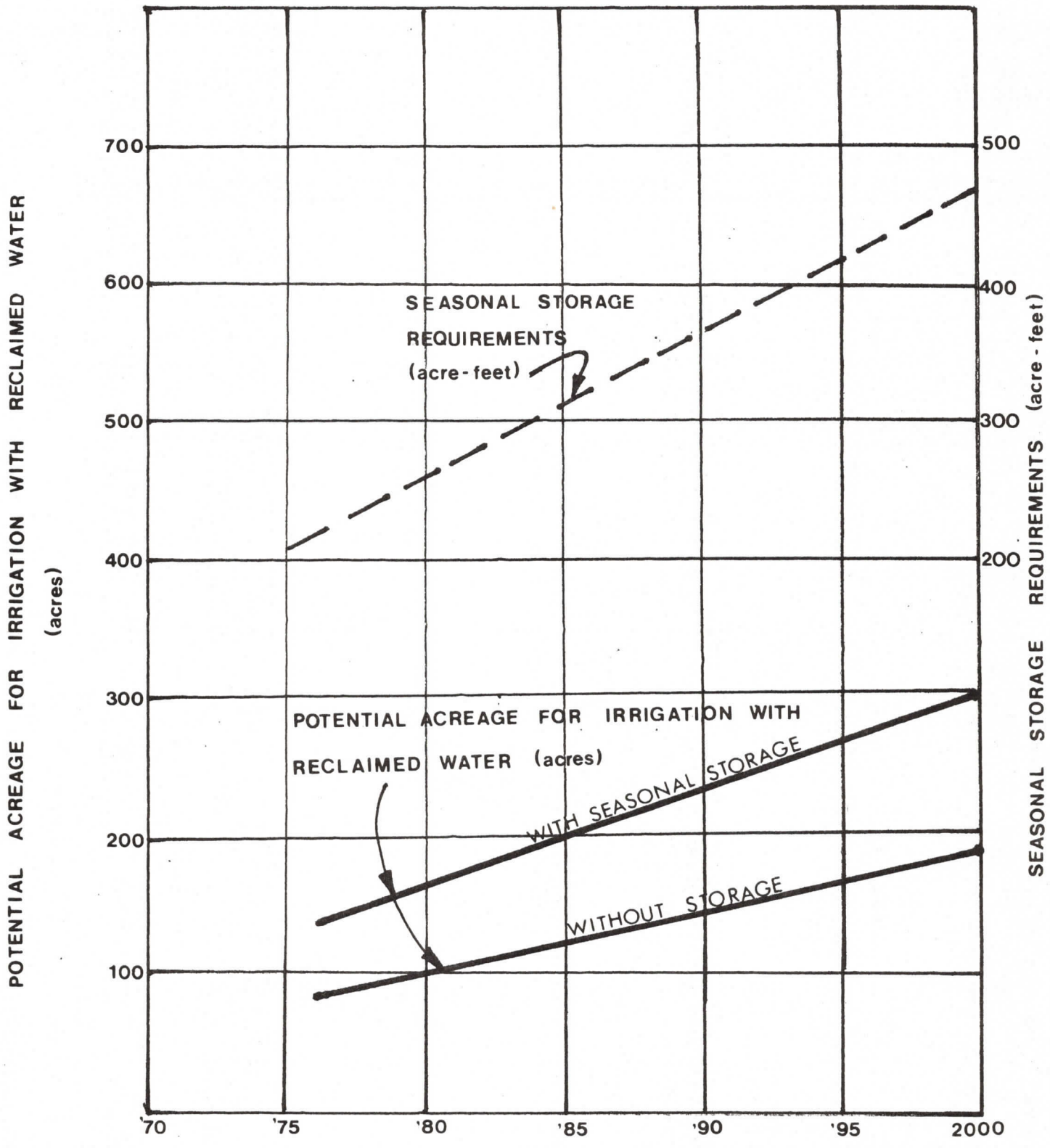

FIG. 5.3.1-B **IRRIGATION REUSE POTENTIAL**

5.3.2.1 Public Health Guidelines

Additional precautions are necessary in a reuse program for the protection of public health. Such precautions have been documented as guidelines issued by the California Department of Health. Particular specific documents are of interest to the Fort Lupton project:

- Guidelines for Use of Reclaimed Water for Landscape Irrigation
- Guidelines for Use of Reclaimed Water for Surface Irrigation of Crops
- Guidelines for Worker Protection at Water Reclamation Use Areas

These guidelines are reproduced in entirety in Appendix C. In addition to general guidelines concerning pipeline coding, on-site water control and use of reclaimed wastewater, the guidelines address such factors as protection from cross-connections, prevention of unauthorized public use, identification tags, minimized exposure of drinking fountains and picnic tables, public notification of the reclamation operation, and precautionary measures concerning employee contact with reclaimed wastewater.

5.3.2.2 Mineral Constituents

In considering the potential for reusing wastewater for irrigation, it is necessary to consider the effects of the specific chemical constituents of the water and their relation with the soil and with plant metabolism. Extensive studies have been conducted in efforts to determine specific acceptable water quality criteria for irrigation waters.

Probably the most encompassing attempt to determine water quality criteria for agriculture has been conducted by the University of California, Cooperative Extension, Committee of Consultants. The results of their analyses have been published in "Water Quality Guidelines for Interpretation of Water Quality for Agriculture". These guidelines are intended for use in estimating the potential hazards to crop production associated with long-term use of the particular water being evaluated.

These guidelines are used in developing the landscape irrigation water quality standards shown in Table 5.3.2-A. As shown in Table 5.3.2-A, existing wastewater at the Fort Lupton treatment facility is suitable for landscape irrigation.

TABLE 5.3.2-A. COMPARISON OF MINERAL WASTEWATER QUALITY WITH IRRIGATION WATER QUALITY CRITERIA

CONSTITUENT	EXISTING WASTEWATER QUALITY (a)	LANDSCAPE IRRIGATION CRITERIA (b)
Electrical Conductivity (umho/cm)	2000	2800
Total Dissolved Solids (mg/l)	1512	2000
Sodium	337	350

(a) See Table 4.1.2-B.

(b) Level at which crop yields will not be reduced--based on bluegrass.

5.3.3 Water Rights Implications

One alternative plan for Fort Lupton considers: 1) discharge to the alluvial groundwater basin during the irrigation season and, 2) pumping of irrigation water for park irrigation from a well located near the wastewater treatment plant. An investigation was conducted to insure that there will be no conflict with Colorado Water Rights Law by implementing this plan. There are three aspects of Water Rights Law which apply to the proposed plan:

1) Underground water found in alluvial aquifers is considered tributary to the stream.
2) Change of discharge location from year-round discharge to the underground basin constitutes a change in point of discharge during certain times of the year.
3) An existing well at the sewage treatment plant has already been adjudicated in the Water Court for Water Division I.

5.3.3.1 Tributary Groundwater

In 1969, the current law governing tributary water within the State of Colorado was passed. This act is known as the Water Rights Determination and Administration Act of 1969. This act states that "It is the policy of the State to integrate the appropriation, use, and administration of underground water tributary to a stream with the use of surface water in such a way as to maximize beneficial use of all waters of the state." This law recognized

that underground water in alluvial aquifers, such as those alluvial aquifers of the South Platte River from which Fort Lupton takes its water, are part of the flow of the South Platte River and that any impact on underground water is reflected in the flow of the river.

The Act also allowed for establishment of augmentation plans which were designed to enable maximum use of ground water throughout the state. The City of Fort Lupton is a subscriber to the augmentation plan operated by the Groundwater Appropriators of the South Platte, Inc. The recognition that underground water is part of the flow of the stream and the establishment of augmentation plans impact the recommended sewerage project as explained below.

5.3.3.2 Change in Point of Discharge

The recommended plan includes provisions for discharging to the South Platte River during the winter months, and discharging to the tributary groundwater basin during months in which irrigation water will be required for the proposed community park. No problem is anticipated with the change of point of discharge. One reason for this is that the 1969 Act recognized that tributary groundwater was in essence the same as the flow of the river. Therefore, discharging to groundwater is legally and technically the same as discharging to the flow of the South Platte River.

It has been a long-held principle in Colorado Water Law that a downstream appropriator may depend on stream conditions to remain the same as when he made his initial diversion. This principle has been rigidly applied in cases where a change in point of diversion has occurred to the detriment of downstream water users. However, it is not applied in cases where changes in point of return or discharge occur. In the 1972 case of "Metropolitan Denver Sewage vs. Farmers Reservoir and Irrigation Company", the Metropolitan Denver Sewage and Sanitary District completely cut off the reservoir company's decreed rights by changing its point of return to a location below the reservoir company's diversion. The Court ruled that while the water must be returned to the river by Denver, the rules governing points of return are not the same as those governing points of diversion. While the Court ruled that a change in point of return cannot be arbitrary or unreasonable, it found that the basis was economic feasibility and normal engineering selection. In this case, a change in point of discharge was reasonable. The same justification is provided for the recommended plan.

The implications of change in the point of discharge as explained above do not appear to impair the rights of any downstream water users and therefore no problem is anticipated as a result of the change in point of discharge.

5.3.3.3 Well Adjudication

The existing well located at the treatment plant has previously been adjudicated under Colorado Water Rights Law in the Water Court for Division I. This well, listed as Well No. 10-10030-F in that adjudication, has an appropriation date of March 24, 1966. The amount of water adjudicated is 2.66 cubic feet per second and the use of the water specified in the adjudication is for "municipal purposes".

The fact that this well has been adjudicated for municipal purposes further reduces any possibility of violation of Colorado Water Rights principles. In fact, even if the city were not discharging effluent to the groundwater, the city would have the right to use this well for any "municipal purpose", including irrigation of the park. Capacity of well pumping facilities proposed in this project will not exceed the present adjudicated amount of water use.

5.3.3.4 Discussion with Division Engineer

The points mentioned above were discussed with the Division Engineer for Division I, South Platte River Basin. He concurred with the results of the analysis.

5.3.3.5 Conclusions Regarding Water Rights

No problem is anticipated from a water rights standpoint by implementing the recommended plan for treatment, discharge and disposal of water by the City of Fort Lupton.

6.0 ANALYSIS OF EXISTING FACILITIES

This section will describe the existing City of Fort Lupton facilities, determine their capacity for future growth, and evaluate effluent quality.

6.1 FACILITIES DESCRIPTION

6.1.1 Collection System

The Fort Lupton wastewater collection system consists of approximately 11 miles of 8- through 15-inch sewers. Some sewers installed before 1950 were constructed with mortar joints; because of this, there probably is some infiltration/inflow entering the system. However, this has been determined to be not "excessive". Sewage collects at the main pumping station, and is transmitted across Highway 85 and the South Platte River to the treatment plant.

6.1.2 Treatment Facilities

The existing Fort Lupton treatment plant consists of two stabilization ponds of equal size, with a total area of 29 acres (Figure 6.1.2-A). The ponds are operated at a depth of 5 feet.

6.2 CAPACITY FOR FUTURE GROWTH

6.2.1 Collection System

Analysis of the main pumping station indicates that its maximum hydraulic capacity, with one standby pump, is approximately 5.0 mgd, which is less than the highest projected peak flow of 3.8 mgd. Therefore, the station has excess capacity for the future. However, a standby engine-generator set should be provided at the station so it will continue to operate during a power outage. As part of this upgrading project, the existing 8-inch highway crossing should be replaced with at least a 10-inch pipeline. Also, an additional pumping station and force will need to be constructed to serve future development occurring north of the main part of the city, and solve existing system deficiencies.

6.2.2 Treatment Facilities

For proper performance of facultative stabilization ponds such as those at Fort Lupton, they should be biologically loaded at no more than 35 pounds of BOD per day per acre during the summer, and 18 pounds BOD/day/acre during the winter. Based on existing loadings shown in Tables 4.2-A and B, approximately 40 acres of ponds should be provided to adequately treat existing flows. The plant is therefore severely overloaded, and has no capacity for future growth.

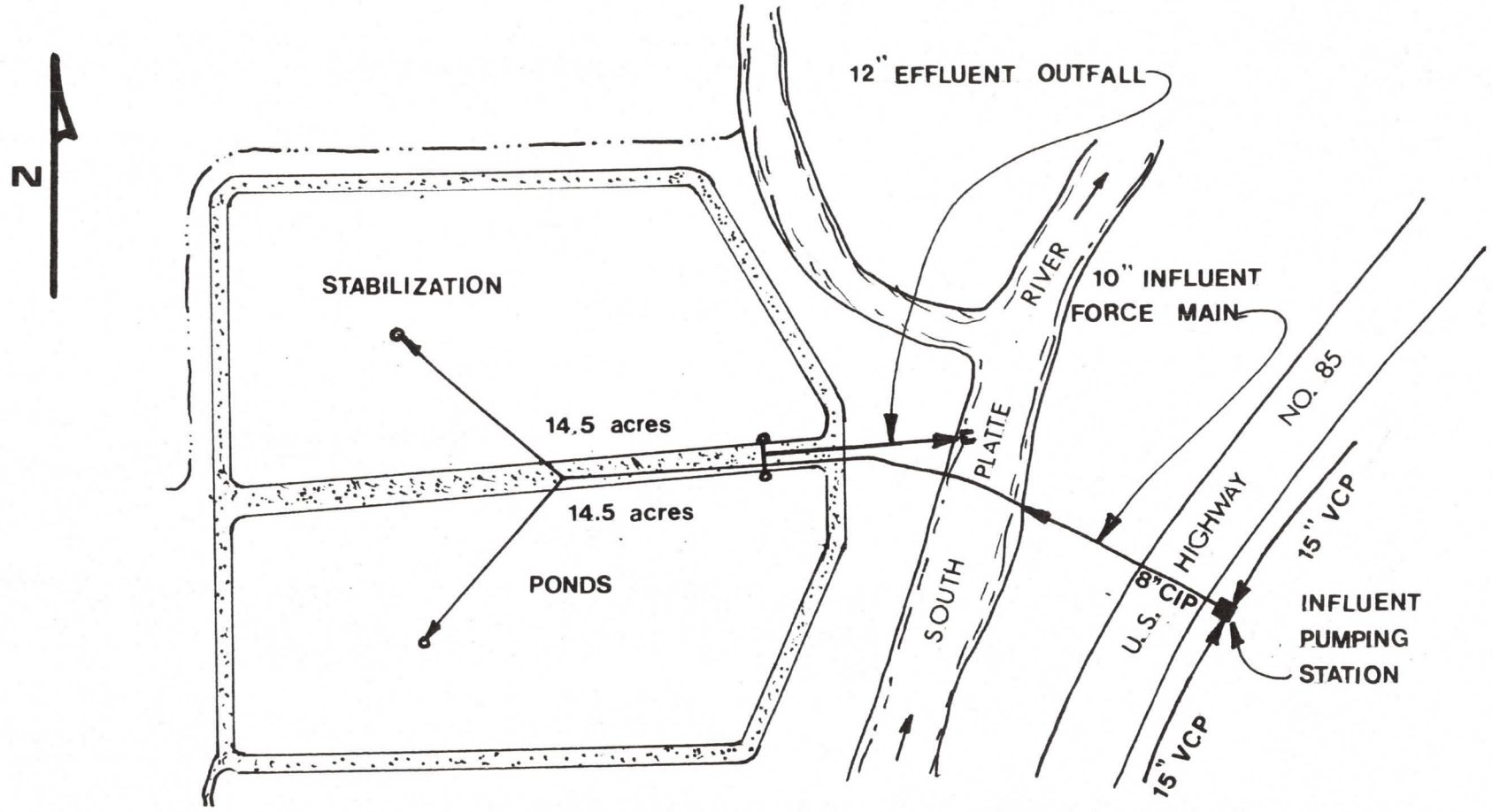

FIG. 6.1.2-A - EXISTING WASTEWATER TREATMENT PLANT - CITY OF FORT LUPTON

6.3 EFFLUENT QUALITY

Because of plant overloading, effluent quality has been continually poorer than required by NPDES permit limitations. As shown in Table 4.1.2-A, BOD, SS, and coliform levels have been exceeded. This will be remedied by this upgrading and expansion project so that effluent of higher quality can be consistently produced.

