



CITY OF LANCASTER

David S. Smith, Mayor

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June 30, 2005

Mr. Dan Dudley
Ohio EPA
Division of Surface Water
P.O. Box 1049
Columbus, OH 43216

RE: Water and Wastewater Master Plan
City of Lancaster

Dear Mr. Dudley:

Enclosed, please find a copy of the Water and Wastewater Master Plan for the City of Lancaster. This plan is the cumulation of four years of planning work by the City and consultants in coordination with the Fairfield County planning goals. It represents the City's commitment to provide service to the designated areas as outlined in the plan.

The plan addresses needs for the immediate needs term for the completion of the US 33 Bypass in 2005; near term development resulting from the US 33 Bypass; and for the long term through 2045. This is submitted for use in the Central Ohio 208 plan currently under development by your agency.

If you have any questions, please contact Denise Crews at (740) 687-6614 or Mike Nixon at (740) 687-6664.

Sincerely,

David S. Smith
Mayor

cc: Tom Bulcher, Malcolm Pirnie, Inc.
Denise Crews, Storm Water Coordinator
Rick Mark, Assistant City Engineer
Mike Nixon, Water/Water Pollution Superintendent



208 AREAWIDE WASTE TREATMENT MANAGEMENT PLAN

City of Lancaster, Ohio

June 2005

Project 0491-038

MALCOLM PIRNIE, INC.
1900 Polaris Parkway, Suite 200
Columbus, Ohio 43240-2020



208 AREAWIDE WASTE TREATMENT MANAGEMENT PLAN

FORWARD

This document was originally developed as a Water and Wastewater Improvements Master Plan for the City of Lancaster. It included all the elements necessary to meet the requirements for the Clean Water Act Section 208 Areawide Waste Treatment Management Plan. However, it also included additional information regarding the City of Lancaster's potable water supply, treatment, and distribution system. Therefore, the Water and Wastewater Improvements Master Plan has been somewhat modified for this 208 Plan. Section 3.0 and associated tables and figures, Appendix C, and Figures D-1 through D-4 from Appendix D in the Master Plan have not been included in this 208 Plan because they pertain to the water system only. There are other miscellaneous references or information in the text and appendices that refer or apply to the water system, but that also apply to the wastewater systems.

**CITY OF LANCASTER, OHIO
 MASTER PLAN FOR
 WATER & WASTEWATER IMPROVEMENTS**

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1

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

The City of Lancaster is located in Fairfield County, approximately 30 miles southeast of downtown Columbus, Ohio. The population of Lancaster, per the 2000 census, is approximately 35,335, covering approximately 17 square miles. The City is currently experiencing considerable growth on the northwest side along the existing U.S. Route 33 Corridor. Growth to the west and northwest is expected to continue, particularly with the construction of the U.S. Route 33 Bypass. The State of Ohio is in the final phase of construction for the U.S. Route 33 Bypass which should be completed by the end of 2005. The City recognizes that with the construction of the bypass, there will be significant pressure for future development in the area.

Malcolm Pirnie, Inc. was selected by the City to provide water and wastewater master planning services for the entire incorporated area of the City and the new U.S. 33 Bypass/Rock Mill Corporate Park area located west of the City. The comprehensive Master Plan identifies and prioritizes future water and wastewater capital improvement projects. The Master Plan originally identified two specific planning goals, "Near-Term" and "Long-Term" Facilities. The Near-Term Facilities would provide capital improvement projects that are necessary to serve projected development needs that will result when the bypass construction is completed in 2005. The Long-Term Facilities would provide infrastructure improvements projected for the city service area for the year 2025 and ultimately through the year 2045. The Master Plan Planning Area is shown in Figure 1-1.

1.2 PROJECT DESCRIPTION

1.2.1 Purpose and Scope of Work

The overall project purpose is to develop a Water and Wastewater Improvements Master Plan that will address the projected development of the entire City through the year 2045 with an emphasis on the development needs of the U.S. 33 Bypass area. An

Immediate Needs Infrastructure Memorandum was submitted in May, 2002, and a Near-Term Facilities Report was submitted in July, 2002. These reports identify Immediate and Near-Term capital improvement projects necessary to serve the Rock Mill Corporate Park and other development areas located along the entire U.S. 33 Bypass Corridor which is expected to develop with the completion of the bypass. The infrastructure for the Immediate Needs Area, presented in the Immediate Infrastructure Needs Evaluation Memorandum, is scheduled for completion in September, 2005 as the Rock Mill Corporate Park Phase 2 – Part 2 Project is completed. Although these reports are not included in this document, the recommended projects and associated costs are included.

Information presented in the Immediate and Near-Term reports are incorporated into this Water and Wastewater Improvements Master Plan along with additional Long-Term needs. The Scope of Work for this Master Plan includes the following major tasks.

- Review Previous Planning Documents
- Planning Area Map and GIS Coordination
- Service Area Populations Projections
- Wastewater Master Planning including Model Analyses, CSO Interactions, and Collection and Treatment Alternatives
- Water Master Planning including Model Analyses, and Storage and Distribution Alternatives
- Prepare Master Planning Documents:
 - Immediate Needs Memorandum
 - Near-Term Facilities Report
 - Long Term Control Plan – Addendum
 - Final Master Plan Report
- Pilot Network GIS
- Stream Modeling for Potential Receiving Stream Quality Analysis

As plans for the utilities services for Rock Mill Corporate Park Phase 2 were developed, consideration for the future service needs for the surrounding properties was necessary in order to effectively plan for the expansion of the City's utilities.

1.2.2 Planning Improvement Phases

A schedule of improvements will help to identify and prioritize the City's future capital improvement projects. This will help the City provide service in a phased implementation program that matches the City's level of needs. In order for Lancaster to serve their growing community efficiently and effectively, the planning documents are comprehensive and can be easily updated in response to changing growth trends and regulations. This not only will ensure that orderly development can be achieved, but it will help to create a smooth transition from the master plan phase to the design phase.

To effectively match level of needs in a phased implementation program, future water and wastewater capital improvement projects were initially identified as Near-Term and Long-Term improvement phases. In addition to the Near-Term and Long-Term phases, the City identified an additional critical area in need of more "Immediate" service for the U.S. 33 Bypass development which will be near full implementation, as modified, upon the completion of the Rock Mill Corporate Park Phase 2 – Part 2 Project. Therefore, the planning area was initially reviewed in three separate improvement phases, to ensure that the interim expansions work for the future system. Once the water and wastewater alternative was selected, the City performed a comprehensive evaluation in which project completion dates were selected. Planning improvement phases for the projected growth areas are outlined hereafter and presented in Figure 1-2.

- **Immediate Needs** – Utility services associated with the completion of Rock Mill Corporate Park, Phase 2, located on the east side of the U.S. 33 Bypass and S.R. 188 interchange.
- **Near-Term Needs** – Utility services for initial development associated with the completion of the U.S. 33 Bypass west of the Lancaster City limits and low pressures in the water distribution system in the River Valley Highlands residential development area.

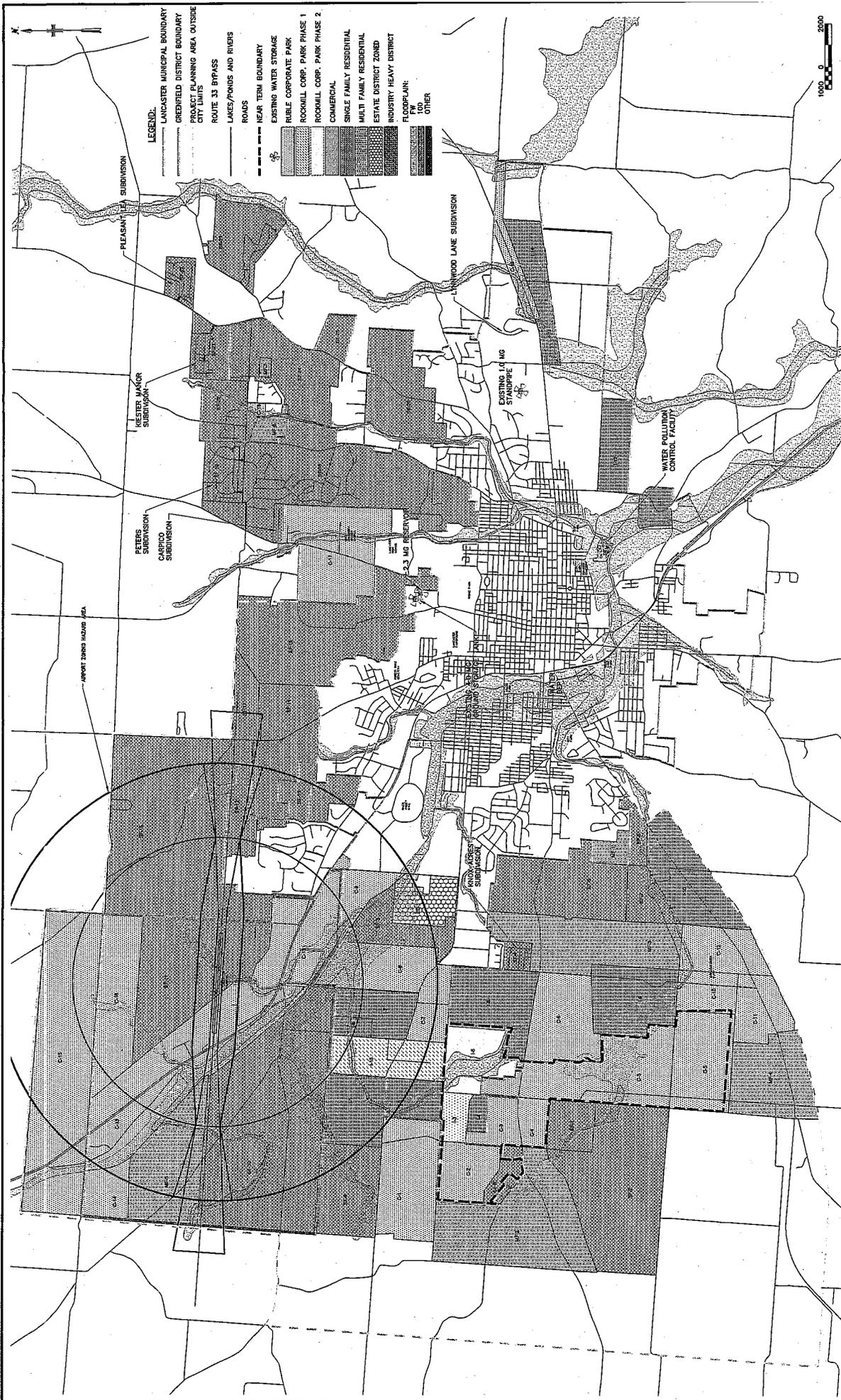
- **Long-Term Needs** – Utility services for all development associated with the completion of the U.S. 33 Bypass west of Lancaster and improvements within the city service area projected for the years 2025 and 2045.

The areas that were identified as the most Immediate need for service include Rock Mill Corporate Park, Phase 2, shown as area I-5 on Figure 1-1, as well as areas I-3, I-4, C-2, C-3, C-4 and SF-6.

The Near-Term phase includes service for areas within the Immediate service area as well as area C-5. In addition, 25% of the projected growth for the year 2025 in areas SF-12, SF-13, SF-14 and SF-16 (River Valley Highlands residential development area) was also included to address low pressures experienced in the water distribution system.

The Immediate and Near-Term information previously submitted have been verified or modified to meet current needs as required in this Master Plan Report. The infrastructure for the Immediate service needs is near complete installation. The Immediate and Near-Term service needs was considered to the greatest extent feasible in order to ensure efficient expansion for the Long-Term service needs. The Long-Term phase includes service for all the remaining development associated with the bypass and improvements within the city service area. The different phases for the proposed water distribution and wastewater collection and treatment systems are shown in the figures presented in Sections 3.0 and 4.0.

For the selection of alternatives, the Immediate needs are included in this report as the first improvement phase and the Near-Term needs are included as the second phase. Long-Term needs projected for the years 2025 and 2045 are included as the third and fourth phases. Upon selection of a water alternative and wastewater alternative, the City assigned year completion dates to the projects to better analyze the projects based on financial capability. Minor modifications and updates were also made to the selected alternatives to better serve the City's needs.



