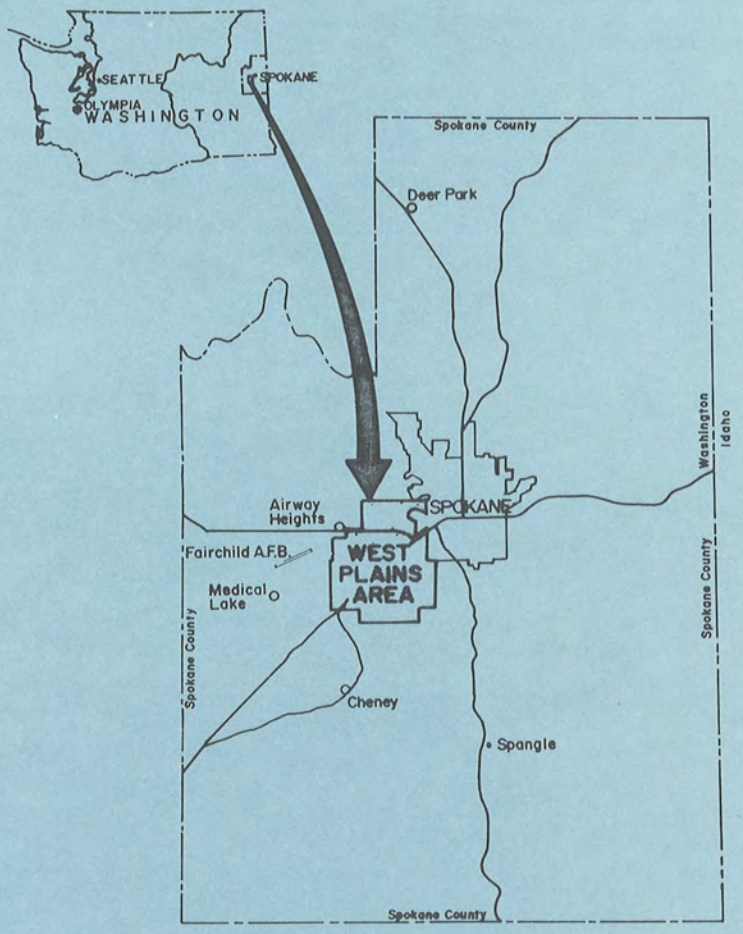
WEST PLAINS AREA
WATER AND SEWER PLAN



CITY OF SPOKANE

SEPTEMBER, 1980

Boyle Engineering Corporation
consulting engineers

Boyle Engineering Corporation
Suite 107
West 222 Mission Avenue
Spokane, Washington 99201

consulting engineers
509 / 326-2013

Mr. John Bjork, P.E.
City of Spokane Utilities Dept.
West 711 Spokane Falls Blvd.
Spokane, Washington 99201

November 10, 1980

West Plains Area Water and Sewer Plan

Pursuant to your instructions and in accordance with the provisions of the agreement between the City of Spokane and this firm, we are submitting herewith our investigation for the development of the water and sewer plan for the West Plains area.

This report sets forth the major improvements, alternatives and cost estimates for phased development of the water and sewer plan for the West Plains area. However, this entire project can be implemented as a whole should the City of Spokane desire. Also presented, is a transitional phase development utilizing the existing water and sewer facilities to their maximum capacity, thereby allowing development to proceed, yet allowing a reasonable schedule for the development of funding, engineering and construction for the proposed water and sewer facilities.

It is our recommendation that the City of Spokane utilize this report in making the determination of whether or not to provide water and sewer service to the West Plains area. The plan, if adopted, should proceed on the proposed schedule as set forth herein and all future planning for the area should be coordinated with this proposed water and sewer plan.

We appreciate the opportunity to work with the City of Spokane's Utility Department, the Planning Department, the Public Works Department, Spokane County staff, and other local, state and federal government personnel, and we remain available for further discussion and implementation of the plan as you may desire.

Respectfully submitted,

BOYLE ENGINEERING CORPORATION

R. LeRoy Givens

R. LeRoy Givens, PE
Managing Engineer

/bt

EXECUTIVE SUMMARY

INTRODUCTION

Boyle Engineering Corporation is pleased to submit this water and sewer plan report to the City of Spokane concerning the West Plains area. This water and sanitary sewer plan is presented in accordance with the City of Spokane's agreement of the West Plains Area Scope of Work.

The investigation included the identification of the existing conditions in the study area as they relate to land use, population and major water and sanitary sewer facilities. This data base allowed identification of projected population and land use for the area through the assistance of past reports, the City of Spokane Planning Department and other local agencies.

Water demands and sanitary sewer flows were based upon projected land use and population density. This allowed development of conceptual water and sanitary sewer plan alternatives required to serve the projected demands in the West Plains area. The proposed water and sewerage facilities have been subdivided into construction phases to provide a flexible development program. These phases are preceded by a transitional phase which can be put into operation economically and rapidly.

However, it should be emphasized the entire project can be undertaken as a whole should this be desirable. The real demands and locations of these demands for these services will dictate both the locations and timing of the construction of these service facilities.

General cost estimates were developed for the water and sanitary sewer alternatives which met the regulatory, institutional and physical constraints associated with the study area. Potential funding sources and methodologies to meet these costs are discussed in this report.

STUDY AREA

The study area encompasses approximately 47 square miles of land southwest of the City of Spokane (Figure I-1). The topographic relief varies between 1900 and 2700 feet in elevation (USGS Datum) or about 800 feet. Geological investigations show the soil mantle is generally less than 40-inches in depth and basalt outcrops occur throughout the study area.

The existing population within the West Plains study area was estimated to be 6,670 people. Preliminary 1980 census data compilation by the City Planning Department in August, 1980, show this estimate may be too large. However, this does not impact the conclusions of this report since it deals with accommodating growth for the entire area whenever it may occur in the future.

The majority of the study area land is presently undeveloped or in crops with low density housing. Commercial areas occur in strips along Interstate 90, U.S. Highway No. 2 and in the several small communities within the study area. Individual industrial or manufacturing sites occur scattered throughout the area. The only major development in the area is the Spokane International Airport and its related aviation-oriented complex. The sparse devleopment of the study area is generally considered to be caused by the lack of adequate water supplies and wastewater disposal facilities necessary to support a larger residential and industrial base.

A projected land use scheme for the study area was developed by the City Planning Department to designate areas which are appropriate for the described land uses. The land use scheme indicates a total area of 30,370 acres within the study area.

It should be noted that the time period for this study is for only a 20 year span and it is estimated that several of the areas designated for particular land uses will not be fully developed during this period. Notwithstanding this, the proposed water and sewer facilities have been planned for based upon the premise that additional unaccountable growth will occur due to the presence or availability of obtaining these facilities where and when the demand dictates a need.

The projected study area permanent population by the Year 2000 is 9,340 people based upon historical growth rates. Saturation population is estimated to be about 27,000 people. The Spokane International Airport (SIA) passenger traffic is projected to more than double in 20 years to 3.76 million passengers per year.

WATER SUPPLY SYSTEMS

Development of a water system or systems to serve the West Plains study area requires consideration of the sources of supply, existing water systems and projected water demands.

The only identifiable sources of the water to serve the West Plains area are local wells, wells extracting water from the Spokane Aquifer and the City of Spokane existing water system. Rainfall is not considered as a potential source due to its meager amounts and erratic occurrence. Surface waters were not considered due to the need for high levels of treatment when other sources are technically and economically available without extensive treatment.

Local wells within the study area supply almost all of the potable water needs for the area through 80 classified water systems and unaccounted numbers of individual wells supplying single residences. Most wells yield only minor amounts of water ranging from 10 to 50 GPM. Recharge is restricted and results in erratic well performance. It is concluded that the local groundwater supply is inadequate to meet the future needs of the West Plains projected development. However, it is assumed that the portion of the West Plains area planned for rural or semi-rural development could continue to be supplied from individual water supply wells for domestic use. This allows flexibility to help meet the maximum demands for domestic water.

Two other classified water systems provide or have the potential to supply water to the West Plains area. The Geiger Heights housing area is supplied by the City's Highland water system. The Fairchild Air Force Base (FAFB) water system is supplied by wells near Fort Wright. There is an intertie

to the Fairchild Air Force Base transmission and storage system to supply the Spokane International Airport in case of emergency. Both of these sources, the City of Spokane Highland system and the Fort Wright well field area, are considered viable sources to meet the projected quantity and quality demands of the study area.

Projections of the water demands for the West Plains area were based upon the existing water demands which were estimated from available records. The Phase IV projected estimated average daily demand is 12.2 million gallons per day (MGD) and the peak day demand is estimated to be 24.4 MGD. Saturation peak day demand is estimated to be 98.6 MGD.

Practically all of the land area classified for development in the West Plains area lies between elevation 2300 and 2400. It is assumed, for the purpose of the planning report, that the proposed system will require one pressure zone. Those small areas below elevation 2300 will be served from the Highland system or served through pressure reducing valves.

The proposed water system plan and Alternate A are presented on Figure III-3. The proposed water system would have two sources of supply; the City system and wells located at Fort Wright. Similarly, two transmission mains would be required; a 30-inch main extending from the City system at Milton Booster and a 24-inch main extending from the Fort Wright area. The system of transmission mains, booster stations and reservoirs are designed to be constructed as a whole or in phases as needed. Enlargement and expansion of this system would allow the City to expand its service area beyond the study area boundary if the need arose and they were requested to provide that service.

Alternate A assumes the sole source of supply to the study area would be a well field at the Fort Wright area. To supply the Phase IV development would require at least twelve 1500 GPM wells, a 36-inch transmission main and booster station to lift the water to the reservoirs and distribution system. These facilities

can also be considered as water system increments to expand water service to meet the area needs beyond the scope of the Phase IV facilities.

It was assumed that the initial demands would be for service to the SIA terminal and to the industrial and commercial areas east of the terminal. Also, the residential lands near the Abbott Pump station were assumed to require water service from the first phase of the system. The subsequent industrial and commercial development was then assumed to proceed east to west and the residential development was assumed to proceed north to south. Furthermore,it was assumed in the proposed system that the capacity available in the City's existing 30-inch pipeline to Milton Booster would be fully utilized before the Fort Wright wells and transmission main would be constructed.

Four water system phases were developed. The costs for the four phases, excluding localized distribution system, right-of-ways, and inflation factors, are:

Phase I	$4,487,000
Phase II	$3,752,000
Phase III	$4,442,000
Phase IV	$3,823,000
Total	$16,504,000

WASTEWATER SYSTEMS

Development of a wastewater collection system to serve the West Plains area requires consideration of the types of treatment systems, suitability to the West Plains area and future sanitary sewage flows.

Three types of wastewater treatment facilities have potential for the West Plains area and are presently being used: septic tanks and drainfields, small on-site package plants, and off-site treatment systems.

Septic tanks are the most common type serving approximately 80% of the area population. However, new construction involving septic tanks is limited since soil permeability is poor and soil cover is minimal in most areas.

Small on-site package facilities can be found at Geiger Heights housing and a private trailer park in the form of non-overflow lagoon systems. Due to poor soil conditions in the area for percolation, effluent disposal would be by irrigation and/or evaporation in areas outside the major development. The necessity of adequate land for disposal and alternate disposal methods for freezing weather lowers the practicality of this method.

Sewer systems (off-site treatment systems) are the most common form of disposal in developed areas. Densities can be increased and maintenance minimized. Most sewer systems are designed to collect and transport sewage by gravity. The study area can be divided into three basic drainage basins with the central basin containing 17,490 acres and the majority of the development. The topography dictates the exact alignment of the sewer lines.

The City of Spokane presently serves the SIA complex with a 12-inch diameter sewer line which basically parallels Sunset Boulevard to the main City system. The sewage is treated at the Spokane Wastewater Treatment Plant which has the capacity to treat at least the additional estimated sewage flows from the study area. The cost of a new local advanced treatment facility for the study area is approximately ten times higher than the cost of an expanded collection system to transport area wastewater to the City system. Enlargement and expansion of the collection system is proposed to serve the West Plains area.

Projections for the wastewater demands for the West Plains area were based upon the current City flows taken from available records and previous reports. The Phase IV average daily flow is estimated to be almost 9.0 MGD.

The proposed sewer plan is presented in Figure IV-1. This plan shows only the general alignments of the proposed sewer lines and alternate routes. The exact alignment and location of the sewer lines will be developed through field surveys during the design phase. The sizing of these lines considers only sanitary wastewater disposal in order to comply with the ongoing efforts of the City towards separated sanitary sewers and storm water sewers. Development of the West Plains area will require a plan for the disposition of storm water, but this was beyond the scope of this study.

Development is assumed to be in an east to west direction. A proposed trunk line, 36-inches and 27-inches in diameter, would follow the route of the existing Geiger sewer line. This would serve the other trunks connected to it as well as adjacent commercial and industrial development.

15-inch and 24-inch sewer lines would serve the industrial and commercial development around the airport with a 15-inch line serving the residential area around Thorpe Road. The residential flows could either be pumped up to a 36-inch trunk or routed down Thorpe Road in a separate trunk. This alternate route would depend in part upon development in this area and adjacent property.

The collection system necessary to connect the anticipated development to the trunk sewers is not shown. The proposed point of connection to the City's sewer system is the West Grove trunk at Audubon Street and 17th Avenue. The City would need to investigate the existing interceptor system to determine its capacity to transport the proposed quantities to the treatment facilities.

Four phases were developed and should be considered in a general context. Actual phasing of the sewer facilities must be reviewed and revised as the development occurs. The costs for four phases, excluding right-of-ways, localized collection systems and inflation factors are as follows:

Phase I	$1,570,000
Phase II	$1,216,000
Phase III	$ 651,000
Phase IV	$ 346,000
Total	$3,783,000

TRANSITIONAL PHASE

In order to permit the West Plains area to start the planned development within the immediate future, a transitional phase water and sewer system plan has been developed (see Figure V-1). This plan is to utilize the existing facilities to their maximum capacity allowing some acreage to develop for either commercial/industrial and residential or a combination thereof. The plan proposes to construct only those facilities required to serve the transitional acreage or development. These facilities will be incorporated into the Phase IV water and sewer system plan.

The water plan contemplates using the existing 12-inch water main between the Milton booster and the Abbott pump station and the existing pumps at the Milton booster to deliver a maximum of 1200 GPM. The 30-inch line would be constructed from Abbott booster to the existing SIA system along with a portion of the proposed SIA booster station. The estimated construction costs would be $1,115,000 for these improvements.

An alternative source of water is the existing intertie between the SIA water system and the Fairchild Air Force Base (FAFB) booster station and reservoir. A new booster pump which would supply up to 2000 GPM would have to be installed at an estimated construction cost of $40,000. This alternative could be initiated upon an agreement between Fairchild Air Force Base and the City, and would provide an immediate and economical supply of potable water to the study area.

The existing sewer system in the West Plains could be improved to provide additional capacity. This system is presently operating at capacity due to high infiltration and root intrusion. Studies by the City Utilities Department

indicate that most of the infiltration occurs in a 1200 foot section of pipe between the freeway and 13th and Lindeke. Repair of this section would allow about 1.0 to 1.2 CFS of additional capacity at an estimated cost of approximately $25,000.

These improvements to the existing water systems could cost up to $1,115,000. Improvements to the sewer system could cost from $25,000 to $250,000. These improvements will provide immediate service for 100 to 400 acres of industrial/ commercial land or residential land depending upon the type of development allowed.

FINANCIAL

Minimal expenditures immediately will provide additional water and sewer capacities within the West Plains area. This is referring to repair of the Geiger Heights sewer line for $25,000, expansion of the Fairchild-SIA booster station and intertie for $40,000 or the expenditure of $1,115,000 for the proposed SIA booster, Milton booster expansion and a new 30" water main inter-tie between the Abbott booster pump station and the existing SIA water system.

The phasing of this project is such that between $3,000,000 and $5,000,000 1980 dollars will have to be expended for each phase of development to meet the proposed industrial and residential growth. The immediate transitional phase will range from as low as $65,000 to about $1,300,000. By providing this needed water and sewer service the industrial growth in the larger land tracts could start almost immediately.

The preliminary construction cost estimates are comparable to those of other developing areas within the Inland Empire area. There is of course, a high degree of variability. However, the square foot cost of total service area for sewer and water service is not unreasonable. This is especially true when the established operation and maintenance procedures of the City of Spokane will alleviate the existing lack of major water supplies or problems arising from plugged or inoperable septic tanks.

The numerous sources of grants and low interest loans will have to be combined for the proposed plan to become a reality. Several funding sources by the City of Spokane are; Water and Sewer Fund, Local Improvement Districts, Local Levies, and General Obligations Bonds. The State of Washington has several grant/loan programs wihch include the Department of Social and Health Services (DSHS) Referendum No. 27 and if passed by the voters, Referendum No. 38. The Department of Ecology (DOE) provides funds for sewage treatment plants and interceptors and administers the Federal Environmental Protection Agency (EPA) funds. The DOE also provides funds through Referendum No. 26, and if approved by the voters, Referendum No. 39.

Provided the City Council elects to proceed with this project, a combined funding package from the above sources appears plausible. This is based on the premise that the existing policies of the City continue to provide funds for water transmission mains, pump stations, and reservoirs, and sewer interceptors. These finances could be from the grants/loans mentioned above. The landowners and residents would finance the water distribution system, sewer trunks and laterals.

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LIST OF ABBREVIATIONS

ABBREVIATIONS	DESCRIPTION
1. CFS	Cubic feet per second
2. CSO	Combined Sewer Overflow
3. DOE	Department of Ecology
4. DSHS	Department of Social and Health Services
5. D.U.	Dwelling Units
6. EDA	Economic Development Administration
7. EPA	Environmental Protection Agency
8. FAA	Federal Aviation Administration
9. FAFB	Fairchild Air Force Base
10. GPAPD	Gallons per acre per day
11. GPCPD	Gallons per capita per day
12. GPD	Gallons per day
13. GPM	Gallons per minute
14. Ldn	Day - night average sound level (aircraft noise methodologies)
15. LID	Local Improvement District
16. lf	Linear feet
17. MGD	Million gallons per day
18. MG	Million gallons
19. mg/l	Milligrams per liter
20. PPD	Passengers per day
21. PSI	Pounds per square inch
22. SBA	Small business administration
23. SIA	Spokane International Airport
24. ULID	Utilities Local Improvement District
25. USAF	United States Air Force

WATER AND SEWER PLAN FOR
WEST PLAINS AREA

INTRODUCTION

A. PURPOSE

Spokane's growth pattern is currently concentrated north and east of the present Spokane City Limits. The West Plains area, located west and southwest of the City limits, is largely undeveloped at this time. The exception to this is the Spokane International Airport (SIA) which is located at the center of the 30,000 acre West Plains study area.

There is a high degree of interest by Spokane County and City officials to assist in the development of the West Plains area. The main impetus for this interest is the ever-increasing demand by industries to locate in the Inland Empire. A lack of large industrial sites within the city limits of Spokane suggests that industry may look to the areas surrounding the Spokane International Airport for development.

Future residential development around the periphery of the airport is and will be restricted because of the Federal Aviation Administration (FAA) policies of limiting this type of development. There is land located in areas that are futher removed from the airport terminals and runways that can be used for residential development.

The principal reasons that the West Plains study area has not seen major development to date is the lack of a reliable source of domestic water and the lack of sanitary sewer service.

The investigation of these two subjects and the development of a water and sanitary sewer system plan is the purpose of this study.

B. AUTHORIZATION FOR INVESTIGATION

This water and sanitary sewer plan is presented in accordance with the March, 1980 City of Spokane's agreement of original and revised West Plains Area Scope of Work. This scope was proposed and presented to the City of Spokane by Boyle Engineering Corporation in February, 1980, and approved and adopted by the Spokane City Council on March 3, 1980, and subsequently amended on April 28, 1980.

C. SCOPE OF INVESTIGATION

This investigation included the following:

1. Identification of existing land use, population, and major water and sanitary sewer facilities for the West Plains area.

2. Identification of projected population and land use for the area.

3. Identification of water demands and sanitary sewer flows for the projected land use and population.

4. Development of a conceptual and transitional phase water and sanitary sewer plan to serve the West Plains area.

5. General cost estimates for the water and sanitary sewer plan.

6. Identification of potential funding sources for water and sewer facilities.

D. CONSTRAINTS/CONTROL MECHANISMS

The identified water and sanitary sewer plans in this report are proposed to serve the types of designated land uses and estimated populations. Land use designations and population statistics reflect current land use and demographic data base for the area, which appear in earlier reports and Spokane City and County in-house data. Where these data were possibly

incomplete, or two or more sources disagree, reasonable interpretation and extentions of this data were made in conjunction with discussions between Boyle Engineering Corporation, Spokane Area Development Council, City of Spokane Planning Department and Spokane County Planning Department. Where projected population and land use data were lacking for portions of the study area, criteria and assumptions have been identified for making these land use and population projections.

The proposed water and sanitary sewer plans were examined relating to known regulatory, institutional, and physical factors associated with the study area. Some of these factors are:

1. The land use recommendations for the area pursuant to the Spokane County '208' Study.

2. Federal (EPA) procedures regarding recognition, authorization and funding of projects requiring regional transport of sewage to the Spokane Advanced Wastewater Treatment Plant.

3. On-site waste disposal pursuant to the State's Public Water Systems Coordination Act (DSHS).

4. The regional or area wide approach in utility planning required by the State of Washington as embodied in Referendum No. 27.

5. Existing water agreements for use of City of Spokane's water by Geiger Heights.

6. Existing wastewater agreements for use of City of Spokane's sewerage system facilities by Spokane International Airport (SIA).

7. Existing water agreement for the SIA's 8-inch pipe connection to the Fairchild Air Force Base's (FAFB) 16-inch water line at Spotted Road and Airport Drive.

8. Existing water agreements which supply the several water purveyors in the area.

9. The possible effect of the City of Spokane's two-phased combined storm sewer overflow (CSO) sewer separation project on the improvement of sewer line capacity, relative to the area's sewer line.

10. Discussions between the City of Spokane and Fairchild Air Force Base to augment the City's water system from additional future wells in the area of Fairchild's existing wells.

11. The 2,200 acre development being planned immediately east of the study area by Cedar Road Development, Incorporated.

12. Washington Fire Code requirements for standby water storage as embodied in the Spokane County Fire Code.

13. Geology of the area, particularly topographic and depth-to-bedrock factors relative to location of water and sewer lines and pump stations.

14. The time period for planning investigation that is recognized by the scope of work is twenty (20) years.

15. The evaluation of the impacts to the environment caused by any of the proposed facilities is not within the scope of this investigation.

The water and sewer system concepts utilize existing facilities or components, right-of-ways, and compatible water and sewer agreements within the study area where possible. New locations for system components were selected to be compatible to the extent possible with statutes and regulations previously identified.

CHAPTER I

CHAPTER 1

DESCRIPTION AND HISTORY OF THE AREA

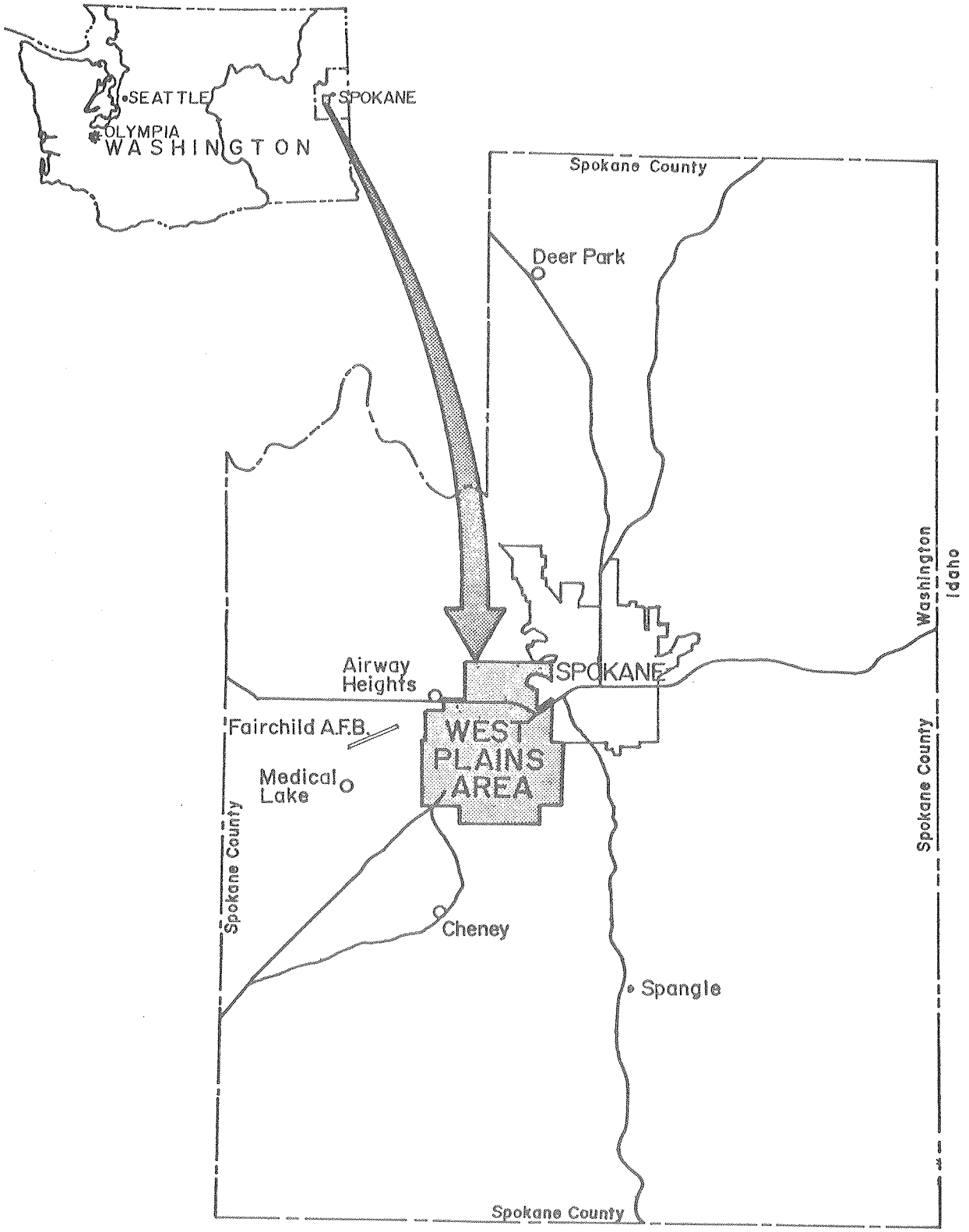
A. PHYSICAL AND NATURAL FEATURES

The study area encompasses approximately 47 square miles just southwest of the City of Spokane (see Figure I-1). Major physical features (highways, airport, railroads, and others) in the study area are shown on Figure II-1. The study area is bounded by Craig Road on the west, Airway Heights and Mission Road to the north, City of Spokane limits on the east, and section line boundaries to the south and southeast. Public entities in the study area are jointly owned City-County Spokane International Airport, City of Spokane, Spokane County, United States Air Force (Geiger Field and Geiger Heights). The unincorporated communities of Hayford and Marshall are also encompassed within the study area. Other existing developments in the area consist of Four Lakes subdivision and golf course, Windsor Hills, Sunset Hills, Garden Springs, Palisades Park and three cemeteries.