7.0 BASIS OF PROJECT DEVELOPMENT

Prior to the development of alternative plans, specific criteria must be established to insure the proper comparison of plans and resultant selection of the apparent best project. Information required includes design criteria for facilities, and basis of cost estimate for facility construction and operation.

7.1 DESIGN CRITERIA

Design criteria and cost data presented in this report apply to preliminary design and layout of facilities. In layouts of this type, it is necessary to make a reasonably close approximation of the size, location, type of construction, route, and cost of the various facilities to be developed. In addition, this information must be given in sufficient detail to permit comparison of alternative plans. Obviously, some relocation and resizing of a portion of the facilities will be required at a later date, as a result of the detailed engineering studies which are made during the preparation of construction drawings and specifications.

Because a significant amount of usable facilities exist at the Fort Lupton treatment facility, the availability, capacity, and condition of those facilities have been assessed, with a view to their incorporation into the various alternative plans. Existing facilities have been retained in the layout of alternative plans when their use is compatible with required functions and is economically justified.

7.2 BASIS OF COST ESTIMATES

The cost of constructing and maintaining the facilities required for each of the alternative plans considered in this report includes the capital outlay necessary for initial funding plus continued expenditures for operation throughout the lifetime of the project. The data presented in the following sections will provide sufficient information for comparison of alternative plans developed later in this report.

7.2.1 Construction and Project Costs

Unit construction cost prices given in this report include contractor's overhead and profit, but do not include engineering, construction contingencies, right-of-ways, or legal costs. Separate allowances are made to cover these items. Because these unit prices represent average bidding conditions for many projects, actual construction bids for a given project may not correspond to the unit prices used herein.

Although additive or deductive items are applied where believed necessary to cover special conditions, the preliminary estimates presented are not presumed to be as accurate as those prepared during final design.

Because costs of construction undergo significant changes in accordance with corresponding changes in the national economy, a cost index is usually presented to reflect the conditions for which the estimates are made. The best and most widely used index is the Engineering-News-Record (ENR) Construction Cost Index, which is computed from prices of construction materials and labor and based on a value of 100 in the year 1913. Based on conditions in the northern Colorado area expected at mid-construction (Fall, 1977) of the recommended plan, cost data in this report are based on an ENR Construction Cost Index of 2200. Although this value may not reflect future conditions, costs of future construction can be related to cost data presented herein by applying the ratio of the then-current ENR Construction Cost Index to 2200.

Project or capital costs include construction costs plus expenditures required to cover engineering services, contingencies for uncertainties unavoidably associated with preliminary design, and overhead items such as legal and administrative fees. Thus, to predict the total project cost of an alternative, an additional 35 percent of construction costs are added to each alternative's total cost.

7.2.2 Annual Costs

Economic evaluation of alternative projects requires consideration of annual as well as project costs. Annual costs include expenditures for capital recovery plus operation and maintenance. Operation and maintenance costs include expenditures for labor, repairs, power, chemicals, supplies, administration, and additional costs which vary from project to project. Operating costs presented herein are based on an ENR Construction Cost Index of 2200.

7.2.2.1 Interest Rates

Interest rates, generally applied as a compounded percentage per year, are an expression of the time value of money. Interest rates must be assumed for purposes of computing the annual cost of capital and for estimating the total cost of prospective bond issues. Based on current data, a rate of 7.0 percent is used in this report for public works construction financing and annual cost calculations.

7.2.2.2 Depreciation and Amortization

Most bonds sold for sewerage projects have redemption periods of about 25 years. However, an estimate of the average economic life of each project is used in computing the annual cost of capital. The annual fixed cost is computed by applying a capital recovery factor to the project's capital cost. The economic life of projects and facilities will vary. Ponds, pipelines, and storage reservoirs are assumed to have a 50-year economic life. Pumping facilities and wastewater treatment facilities are assumed to have an economic life of 30-years.

8.0 ALTERNATIVE PLANS FOR TREATMENT AND DISPOSAL

This section includes a discussion of process selection criteria and a discussion of alternative treatment processes, and the development and evaluation of alternative plans.

8.1 PROCESS SELECTION CRITERIA

The selection of the optimum process for an individual community should not be based exclusively on the economics of the individual processes capable of satisfying discharge requirements. Many of the technical and social factors should be considered in evaluation of viable alternatives. Community characteristics such as growth rate, land cost and availability, proximity of treatment facilities to residential or commercial areas, available operator capabilities, and treatment facility aesthetics effects (visual and odor) on the community, all have a bearing on the treatment facilities best suited for a given community.

There are a great number of alternative treatment processes capable of satisfying BOD and suspended solids (SS) discharge requirements. The alternatives discussed in the following sections are those which have been found suitable for smaller communities. Processes requiring extremely sophisticated operator capabilities generally unavailable in smaller communities, such as continuous operator monitoring, are not considered in this report.

There are two major treatment plant classifications: biological and physical/chemical. Both types of processes have the same objective--removal of dissolved and particulate organic material. Biological treatment processes, some of which have been used since the turn of the century, depend on microorganisms to convert putrescible substances to less noxious chemical forms which are compatible with the environment. Controlled biological processes are those such as activated sludge or biofilters in which the biological growth conditions are artificially controlled; stabilization ponds or aerated lagoons are considered uncontrolled biological processes. Although the biofiltration process will produce a relatively high degree of treatment, it is difficult to consistently produce biofilter effluent quality that meets the 30 mg/l suspended solids limitation of the secondary treatment requirement. Therefore, the biofiltration process will not be considered further in this report. Physical/chemical treatment consists of the addition of various chemicals to aggregate and to aid settling particulate matter and to oxidize organic substances. Depending on the particular effluent quality goals, physical/chemical plants may employ multimedia filtration, activated carbon adsorption, ozonation or any one of several other processes. While there are several small physical/chemical package plants currently on the market, none will be considered in view of their stringent operational requirements.

8.2 ALTERNATE TREATMENT PROCESSES

The treatment processes that will be considered as alternatives in this report are shown in Table 8.2-A. Each is described below.

TABLE 8.2-A. ALTERNATIVE TREATMENT PROCESSES

DESIGNATION	PROCESS
	POND SYSTEMS
1	Stabilization ponds
2	Aerated lagoons
3	Aerated lagoons; algae filtration
4	Total evaporation systems
	MECHANICAL SYSTEMS
5	Oxidation ditches
6	Extended aeration
7	Rotating biological contactor

8.2.1 Pond Systems

According to the EPA, 25 percent of the wastewater treatment plants in this country are lagoons (Fed. Reg. 10/2/76). Nearly 90 percent of these wastewater treatment ponds serve communities of 5,000 population or less [ibid]. The reason they are so popular with small communities is because initial installation costs and operation and maintenance costs are relatively low. Because of the fairly long detention times in lagoons, they are less susceptible to shock loads or breakdown than are mechanical plants.

8.2.1.1 Stabilization Ponds

Stabilization ponds are lagoons with no mechanical aeration or mixing. These ponds generally range in depth from 3 to about 7 feet. Algae growing in the ponds supply dissolved oxygen. Because oxygen is only produced when algae is active, the ponds normally are anaerobic (no dissolved oxygen) at night and during the winter months. Odors are produced during anaerobic conditions. These odors can be especially noticeable during the spring thaw. Unless the ponds are located quite a distance from inhabited buildings, the aesthetic effects make them undesirable. Further, it is stated in Colorado's manual of design criteria that, "It is very doubtful that unaerated waste stabilization ponds can meet the effluent standards for discharge." [Rozich, 1973].

8.2.1.2 Aerated Lagoons

Aerated lagoons are physically similar to stabilization ponds. One or more ponds are aerated, with the liquid portion mixed mechanically. This virtually eliminates periods of zero dissolved oxygen, and therefore odors are controlled. Since the addition of energy is required, operation and maintenance (O&M) costs are higher than for stabilization ponds, but not as high as for mechanical plants. These plants are normally designed with two or more cells in series. The final cell must be a quiescent pond to settle heavy particles. The weight of algae is so close to the weight of water that it remains suspended in the water and is difficult to settle. It is for this reason that EPA is considering changing the suspended solids standard for lagoons.

8.2.1.3 Aerated Lagoons with Algae Removal

Many processes have recently been tested which could be added to lagoons to remove algae. These include rapid sand filters, intermittent sand filters, rock filters, air flotation, and chemical addition which aids settling. Chemical costs and/or operational costs for several of these processes are so high that the advantages of using lagoons are eliminated. Rock filters showed a great deal of promise. Several have been installed in Colorado recently. Evaluation of these indicates that about 50 percent of the algae is removed by the filter. Unfortunately, suspended solids concentrations due to algae frequently exceed 90 mg/l in the summer, indicating the 30 mg/l effluent standard cannot be consistently met with rock filters. Mixed-media filtration also is limited to approximately 50 percent algae removal, and is characterized by relatively high O&M costs. The other process of promise is the intermittent sand filter. Sand beds are installed with underdrains. Lagoon effluent is spread on the beds intermittently, allowed to percolate, and dry out. Periodically the sand is scarified and eventually replaced after it becomes thoroughly plugged. Algae removal rates are very high using intermittent sand filters; their principal drawback is high O&M costs.

8.2.1.4 Total Evaporation System

In Colorado the evaporation rate exceeds the precipitation rate by about 33 inches per year. This phenomenon can be utilized by designing ponds of sufficient volume to store water during periods of low evaporation, and to totally evaporate when the rate is high. Since no discharge occurs, the need to meet standards is eliminated.

8.2.2 Mechanical Systems

As previously stated, only biological mechanical plants will be evaluated in this report.

8.2.2.1 Oxidation Ditches

The oxidation ditch is a modification of the extended aeration-activated sludge process which utilizes a closed loop channel as an aeration chamber. The process was originally developed as a low-cost system requiring non-sophisticated construction methods and mechanical equipment. The process flow scheme consists of aeration of raw wastewater in the loop channel followed by the sedimentation of the activated sludge in a clarifier. The activated sludge (active microorganisms) is returned from the clarifier back to the aeration tank. Brush aerators are used to supply oxygen and to retain solids in suspension in the aeration channel.

Internal sluge digestion occurs and eliminates the requirements for external sludge digestion facilities. Depending on land availability for sludge drying beds, it may be cost-effective to provide for external sludge digestion in plants having design flowrates greater than 0.5 mgd. Sludge also can be disposed of by other methods such as land treatment, or in a sanitary landfill.

The biological stability of the oxidation ditch process causes it to have one of the lowest operation and maintenance requirements of any of the controlled biological treatment processes such as activated sludge or bio-filters. This is a significant advantage for smaller communities where highly-trained operators might not be readily available. Land requirements are typical of controlled biological processes.

8.2.2.2 Extended Aeration

Extended aeration is a particular mode of the activated sludge process suitable for use by smaller communities. Basically, raw wastewater is aerated for 24-hours in a tank containing a high concentration of activated sludge microorganisms which break down the waste substances. The mixture of water and sludge is then transferred to a clarifier where the activated sludge organisms are settled from the liquid. The settled sludge is returned to the aeration tank and the clarified wastewater is discharged or reused.

The major mechanical equipment required for an extended aeration plant are aerators (diffused or mechanical) and sludge return pumps. External separate sludge digestion facilities are not required since digestion occurs while the sludge is in the aeration circuit (internal digestion). A relatively small aerated sludge holding tank enabling uniform wasting of sludge from the aeration compartment would be required in Colorado. Depending on local conditions, sludge is generally pumped to sludge drying beds for dewatering and subsequent trucking to sanitary landfills, disposed of by land treatment, or trucked as a liquid to an appropriate disposal site.

The primary advantage of extended aeration over conventional activated sludge is that extended aeration is more stable biologically and thus requires less operation and maintenance. Proper operation will still require the services of a relatively well-trained operator for several hours each day. It has generally been found that a well-operated plant does not result in any odor problems.

8.2.2.3 Rotating Biological Contractor

A rotating biological contactor is similar in operation to a trickling filter plant. It is available in package form and can therefore be installed by a small community for much less money than can a trickling filter plant. This plant uses a rotating drum on which a biological slime layer grows. This slime layer is the BOD_5 removal mechanism. Remaining solids are settled in a clarifier prior to discharge.

8.3 OPERATION AND MAINTENANCE

The State of Colorado requires that all wastewater treatment plants be operated by a certified operator. Different degrees of skill are required for various sizes and complexities of treatment plants.