LEGEND:
 LANCASTER MUNICIPAL BOUNDARY
 GREENFIELD DISTRICT BOUNDARY
 PLANNING AREA OUTSIDE CITY LIMITS
 ROUTE 33 BYPASS
 LAKES/POND AND RIVERS
 ROADS
 NEAR TERM BOUNDARY
 EXISTING WATER STORAGE
 ROCKWELL CORP. PARK PHASE 1
 ROCKWELL CORP. PARK PHASE 2
 COMMERCIAL
 SINGLE FAMILY RESIDENTIAL
 MULTI FAMILY RESIDENTIAL
 ESTATE DISTRICT ZONED
 INDUSTRY HEAVY DISTRICT
 FLOODPLAIN:
 FV
 FD
 OTHER

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COMPILED © 2005
 MALCOLM PIRNIE, INC.
 DATE APRIL, 2005
 FIGURE 1-1
 CAD REF. NO. 0491A040

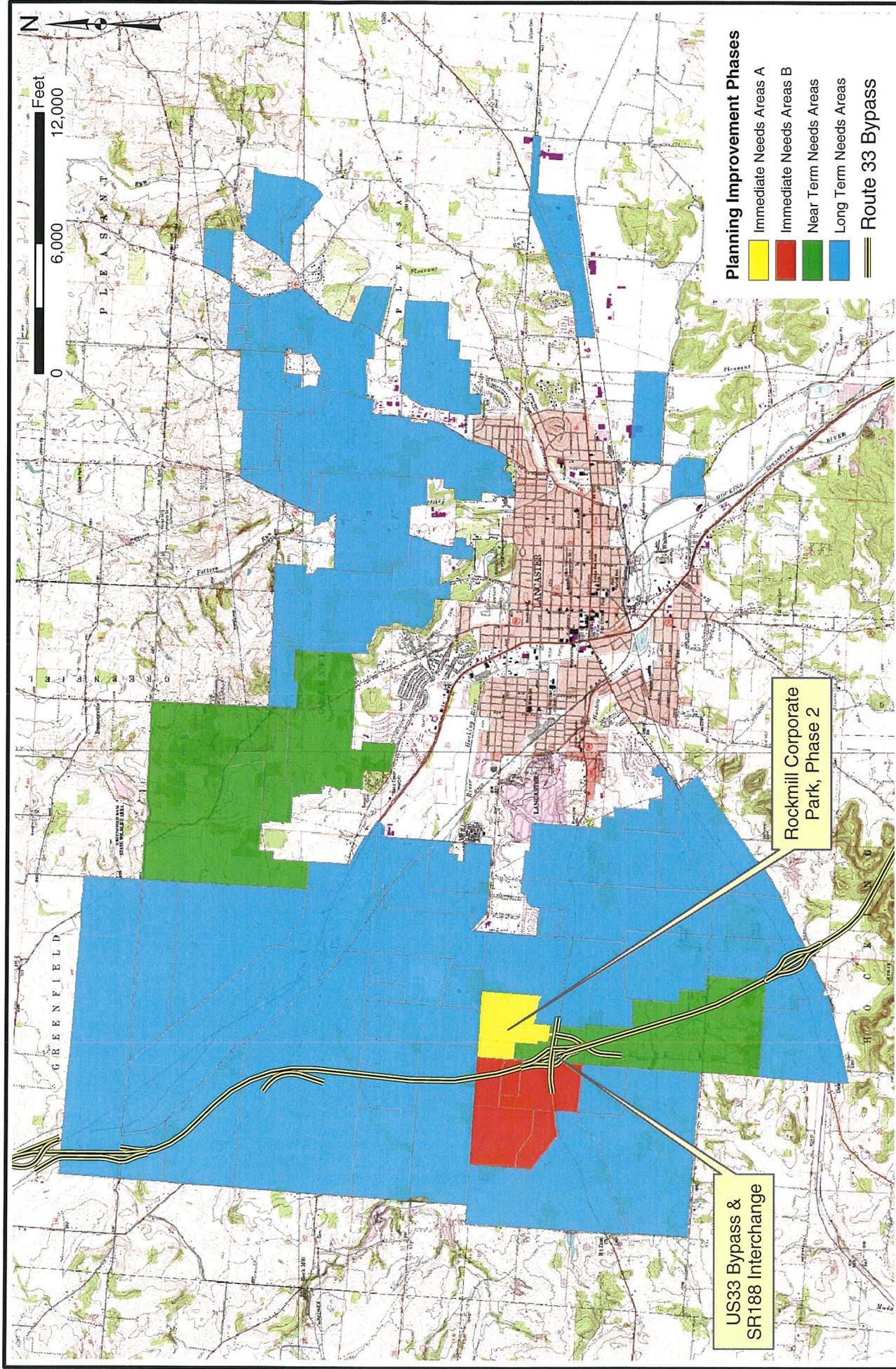
MASTER PLAN PLANNING AREA

**CITY OF LANCASTER
 LANCASTER, OHIO
 WATER AND WASTEWATER
 IMPROVEMENTS MASTER PLAN**

NO.	DATE	REVISIONS	BY	CHKD	APP'D



Standard Graphic Standard File: 0491A040.DWG Scale: 1" = 1000' Date: 04/27/2005 Sheet: 17 of 26 Layout: Figure 1



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DATE April, 2005

Master Plan Growth Areas Planning Phases

City of Lancaster
Lancaster, Ohio
Master Plan for Water and
Wastewater Improvements



2

2.0 METHODOLOGY

2.1 PLANNING AREA

The Master Plan Planning Area includes the entire city limits of Lancaster. In addition, other areas to the west of the City are included to consider development associated with the new U.S. 33 Bypass and north of the City to consider anticipated growth trends toward Columbus. The areas west and north of the City limits were determined based on past planning reports and through workshops with Malcolm Pirnie and City staff. The approximate overall boundaries include the city corporation limits to the east, the interchange of U.S. 22 and the U.S. 33 Bypass to the south, Hocking and Greenfield Townships to the west and Coonpath Road to the north. The planning area is outlined on Figure 1-1.

On April 8, 2003, the Fairfield County Commissioners adopted, Resolution 03-04.08.g, the Fairfield County Development Strategy and Land Use Plan (FCDSLUP). A copy of the resolution is provided in Appendix A. The FCDSLUP planning areas are shown in Appendix A on the Wastewater Treatment Map of Fairfield County and the Fairfield County Centralized Water Systems Service Boundaries Map. The City of Lancaster Planning Area agrees with the planning area shown in the FCDSLUP.

Areas of possible development were determined by using land use information obtained from Fairfield County as well as the current zoning code for the City of Lancaster. Areas are designated on Figure 1-1 as single-family residential (SF), multi-family residential (MF), estate district (ED), commercial (C), or industrial (I) properties. Meetings were held with City staff members to further define areas of development and to estimate approximate growth intensity projections for each area of development. The projected distribution of land uses for the growth areas in the year 2045 is presented in Figure 2-1.

2.2 REFERENCES AND RESOURCES

The reports prepared by Malcolm Pirnie Inc. as a part of the overall Master Plan Project (*U.S. 33 / Rock Mill Corporate Park Immediate Infrastructure Needs Evaluation Memorandum, May 2002 and Near-Term Facilities Report, July 2002*) were used as the basis for final master planning improvements in the Project Area. Parts of the information and recommendations presented in the Immediate Needs Memorandum and in the Near-Term Report were modified or updated as necessary to complete this report and to coordinate with the Final Master Plan facilities recommendations.

2.2.1 Previous Studies

Design references and planning documents were reviewed to determine the most appropriate design criteria for the area. These included the City of Lancaster Zoning Code, the Department of Engineering Sanitary Sewer Design Manual and Pump Station Design Manual, the Fairfield County Land Use Development Plan, the Water Pollution Control Department Combined Sewer System Long-Term Control Plan and Characterization Report, and the U.S. Route 33 Bypass Utilities Services Planning Report.

Other sources of information reviewed included SIECO, Inc.'s 1995 Lancaster Water Master Plan, costs from recent water line, sewer line, and street projects, miscellaneous mapping and drawings prepared by developers for the Rock Mill Phase 2 and Ruble Corporate Parks, and Fairfield County Soil and Water Conservation District maps. Water Pollution Control Department and Water Department operating and billing records, system maps, planning documents, and equipment information were also reviewed for historical data.

2.2.2 Utility Modeling Software

Modeling software was used to evaluate master planning services for future water and wastewater development phases to the year 2045. Existing Fairfield County GIS data was used to assign elevation and mapping values for the water distribution system model. In addition, the City's existing utility billing system accounts were geocoded in the GIS

to distribute actual system demands into the water distribution system model. This will allow input of future usage records enabling rapid update of the City's utility computer models.

It was initially planned to analyze future demands on the water distribution system using the City's existing water distribution system model. However, there was uncertainty regarding whether the existing model was suitable for use as a planning tool. Therefore, the City of Lancaster requested that Malcolm Pirnie develop and calibrate a new dynamic water distribution model for the maximum day demand and fire demand conditions for the City of Lancaster water distribution system. The model is discussed in detail in Section 3.0 of this report.

Malcolm Pirnie developed the City's wastewater collection system model in 1995. The City has been maintaining the model since that time. To adequately analyze the City's future utility service needs, Malcolm Pirnie converted the City's model to the most current software version, XP-SWMM Version 8.5. The model is discussed in detail in Section 4.0 of this report.

2.3 DESIGN CRITERIA

The design criteria are based on the references and resources discussed in Section 2.2 that were established in order to effectively plan for the expansion of the City's utilities. Future flow increases in Lancaster's water and wastewater systems were based on projected growth associated with future residential, commercial, and industrial developments. Future flows associated with the projected developments were incorporated into the Lancaster water and wastewater utility system models to estimate impacts on the respective utility systems.

2.3.1 Average Flows

The average day water and sanitary flows were projected to be 1,000 gallons/acre/day for residential usage based on guidance from the City of Lancaster's Sanitary Sewer Design Manual. For single family homes, it is assumed that there would be three people per unit. At three and one third units per acre, the total projected

population would be 10 people per acre for a fully developed area. Lower densities could occur for single family homes down to three people per acre. Higher population densities could occur for multi-family homes up to 65 people per acre. Therefore, 10 people per acre was selected as the population density for a fully developed area. Based on 100 gallons per person per day, the average day flow for a fully developed residential area was projected at 1,000 gallons per acre per day. The Projected Development Acreages, Populations, and Average Flows are presented in Table A-2 of Appendix A.

For commercial development, the average day water and sanitary flows were projected to be 1,000 gallons per acre per day for fully developed areas. This was based on guidance from the City of Lancaster's Sanitary Sewer Design Manual. Although the manual does not have a specific recommendation for commercial development, the recommended water usage rate for the "Light or Low Density Industrial" from "Scientific Research Use Groups" is 1,000 gallons per acre per day.

For industrial development, the average day water and sanitary flows were projected to be 1,300 gallons/acre/day for fully developed areas. This was based on guidance from the City of Lancaster's Sanitary Sewer Design Manual. The recommended water usage rate varies from 1,000 gallons per acre per day for "Light or Low Density" industrial, to 1,500 gallons per acre per day for "Medium Density" industrial, to 3,000 gallons per acre per day for "High Density" industrial. An intermediate average day flow rate of 1,300 gallons per acre per day was selected for fully developed industrial areas.

The above flow rates per acre for residential, commercial, and industrial were then used to determine the projected average flows for each of the areas designated for future development as Shown on Figure 1-1. The average day flows were then used to determine the appropriate peak flows for sizing future water and wastewater piping and facilities.

In addition to the average flows associated with projected future development shown on Figure 1-1, additional existing flows associated with areas that are not currently served by the City of Lancaster, are also included in the total projected average flows:

- It is expected that Fairfield County will connect to the City's water and wastewater system from five existing subdivisions: Knox Acres, Carpico Drive, Kiester Manor, Pleasant Lea, and Lakeside. The estimated flows for these areas are summarized in a letter report to the Fairfield County Utilities Department, which is provided in Appendix A.
- The City currently has a wastewater service contract with Greenfield Township for a maximum capacity of 400,000 gallons per day, displayed in Appendix A. Currently, the City is receiving approximately 150,000 gallons per day from Greenfield Township. Lancaster expects that with the anticipated growth in the area, Greenfield Township may wish to contract with the City of Lancaster for water and wastewater services. Therefore, this Master Plan includes recommendations for necessary facilities to serve projected development from Greenfield Township as shown on Figure 1-1.