Major transportation routes through the area include the northeast-southwest running Interstate No. 90 freeway and the Burlington Northern Railroad. Major east-west roads are Sunset Highway, 44th Avenue and Hallett Road. Major north-south roads are Craig Road, Hayford Road and Spotted Road.

Topographic, geologic, and hydrologic features are important factors to the development of the water and sewer system in the area. The topography in the study area ranges between elevation 1900 and 2700 feet. The majority of the area, however, is between elevation 2200 and 2500 feet. General land slope is from southwest to northeast and is normally less than eight percent. In most instances the slope is approximately two percent.

Geologic conditions indicate that the soil mantle is generally less than 40-inches in the eastern portion of the study area and penetrated by bedrock outcrops which are scattered throughout the entire study area. These outcrops



WEST PLAINS AREA VICINITY MAP

FIGURE I-1

consist mainly of basalt. Data obtained from the Washington State Department of Ecology indicate that most wells are within 300 feet of the surface and with yields ranging from 10 GPM TO 1300 GPM (both of these yields are from 300 foot deep wells). It is noted that most wells are of very low yield which is to be expected due to the nature of the subsurface basalt which restricts the groundwater movement.

B. HISTORY

Through recent history, the West Plains area has witnessed major Indian battles, the establishment of a large dairy farm and the development of both military and private aeronautics centers according to reports by Bal (1976) and the Spokane City/County Historic Preservation office.

For centuries the area around Four Lakes had been a popular campsite for Indians. The vicinity contained both lakes and springs and was a natural hunting ground for the Indians who lived in or traveled through the area.

The Four Lakes region was visited by white men in 1858 when Colonel George Wright brought his army troops into the area and established a camp near Granite Lake. Wright was the first to call it "Four Lakes" although there were actually seven lakes in the immediate vicinity. The day after their arrival, the army fought a combined force of Spokane, Palouse and Coeur d'Alene Indians in retaliation for the Steptoe defeat a few months earlier. This "Battle of Four Lakes" and the subsequent "Battle of Spokane Plains", which was a running battle across the plains toward the Spokane River, were the only Indian Wars ever fought in Spokane County. The army's victory at the conclusion of this campaign effectively ended armed Indian resistance to white settlement in eastern Washington.

One of Spokane County's earliest settlers, Wilbur Fiske Bassett, homesteaded in 1872 in that same area where Wright and his troops had camped 14 years earlier.

The little community of Marshall was founded in 1879 when William Marshall established a sawmill on Lake Creek. This sawmill was on the proposed route of the Northern Pacific Railroad line and railroad ties were in demand. The Lake Creek mill quickly became the nucleus of a small community of people who were working on the railroad. Marshall attempted to win, but lost to Cheney, the bid for county seat, the railroad moved on, and by 1883 the "boom" was over for Marshall.

However, in 1886 the Northern Pacific added a spur line from Spokane to Palouse which branched off the main line at Marshall and headed south. This revival of railroad activity brought a new period of growth to Marshall Junction, as it was then called. The town was platted in 1887, the sawmill was improved, and a flour mill was built. But after this second "boom" the economy of Marshall slowly declined. In the 1920's the Marshall area was well known for its bootleg operation. According to local residents, a number of highly mobile distilling operations were scattered around the woods.

In the 1890's two brothers, George and David Brown, and a brother-in-law, John L. Smith, established a dairy known as Hazelwood Farm at the corner of Hayford Road and U.S. Highway No. 2. It wasn't long before the Hazelwood farm was one of the largest dairies in the Pacific Northwest, eventually becoming the second largest dairy operation in the United States. Their products were sold as far away as New Orleans and New York City. In addition to dairy products, emphasis at Hazelwood also focused on cattle breeding. John Smith was primarily responsible for developing the world famous "Hazelwood Holstein" breed which eventually became the core of the dairy herd for Seattle's Carnation Company.

With the success of the dairy, David Brown and John Smith decided to turn their farmland west of Spokane into orchards using water pumped from Silver Lake for irrigation. The Hazelwood Company acquired 3,000 acres extending from what is now Survival School to Hayford Road on the east and bounded by Sunset Highway on the north. They divided this land into 5 and 10 acre parcels and began an extensive promotion campaign to sell the lots which could be bought for $250 per acre.

The irrigation system consisted of a pump placed in Silver Lake south of the bridge and on the east side of the lake. A 16-inch pipe carried 7,000 gallons per minute to a 36-inch barrel flume 70 feet above the lake. The water flowed through a ditch by gravity to the McFarland and Craig Road intersection and was distributed underground in a wire-wound wooden pipe. Flow was controlled through weir boxes and water was only pumped between May 1 and September 5.

The promotion campaign was successful. Parcels were sold, orchards were planted, the irrigation system was installed, and the population in the area increased. (Spokane was also increasing in population during this time, growing from approximately 36,850 in 1900 to nearly 100,000 in 1906.)

After they began pumping in 1907 the lake began receding rapidly. Due to lack of groundwater supply, Silver Lake was just not able to replenish itself. Over the years Silver Lake was reduced to not much more than a pond. Finally in 1922 the managers saw that the lake would eventually run dry and pumping was discontinued. The tract owners attempted to convert to wells and at least 30 wells were dug, but none could provide enough water for irrigation. In 1924 the company abandoned all efforts to irrigate. The orchards dried up and were eventually removed so grain crops could be planted. Many of the abandoned houses were used as roadhouses and stills during the prohibition era.

Two electric trolley lines, carrying passengers from Medical Lake and Cheney to Spokane across the Spokane Plains (West Plains) area, existed at the turn of the century. Electric Avenue is one of these abandoned trolley grades. Northern Railroad and Great Northern Railroad had also set up lines across the plains to Spokane.

Spokane desired a major aviation center in the 1920's. Felts Field was established east of town in 1920. In 1938 the County Government bought land and established the Sunset Airport west of Spokane. In 1940 the Federal Government purchased the site and the Army Air Force moved in. The airport was renamed Geiger Field. After the war the City and County bought the airport and it became Spokane International Airport.

In April of 1941, Spokane was selected as a possible site for an Army Air Corp depot. $125,000 was raised by the citizens of Spokane to purchase the 2500 acres for the depot and to present the land to the Army. This impressed the Army Air Corps to the point that in November, 1941, the site was officially selected and obtained from the City.

The town of Airway Heights was developed as a townsite during the war years to provide housing for the air depot. In 1945, the depot came under the jurisdiction of the Air Force and in 1951 was renamed Fairchild Air Force Base. Since that time Spokane and the military have continued to support each other and Fairchild Air Force Base has been an integral part of the Spokane area.

CHAPTER II

CHAPTER II

POPULATION AND AREA DEVELOPMENT

A. GENERAL

The water and sanitary sewer needs of the area are directly related to the land use, whether it be for residential, industrial or commercial use. One of the most common parameters used in determining residential water or sanitary sewer use is unit consumption or discharge per capita. Industrial and commercial water and sewer needs are commonly based upon a unit consumption or discharge per acre of land use. The determination of population and forecasted land use are therefore required to estimate the water and sanitary sewerage capacities required for the development. The projections of these data are utilized to develop the sizes and locations of the water lines and sanitary sewers for the area. Unless noted otherwise, these data described in this section have been based upon information from the City of Spokane Planning Department.

B. POPULATION

Population estimates for residential land use have been developed in phased increments for the study period. These estimates will be utilized in developing residential water demands and wastewater discharges.

The present population of 6,670 is essentially located in single family residences in the areas adjacent to the Spokane City Limits, Geiger Field housing, Geiger Heights housing and the unincorporated areas of Marshall and Hayford as shown on Table II-1. Preliminary 1980 census results show a population of 4,660 (August, 1980) according to the City Planning Department. However, this does not impact the conclusion of this report since it deals with accommodating growth for the entire area whenever it may occur in the future.

In addition to the permanent population, there are large numbers of airline passengers who move through the area daily. These passengers must be accounted

TABLE II-I

PROJECTED PERMANENT POPULATION

Projected Land Use Categories	Population				
	Transitional	Phase I	Phase II	Phase III	Phase IV
Single Family Residential	2,750	3,170	3,580	4,030	4,450
Multi-Family Residential	10	300	320	330	350
Agricultural/Residential	1,340	1,490	1,640	1,800	1,950
Commercial (a)	340	340	340	340	340
Industrial (a)	1,380	1,380	1,380	1,380	1,380
Agricultural/Industrial (a)	290	290	290	290	290
Agricultural	30	40	40	40	50
Public/Semi-Public (a)	330	330	330	330	330
Spokane International Airport (a)	200	200	200	200	200
Totals	6,670	7,540	8,120	8,740	9,340

(a) Categories Now - Conforming to Residential Uses.

3. 1980 Spokane County population estimates are based on 1970 census data and 1978 County estimates for the enumeration districts. The growth rate was determined for 1970 to 1978 and was assumed to continue to 1980. (Preliminary 1980 census data was not available until the end of the study sequence).

4. Utilizing the growth rates used in the City of Spokane Planning staff memorandum to Boyle Engineering Corporation dated May 13, 1980 (these are updated growth rates based on Water Resource Study, 1974 Growth Rates) the 1980 base populations were projected through 2000. The people per dwelling unit densities established in the 1980 enumeration district were assumed constant through 2000 and used.

5. The results from each enumeration district were then proportioned to the individual land use categories by the factors determined in Steps 1 and 2 above and totalled. Multi-family was determined by the following:

Assumptions: Single Family and multi-family rates of increase are equal.

Where: Saturated population = area x Dwelling Unit (D.U.)/ acre x people/D.U. x (1-vacancy rate)

Single family: 2.758 people/D.U.
2.5 D.U./acre
.01555 vacancy rate

Multi-family: 1.542 people/D.U.
16 D.U./acre
.05260 vacancy rate

for in developing water and sewer systems. The number of arriving and departing passengers logged at the Spokane International Airport is increasing annually. According to data from Spokane International Airport's administration, the passenger traffic in 1979 amounted to 1,578,000 passengers, or almost 4,320 passengers per day. Currently the airport is expanding its facilities to accommodate the increasing passenger volume and parking. The forecast daily airport passenger traffic is set forth in Table II-2.

TABLE II-2
PROJECTED AIRPORT TERMINAL TRAFFICE

	1979	Transitional	Phase I	Phase II	Phase III	Phase IV
Average Passengers Per Day (PPD)	4,320(a)	4,420	5,900	7,400	8,900	10,400
Employees(b)	230	230	300	400	500	600
Total People Per Day	4,550	4,650	6,200	7,800	9,400	11,000

(a) Source: SIA Passenger Traffic Records, SIA Administrative Office

(b) Assumes air terminal and air carrier employee to passenger ratios of approximately 1:19.

Population Estimates - Population forecasts for the area were generated through a five step precedure. The five steps utilized are as follows:

1. Determined: Enumeration districts wholly and partially within the projected land use areas (see Figure II-2) from superimposing the projected land use map over the enumeration district map. (Ref. 1: 1978 population estimates, Spokane County Planning Department, Data and Information Center, May, 1979).

2. Determined: Proportioning factors from the ratio of an area of an enumeration district in a land use to the total area of the enumeration district.

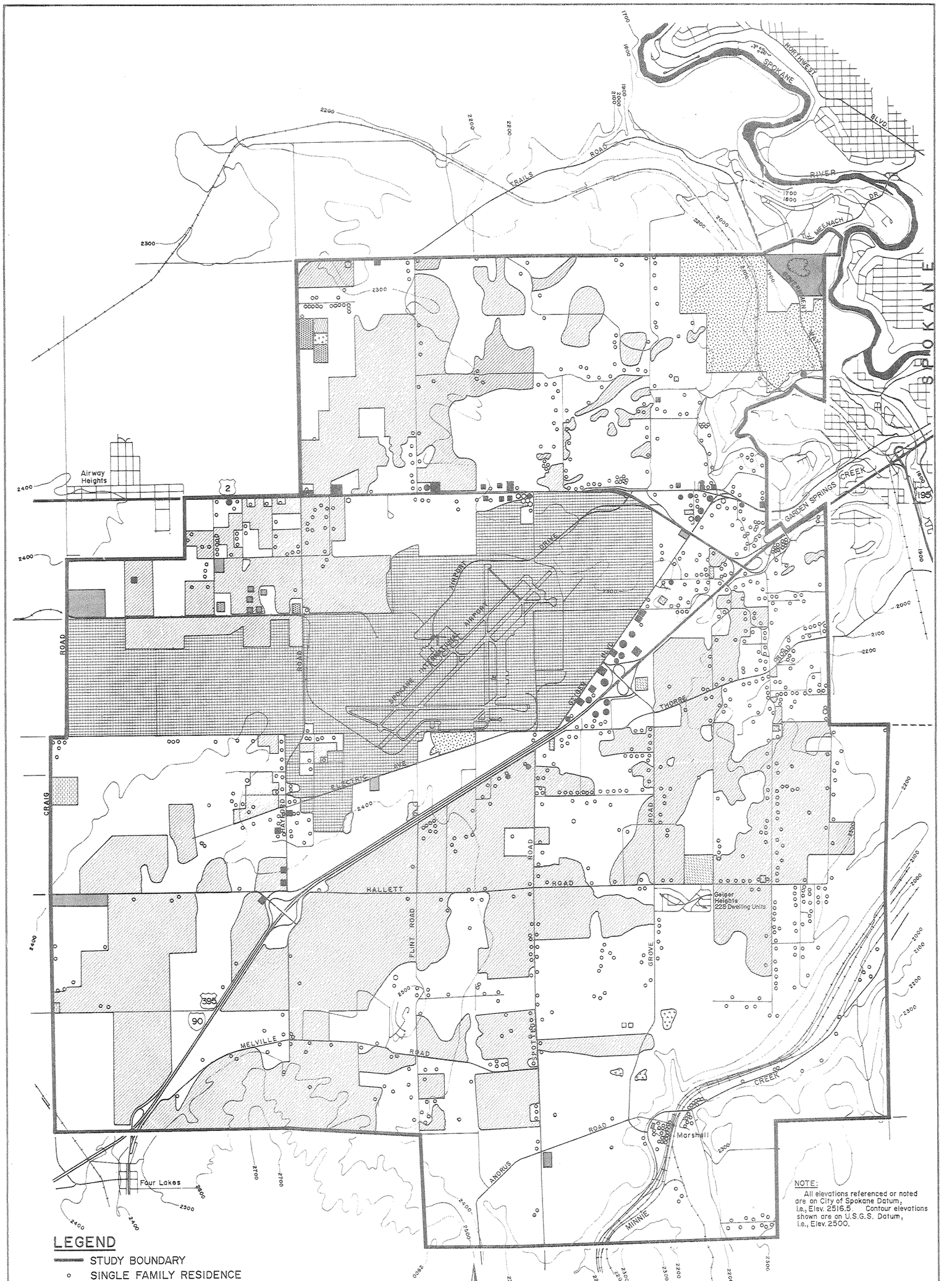
Estimated populations appear in Table II-1 by projected land use categories. A map (Figure II-1) shows the existing land use and in Figure II-2 appears the distribution of the projected land uses. As indicated in these figures, existing population is scattered throughout the study area and not confined to areas forecast for residential use. For example, approximately 34% of the existing population resides in areas that are proposed to be designated as agricultural but will eventually be converted to industrial.

C. AREA DEVELOPMENT

The projected development of the West Plains area has been described in many past and current studies and reports. To date, development in the study area has been negligible and is generally considered to be caused by the lack of adequate water supplies and wastewater disposal facilities necessary to support a larger industrial, commercial and residential base.

The study area would be considered suitable and desirable for development of all types if the water and wastewater situation were corrected. The area is readily accessible to all modes of transportation; via Interstate Highway 90, Spokane International Airport and Burlington Northern Railroad. Careful planning of the needs of the public and private sectors of the area could allow development in a timely and beneficial manner.

Existing Land Use - Existing land use in the area appears in Figure II-1. The Spokane International Airport currently is the only major development in the area and comprises approximately 3,270 acres. The airport is owned jointly by the City and County. Most of the industrial land surrounding the airport is undeveloped. Limited commercial and industrial areas occur in strips along U.S. Highway No. 2 and in small communities such as Hayford and Marshall. The remainder of the land in the study area is relatively undeveloped or in crops with low density housing occupying land in close proximity to the streets, roads and highways.



NOTE:
All elevations referenced or noted are on City of Spokane Datum, i.e., Elev. 2516.5. Contour elevations shown are on U.S.G.S. Datum, i.e., Elev. 2500.

LEGEND

- STUDY BOUNDARY
- SINGLE FAMILY RESIDENCE
- MULTIPLE FAMILY RESIDENCE
- HOTELS, MOTELS & TRAILER COURTS
- PUBLIC & QUASI-PUBLIC SCHOOLS
- RETAIL BUSINESS
- WHOLESALE & WAREHOUSING
- OTHER PUBLIC & QUASI PUBLIC SERVICES
- MANUFACTURING
- TRANSPORTATION, COMMUNICATIONS & UTILITIES
- MINING ACTIVITIES
- AGRICULTURE & FORESTRY
- PRIVATE VACANT LAND
- OTHER PUBLIC & QUASI-PUBLIC OPEN SPACE
- INCORPORATED AREA & AIRPORT

SCALE 0 1000 2000 3000 4000 5000 FT.

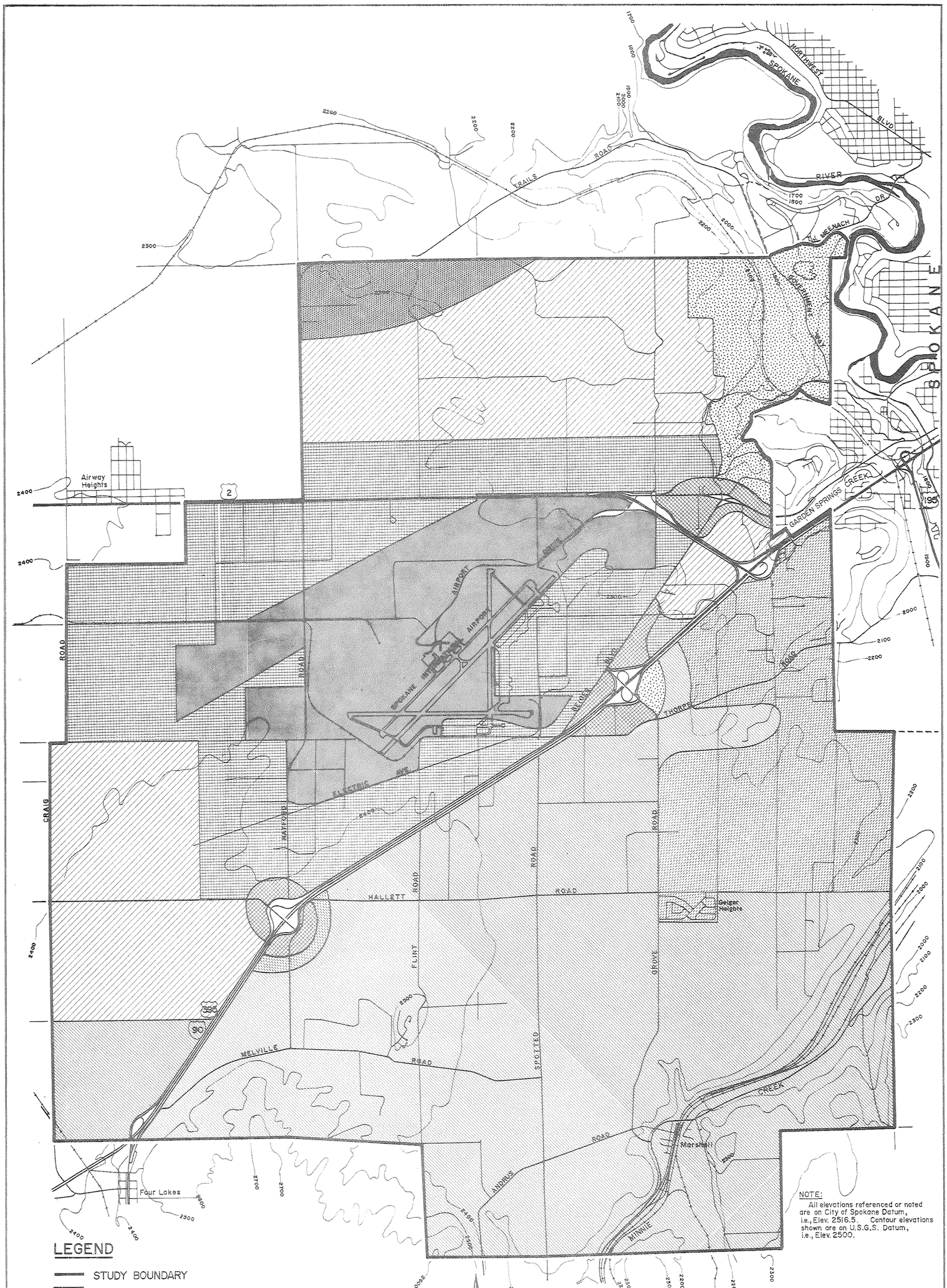
SOURCE: Spokane Co. Planning Dept.

WEST PLAINS AREA WATER AND SEWER PLAN FOR CITY OF SPOKANE

EXISTING LAND USE

Boyle Engineering Corporation
consulting engineers / architects

FIGURE II-1



NOTE:
All elevations referenced or noted are on City of Spokane Datum, i.e., Elev. 2516.5. Contour elevations shown are on U.S.G.S. Datum, i.e., Elev. 2500.

LEGEND

- STUDY BOUNDARY
- SPOKANE INTERNATIONAL AIRPORT [SIA]
- INDUSTRIAL (LIMITED) [IND]
- AGRICULTURAL (EVENTUAL INDUSTRIAL) [AG-IND]
- COMMERCIAL [C]
- MULT-FAMILY RESIDENTAL [MFR]
- SINGLE FAMILY RESIDENTIAL [SFR]
- AGRICULTURAL (EVENTUAL RESIDENTIAL) [AG-R]
- AGRICULTURAL [AG]
- PUBLIC / SEMI-PUBLIC [P/SP]

SCALE 0 1000 2000 3000 4000 5000 FT.

SOURCE: City of Spokane Planning Dept.

WEST PLAINS AREA WATER AND SEWER PLAN FOR CITY OF SPOKANE

PROJECTED LAND USE

Boyle Engineering Corporation
consulting engineers / arcpitects

FIGURE II-2

Projected Land Use and Development - A projected land use scheme for the study area was developed by the City of Spokane Planning Department (June 20, 1980). These projected land uses were used in determining the general area where future development will occur and are depicted in Figure II-2. The several land uses are defined as follows:

Single Family Residential - This category accommodates predominately single family homes with some duplexes and even with some apartments at key locations where they will be compatible with their surroundings. It is intended that such residential uses will be located clear of aircraft approach zones and in areas subject to noise levels below 65 Ldn (day-night average sound level); nevertheless, aviation easements, sound proofing measures, building height limitations, and lighting controls may be required to insure compatibility of permitted uses with airport operations. It is expected that many areas will retain a suburban or semi-rural character including agricultural uses and farm animals under specified conditions to protect the residential uses. It is expected that most development will average about two and one half dwelling units per gross acre except where farm animals are allowed. The minimum net lot size for single family residences is 7,200 square feet and minimum net lot area for duplex or apartment units, where permitted, is 3,000 square feet per dwelling unit. Schools, playgrounds, churches and other public or semi-public community facilities as needed are also appropriate uses in this category.

Multi-Family Residential - This category accommodates small apartment buildings with some intermingling of single family homes and duplexes. It is intended that locations and development be compatible with airport operations as specified for the single family residential category. One location for multi-family residential is indicated on the Land Use Plan map to the south of the Interstate 90 Medical Lake interchange. The City of Spokane Zoning Board may approve additional locations where such use would be compatible with surrounding existing uses or uses

intended by the Land Use Plan. In particular, such multi-family use may be appropriate along major arterials and as an intermediate use between single family areas and non-residential uses. Public and semi-public community facilities as needed are also appropriate uses in this category.

Agricultural/Residential - These areas lying generally south of the freeway and west of Grove Road are located beyond the significant 65 Ldn (day-night average sound level) noise impact areas. It is anticipated however, that water and especially sewer service will not be extended to these areas as soon as to the areas adjacent to the City designated single family residential. They are expected therefore to remain in predominately agricultural use with some residential use on large tracts for the immediate future. Minimum lot size for residential use would be five acres and other zoning standards would be similar to the agricultural category except that agriculture related industrial or commercial uses that would be detrimental to the expected eventual residential use would not be appropriate in these areas.

At such time as full utilities may be extended to these areas they may be expected to gradually develop to some type of low density residential use. It is anticipated however, that many areas will retain a suburban or semi-rural character and consequently, zones which allow farm animals and mandate lower densities may be eventually appropriate for these areas.