For Fort Lupton, any of the lagoon alternatives would require a "D" operator, which is the lowest operator classification. Any mechanical plant would require a Class C operator, which is a more skilled class of operator.

The LWRCOG is presently evaluating the feasibility of a centralized O & M agency. It is visualized that this agency would provide technical assistance to the city plant operator. The agency could also satisfy the city's certification requirements.

Since this agency is still in the conceptual stage, O&M costs presented in this report assume that no supplemental assistance will be provided from outside the community.

8.4 DEVELOPMENT OF ALTERNATIVE PLANS

The alternatives discussed above are presented to give the reader a better understanding of the decisions involved in choosing a best alternative. The total evaporation is not considered further in this report because of excessively high areal requirements, and problems because of high groundwater.

8.4.1 Estimated Costs

Table 8.4.1-A presents estimated costs of the other six alternative processes under consideration. For preliminary evaluation purposes, costs are based on the construction of complete new facilities at a capacity of 1.5 mgd average flow.

TABLE 8.4.1-A. ESTIMATED COSTS OF ALTERNATIVE PLANS FOR TREATMENT (a)

PROCESS	PROJECT COST (b,d) ($)	TOTAL UNIT COST (c,d) ($/1000 gal)
Aerated lagoons	750,000	.20
Stabilization ponds	800,000	.19
Oxidation ditch	930,000	.25
Extended aeration	980,000	.27
Rotating biological contactor	1,120,000	.37
Aerated lagoons + intermittent filters	1,410,000	.38

(a) Based on an estimated ENR Construction Cost Index of 2200 (September, 1977); assumes complete new facilities.
(b) Construction cost plus 30 percent for construction contingencies and engineering.
(c) Capital recovery plus O & M costs.
(d) Based on a projected design capacity of 1.5 mgd.

8.4.2 Evaluation of Alternatives

From an analysis of Table 8.4.1-A, it can be seen that aerated lagoon systems are the most economical in terms of project costs, whereas stabilization pond systems have the lowest total unit cost. Costs of other processes generally increase with increasing complexity and operational requirements.

Continued use of stabilization ponds at Fort Lupton would require more than 100 acres of land for ultimate flows. This would involve significant land purchase costs, and would eliminate a large area of land from useful production. Also, it is questionable whether pond effluent would be of sufficient quality for irrigation reuse.

If aerated lagoons were utilized at Fort Lupton, a significant portion of the existing facilities could be incorporated into the upgrading project. Assuming the proposed EPA regulations (10/2/76) concerning pond treatment levels are adopted, aerated lagoons followed by polishing ponds would not have to be upgraded to provide for algae removal, a costly additional process. Preliminary indications are that the draft regulations will be adopted. However, variance in lagoon effluent standards will only apply when the design flow is 1 mgd or less, according to the draft standards.

Of the three mechanical treatment systems, the oxidation ditch appears to be the alternative of lowest capital and total cost, is the most stable and reliable, and has the least operation and maintenance problems. High quality effluent is continuously produced from oxidation ditch facilities at Berthoud and Eaton, Colorado. However, some sludge handling facilities are required with the oxidation ditch system; and that process has higher O&M costs, including power, and requires a higher level of operation than aerated lagoon systems.

Based on the preliminary evaluation of alternatives, the aerated lagoon and oxidation ditch options warrant further detailed evaluation.

8.4.3 Detailed Analysis of Viable Alternatives

The aerated lagoon and oxidation ditch alternatives are the two most viable alternative plans, and are evaluated further. Figure 8.4.3-A is a schematic diagram of the facilities contemplated in the aerated lagoon option; corresponding oxidation ditch facilities are shown on Figure 8.4.3-B.

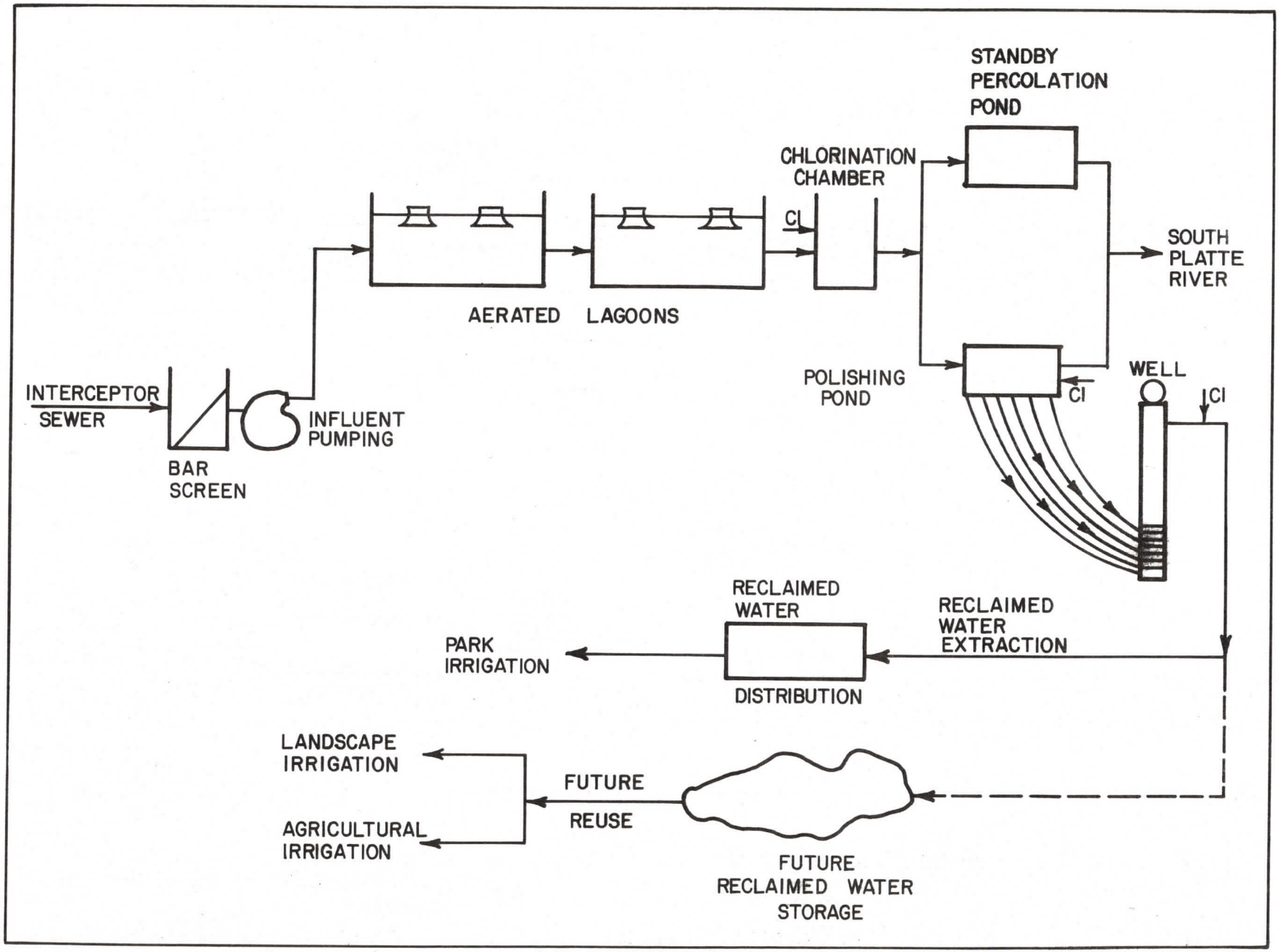

FIG. 8.4.3-A. **SCHEMATIC FLOW DIAGRAM - AERATED LAGOON ALTERNATIVE**
FORT LUPTON TECH PLAN

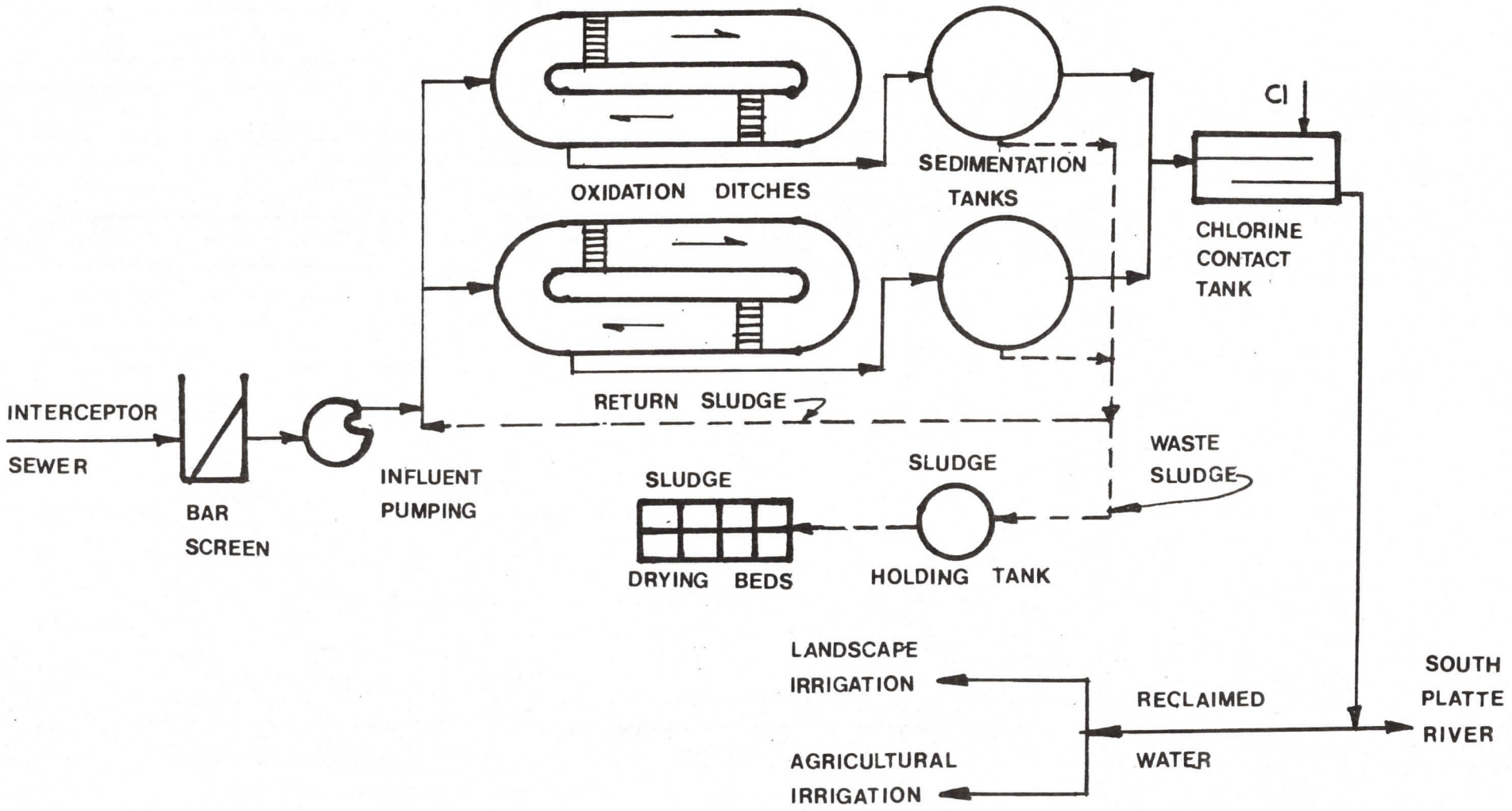

FIG. 8.4.3-B **SCHEMATIC FLOW DIAGRAM - OXIDATION DITCH ALTERNATIVE**

Construction of aerated lagoons would represent a savings in capital and total costs compared to oxidation ditches. However, the effective capacity of aerated lagoons without additional processes for algae removal could be limited to 1.0 mgd, less than the total Fort Lupton flow. This could possibly be overcome in two ways: 1) convince EPA that aerated lagoons are cost-effective at flows greater than 1.0 mgd; or 2) when total flows reach 1.0 mgd (around 1987), modify the aerated lagoons so that industrial wastewaters are treated separately; municipal flows then would not exceed 1.0 mgd. If neither of these options can be accomplished, it would be necessary to change to the oxidation ditch process in 1987.

Because of all the above variables, three alternative programs are outlined for a more rigorous economic analysis:

Program I:	Upgrade existing facilities to aerated lagoons-1977 (1.5 mgd capacity)
Program II:	Construct oxidation ditches-1977 (1.5 mgd)
Program III:	Upgrade to aerated lagoons-1977 (1.0 mgd) Construct oxidation ditches-1987 (1.5 mgd)

To evaluate the relative costs of these programs, it is necessary to determine their "present worth", and their total annual cost. The present worth of a plan is the amount of funds at current price levels, which would have to be invested initially in order to meet all the financial needs of the program, including project and operating costs, as they occur from year to year. Present worth is an engineering-economy criteria used to account for the reduced present value of deferred construction, and to compensate for varying project lives.

The present worth calculations are presented in Table 8.4.3-A for two options of each alternative program. "A" options consider total costs; "B" options consider only local costs, and exclude governmental grants. A summary of the present worth analysis is shown in Table 8.4.3-B. Annual costs are tabulated in the same manner in Table 8.4.3-C. The results of this detailed economic analysis indicate that: (1) aerated lagoons should be constructed now, and efforts made to insure their cost-effectiveness above 1.0 mgd (Program I); (2) assuming that (1) does not materialize, construct aerated lagoons now, and construct new oxidation ditch facilities in 1987 (Program III).