2.3.2 Peak Water Distribution System Flows

Based on evaluation of typical daily water demand data, the peak hourly water demand for any given day in Lancaster is approximately 1.33 times the peak day water demand for that day. Based on evaluation of daily water demands, the historical peak day flow for Lancaster is approximately 1.3 times the average day flow. In order to project future water needs, a slightly higher peak day to average day factor of 1.5 was used. Therefore, the peak hourly water demand utilized for the water distribution system model is 1.33 times 1.5 which equals 2.0 times the average day water demand.

2.3.3 Peak Wastewater Collection and Treatment Systems Flows

A peaking factor of 3.5 is recommended in the Lancaster Sanitary Sewer Design Manual to calculate peak hourly sanitary flows. However, this value is intended for developers who are installing small system lines for individual developments. Since the Master Plan focuses on main lines for a developer to connect local arteries, the 3.5 peaking factor is not applicable across the spectrum of all collection system sizes. Therefore, the interceptor sewer lines were sized to transport peak hourly sanitary flow capacities that were calculated in accordance with the Ten States Standards' Ratio of Peak Hourly Flow to Design Average Flow. This formula is based on equivalent population. A copy of the formula and associated peaking factor graph is included in Appendix A. For an area with an equivalent population of 1,000 (average day flow of

100,000 gallons per day at 100 gallons per person per day), the hourly peaking factor would be 3.8. For an average day flow of 1,000,000 gallons per day, the hourly peaking factor would be 2.95 and for 2,000,000 gallons per day, the hourly peaking factor would be 2.65.

The adjusted peak sanitary flows used to determine the size of the proposed sanitary sewer interceptors for the wastewater alternatives considered in Section 4.0 of the report are presented and are summarized in Table A-3 and Table A-4 of Appendix A. Table A-3 "Projected Sewershed Flows" projects new sewershed flows based on the areas of development that are located in the sewershed and discussed in Table A-2. Table A-4 "Sanitary Sewer Sizing Per Ten States Standards" determines what percentage of average flow within a sewershed, based on the projected sewershed flow in Table A-3, will be transported to the proposed sanitary sewer interceptor. Then, Table A-4 uses the hourly peaking factor from Ten States Standards' Ratio of Peak Hourly Flow to Design Average Flow to determine the peak flow to the interceptor. The interceptor was then sized based on Table A-1 "Sanitary Sewer Sizing Criteria Calculations". The proposed sanitary sewer interceptors are shown in the Figures presented in Section 4.

2.3.4 Piping and Facilities

Piping was sized based on 2045 peak hourly flow projections. Main water lines and trunk sewers were determined for projected areas of development. Smaller branch lines and local arteries were not considered in the Master Plan. The facilities were sized for the three improvement phases (Near-Term, Long-Term 2025, and Long-Term 2045) such that the facilities initially completed can ultimately handle the Long-Term 2045 peak flow conditions.

Interceptors were sized based on the following criteria as outlined in the City of Lancaster's Sanitary Sewer Design Manual:

- Manning "n" value of 0.013.
- Minimum velocity = 2.0 feet per second.

- 8-inch through 15-inch flowing 50 percent full.
- 18-inch through 27-inch flowing 75 percent full.
- 30-inch and larger flowing 90 percent full.

The incremental capacities of the proposed wastewater pump stations and the Water Pollution Control Facilities (WPCF) correspond to the projected flows for the three improvement phases. Pump station capacities were based on peak hourly wastewater flow projections. Water Pollution Control Facilities capacities were based on average day flow rate projections.

Water storage was based on a minimum water distribution system pressure of 50 psig during normal peak hourly demands and providing fire protection for a 5,000 gallon per minute industrial fire for a four-hour duration while maintaining a minimum pressure of 20 psig during peak hourly demands. With recent completion of the new Water Treatment Plant, the need for additional water treatment facilities are not anticipated within the next 20 years and are not addressed in detail in this Master Plan.

2.3.5 Calculations

Calculations and data supporting the design criteria used are presented in Appendix A.

2.4 GROWTH PROJECTIONS AND HISTORICAL TRENDS

As discussed above, Malcolm Pirnie prepared population projections in conjunction with City staff members, considering any projections defined by previous studies. Population projections and future development acreage for the service area were estimated based on current and previous census data together with pertinent City and County planning projections for residential, commercial and industrial growth areas. Projected land use and utility development data are presented in Table A-2 of Appendix A. Population and census information for the City of Lancaster and Fairfield County are presented in Appendix B.

2.4.1 Developed Acreage Projections

Malcolm Pirnie and City Staff met to review geographical development intensities, land use types for growth areas, and service agreement projections to establish average and peak wastewater flows and water demands for 20-year (Long-Term 2025 improvement phase) and 40-year (Long-Term 2045 improvement phase) planning periods. From these meetings, Malcolm Pirnie and the City defined future development areas as shown on Figure 1-1.

Recognizing that future development would not occur at uniform rates and that all areas identified would not be fully developed (the density of some developments would be greater than others), approximate growth intensity percentages were assigned for the years 2025 and 2045 for each growth area. The growth intensity percentages for each growth area were then used to determine the future developed equivalent acreage for the years 2025 and 2045. The 2045 growth percentages for land use areas are shown graphically in Figure 2-1, at the end of this section.

Next, the future developed equivalent acreages were multiplied by the per-capita (for residential areas), or multiplied by the per acre (for commercial and industrial areas) average day water and wastewater flows as discussed in Section 2.3, to determine the future overall average day flows. For example, assume the total acreage of a projected future single family development is 100 acres. Assume that in 2025, the area will be 30 percent developed and in 2045 will be 70 percent developed. At 1,000 gallons per acre per day (at 100 gallons per person per day, at 3 people per housing unit, and at 3.33 housing units per acre), the projected average day flow from this new development for 2025 would be 100 acres x 30% development intensity x 1,000 gallons per acre per day = 30,000 gallons per day. In 2045, the projected average day flow would be 70,000 gallons per day.

The average day flow projections for the years 2025 and 2045 are presented in Table A-2 of Appendix A. A summary of the distribution of the projected segments (percent residential, percent commercial, and percent industrial) of development for the projected growth areas is presented in Table 2-1 at the end of this section. As can be

noted, the relative percentages of projected commercial and industrial development are somewhat higher than current conditions.

2.4.2 Population Projections for Lancaster

As previously explained, population projections were based on an average ultimate density of 10 people per acre. The population was calculated for Lancaster for each of the designated Residential Single-Family (SF), Residential Multi-Family (MF), and Estate District (ED) areas. The City of Lancaster population projections for the years 2025 and 2045 are presented in Table A-2 of Appendix A.

There are several existing subdivisions, outside the City, which are not yet connected to the Lancaster utility system, but for which there are plans to connect. In Appendix A, there is a copy of a letter report to Fairfield County Utilities that addresses flows from these subdivisions. The subdivisions include Knox Acres, Carpico Drive, Kiester Manor, Pleasant Lea, and Lakeside. In Table A-2, Appendix A, these areas are shown as contributing to the future projected flows. However, in Table A-2, there is a dash in the "Developed Acreage" column and they are not included in the future population projections for Lancaster.

In addition, there are estimated flows for development in Greenfield Township shown in Table A-2. It is estimated that of the projected flows shown for the Greenfield Township areas, approximately 75,000 gallons per day is for existing Single-Family Residential (SF-11), as well as approximately 75,000 gallons per day is for Commercial (C-13). Because this area is not within the City of Lancaster, and because it is not anticipated that this area will be annexed to Lancaster, the Greenfield Township residential development is not included in the City of Lancaster population projections.

It should be noted that there are also areas not currently within the City of Lancaster, particularly in the bypass area, for which considerable development is projected. Although, it is not certain that these areas will ever be annexed to the City of Lancaster, population projections for these areas are included as the City of Lancaster for

growth comparison purposes. A summary of the population data is presented in Table 2-2 for comparison.

**Table 2-2
Projected Populations**

	Total Fairfield County	Fairfield County Outside Lancaster		City of Lancaster	
1990 Population (ODOD)*	103,461	68,954	66.4%	34,507	33.4%
2000 Population (ODOD)	121,259	82,686	68.2%	38,573	31.8%
Projected 2005 Population	135,230	94,449	69.8%	40,781	30.2%
Projected 2010 Population	143,650	100,533	70.0%	43,117	30.0%
Projected 2015 Population	153,880	108,294	70.4%	45,586	29.6%
Projected 2025 Population	n/a	n/a		49,392	
Projected 2045 Population	n/a	n/a		63,449	
Average Annual % Increase	1.60	1.80		1.12	

* ODOD = Ohio Department of Development, Office of Strategic Research and the U.S. Census Bureau

The bypass has already stimulated new development west of Lancaster, which is evident by the construction of the Rock Mill Corporate Park. The City has also been approached by developers planning to develop land along the bypass corridor, including the proposed Ruble Corporate Park Development, a hotel, condominiums, restaurants and retail stores. These implications were considered and taken into account when estimating areas of future growth and the associated percent developed.

The increased growth rate projected for the City is also supported by Fairfield County's aggressive rate of growth currently experienced just north of Lancaster along the U.S. Route 33 corridor that connects Lancaster to the City of Columbus. From 1990 through 2015, the total growth projected for Fairfield County by the ODOD is approximately 1.6 percent per year. The projected growth rate for the City of Lancaster during this period is significantly lower at approximately 1.1 percent per year. The projected growth rate for areas in Fairfield County, but outside the City of Lancaster, is approximately 1.8 percent per year. The increased development along the US 33 corridor is expected to affect Lancaster populations in the future at a higher rate than currently experienced, but at lower rate than experienced elsewhere in the County.

2.4.3 Implications of Projected Growth Rate

The population projections resulting from the discussions between Malcolm Pirnie and the City of Lancaster, as summarized in Table 2-2, provided a more aggressive rate of growth than Lancaster has historically experienced. The projected populations for the years 2025 and 2045 in Table 2-2 represent a relatively aggressive growth for the water distribution system and wastewater collection and treatment systems. The maximum demand would be placed on the water and wastewater system if all identified areas developed as estimated. Even if all of the projected development does not occur as rapidly as estimated, piping should still be designed to handle the maximum projected size of the growth area that it would serve. However, the Master Plan improvement phases were created to prevent unnecessary capital expenditure and to accommodate the possibility of a more moderate rate of growth. The alternatives presented in Sections 3.0 and 4.0 are phased as much as possible to enable the City to pace these improvements to the actual rate of growth.

2.5 ALTERNATIVE ELVALUATIONS

To determine how to best serve the growing needs of Lancaster, several water and wastewater design alternatives were analyzed. Alternative analyses utilized the model results in consideration with the future growth anticipated, existing operation conditions, sizing, estimates of capital cost, O&M cost, and life cycle costs. Environmental considerations such as flood hazard determination and regulatory impacts were also reviewed for each alternative. Optimal areas for construction and projected development service needs were identified. For each alternative developed, a brief description including a list of advantages and disadvantages was prepared for review. Each alternative was discussed for consideration during project meetings with the City and Malcolm Pirnie. Alternatives that were deemed undesirable or non-feasible were eliminated from further consideration. The alternatives identified as feasible design options were then further analyzed based on the City's needs. All feasible and non-feasible alternatives are presented and evaluated in Section 3.0 (water system) and Section 4.0 (wastewater system) of this report.

As part of the design alternative analysis, various criteria were discussed as appropriate to determine if an alternative should be considered for further evaluation as well as for the final selection of the evaluated alternatives. These criteria included:

- **The City's Long Term Control Plan:** Commitments to keep CSO discharge volumes to 1995 levels (antidegradation). Reduce combined sewer discharges in anticipation of additional Ohio EPA requirements.
- **Future Growth:** Provide water and sewer service to facilitate future growth in the City of Lancaster and projected growth areas without increasing combined sewer overflow volumes.
- **Capacity and Condition:** The condition/capacity of the existing water lines, sanitary sewer interceptors, CSO structures, and existing pump stations has to be considered.
- **Regulatory Requirements:** Consider the number and type of permits required for the site. Some permits can significantly increase the time and cost required to use a particular site. In addition, permits may be denied for sites that conflict with environmental issues. Sites with minimal environmental concerns are preferred.
- **Land Acquisition:** The greater the number of landowners, the greater the effort to obtain the proposed site. If a landowner is unwilling to sell at a fair price, the City will have to enforce eminent domain, which may increase the time and effort required to purchase the property. Sites with one or two landowners are preferred.
- **Construction Access and Feasibility:** Relatively flat sites with appropriate subsurface characteristics for foundation support are preferred. Sites with access to major roads are also preferred.
- **Proximity to Existing Water and Wastewater Service Needs:** Access to existing infrastructure is preferred. It will help to control costs associated with additional construction materials and labor, site acquisition and permitting.
- **Aesthetic Concerns:** Consider potential impacts that could affect public acceptance, such as odor control and visual impacts. Sites and system elements with minimal public controversy are preferred.