Commercial - This is a generalized category and areas delineated on the Land Use Plan may include, as appropriate and determined by the Zoning Board; neighborhood or community business districts providing a variety of retail goods and services primarily serving the needs of residents of the West Plains area; business areas primarily providing services to the airport or highway traveler; Commercial parks providing for primarily non-retail business uses,

office uses and some light industrial uses, all developed as attractive, landscaped sites; heavy commercial areas primarily providing for wholesale and warehouse uses, heavy equipment sales and similar uses at selected locations convenient to highways and/or to the airport or rail lines.

Residential uses are generally inappropriate in this category but may be approved as a part of planned commercial developments at locations where noise levels do not exceed 65 Ldn provided the development plans assure provision of a substantial degree of residential amenity within the housing area. Commercial areas may be established at locations subject to noise levels in excess of 65 Ldn; however, aviation easements, height limits and smoke and lighting controls would be generally applicable. Sound proofing construction may be required to protect worker and customer areas.

Industrial - This category is intended to provide for a variety of industrial development including industrial parks and general light industrial uses which do not produce excessive vibration, dust, smoke, odors or other objectionable features. Commercial, wholesale goods, transfer terminals and other uses particularly desireous of airport and/or highway proximity may also be located in this category. Residential uses are generally inappropriate in the category. Industrial areas may be established at locations subject to noise levels in excess of 65 Ldn. It is intended that development controls assure compatibility with airport operations as specified for the Commercial category. Industrial establishments having operations with a low tolerance to noise and vibrations characteristic of airport operations should not locate in these areas.

Agricultural/Industrial - These areas are at locations subject to noise levels generally unacceptable (above 65 Ldn) for residential use, and are expected therefore to eventually be developed to industrial use. Some areas are presently in agricultural use, some have scattered residential use on acreage tracts and some areas are predominately vacant. Most areas so designated are not expected to be immediately accessible to sewer and water service. In order to insure that such areas will not be prematurely developed to uses incompatible with the anticipated eventual industrial use, and in order to allow some reasonable immediate future use compatible with existing uses, the areas would be subject in short term to the same zoning standards to be applied in the agricultural/residential areas (minimum residential lot size of five acres). As full utility services become available and as demand warrants these acres would be expected to gradually develop to industrial use.

Agricultural - This category is intended primarily to accommodate the production of agricultural crops, dairy and livestock products, nursery stock and forest products and to help conserve suitable agricultural land in and around Spokane for these purposes. Establishments for processing, packing, storage and sale of agricultural products as well as certain other commercial uses related to agriculture may be allowed by special permit in areas specifically identified for such uses. While it is recognized that many residents on land in this category will not farm their land as their primary source of income, it is nevertheless intended that residential use be incidental to the primary agricultural use of the land. For this purpose and because it is not anticipated that public water and sewers will be provided to such areas the minimum lot size for single family residences is five acres.

Land identified in this category is not intended to be converted to urban residential or industrial use at some future date but to remain in agricultural use at least during the foreseeable future.

Public/Semi-Public - This category is intended to recognize the existing or anticipated major public and semi-public land uses in the area - chiefly the City Park Lands, cemeteries and private school lands. Future smaller sites needed for schools, local parks, churches, etc. are not designated but would be located as required primarily within residential areas.

Spokane International Airport - This category includes all land intended for future airport operations use by Spokane International Airport even though such land category does not include land area now owned by the airport but proposed to be leased or sold for industrial development. The area delineated on the projected Land Use Plan (Figure II-2) is as shown on the Master Plan for Spokane International Airport, Bovay, December, 1978, with proposed modifications.

Figure II-2 shows this land use scheme contains a total area of 30,370 acres within the study area boundaries. 14,500 acres of the total area is designated as eventual residential use. 10,400 acres eventually will be designated industrial use. Spokane International Airport boundaries should remain unchanged, encompassing 3,270 acres per this land use scheme. The 1,110 acres of cemeteries and parks is designated as public/semi-public. Agricultural land use boundaries encompass 570 acres. A tabulation of the land use distribution is presented in Table II-3. These figures represent a major land use conversion from an area which is presently agricultural and rural in nature, with the exception of the airport and a small (less than 500 acres) light industrial base, to a different land use configuration. Accordingly, major water supplies and sanitary sewage facilities will need to be developed to meet the requirements created by a considerable increase in industrial land development, and a conversion of nearly 14,500 acres of what is currently undeveloped land or cropland, to residential uses.

TABLE II-3

PROJECTED LAND USE
WEST PLAINS AREA

Projected Land Use	Area, Acres	Percent of Total
Single Family Residential	2,680	8.8
Multi-Family Residential	80	0.3
Agricultural/Residential	11,740	38.6
Commercial	520	1.7
Industrial	5,460	18.0
Agricultural/Industrial	4,940	16.3
Agricultural	570	1.9
Public/Semi-Public	1,110	3.7
Spokane International Airport	3,270	10.7
Totals	30,370	100.0

Source: Projected Land Use Map - City of Spokane Planning Department, June 20, 1980.

It should be noted that the time period for this study is for only a 20 year span and it is estimated that most of the areas or land use patterns will not be fully developed during this period, as indicated in Table II-4. If and when water and sanitary sewer facilities are developed for these areas, projections should be extended to approximately 50 years. This period would more closely correspond to the design life of the facilities. Estimating growth patterns for each of these non-developed land use areas for 50 years in the future is, at best, tenuous. Regional planning can be used as a guide for overall anticipated growth, but is of little help in a limited study area. The projected growth trends shown in Table II-1 indicate almost a 10 percent increase for each phase. Continued growth at this rate could be used for sizing of the required water and sanitary sewer facilities for the future planning period. However, unaccounted growth may occur due to the availability of water and sewer facilities in the area. The timing and location of the demands for these facilities will dictate the timing and location of the construction of these facilities.

The overall development of the study area was based on the estimated population increases for the residential area and the forecasted demand for expansion of commercial and industrial lands. The population increase for the phased increments are as shown on Table II-1. The development of the commercial and industrial designated lands are at a rate of approximately 75 acres and 625 acres per phase respectively.

The basis for the development of a particular area considers the type of land use and availability, topography, physical access and availability of water and sanitary sewer facilities. In applying these considerations to the study area, it is anticipated that the majority of the development will occur within the areas immediately surrounding the airport. This area has been labeled the "Central Drainage Basin". This forecasted development is in part due to the following:

TABLE II-4

PROJECTED LAND USE SERVED BY
PROPOSED WATER AND SEWER SYSTEMS

Projected Land Use Categories	Transitional Phase	Phase I	Phase II	Phase III	Phase IV	Saturation Serviceable
Single Family Residential	290	350	400	460	520	2,680
Multi-Family Residential	0	0	0	0	0	80
Agricultural/Residential	0	0	0	0	0	11,740
Commercial	75	120	195	270	345	520
Industrial	175	550	1,175	1,800	2,425	5,460
Agricultural/Industrial	0	0	0	0	0	4,940
Agricultural	0	0	0	0	0	570
Public/Semi-Public	0	0	0	0	0	1,110
Spokane International Airport	3,270	3,270	3,270	3,270	3,270	3,270
Total Acreage	3,810	4,290	5,040	5,800	6,560	30,370

1. The existing airport and industrial complex is within the "Central Drainage Basin". Land is currently available for lease to industry. Outlying areas zoned for industrial uses are currently in other uses and are not immediately available for acquisition by industry.

2. Approximately 80 percent of the designated industrial land and 85 percent of the designated commercial land is within this area.

3. Major industries such as assembly and light manufacturing plants, utilities and food processing firms are interested in locating in the West Plains area and more particularly this "Central Drainage Basin".

4. 80 percent of the single family residential and all of the multi-family residential lands are located within this area.

5. Extension and development of water and sewer facilities to this area are technically and economically more practicable than to other areas.

6. Stronger financial base for utility extensions to serve the higher population density and developed commercial and industrial areas.

CHAPTER III

CHAPTER III

WATER SUPPLY SYSTEMS

A. GENERAL

In order to develop a water system or systems to serve the West Plains study area, it is necessary to consider the following factors:

1. Sources of supply
2. Existing water systems
3. Projected water demands

The following text describes each of the factors listed above. In addition, a phased water system plan for the West Plains area is developed, together with the estimated construction costs.

B. SOURCES OF SUPPLY

The only identifiable sources of water to serve the West Plains area are:

1. Local wells (within the study area)
2. Wells extracting water from the Spokane Aquifer
3. City of Spokane existing water system

Rainfall and surface runoff are not considered as a potential source of potable water supply because of meager amounts and erratic occurrence. This source only provides for the small demands for the sparse native vegetation.

C. AREA HYDROGEOLOGY

There have been a number of investigations and reports regarding the geology of the Spokane area. In most instances the West Plains area was peripheral to the areas of investigation, however, their findings can be extrapolated to the study area with a relatively high degree of confidence. The following reports were of particular value in the preparation of this investigation: State of Washington, Department of Ecology Water Resources Information System Technical Bulletin No. 15; "Geology, Groundwater and Water Quality of Part

of Southern Spokane County, Washington"; "Water Resources Study Metropolitan Spokane Region, Geology and Groundwater" December 1974; and U.S. Geological Survey Open File Report No. 77-829, "Spokane Valley - Rathdrum Prairie Aquifer, Washington", 1978. All information relative to geology and groundwater was extrapolated from published and unpublished studies and reports.

The geologic section in the study area can be broadly divided into three units:

1. Bedrock unit
2. Mid-Tertiary through Pleistocene consolidated rocks
3. Pleistocene and Holocene unconsolidated rocks

The bedrock unit consists of Precambrian sediments and granite rocks of plutonic origin of probable late Jurassic or Cretaceous age. The surface of the bedrock unit exhibits considerable relief. In some instances, isolated remnants of the bedrock surface protrude through the subsequent series of rocks outside the study area which are indicative of the extent of the relief of the relic basement complex.

Overlying the bedrock unit is a succession of extrusive igneous rocks interbedded with a series of fine grain sedimentary rocks. The extrusive igneous rocks are predominantly basalt flows with attendant breccias and tuff. The individual lava flows range in thickness from 25 feet to 120 feet and have a reported maximum thickness in excess of 945 feet. The basalt flows are referred to as the Columbia River basalt and the fine grain clastic sedimentary unit as the Latah Formation. The oldest beds of the Latah Formation overlie the basement complex. Individual beds of the Latah Formation are interbedded with individual flow units of the Columbia River basalt. Available information suggests that the basalt and interbedded sediments date from lower Miocene time. Flow members of the Columbia River basalt were instrumental in damming streams and rivers, and during these hiatal periods in volcanic activity, fine grained clastic sediments of the Latah Formation were deposited in lakes created by the basalt dams. This resulted in a succession

of relatively dense basalt flows interbedded with fine grain clastics and clays. Deposition of the two formations is reported to have been continuous through Miocene and possibly lower Pliocene time.

Subsequent to the last episode of the volcanic activity during late Tertiary and possible early Pleistocene the area was uplifted and eroded. During early Pleistocene an eolian series of deposits were laid down over the area. This is known as the Palouse Formation. The windblown deposits are sometimes found intermixed with gravel and occasional boulders, the result of reworking by subsequent glaciation. The thickness of the Palouse Formation loess deposits is reported to range from a few inches to 100 feet. During Pleistocene time there are reported to have been several periods of glacial advance and retreat. With the retreat of the glaciers, melt water scoured the land surface resulting in deposits of glacier outwash and till. Each cycle would essentially obliterate evidence of preceeding periods of glaciation. Subsequent to the close of the Pleistocene when the present drainage pattern was found, the prominent topographic features have been subjected to erosion and extensive deposition of alluvial material has occurred in the valley floors. Concurrent weathering of the fine grained Latah Interbeds has resulted in colluvial talus deposits along the canyons cutting through the Columbia River plateau. This pattern continues to the present.

The stratigraphic units in the study area have differing lithologic composition and their ability to store and transmit groundwater is governed to a great extent by their lithology.

Formations in the study area can be broadly grouped into three units as regards their groundwater potential:

1. Bedrock unit - Mesozoic and older igneous and metamorphic rocks
2. Mid-Tertiary to Pleistocene and consolidated rocks
3. Pleistocene and Holocene unconsolidated rocks

The bedrock unit is comprised of dense crystalline rocks and is almost totally deficient of groundwater. The exception is where there has been extensive weathering of the bedrock or fracturing resulting from tectonic activity. Generally yields from wells in this unit do not exceed 10 to 15 GPM, and are sufficient for domestic water supplies only. The mid-Tertiary to Pleistocene consolidated rock unit consists of the Latah Formation and the Columbia River basalt group. The Latah Formation is considered with the basalt as they are interbedded. Wells penetrating the basalt may encounter varying thicknesses of the Latah Formation between individual flow units. The Latah is made up of semi-consolidated clays and silt with occasional sand and gravel beds. Groundwater in this formation occurs in thin beds of sand and gravel. The sand and gravel fraction of the Latah represents only a small portion of the formation and the predominant lithology is silty clay which is impervious. For all practical purposes the Latah is an aquaclude or barrier to groundwater movement.

The Columbia River basalt group is the major aquifer in the study area. The formational unit consists of a succession of basalt flows. The individual flow units are dense and normally impervious to vertical movement of groundwater. The tops are scoriaceous and sometimes fractured and these zones are permeable and capable of transmitting varying amounts of groundwater. Locally, individual flows pinch out resulting in lateral discontinuity. The degree of fracturing at the flow interfaces also affects the permeability. As a consequence, the permeability and transmissivity of the basalt aquifers has a wide variation within short horizontal distances. As there is a direct relationship between the number of flows penetrated and groundwater yield, there is generally a direct relationship between yields to individual wells and the depth of the wells. Yields are not predictable as the thickness of the individual flow units varies and the degree of weathering and fracturing between units varies. As a consequence, a wide variation in yield of wells of comparable depth may be expected within a given area. This is further compounded by the presence or absence of Latah interbeds between flow units. Deposition of the fine grain

silts and clays of the Latah Formation on the upper surface of a basalt flow reduces the permeability of the basalt as the fractures and other openings in the surface of the flow unit are filled with relatively impermeable material.

The Palouse Formation overlies the Coumbia River basalt. The Palouse is eolion, deposited by wind action, and consists of clays, silt and very fine sand with low permeabilities. Exposures are erratic and the formation is thin and due to its position in the geologic section it is of little consequence as regards groundwater potential.

The Palouse Formation is overlain by glacier related deposits. They consist primarily of bedded sand and gravel with local beds of silt and clay. They are relatively thin, less than 25 feet. Porosity and permeability are reported to be relatively high but due to their stratigraphic position there is very little recharge and yields and water levels are subject to extreme seasonal variation. There is alluvium in the Marshall Creek Valley. The thickness is highly variable, but wells with yields as high as 300 GPM have been drilled near Marshall and Hangman Creeks. A recently drilled well located 2 miles west of Hayford is reported to have a yield of about 1300 GPM. 4 miles easterly, at the airport, an existing well has a reported yield of only 450 GPM. Most other wells in the area yield only minor amounts ranging from 10 to 50 GPM.

The West Plains study area is underlain by the Columbia River basalt complex which is the principal aquifer and under the most favorable conditions may yield hundreds of gallons per minute to fully penetrating wells. Recharge to the basalt aquifer is restricted however, and results in erratic well performance. The consensus opinion of investigators is that due to limited recharge and restricted permeabilities, a wide variation in yield can be expected from wells drilled in the basalt aquifer. In view of the foregoing, it is concluded that the local groundwater supply is inadequate to meet the future needs of the West Plains projected development. However, it is assumed that the portion of the West Plains area classified for rural or semi-rural development would continue to be supplied from individual water supply wells for domestic use.

Spokane Aquifer - The City of Spokane and the east Valley area obtain their water supplies almost exclusively from the Spokane Aquifer. The water supply from the Spokane Aquifer could be delivered to the West Plains area through existing City owned facilities or directly from new wells located near the Spokane River. For the purposes of this study it was assumed that the City of Spokane would provide the water supply, either through the existing City system, from new wells constructed, owned and operated by the City, or through an agreement with Fairchild Air Force Base utilizing water from their well system through the SIA intertie.

The Spokane Aquifer has been studied in detail. Several of the published reports, studies and papers conclude that the water supply from the aquifer is more than adequate to meet the existing and foreseeable demands of the City of Spokane, including the West Plains area. The water plan developed herein assumes that sufficient water can be obtained from the Spokane Aquifer to serve the West Plains area and it is also assumed that there are no legal or other impediments which would prevent such extraction and delivery of water to the West Plains area.

D. EXISTING WATER SYSTEM

Existing water systems in the study area obtain their water supplies from either local wells or from the Spokane Aquifer. The existing water systems are segregated into several classes by the Washington State Department of Social and Health Services, depending upon the permanency of the population served and the number of service connections. There are a total of 81 water systems in the West Plains study area. Information relating to these systems is summarized in Table III-1 and shown on Figure III-1. The systems described in this table do not include the many individual water systems serving only a single residence. The 81 water systems are individually listed in Appendix B.

It should be noted that Fairchild Air Force Base (FAFB), which is located about 2 miles west of the study area boundary, obtains its water supply from wells located at Fort Wright. The well water is collected and is then pumped through a 20-inch diameter pipe for about 3/4 of a mile to the Rimrock Booster facility. From there the water is conveyed through a 16-inch diameter line which passes

TABLE III-1

EXISTING WATER SYSTEMS

IN WEST PLAINS AREA

System/Class (a)	Estimated Population Served	Source	Total Average Daily Water Use	
			GPD	GPCPD
Geiger Heights (Class 1) (d)	1,030	City of Spokane	165,000	160
11 Systems (Class 2)	800	Local Wells	122,000	153
Spokane International Airport (Class 3)	1,100	Local Wells	506,000 (e)	460
30 Systems (Class 3)	450	Local Wells	146,000	324
38 Systems (Class 4)	370	Local Wells	49,000	132
Totals	3,750		988,000	263 (c)
	2,650 (b)		482,000 (b)	181 (b)(c)

Source: Washington State Department of Social and Health Services, 1980.

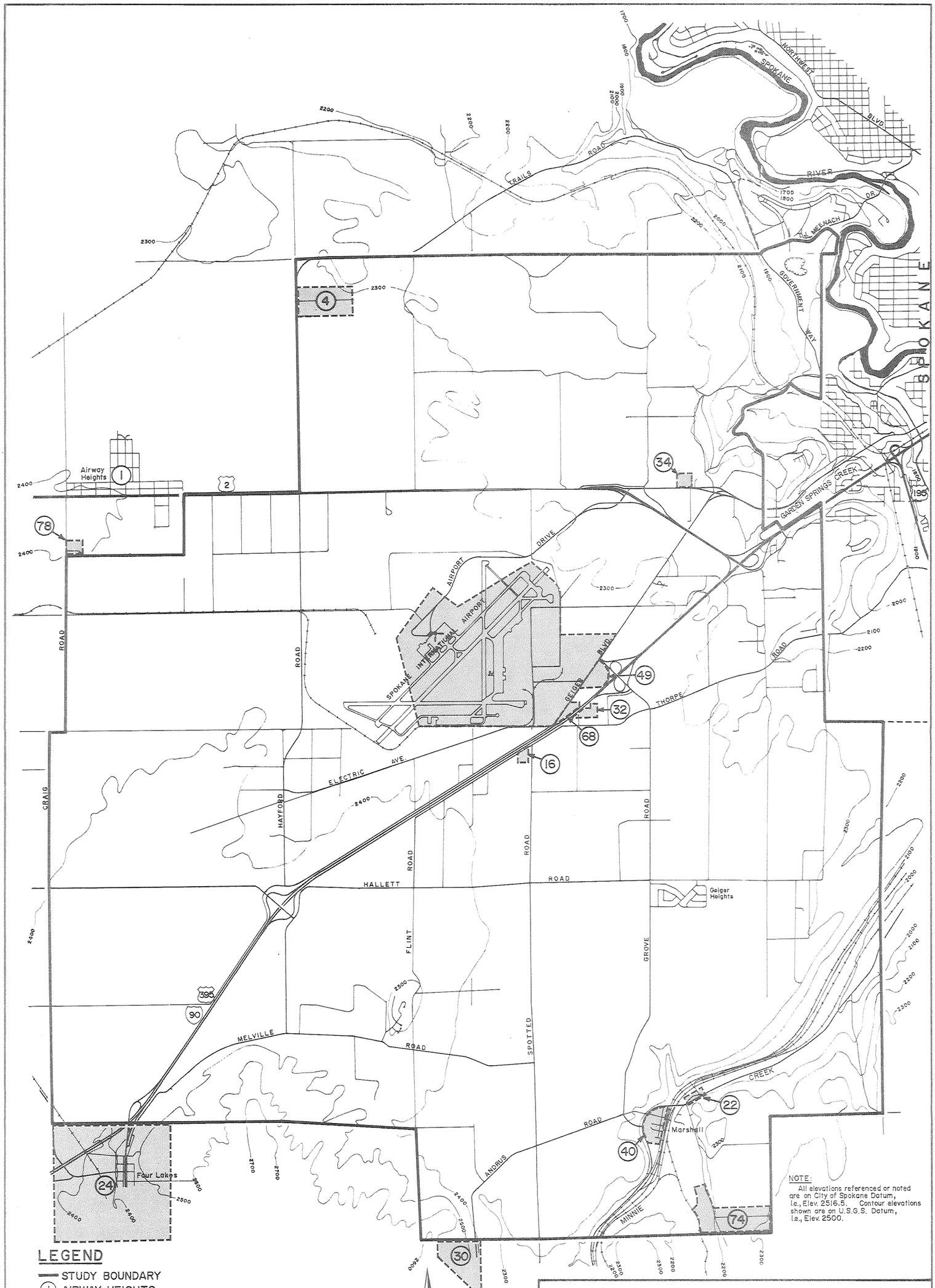
(a) Class 1: Community with 100 services or more
Class 2: Community with 99 services or less
Class 3: Non-community systems for at least 25 people
Class 4: Community with less than 10 services. Non-community for less than 25 people.

(b) Excluding Spokane International Airport

(c) Weighted Average

(d) Contract for Water Services - 1980, City of Spokane-Fairchild Air Force Base

(e) Pump Records, Ground Maintenance Office - Spokane International Airport



LEGEND

- STUDY BOUNDARY
- (1) AIRWAY HEIGHTS
- (4) BALMER GARDENS
- (16) EXPLORER TRAILER COURT
- (22) FAVRES VILLAGE
- (24) FOUR LAKES WATER DISTRICT
- (30) HIDDEN HILLS ESTATES
- (32) HIDEAWAY TRAILER COURT
- (34) HILLTOP MOTEL & TRAILER COURT
- (40) MARSHALL COMMUNITY WATER
- (49) SHADY PINES TRAILER COURT
- (68) STARLITE MOTEL & MOBILE HOME PARK
- (74) VALLEY OF THE HORSES
- (78) VIETZKE VILLAGE

SCALE 0 1000 2000 3000 4000 5000 FT.

SOURCE: City of Spokane Utilities Dept.
Spokane Co. Utilities Dept.
Wash. State D.S.H.S.

NOTE:
All elevations referenced or noted are on City of Spokane Datum, i.e., Elev. 2516.5. Contour elevations shown are on U.S.G.S. Datum, i.e., Elev. 2500.

WEST PLAINS AREA WATER AND SEWER PLAN FOR CITY OF SPOKANE

EXISTING WATER PURVEYORS

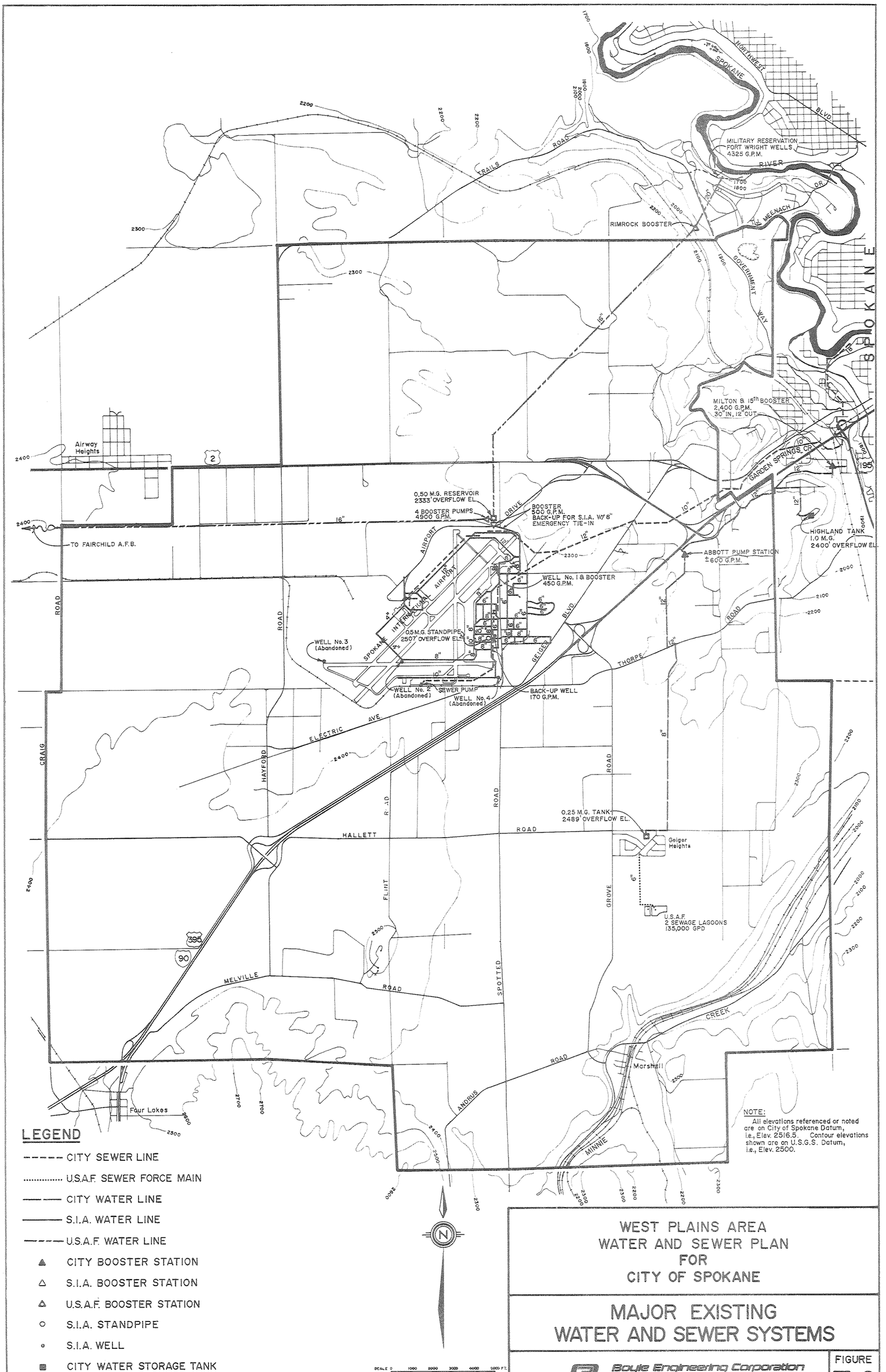
Boyle Engineering Corporation
consulting engineers / architects

FIGURE III-1

through the study area and on to serve the Air Force Base. At the point where the 16-inch line is nearest to the Spokane International Airport (SIA) area, a connection has been made between the Fairchild system and the SIA system. This connection is composed of a 500 GPM booster and an 8-inch pipeline and is used to deliver water to the SIA system during times of emergency and only then if sufficient capacity is available to meet the demands of the Fairchild system.