TABLE 8.4.3-A.
PRESENT WORTH COST ANALYSIS OF ALTERNATIVE PROGRAMS

ALT. DESIG.	ALTERNATIVE DESCRIPTION	YEAR	PROJECT COST	AVERAGE O&M COST	PRESENT WORTH			CUMULATIVE O&M COSTS ($1000)
					PROJECT COST	O&M	TOTAL	
IA	Upgrade to aerated lagoons (1977)	1977-2000	620,000 (e)	25,000	620,000	282,000	902,000	575
IB	Same as IA, with consideration of 25% State grant (1977)	1977-2000	430,000	25,000	430,000	282,000	712,000	575
IIA	Construct oxidation ditches (1977)	1977-2000	880,000 (c)	33,000	926,000 (d)	372,000	1,298,000	759
IIB	Same as IIA, with consideration of 25% State grant (1977)	1977-2000	650,000	33,000	696,000 (d)	372,000	1,068,000	759
IIIA	Upgrade to aerated lagoons (1977)	1977-1987	500,000 (b)	21,000	500,000	147,000	647,000	210
	Construct oxidation ditches (1987) (a)	1987-2000	910,000	35,000	460,000	293,000	753,000	455
	Total		1,410,000	-	930,000	440,000	1,400,000	665
IIIB	Same as IIIA with consideration of 25% State grant (1977) and possible 75% EPA grant (1987)	1977-1987	340,000	21,000	340,000	147,000	487,000	210
		1987-2000	212,000	35,000	108,000	293,000	401,000	455
	Total		552,000	-	448,000	440,000	888,000	665

(a) Abandon aerated lagoons; 1.5 mgd capacity.
(b) $630,000 project cost of 1.0 mgd facilities, less salvage value of existing facilities ($130,000)
(c) $930,000 project cost of 1.5 mgd facilities, less salvage value of existing facilities ($50,000)
(d) Equivalent cost of 0.4 mgd additional capacity needed in 2000 included
(e) $750,000 project cost of 1.5 mgd facilities, less salvage value of existing facilities ($130,000)

TABLE 8.4.3-B

SUMMARY OF PRESENT WORTH COST ANALYSIS

PROGRAM DESIG.	ALTERNATIVE DESCRIPTION	PRESENT WORTH ($) TOTAL COSTS (a)	PRESENT WORTH ($) LOCAL COSTS (b)
I	Upgrade to aerated lagoons (1977)	902,000	712,000
II	Construct oxidation ditches (1977)	1,298,000	1,068,000
III	Upgrade to aerated lagoons (1977); Construct oxidation ditches (1987)	1,400,000	888,000

(a) Project costs plus O&M costs.

(b) Total costs less State and Federal grants.

TABLE 8.4.3-C

SUMMARY OF ANNUAL COST ANALYSIS

	ANNUAL COST ($/YR)					
	1977-1987			1987-2000		
	Capital Recovery	O&M	Total	Capital Recovery	O&M	Total
IA	58,000	22,000	80,000	58,000	28,000	86,000
IB	40,000	22,000	62,000	40,000	28,000	68,000
IIA	83,000	29,000	112,000	83,000	38,000	121,000
IIB	61,000	29,000	90,000	61,000	38,000	99,000
IIIA	47,000	21,000	68,000	132,000	38,000	170,000
IIIB	32,000	21,000	53,000	52,000	38,000	113,000

A = Project costs plus O&M costs.

B = Local costs = Total costs less State and Federal grants.

9.0 BEST ALTERNATIVE PROJECT

The previous sections of this report have indicated that: (1) the City of Fort Lupton's treatment plant needs to be expanded and upgraded utilizing aerated lagoons and polishing ponds; (2) improvements need to be made to the existing influent pumping station; (3) the proposed community park should be irrigated with reclaimed water from the treatment facilities; and (4) new wastewater pumping and interceptor facilities are required to solve system deficiencies and to serve future development to the north. The best alternative project therefore consists of the following components:

- Treatment plant upgrading and expansion, and influent pumping station improvements;
- Reclaimed water distribution system;
- Collection system facilities.

The approximate location of these facilities is shown on Figure 9.0-A.

9.1 TREATMENT AND PUMPING FACILITIES

It is proposed to upgrade and expand the existing treatment facilities to a capacity of 1.5 mgd average flow utilizing the aerated lagoon process. A layout of the proposed facilities is shown on Figure 9.1-A. Design criteria for the proposed facilities are listed in Table 9.1-A.

TABLE 9.1-A. DESIGN CRITERIA FOR PROPOSED TREATMENT FACILITIES

DESIGN CRITERIA	LOADING		
	1976	1983	2000
Aerated lagoons (15-day detention)			
Total volume, million gallons	22	22	22
Total area, acres (8-ft. depth)	8.4	8.4	8.4
Power requirements (HP)			
Normal operation (65 HP/mgd)	30	40	65
Canning season (87 HP/mgd)	50	77	128
Aerator units operating			
Normal conditions	(2)20HP	(2)20HP	(2)20HP + (1)25HP
Canning season	(3)20HP	(4)20HP	(4)20HP + (2)25HP
Chlorination Facilities			
Volume, (cubic feet)	8400	8400	8400
Detention (hours)	2.2	1.7	1.0
Feed rate (#/day)	100	150	250
Polishing Ponds (5-day detention)			
Volume each, million gallons	7.4	7.4	7.4
Area each, acres (8-ft. depth)	2.8	2.8	2.8

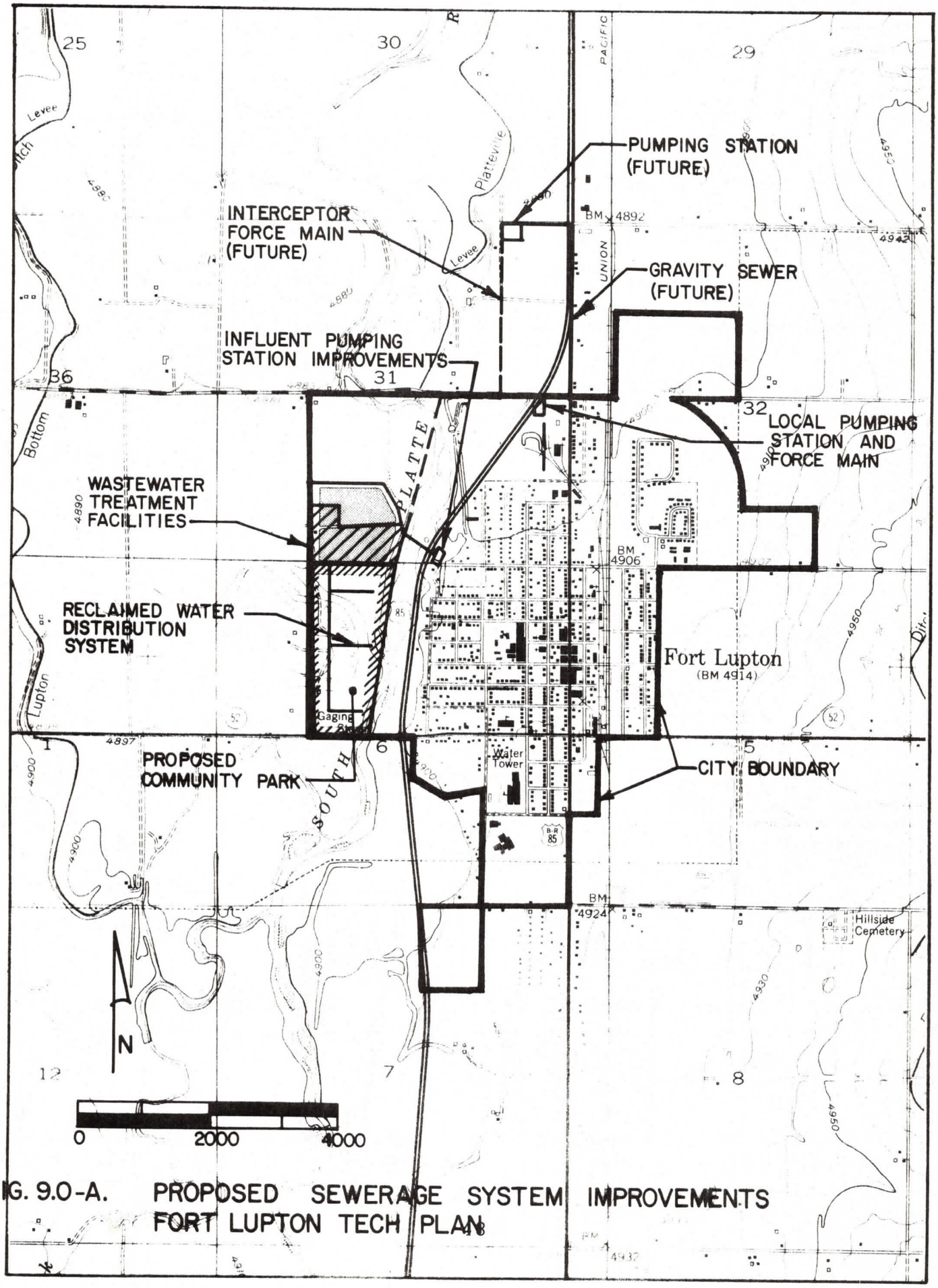

FIG. 9.0-A. PROPOSED SEWERAGE SYSTEM IMPROVEMENTS FORT LUPTON TECH PLAN

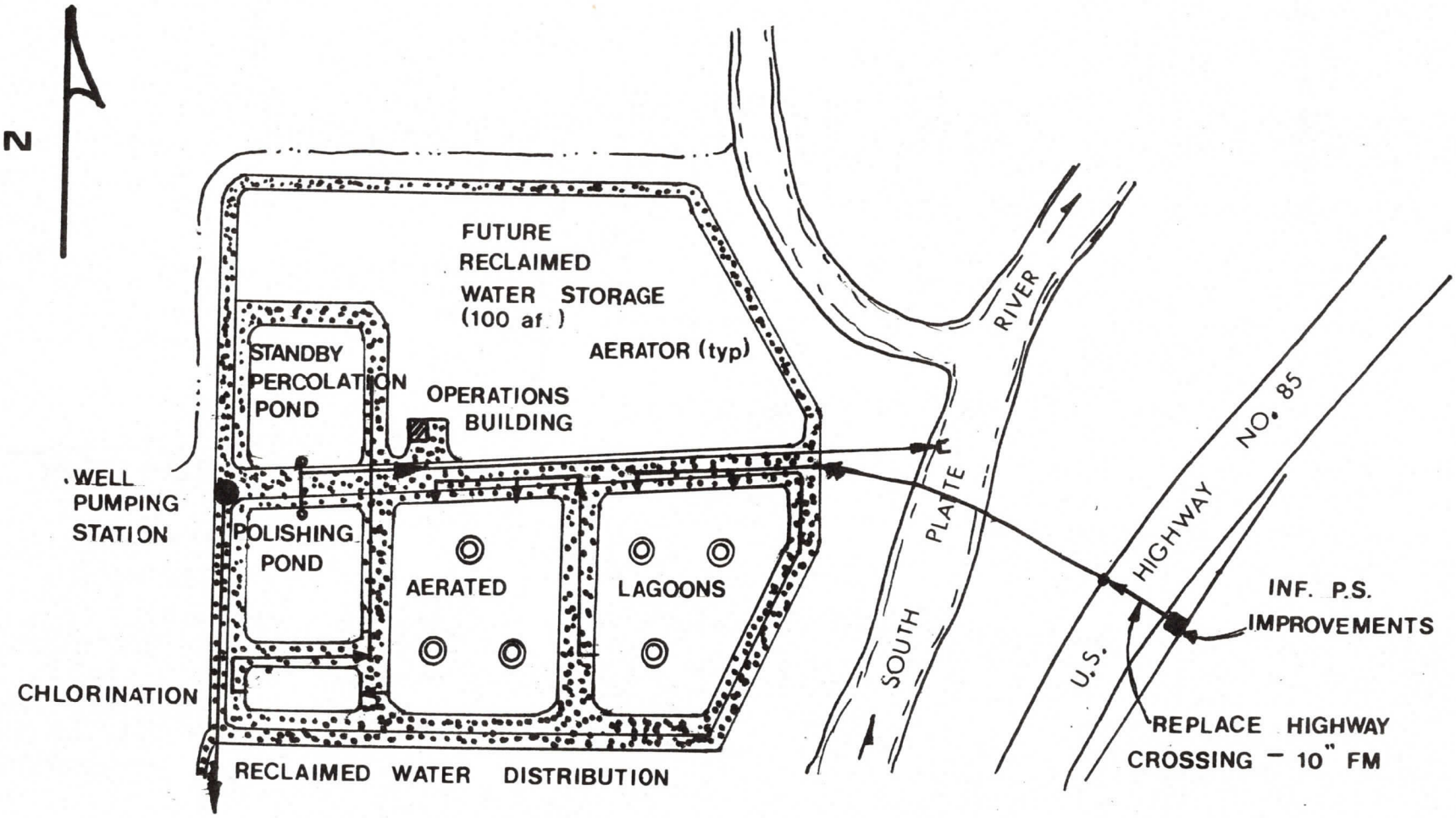

FIG. 9.1.A **– PROPOSED WASTEWATER TREATMENT FACILITIES – CITY OF FORT LUPTON**

The recommended improvements to be constructed under this component of the best alternative project are:

- Influent pumping station improvements - standby power generator, bar screen, float recorder (existing Parshall flume)
- Earthwork - lagoons, chlorination chamber, polishing ponds
- Floating aerators - (4) 20 HP + (2) 25 HP
- Chlorination facilities - chamber, chlorinators, controls, cylinder storage
- Plant piping
- Operations building - motor control center, chlorinator room, laboratory, equipment storage
- Electrical control equipment
- Sitework
- Laboratory equipment

TABLE 9.1-B. ESTIMATED COST - TREATMENT & PUMPING FACILITIES

ITEM	COST ($) (a)
Influent P.S. improvements	9,000
Earthwork	61,000
Floating aerators	43,000
Chlorination facilities	30,000
Plant piping	33,000
Operations building	13,000
Electrical control equipment	25,000
Sitework	25,000
Laboratory equipment	9,000
Subtotal - Construction Cost	246,000
Construction contingencies and engineering - 35 percent	86,000
Total - Project Cost	332,000

(a) Based on an ENR Construction Cost Index of 2200 (Fall, 1977).

9.1.1 Estimated Cost

As indicated in Table 9.1-B, the total construction cost, based on a mid-construction period of Fall, 1977, amounts to approximately $246,000. Including allowances for construction contingencies and engineering, the total project cost amounts to about $332,000.

9.1.2 Facilities Operation

Influent wastewater will be pumped directly to the aerated lagoons, which will operate in series. During maximum summer flow conditions, all aerators will be operating. Under winter conditions, one-half of the aerators will operate on a rotational basis to insure good mixing of the liquid in the lagoon.