- **Maintenance:** Consider the frequency and level of effort associated with routine and special maintenance tasks. System elements with minimal maintenance requirements and safety hazards are preferred.
- **Performance:** Consider the ability to meet the system requirements for the three different improvement phases. A system element that is flexible to meet future demands efficiently and effectively is preferred.
- **Capital Cost:** Economical options that provide the high value for the cost are preferred.

Figure 2-1
Water and Wastewater Improvements Master Plan
Long-Term Needs (2045)
Land Use

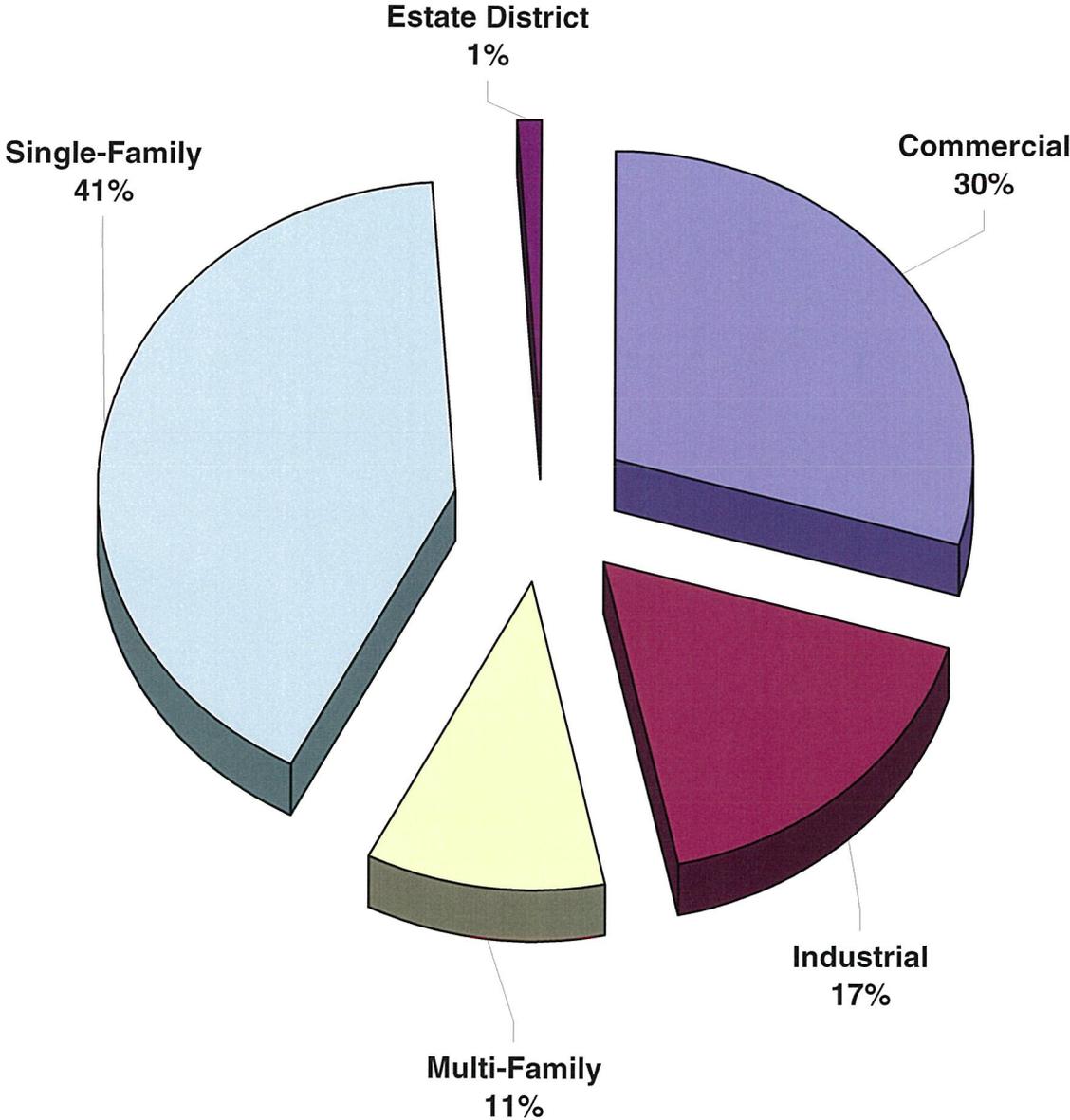
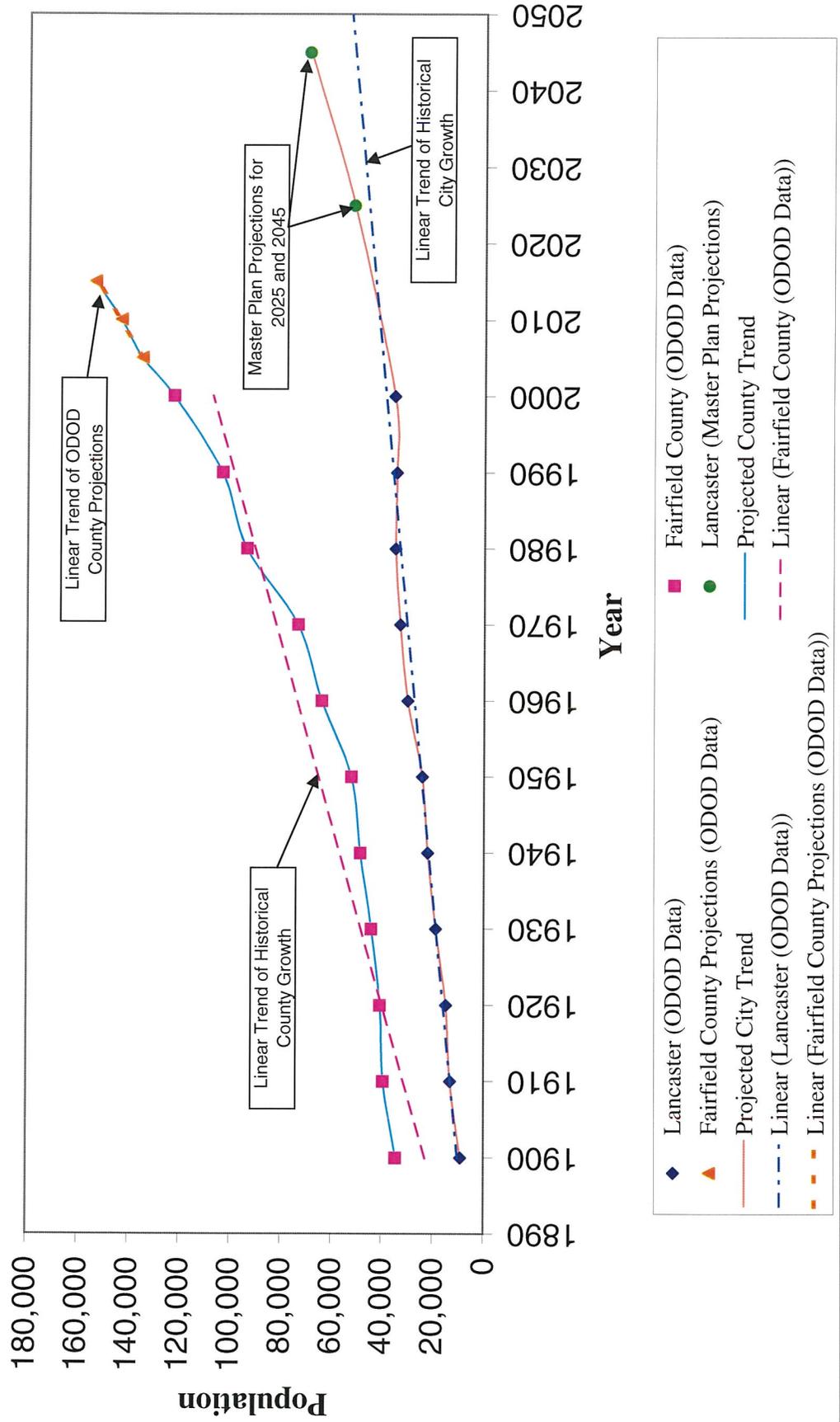


Figure 2-2 Comparison of Historical and Projected Populations



4

4.0 WASTEWATER SYSTEM IMPROVEMENTS

4.1 EXISTING FACILITIES

The City of Lancaster, Ohio owns and operates the Lancaster Water Pollution Control Facility (WCPF). The WCPF is adjacent to the Hocking River. It has an average design capacity of 10.0 MGD and a peak capacity of 18.0 MGD. Currently, the average dry day flow is approximately 6.0 MGD. The wastewater collection system conveys residential, commercial and industrial flows to the WCPF with pipe ranging between 6-inch and 60-inch in diameter. It is composed of two main drainage areas: the Baldwin Run (east side) and Hocking River (central and west side) drainage areas. The drainage areas contain both sanitary and combined sewers. There are four pump stations to transport flows to the WCPF where gravity flow is not possible.

Older sections of the City's wastewater collection system in the central part of Lancaster are classified as "combined sewers" since they were designed to carry both sanitary flow and storm water flow in the same pipe. During wet weather, flows greater than the sewer capacity are discharged to receiving streams through the systems 31 combined sewer overflow (CSO) structures. As Lancaster has grown, the wastewater system has expanded, causing the combined sewers in the older sections of town to become over-stressed. The addition of separate "express" sanitary sewers, which bypass the existing system and flow directly to the WCPF, interceptor sewers and the separation of storm flow from sanitary flow in some combined sewer areas have provided some relief to problem areas.

4.2 CURRENT WASTEWATER FLOWS

A Sanitary Sewer Extension Evaluation was completed for the City of Lancaster by Malcolm Pirnie as a part of the Long Term Control Plan submitted to the Ohio EPA in June, 2000. Growth and development were forecasted through the year 2020. It was found that without CSO and/or infiltration/inflow reduction projects, there would be significant increases in CSO discharges to the City's receiving streams by the year 2020.

The City has committed to keep CSO discharge volumes to 1995 levels or less. Therefore this master planning process has incorporated collection systems to help meet the City's goal through intercepting combined flows and expressing future sanitary flows directly to a treatment facility.

The City of Lancaster's existing wastewater system service areas are summarized schematically in Figure 4-1. The service areas are identified as either separated sewers (sanitary only) or combined sewers (sanitary and storm water). In addition, the existing wastewater capture areas for the City's collection system are outlined in Figure 4-2. As can be seen in the figures, there are currently 32 wastewater system capture areas. 17 of the capture areas collect sanitary only, but then connect to a combined system of sanitary and storm water. Some of the separated sewers could be intercepted before connecting to the combined system as part of the master plan improvements to help reduce existing CSO impacts on receiving waters and meet regulatory requirements. They include:

- **Existing Capture Area 1**
This flow can connect to a new express sewer to the existing WPCF, reducing the stress on CSO 1034. Also, Capture Area 1 includes the industrial areas I-7 through I-10 identified in Figure 4-3 of the June 2000 Long Term Control Plan for Lancaster.
- **Existing Capture Area 10**
This flow can connect to a new express sewer to the existing WPCF, reducing the need for CSO 1006.
- **Existing Capture Areas 12A, 12B, 13, and 32**
This flow is all transported to the South Broad Street Pump Station. The pump station force main can connect to a new express sewer to the existing WPCF.
- **Existing Capture Areas 28, 29, 30 and 31**
Re-routing this flow to a new water pollution control facility or via an express sewer to the existing Water Pollution Control Facility would also relieve the YMCA Pump Station, which is currently operating at full capacity. The new water pollution control facility would also provide the infrastructure for the growth to the west and northwest of Lancaster.
- **Lake and Allen Sewer Separation**
This Sewer Separation Project will provide full separation of Sewer Shed 8D and partial separation of Sewer Shed 8C, 8E, and 11.