In prior reports various methods of combining the Fairchild Air Force Base system with the system to serve the West Plains area have been proposed. Nothing concrete, however, has developed in the many years of negotiations. It is estimated that 4 wells would be required having an estimated capacity of 1500 GPM (2.2 MGD) each in order to meet the Phase IV demand of the West Plains area and supplement the 17 MGD through the City's 30-inch pipeline to the Milton booster. Among the many water systems in the West Plains area, only four can have any measure of influence on the water system plan developed herein. One is the Fairchild Air Force Base well and transmission system, which was described above. The remaining three are (1) the City of Spokane system, (2) the Spokane International Airport system, and (3) the Geiger Heights system. Each of these water systems are described in sufficient detail in the following text to permit a determination of their influence on the water system plan for the West Plains area. These four water systems are shown on Figure III-2.

In 1973 the City of Spokane prepared a digital computer model of the major facilities of the City water system. Using this computer model the City was able to impose certain flow rates at the Milton Booster at 15th and Milton, which is the terminus of the existing 30-inch City transmission main, and to determine the influence on the City's existing water system under peak day demand condition. Flow rates of 5,000, 10,000 and 15,000 GPM were imposed at the Milton Booster and the following results were obtained:



WEST PLAINS AREA WATER AND SEWER PLAN FOR CITY OF SPOKANE

MAJOR EXISTING WATER AND SEWER SYSTEMS

Boyle Engineering Corporation
consulting engineers / architects

FIGURE III-2

Assumed Flow Rate at Milton Booster		Residual Water Pressure At Suction of Milton Booster
GPM	MGD	PSI
5,000	7	34
10,000	14	25
15,000	22	9

On the basis of the foregoing, it is estimated that the maximum flow rate that could be conveyed to the West Plains area from the existing City's system would be about 12,000 GPM(17 MGD). However, in order to utilize this full capacity for water service in the West Plains area, additional facilities would be required. These additional facilities are described later in this chapter.

Spokane International Airport System - The primary water supply for the Spokane International Airport (SIA) is obtained from one well on the airport property (see Figure III-2). This well is approximately 400 feet deep with a 10-inch diameter casing and its production is rated at 450 GPM. The pump is driven by a 75 horsepower motor. From this well the water is pumped into the system and to a standpipe storage facility having a capacity of 0.5 MG and an overflow elevation of 2,507 feet. It is reported that this well can be pumped continuously at 450 GPM without any significant drawdown. The water lines in this system are mostly cast iron and are reported to be in fair condition, however, some leaking joints have been reported by SIA ground maintenance personnel.

Within the SIA system, there is a second well which is infrequently pumped. This well is approximately 400 feet deep and is equipped with a pump having a capacity of 180 GPM. Pumping this well for more than two hours causes excessive drawdown to occur. SIA ground maintenance personnel report that this second well is only used during emergencies.

Geiger Heights System - The Geiger Heights military housing development originally obtained its water supply from a local well which pumped directly into the distribution system and elevated storage reservoir located on the military property. In the mid 1960's this well went dry. At that time, water service was made available to the Geiger Heights area from the water system of the City of Spokane. A water service contract between the City and Fairchild Air Force Base provides, among other things, that the City will make available 550 GPM for the Geiger Heights military housing complex.

Water to serve Geiger Heights from City wells is first pumped at the Milton Booster into the Highland pressure zone. From there the water is conveyed through a 12-inch pipe to the Abbott pump station where the water is again conveyed through approximately 1.1 miles of 12-inch pipe and then through approximately 1.6 miles of 8-inch pipe to the Geiger Heights area. Water arriving at the Geiger Heights area is then delivered directly to either the water distribution system and/or an elevated 250,000 gallon tank having an overflow elevation of 2,489 feet. The tank and the Geiger Heights distribution system are the property of the United States Government. The remainder of the conveyance system is owned and operated by the City of Spokane. The Milton Booster plant presently has a capacity of about 2400 GPM(3.5 MGD). The Abbott Pumping Station presently has a capacity of about 600 GPM(0.86 MGD).

Existing Water Quality - Water quality information from the Fort George Wright wells, Spokane International Airport wells and the City of Spokane system is summarized in Table III-2. The information shows water quality from these sources to be within the State's Standards for potable water for those characteristics analyzed.

E. EXISTING WATER DEMANDS

To provide a basis for projecting the water demands for the West Plains area, the existing water demands were estimated from available records. Categories of water use which were selected include:

TABLE III-2

WEST PLAINS EXISTING WATER QUALITY

Constituent	MCL (e)	Fairchild AFB			Spokane International Airport mg/l	City of Spokane N9924 Fotheringham mg/l
		Fort George Wright #5 mg/l	#6 mg/l	#7 mg/l		
Arsenic	0.05	<0.010	<0.010	<0.010	<0.01	<0.010
Barium	1.0	<1.0	<1.0	<1.0	<0.02	<0.25
Cadmium	0.01	<0.010	<0.010	<0.010	<0.002	<0.002
Chromium	0.05				<0.005	<0.010
Iron	0.3	<0.10	<0.10	<0.10	<0.02	<0.05
Lead	0.05	<0.050	<0.050	<0.050	<0.02	<0.010
Manganese	0.05	<0.050	<0.050	<0.050	<0.003	<0.010
Mercury	0.002	<0.002	<0.002	<0.002	<0.0003	<0.0005
Selenium	0.01	<0.010	<0.010	<0.010	<0.002	<0.005
Silver	0.05	<0.010	<0.010	<0.010	<0.003	<0.010
Sodium						
Hardness (a)		136	113	154	98	150
Turbidity (b)	1.0				0.3	0.1
Sp. Cond. (c)	700				235	290
Color (d)	15.0	<5.0	<5.0	<5.0	3.0	5.0
Fluoride	2.0	<0.1	<0.1	<0.1	0.4	0.4
Nitrate	10.0	0.7	0.6	1.6	2.1	1.2
Chloride	250					
Sulfate	250					

(a) mg/l as $Ca\ CO_3$

(b) NTU

(c) Micrombos/cm, 25° C.

(d) Color Units

(e) Maximum Contaminant Level allowed, Department of Social and Health Services, State of Washington, 1930

Source: Department of Social and Health Services, Spokane Regional office, Water and Wastewater Division.

1. Residential
2. Commercial
3. Industrial
4. SIA Terminal

Each of these water use demands are discussed as follows:

Residential Demands - Based on information obtained from the Utilities Department of the City of Spokane, the average daily per capita water use for years 1978 and 1979, was found to be 300 and 377 GPCPD, respectively. These are overall uses encompassing residential as well as industrial, commercial and other use categories. Thus the numbers are somewhat higher than typical averages.

The estimated total annual water use in 1979, of the 81 water systems is shown in Table III-1. Using the estimated population served by these systems with the exception of SIA, the average daily water use was calculated to be 181 GPCPD and ranges from 132 to 324 GPCPD. The SIA was excluded because the water use includes passengers, employees, terminal irrigation, etc. Therefore, the unit water use per permanent resident is not considered applicable. Unit water use of the terminal faciltities is determined later in this chapter on the basis of gallons per passenger per day.

Considering the water demands presented above, and for the purpose of projecting water demands for the West Plains area, the standard average daily water use of 200 GPCPD was selected.

Industrial/Commercial Water Use - To provide the basis for projecting future water needs of the West Plains area it was decided to combine the commercial and industrial water uses.

The water use records of several commercial and industrial developments in the Spokane area were obtained together with their approximate acreage. It was considered that the unit water use in gallons per day per acre would be applicable and convenient for projecting future water demands (see Table III-3).

TABLE III-3

COMMERCIAL AND INDUSTRIAL UNIT WATER USE

Industry	Acreage (a)	Calculated Average Daily Water Use Gallons/Acre/Day (b)
Industrial Park, 1979 Records	240	3,670 (c)
Meat Processor	2.4	7,890
Bakery	.7	77,480
Food Processor	1.7	60,010
Food Distributor	.6	6,090
Chemical Laboratory	1.4	61,810
Motel	3.9	9,340
Laundry	.3	14,520
Warehouses	12.1	1,340
Office Complex	1.5	6,200
Office Complex	.6	1,900
Office Complex	7.5	4,150
Existing Commercial and Industrial Development at SIA Complex (1979)	100	3,320 (d)

(a) City of Spokane Field Engineers Plats

(b) City of Spokane Water Use Records, 1979

(c) Spokane Industrial Park Water Use Records, 1979

(d) Spokane International Airport, Administration Water Use Records, 1975 to 1979 Average Use.

The type of industry that will eventually locate in the study area is not known. However, for the purpose of projecting future industrial and commercial water demands in the West Plains area, it is believed 4000 gallons per acre per day reflects a reasonable value when compared with unit water usage shown in Table III-3.

SIA Terminal Water Use - To provide the basis for projecting future water demands for the SIA terminal, a unit water use expressed in gallons per passenger per day was determined. The following categories of water use at the airport terminal were selected:

1. Terminal use by passengers and employees
2. Terminal use for irrigation
3. Food preparation facilities (Ogden Foods)

Table III-4 summarizes the water use for the listed categories for year 1975 through 1979.

Based on the foregoing, a value of ten (10) gallons per passenger per day was selected for use in projecting the future demands of the SIA terminal. The standard range of airport water use per passenger is presented as 3 to 5 gallons per day in some sources. The uses here include categories besides direct passenger use and thus the selected value is deemed reasonable.

F. PROJECTED WATER DEMANDS

As noted in the previous section the existing water demands for the West Plains area were divided into selected categories for use in projecting the future demands of the area. The selected categories are: residential, industrial/commercial, and SIA terminal. In order to plan the water system to meet the projected demands of the West Plains area it was necessary to estimate the peak demands of the area.

The ratio of peak day to average day demands for the City of Spokane is about 3:1. However, the projected demands in the West Plains area are primarily for industrial use and it is believed that the peak demands for the future West Plains development would be substantially less than what the City is now experiencing. Therefore, a peaking rato (peak day to average day) of 2:1 reflects a reasonable value for the water system planning in the West Plain area.

TABLE III-4

SPOKANE INTERNATIONAL AIRPORT

WATER USE

	Year				
	1975	1976	1977	1978	1979
Average Water Use of SIA Terminal(a) (gallons per day)	31,100	33,800	26,500	30,700	38,311
Average Number of Passengers Per Day(b)	2,700	3,000	3,400	3,700	4,300
Average Water Use (gallons per passenger per day)	11.5	11.3	7.8	8.3	8.9

(a) Includes water use by passengers, employees, terminal irrigation, and Ogden Foods.

(b) Passenger count records, SIA Administrative Office

The projections of population, industrial and commercial development and passenger traffic at SIA were also set forth in Chapter II. Using those projections and the unit water demands and the peaking factor developed in this chapter, the total projected average daily and peak day demands can be estimated. Table III-5 shows the resulting projected water demands for the West Plains area.

Criteria - As shown on Figure III-3, practically all of the land area classified for development in the West Plains area lies between elevation 2300 and 2400. For the purposes of the planning report it is assumed that the system to serve the West Plains area would require only one pressure zone. Although in final system design a refinement of this could be made and the small portion of the development (commercial and residential) in the eastern portion of the study area could be served from the existing Highland pressure zone (2200-2300). The overflow elevation of the Geiger Heights elevated tank is 2,489 feet and the overflow elevation of the elevated storage tank at the SIA is 2507 feet. Elevated storage to serve the pressure zone between elevation 2,300 and 2,400 feet would be designed to meet the higher elevation of about 2507 feet. Therefore, it is believed that both of the existing tanks could be easily integrated into the described system plan for the West Plains area allowing sufficient pressure throughout the system.

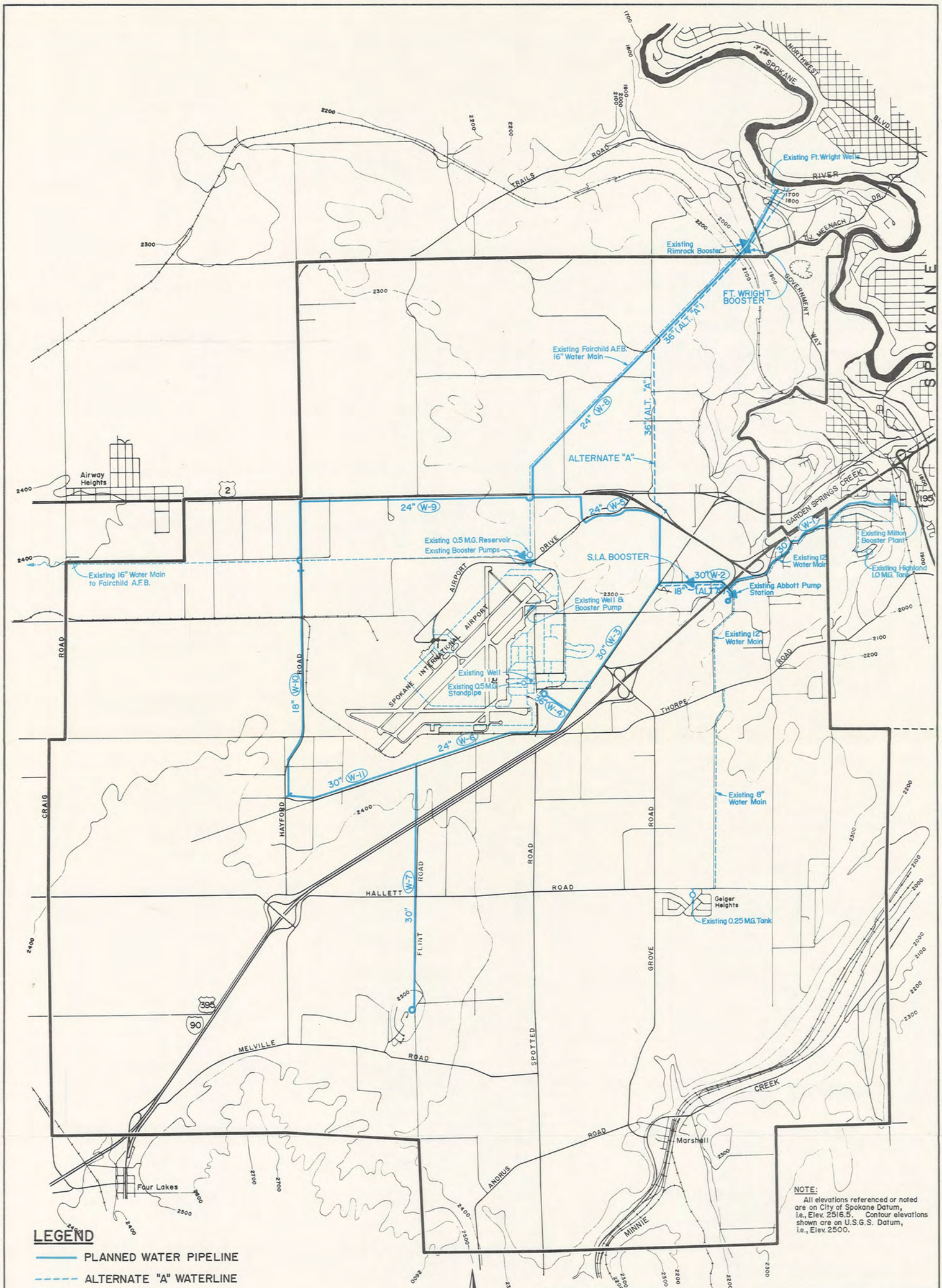
Transmission facilities (pipelines and booster stations) should be designed to convey the peak day demand, with the hourly fluctuations regulated by local storage. Average pipeline design velocities for transmission pipelines are usually kept within the range of about 3-5 feet per second with the higher velocities used for smaller pipes, say under 12-inches in diameter. The amount of storage to regulate the peak day varies, but a value of 25% of the peak day demand is usually considered adequate. In addition to regulating storage it is customary to provide storage for fire fighting purposes within

TABLE III-5

PROJECTED WATER DEMANDS
FOR THE WEST PLAINS AREA

Water Use Category	Phase				Saturation Demand
	I	II	III	IV	
Residential					
Population	3,200	3,600	4,000	4,500	27,000
Average Demand (MGD)(a)	0.64	0.72	0.80	0.90	5.4
Peak Day Demand (MGD)(b)	1.28	1.44	1.6	1.8	10.8
Industrial/Commercial					
Area (Acres)	700	1,400	2,100	2,800	10,900
Average Demand (MGD)(c)	2.8	5.6	8.4	11.2	43.7
Peak Day Demand (MGD)(b)	5.6	11.2	16.8	22.4	87.4
SIA Terminal					
Passengers Per Day	6,200	7,800	9,400	11,000	27,400
Average Demand (MGD)(d)	0.06	0.08	0.09	0.1	.27
Peak Day Demand (MGD)(b)	0.12	0.16	0.2	0.2	.54
Totals					
Average Demand (MGD)	3.50	6.40	9.29	12.2	49.37
Peak Day Demand (MGD)	7.00	12.84	18.60	24.4	98.74
Peak Day Rounded(e)	7.0	12.8	18.6	24.4	98.7

(a) Based on 200 gpcpd
(b) Peaking factor = 2
(c) Based on 4000 gal/ac/day
(d) Based on 10 gal/passenger/day
(e) Rounded to nearest 0.1 MGD



NOTE:
All elevations referenced or noted are on City of Spokane Datum, i.e., Elev. 2516.5. Contour elevations shown are on U.S.G.S. Datum, i.e., Elev. 2500.

LEGEND

- PLANNED WATER PIPELINE
- ALTERNATE "A" WATERLINE
- EXISTING WATERLINE
- (W-6) PLANNED PIPELINE IDENTIFICATION NUMBER
- ▲ PUMP STATIONS
- ○ WATER STORAGE TANK

PHASES	TRANSMISSION PIPELINE DESIGNATION
PHASE I	(W-1) (W-2) (W-3) (W-4) (W-5)
PHASE II	(W-6), (W-7)
PHASE III	(W-8), (W-9)
PHASE IV	(W-10), (W-11)

SCALE 0 1000 2000 3000 4000 5000 FT.

WEST PLAINS AREA WATER AND SEWER PLAN FOR CITY OF SPOKANE

WATER SYSTEM PLAN

Boyle Engineering Corporation
consulting engineers / architects

FIGURE III-3

each zone or service area. Storage for fire fighting purposes within each zone or service area is calculated for a flow rate over a certain duration. Various types of developments require various amounts of storage. The following tabulation gives a typical example of the possible range of required storage.

Type of Development	Fire Fighting Flow Rate GPM/MGD	Duration of Fire hrs.	Required Storage MG
Single Family Residential	1000/1.44	1	0.06
High Density Residential	2000/2.88	2	0.24
Commercial Areas	3000/4.32	3	0.54
High Density Commercial or Industrial	4000/5.76	4	0.96

These rates are within the range between the requirements of the Spokane County Fire Code and the requirements suggested by the National Board of Fire Underwriters and are deemed appropriate for the type of development expected in the West Plains area.

In addition to the foregoing, it is customary to provide storage for emergency use. This depends on the reliability of the source system, frequency and duration of power failures, etc. For this report it is assumed that 25% of the peak day demand would be provided for emergency use.

From the above, the Phase IV storage criteria for the water plan for the West Plains area is proposed as follows:

Water Use Category	Phase IV Peak Day (MGD)	Storage Criteria (MG)			Total Storage
		Regulatory	Fire	Emergency	
Residential	1.8	.45	.24	.45	1.14
Industrial/SIA	22.6	5.65	1.0	5.65	12.3
Total	24.4	6.10	1.24	6.10	13.44

It was assumed for cost estimating purposes, that required storage in the West Plains area would be provided in the form of standpipes approximately 120 feet high. In final design, consideration should be given to the possibility of elevated tanks or locating the storage at more remote higher ground elevations away from air traffic approach zones. Combined phasing and/or economics should also be considered by constructing larger storage tanks.

The water system plan for the West Plains area would include the enlargement of certain existing booster stations and the construction of new stations. The calculated horsepower values were based on peak day flow, total dynamic head (static plus friction) and an average pumping efficiency of about 60%. Using the foregoing criteria the water system plan was developed.

G. GENERAL DESCRIPTION OF WATER SYSTEM PLAN

The water system plan and Alternate A are presented herein and shown on Figure III-3. The proposed water system plan would have two sources of supply; the City system (Milton booster) and wells located at Fort Wright. Similarly two transmission mains would be required, a 30-inch main extending from the City system (Milton booster) and a 24-inch main extending from the Fort Wright area. The system of transmission mains, booster stations and reservoirs are designed to serve the Phase IV development. This system shall serve as the backbone system to serve the entire study area. The system can be enlarged and/or expanded to serve demands when and where needed.

As noted previously, the City representatives estimated that about 17 MGD can be obtained from the City system. However, at the present time the pumps at the Milton booster are capable of producing only about 3.5 MGD. Therefore, at least 13.5 MGD of additional capacity would be required to bring the booster station up to the full transmission capability of the 30-inch main. In order to convey the available capacity to the West Plains area it would be necessary to extend the transmission main into the area and provide sufficient booster capacity to deliver water to elevation 2507 feet for service to the 2300-2400 pressure zone.

The present Abbott booster has a capacity of 600 GPM (0.86 MGD) and a connected load of 45 horsepower. It would be necessary to add about 0.9 MGD of capacity to this booster for Geiger Heights and the surrounding residential development, which would require an additional 35 horsepower.

From the Milton Avenue booster, a new transmission line would be extended to the Abbott booster and would be sized to carry the City's estimated maximum flow of about 17 MGD. Any additional transmission capability provided by the existing 12-inch line, would be considered in the final design. However, for this report the full 30-inch transmission main is provided between the Milton booster and the Abbott booster.

A portion of the flow will continue through the Abbott booster and serve the area classified for residential development. The remaining portion will be diverted westerly to serve the SIA and its surrounding industrial areas.

The Phase IV average daily demand for the residential area is 0.9 MGD (see Table III-5). Assuming a peaking factor of 2.0, the Phase IV peak day demand for the entire residential development would be about 1.8 MGD. The existing 12-inch diameter pipe between the Abbott booster station and Thorpe Road could convey this quantity of flow. Furthermore, the portion of the residential area within the study area, between elevation 2200 and 2300 feet would probably be served from the City's Highland pressure zone, which includes the reach of transmission main between the Milton booster and the Abbott booster.

As shown on Figure III-1, the existing line extending from Thorpe Road to Geiger Heights has a diameter of 8-inches and it is estimated that its capacity will be fully used to meet the contractual commitment to Geiger Heights. Therefore, to the extent that residential demands are developed south of Thorpe Road, it is recommended that a 12-inch main or mains be extended from the existing 12-inch main at Thorpe Road. The location of the 12-inch mains cannot be determined at this time, therefore, they are not shown. However, the cost estimates presented later in the Chapter assume that about 10,000 feet of 12-inch diameter pipe would

be required in Phase IV (about 2500 feet each phase). Also, means should be provided in the final design of these 12-inch mains to loop the lines back to the 30-inch main if possible.

Based on the projected development by Phase IV, the other branch of the transmission main to serve the SIA area would be sized to carry the remaining estimated flow from the existing City system after deducting the residential demands in the Geiger Heights and surrounding residential area. This remaining flow rate would be about 15 MGD. This flow rate would require an extension of the 30-inch main acorss the freeway leading to another booster station to lift the water to elevation 2507 for the next higher zone (2300 - 2400). For purposes of identification, this pumping plant will be referred to as the "SIA booster". Although a portion of the flow would be required to serve the industrial/commercial lands in the lower (2200 - 2300 feet) zone it is recommended that the Phase IV capacity of the booster station should not be less than about 15 MGD. The transmission mains which would be constructed within the SIA complex area would be sized to carry the water from the City system, and also to carry the estimated flow required from new wells, booster, and transmission facilities which would be constructed by the City.

When the Phase III projected water demands of 18.6 MGD are placed on the system, a supply deficit of 1.6 MGD will occur. The Milton booster main has a capacity of only 17 MGD and thus the need for an alternate source is required by this phase. A groundwater source and a well field in the proximity of the Fairchild Air Force Base Fort Wright wells reflects the most viable supplementary source. This location will provide a proven reliable well site and as well as excellent distribution of the transmission mains. This distribution provides protection against unforeseen complications arising in one of the source transmission mains.

Phase IV projected water demands dictate construction of four wells with each producing 2.2 MGD. A booster station with a capacity of 7.4 MGD will be on line with regulatory suction storage of 0.2 MG. A 24-inch transmission main will provide connection to the West Plains system.

Figure III-3 shows the transmission main system which would be required in Phase IV. Assuming that the demands for water service would progress from east to west over time, it was estimated that certain portions of the system would be required in each of four phased intervals. A summary of the facilities required together with the estimated construction costs are presented later in this Chapter.