Treated wastewater will flow from the second lagoon to the chlorination chamber, into which chlorine will be fed for disinfection. Chlorinated effluent will then flow to one of the polishing/percolation ponds, from which treated water will percolate. The two polishing ponds should be alternated to allow for drying periods such that optimum percolation rates can be maintained. Percolated water will flow through the soil underneath the percolation ponds and be extracted by new well pumping facilities located near the existing ponds. This pump will transfer the extracted water to the reclaimed water distribution system for peak irrigation. Reclaimed water not utilized for irrigation will be transferred from the polishing ponds and discharged to the South Platte River.

9.2 RECLAIMED WATER DISTRIBUTION FACILITIES

9.2.1 Facilities Description

As shown on Figure 9.0-A, facilities are planned to be constructed to supply and distribute reclaimed water for irrigation of the community park adjacent to the treatment facilities. Required facilities include: pumping facilities, transmission mains from the treatment plant through the entire park area, and the onsite park irrigation system. The onsite irrigation system includes distribution pipelines, couplers, sprinkler sets, valves, and appurtenances. Total project cost of the reclaimed water distribution system is estimated at $125,000, and is described in Table 9.2.1-A.

9.2.2 Value of Reclaimed Water Supply

When evaluating the costs of the proposed reclaimed water system, it should be noted that the majority of the cost of facilities shown in Table 9.2.1-A will be required for irrigation of the park with any source of water. The net additional cost of facilities necessary for irrigation with reclaimed water is insignificant. This is possible because of the proximity of the treatment facilities to the proposed park site. Additional treatment facility costs for reuse amount to less than $25,000.

TABLE 9.2.1-A. ESTIMATED COST - RECLAIMED WATER DISTRIBUTION FACILITIES

ITEM	COST ($) (a)
Pumping facilities - 500 gpm @ 75 psi	30,000
Reclaimed water transmission main- 3300' - 8" & 6" pipeline	12,000
Onsite irrigation system - 36,000' - 3" pipeline, couplers, sprinkler sets, valves, appurtenances	58,000
Subtotal - Construction Cost	100,000
Construction contingencies and engineering - 25 percent	25,000
Total - Project Cost	125,000

(a) Based on an ENR Construction Cost Index of 2200 (Fall, 1977).

The fertilizer value of the nutrients contained in the reclaimed water should also be considered. Reclaimed water contains nutrients in the form of nitrogen and phosphorous compounds which can be utilized by the irrigated grass and thereby reduce the fertilizer application requirements. The amount of nitrogen and phosphorous available to the grass is dependent not only on the amount in the reclaimed water but also its chemical form. Effluent similar to that expected from the Fort Lupton planned facilities will contain about 250 lbs. of nitrogen and 80 lbs. of phosphorous per million gallons. Based on irrigation application rates used in the Fort Lupton area, plus fertilizer costs of about $.10/pound, the benefit of using reclaimed water in Fort Lupton is estimated at $5/acre-foot for effluent similar to that from the upgraded facilities.

9.3 COLLECTION SYSTEM FACILITIES

9.3.1 Interim Program

The temporary pumping station located on Fourteenth Street continues to be plagued by operating problems and pump failures. The station also does not have sufficient capacity for tributary flows from near-term anticipated development to the east. The station should be replaced with a permanent factory-built pumping station and 6-inch force main which would join the existing 8-inch gravity sewer in Park Avenue. The estimated project cost of the interim program facilities is $73,000, as shown in Table 9.3.1-A.

TABLE 9.3.1-A

ESTIMATED COST - COLLECTION FACILITIES

ITEM	COST ($) (a)
INTERIM PROGRAM	
Local pumping station - .45 mgd	35,000
1000' - 6" force main	7,000
Subtotal - Interim Program Construction Cost	42,000
Construction contingencies and engineering - 25 percent	11,000
Total - Interim Program Project Cost	53,000
FUTURE PROGRAM	
3700' - 12" interceptor	74,000
Pumping station - 1.2 mgd	65,000
5700' - 8" interceptor force main	51,000
Subtotal - Future Program Construction Cost	190,000
Construction contingencies and engineering - 30 percent	60,000
Total - Future Program Project Cost	250,000
GRAND TOTAL - Collection Facilities Project Cost	303,000

(a) Based on an ENR Construction Cost Index of 2200 (Fall-1977).

9.3.2 Future Program

When sufficient development has occured in the north and east portion of the study area, the future programs facilities should be constructed. Tentative locations for these facilities are shown on Figure 9.0-A. Required facilities include a 12-inch gravity sewer in Denver Street from 14th Street north approximately one-half mile, where it would join a pumping station rated at 1.2 mgd peak flow.

The wastewater from this station would be conveyed back to the treatment plant through an 8-inch force main interceptor. As shown on Table 9.3.1-A, project costs for the future wastewater collection program are estimated at approximately $255,000.

9.4 PROJECT SUMMARY

The project cost of all components of the sewerage system improvements program is summarized in Table 9.4-A. The total cost of the components to be implemented immediately is $510,000. Including the future collection system program, the total cost of all facilities is $760,000.

TABLE 9.4-A. SEWERAGE SYSTEM IMPROVEMENTS - COST SUMMARY (a)

FACILITIES	PROJECT COST ($) (a)
Treatment and pumping facilities	332,000 (b)
Reclaimed water distributuion facilities	125,000 (c)
Collection facilities - interim program	53,000 (d)
Subtotal - This Project	510,000
Collection facilities - future program	250,000 (d)
Total - All Facilities	760,000

(a) Based on an ENR Construction Cost Index of 2200 (Fall, 1977).
(b) See Table 9.1-B for description of components.
(c) See Table 9.2.1-A for description of components.
(d) See Table 9.3.1-A for description of components.

9.5 IMPLEMENTATION PROGRAM

Successful implementation of the proposed project calls for a well-organized program to ensure effective achievement of the project goals. Complete coordination of all activities including planning, design, and construction activities must necessarily be maintained throughout all portions of the project. To provide a time frame upon which project financing and coordination can be based, and to indicate approximate time-span requirements for the major project activities, a project implementation schedule has been prepared. The recommended schedule is presented in Table 9.5-A and shows that construction of the proposed facilities is anticipated to occur from July to December, 1977. Startup and initial operation of facilities, together with compliance with NPDES permit requirements, is anticipated by January, 1978.

TABLE 9.5-A
IMPLEMENTATION PROGRAM FOR PROPOSED PROJECT

PROJECT TASK	IMPLEMENTATION DATE
• Review and approval of Technical Planning Report by the City	November, 1976
• Technical Planning Report submittal to Colorado Department of Health, together with revised site application	November, 1976
• Finalize Financial Program	November, 1976
• Project approval by State of Colorado	December, 1976
• Prepare engineering plans and specifications	January - March, 1977
• Bond election (tentative)	March, 1977
• Review and approval of plans and specifications by Colorado Department of Health	April, 1977
• Advertise and award construction contracts	May - June, 1977
• Construction of proposed facilities	July - December, 1977
• Operator training	December, 1977
• Review and approval of construction by Colorado Department of Health	January, 1978
• Startup and initial operation of facilities	January, 1978
• Compliance with NPDES permit requirements	January, 1978

The schedule presented in Table 9.5-A sets forth the minimum practicable timetable for the proposed project, given present requirements for review and comments by governmental agencies. Delays in implementation may also occur due to unforeseen delays in equipment delivery by manufacturers. Past experience has shown that delays are inevitable and therefore must be anticipated.

10.0 FINANCIAL PROGRAM

10.1 EXISTING CONDITIONS IN FORT LUPTON

10.1.1 Financial Capabilities

The 1975 estimated population of Fort Lupton was 3,100,* an increase of slightly more than 600 people, or 24% over the 1970 census figure.

The community's 1977 financial picture can be briefly summarized as follows:

- Assessed Valuation (1976): $4.93 million
- Anticipated Revenue from Property Tax (1977): $71,485
- Combined Mill Levy on Fort Lupton Taxpayers: 79.09 mills
  - City 14.50 mills
  - County 21.13 mills
  - School District 43.46 mills
- Total Sales Tax: 4% (3% State, 1% City)**
- Additional Sales Tax Capability (City and County): 3%
- City's General Obligation Bonded Indebtedness (Excluding Water Issues): -0-
- General Obligation Water Bonds: $250,000 (as of 1/1/77)
- Sewer System Revenue Bonds: 70,000 (as of 1/1/77)
  - Total $320,000
- City's Unused General Obligation Bond Capacity (10% of Assessed Valuation): $493,000
- Median Family Income: $7,912

These financial statistics indicate that Fort Lupton has the ability to obtain further general fund revenues within the limitations of its legal taxing authority. Although there is probably little remaining capacity for major new property tax revenues, both sales taxes and general obligation bonding could be further utilized to expand general revenues. Of course, this potential for additional general fund monies must be viewed in relation to the City's needs for future capital improvements (especially those other than revenue producing utilities).

---

* Source: Weld County Planning Department.

** Effective 7/1/77 sales tax will be 2%.

However, in terms of available revenue sources, it appears Fort Lupton is in a reasonably sound financial condition.

10.1.2 Sewage Handling Facilities and Proposed Improvements

On January 1, 1977, there were an estimated 900 sewer customers, all but 25 of whom paid a flat rate for sewer service. Current annual rates are $52 per single family dwelling, and $42 per unit in a multiple-family dwelling. All other types of users are on a sliding-fee scale.

The current tap fee for attaching to the system is $600, regardless of tap size or type of use.

There is now a total principal amount of $70,000 in outstanding sewer revenue bonds, requiring an annual debt service of approximately $9,000. These bonds will be completely retired in 1985.

In 1976 total revenues from sewer service fees and tap fees amounted to $81,800 and maintenance and operations costs for the system were $28,790. Cash outlays for the sewer system in 1976 were $38,290 for maintenance, operations, and debt requirements. The sewer fund has also contributed significant amounts of revenue to the General Fund--$33,510 in 1976. According to city officials, this practice will be discontinued in 1977.

In light of the present obligations, the sewer utility appears financially sound. Current service rates are moderate, and outstanding debt requires only some $10 per tap in annual debt service and will be completely retired by 1985. By eliminating the past practice of transfering sewer funds to the General Fund, further financial resources will be available for sewer facility related purposes.

The engineering analysis has suggested two levels of improvements for immediate implementation. The capital cost of the "minimum" system is estimated at $385,000. The addition of a reclaimed water distribution facility to irrigate the community park adjacent to the basic treatment facility would add $125,000, and bring the total cost for capital improvements to $510,000. The expanded facilities are expected to increase the 1977 budgeted operations and maintenance costs of $28,790 by $19,000 if the reclaimed water facilities are not provided. Twenty five thousand dollars per year must be added to the 1977 budgeted O & M if the reclaimed water facilities are also constructed.

10.2 RECOMMENDATIONS FOR SEWER UTILITY MANAGEMENT

The following are suggested general principles for a balanced utility program. This management process has proven successful in preventing construction and operation of sewer systems from posing an unreasonable burden on residents of growing communities, and is the basis for determining optimum financial capabilities.

10.2.1 Utility Service Area

The community should lead, not merely follow, development. The community should decide where it is most economical and efficient to provide services, and make known where it prefers growth to take place. By not annexing or extending utility lines outside the Town into areas it does not want to see grow, it can avoid having to serve those areas. Conversely, for those areas in which it wishes to encourage growth, it can build trunk lines into them and save potential developers that front end cost. This approach must be tied to other community goals, programs, and strategies in order to be successful.

10.2.2 Financial Policies

Utility financing for growing communities should be designed so that "he who benefits pays." This approach may be tempered by other community policies, such as a desire to keep or attract an industry unable to pay its fair share, or to assist development of low income housing which could not be built if a full tap fee were required.

This philosophy can be implemented by applying the following policies:

- Establish service fees based on all cost of operation including employees' wages and benefits, maintenance, and depreciation. Additional costs may be included, such as a reasonable fee paid into the General Fund for services or facilities, provided to the sewer utility by other municipal departments, such as office space and vehicles.

- Establish plant investment or tap fees (PIF) for all new customers or expansions of service, proportionate to treatment plant and trunk capacities the customer is expected to use. (See 10.3.1.1).

- Charge all direct costs of attaching to the system directly to the customer; e.g., costs of tapping into the line, and laterals and pipe from the street to the building.

10.2.3 Service for New Developments

Internal or lateral lines or pumps required to serve new developments should be provided by the developers. They may directly finance and build them, passing on costs to future occupants; or, where occupancy is relatively assured, the community may permit a special improvement district to be formed with the bonds paid back over an extended period of years through added mill levies on the properties benefiting. The cost of these localized facilities should not be borne by the community at large.

All extensions of lines past undeveloped areas to a development should be financed by the development seeking the service. Some of these costs can be paid back as intervening property is developed and attached to the system. The community should not be committed to providing such lines on request.

10.3 ANALYSIS OF FORT LUPTON'S ABILITY TO PAY THE COSTS OF THE UPGRADED FACILITY

The major questions a community must ask itself when considering its capabilities to finance and operate a sewer utility are:

- Can the community raise enough money to cover capital cost requirements?
- Can the community support the system on a continuing basis (operating and maintenance costs)?
- What are the utility financing implications of whether or not the population in the community increases?

In developing a financing program, sewer utility needs for financing should also be placed in the context of total community funding needs. Because locally generated funds all come from the same taxpayer or user, a more moderate commitment to sewer costs may be necessary in order to achieve other community goals. Considering that there are many ways to accomplish funding goals, financing strategy must be used to develop the most equitable system for the users with a minimum of future risk.

Table 10.3-A illustrates the basic financial picture. The residents of Fort Lupton will have to pay an estimated $64,325 annually by 1981 (this includes present plus additional operating costs inflated to 1981) to maintain the improved system, plus some amount to retire whatever borrowing is required for construction. The table shows how much cost for these two items would fall upon each system user (tap) annually under various assumptions about future growth and required borrowing.

The remainder of this section addresses questions of how capital and operating funds for the system might be raised and, in particular, the implications of various population growth rates.

10.3.1 Financing the Proposed Capital Improvements

Total capital investments of either $385,000 or $510,000 would be required to implement the improvements proposed in the engineering analysis. Major sources of of capital funding are plant investment fees (PIF's), grants, and borrowing.