Malcolm Pirnie determined 25 additional sewershed areas that are associated with the projected development areas which are shown in Figure 4-3.

4.3 WASTEWATER COLLECTION SYSTEM MODEL

Malcolm Pirnie analyzed the existing wastewater collection system conveyance capacity utilizing the existing City SWMM model to estimate the impact of the design flow from the U.S. 33 Bypass Area on the existing wastewater system and the impact of future flows on the entire Lancaster service area. In addition, Malcolm Pirnie assessed the potential interaction of the CSO System with any projected extension or improvements to the separate sanitary sewer system associated with service to the U.S. 33 Bypass Area.

The model was used to characterize the future sewer system based on projected wastewater flows, determine the corresponding CSO volume during wet weather for a range of storm events, and establish the hydraulic capacity of the sewer system during dry weather and wet weather.

4.4 WASTEWATER COLLECTION SYSTEM ALTERNATIVE EVALUATIONS

As previously discussed in Section 2.5, several wastewater design alternatives were analyzed to determine how to best plan for Lancaster's needs based on various design-specific criteria. Due to time and priority to create a new water distribution system model for the City by June 2002, the Near-Term Facilities Report did not review alternative collection system options. After submitting the Near-Term Facilities Report in July, 2002, other Near-Term possibilities were realized and considered for evaluation in the Master Plan Report.

For each alternative developed, a brief description including a list of advantages and disadvantages were prepared for review. Each alternative was discussed for consideration during project meetings with the City and MPI. Alternatives that were

deemed undesirable were eliminated from consideration. The remaining alternatives identified as feasible design options were compiled into four core alternatives with variations in the flow paths and facilities. They were then further analyzed based on the City's needs.

As part of the design alternative analysis, various criteria were discussed as appropriate to determine if the alternative should be considered for further evaluation. The alternatives were analyzed on a system-wide basis with the considerations discussed in Section 2.5.

4.4.1 Alternatives

During the July 17, 2002 project meeting, alternative design options for wastewater services were discussed. Malcolm Pirnie compiled the design options into four core alternatives with variations in the flow paths and facilities in order to include all of the options suggested at project meetings. As can be seen on Figure 4-4 through Figure 4-7, the varying flow schemes for each core alternative resulted in multiple alternatives for consideration. Each flow variation was reviewed to determine if it was a feasible option to consider for further evaluation. Alternatives that were eliminated from further evaluation are shown on Figure 4-4 through Figure 4-7 with strikeout. The four core alternatives are presented hereafter:

- **Alternative 1:** No New Satellite Water Pollution Control Facility.
- **Alternative 2:** New Upper Hocking Water Pollution Control Facility.
- **Alternative 3:** New Hunters Run Water Pollution Control Facility with YMCA Pump Station Upgrade.
- **Alternative 4:** New Hunters Run Water Pollution Control Facility without YMCA Pump Station Upgrade.

The following alternatives were eliminated:

- **Alternative 1.A.(2):** This was eliminated based on the inefficiency of crossing flows to two new pumping facilities.

- **Alternatives 2.B, 3.B and 4.B:** All alternatives that would require the YMCA Pump Station to be upgraded were eliminated since this would impact the City's wellfield protection zone 1. The City's Wellhead Protection Zone Delineation Map is included in Appendix A. For these alternatives, new force main(s) and interceptor(s) would be required to "express" the additional flow to the existing WPCF. The only feasible location for the interceptor(s) is through the City's wellfield protection zone 1. Historically, the City has had extreme regulatory difficulties when attempting to work within this zone.

The remaining four alternatives selected for final consideration in the Master Plan Report are presented hereafter:

4.4.2 Alternative 1.A.(1): No New Satellite Water Pollution Control Facility

Utilizing the existing wastewater collection and treatment system to its full capability to process the projected flows for 2045 would require the following major facilities (Refer to Figure 4-8):

- Hunters Run drainage basin express sewer to the existing WPCF.
- Rock Mill Lift Station.
 - Immediate: 1.0 mgd
- Lake and Allen Sewer Separation.
- New WPCF adjacent to the existing WPCF site.
 - 2025: 1.00 mgd
 - 2045: 2.60 mgd upgrade
- Baldwin Run Express Sewer.
- Broad Street Pump Station Express Sewer.
- Upper Hocking Pump Station.
 - Near Term: 6.5 mgd
 - 2025: 4.0 mgd upgrade
 - 2045: 4.5 mgd upgrade
- Approximately 224,802 feet of sewer line ranging between 8-inch and 60-inch diameter.

- Captures all existing wastewater service areas discussed in Section 4.2 to reduce CSO impacts.

4.4.2.1 Advantages for Alternative 1.A.(1):

- Adjacent property could be purchased to build a new WPCF before 2025. There are approximately 58 acres adjacent to the existing WPCF to the south and across the Hocking River. This property is currently zoned as industrial – moderate and could be purchased by the City. The City zoning code allows utilities to construct “by right” in any industrial area (low, moderate or high).
- Adjacent facilities would be easier to manage. Issues such as operations, maintenance and permitting are contained to one general area. Access and permitting would be minor. Also, solids from the new WPCF could be pumped to the existing WPCF rather than hauled by a truck.
- Other alternatives would only use 7.5 mgd of the total 10 mgd available at the existing WPCF. Routing all of the flow to the existing site would use the entire 4 mgd capacity remaining at the existing WPCF. This would allow a smaller rated capacity for the new WPCF as well as delaying its construction approximately 5 to 10 years.
- Avoids stream water quality issues at Hunters Run.
- Less stringent treatment limits than for Hunters Run.
- Public acceptance for a new WPCF site not required.

4.4.2.2 Disadvantages for Alternative 1.A.(1):

- The existing WPCF is currently treating 6.5 mgd. There is no room for expansion beyond 10 mgd.
- Upper Hocking Pump Station requires a substantial length of force main.
- Requires a substantial amount of sewer to be installed during the Near Term phase in order to transport Hunters Run flows to the WPCF.

4.4.3 Alternative 2.A.(1): New Upper Hocking Water Pollution Control Facility

Construction of an Upper Hocking River WPCF to process projected flows from both the Upper Hocking River and Hunters Run drainage basins for 2045 would require the following major facilities (Refer to Figure 4-9):

- Rock Mill Lift Station.
 - Immediate: 1.0 mgd
- Lake and Allen Sewer Separation.
- New Upper Hocking WPCF at Collins Road.
 - Near Term: 2.00 mgd
 - 2025: 2.10 mgd upgrade
 - 2045: 2.70 mgd upgrade
- Upper Hocking Pump Station.
 - Near Term: 4.75 mgd
 - 2025: 4.25 mgd upgrade
 - 2045: 4.0 mgd upgrade
- Hunters Run Pump Station.
 - Near Term: 0.25 mgd
 - 2025: 1.10 mgd upgrade
 - 2045: 1.20 mgd upgrade
- Hunters Run express sewer to transport flow to new Upper Hocking WPCF.
- Baldwin Run Express Sewer.
- Broad Street Pump Station Express Sewer.
- Approximately 208,253 feet of sewer line ranging between 8-inch and 48-inch diameter.
- Captures all existing wastewater service areas discussed in Section 4.2 to reduce CSO impacts.

4.4.3.1 Advantages for Alternative 2.A.(1):

- The majority of the Hunters Run sewer to the new WPCF is gravity rather than force main.
- Adds flow to Hocking River through Lancaster.
- Less stringent treatment limits than for a Hunters Run WPCF.
- Diverts flow from YMCA Pump Station and CSOs.

4.4.3.2 Disadvantages for Alternative 2.A.(1):

- New site would need to be acquired, approximately 24 acres (900ft by 1170ft) would be needed for a new WPCF and any required expansions projected for 2045 growth.
- Siting of new facilities are subject to public opposition.
- A WPCF upstream of the Water Treatment Plant could cause regulatory problems.
- Additional staff required to operate two separate facilities.

4.4.4 Alternative 2.A.(2): New Upper Hocking Water Pollution Control Facility and Existing WPCF Upgrade

Construction of an Upper Hocking River WPCF to process projected flows from the Upper Hocking River drainage basin for 2045 would require the following facilities (Refer to Figure 4-10):

- Rock Mill Lift Station.
 - Immediate: 1.0 mgd
- Lake and Allen Sewer Separation.
- New Upper Hocking WPCF at Collins Road.
 - Near Term: 2.00 mgd
 - 2025: 1.75 mgd upgrade
 - 2045: 2.20 mgd upgrade
- Upper Hocking Pump Station.
 - Near Term: 4.75 mgd
 - 2025: 4.25 mgd upgrade
 - 2045: 4.0 mgd upgrade
- Hunters Run express sewer to transport flow to the existing WPCF.
- Baldwin Run Express Sewer.
- Broad Street Pump Station Express Sewer.
- Approximately 219,189 feet of sewer line ranging between 8-inch and 48-inch diameter.

- Captures all existing wastewater service areas discussed in Section 4.2 to reduce CSO impacts.

4.4.4.1 Advantages for Alternative 2.A.(2):

- Adds flow to Hocking River through Lancaster.
- Less stringent treatment limits than for a Hunters Run WPCF.
- Routing flow from the Hunters Run basin to the existing plant works well to incorporate the reduction of CSOs.
- Routing flow from the Hunters Run basin to the existing plant maximizes the existing facility's 10 mgd capacity.
- Diverts flow from YMCA Pump Station and CSOs.

4.4.4.2 Disadvantages for Alternative 2.A.(2):

- New site would need to be acquired, approximately 24 acres (900ft by 1170ft) would be needed for a new WPCF and any required expansions projected for 2045 growth.
- Siting of new facilities are subject to public opposition.
- A WPCF upstream of the Water Treatment Plant could result in regulatory constraints.
- Additional staff required to operate two separate facilities.

4.4.5 Alternative 4.A: New Hunters Run Water Pollution Control Facility without YMCA Pump Station Upgrade

Construction of a WPCF on Hunters Run to treat the projected flows for 2045 west of the City from the Upper Hocking River and Hunters Run drainage basins within the U.S. 33 Bypass development areas would require the following facilities (Refer to Figure 4-11):

- Rock Mill Lift Station.
-Immediate: 1.0 mgd
- Lake and Allen Sewer Separation.

- New Hunters Run WPCF.
 - Near Term: 2.00 mgd
 - 2025: 2.25 mgd upgrade
 - 2045: 2.50 mgd upgrade

- Upper Hocking Pump Station.
 - Near Term: 6.5 mgd
 - 2025: 4.0 mgd upgrade
 - 2045: 4.5 mgd upgrade

- Hunters Run express sewer to transport flow to the existing WPCF.
- Baldwin Run Express Sewer.
- Broad Street Pump Station Express Sewer.
- Approximately 235,595 feet of sewer line ranging between 8-inch and 48-inch in diameter.
- Captures all existing wastewater service areas discussed in Section 4.2 to reduce CSO impacts.

4.4.5.1 Advantages for Alternative 4.A.:

- Hunters Run WPCF rural location may avoid strong public opposition.
- Diverts flow from YMCA Pump Station and CSOs

4.4.5.2 Disadvantages for Alternative 4.A.:

- The Ohio EPA may limit the Hunters Run WPCF effluent to a maximum of 3.0 MGD to maintain water quality standards based on the low-flow condition of Hunters Run. If this would occur, the remaining treated effluent anticipated from the proposed WPCF would have to be discharged to the Hocking River to meet projected 2025 and 2045 needs.
- The line to discharge treated effluent to the Hocking is extremely long.
- Level of treatment required to discharge to Hunters Run is higher than for the Hocking River.

4.4.6 Alternative Cost Comparison

Detailed costs were developed for each alternative and for each improvement phase. The preliminary wastewater collection system costs represent installation of wastewater interceptors and appurtenances including manholes. They do not include local arteries that will be required for the individual developments that are assumed to be provided by the developers. A multiplier of 1.23 was used to estimate engineering costs. A multiplier of 1.30 was added to estimate contingency costs. Table 4-1 hereafter provides a breakdown of the estimated costs of each alternative and for each improvement phase.