Phasing of Water System Plan - It was assumed that the initial demands for water would be for service to the SIA terminal and to the industrial and commercial areas east of the terminal. Also, the residential lands near the Abbott pump station were assumed to require water service from the first phase of the system. The subsequent industrial and commercial development was then assumed to proceed east to west and the residential development was assumed to proceed north to south.

Construction of transmission main extensions, booster stations and wells could be phased as the demands for water increase. Furthermore, it was assumed that the estimated capacity available in the City's existing 30-inch pipeline would be fully utilized before the Fort Wright wells and transmission main would be constructed.

The water system plan for the projected Phase IV development is shown on Figure III-3, which shows the transmission mains and location of required booster stations. Segments of the required transmission mains are designated with a letter "W" and a number; the sequence of numbers indicating generally the sequence of construction. The assumed phasing of the transmission facilities is presented as follows:

Initial Phase	Transmission Pipeline Designation
Phase I	W-1, W-2, W-3, W-4, W-5
Phase II	W-6, W-7
Phase III	W-8, W-9
Phase IV	W-10, W-11

The additional facilities (booster pumps, stations and storage) which would be required for the four phases are described below:

Phase I - Increase Milton Avenue booster from its present capacity of 3.5 MGD to 7.0 MGD (375 hoursepower increase) and increase the Abbott pumping station from 0.9 MGD to 1.8 MGD (increase of 35 horsepower). Construct a new booster station (SIA booster station) having a capacity of about 5.7 MGD which would require 350 horsepower. Provide a new 1.0 MG storage tank adjacent to the Abbott booster pump station and provide an additional 3.0 MG storage in the general SIA area (Geiger Field).

Phase II - Increase Milton Avenue booster from 7.0 MGD to 12.8 MGD (additional 700 horsepower bringing total horsepower to 1300). Increase the SIA booster from 5.7 MGD to 11.4 MGD (additional 350 horsepower bringing total horsepower to 700). Add 0.5 MG of storage at the Abbott booster area and add 3.0 MG storage in the general area (Flint Road).

Phase III - Construct and equip the first well in the Fort Wright area to produce about 2.2 MGD (would require 250 horsepower total). Construct the new Fort Wright booster together with 0.2 MG of suction storage for regulation between the wells and the Fort Wright booster. This would require about 300 horsepower. Increase Milton Avenue booster from 12.8 MGD to 17.0 MGD (additional 700 horsepower bringing total to 2000 horsepower). Increase SIA booster from 11.4 MGD to 15.0 MGD (additional 200 horsepower bringing total to 900 horsepower). Construct an additional 3.0 MG storage in the general SIA area (Flint Road) bringing the total to 9.0 MG.

Phase IV - Construct and equip 3 additional wells in the Fort Wright area to produce 6.6 MGD, bringing the total well production capability to 8.8 MGD (250 horsepower each well for a total of 750 horsepower required). Increase the Fort Wright booster by 5.8 MGD bringing the capacity to a total of 7.4 MGD. (Additional 1000 horsepower bringing total to 1300 horsepower). Construct an additional 3.0 MG storage in the general SIA area (Flint Road) bringing the total to 12.0 MG.

Alternate A to the Water System Plan - The development of a well field in the area of the existing Fort Wright wells to supply the study area was investigated. To supply the area for the Phase IV development would require at least twelve 1500 GPM wells. If higher production wells are feasible they should be considered as an alternate. Based upon the data for the existing Fort Wright wells, the proposed wells would be approximately 200 feet deep. As shown in Figure III-3 the well pumps would pump to the proposed Fort Wright booster in a 36-inch diameter transmission main. The Fort Wright booster would lift the water through the 36-inch transmission main to the reservoirs and distribution system . The cost for this Alternate A is estimated to be $1,700,000 greater than the costs estimated in Section H for the recommended water system plan.

These facilities can also be considered as the water system increment to expand the water service to meet the area needs beyond the scope of the Phase IV facilities. At the time this increment is installed it can be sized to meet current planning guidelines for the West Plains area.

H. ESTIMATED CONSTRUCTION COSTS

Estimated Construction Costs - Based on the construction of the system features described herein, the estimated construction costs can be determined. It should be noted that the costs presented herein do not include any allowances for localized distribution systems. Costs are only for the major water transmission, pumping and storage facilities required to serve the area for the various phases of construction. The distribution systems required would be made up of water lines in sizes from 6-inches to 12-inches in diameter. It is estimated that the distribution systems would range from 20,000 to 100,000 linear feet per square mile.

The construction costs presented are at 1980 price levels with no allowance for inflation or right-of-ways. Unit prices for pumping facilities include allowances for site grading, pumps, motors, starters, valves, meters, manifolding and miscellaneous appurtenances. Unit prices for pipe include pipe, excavation and backfill and allowances for fittings, valves and other appurtenances. Unit prices for steel tank storage facilities include allowances for site grading, foundation, erection, connections, controls, lighting, fencing and appurtenances. Unit prices for wells include allowances for drilling, developing, testing, pump, motor, starter, controls, valves, meters, manifolding and other miscellaneous appurtenances.

Total estimated costs including contingencies, engineering, legal and Washington State taxes are presented in Chapter VI.

Phase I - The estimated construction costs of the Phase I facilities are presented as follows:

Milton Booster Improvements
(7 MGD required)
(3.5 MGD existing)
Requires an increase in capacity of 3.5 MGD
which would require an additional 375 HP
@ $750/HP $281,250

Abbott Booster Improvements	
(1.8 MGD required)	
(0.9 MGD existing)	
Requires increase in capacity of 0.9 MGD	
which would require an additional 35 HP	
@ $750/HP bringing total to 80 HP	$ 26,250
Construction of SIA Booster	
(5.7 MGD required)	
Requires 350 HP @ $750/HP	$ 262,500
Transmission Mains	
Construct W-1, 2, 3, 4, and 5 as shown	
on Plate III-3.	
Requires:	
1,350 lf 36" main @ $90/lf	$ 121,500
18,500 lf 30" main @ $80/lf	$1,480,000
9,700 lf 18" main @ $45/lf	$ 436,500
2,500 lf 12" main @ $30/lf	$ 75,000
Storage	
Abbott Booster area	
Construct 1.0 MG storage	
@ $.25/gal.	$ 250,000
SIA General Area (Geiger Field)	
Construct 3.0 MG storage	
@ $.20/gal.	$ 600,000
Total Estimated Construction Cost	
for Phase I Facilities	$3,533,000

Phase II - The estimated construction costs of the Phase II facilities are presented as follows:

Milton Booster Improvements	
(7.0 MGD existing from Phase I)	
(12.8 MGD required)	
Requires increase in capacity of 5.8 MGD	
which would require an additional 700 HP	
@ $750/HP bringing total to 1300 HP	$ 525,000
SIA Booster Improvements	
(5.7 MGD existing from Phase I)	
(11.4 MGD required)	
Requires increase in capacity of 5.7 MGD	
which would require an additional 350 HP	
@ $750/HP bringing total to 700 HP	$ 262,500
Transmission Mains	
Construction W-6 and W-7 as shown on Plate III-3	
Requires:	
11,000 lf 30" main @ $80/lf	$ 880,000
7,700 lf 24" main @ $60/lf	$ 462,000
2,500 lf 12" main @ $30/lf	$ 75,000
Storage	
Abbott Booster area	
(1.0 mg existing from Phase I)	
(1.5 MG required)	
Requires an additional 0.5 MG	
@ $.30/gal.	$ 150,000

SIA General Area (Flint Road)
(3.0 MG existing from Phase I)
(6.0 MG required)
Requires an additional 3.0 MG
@ $.20/gal. $ 600,000

Total Estimated Cost
for Phase II Facilities $2,954,500

Phase III - The estimated construction costs of Phase III facilities are presented as follows:

Font Wright Wells
(1.6 MGD required)
Requires one well (2.2 MGD)
@ $75,000 $ 75,000

Construction of Fort Wright Booster
(1.6 MGD required)
Requires 300 HP @ $750/HP $ 225,000

Milton Booster Improvements
(12.8 MGD existing from Phase II)
(17.0 MGD required)
Requires increase in capacity of 4.2 MGD
which would require additional 700 HP
@ $750 HP bringing total to 2000 HP $ 525,000

SIA Booster Improvements
(11.4 MGD existing from Phase II)
(15.0 MGD required)
Requires increase in capacity of 3.6 MGD
which would require an additional 200 HP
@ $750/HP bringing the total to 900 HP $ 150,000

Fort Wright Storage

Requires 0.2 MG storage for regulation	
@ $.30/gal.	$ 60,000

Transmission Mains

Construct W-8 and W-9 as shown on Plate III-3	
Requires:	
29,800 lf 24" main @ $60/lf	$1,788,000
2,500 lf 12" main @ $30/lf	$ 75,000

Storage

SIA General Area (Flint Road)	
(6.0 MG existing from Phase II)	
(9.0 MG required)	
Requires an additional 3.0 MG	
@ $.20/gal.	$ 600,000

Total Estimated Construction Cost for Phase III Facilities	$3,498,000

Phase IV - The estimated construction costs of the Phase IV facilities are presented as follows:

Fort Wright Wells

(2.2 MGD existing from Phase III)	
(7.4 MGD required)	
Requires an additional 5.2 MGD capacity.	
Construct 3 additional wells @ 2.2 MGD	
(6.6 MGD total) @ $75,000 ea.	$ 225,000

Fort Wright Booster Improvements

(1.6 MGD existing from Phase III)
(7.4 MGD required)
Requires increase in capacity of 5.8 MGD
which would require an additional 1000 HP
@ $750/ HP bringing total to 1300 HP $ 750,000

Transmission Mains

Construct W-10 and W-11 as shown on Plate III-3
Requires:
17,000 lf 30" main @ $80/lf $1,360,000
2,500 lf 12: main @ $30/lf $ 75,000

Storage

SIA General Area (Flint Road)
(9.0 MG existing from Phase III)
(12.0 MG required)
Requires an additional 3.0 MG
@ $.20/gal. $ 600,000

Total Estimated Construction Costs
for Phase IV Facilities $3,010,000

A summary of the estimated construction costs for the water system are presented in the following tabulation in 1980 dollars:

Phase I	$ 3,533,000
Phase II	$ 2,954,500
Phase III	$ 3,498,000
Phase IV	$ 3,010,000
Total Estimated Construction Cost for Water Systems	$12,995,500

CHAPTER IV

CHAPTER IV

WASTEWATER SYSTEMS

A. GENERAL

The West Plains area presently has only limited wastewater systems and development of the area will require new facilities. Planning these facilities require consideration of the following:

1. Types of wastewater systems
2. Suitability to West Plains area
3. Future sewage flows

This section describes the influence of these factors in developing a plan for wastewater disposal in the West Plains area. A phased plan is described together with a cost estimate for construction. This phasing can be used as a general guide for construction, but the actual construction should occur when and where the demand for these services warrant such action. This study has assumed that the City of Spokane has or will provide the appropriate capacity in its existing sewer system (southwesterly portion of the City and southerly of the Spokane River) to transport the collected wastewater from the study area to the City's existing advanced wastewater treatment plant. If, however, future studies indicate it to be feasible to transport the wastewater northeasterly from the study area and across the Spokane River directly to the treatment plant, this alternate should be considered and/or instituted.

B. EXISTING WASTEWATER SYSTEMS

Presently there are only three existing sewage collection and disposal systems within the West Plains study area.

1. A City of Spokane sewer serving the Spokane International Airport and nearby development.
2. Geiger Heights collection and lagoon system.
3. A private trailer park collection and lagoon system.

The remainder of the population, approximately 80%, utilize septic tanks for sewage treatment.

Spokane International Airport Sewer System - The Spokane International Airport (SIA) and nearby development is connected to the city sewer system by a sewer known as the Geiger sewer. This sewer is constructed of 10-inch and 12-inch diameter clay pipe and flows by gravity to the City of Spokane system (West Grove trunk). The sewer serves the airport terminal, Ramada Inn, Geiger Field Housing, Washington Air National Guard, Washington State Patrol and assorted aviation structures. The sewer was constructed in 1941 and is reported to have severe infiltration and root penetration problems.

Treatment of the sewage is by the City of Spokane Treatment Plant. This is an advanced wastewater treatment plant that started operating in October of 1977. This plant, located approximately 3 miles northeast of the study area, is designed to treat 40-44 million gallons per day of wastewater with a conventional activated sludge system plus phosphorous removal facilities. In addition, it has the capacity to provide primary treatment and chlorination for an additional 89 million gallons per day of stormwater.

Geiger Heights System - The United States Air Force owns and operates the sewage system which serves the Geiger Heights housing project. This system includes a sewer collection system and a two-cell evaporation lagoon. The system was designed to serve the 325 USAF housing units within the project.

Trailer Park System - This is a privately owned and operated sewage collection system and sewage lagoon.

Existing Wastewater Flows - The City of Spokane does not meter sewage flows from most users. Billings are fixed amounts or a function of water use. Sewage flows were measured for selected users in 1974 to compile data for user charges. Comparison of measured flows to metered water usage indicate that 70% to 80% of the water used reached the sewers. Records from the City of Spokane indicate average daily water demands of from 41 MGD to 45 MGD based on pumping rates less the losses within the system. The treatment plant processes from 31 MGD to 34 MGD. This is a ratio of approximately 70% sewage flows to water usage.

C. POTENTIAL WASTEWATER TREATMENT SYSTEMS

Wastewater treatment systems may be divided into two general classes; on-site systems and off-site systems. On-site systems include septic tanks with drainfields and small package systems with local effluent disposal. Off-site systems would include some type of collection system to transport the sewage to a central point from treatment and disposal. Some of the major considerations influencing selection of a system are:

1. Local and State Laws (water quality and public health requirements)

2. Suitability of the Area (environmental considerations)

3. Costs (capital, operation and maintenance)

4. Planning and zoning (wastewater flows and quality)

Septic Tanks and Drainfields - Septic tanks are the most common means of wastewater treatment in communities without collection systems. A septic tank is usually an underground concrete box sized for a detention time of approximately two days. The functions of a septic tank include sedimentation, storage of sludge and anaerobic digestion of organic material.

Effluent from the septic tank is conveyed to drainfield where the remaining organic material is aerobically decomposed. For proper operation of the drainfield, leaching of the effluent into the surrounding soil is essential. High groundwater or low permeability of the soil result in hydraulic and organic overloading and subsequent failure of the system. Effluent disposal is critical to the operation of the system.

Small On-Site Package Plants - Small package plant systems are available to treat wastes from apartments, trailer parks, hospitals, golf courses, and the like. These systems can be prefabricated or built in place. The quality of effluent produced from these package plants can be very good provided they are designed and operated properly. These systems can utilize several types of processes, such as oxidation, extended aeration, activated sludge and others.

Effluent disposal is usually by infiltration-percolation or irrigation. Drainage and absorption ponds are examples of infiltration-percolation disposal. Spray fields and flooding are examples of irrigation disposal. These rely on evapo-transporation for utilization and disposal of the effluent.

Off-Site Treatment Systems - This type of system is used in most developed areas where on-site treatment is not practical or economical. This would include areas where the ground is not suitable, or where densities are too high to support septic tanks.

Off-site systems include a network of sewers to collect the sewage from various sources and transport it to a central point for treatment. The treatment facility may be existing, expanded, or built to serve the area being served. The use of existing facilities is predicated on availability of organic and hydraulic treatment capacity and distance between collection area and treatment facility. If capacity is available, but costs of transporting sewage are too high, new local treatment facilities may be economically justified. This method is different from on-site package plants. in that the service area is usually much larger and the treatment facility is not located on the property being served. Effluent disposal can be similar to on-site treatment or discharged to a natural watercourse if water quality criteria are met.

D. SUITABILITY OF WASTEWATER SYSTEMS TO WEST PLAINS

All three types of wastewater systems are being utilized in the West Plains study area. Septic tanks are the most common type. However, new construction involving septic tanks will be limited since soil permeability is poor and soil cover is minimal in most areas. Regulations regarding minimum lot size in areas without sanitary sewers limit development to a low density environment.

Construction of package treatment plants to serve various locations within the study area could be practicable under certain conditions. The use of these systems would be limited to certain localities and types of development.

State of Washington regulations limit the use of these systems to types of development that may be held accountable. Residential systems would require a public agency to own and operate the facility. Private industrial facilities could be built providing suitable effluent disposal methods could be utilized.

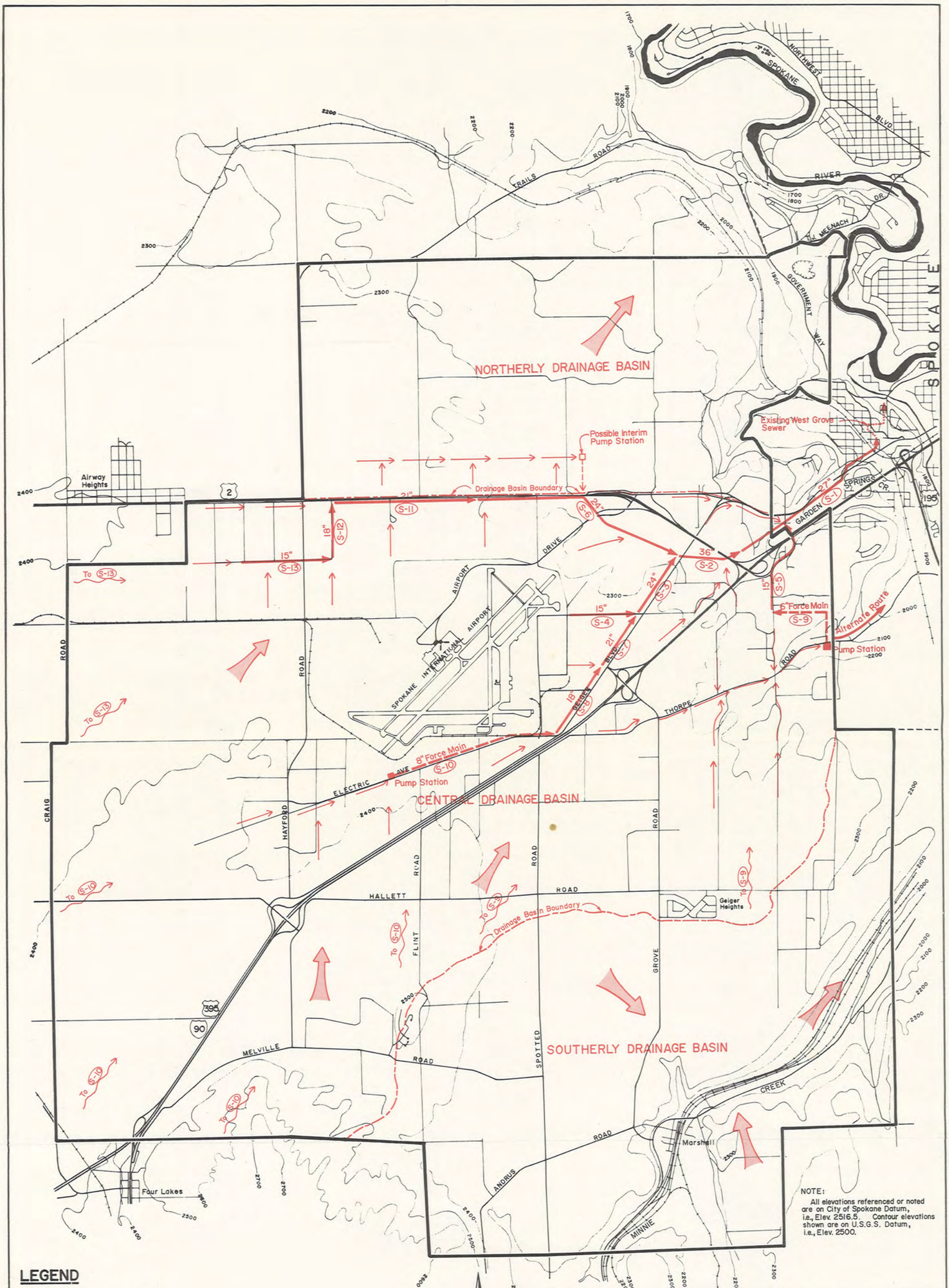
Due to the poor soil conditions for percolation, effluent disposal would probably be by irrigation and/or evaporation. Freezing weather, however, might require some type of winter storage or alternate disposal methods. It is anticipated that use of these package plant systems would be limited to areas outside the major development. The necessity of adequate land for effluent disposal would limit use to areas of lower land values. If the disposal area could be utilized as part of the development, such as golf courses and greenbelts the practicality increases.

Sewer Systems - Sewage collection systems are the most common disposal in developed areas. The high cost of land makes sewers economically attractive for development. Densities can be increased and maintenance minimized.

Most sewer systems are designed to collect and transport sewage by gravity. Therefore, topography influences the practicability of sewers. The West Plains area can be divided into three basic drainage basins (See Figure IV-1).

The southerly basin comprises about 7,310 acres of land that naturally slopes and drains toward Minnie Creek (USGS designation). The central basin has about 17,490 acres of land that drains toward Garden Springs Creek. The northerly basin comprises about 5,570 acres of land that drains north easterly towards the Spokane River.

The boundary line between the center basin and the northerly basin was located along U.S. Highway No. 2 for the following reasons:



LEGEND

- 21" — GRAVITY SEWER
- PUMP STATION AND FORCE MAIN
- (S-5) — SEWER LINE IDENTIFICATION NUMBER
- GENERAL FLOW DIRECTION
- COLLECTION SYSTEM FLOW DIRECTION

PHASES	TRANSMISSION PIPELINE DESIGNATION
PHASE I	(S-1), (S-2), (S-3), (S-4), (S-5)
PHASE II	(S-6), (S-7), (S-8), (S-9)
PHASE III	(S-10), (S-11)
PHASE IV	(S-12), (S-13)

NOTE:
All elevations referenced or noted are on City of Spokane Datum, i.e., Elev. 2516.5. Contour elevations shown are on U.S.G.S. Datum, i.e., Elev. 2500.

WEST PLAINS AREA WATER AND SEWER PLAN FOR CITY OF SPOKANE

DRAINAGE BASINS AND SEWER PLAN

Boyle Engineering Corporation
consulting engineers / architects

FIGURE IV-1

1. This was the maximum northerly boundary of land than can be served by gravity to a new Geiger trunk.

2. Location of a new trunk in the same alignment as the existing sewer would save land acquisition costs and capacity exists in the West Grove trunk for the West Plains service area.

Treatment Plant Facilities - The sewage collected from the West Plains area could be treated locally by the construction of a treatment facility or treated at the existing city facility by construction of a connecting sewer. Costs of developing the collection system within the study area would be approximately the same for either method. Therefore, the costs of building and maintaining a new facility must be compared to the cost of a trunk sewer.

Based on a typical cost of $1.50/gallon, a treatment facility to process 8.9 MGD would cost approximately $13,300,000. This is construction cost only; maintenance and operating costs of a new facility would also have to be added. Part of the costs of maintenance and operation could possibly be offset by using the effluent for irrigating parks, greenbelts, golf courses, and cemetaries. This method of disposal could be utilized about 8 months of the year. The remaining 4 months the effluent may have to be stored for later disposal.

A sewer 36-inches in diameter would be required to handle 8.9 MGD. This assumes a peaking factor of 3.0. Using an average installed cost of $80 per linear foot of 36-inch sewer, 31 miles of pipe could be laid for the cost of a treatment plant. Since the West Plains area is only 3 miles from the City sewer system, the costs of a new 36-inch trunk are approximately one tenth the costs of a treatment facility.

The construction of a trunk sewer also offers potential for expansion at a lower cost than a treatment facility. As a comparison, the trunk sewer capacity can be doubled for only a 25 percent increase in the construction cost.

E. ESTIMATED SEWAGE FLOWS

Sewage flows can be estimated on a per capita basis or on a per acre basis. The method used is a function of land use involved. Residential flows and the airport terminal will be estimated on a per capita and per passenger basis respectively. Flows from the commercial and industrial areas will be estimated on a per acre basis.

Average daily residential flows vary from 60-120 gallons per capita per day (GPCPD) in various parts of the country. The City of Spokane estimates the existing sewage flows at approximately 100 gallons per capita per day. For this study a value of 100 GPCPD will be used. The allowance for industrial and commercial development vary from 2,000 to 50,000 gallons per acre per day (GPAPD), depending on type of development. This range covers all types of industry from light manufacturing to heavy industrial operations. Based on the types of development anticipated and existing averages within the Spokane area, a rate of 3,000 GPAPD will be used in this study. The rate for the airport terminal and associated facilities was set as a function of the water demand. It is estimated that approximately 75% of the water used reaches the city sewer system. A rate of 7 gallons per passenger per day will be used in this study, which is somewhat higher than the national average of between 2.5 and 5. Again, this increase is accounted for by the non-direct passenger uses projected in the estimates.

The total average daily sewage flows for the West Plains are shown in Table IV-1. This table is for the same twenty year time period as for all of the study, in order to facilitate comparisons. However, if sewers are to be considered for this area, projections should be extended to approximately fifty years. This would correspond to the average design life of a sewer system.

F. SEWER SYSTEMS IN WEST PLAINS AREA

The practicality of constructing sewers in any particular area is based on the type of land use anticipated and the rate of development. As previously discussed, it is anticipated that the majority of development will occur in the central drainage basin. Since the northerly and southerly basins have no existing sewers and little development is projected, construction of a collection system is not anticipated. The existing density of these two basins is approximately one person per 10 acres. Based on this density, a sewerage collection system would not be economically justified unless the population were concentrated in one area. This would be a major change in lifestyle and is not considered probable.

Development may occur in the industrial land adjacent to the north side of U.S. Highway No. 2 which would require a sewer system. This system would flow northerly toward the City's existing treatment facility. Connection to the City system would require crossing the Spokane River by bridge or by inverted siphon. On an interim basis a pump station could be built to serve this area. The pump station would pump sewage into the central basin for disposal until a trunk sewer is justified.

Total development of the southerly zone would require some type of sewer connection to the City system. An interceptor could be built from Marshall to the City system along the Cheney-Spokane Road. The cost of this sewer would be prohibitive based on the projected residential population for Phase IV in this area. This could change if development exceeds projections or if nearby areas develop.