10.3.1.1 Plant Investment Fees

A plant investment fee is normally set by dividing the total capital cost of the system by its capacity, and determining the

pro rata share. For example, a $100,000 system to serve 100 units would indicate a PIF of $1,000 per unit. Where a community is large and wealthy enough to generate proportionate shares of the capital cost, PIF's could fully finance its system. (10.3.1.1 continued on page 63).

TABLE 10.3-A*

TYPICAL ANNUAL COST FOR EACH UNIT ON THE SYSTEM

Annual Growth
Every Year
Through 1996

New Population Each Year	New Taps	Funds Borrowed By City For Sewer System Improvements				
		$150,000	200,000	250,000	300,000	350,000
0	0	$98/unit	103	109	114	120
19	5	92	97	103	108	114
38	10	87	92	97	102	108
57	15	81	86	91	96	102
75	20	76	81	86	91	97
94	25	71	76	81	86	91
113	30	67	72	76	81	86
131	35	63	68	71	77	82
150	40	58	63	67	73	77
169	45	54	59	63	68	72
188	50	51	55	59	63	68
206	55	47	51	55	60	64
225	60	44	48	52	56	60
244	65	40	43	48	52	56
263	70	37	41	45	49	52
281	75	34	38	41	45	49
300	80	31	35	38	42	46
ANNUAL COSTS:						
Operation and Maintenance		64,325	64,325	64,325	64,325	64,325
Old Debt		9,170	9,170	9,170	9,170	9,170
New Debt (7½%, 20 year)		14,718	19,624	24,530	29,436	34,342
TOTAL ANNUAL COSTS		88,213	93,119	97,845	102,931	107,837

* See notes page 62 .

NOTES ON TABLE 10.3-A

- All costs are calculated for 1981, but nevertheless are close enough estimates of any year through 1996.

- The operations and maintenance (O & M) costs are those associated with the land application system and are inflated for price and wage increases to 1981. In 1977 dollars, the total operations and maintenance cost would be $47,970. Inflated at 5% annually, this would rise to $64,325 by 1981.

- New debt is figured at being retired in 20 years and paying an interest rate of 7-1/2%. Actual terms will be closely related to local financial conditions and bond market conditions upon issue.

- Tap or Plant Investment fees are used to retire as much new debt as possible. For instance, with the addition of 50 taps at $600 each, as much as $30,000 in new debt could be retired. In some cases where the growth rate is high and borrowing low, tap fees are applied to the cost of old debt and/or O & M costs.

- The yearly growth rate necessary to achieve the annual costs shown on the chart would have to occur every year. For example, if $150,000 were borrowed, 20 new taps would have to be added every year for the next five years (or a total of 100 taps added to the system over the five-year period) for the annual cost to be $76 per unit by 1981. To maintain that annual charge, the growth would have to continue by that rate beyond 1981

- The source of revenue to pay the annual costs is a local decision. The Table simply indicates the amount needed.

- The Table may be adjusted as new information becomes available by using the following basic formula:

$$\text{Annual Cost Per Unit} = \frac{\text{Annual O\&M + Annual Debt Service - Tap Fees}}{\text{Number of Units on System}}$$

- Note that the tables show the remaining cost, over and above that paid by tap fees, to be shouldered by system users. It may be determined that the maximum or "worst case" figure shown in the top row of the table is not unreasonable in terms of user's ability to pay. This is the case if no growth occurs and only current residents are available to pay the full cost. An alternative would be initially to scale down the amount of borrowing, if possible.

(Continuation of 10.3.1.1)

In the case of Fort Lupton, most of the City's residents are already connected to the central sewage system, so the primary source of PIF's will be new development that occurs. The City may choose to generate some immediate capital funding by requiring proposed developments to prepay some of their PIF's. At $600 each, financing even the less expensive engineering alternative would require almost 650 such PIF's--even in a rapid growth situation, this is clearly an unrealistic figure. While some amount of capital funding may be generated through prepaid PIF's, Fort Lupton cannot count on this source as the major source of needed funds.

10.3.1.2 Grants and Subsidized Loans

Grant funds are likely to be available to assist with the costs of capital construction. Because the availability of such funds will be important in figuring the remaining burden on the local residents, this source of funding should be investigated early in the process of deciding if and how the Town should proceed.

Determine the approximate amount of grants (and/or subsidized loans) available from various government sources. For communities such as Fort Lupton, these are the most likely sources at this time:

- Farmers Home Administration
- The Colorado Department of Local Affairs
- HUD Community Development discretionary funds for service lines.

In order to gauge a community's eligibility, these funding agencies typically evaluate the locality's ability and efforts to finance its own system. For example, for each community requesting assistance the Colorado Department of Local Affairs takes into consideration the following:

- Legal ability to tax
- Assessed valuation
- Median family income
- Current bonded indebtedness
- Total tax effort
- Number of people on fixed incomes
- Level of user charges

The key element considered by the Department of Local Affairs, and the Farmers Home Administration, other factors being equal, is the state guideline that a community's annual user charge for sewer service should be at least 1-1/2% of the median family income. This guide is used to determine if a community is doing its fair share to pay for the system. The figure can be lowered for a number of reasons: for example, if a town is in a weak financial condition, or has a large number of people on fixed

incomes. But as a general guide, this tells a community how it will stand in potential aid levels from the various funding sources.

The state guideline that 1-1/2% of a community's median family income represents a reasonable annual user fee, indicates that Fort Lupton's minimum fee level would be $119 per tap per year (1-1/2% of $9,047). Comparing this figure with annual costs projected in Table 10.3-A above indicates that Fort Lupton might qualify for some grant assistance. How much assistance might be received will depend on funding agencies' priorities and fund availability. It is unlikely that a 100% grant would be received from any given agency. All potential sources should be checked for assistance. A summary of sources of financial aid can be found in Table 10.3.1-A. Funding availability varies from month to month as new revenues are made available or previously obligated funds are returned for redistribution.

10.3.1.3 Town Borrowing

To determine estimated borrowing needs, deduct anticipated grant amounts and any immediate local funds (such as PIF's charged existing residents or obtained from a developer) that might be allocated to the project from the capital cost estimates for the proposed system.

Whenever possible, revenue bonds should be used to finance sewer system improvements. If a community must borrow to finance utility improvements, it is desirable to protect its general obligation bonding capacity (tied by state law to assessed valuation) for uses where revenue bonding is not feasible. This is because numerous community needs usually cannot be financed from revenue bonds (e.g., parks, libraries, or police facilities). Therefore, any revenue generating operation, such as a sewer system, should borrow on the direct ability of the system to retire the debt.

There are limitations to this financing method; i.e., cases where the cost of the system exceeds its ability to generate revenue, or where general obligation bonds are not limited by state statute (e.g., bonds for water improvements). Even in these cases, the maximum reasonable revenues should be raised from PIF and user fees to retire at least a portion of the debt. Other sources must then supplement system revenues if the project is to occur.

Fort Lupton's borrowing capacity for general obligation bonds, at the statutory limit of 10% of assessed value, is approximately $493,000 at the present time.

10.3.2 Sources for Financing System Operating Costs

Funds to pay annual operating costs can be obtained from a number of sources. Most typically, these sources are service or user rates, property taxes and sometimes other general fund revenues. Approximately $82 per tap will be required of each of the 900 system taps to pay existing debt service and the operating costs

TABLE 10.3-B
SOURCES OF POTENTIAL FINANCIAL AID

	FHA COMMUNITY FACILITY LOANS/GRANTS - FEDERAL	CONSTRUCTION GRANTS FOR SEWERAGE WORKS (STATE OF COLORADO) STATE	FOUR CORNERS REGIONAL COMMISSION, SUPPLEMENTAL GRANT-REGIONAL	COMMUNITY DEVELOPMENT ACT (HUD)-DISCRETIONARY FUNDS FEDERAL	EPA CONSTRUCTION GRANTS - FEDERAL	PREDESIGN ENGINEERING GRANTS (STATE OF COLORADO) STATE	ECONOMIC DEVELOPMENT-ADMINISTRATION (EDA) - FEDERAL
PROGRAM DESCRIPTION							
FUND USAGE	TO CONSTRUCT, ENLARGE, EXTEND, OR IMPROVE SEWERAGE SYSTEMS.	TO CONSTRUCT, EXPAND, OR MODERNIZE SEWAGE TREATMENT FACILITIES	PROGRAM IS GEARED FOR ECONOMIC DEVELOPMENT TYPE PROJECTS, HOWEVER ECONOMIC DEVELOPMENT HAS A VERY BROAD DEFINITION.	TO CONSTRUCT SEWAGE COLLECTION LINES NOT TREATMENT FACILITIES.	TO PLAN, DESIGN, AND CONSTRUCT SEWERAGE COLLECTION AND TREATMENT FACILITIES.	PREDESIGN ENGINEERING FOR THE EXPANSION, CONSTRUCTION, OR MODERNIZATION OF SEWAGE TREATMENT SYSTEMS INCLUDING COLLECTION OF FACILITIES	THE PROGRAM IS CURRENTLY BEING RECONSIDERED BY THE CONGRESS. IT IS ANTICIPATED THAT THE QUALIFICATION REQUIREMENTS WILL NOT CHANGE. THE BASIC REQUIREMENT BEING HIGH UNEMPLOYMENT RATE AND HIGH NUMBER OF UNEMPLOYED.
FORM OF ASSISTANCE	MAY BE EITHER LOAN OR GRANT, GRANT OR LOAN 50% OF PROJECT, LOAN 40 YEARS AT 5%.	ASSISTANCE IS GIVEN IN THE FORM OF A GRANT. THE AMOUNT VARIES UPON THE FINANCIAL NEED OF THE COMMUNITY	ASSISTANCE IS IN THE FORM OF A GRANT. MAXIMUM SUPPLEMENTAL GRANT IS 60% OF OTHER FEDERAL FUNDING OR $150,000.	GRANT FROM DISCRETIONARY FUNDS FOR ALL PORTION OF PROJECT.	ASSISTANCE IS IN THE FORM OF A 75% GRANT.	NORMAL STATE GRANT OF 30% APPLICANT MATCHING FUNDS OF 2%. THE APPLICANTS SHARE IS VARIABLE DEPENDING UPON FINANCIAL NEED.	
AMOUNT OF ASSISTANCE	LOAN/GRANT RANGE: $20,000-$200,000.	AVG. GRANT: $50,000 MAX. GRANT: $500,000	AVG. GRANT: $75,000	AVG. GRANT: $130,000 GRANT RANGE: $50,000-$300,000	AVG. GRANT: N/A GRANT RANGE:	AVG. GRANT: $3,000	
CURRENT FISCAL YEAR APPROPRIATION	$4.8 MIL LOANS, .9 MIL GRANTS	$2.3 MIL	$2.5 MIL	$2.5 MIL FISCAL YEAR 1977 (COLORADO NONMETROPOLITAN)		$200,000	
ANTICIPATED APPROPRIATION NEXT FISCAL YEAR	ABOUT THE SAME AS PRIOR YEAR.	$2.9 MIL	$1.7 MIL	MINOR INCREASE FOR FY 1978		$200,000	
ELIGIBILITY REQUIREMENTS							
ELIGIBLE ENTITIES	MUNICIPALITIES AND DISTRICTS	ANY MUNICIPALITY OR SPECIAL DISTRICT	ANYONE WHO CAN GET FEDERAL BASIC FUNDING	A FORM OF GENERAL PURPOSE GOVERNMENT, E.G. INCORPORATED MUNICIPALITIES, COUNTIES, THE STATE OR INDIAN TRIBES.	SEE ATTACHED NOTICE OF FINAL ADOPTION OF FEDERAL CONSTRUCTION GRANT PRIORITY SYSTEM, DATED AUG. 20, 1975.	ANY MUNICIPALITY OR SPECIAL DISTRICT.	
ELIGIBILITY REQUIREMENTS	MUST NOT HAVE THE CAPABILITY TO FINANCE THE PROJECT THROUGH AVAILABLE COMMUNITY RESOURCES. HAVE POP. LESS THAN 10,000 AS OF LAST CENSUS	APPLICANT'S POPULATION MUST BE 5,000 OR LESS, AS OF THE LATEST CENSUS.	MUST HAVE RECEIVED ANOTHER SOURCE OF FEDERAL AID.	N/A	N/A	APPLICANT'S POPULATION MSUT BE 5,000 OR LESS, AS OF THE LATEST CENSUS.	
DISCRIMINATING FACTORS	FINANCIAL NEED, THE ENTITY MUST BE AT OR NEAR THEIR LIMIT ON BONDING INDEBTEDNESS.	FINANCIAL NEED, BONDED INDEBTEDNESS, ASSESSED VALUATION, MEDIAN INCOME, ETC.	THE PROJECT MUST PROMOTE ECONOMIC DEVELOPMENT.	EXTENT TO WHICH: COMMUNITY HAS POVERTY, SUBSTANDARD HOUSING, BENEFITS LOW-MODERATE INCOME HOUSING, NEEDED FOR HOUSING STOCK, ALLEVIATING HEALTH,SAFETY, & WELFARE PROBLEMS AND GRANTS FROM OTHER AGENCIES.	N/A	FINANCIAL NEED, SERIOUSNESS OF POLLUTION PROBLEM.	
APPLICATION MECHANICS							
APPLICATION PROCESS	BEGIN WITH COUNTY FHA REPRESENTATIVE.	A. SUBMIT GRANT APPLICATION TO DIRECTOR OF LOCAL GOVERNMENTS AND APPLY FOR SITE APPROVAL FROM THE COLORADO WATER POLLUTION CONTROL COMMISSION. B. DIVISION OF LOCAL GOVT. THEN ISSUE A CERTIFICATE OF FINANCIAL NEED STATING AMOUNT OF GRANT AND THAT THE APPLICANT MUST OBTAIN SITE APPROVAL. C. SUBMIT SITE APPROVAL, FINAL PLANS AND SPECIFICATIONS TO THE DIVISION OF LOCAL GOVERNMENTS. D. SUBMIT TWO SETS OF FINAL PLANS AND SPECIFICATIONS TO COLORADO DEPARTMENT OF HEALTH.	DETERMINE A SOURCE OF FEDERAL FUNDING OR POSSIBILITY THEREOF, ARRANGE A PRE-APPLICATION CONFERENCE WITH THE FOUR CORNERS REGIONAL COMMISSION REPRESENTATIVE, ARRANGE FOR AN A-95 REVIEW OF PROJECT.	APPLICATION PROCESS WAS PUBLISHED IN THE FEDERAL REGISTER ON OCT. 13, 1976. COMPETITION IS VERY STIFF FOR THESE FUNDS.	THE STATE HEALTH DEPARTMENT WILL CONTACT THE MUNICIPALITY WHEN FUNDING BECOMES AVAILABLE.	A. OBTAIN LETTER FROM LOCAL HEALTH DEPARTMENT OFFICIAL CERTIFYING THAT SYSTEM IS CURRENTLY IN VIOLATION OF STATE STANDARDS. B. OBTAIN ENGINEERS PROPOSAL FOR WORK. C. OBTAIN APPLICATION FORM LGPS275. SUBMIT ALL OF THE ABOVE TO THE DIVISION OF LOCAL GOVERNMENTS.	
APPLICATION DEADLINES	FIRST COME, FIRST SERVED UNTIL APPROPRIATION RUNS OUT.	FUNDING IS ON A FIRST COME, FIRST SERVE BASIS.	NO DEADLINES, FUNDING IS ON A FIRST COME, FIRST SERVE BASIS.	TO BE DETERMINED	N/A	FUNDING IS ON A FIRST COME, FIRST SERVE BASIS.	
TIME REQUIRED TO EVALUATE APPLICATION	3 MONTHS	1-3 MONTHS. THIS INCLUDES TIME REQUIRED FOR HEALTH DEPARTMENT REVIEW OF PLANS AND SPECIFICATIONS.	VERY FAST, AS FUNDING IS TIED TO ALREADY APPROVED FEDERAL FUNDING.	TO BE DETERMINED 5-6 MONTHS, EXCEPT FOR EMERGENCY SITUATIONS	N/A	2 MONTHS	
SCELLANEOUS		IF FUNDING IS NOT RECEIVED UPON INITIAL APPLICATION, IT IS REVIEWED MONTHLY UNTIL IS IS FUNDED OR THE APPROPRIATION IS EXHAUSTED. THESE FUNDS MAY BE USED IN CONJUNCTION WITH OTHER LOANS OR GRANTS. THE COMMUNITY MUST BE PREPARED TO USE 1.5% OF ITS MEDIAN FAMILY INCOME PER CUSTOMER PER ANNUM TO OPERATE ITS EXISTING SYSTEM AND/OR PAY FOR ITS SHARE OF THE NEW PROJECT.			CURRENTLY THERE IS A LARGE EMPHASIS ON STEP 1 AND 2 GRANTS. HOWEVER, AS COMMUNITIES BECOME READY FOR STEP 3 GRANTS, THE AMOUNTS AVAILABLE FOR STEP 1 AND 2 GRANTS WILL BE GREATLY DIMINISHED.	THESE FUNDS MAY BE USED IN COMBINATION WITH OTHER LOANS/GRANTS.	
NTACTS	JOHN MEIKLE, FHA, 337-4717	BILL PEED, STATE OF COLORADO, DIVISION OF LOCAL GOVERNMENTS 892-2156 JEB LOVE, STATE HEALTH DEPT. 388-6111	IVO ROOSPOLD, DEPT. OF LOCAL AFFAIRS, RURAL DEVELOPMENT 892-2631	ARMAND SEDGELEY, HUD-DENVER 837-4666	RON SCHUYLER, STATE DEPT. OF HEALTH, 388-6111 JERRY BURKE, SAM BERMAN FEDERAL EPA, 837-3961	BILL PEED, STATE OF COLORADO DIVISION OF LOCAL GOVERNMENTS 892-2156	PAUL RENNE, ALL PROGRAMS, JOHN ZENDER LOCAL PUBLIC WORKS ACT, 337-4714