**Table 4-1
Wastewater Alternative Costs**

	Immediate	Near-Term	2025	2045
Alternative 1A(1)a:				
No New Satellite Plant	\$ 3,566,281	\$ 29,262,884	\$ 31,987,462	\$ 45,562,762
Cumulative Total	\$ 3,566,281	\$ 32,829,165	\$ 64,816,627	\$ 110,379,389
Alternative 2A(1)a,b,c:				
New Upper Hocking Water Pollution Control Facility	\$ 3,705,016	\$ 30,703,376	\$ 36,921,357	\$ 32,794,584
Cumulative Total	\$ 3,705,016	\$ 34,408,392	\$ 71,329,749	\$ 104,124,333
Alternative 2A(2)a,b,c:				
New Upper Hocking Water Pollution Control Facility	\$ 3,566,281	\$ 32,882,535	\$ 36,827,922	\$ 32,357,787
Cumulative Total	\$ 3,566,281	\$ 36,448,816	\$ 73,276,738	\$ 105,634,525
Alternative 4A(1)a,b; 4A(2); 4A(3)a,b:				
New Hunters Run Water Pollution Control Facility	\$ 3,566,281	\$ 31,503,499	\$ 40,624,429	\$ 35,962,762
Cumulative Total	\$ 3,566,281	\$ 35,069,780	\$ 75,694,209	\$ 111,656,971

Supporting data in Table D-5 through Table D-8 of Appendix D represents the costs broken down by improvement phase, pipe, pumping equipment, and treatment facilities.

4.5 WASTEWATER SYSTEM RECOMMENATION

Lancaster City staff and Malcolm Pirnie evaluated the advantages and disadvantages of the four alternatives to determine a recommendation for the wastewater collection system and treatment needs. Alternative 2.A.(1): A New Upper Hocking River Water Pollution Control Facility (Treat Upper Hocking and Hunters Run Basins) is the recommended alternative for the Long-Term wastewater treatment and collection system needs. This alternative would provide the most cost-effective and reliable service for the different improvement phases. Since the selection of Alternative 2A, changes and updates have been made to better serve the City's needs and to further reduce CSO volumes as required by Ohio EPA. Figure 4-12 shows updates and changes to the selected alternative, and Table D-9 of Appendix D shows the updated costs associated with the changes.

4.5.1 Immediate Infrastructure Needs

The infrastructure needs recommended in the Immediate Memorandum were modified in the Near-Term Report. The proposed Anchor Avenue and U.S. 33 Bypass / S.R. 188 interchange sewer alignments were modified to better follow the existing grade and avoid excessive excavation or depths of sewers. Also, the capacity of the proposed Lift Station at Rock Mill Corporate Park Phase 2 was modified.

In the Immediate Needs Memorandum, the capacity of the proposed Rock Mill Lift Station was based on 2025 peak wastewater flow projections. During the evaluation of the Near-Term wastewater needs, it was determined that rather than installing a Near-Term sewer parallel to the existing sewer downstream of the Rock Mill Lift Station to serve the projected 1.5 mgd flows by the year 2025, a Near-Term sewer could be installed upstream of the Rock Mill Lift Station. This would allow the Near-Term sewer to intercept the projected flows (1.5 mgd by 2025 and 3.1 mgd by 2045) and abandon the Rock Mill Lift Station. Therefore, the lift station could be sized based on the capacity of the existing sewer located in Rock Mill Park Phase 1. The existing 12-inch sewer capacity is approximately 1.1 mgd. A 1.0 mgd Lift Station could serve the Immediate

needs until the Near-Term sewer could be installed to intercept the flow before it exceeds 1.0 mgd. The Immediate infrastructure needs are shown as the first improvement phase on Figure 4-9.

4.5.2 Near-Term Infrastructure Needs

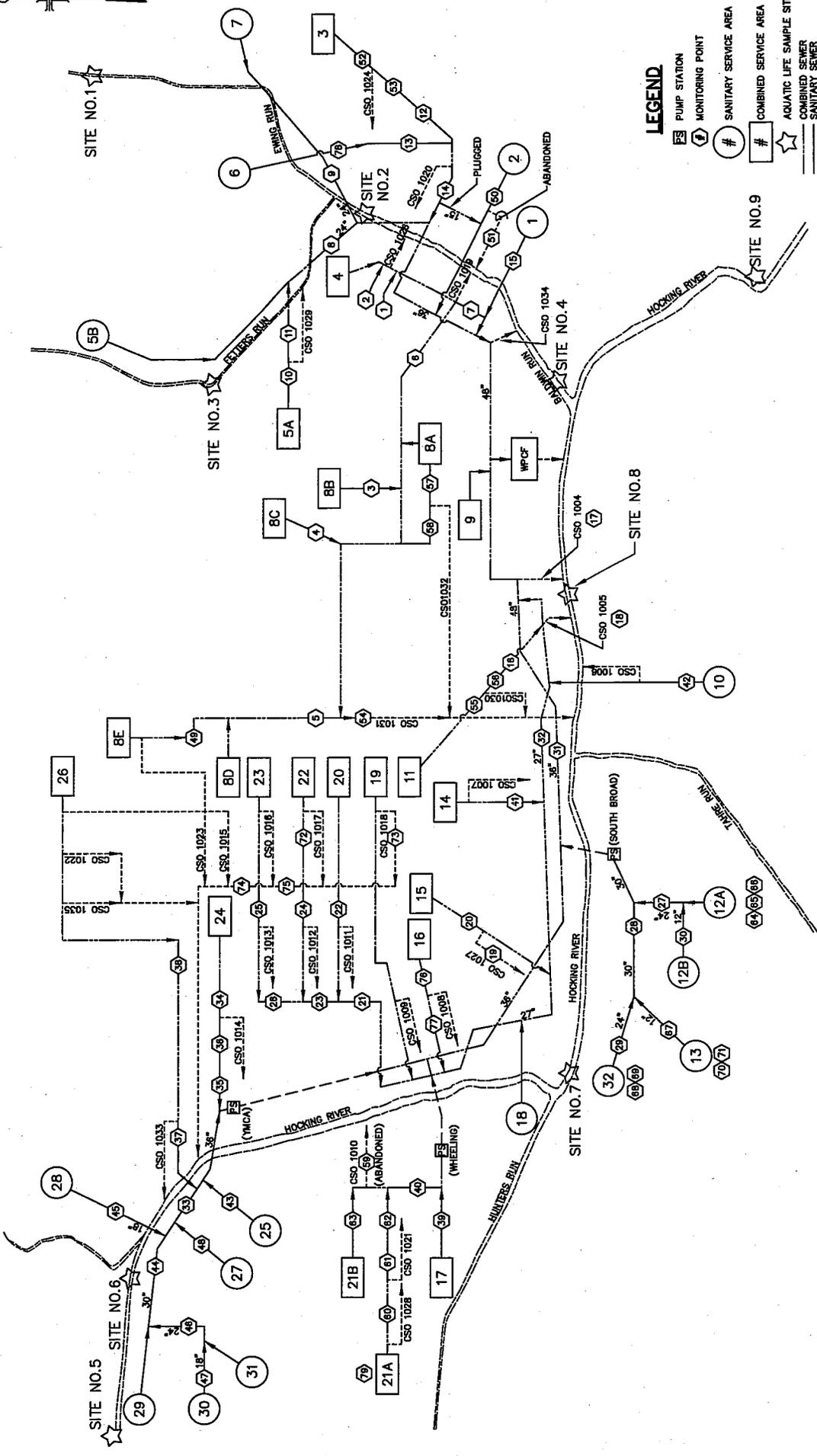
Near-Term infrastructure needs supplement the Immediate needs by including sewer lines in Area C-5 to serve the interchange of the U.S. 33 Bypass and U.S. 22. Near-Term facilities must also transport increased flows received from the Immediate infrastructure. Because of the topography of the drainage basins west of Lancaster, gravity flow is limited. As previously discussed, the existing wastewater system is also limited. Therefore, a pump station and water pollution control facility are proposed to treat the projected flows generated from the bypass development.

In addition to serving the Hocking River tributary drainage basins, the Ety Road Pump Station would allow an interceptor sewer to be installed to relieve the older sections of CSOs in the system. This will also help to relieve the YMCA Pump Station, which is operating at full capacity while maintaining the City's commitment to keep CSO discharge volumes at or below 1995 levels. It was determined that the interceptor can divert approximately 4.3 MGD from the existing system to the proposed Ety Road Pump Station. A force main will transport the flows from the pump station to the proposed Hunters Run Water Pollution Control Facility. The proposed 1.6 MGD WPCF will also serve the Hunters Run tributary drainage basins.

In addition to the Immediate infrastructure needs, the Near-Term needs will require a 6.6 MGD pump station for Near-Term needs, expandable to 12.6 MGD for 2025 and 21.0 MGD for 2045 is proposed. A 1.6 MGD WPCF for Near-Term needs, expandable to 4.8 MGD for 2025 and 8.4 MGD for 2045 is also proposed. An 18-inch force main would be required to transport the Near-Term flows from the Ety Road Pump Station. An additional 18-inch force main would be required at 2025, and a 21-inch force main would be required at 2045. The force mains are based on a velocity of approximately 5.5 feet per second. The Near-Term infrastructure is shown as the second improvement phase to the system on Figure 4-9.

4.5.3 Long-Term Infrastructure Needs

Long-Term infrastructure needs supplements the Immediate and Near-Term needs by including sewer lines and facilities for the remaining areas projected for development near the U.S. 33 Bypass Area and other areas identified by City staff within Lancaster's corporation limits. The Long-Term lines are shown on Figure 4-9 in two phases, for the years 2025 and 2045.



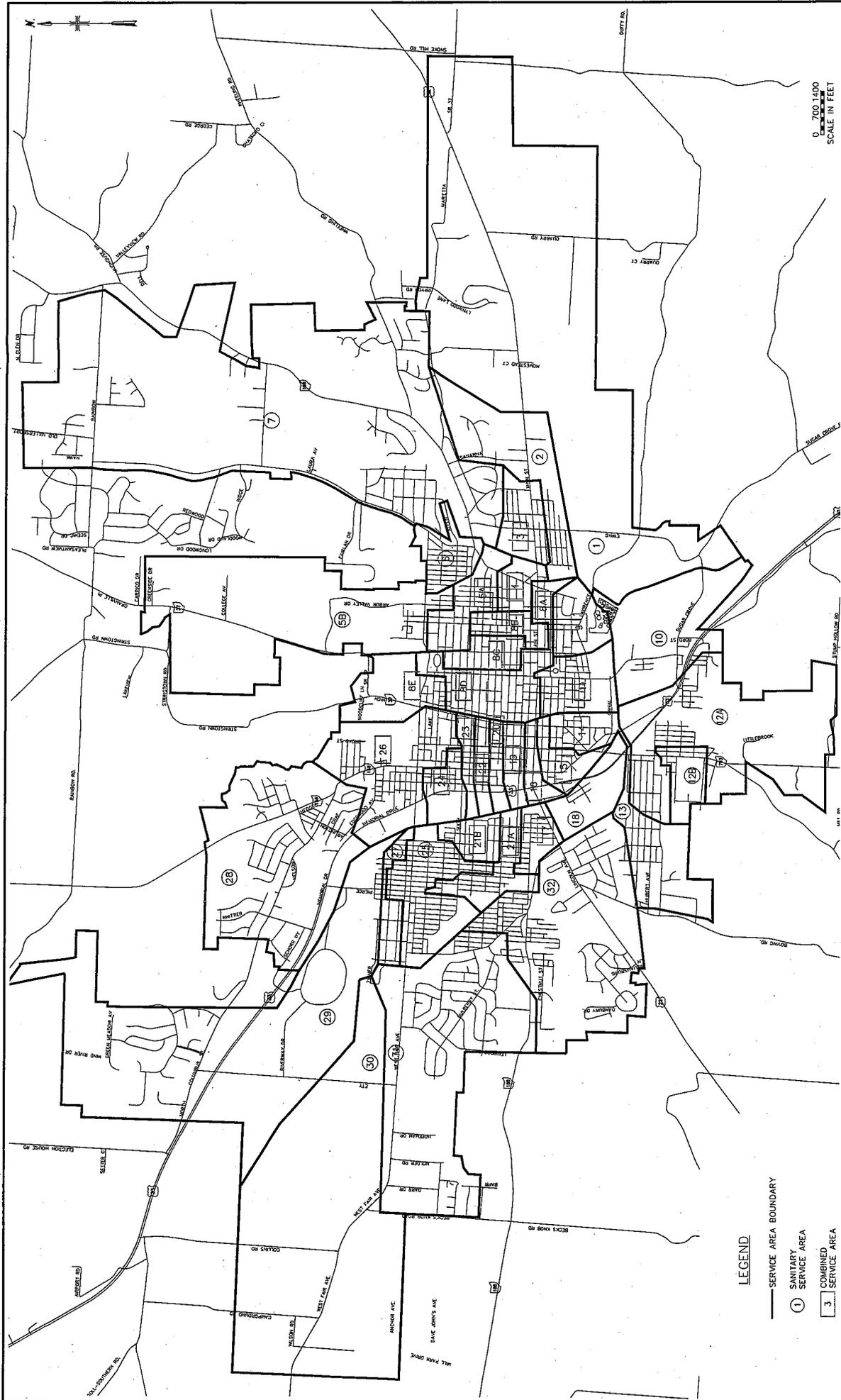
- LEGEND**
- ☐ PUMP STATION
 - ⦿ MONITORING POINT
 - ⊃ SANITARY SERVICE AREA
 - ⊃ COMBINED SERVICE AREA
 - ☆ AQUATIC LIFE SAMPLE SITE
 - COMBINED SEWER
 - SANITARY SEWER
 - FORCE MAIN
 - - - CSO DISCHARGE