TABLE IV-1

PROJECTED SEWAGE FLOWS
FOR THE WEST PLAINS AREA

Sewage Flow Category	Phase				Saturation Demands
	I	II	III	IV	
Residential					
Population	3,200	3,600	4,000	4,500	27,000
Average Flow (MGD)(a)	0.32	0.36	.40	0.45	2.70
Industrial/Commercial					
Area (Acres)	700	1,400	2,100	2,800	10,900
Average Flow (MGD)(b)	2.10	4.20	6.30	8.40	32.70
SIA Terminal					
Passengers Per Day	6,200	7,800	9,400	11,000	27,400
Average Flow (MGD)(c)	.04	.05	.07	.08	.19
Totals					
Average Flow (MGD)	2.46	4.61	6.77	8.93	35.59

(a) Based on 100 GAL/CAPITA/DAY

(b) Based on 3000 GAL/AC/DAY

(c) Based on 7 GAL/PASSENGER/DAY

Only the central drainage basin has existing sewers and the projected development necessary to consider sewer systems.

Sanitary Sewer System for the Central Basin - The existing system within the West Plains area could be expanded to provide some additional capacity until a new trunk system is constructed. See Chapter V for explanation. Development of the West Plains area will require a plan for the disposition of storm water, but this is beyond the scope of this study.

The sewer system shown on Figure IV-1 was routed to those areas where major development is projected. The system is conceptual only and should not be considered as a basis for design. General topographic features were considered in regard to overall slope, but routes were not field surveyed or checked. The system was routed to those areas considered most likely to be developed within the central drainage basin. Development is assumed to be in a east to west direction. The alignment of the proposed 36-inch and 27-inch sewer from Geiger Boulevard through the Arboretum is the same as the existing sewer line. This would serve the other trunks connected to it as well as adjacent commercial and industrial development.

The 15-inch to 24-inch sewer line along the north side of the Spokane International Airport would serve the projected development of the industrial land from Grove Road west to Airway Heights. The proposed sewer lines along Geiger Boulevard and Electric Avenue would serve the projected development of the industrial land south and east of the airport. The area near Flint Road and Electric Avenue would require a lift station and force main because of topography.

An alternate route for the trunk sewer from the Electric Avenue area is along Thorpe Road instead of along Geiger Boulevard. Sewers will be necessary along both of these roads to serve adjacent property. The trunk was located along Geiger Boulevard since this is the shorter distance.

The 15-inch sewer along Assembly Road would have the capacity to serve the projected development in the single family residential area. Collection sewers would connect to this trunk or to a lift station at Thorpe Road. The lift station could be eliminated by constructing a sewer easterly along Thorpe Road to the City system. The advantages of this alternate would depend in part on development in this area and adjacent property. The gravity sewers shown on this plan range in size from 15-inches to 36-inches in diameter. These are considered trunk sewers. Sewers 12-inches and smaller are considered to be part of the collection system. A sewer 15-inches in diameter has the capacity to serve approximately 330 acres of commercial or industrial property. This is based on an average daily flow of 3,000 gallons per acre per day, a peaking factor of 3 and an average slope of 0.5 percent. This same size sewer can serve approximately 9,900 people based on 100 gallons per capita per day, and the same peaking factor and slope.

The sewers shown were sized based on the following considerations:

1. Average daily flows from Table IV-1
   Phase IV x a peaking factor of 3.

2. Infiltration limited to 1,000 gallons/day/in.
   of diameter /mile.

3. Slope to maintain a minimum velocity of 2 ft./sec.

4. No storm water other than that included in the
   infiltration figures (above).

The collection system necessary to connect the anticipated development to the trunk sewers is not shown. Location and size of the collectors are a function of the type of development. The length of the collection system can vary from 20,000 to 100,000 linear feet per square mile depending on type of

development and density. Costs of this collection system must be considered in the economics of development. The system of trunk lines and pump stations is designed to serve the Phase IV development. The system can be enlarged and/or expanded to serve demands when and where needed.

The proposed point of connection to the City's system is the West Grove trunk at Audubon Street and 17th Avenue. This sewer has approximately 90% of the necessary capacity for the development expected in the West Plains area by Phase IV. Connection to other existing sewers in the same area could handle the remaining 10% or the West Grove system could be improved to carry the entire flow. The City would need to investigate the existing interceptor system to determine its capacity to transport the proposed quantities to the treatment facility. Consideration must be given to the costs of any improvements necessary to the interceptor system.

Phasing of Sewer Plan - The existing sewer system has limited possibility for expansion. Therefore, development will require the construction of a new trunk system. The development is assumed to proceed in a westerly direction.

The sewer plan for Phase IV is shown on Figure IV-1. Segments of the system are identified by the letter "S" and a number. The sequence of the numbers generally indicate the order of construction. Certain portions of the system are essential for development to commence.

Additional portions of the system are required to meet each of the phase's requirements. The phasing of the sewers is as follows:

Phase	Sewer Designations
Phase I	S-1, S-2, S-3, S-4, S-5
Phase II	S-6, S-7, S-8, S-9
Phase III	S-10, S-11
Phase IV	S-12, S-13

The above phasing is approximate and should be considered in a general context. Actual phasing of facilities must be reviewed and revised as the development occurs.

Cost Estimate for Sewer System - The unit costs are for construction of sewers in average conditions of the West Plains area, including construction in basalt. The unit prices also include all necessary appurtenances but do not include right-of-ways acquisition. Total construction cost estimates including contingencies, engineering, legal and Washington State taxes are presented in Chapter VI.

Phase I:

S-1	8,000 lf of 27" sewer @ $65/lf	$520,000	
S-2	3,000 lf of 36" sewer @ $80/lf	$240,000	
S-3	3,200 lf of 24" sewer @ $55/lf	$176,000	
S-4	3,000 lf of 15" sewer @ $40/lf	$120,000	
S-5	4,500 lf of 15" sewer @ $40/lf	$180,000	
	Total Phase I		$1,236,000

Phase II:

S-6	10,000 lf of 24" sewer @ $55/lf	$550,000	
S-7	3,000 lf of 21" sewer @ $50/lf	$150,000	
S-8	3,500 lf of 18" sewer @ $45/lf	$157,500	
S-9	4,000 lf of 6" force main with pump station @ $25/lf	$100,000	
	Total Phase II		$957,500

Phase III:

S-10	7,500 lf of 8" force main with pump station @ $25/lf	$187,500	
S-11	6,500 lf of 21" sewer @ $50/lf	$325,000	
	Total Phase III		$512,500

Phase IV:

S-12	2,500 lf of 18" sewer @ $45/lf	$112,500	
S-13	4,000 lf of 15" sewer @ $40/lf	$160,000	
		Total Phase IV	$272,500
		Total For All Phases	$2,978,500

CHAPTER V

CHAPTER V

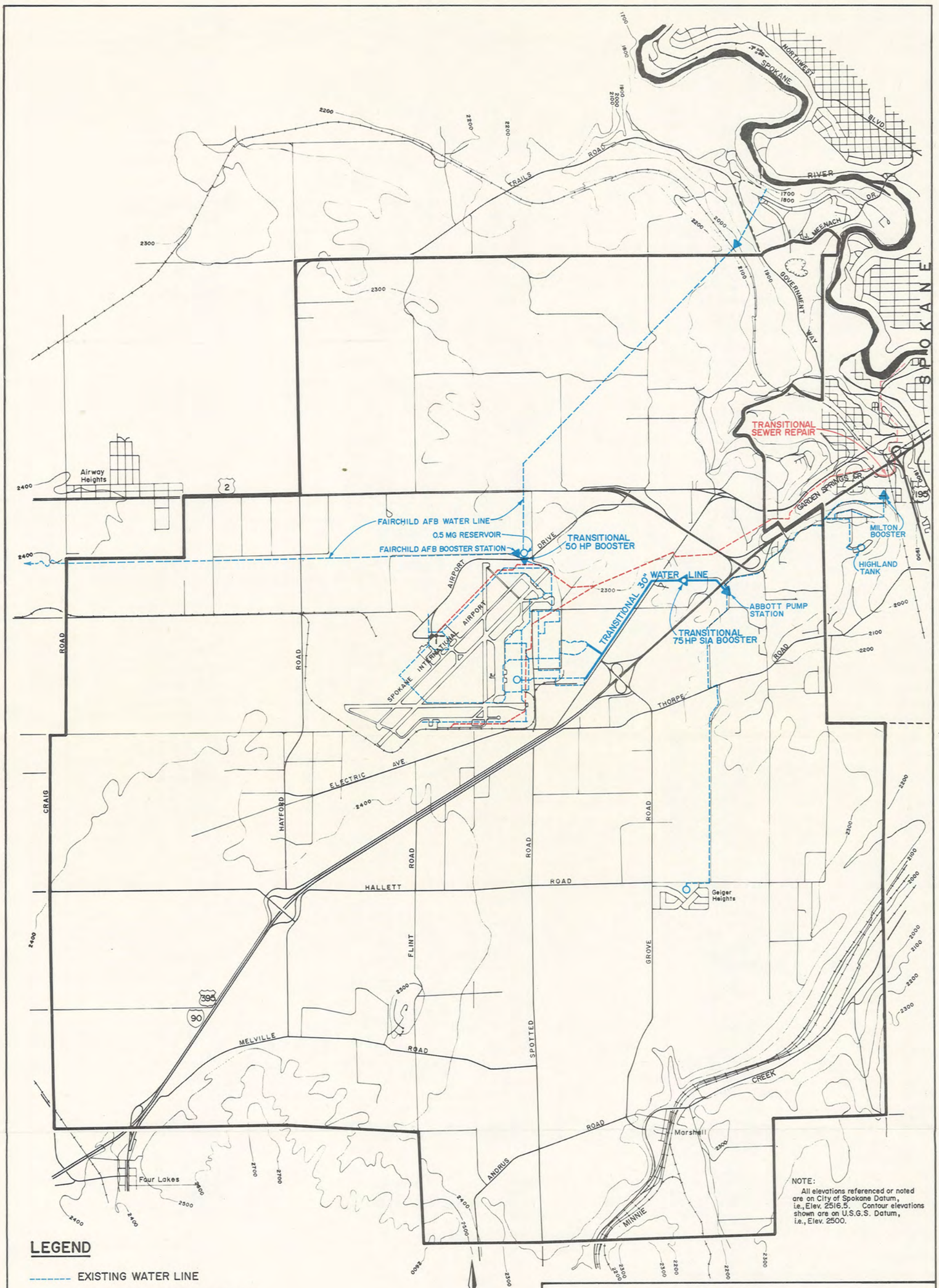
TRANSITIONAL PHASE - WATER AND SEWER SYSTEM PLAN

A. GENERAL

In order for the West Plains area to start the planned development within the immediate future, a transitional phase water and sewer system plan has been developed (see Figure V-1). This plan is to utilize the existing utilities to their maximum capacity allowing some acreage to develop for either commercial/ industrial, residential or a combination thereof. The plan proposes to construct only those facilities that will be required to serve the transitional acreage or development and still be incorporated where possible into the Phase IV water and sewer system plan.

B. TRANSITIONAL PHASE WATER PLAN

This water plan contemplates using the existing 12-inch water main between the Milton Booster and the Abbott Pump Station and the existing pumps at the Milton Booster to deliver a maximum of 1200 GPM. The 1200 GPM is the maximum amount of water that can be pumped through the existing 12-inch line and still maintain a hydraulic gradient to serve the existing Highland system. A new water main (30-inch) will be required to be constructed from the Abbott Pump Station across Interstate 90 to Geiger Road and southwesterly along Geiger Road to a connection point in the existing SIA system. Construction of a portion (75 horsepower) of the SIA booster will also be required to be constructed. These new



LEGEND

- EXISTING WATER LINE
- TRANSITION PHASE WATER LINE
- EXISTING PUMP STATION
- TRANSITION PHASE PUMP STATION
- EXISTING WATER STORAGE
- EXISTING SEWER
- TRANSITION PHASE SEWER

NOTE:
All elevations referenced or noted are on City of Spokane Datum, i.e., Elev. 2516.5. Contour elevations shown are on U.S.G.S. Datum, i.e., Elev. 2500.

WEST PLAINS AREA WATER AND SEWER PLAN FOR CITY OF SPOKANE

TRANSITIONAL PHASE WATER AND SEWER SYSTEM PLAN

Boyle Engineering Corporation
consulting engineers / architects

FIGURE V-1

facilities (W-2 and a portion of W-3) are a part of the proposed Phase IV development as shown on Figure III-3. The estimated costs of these improvements are $1,115,000. These costs do not include any distribution system costs.

Another alternative source of water is the existing intertie between the SIA water system and the Fairchild Air Force Base's (FAFB) booster station and 0.5 MG reservoir located on Airport Drive. This intertie has a potential capability of delivering about 1000 to 2000 GPM into the existing SIA system. The existing booster station is reported to have a capability of pumping about 500 GPM. A new booster pump (50 horsepower) would have to be installed at an estimated cost of $40,000. This cost does not include any distribution system to deliver water to the proposed development.

Yet another alternative is to develop a portion of the proposed City well field at Fort Wright. A single well with a capacity of 1200 to 1500 GPM could be developed and either pumped into the existing FAFB's 20-inch and 16-inch mains or proposed new mains or portions thereof might be constructed. It is reported that the existing 16-inch main might not have sufficient capacity during FAFB emergency conditions. Therefore, if this alternative is selected, it is recommended that the following be constructed:

1. Construct a 1500 GPM well at Fort Wright area.
2. Utilize existing 20-inch FAFB main to Rimrock area.
3. Construct a 150 horsepower (1.7 MGD) booster station at the Rimrock area.

4. Construct approximately 3 miles of 24-inch water main to the SIA system and FAFB intertie.

Either of these sources of water supply would allow the development of approximately 400 acres of either commercial/industrial or single family residential.

C. TRANSITIONAL PHASE SEWER PLAN

The existing sewer system in the West Plains area could be improved to provide additional capacity. This system is presently operating at capacity due to high infiltration and root intrusion. Studies by the City Utilities Department indicate that most of the infiltration occurs in a 1200 foot section of pipe between the freeway and 13th and Lindeke. Repair of this section would make about 1 to 1.2 CFS of additional capacity available in the system. The estimated cost of this repair is approximately $25,000. This additional capacity would allow the connection of from 100 to 400 acres of industrial/commercial land to the system, depending on the type of development.

Additional development could be connected to the existing sewer by means of an equalizing basin. This basin would store sewage during the daily peak flows and release it during low flows. Sewers are usually designed to carry the peak flows which are approximately 3 times the daily average. By using an equalizing basin the Geiger sewer has a maximum capacity of approximately 2 CFS and could serve an additional 200 to 300 acres of commercial/industrial acreage. The costs of a basin this size are estimated at approximately $250,000.

CHAPTER VI

CHAPTER VI
FINANCIAL STUDY

A. FUNDING SOURCES

Much of the capital outlay summarized in Chapter III and IV will depend upon the rate of industrial, commercial, and residential development within the central drainage basin. The hub of that growth is the Spokane International Airport and the anticipated industrial park.

At the present time, the existing water and wastewater facilities are reportedly meeting the service demands of the present users. This standard of service can only be continually provided if the existing facilities are repaired or replaced, and new facilities added. Rehabilitation and expansion of existing equipment can be accomplished very rapidly if immediate funds are available. Following a definite plan of action as outlined in this report is necessary.

The present financial methods the City of Spokane has at its disposal to accomplish the water and sewer plan goals are as follows:

Water and Sewer Fund - City residents are charged monthly for water and sewer services. Presently, these funds provide for maintenance, repair, and some capital construction projects in the water and sewer facilities. The City of Spokane, after approximately 20 years of a combined water-sewer fund, is currently in the process of separating this single fund into two separate funds.

Presently, the existing water and sewer fund revenues are limited to meeting budgeted expenditures, however, the City's current water and sewer rates are well below the state averages and could be increased to assist in meeting a future debt service.

Local Improvement Districts (LID) - Local Improvement Districts may be formed by individual water and sewer users in an area where revenues would not be sufficient to allow the utilities to regain their original investments. Each individual user and all members of the LID would be assessed their proportional share of the costs. This method has been used for sewer improvements as a general rule. LID's for water service facilities had not been used for several decades.

Local Levies - Local levies could be assessed for water and sewer facilities if desired by the City of Spokane residents under local ordinance.

General Obligation Bonds - General obligation bonds could be issued by the Spokane City Council for water and sewer facilities, if approved by the voters. Revenue bonds, which would have to be taken from revenues of the water and sewer funds, could additionally be issued for facilities.

State Aids - State aids are or will be available for water and sewer facilities. Ongoing programs include the following:

Department of Social and Health Services (DSHS) - Referendum No. 27 for water projects, and the extension of that program to the present time period, has been a source of some funding (loans and grants) assistance to muncicipal entities. These funds are used for engineering (loans), design (loans), construction of wells (grants), transmission mains (grants), interties (grants) and reservoirs (grants). The total available grant is to a maximum amount of 40% of the allowable costs. The City of Spokane (based on its population) would be allowed a total of $750,000 for all its applicable Referendum No. 27 projects.

This assumes that the projects are of high priority and the City is interested in pursuing the projects. Presently, the City of Spokane will have two applications to the DSHS under Referendum No. 27. The amount of funding available for the West Plains project would be the difference between the maximum of $750,000 and the amount of funding previously requested.

Referendum No. 38 will be on the ballot this fall (1980) as a replacement for Referendum No. 27. If it is approved by the Washington State voters, there will be $75 million to help assure public health standards are met for drinking water and increase reliability of water service. This reliability is needed because existing facilities deteriorate over time, more stringent standards have been promulgated, and energy saving technology must be incoporated into existing facilities. If Referendum No. 38 is passed by the voters, the water portion of the West Plains construction would fit into health related grant construction projects, critical water quantity (storage and source) projects and regional projects designed to preclude duplication of facilities. Projects eligible for loans would include planning studies, engineering reports, and preparation of plans and specifications. All of this discussion is based on a program that can only be put into place after voter approval in November, 1980.

Department of Ecology (DOE) - DOE funding (15%) for sewage treatment and interceptors has been tied to funding (75%) through the Environmental Protection Agency (EPA) covering the allowable costs in past years. In the last 3 years the amount of funds committed to this program has continued to decline. This information,

coupled with the fact that interceptors are of a very low priority, implies funding for sewers from the EPA and DOE will not be forthcoming..

A second program that involves state funding of sewer projects is now under way. The State Construction Grant Program is administered by the DOE. They are responsbile for reviewing applications and allocating all state grant funds. Funds for this program are a part of the Referendum No. 26 Washington Future Program which was originally approved by the voters during the fall of 1972. There is approximately $65 million remaining. This program will end in 1981.

A replacement Referendum No. 39 will be on the November 1980 ballot. If the new $450 million referendum is approved by voters this fall, the program will continue through 1991. If this additional funding is authorized, the rules and regulations for using the money will be re-examined based on experience gained from the original state program and the time lag may be 6 to 9 months before funds are available.

This state program is independent of the Federal (EPA) Construction Grant Program. It is designed to expedite the construction of needed wastewater facilities, and to minimize the state and federal regulatory agency involvement in the wastewater construction program. An applicant must be a public body (created under Washington State Law) and must have the authority to dispose of sewage and industrial wastes. Also, the public body must have the authority to plan, design, finance, construct, operate, and maintain sewage treatment works. The City of Spokane is capable of doing all of these functions.

The three types of eligible projects would be:

- Construction or expansion of facilities to primary treatment is an eligible cost if it is allowed or required by DOE enforcement action.
- Construction or upgrade of facilities to secondary treatment.
- Interceptors.

Under this new program, the state places all eligible projects on a priority list based on the following factors: the extent of pollution, threat to public health, the number of people it will benefit, problem prevention and the amount of money already invested at the local level.

A second priority list applies to 15 percent of the grant funds and uses only the following factors: local investment, population and benefit and problem prevention. This is intended to encourage local government investment in problem prevention.

In past years, accelerated financial advances have been available to public works projects and public works planning projects. These types of programs, though they may be available, can not be currently counted upon as a firm source of funding.

B. COSTS

Costs of the study area proposed water and sewer facilities projects have been segregated into four phases in Table VI-1. The cost figures are only preliminary estimates based on current engineering, and recently bid construction costs. These costs are for comparison only and are not to be used as preliminary engineering estimates of construction costs.

It must be noted that the cost of construction has risen drastically over the last decade. Figure VI-1 shows this trend. (Source: Engineering News Record, March 20, 1980).

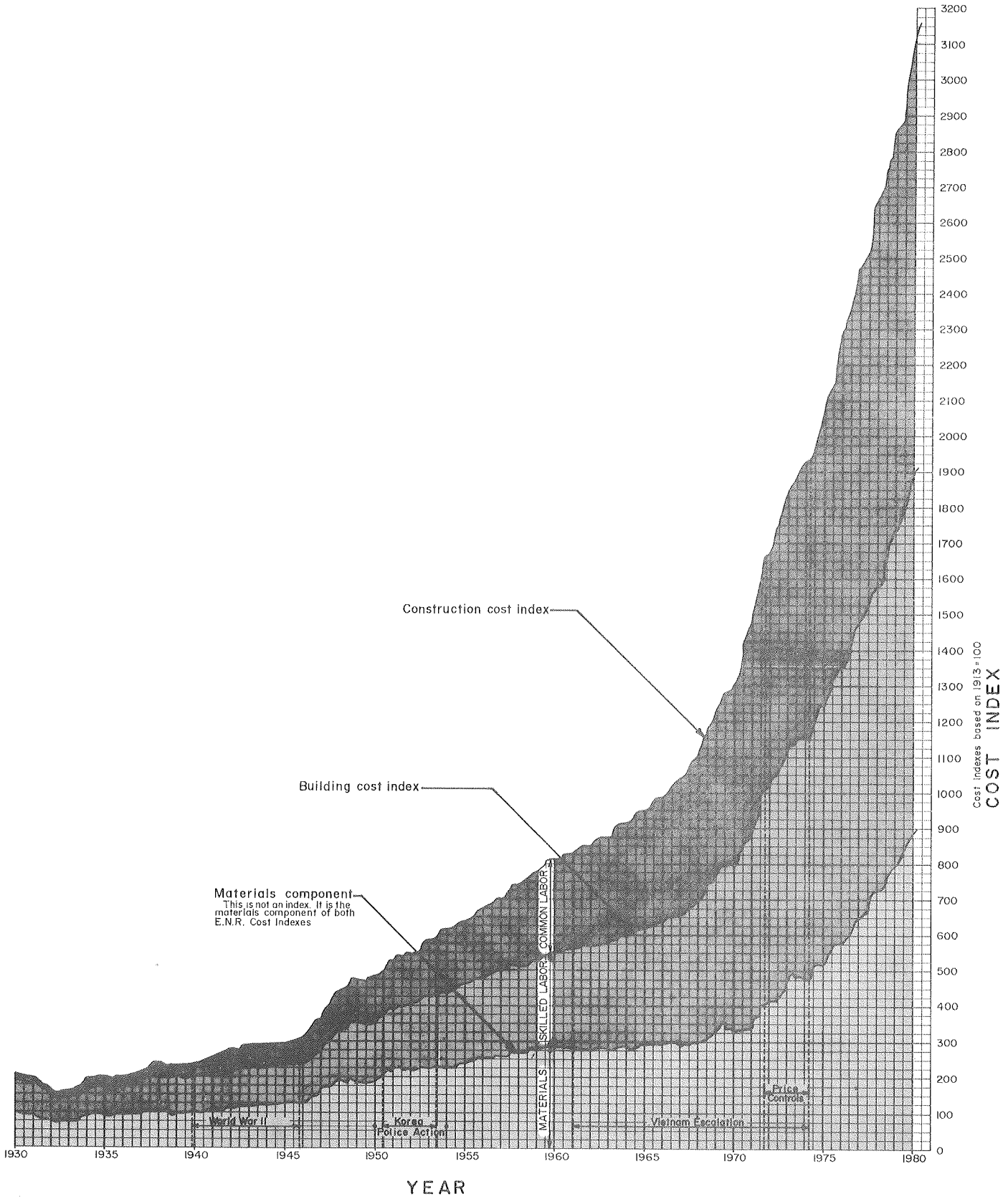
These cost numbers are, however, the best available at this time. These costs will provide the City Council and the West Plains individuals with a means to grasp the magnitude of the project phases and various ways of providing a financial base adequate for future water and sewer services within the West Plains area.

TABLE VI-1

COMBINED CONSTRUCTION COSTS FOR
SEWER AND WATER PLAN BY PHASE FOR
WEST PLAINS AREA

Phase	Water	Sewer	Total
I	$ 3,533,000	$1,236,000	$ 4,769,000
II	$ 2,954,500	$ 957,500	$ 3,912,000
III	$ 3,498,000	$ 512,500	$ 4,010,500
IV	$ 3,010,000	$ 272,500	$ 3,282,500
Total	$12,995,500	$2,978,500	$15,974,000

To facilitate computation of construction costs at a later date, the Engineering News Record Constrction Cost Index is 3300 at the writing of this report.



MATERIALS AND LABOR COST TRENDS IN THE U.S.

This is a reproduction of a graph published in Engineering News Record (March 20, 1980 – pages 112 & 113).

Boyle Engineering Corporation
consulting engineers

FIGURE VI-1

The construction costs are estimates of 1980 dollars needed to provide the West Plains sub-areas with phased water and sewer services. The first projects are in the transitional phase which include repair, replacement and/or expansion to the physical limit of the existing facilities. The proposed phase projects include proposed construction of facilities.

The basic backbone system construction costs shown in Table VI-1 do not include the costs for legal, financial, administration, engineering, contingencies or state sales taxes. The estimated amount of these costs are as shown in Table VI-2.

This last year, the City of Spokane's existing water and sewer fund generated an excess of only $230,000. If this fund was capable of continuing this amount of overage for the next twenty years, it would be able to generate only about $4,000,000. However, the proposed capital outlay programmed by this report is at least $20,000,000 resulting in a $16,000,000 deficit. Therefore, it is imperative that other additional sources of funds and revenues be found and acquired to make up this difference if long term adequate water and sewer service is to be provided to the West Plains area by the City of Spokane. As indicated earlier, the water and sewer rates are well below the state average and could be increased to assist in this deficit.