BRISCOE, MAPHIS, MURRAY & LAMONT, INC. MARCH 3, 1976

of the proposed new system.

Service or user rates can be the most equitable source of funds. The beneficiary should pay in proportion to the amount of benefit received. Rates should be pegged to reflect the full cost of operation, maintenance, and depreciation, and perhaps some portion of debt service where borrowing to provide a plant for existing customers remains unpaid. Tap or plant investment fees can also be used if necessary, but this is not considered a desirable practice for paying operating costs, as it defeats the purpose of the tap fee.

Rather, tap fees should be applied to repay bonds issued to finance the added plant capacity serving the new taps.

Because of historical precedent, many communities do not charge users in proportion to their use, but keep a low user rate by subsidizing costs with mill levies on property. This is particularly true in special districts where high user rates would discourage potential hookups. The argument against this use of property tax revenues is that it depletes an important source of funding general purpose, non-revenue producing facilities.

A community can choose to subsidize rates from its general fund monies. These might be composed, for example, of revenue sharing funds, sales tax, fees or licenses, or cigarette taxes. The same drawback as with using property taxes applies.

Most generally, however, operations and maintenance costs are covered by annual user rates. To determine if a community can generate sufficient user rate revenue to support the system, the state guideline of 1-1/2% of the median family income can be used as a general guide. While a community can certainly charge more than 1-1/2%, anticipated user fees far in excess of this figure may indicate that the residents of the community will find the sewer utility extremely difficult to support.

$119 represents a reasonable annual user fee level, according to the state guideline. With 900 sewer customers, Fort Lupton can easily generate sufficient revenue to pay the maintenance and operating costs of $64,325 for an expanded system, together with the existing $9,170 in annual debt service. At $119 each, 900 users would raise over $101,000 annually. As shown in Table 10.3-A, Fort Lupton could handle some substantial portion of capital costs for upgrading, in addition to the operating costs, and still stay within the state guideline.

10.3.3 Effects of Population Growth

Increased population can provide increased revenue through PIF's, user fees, and taxes, all of which can ease the burden of supporting the sewer utility on existing residents.

A realistic anticipation of growth might encourage the community

to borrow more money to finance its system, and will influence the size and/or type of system the community decides to use.

However, bear in mind that increased population may also generate needs for system expansion (necessitating further borrowing) and that projected growth with does not occur on schedule may seriously burden existing residents with higher annual payments than had been planned. Recognizing the possibility for growth--without counting on it to carry the community's financing needs--is a necessary component of evaluating the community's capabilities to support the sewer utility.

Table 10.3-A illustrates impacts for Fort Lupton of various combinations of borrowing levels and growth rates. It can be used to evaluate risk and anticipated cost per user should the Town borrow money to develop a system.

10.4 CONCLUSIONS AND RECOMMENDATIONS FROM FINANCIAL ANALYSIS

10.4.1 Conclusions

The residents of Fort Lupton will have to obtain some outside financial assistance in order to afford the construction of $385,000 to $510,000 of sewer system improvements. Even though the Town is in relatively strong financial condition, it must be careful not to overextend itself in financing wastewater improvements. With its history of rapid growth since 1970, other community needs will likewise press for funds.

In view of the state guideline for local financial effort, the citizens should anticipate some need to raise the present annual user rates for sewer service. In order to obtain grant assistance for the capital costs of plant upgrading, charges more in the area of $10 per month, or $120 per year may be required.

If rates are raised to the 1-1/2% guideline level, and grant assistance can be obtained so that the Town's borrowing can be limited to no more than $300,000, even without any future growth, debt service and operating costs can be handled.

This guideline of 1-1/2% provides only one indicator. It may be possible to achieve a larger grant; on the other hand, there may not be enough grant money available and a smaller grant may have to be used. In that event, the way the local financing package is developed becomes much more important. Longer term borrowing, or ballooning the loan so there are smaller payments in the near term with larger payments later so that growth will help to provide a base, become considerations. The Table can show what to expect in this regard.

For instance, suppose the maximum available in grant monies is $103,000 (a sum tentatively approved by the State already) and the City wishes to construct the $510,000 system. In this case

the Table indicates that each user may be required to pay more than $120 annually by 1981, in the unlikely event no growth occurs.

10.4.2 Recommendations

It is recommended that Fort Lupton be sure of its citizens' willingness and ability to pay larger annual user fees. Doing so may well be advisable in light of the possibilities for obtaining grant assistance with the plant upgrading.

Secondly, with some idea in mind as to the total amount of grant assistance required, town representatives should contact the agencies suggested above to get an idea of the likelihood of obtaining financial aid. It appears something of in the area of at least $100,000 to $200,000 will be required depending on whether or not the smaller or larger system is selected. Finally, the Town should agree on policies regarding its overall approach to management of a central wastewater system. A recommended approach is discussed in detail in the Utility Management Handbook (1977), available from the Larimer-Weld Council of Governments.

APPENDIX A

BIBLIOGRAPHY

Colorado Department of Health, Water Quality Control Division, Comprehensive Water Quality Management Plan-South Platte River Basin, Colorado, Engineering Consultants, Inc., Toups Corporation, October, 1974.

Colorado Department of Health, Criteria Used in the Review of Wastewater Treatment Facilities, Frank J. Rozich, June, 1973.

Eckenfelder, W.W., et al, "Study of Fruit and Vegetable Processing Waste Disposal Methods" - New York Canner's Association, September, 1958.

Environmental Protection Agency, 12060 DSB 09/71, Demonstration of a Full Scale Waste Treatment System for a Cannery, Office of Research and Monitoring, September, 1971.

Environmental Protection Agency, Technology Transfer Seminar Publication, Waste Treatment - Upgrading Food Processing Facilities to Reduce Pollution, January, 1975.

Environmental Protection Agency, Alternative Waste Management Techniques for Best Practical Waste Treatment, EPA 430/9-75-013, October, 1975.

Fort Lupton Canning Company, Personal Communication, Mr. Ben Counter.

Goleta County Water District, Feasibility Study - Wastewater Reclaimation by Irrigation, Toups Corporation, August, 1975.

Larimer-Weld Regional Planning Commission, Interim Water and Sewer Planning for Region II - Larimer and Weld Counties, 1972.

Nelson, Haley, Patterson and Quirk, Inc., Preliminary Engineering Report - Wastewater Treatment Improvements - City of Fort Lupton, July, 1974.

N. L. Nemerow, Liquid Waste of Industry - Theories, Practice, and Treatment, Addison-Wesley Publishing Company, 1971.

Mr. Tom Norton - Personal Communication.

Rudolfs, W., Industrial Waste Treatment, Reinhold Publishing Corporation, 1953.

University of California - Cooperative Extension, "Water Quality Guidelines for Interpretation of Water Quality for Agriculture", R.S. Ayers and R. L. Branson, January, 1975.

Water Rights Determination and Administration Act - State of Colorado, 1969.

APPENDIX B

NPDES WASTE DISCHARGE PERMIT - CITY OF FORT LUPTON

RENEWAL

Permit No: CO-0021440

County: Weld

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"), and the Colorado Water Quality Control Act (CRS, 1973 as amended, 25-8-101 et. seq.)

the City of Fort Lupton,

is authorized to discharge from its wastewater treatment facility,

to receiving waters named the South Platte River,

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective thirty (30) days after the date of receipt of this permit by the Applicant.

This permit and the authorization to discharge shall expire at midnight, June 30, 1978.

Signed this 11th day of May, 1976

COLORADO DEPARTMENT OF HEALTH
Division of Administration

Robert D. Siek
Assistant Director, Department of Health
Environmental Health

B

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - SEE ANY ADDITIONAL REQUIREMENTS UNDER PART III.

1. Effluent Limitations

Effective immediately, the quality of effluent discharged by the facility shall, as a minimum, meet the limitations as set forth below:

There shall be no change in operation that will significantly deteriorate the quality of the discharge below that presented in the permit application.

2. Monitoring requirements shall be those outlined in Part I, page 3 of this permit.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - SEE ANY ADDITIONAL REQUIREMENTS UNDER PART III.

1. Effluent Limitations

Effective as soon as reasonable and practical but no later than July 1, 1977, the quality of effluent discharged by the facility shall, as a minimum, meet the limitations as set forth below:

Parameter	Average Effluent Concentration Discharge Limitations Concentration mg/l 30-day Avg.		mg/l 7-day Avg.		Monitoring Requirements Measurement Frequency e/	Sample Type f/
Flow - m^3/Day (MGD)	N/A			N/A	Weekly	Instantaneous or continuous
BOD_5 - mg/l	30	a/	45	b/	Weekly g/	Grab
Total Suspended Solids	30	a/	45	b/	Weekly g/	Grab
Fecal Coliforms - number/100 ml	200	c/	400	c/	Weekly	Grab
Total Residual Chlorine - mg/l		0.5 d/		h/	Daily	Grab

Oil and Grease shall not exceed 10 mg/l in any grab sample nor shall there be a visible sheen. The effluent shall be monitored daily by visual observation.

pH - units shall remain between 6.0 and 9.0 and shall be monitored daily by a grab sample. d/

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Continued)

a/ This limitation shall be determined by the arithmetic mean of a minimum of three (3) consecutive samples taken on separate weeks in a 30-day period (minimum total of three (3) samples); not applicable to fecal coliforms -- see footnote c/.

b/ This limitation shall be determined by the arithmetic mean of a minimum of three (3) consecutive samples taken on separate days in a 7-day period (minimum total of three (3) samples); not applicable to fecal coliforms -- see footnote c/.

c/ Averages for fecal coliforms shall be determined by the geometric mean of a minimum of three (3) consecutive grab samples taken during separate weeks in a 30-day period for the 30-day average, and during separate days in a 7-day period for the 7-day average. (minimum total of three (3) samples).

d/ Any single analysis and/or measurement beyond this limitation shall be considered a violation of the conditions of this permit.

e/ Quarterly samples shall be collected during the months of January, April, July, and October, if a continual discharge occurs. If the discharge occurs on an intermittent basis, the quarterly sample shall be collected during the period when that intermittent discharge occurs.

f/ See definitions, Part B.

g/ In addition to monitoring the final discharge, influent samples shall be taken and analyzed for this parameter at the same frequency as required as for this parameter in the discharge.

h/ Total Residual Chlorine shall be measured if chlorination is used in the treatment process.

B. MONITORING AND REPORTING

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on April 28, 1976. If no discharge occurs, "No Discharge" shall be reported. Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

Colorado Department of Health
Water Quality Control Division
4210 East 11th Avenue
Denver, Colorado 80220

U.S. Environmental Protection Agency
1860 Lincoln Street - Suite 900
Denver, Colorado 80203
Attention: Enforcement - Permit Program

3. Definitions

a. A "composite" sample, for monitoring requirements, is defined as a minimum of four (4) grab samples collected at equally spaced two (2) hour intervals and proportioned according to flow.

b. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

c. An "instantaneous" measurement, for monitoring requirements, is defining as a single reading, observation, or measurement using existing monitoring facilities.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, and Colorado State Effluent Limitations (400), under which such procedures may be required.