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CITY OF LANCASTER, OHIO
 WATER AND WASTEWATER IMPROVEMENTS MASTER PLAN
EXISTING WASTEWATER SYSTEM SCHEMATIC

MALCOLM PIRNIE

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EXISTING WASTEWATER
 CAPTURE AREAS

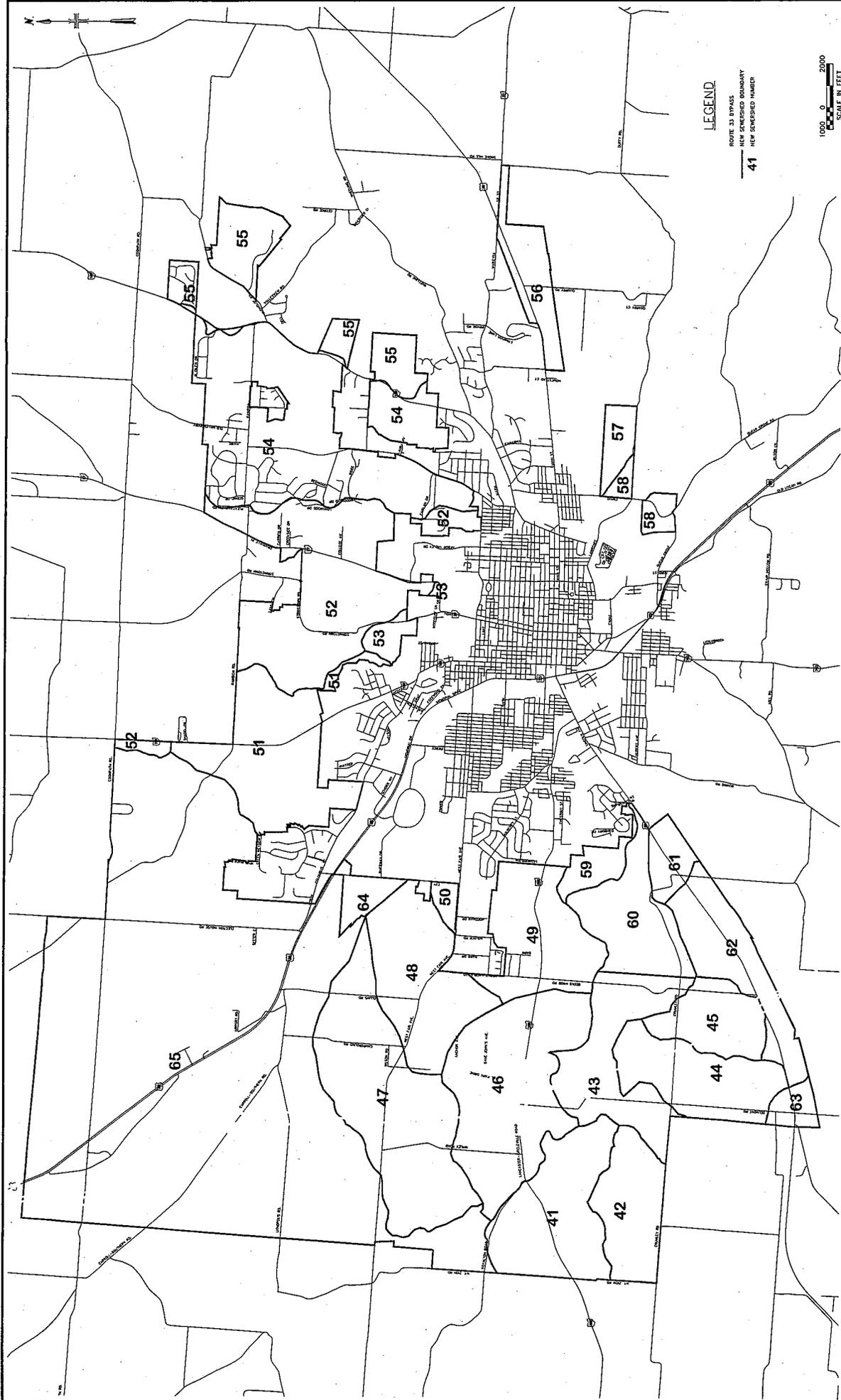
CITY OF LANCASTER
 LANCASTER, OHIO
 WATER AND WASTEWATER
 IMPROVEMENTS MASTER PLAN

REV.	BY	DATE	REVISIONS	ISS.	DES.	CHK.	APP.

MALCOLM
PIRNIE

DATE: JUNE, 2005
 FIGURE 4-2
 CAD REF. NO. 0491A047

This drawing is the property of Malcolm Pirnie, Inc. and is not to be used for any other project without the written consent of Malcolm Pirnie, Inc.



NEW WASTEWATER CAPTURE AREAS

WATER AND WASTEWATER IMPROVEMENTS MASTER PLAN

CITY OF LANCASTER
LANCASTER, OHIO

DATE: JUNE, 2005
FIGURE 4-3
CAD REF. NO. 0491A048

NO.	DATE	REVISION	BY	CHK

MALCOLM PIRNIE

THE ABOVE SHOWN PLAN IS A PRELIMINARY PLAN AND IS NOT TO BE USED FOR CONSTRUCTION. SCALE: 1"=400'. DATE: 05/24/2005. DRAWN BY: J. B. BROWN. CHECKED BY: J. B. BROWN.

FIGURE 4-4
WATER AND WASTEWATER IMPROVEMENTS MASTER PLAN
ALTERNATIVE 1: NO NEW SATELLITE WPCF - FLOW CHART

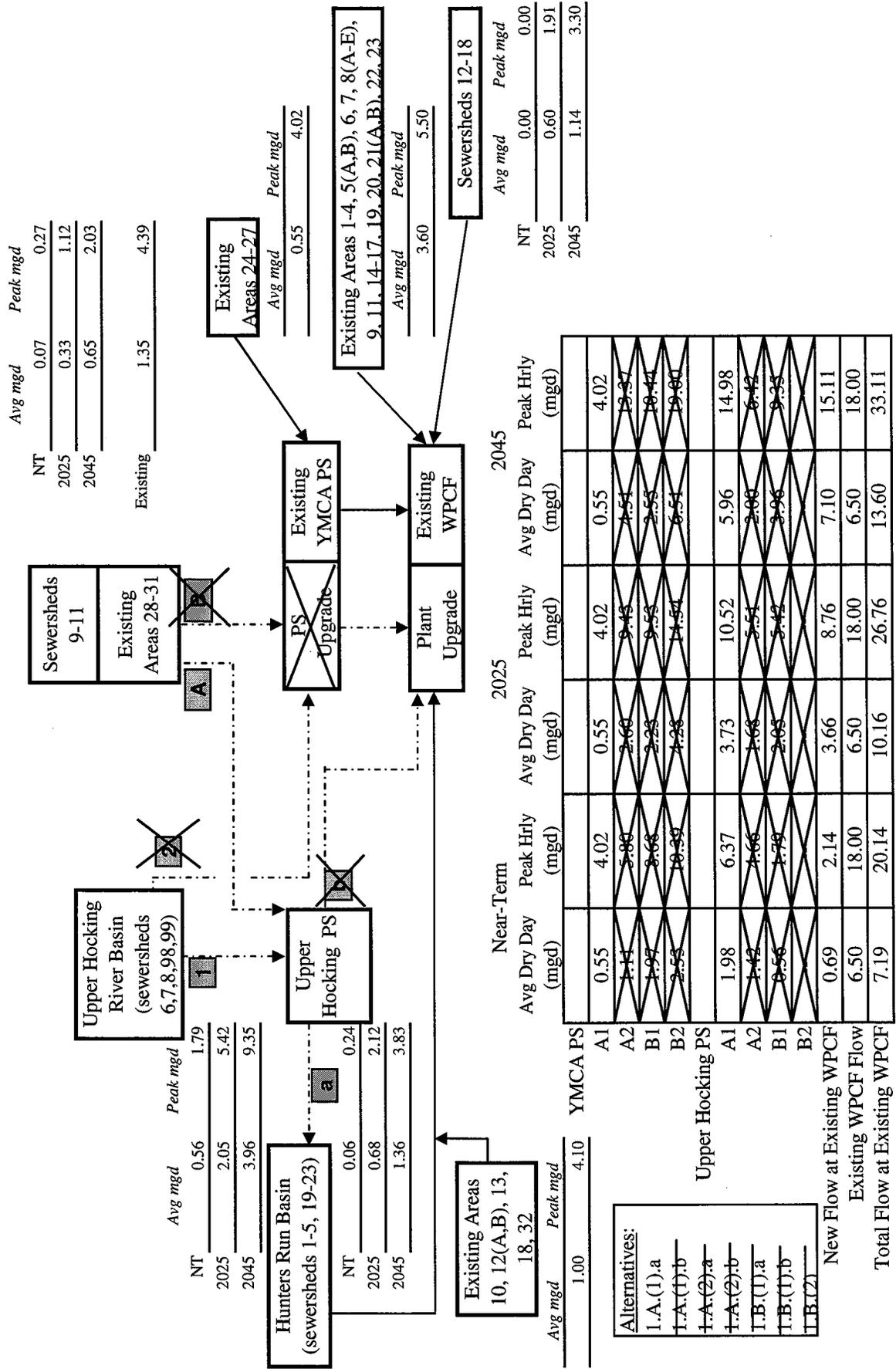


FIGURE 4-6
WATER AND WASTEWATER IMPROVEMENTS MASTER PLAN
ALTERNATIVE 3: NEW HUNTERS RUN WPCF WITH YMCA PS UPGRADE - FLOW CHART