The City of Spokane is closely tied to the West Plains area because they now provide some water and sewage treatment for that area. However, the citizens and homeowners of Spokane West Plains residents, industries, commercial businesses and the Spokane International Airport must decide how to provide the much needed funds to pay for the utilities (water and sewer services) that are necessary and demanded for the area.

TABLE VI-2

ESTIMATED PROJECT COSTS FOR SEWER AND WATER
FACILITIES BY PHASE FOR WEST PLAINS AREA

Item	Transitional Phase	Phase I	Phase II	Phase III	Phase IV	Total Phases I, II, III, IV
Construction Costs	1,180,000	4,769,000	3,912,000	4,010,500	3,282,500	15,974,000
Legal, Administration, Financial	24,000	95,000	78,000	80,000	66,000	319,000
Engineering	118,000	477,000	391,000	401,000	328,000	1,597,000
Easements or Land Acquisition(a)	---	---	---	---	---	---
Contingencies	118,000	477,000	391,000	401,000	328,000	1,597,000
Washington State Sales Tax	59,000	238,000	196,000	200,000	165,000	799,000
Total	1,499,000	6,056,000	4,968,000	5,092,500	4,169,500	20,286,000

(a) Not taken into account for these projects.

C. INCENTIVE FOR NEW INDUSTRIES

Providing Water and Sewer - The most probable reasons why the West Plains area has become the preferred area for industrial development is its access to transportation modes including the Spokane International Airport, and larger tracts of relatively undeveloped land. The lack of water and sewer services are therefore the main reasons why the West Plains area has not flourished.

Financial Assistance - Financial assistance is one of the several incentives that attract an industry to an area after land parcels, and water and sewer services have been proven to be available and adequate. Every effort should be made to stay up to date with the incentive programs and the current industrial financial assistance program. Various private, county, state and federal assistance programs that are available to industries locating in the West Plains area include: Economic Development Administration (EDA), Housing and Urban Development (HUD), Small Business Administration (SBA), Local Business Development Corporation, and state incentive for manufacturing plants in high unemployment areas.

Tax Incentives - In addition to no corporate or personal income tax within the State of Washington, there are other tax exemptions that are advantageous. These exemptions are as follows:

- Tax Deferral - Land and Capital Improvements
- Tax Deferral - Equipment and/or Machinery
- Free Port
- Tax Exemption - Manufacturer's Inventories
- Statewide Uniform Property Tax Evaluation Law

Source: (a) Industrial Park Master Plan, Bovay Engineers, Inc. December, 1978

(b) Inland Empire Economic Base Study, Prepared for Spokane Area Development Council, July, 1976

Capital Cost Financing - The water extension policy of the City of Spokane has been to extend the primary transmission mains, install pump stations and construct reservoirs with financing from the water fund. Therefore, in the past, residents or water users would only have to finance their local distribution lines and individual connections. These costs would vary depending on the distance from the main transmission line, the size and type of development, and when the needed facilities were constructed. The cost to construct these facilities in the West Plains area will be somewhat higher than in currently established, domestically developed areas. The important factor to remember is that whether the system is owned by a private individual, private water purveyor, or a municipal water purveyor the construction costs should be approximately the same. This is true because the Washington State, Spokane County, and City of Spokane codes must be met no matter which entity has jurisdiction. The benefits that an established municipality would provide is that they have proven record of past projects and an established water system to start providing services immediately.

The sewer extension policy of the City of Spokane is that the costs for sewers are to be supported by means of an assessment to the land involved with the exception of treatment and main interceptor costs. In the West Plains project, neither a new treatment plant nor a major sewer interceptor are anticipated; therefore, all costs would have to be paid by the landowners.

Operation and Maintenance Expenses - Operation and maintenance expenses could be estimated for the West Plains study area, although the applicability of this would be questionable. The best estimate would be the existing rates being charged for sewer and water for the entire City of Spokane. These rates were increased the first part of 1980, and were implemented in order to keep a balanced expenditures and revenues budget.

For 1979, the operation and maintenance budget was $7,756,000 for both water and sewer. Within the existing city limits there is about 760 miles of water lines and 643 miles of sewer lines that the City now has under their jurisdiction. Therefore, it costs $5,700 per mile of line to provide operation and maintenance needs each year. Another way to express these figures is that it costs about $216 per acre per year to provide sewer and water line operation and maintenance. Inflation or other costs are not included in these 1979 costs.

D. SUMMARY

Minimal expenditures of about $1,500,000 immediately will provide additional water service and sewer capacities to 400 acres within the West Plains area. This includes repair to Geiger Heights sewer line for $25,000, expansion of the Fairchild-SIA booster station and intertie for $40,000 and the expenditure of $1,115,000 for the proposed SIA booster, Milton booster expansion and a new 30" water main intertie between the Abbott booster pump station and the existing SIA water system. These minimal transitional phase costs would allow immediate development and a financial base for additional and future industrial and residential growth.

Funding sources from the City of Spokane, State of Washington and numerous federal agencies will need to be combined if the entire proposed plan is to become a reality within the near future. If the City Council decides to proceed with this project, a combined funding package appears plausible if municipal, private, state and federal agencies are asked to assist. This is

based on the premise that the existing policies of the City continue to provide funds for water transmission mains, pump station, and reservoirs, and sewer interceptors. The landowners and residents would finance the water distribution lines and sewer trunks and laterals. These dollars could probably be assisted by state and federal grants and loans.

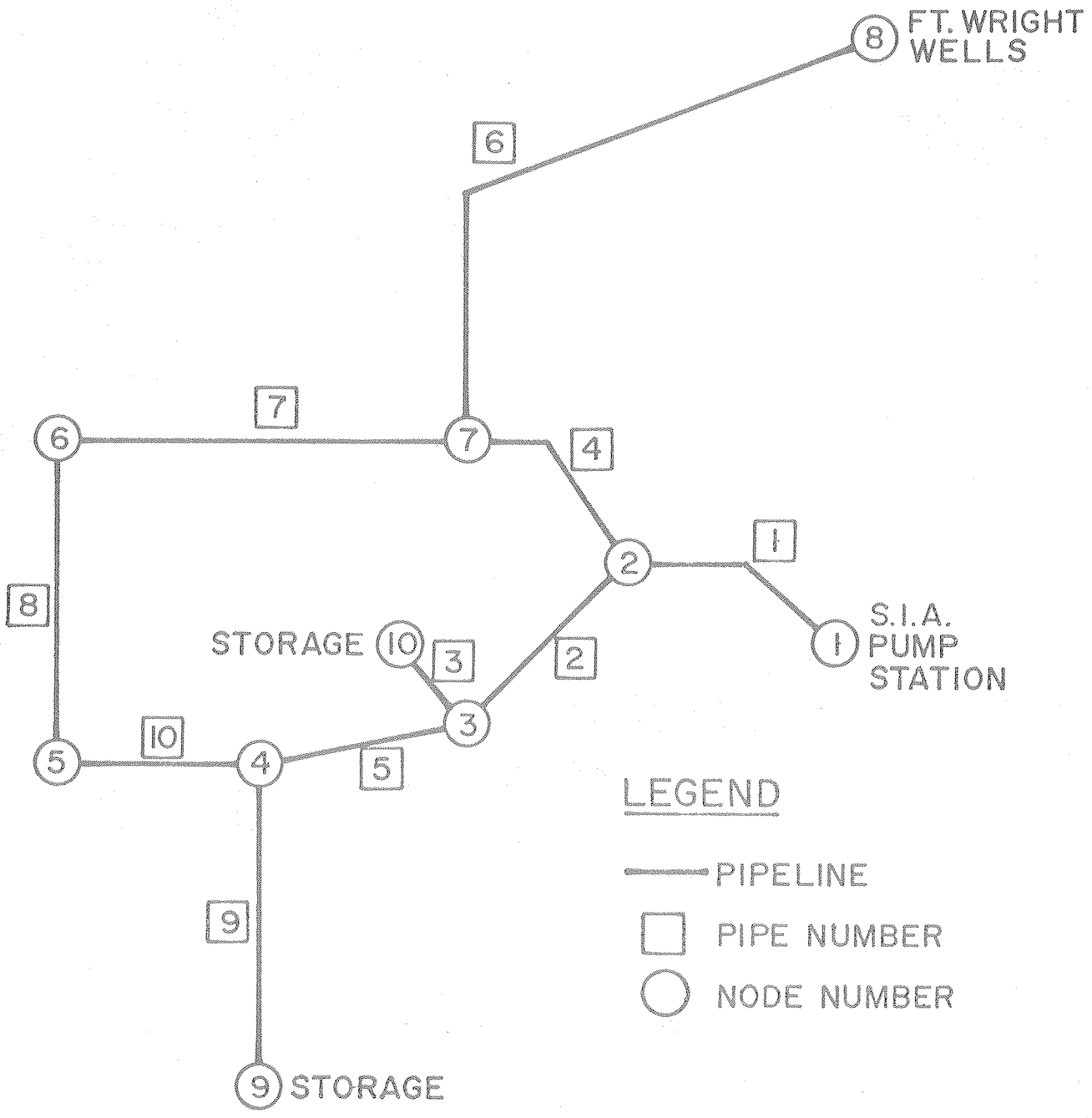
To meet the proposed industrial and residential growth of the West Plains area, an estimated $3,000,000 to $5,000,000 (1980 dollars) will be required for each of the projected phased developments. The immediate transitional phase will range from as low as $65,000 to about $1,500,000. By providing this much needed water and sewer service, it is anticipated the industrial growth of the area would flourish.

The preliminary estimated construction costs are comparable to those of other developing areas within the Inland Empire area. There is of course, a high degree of variability. This is especially true when the established operation and maintenance procedures of the City of Spokane will alleviate the existing lack of major water supplies or surfacing sewage from plugged or inoperable septic tanks.

It appears enough reports and studies have been done in this area. The next steps would be to accept this proposed plan, obtain the acceptance of the West Plains landowners, prepare the Environmental Impact Statement, implement the transitional phase, pursue industrial development, and implement the program for Phase I through Phase IV.

APPENDIX A

Computer Analysis for Water System Design



WATER PLAN
SCHEMATIC COMPUTER ANALYSIS

FIGURE A-1

```
WP001 WEST PLAINS WATER SYSTEM PLAN---P.F.=2---5000GPM FIRE FLOW AT NODE  5

INPUT FILE NAME WPLNS01.T.BOYLE

NUMBER OF PIPES                    10
NUMBER OF NODES                    10
NUMBER OF FIXED HGL NODES           2
NUMBER OF UNKNOWN DEMAND NODE       2
NUMBER OF SOURCE PUMP NODES         0
NUMBER OF BOOSTER PUMP PIPES        0
NUMBER OF PRV PIPES                 0
PEAKING FACTOR                  2.000
STOP WHEN FLOW CORR LESS THAN   1.00 US GPM
MAXIMUM NUMBER OF ITERATIONS      50
CONVERGENCE FACTOR              1.000
NUMBER OF ITER TO USE CONV FACT    0
VELOCITY CHECK - HIGH             10.     FT/SEC
               - LOW               0.     FT/SEC
HEADLOSS CHECK - HIGH             10. FEET  /1000
               - LOW               0. FEET  /1000
PRESSURE CHECK - HIGH            100. PSI
               - LOW              35. PSI
PRESSURE DROP CHECK
   ALLOWABLE DROP FROM STATIC    50. PCT
   STATIC HGL ELEVATION        2507. FEET



SUM OF (-) FIXED DEMANDS = -5000.00
SUM OF (+) FIXED DEMANDS = 16000.00

SUM OF ALL FIXED DEMANDS ----------    -11000.00
SUM OF THE DEMANDS SUBJECT TO PEAKING     7857.00
SUM OF DEMANDS PEAKED AND UNPEAKED --     4714.00


SOLUTION REACHED IN    4 ITERATIONS
LAST FLOW CORRECTION WAS   .0106
```

WP001 WEST PLAINS WATER SYSTEM PLAN---P.F.=2---5000GPM FIRE FLOW AT NODE 5

PIPE NO	--NODES-- FROM	TO	DIAM INCHES	LENGTH FEET	H-W C	FLOW US GPM	-VELOCITY- FT/SEC	--CK	---HEADLOSS--- FT	FT/1000	--CK
1	1	2	30.0	2950.0	120	10000.00	4.5		7.1	2.4	
2	2	3	30.0	7050.0	120	7597.71	3.4		10.3	1.5	
3	3	10	36.0	1350.0	120	842.51	.3		.0	.0	
4	7	2	24.0	9700.0	120	217.71	.2		.1	.0	
5	3	4	24.0	7700.0	120	3749.20	2.7		9.0	1.2	
6	8	7	24.0	18300.0	120	6000.00	4.3		51.0	2.8	
7	7	6	24.0	11500.0	120	4228.29	3.0		16.8	1.5	
8	6	5	18.0	10400.0	120	1548.29	2.0		9.6	.9	
9	9	4	30.0	11000.0	120	5556.51	2.5		9.0	.8	
10	4	5	30.0	6000.0	120	6761.71	3.1		7.0	1.2	

WP001 WEST PLAINS WATER SYSTEM PLAN---P.F.=2---5000GPM FIRE FLOW AT NODE 5

NODE	GROUND EL FEET	FLOW US GPM	HGL EL FEET	HEAD FEET	PRESSURE PSI	--CK	PCT DROP	--CK
1	2260.0	10000.00	2524.4	264.4	114.	HI	-7.	
2	2300.0	-2620.00	2517.3	217.3	94.		-5.	
3	2390.0	-3006.00	2507.0	117.0	51.		-0.	
4	2390.0	-2544.00	2498.0	108.0	47.		8.	
5	2390.0	-8310.00	2491.0	101.0	44.		14.	
6	2360.0	-2680.00	2500.6	140.6	61.		4.	
7	2290.0	-1554.00	2517.3	227.3	98.		-5.	
8	1700.0	6000.00	2568.4	868.4	376.	HI	-8.	
9	2507.0	5556.51U	2507.0F	.0	0.	LO	0.	
10	2507.0	-842.51U	2507.0F	.0	0.	LO	0.	

MAXIMUM UNBALANCED HEAD LOSS= .00000

```
WP005 WEST PLAINS WATER SYSTEM PLAN--P.F.=6.0 --PEAK HOUR FLOWS

INPUT FILE NAME WPLNS03.T.BOYLE

NUMBER OF PIPES                    10
NUMBER OF NODES                    10
NUMBER OF FIXED HGL NODES           2
NUMBER OF UNKNOWN DEMAND NODE       2
NUMBER OF SOURCE PUMP NODES         0
NUMBER OF BOOSTER PUMP PIPES        0
NUMBER OF PRV PIPES                 0
PEAKING FACTOR                  6.000
STOP WHEN FLOW CORR LESS THAN  1.00 US GPM
MAXIMUM NUMBER OF ITERATIONS       50
CONVERGENCE FACTOR              1.000
NUMBER OF ITER TO USE CONV FACT     0
VELOCITY CHECK - HIGH              10.     FT/SEC
               - LOW               0.     FT/SEC
HEADLOSS CHECK - HIGH              10. FEET  /1000
               - LOW               0. FEET  /1000
PRESSURE CHECK - HIGH             100. PSI
               - LOW               35. PSI
PRESSURE DROP CHECK
   ALLOWABLE DROP FROM STATIC      50. PCT
   STATIC HGL ELEVATION          2507. FEET



SUM OF (-) FIXED DEMANDS =       .00
SUM OF (+) FIXED DEMANDS = 16000.00

SUM OF ALL FIXED DEMANDS ----------    -16000.00
SUM OF THE DEMANDS SUBJECT TO PEAKING     7857.00
SUM OF DEMANDS PEAKED AND UNPEAKED --    31142.00


SOLUTION REACHED IN    4 ITERATIONS
LAST FLOW CORRECTION WAS   .1191
```

WP005 WEST PLAINS WATER SYSTEM PLAN--P.F.=6.0--PEAK HOUR FLOWS

PIPE NO	--NODES-- FROM	TO	DIAM INCHES	LENGTH FEET	H-W C	FLOW US GPM	-VELOCITY- FT/SEC	CK	---HEADLOSS--- FT	FT/1000	CK
1	1	2	30.0	2950.0	120	10000.00	4.5		7.1	2.4	
2	3	2	30.0	7050.0	120	3022.19	1.4		1.9	.3	
3	10	3	36.0	1350.0	120	19395.59	6.1		4.6	3.4	
4	2	7	24.0	9700.0	120	5162.19	3.7		20.5	2.1	
5	3	4	24.0	7700.0	120	7355.39	5.2		31.3	4.1	
6	8	7	24.0	18300.0	120	6000.00	4.3		51.0	2.8	
7	7	6	24.0	11500.0	120	6500.19	4.6		37.2	3.2	
8	5	6	18.0	10400.0	120	1539.81	1.9		9.5	.9	
9	9	4	30.0	11000.0	120	11746.42	5.3		35.9	3.3	
10	4	5	30.0	6000.0	120	11469.81	5.2		18.7	3.1	

WP005 WEST PLAINS WATER SYSTEM PLAN--P.F.=6.0--PEAK HOUR FLOWS

NODE	GROUND EL FEET	FLOW US GPM	HGL EL FEET	HEAD FEET	PRESSURE PSI	CK	PCT DROP	CK
1	2260.0	10000.00	2507.7	247.7	107.	HI	-0.	
2	2300.0	-7860.00	2500.5	200.5	87.		3.	
3	2390.0	-9018.00	2502.4	112.4	49.		4.	
4	2390.0	-7632.00	2471.1	81.1	35.		31.	
5	2390.0	-9930.00	2452.4	62.4	27.	LO	47.	
6	2360.0	-8040.00	2442.9	82.9	36.		44.	
7	2290.0	-4662.00	2480.1	190.1	82.		12.	
8	1700.0	6000.00	2531.1	831.1	360.	HI	-3.	
9	2507.0	11746.42U	2507.0F	.0	0.	LO	0.	
10	2507.0	19395.59U	2507.0F	.0	0.	LO	0.	

MAXIMUM UNBALANCED HEAD LOSS= .00011

```
WP006 WEST PLAINS WATER SYSTEM PLAN---P.F.=0.5---LOW NIGHT FLOWS

INPUT FILE NAME WPLNS03.T.BOYLE

NUMBER OF PIPES                    10
NUMBER OF NODES                    10
NUMBER OF FIXED HGL NODES           2
NUMBER OF UNKNOWN DEMAND NODE       2
NUMBER OF SOURCE PUMP NODES         0
NUMBER OF BOOSTER PUMP PIPES        0
NUMBER OF PRV PIPES                 0
PEAKING FACTOR                   .500
STOP WHEN FLOW CORR LESS THAN   1.00 US GPM
MAXIMUM NUMBER OF ITERATIONS       50
CONVERGENCE FACTOR              1.000
NUMBER OF ITER TO USE CONV FACT     0
VELOCITY CHECK - HIGH              10.     FT/SEC
               - LOW                0.     FT/SEC
HEADLOSS CHECK - HIGH              10. FEET  /1000
               - LOW                0. FEET  /1000
PRESSURE CHECK - HIGH             100. PSI
               - LOW               35. PSI
PRESSURE DROP CHECK
   ALLOWABLE DROP FROM STATIC      50. PCT
   STATIC HGL ELEVATION          2507. FEET



SUM OF (-) FIXED DEMANDS =       .00
SUM OF (+) FIXED DEMANDS = 16000.00

SUM OF ALL FIXED DEMANDS ----------    -16000.00
SUM OF THE DEMANDS SUBJECT TO PEAKING     7857.00
SUM OF DEMANDS PEAKED AND UNPEAKED --    -12071.50


SOLUTION REACHED IN     6 ITERATIONS
LAST FLOW CORRECTION WAS    .0054
```

WP006 WEST PLAINS WATER SYSTEM PLAN---P.F.=0.5---LOW NIGHT FLOWS

PIPE NO	--NODES-- FROM	TO	DIAM INCHES	LENGTH FEET	H-W C	FLOW US GPM	-VELOCITY- FT/SEC	CK	---HEADLOSS--- FT	FT/1000	CK
1	1	2	30.0	2950.0	120	10000.00	4.5		7.1	2.4	
2	2	3	30.0	7050.0	120	11945.87	5.4		23.7	3.4	
3	3	10	36.0	1350.0	120	10412.49	3.3		1.5	1.1	
4	7	2	24.0	9700.0	120	2600.87	1.8		5.8	.6	
5	3	4	24.0	7700.0	120	781.88	.6		.5	.1	
6	8	7	24.0	18300.0	120	6000.00	4.3		51.0	2.8	
7	7	6	24.0	11500.0	120	3010.63	2.1		8.9	.8	
8	6	5	18.0	10400.0	120	2340.63	3.0		20.6	2.0	
9	4	9	30.0	11000.0	120	1659.01	.8		1.0	.1	
10	5	4	30.0	6000.0	120	1513.13	.7		.4	.1	

WP006 WEST PLAINS WATER SYSTEM PLAN---P.F.=0.5---LOW NIGHT FLOWS

NODE	GROUND EL FEET	FLOW US GPM	HGL EL FEET	HEAD FEET	----------PRESSURE---------- PSI	CK	PCT DROP	CK
1	2260.0	10000.00	2539.3	279.3	121.	HI	-13.	
2	2300.0	-655.00	2532.2	232.2	101.	HI	-12.	
3	2390.0	-751.50	2508.5	118.5	51.		-1.	
4	2390.0	-636.00	2508.0	118.0	51.		-1.	
5	2390.0	-827.50	2508.4	118.4	51.		-1.	
6	2360.0	-670.00	2529.0	169.0	73.		-15.	
7	2290.0	-388.50	2537.9	247.9	107.	HI	-14.	
8	1700.0	6000.00	2589.0	889.0	385.	HI	-10.	
9	2507.0	-1659.01U	2507.0F	.0	0.	LO	0.	
10	2507.0	-10412.49U	2507.0F	.0	0.	LO	0.	

MAXIMUM UNBALANCED HEAD LOSS= .00001

APPENDIX B

Existing Water Systems Within Study Area Boundaries

WEST PLAINS FEASIBILITY STUDY==========CITY OF SPOKANE
EXISTING WATER SYSTEMS WITHIN STUDY AREA BOUNDARIES
SOURCE=======DSHS WATER FACILITIES INVENTORY, SPOKANE COUNTY, 1980.

==========CLASS 1==========
GEIGER HEIGHTS (CITY OF SPOKANE)

==========CLASS 2==========
BALMER GARDENS
FOUR LAKES WATER DISTRICT
GEIGER ARMS APARTMENTS
HILLTOP MOTEL & TRAILER COURT
MARSHALL COMMUNITY WATER ASSOCIATION
RUNKLES TRAILER COURT
SHADY PINES TRAILER COURT
SPANISH VILLAGE APARTMENTS
STARLIGHT MOTEL & MOTOR HOME PARK
VIETZKE VILLAGE
WESTSIDE CAFE

WEST PLAINS FEASIBILITY STUDY▪▪▪▪▪▪▪▪▪▪▪▪CITY OF SPOKANE
EXISTING WATER SYSTEMS WITHIN STUDY AREA BOUNDARIES
SOURCE▪▪▪▪▪▪▪DSHS WATER FACILITIES INVENTORY, SPOKANE COUNTY, 1980.

▪▪▪▪▪▪▪▪▪▪▪CLASS 3▪▪▪▪▪▪▪▪▪▪▪
ALLOY MANUFACTURING COMPANY
BELL MOTEL
BENSON MOTEL
BUNKERS ADDITION
CEDAR VILLAGE MOTEL
CHENEY SCHOOL DISTRICT #360-GARAGE
DIX STEEL
DOMPIER WATER
EMPIRE MACHINERY COMPANY
EVERGREEN VILLAGE MOTEL
FOX FARMS, INC.
HAYFORD COMMUNITY CHURCH
HIDDEN HILLS ESTATES
KINGS COMMUNITY CHURCH
KRAZZY ACRES MOTEL
LONGHORN BURGER STOP
MAPLE LEAF MOTEL
MEYERS PARK RESORT
OVERLAND STATION MOTEL AND RESTAURANT
R. A. PEARSON CO., INC.
RANCH MOTEL
ROWAND MACHINERY COMPANY
SLEEPY HOLLOW APARTMENTS
SPOKANE INTERNATIONAL AIRPORT
STRAGIER-WINDSOR GRANGE
SUN RUNNER MARINE
SUNSET CAMPGROUND
UPPER COLUMBIA CONFERENCE
WELK BROS. METAL PRODUCTS, INC.
WEST-END DRIVE IN
WINDSOR BAPTIST CHURCH

WEST PLAINS FEASIBILITY STUDY▪▪▪▪▪▪▪▪▪▪▪▪CITY OF SPOKANE
EXISTING WATER SYSTEMS WITHIN STUDY AREA BOUNDARIES
SOURCE▪▪▪▪▪▪▪DSHS WATER FACILITIES INVENTORY, SPOKANE COUNTY, 1980.

▪▪▪▪▪▪▪▪▪▪▪CLASS 4▪▪▪▪▪▪▪▪▪▪▪
BIG RED TRAILER COURT
CASE POWER AND EQUIPMENT
CENTRAL PRE-MIX
CUSTOM BUILDING SUPPLY, INC.
DIETZ & JOHNSON
DIKO, INC.
FAVRES VILLAGE
GARDEN SPRINGS CHURCH OF GOD
GARDEN SPRINGS GREENHOUSE
GEIGER FIELD MAINTENANCE
HEARTS WELDING & REPAIR
HI WAY TRAILER SERVICE
INDIAN CANYON STABLE
INLAND POWER & LIGHT-FOUR
INLAND POWER & LIGHT-SPRING
LAURALEE KENNELS
EUGENE LEHNERTZ
LINDELL WATER SYSTEM
MEAKIN COURT
MY GREEN HOUSE
NANSONS GREENHOUSE & NURSERY
OLIA MEADOWS MOBILE HOME PARK
OUR VILLA MOTEL
PAFFILE TRUCK LINES
PATTERSON ADDITION
ROGERS MOTEL
ROSEDALE GREENHOUSES
SALISBURY & DIETZ, INC.
SCAFCO CORPORATION
SPIRAL & RAILING HOUSE
SPOKANE COUNTY FIRE PROTECTION
SPOKANE VEGETABLE GROWERS
SUNSET APARTMENTS
SUNSET FLORIST & GREENHOUSE
THE PLACE-USDA
TYLER STORE
VALLEY OF THE HORSES
WOOD TRUSS STEEL BUILDINGS

APPENDIX C
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1963 Feasibility and Economic Justification Study

Report Objective

Investigate feasibility of extending City's water system to the southwest area including Geiger Field, Garden Springs, Windsor, Geiger Heights and Sunset Hills.