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State Water Quality Control Divison.

C. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

The permittee shall submit to the permit issuing authority in less than ninety (90) days after the issuance of this permit, a new implementation plan for an abatement program designed to achieve the effluent limitations specified in this permit for discharge from outfall 001.
The implementation plan shall consist of an outline of intended design, construction and operation, including a compliance schedule setting forth the dates by which compliance with the effluent limitations will be reached. The compliance schedule shall include, where appropriate, dates to accomplish the following:

(a) completion of preliminary plans
(b) completion of final plans
(c) award of contract(s)
(d) commencement of construction
(e) completion of major construction phases
(f) completion of all construction
(g) attainment of operational level

Upon approval of the implementation plan by the permit issuing authority, the schedule of compliance shall become conditions of this permit.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

Compliance and interim reporting dates shall be for periods not to exceed nine (9) months and to the extent practical shall fall on the last day of March, June, September, and December.

3. A completed Standard Form A - Municipal Section IV Industrial Waste Contribution to Municipal System shall be submitted for each major industrial discharger within 120 days of the effective date of this permit. (See Part III Industrial Wastes of this permit.)

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges or pollutants must be reported by sumbission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. Noncompliance Notification.

If, for any reason, the permittee does not comply with any maximum effluent limitation specified in this permit the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. Bypassing (see additional requirements under Part III)

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

6. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering State waters.

7. Power Failures

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall;

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control and lift station facilities.

8. Any discharge to the waters of the State from a point source other than specifically authorized is prohibited.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the head of the State water pollution control agency, the Regional Administrator, and/or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in the permit; and to sample any discharge of pollutants.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Act and Regulations for the State discharge permit system (506), all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the

State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act, and CRS (1973) 25-8-610.

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. Toxic Pollutants

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. *Property Rights*

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. *Severability*

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

OTHER REQUIREMENTS

Additional Bypassing Requirements

If, for other reasons, a partial or complete bypass is considered necessary, a request for such bypass shall be submitted to the State of Colorado and to the Environmental Protection Agency at least sixty (60) days prior to the proposed bypass. If the proposed bypass is judged acceptable by the State of Colorado and by the Environmental Protection Agency, the bypass will be allowed subject to limitations imposed by the State of Colorado and the Environmental Protection Agency.

If, after review and consideration, the proposed bypass is determined to be unacceptable by the State of Colorado and the Environmental Protection Agency, or if limitations imposed on an approved bypass are violated, such bypass shall be considered a violation of this permit; and the fact that application was made, or that a partial bypass was approved, shall not be a defense to any action brought thereunder.

Percentage Removal Requirements (Applies to Sewage Treatment Plants only)

If not presently being complied with, effective as soon as reasonable and practical, but no later than July 1, 1977, the arithmetic mean of the Total BOD_5 and the Total Suspended Solids concentrations for effluent samples collected in a period of 30 consecutive days shall not exceed 15 percent of the arithmetic mean of the concentrations for influent samples collected at approximately the same times during the same period (85 percent removal). This is in addition to the concentration limitations on Total BOD_5 and Total Suspended Solids.

OTHER REQUIREMENTS (Continued)

Industrial Wastes

A. Each major contributing industry, if not previously indentified, must be identified as to qualitative and quantitative characteristics of the discharge and production data. Such information shall be submitted within one hundred twenty (120) days of the issuance of this permit. A major contributing industry is defined as an industrial user discharging to a municipal treatment works that satisfies any of the following: (1) has a flow of 50,000 gallons or more per average work day; (2) has a flow greater than five percent of the flow carried by the municipal system receiving the waste; (3) has in its waste a toxic pollutant in toxic amounts as defined in standards issued under Section 307(a) of Public Law 92-500 (not published as of December 1, 1975).

B. The permittee must notify the permitting authority of any new introductions by new or existing sources or any substantial change in pollutants from any major industrial source. Such notice must contain the information described in "A" above and be forwarded no later than sixty (60) days following the introduction or change.

C. Pretreatment Standards (40 CFR Part 128) developed pursuant to Section 307 of the Act require that under no circumstances shall the permittee allow introduction of the following wastes into the waste treatment system:

(1) Wastes which create a fire or explosion hazard in the publicly owned treatment works.

(2) Wastes which will cause corrosive structural damage to treatment works, but in no case, wastes with a pH lower than 5.0, unless the works are designed to accommodate such wastes.

(3) Solids or viscous substances in amounts which would cause obstruction to the flow in sewers, or other interference with the proper operation of the publicly owned treatment works.

(4) Wastewaters at a flow rate and/or pollutant discharge rate which is excessive over relatively short time periods so that there is a treatment process upset and subsequent loss of treatment efficiency.

Violations Resulting from Overloading

Should there be a violation of any conditions of this permit, the Environmental Protection Agency has the authority under Section 402(h) of the Federal Water Pollution Control Act Amendments of 1972 to proceed in a court of competent jurisdiction to restrict or prohibit further connections to the treatment system covered by this permit by any sources not utilizing the system prior to the finding that such a violation occurred. It is intended that this provision be implemented by the Agency (or the State) as appropriate.

OTHER REQUIREMENTS (Continued)

Testing

Test procedures shall conform with those procedures specified in the Federal Register, Volume 38, Number 199, October 16, 1973. These procedures involve the use of one of the following references:

1. "Standard Methods for the Examination of Water and Waste Water," 13th Edition, 1971.

2. "ASTM," Annual Book of Standards, Part 23, Water, Atmosphere Analysis, 1973.

3. "Methods for Chemical Analysis of Water and Wastes," 1971, Environmental Protection Agency.

Expansion Requirements

Pursuant to Colorado Law, C.R.S. 1973 25-8-501(6), the permittee is required to initiate engineering and financial planning for expansion of the treatment works whenever throughput and treatment reaches eighty (80) percent of design capacity. Whenever ninety-five (95) percent of either the hydraulic or organic capacity of the treatment works is met, the permittee shall commence construction of the necessary treatment expansion.

In the case of a municipality, construction may be commenced, or building permit issuance may be terminated, until such construction is initiated, except that building permits may continue to be issued for any construction which would not have the effect of increasing the input of sewage to the municipal treatment works.

Within three (3) months after the date of permit issuance, a flow-measuring device shall be installed to give representative values of effluent volume at some point in the plant circuit, if not already a part of the wastewater plant.

Until adequate capacity is provided in the collection system and the wastewater treatment facilities, additional taps to the system will be limited an average of 20 taps per year, not to exceed 25 taps in any one year period.

OTHER REQUIREMENTS (Continued)

At the request of the Regional Administrator of the Environmental Protection Agency or the Director of the State Water Quality Control Division, the permittee must be able to show proof of the accuracy of any flow-measuring device used in obtaining data submitted in the monitoring report. The flow-measuring device must indicate values within ten percent of the actual flow being measured.

The limitations stated in Part I, Section A, are calculated on the basis of gross measurements of each parameter in the designated discharge regardless of the quantity and quality of these parameters in the plant inflow.

If the permittee desires to continue to discharge, he shall reapply at least 180 days before this permit expires.

Within 60 days of the issuance of this permit, the permittee shall file a statement with the Environmental Protection Agency and the State of Colorado which shall contain the names of the person or persons who are designated to report conditions as noted in Part II, Seciton A, Paragraph 2a (Noncompliance Notification), and as noted in Part II, Section B, Paragraph 7 (Oil and Hazardous Substance Liability).

APPENDIX C

CALIFORNIA DEPARTMENT OF HEALTH - WASTEWATER RECLAIMATION GUIDELINES

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR USE OF RECLAIMED WATER FOR SURFACE IRRIGATION CROPS

1. Reclaimed water shall meet the Regional Water Quality Control Board requirements and the quality requirements established by the State of California Department of Health for health protection.

2. The discharge shall be confined to the area designated and approved for disposal and reuse. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

3. Maximum attainable separation of reclaimed water lines and domestic water lines shall be practiced. Domestic and reclaimed water transmission and distribution mains shall conform to the "Separation and Construction Criteria" (see attached).

   a. The use area facilities must comply with the "Regulations Relating to Cross-Connections," Title 17, Chapter V, Sections 7583-7622, inclusive, California Administrative Code.

   b. Plans and specifications of the existing and proposed reclaimed water system and domestic water system shall be submitted to State and/or local health agencies for review and approval.

4. All reclaimed water valves and outlets should be appropriately tagged to warn the public that the water is not safe for drinking or direct contact.

5. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

6. All reclaimed water valves and outlets should be of a type that can only be operated by authorized personnel.

7. Adequate means of notification shall be provided to inform the public that reclaimed water is being used. Conspicuous warning signs with proper wording of sufficient size to be clearly read shall be posted at adequate intervals around the use area.

8. The public shall be effectively excluded from contact with the reclaimed water used for irrigation.

   a. The irrigated areas should be fenced where primary effluent is used.

   b. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

9. Adequate measures should be taken to prevent the breeding of flies, mosquitoes, and other vectors of public health significance during the process of reuse.

10. Operation of the use area facilities should not create odors, slimes, or unsightly deposits of sewage origin.

11. Adequate time should be provided between the last irrigation and harvesting to allow the crops and soil to dry.

    a. Animals, especially milking animals, should not be allowed to graze on land irrigated with reclaimed water until it is thoroughly dry.

12. There should be no subsequent planting of produce on lands irrigated with primary effluent.

13. Adequate measures shall be taken to prevent any direct contact between the edible portion of the crops and the reclaimed water.

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR USE OF RECLAIMED WATER FOR LANDSCAPE IRRIGATION

1. Reclaimed water shall meet the Regional Water Quality Control Board requirements and the quality requirements established by the State of California Department of Health for health protection.

2. The discharge shall be confined to the area designated and approved for disposal and reuse. Irrigation should be controlled to minimize ponding of wastewater and runoff should be contained and properly disposed.

3. Maximum attainable separation of reclaimed water lines and domestic water lines shall be practiced. Domestic and reclaimed water transmission and distribution mains shall conform to the "Separation and Construction Criteria" (see attached).

   a. The use area facilities must comply with the "Regulations Relating to Cross-Connections," Title 17, Chapter V, Sections 7583-7622, inclusive, California Administrative Code.

   b. Plans and specifications of the existing and proposed reclaimed water system and domestic water system shall be submitted to State and/or local health agencies for review and approval.

4. All reclaimed water valves, outlets and/or sprinkler heads should be appropriately tagged to warn the public that the water is not safe for drinking or direct contact.

5. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

   a. Where feasible, differential piping materials should be used to facilitate water system identification.

6. All reclaimed water valves, outlets, and sprinkler heads should be of a type that can only be operated by authorized personnel.

   a. Where hose bibbs are present on domestic and reclaimed water lines, differential sizes should be established to preclude the interchange of hoses.

7. Adequate means of notification shall be provided to inform the public that reclaimed water is being used. Such notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read. At golf courses, notices should also be printed on

score cards and at all water hazards containing reclaimed water.

8. Tank trucks used for carrying or spraying reclaimed water should be appropriately identified to indicate such.

9. Irrigation should be done so as to prevent or minimize contact by the public with the sprayed material and precautions should be taken to insure that reclaimed water will not be sprayed on walkways, passing vehicles, buildings, picnic tables, domestic water facilities, or areas not under control of the user.

   a. Irrigation should be practiced during periods when the grounds will have maximum opportunity to dry before use by the public unless provisions are made to exclude the public from areas during and after spraying with reclaimed water.

   b. Windblown-spray from the irrigation area should not reach areas accessible to the public.

   c. Irrigated areas must be kept completely separated from domestic water wells and reservoirs. A minimum of 500 feet should be provided.

   d. Drinking water fountains should be protected from direct or windblown reclaimed water spray.

10. Adequate measures should be taken to prevent the breeding of flies, mosquitoes, and other vectors of public health significance during the process of reuse.

11. Operation of the use area facilities should not create odors, slimes, or unsightly deposits of sewage origin in places accessible to the public.

STATE OF CALIFORNIA DEPARTMENT OF HEALTH

GUIDELINES FOR WORKER PROTECTION
AT WATER RECLAMATION USE AREAS

1. Employees should be made aware of the potential health hazards involved with contact or ingestion of reclaimed water.

2. Employees should be subjected to periodic medical examinations for intestinal diseases and to adequate immunization shots.

3. Adequate first aid kits should be available on location, and all cuts and abrasions should be treated promptly to prevent infection. A doctor should be consulted where infection is likely.

4. Precautionary measures should be taken to minimize direct contact of employees with reclaimed water.

   a. Employees should not be subjected to reclaimed water sprays.

   b. For work involving more than a casual contact with reclaimed water, employees should be provided with protective clothing.

   c. At crop irrigation sites, the crops and soil should be allowed to dry before harvesting by employees.

5. Provisions should be made for a supply of safe drinking water for employees. Where bottled water is used for drinking purposes, the water should be in contamination-proof containers and protected from contact with reclaimed water or dust.

   a. The water should be of a source approved by the local health authority.

6. Toilet and washing facilities should be provided.

7. Precautions should be taken to avoid contamination of food taken to areas irrigated with reclaimed water, and food should not be taken to areas still wet with reclaimed waer.

8. Adequate means of notification shall be provided to inform the employees that reclaimed water is being used. Such notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read.

   a. In some locations, especially at crop irrigation use areas, it is advisable to have the signs in Spanish as well as English.

9. All reclaimed water valves, outlets, and/or sprinkler heads should be appropriately tagged to warn employees that the water is not safe for drinking or direct contact (direct contact is allowed at non-restricted recreational impoundments).

10. All piping, valves, and outlets should be color-coded or otherwise marked to differentiate reclaimed water from domestic or other water.

    a. Where feasible, differential piping materials should be used to facilitate water system identification.

11. All reclaimed water valves, outlets, and sprinkler heads should be of a type that can only be operated by authorized personnel.

    a. Where hose bibbs are present on domestic and reclaimed water lines; differential sizes should be established to preclude the interchange of hoses.