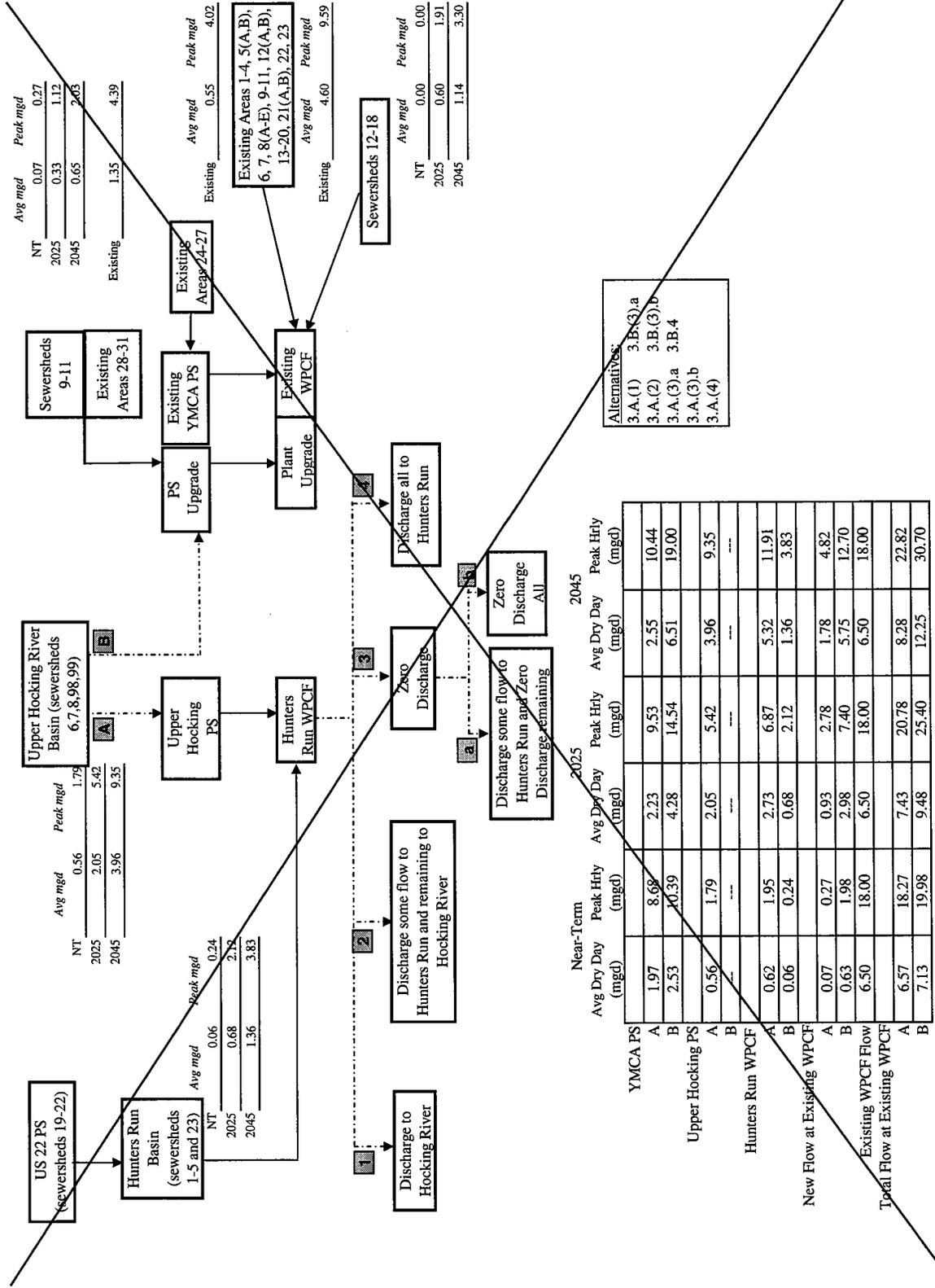
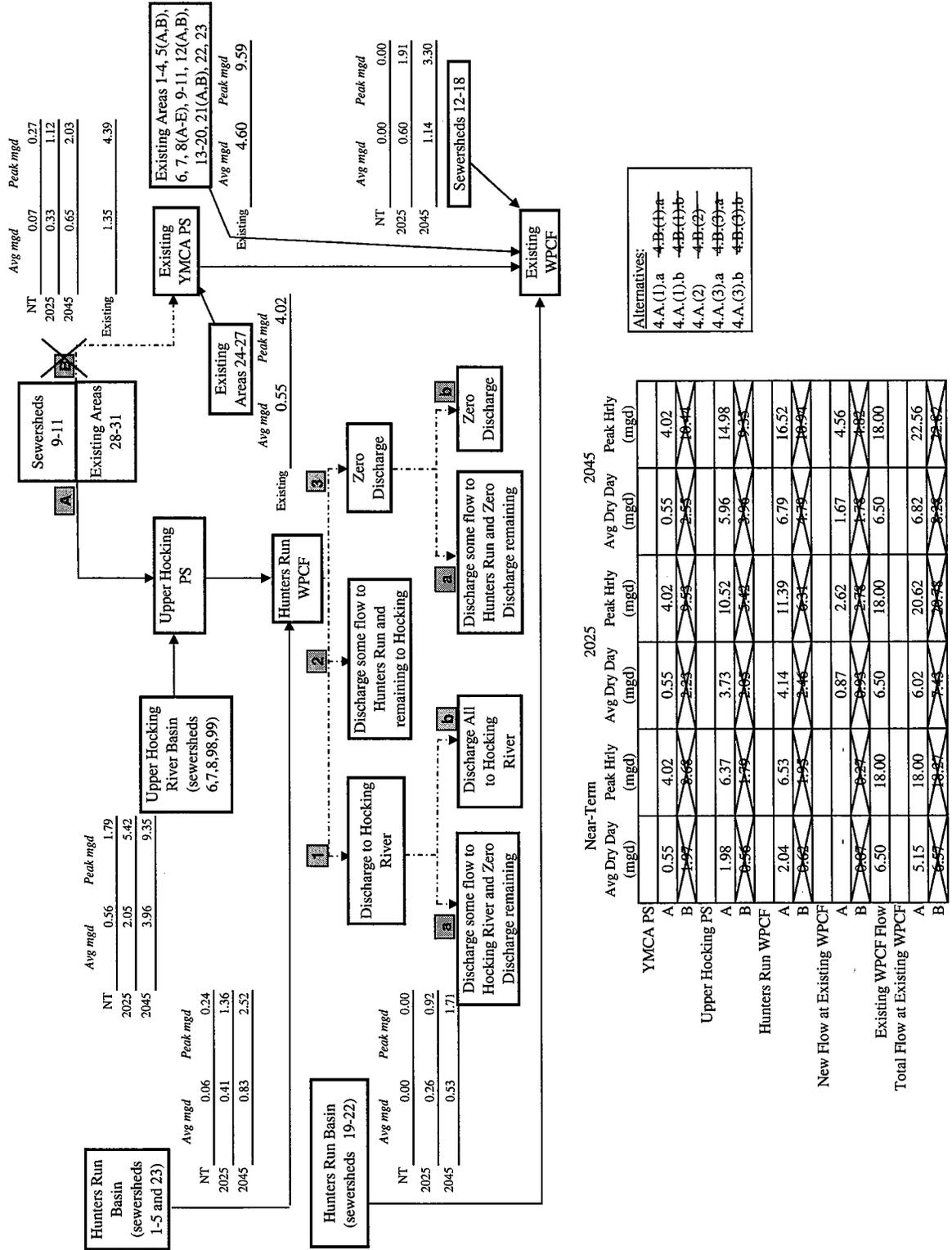
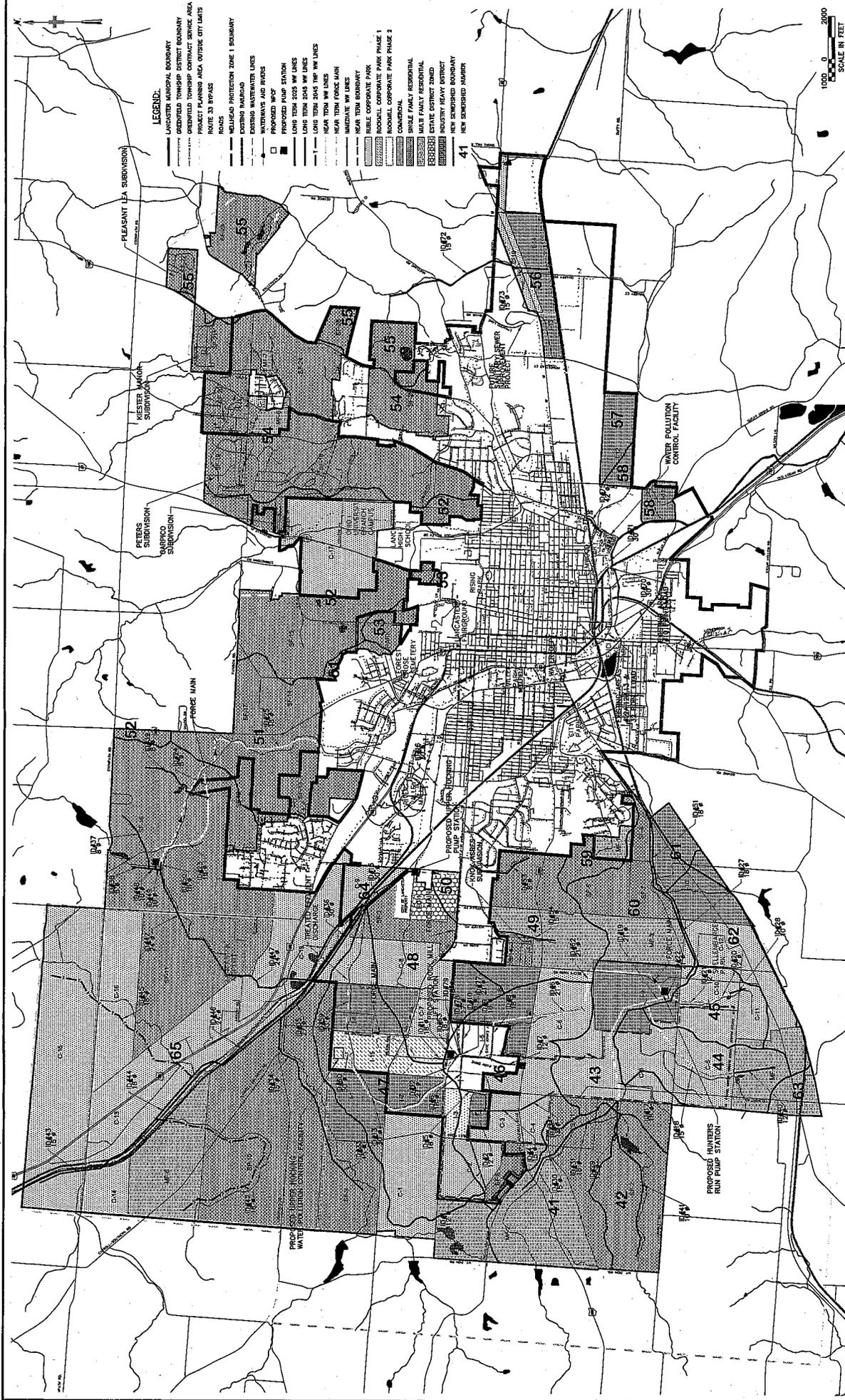


FIGURE 4-7
WATER AND WASTEWATER IMPROVEMENTS MASTER PLAN
ALTERNATIVE 3: NEW HUNTERS RUN WPCF WITHOUT YMCA PS UPGRADE - FLOW CHART





- LEGEND:**
- LANCASTER MUNICIPAL BOUNDARY
 - CREDITED TOWNSHIP DISTRICT BOUNDARY
 - CREDITED TOWNSHIP CONTRACT SERVICE AREA
 - PROJECT PLANNED AREA OUTSIDE CITY LIMITS
 - ROUTE 20 BYPASS
 - HOUSING PROTECTION ZONE 1 BOUNDARY
 - EXISTING PARKWAY
 - EXISTING WASTEWATER LINES
 - WATERWAYS AND RIVERS
 - PROPOSED WWP
 - PROPOSED PUMP STATION
 - LONG TERM 2025 WW LINES
 - LONG TERM 2045 WW LINES
 - NEAR TERM WW LINES
 - HIGH TON FORCE MAIN
 - IMMEDIATE WW LINES
 - HIGH TON FORCE MAIN
 - ROYAL CORPORATE PARK PHASE 1
 - ROYAL CORPORATE PARK PHASE 2
 - CONDOMINIUM
 - SINGLE FAMILY RESIDENTIAL
 - MULTI FAMILY RESIDENTIAL
 - ESTATE DISTRICT ZONED
 - INDUSTRY HEAVY DISTRICT
 - NEW SUBDIVISION BOUNDARY
 - NEW SUBDIVISION NUMBER

DATE: JUNE, 2005
 FIGURE 4-9
 CAD REF. NO. 0491A037

NEW UPPER HOCKING WATER POLLUTION CONTROL FACILITY
 ALTERNATIVE 2.A.(1).a,b,c
 WASTEWATER NEEDS

CITY OF LANCASTER
 LANCASTER, OHIO
 WATER AND WASTEWATER IMPROVEMENTS MASTER PLAN

NO.	REV.	DATE	REVISIONS	BY	CHKD.	DATE

MALCOLM FIRNIE