Major Elements

Reasons for the study design and costs.

Reasons

Geiger Heights' well has an inadequate water supply, 125 gpm pump is throttled down to 90 gpm. Many of the Garden Springs' wells have dried up. Fairchild Air Force Base has expressed concern over the critical position they would be in if their supply were cut off for any extended periods.

Design

30" main from 5th and Monroe, storage (steel reservoir) for booster stations at 17th and Milton, 8" line to Geiger Field, 18" and 30" mains use coal tar coated and asbestos wrapped steel pipe, and cast iron pipe for 12" and 8" mains.

Costs

Costs to provide service to Geiger Field, Fairchild Air Force Base, and Geiger Heights housing is 1,132,566. Military's share is $675,300, City of Spokane's share is $117,950, and Spokane International Airport's share is $339,282.

1973 Interim Report on Spokane Plains
Water Supply for Spokane County Washington

Report Objective

To perform engineering and economic feasibility studies to determine the optimum means of providing water to Cheney, Medical Lake and Spokane International Airport (171 square miles).

Major Elements

Potential water supplies, transmission systems, funding sources.

Water Supplies

Based on moderate population growth expected at 41,200 in study area by year 2000. Slow growth projected at 31,900, rapid growth at 72,250. Generalized land use plan in report differs from land use plan provided to Boyle by City Planning Department.

Report based water supply requirements on 500 gpcpd maximum water use.

Report uses 3 mgd for Spokane International Airport use for year 2000. Using the 7,000 acres of industrial development in Boyle's report divided into the 3 mgd results in 429 gallons per developed acre.

Identifies local wells, 17th and Milton station and Fort Wright as water sources. Good information on Fort Wright well specifications.

Four plans for developing sources of supply. All include Fort Wright wells and 17th and Milton boosters.

Transmission System

Concludes repumping required to serve ground above 2,500 feet within the study area.

Funding Sources

Grants-in-aid, bonded debt average unit costs are as follows.

	1975 Projected Water Sales			Potential Customer Units Included		
	Total $	Units ccf	Unit Cost cents/ccf	Total $	Units ccf	Unit Cost cents/ccf
Operating Expenses	207,000	2,392,800	8.7	220,000	2,920,000	7.5
Debt Service	488,000	2,392,800	20.3	488,000	2,920,000	16.7
Total	695,000	2,392,800	29.0	708,000	2,920,000	24.2

Date of Report
July 1974

FINAL REPORT ON SPOKANE PLAINS WATER SUPPLY FOR SPOKANE COUNTY, WASHINGTON

Report Objective

"Make engineering and economic feasibility studies as required to determine the optimum means to provide the study area with an adequate supply of water, suitable for public consumption." Provide cost estimates and options, means of financing, allocation of annual costs, and discuss methods to establish an authority to construct and operate the system.

Major Elements

Population, water supply requirements, water supply, revenue requirements.

Study Area

The study area extends from the Spokane River and the Spokane City Limits on the east, to west of Medical Lake. Deep Creek forms the northwest boundary and the southern most point is south of Cheney. The southwest boundary is Salnave Road and the southeast boundary is near Marshall Creek and the Union Pacific Railroad. Incorporated towns within the study area are Airway Heights, Cheney, Four Lakes, Medical Lake, and Fairchild Air Force Base. It also includes the unincorporated area of Geiger Heights. The rural areas outside the population centers are sparsely developed.

Population

The following population projections were made for the Spokane Plains area:

Year	Population
1973	23,600 (existing)
1975	24,700
2000	41,000 (moderate growth)
2000	72,000 (rapid growth)

From these figures the water requirements were established, based on a consumption of 500 gallons per capita per day maximum.

Facilities Plan

The report discusses the planning for phase development of the 171-

square mile Spokane Plains area for a 1973 to 2000 study period. The interim report included four plans for developing water in the area. Plan A required that new wells be developed near the former George Wright AFB and the installation of a 36-inch pipeline to ground storage near the Spokane International Airport. The 36-inch pipeline would have a capacity of 26 mgd. Combined with the existing 4 mgd capacity of the Fairchild AFB, the system would have a 30 mgd capacity, meeting the 27 mgd, year 2000, water demand.

Plan B suggested use of the Fairchild AFB wells combined with water purchased from the city. City water would be obtained at 17th and Milton through a 36-inch pipeline to the Spokane International Airport.

Plan C called for phased development of the George Wright wells, Fairchild AFB wells, and City water. Phase I required a 30 and 36-inch pipeline from the George Wright wells to SIA and a modification of the Fairchild AFB wells, providing an initial 20 mgd, meeting the 1975, 18 mgd requirement. A 30-inch pipeline would be built from 17th and Milton in Phase II, increasing the system capacity to 36 mgd meeting the year 2000, 27 mgd requirement.

In Phase I of Plan C-1, a 36-inch line would be built from the George Wright wells. Phase II required a 24-inch pipeline from 17th and Milton, increasing the system capacity to 39 mgd.

Plan A was recommended because it was the most cost effective, based on the available information. Total project cost would be $8,800,000 ($7,800,000 1973 dollars inflated to 1975 dollars).

The final report called for phased development of Plan A. In Phase I, water would be supplied to those who have "expressed intent to become part of a Utilities Local Improvement District (ULID)." Water, 10 mgd, would be supplied by a well adjacent to the Spokane River, meeting the initial requirements for 1975. Main storage and pumping facilities would be located at the intersection of Thorpe Road and Highway 10. Storage on Needham Hill, near Medville Road, should be built in Phase I, but could wait until Phase II. The well field and booster capacity would be increased to 16mgd in Phase II. To meet the 21 mgd required in the year 2000, Phase III is needed. The well field and booster capacities would be increased and additional water would be purchased from the City. A 2 mg storage tank would be constructed at 17th and Milton. Total first phase project costs would be $6,350,000.

1975 Geology Groundwater and Water Quality
of Part of Southern Spokane County, Washington

Report Objectives

Investigate geohydrological conditions in 290 square miles of the Marshall and Hangman Creek drainage basins. The southern half of the West Plains study area is included in this study.

Major Elements

Geology and groundwater resources, water quality.

Geology and Groundwater

Annual precipitation is 17 inches. Approximately 0.47 inches reaches the aquifer, the remainder is lost from the area through surface runoff or evapotranspiration. Annual recharge to bedrock is estimated at 3 acre feet per square mile; to the sediments 22 acre feet per square mile. Recharge (6,187 acre feet per year) exceeds withdrawals (5,000 acre feet per year).

Water Quality

There were more shallow wells in the area that tested positive for total coliform (41%) than deep wells (19%) and that tested positive for Pseudomonas (78%) than deep wells (55%). "Presence of total coliform and Pseudomonas in well water may indicate potential fecal pollution in the future."

1976 U. S. Army Corps of Engineers
Metropolitan Spokane Region Water Resources Study
Technical Report

Report Objective

To prepare a planning report on water resource management for the 2,295 square miles drained by the Spokane River and its tributaries within the State of Washington. Twelve other reports (1 summary report and 11 appendices) were prepared for the study.

Major Elements

Water, Wastewater and flood control. These are summarized for West Plains as follows:

Summary of All Elements

Four plans identified: treatment at the Spokane Wastewater Plant, land application, separate tertiary treatment and stream bed disposal, separate secondary treatment and disposal to Spokane River. Technical report recommends treatment at sewage treatment plant.

Water systems for West Plains per se are not discussed. Report does show SIA average daily demand of 0.46 mgd, peak day demand of 0.65 mgd, maximum 7 day demand of 3.5 mgd and total annual demand of 168 mgd.

1976 EIS on Spokane Plains Water Supply Project

Report Objective

To identify the environmental impacts of supplying water to a 171 square mile area in western Spokane.

Major Elements

Proposed action and project impacts.

Proposed Action

Supply water to Cheney, Medical Lake and Spokane International Airport from the 17th and Milton Street booster station. A 30-inch line (16 mgd capacity), 2 mg reservoir near SIA and another 2 mg reservoir near the center of the transmission system to control pressure and pumps at Spokane International Airport pump station are suggestions for the proposed action.

Additional summary discussion of system is included in the report, including eight alternate pipeline segments.

Impacts

Traffic disruption, fugitive dust, noise increases, vegetation removal, aesthetic degradation, soil profile destruction and soil compaction, all occurring during or due to construction.

1978 Project Narrative for Spokane Plains
Water Supply and Wastewater Disposal Project

Report Objective

Discuss reasons for the development of West Plains Study Area. Study area differs from Boyle's study area.

Major Elements

Growth in West Plains and Construction Constraints costs.

Growth/Constraints

"Total preliminary industrial development plans project new jobs for 10 to 18,000 people." Industry interest includes a major food processor, 500 acres acquired by a major utility company. Major industry has also been discouraged for lack of water. Not so much for processing, but for fire suppression.

Construction Costs

Total cost for water and sewer estimated at $24,296,000.00.

1978 SIA Industrial Park Master Plan

Report Objective

To develop a plan for areas adjacent to the Spokane International Airport. Report done for the County.

Major Elements

SIA park existing conditions

SIA park development plan

SIA management and implementation plan

Existing Conditions

East Industrial Park: poor road conditions; some salvageable existing structures. West Industrial Park: no road system or utilities. Burlington Northern railroad parallels the park along its north boundary. 2000 gpm disparity between water pumped and water used at SIA.

Development Plan

East Industrial Park: light industrial administrative and airline support. West Industrial Park: heavy industrial, integrate East and West Industrial park water systems. Construct 0.5 mg reservoir in West Industrial Park. Two million gallons of water storage is considered adequate in this report for ultimate development of the Industrial Park.

Implementation Plan

Four phases. Costs for each phase are as follows:

	East Industrial Park	West Industrial Park
I	$ 9,306,000	$ 308,000
II	1,738,000	517,000
III*	3,047,000	3,069,000
IV	1,199,000	1,155,000
Subtotal	$15,290,000	$5,049,000
Total	$20,339,000	

*0.5 mg water storage in West Industrial Park, system integration.

1978 R.W. Beck Report on Interim Management Objectives and Policies for Water and Wastewater Utility Service

Report Objectives

Development of interim policies for providing water and wastewater services for growth areas of the County.

Major Elements

Policies for providing water and wastewater service areas for the County. This report treats areas under the jurisdiction of the County. The West Plains area is being planned by the City so there does not appear to be any obvious significant and relative elements in this report.

1979 Spokane County Overall Economic Development Plan

Report Objective

To serve as one vehicle for meeting the legal requirement for Economic Development Administration funding of public works and business development projects.

Major Elements

Description of study area (metro-Spokane), priority lists for development projects, and description of priority projects. The following describes the West Plains Water and Sewer Project.

West Plains Water and Sewer Project

Recognizes the Black and Veatch water project for West Plains with a 1979 cost of approximately $12 million. Recognizes Corps of Engineers study identifying the present sewage treatment plant as the best alternative of treating the area's sewage and assigns a cost of $18 million for this, for a total of $30 million.

The report summarized the industrial situation for the study area as follows:

Industries which have indicated an interest in locating in the West Plains area have not done so because of the water problem. A major food processor at one time was looking seriously at Cheney, but drew away because of the lack of water. More recently, a high water using industry rejected locating in the west because of the inability to project an adequate and continuing supply of water. The industries which are currently located in the area are using wells which will not provide the necessary pressure and capacity for the fire flow required by insurance companies. This, of course, raises their premiums substantially. On this count alone, many decide to locate elsewhere.

That part of the West Plains area in the vicinity of Spokane is poised waiting for water to open up development. An industrial park at the airport is currently under study. One of the major utility companies has acquired over 500 acres for industrial development when (or if) water becomes available.

1979 Fringe Area Comprehensive Plan Study
Synopsis of Citizen Participation

Summary

Lists responses to issues/questions asked the public during public meetings, newspaper questionnaire and television Call-In Question Answer show. Questions covered development in the Fringe Area portion of the County. Most frequently discussed issues are as follows:

Issue: Should fill-in of existing unincorporated urban areas be incorporated?

Responses: "Encourage fill-in development to facilitate the establishment of services, including sewers, but only if the development is in compliance with a comprehensive plan and proper zoning which maintains the character of the area."

"Fill-in of vacant urban areas should not be encouraged. Let it occur as property owners decide to sell or develop their lands."

Issue: Should a variety of lifestyles from rural to urban densities be planned for the fringe area?

Responses: "We recommend a semi-rural lifestyle with a minimum of two acres for building."

"A comprehensive long-range plan should be made through public participation to provide a variety of lifestyles in specified fringe areas ranging from agricultural to high density urban with adequate separation to insure their compatibility and have same substantial permanence to withstand modification."

"Urban living should be limited to the small village areas already existing. Suburban growth and industry should be discouraged except very close to urban areas. Existing rural areas should be preserved by controlling density to no less than five acre parcels."

Issue: Who should pay for the initial establishment and maintenance of public facilities and services (such as streets, transit, sewer, water, parks, and schools)?

Responses: "Land developers should pay to establish new public facilities and services while local government should pay to maintain them. Late-comers should pay a portion of the cost for installed facilities, but distribution of costs should be planned for at the time of initial development whether utilities are installed then or at a later date. Property for parks should be set aside by the developer or a 'fee in lieu of dedication'."

"To defray additional County costs for schools, streets, parks, etc., a small sales tax for everyone, not just property owners or business."

Issue: Should coordination of comprehensive planning and implementation programs for the mutual benefit of the fringe area be continued and intensified by the County and the City?

Responses: "Coordination should be continued and intensified with a qualified neutral mediator introduced to deal with specific problem areas."

"Coordination of comprehensive planning and implementation programs for the fringe area should be continued and intensified among intra and inter governmental units, including planning, utilities, transportation, engineering, etc."

"The City and the County should pursue planning and implementation programs independently."

Issue: Should annexation of existing potential industrial, commercial, urban and suburban residential areas in the fringe area be encouraged by the County and the City?

Responses: "Annexation in the fringe areas should be encouraged. A city has to grow. The logical and necessary area is the fringe."

"Before annexations are aggressively encouraged, concentrate on 'fill-in' development and redevelopment through rehabilitation of older decaying areas where urban facilities and services are already in existence."

"Let local property owners and businesses initiate and stimulate annexations, with the cooperation of the City and County government. We encourage the use of a comprehensive plan."

1979 Fringe Area Comprehensive Plan Study
Technical Report

Report Objective

Establish framework to guide development of comprehensive plan for urbanizing areas of Spokane County.

Major Elements

Land use, transportation, community facilities, goals and policies.

Land Use Summary

Eight subareas. Study area is included in subarea 1 entitled West Suburban. West Suburban consists of 50,261 gross acres, 2,860 housing units, and an average gross density of 0.06 housing units per acre.

Transportation Summary

Nine transportation corridors identified for the County. The two major corridors run north and east. A freeway corridor and a minor corridor extend southwest and west, respectively, through the study area.

Facilities Summary

"Growth has been hampered in the west suburban area because of a general lack of water." The 1974 Black & Veatch water study is identified as source for water services and construction costs. "However, funding is not presently available, and without it, the opportunity for growth in this area will remain limited."

Critical water supply service area (CWSSA) study is now being undertaken pursuant to the Water System Coordination Act passed by State Legislature in 1977. Purpose is to identify efficient public water system planning for areas in the County. Act also seeks to establish minimum fine flow standards. The study area is in critical water planning area No. 4.

Per household tax revenues higher in County than City, are both currently experiencing downward trends, due to the other funding sources." In general, expenditures are increasing at a faster rate than local revenues, and Federal and State funding is playing an increasingly important role in local fiscal management.

Goals, Objectives, Issues & Policies

6 goals, 32 objectives, 26 issues, 44 policies. Goals include; providing new locations for desirable industries, developing new land use patterns which provide for orderly growth, and striving to conserve existing and future energy resources.

Four pertinent major policies are Nos. 18, 19, 20 and 21. These are as follows:

Policy No. 18: The County shall encourage existing and potential contiguous industrial, commercial, and urban residential development to annex to the City and obtain urban services.

Explanation:
Spokane County is more limited than the City by state statue for the provision of the public services necessitated by intense urban development. A main purpose of municipal government is to provide necessary public services for urban development. Spokane City has the capacity and the capabilities to provide such services to existing and future development. In addition, due to the current governmental structure and facilities base, the City generally can provide urban services in a more cost-effective manner.

Policy No. 19: The proponent of new development will bear the responsibility, including costs, for the initial establishment of community facilities and services such as streets, sewer, water, parks, and school sites. The general public, through municipal, county, special purpose governments, and municipal enterprise programs, will have the responsibility for maintenance of such facilities.

Policy No. 20: Existing development will pay the initial cost of establishing any additional public services and facilities necessary to assure non-degradation of the environment, maintain the public health, and assure the safety and security of the population.

Explanation:
These policies are oriented toward the equitable distribution of cost in relation to the benefits of public services necessary to maintain the health, safety, and welfare of the general public. That is, those people creating the need for the provision of public services should bear the financial responsibility for establishing the needed facilities rather than assessing such costs to the general public. While, as stated in Policy Number 19, the proponent of new development will bear such responsibility, the real cost will likely be passed to the eventual owners of the property.

Policy No. 21: The City and the County, utilizing the water system coordination act, will oversee the orderly and sound development of local water districts.

Explanation:
Because of the proliferation of water districts and purveyors, confusion over service area boundaries, and differences in standards, a mechanism was needed to coordinate water provision in order to assure this resource is provided effectively and efficiently.

1979 Fringe Area Comprehensive Plan Study
Final Report

Report Objective

Recommends policy guidelines and feasible land uses based on the Technical Report and Citizen Participation Report.

Major Elements

Recommendations.

Recommendations

These are in the form of responses to 12 questions/issues discussed at public meetings. Recommendations more pertinent to the study area include:

- Encourage growth in selected portions of "Fringe Area".
- Encourage proper industrial growth, located to: protect the aquifer, be accessible to existing transportation facilities.
- Include energy effluent patterns and alternate energy sources in guiding growth.
- Growth in the fringe area should be managed by controlling the provision of public services and utilities.
- City and County should coordinate on utility provisions.
- Annexation should be initiated and stimulated by local property owners and businesses, except where it is clearly in the best interest of the general population for the City or County to do so.

1979 Goals and Policies to Update the Land Use Plan

Report Objective

To provide a foundation for updating the land use element of the City's Comprehensive Plan.

Major Elements

City growth and annexation, residential land use, commercial land use, industrial land use, parks and open space, and transportation. City growth and annexation and industrial land use is characterized below.

City Growth and Annexation

Actively pursue annexation of periphery to accommodate growth, encourage enactment of favorable urban annexation legislation. Industry and local business should be situated convenient to residential areas. RCW 35.13.177 gives cities authority to plan areas that are reasonably expected to be annexed.

Industrial Land Use

Assembly and development of industrial land should be considered using the Land Bank and Development Corporation, industrial development revenue bond financing and tax increment financing. Cluster industry around common transportation needs. A 1976 study by Economic Research Associates projected a demand for 284 additional acres of industrial land in Spokane County by the year 2020. City has adopted a policy of one-step permitting procedure for industry on February 12, 1979.

1979 201 Spokane County Comprehensive Wastewater Management Plan (CWMP)
201 Review Committee Information Package

Report Objective

To explain objectives of the County's Comprehensive Wastewater Management Plan and role of the 201 Review Committee.

Major Elements

Summaries of other plans and studies in the Critical Water Supply Service Area (CWSSA) which coincides with the boundaries for Spokane County Co-ordinated Water System Plan (CWSP).

Plan Summaries

Eight summaries including:

- 208 Study
- City of Spokane Facilities Plan
- North Spokane Facilities Plan
- Liberty Lake Facilities Plan
- West Plains
- Newman Lake
- Spokane Valley
- Moran Prairie

The West Plains Study recommended a sewer to the Spokane Wastewater Treatment Plant with Phase I connecting to Airway Heights and Phase II connecting to Fairchild Air Force Base and Medical Lake. Cost estimated at $14.054 million dollars at ENR 2680.

1979 Economic & Engineering Services
Spokane County Coordinated Water System Plan

Report Objective

Develop administrative and management systems that are necessary to coordinate issues related to urban growth with water utility service so water demands can be met. Area of study is the CWSSA (Critical Water Supply Service Area), subdivided into four areas.

Major Elements

Water service areas, findings on plans to serve CWSSA's. A summary on findings for the West Plains study area is found below.

Findings

A major portion of the CWSSA #4 known as the West Plains has been designated as the future service area of the City of Spokane. The County's General Water Plan needs to be amended by the County or the City in accordance with the City's Plan.

1979 Comparison of City and County Plans for West Plains Report #1

Report Objective

Study City and County plans to recommend measures for reconciling differences between the plans to allow fiscal impact analysis to proceed. Study included 18,000 acres.

Major Elements

Differences in the plans.

Plan Differences

Overall observation of commercial planning consultants is that the West Plains appears to be the one location in the study area which meets the needs for new industry. Study also summarizes the Industrial Airport Plan, the 1980 City Plan and the Fringe Area Study for the area. The land use sketch plan does not agree totally with the City's projected land use for the study area.

Fringe area study has been accepted by City but has not been adopted by the County. Report states that the County Commissioners do not agree that the City can provide services to urban areas best; the County does not wish to provide services solely to rural areas.

Report also shows discrepancies between the City's and County's plan for West Plains. There are also discrepancies between both of these plans and the projected land use plan supplied to Boyle by the City Planning Department for use in the report.

Date of Report
April 1980

CITY AND COUNTY OF SPOKANE ANNEXATION OF THE WEST SPOKANE PLAINS AREA BY THE CITY

Fiscal Impact Analysis

Report Objective

The City of Spokane is proposing to annex the West Plains area. As a result, the report was done to "clarify the total fiscal impacts of City and County domains for the West Spokane area." Based on this fiscal analysis a recommendation would be made as to whether or not the City should annex the area.

Major Elements

Population projection, economic/demographic assumptions, fiscal forecasting assumptions, expenditures, revenue requirements.

Analysis

Both the City of Spokane and Spokane County favor development of the West Plains area. Increased development would provide a larger tax base for either government. Previous studies indicated that extending services to the area would increase the industrial growth. As a result, the County established the following zones for development*:

Industrial - along Highway 2 and between I-90 and the airport
Commercial - at freeway interchanges
Urban Residential - south of I-90
Semi-Rural - northeast and southwest of airport
Rural - north, west, and south of industrial area

The report discussed the financial effects of annexing the West Plains area to the City of Spokane. To effectively do this, three assumptions were made. First, it was assumed that annexation would not be implemented and no services would be extended to the area. Analysis under this assumption established a baseline to compare other assumptions with. A second analysis was made assuming that annexation would be implemented and City services would be extended to the area. Finally, a supplemental analysis was done assuming that the County would provide water and sewer service to the area.

* Appendix I of the report defines these land uses.

Projections were made from the above assumptions, through the year 1990. It was assumed that a recession would occur in 1980, with a slow recovery in 1981. Inflation was included in the projections since the inflation rate differed for separate considerations. The following items were included in the projection figures:

- Required levels of service from each service agency
- Cost of providing service at the required levels
- Property tax revenue requirements
- Surpluses or deficits after the provision for maximum property tax levies

In finding a base for these projections it was determined that the City's revenue sources are lower risk than the County's. The City generates 72% of its own revenue where the County only generates 31%.

The completed projections provided an economic basis to analize the annexation question. Any projection has limitations. A section describes these limitations. One critical assumption was that the City's current service-delivery rates would be maintained. Other critical assumptions were economic circumstances, capital spending projects, availability of state or federal funds, and the legal limits on annual increases in property taxes.

From the projections it was determined that annexation of the West Plains area would increase the deficits of both the City and the County. Although the deficits would increase, the increase would be insignificant. Annexation would be affordable to the City, but high capital expenditures would initially be required. Expenditures from 1981 to 1985 would be approximately $13,816,000. To provide water service, roads, fire protection, and other City services to the area would be the primary source of costs for these expenditures, but this could be offset by a higher property base.

No fiscal reasons could be found for the County to object to the City annexation. The County is currently in trouble because of increasing deficits. Annexation would add negligibly to the revenue requirements and long term effects would be less significant. The report recommended that a County-owned utility should not be established, primarily due to the strain on the County budget from capital expenditures.

The final recommendation was to annex the West Plains area to the City of Spokane. Industrial development could be promoted by the City, but the annexation would probably not result in budget surpluses.

1980 Critical Water Service Supply Area

These maps delineate boundaries for water service supply areas and water districts in the County. Several of these maps were used to identify water district boundaries within the study area.

1980 Comprehensive Wastewater Management Plan
Phase II Report

Report Objective

To document future wastewater service needs in Spokane County. Study area differs from Boyle's study area.

Major Elements

Population forecasts, wastewater flow forecasts, existing sewer system capacities.

Population Forecast for West Plains

Shows population growth from a year 1980 base of 2,608 to a year 2020 base of 5,084 or a 2.3% average annual growth. Our report shows 9,340 people in the year 2000 from 6,670 in 1980 for an average annual growth rate of 2.0 percent.

Wastewater Flow Forecast

Shows 1980 average dry weather flow for West Plains of 0.23 mgd and 1980 peak wet weather flow of 0.79 mgd and year 2000 average dry weather flow of 0.33 mgd and peak wet weather flow of 1.10 mgd.

Existing Sewer System Capacities

Consists of one table. Data from this table was used to construct Table 9 in the report. Existing airport has excessive infiltration through Spring Creek. Report also identifies the West Grove trunk line as a potential location to handle interim capacity for the West Plains area. Other valuable information on potential tie-ins of the City line to the West Plains area.