COMPREHENSIVE PLAN, 1989–2010

FOR

THE CITY OF PLAINVIEW, TEXAS

VOLUME 2

OCTOBER 1989

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INTRODUCTION

The protection of the City's population from the hazards and inconvenience associated with storm water runoff, both present and future, depends upon the provision of adequate drainage facilities. The public has come to expect that no damage will result to property from storm drainage or high water, and gives no thought to the location of neighborhoods in relation to ground elevation drainage flows, etc., all of which directly affect the surface storm drainage immediately adjacent to homes or business structures. Storm drainage facilities required for a city may include inlets, storm sewers, culverts, bridges, concrete lined channels, natural drainage channels, overflow swales, creeks, rivers, and lakes.

A storm drainage system plan is provided as a guide for flood control and the improvement of drainage facilities in an economical manner. It is the purpose of this report to present short range and long range plans for the development and construction of facilities to meet the needs of the growing population and to make recommendations concerning the implementation of these plans. It should be noted that any plan is subject to change with changing economic and growth conditions, and frequent evaluations should be made in order to prevent the plan from being outdated. Revisions, additions, and deletions should be made as conditions warrant. The City Planning and Zoning Commission should be concerned with the proper relationship of proposed drainage facilities to the Thoroughfare Plan and to the Land Use Plan.

Previous studies conducted for the City of Plainview and referenced for this report include:

Koch, Fowler, and Grafe, Incorporated, "Plainview Comprehensive Plan Report 5, Utilities", 1961.

Fowler and Grafe, Incorporated, "1985 Plainview Comprehensive Plan", 1963.

Chevalier and Musiak, "Running Water Draw Regional Park, Development Plan and Report", 1967.

Parkhill, Smith, and Cooper, Incorporated, "Storm Drainage Study", 1974.

U.S. Army Corps of Engineers, Fort Worth District, "Brazos River Basin, Texas, Running Water Draw Local Flood Protection, Plainview, Texas, Design Memorandum No.1, General Phase I - Plan Formulation", 1977.

U.S. Army Corps of Engineers, Fort Worth District "Brazos River Basin, Texas, Running Water Draw Local Flood Protection, Plainview, Texas, Environmental Impact Statement", 1977.

Parkhill, Smith, and Cooper, Incorporated, "Community Development Drainage Study", 1979

STORM DRAINAGE PLANNING

The cost of correction to drainage problems by underground storm sewers and inlets is considerable, and could in some cases require additional right-of-way. The complexity of the drainage facilities increase greatly as larger areas within the region are covered. Small local areas will develop and ultimately cover regional drainage basins. The drainage systems must be properly coordinated into the overall plan for the entire city. This will prevent improper designing, or delays in development. If the drainage systems are under designed, money is wasted through maintenance repair cost and flood damage will occur due to inadequate drainage structures. The complete replacement of an inadequate system may then be required.

To properly plan the drainage system, consideration must be given to evaluate the future development patterns which may occur upstream from the project location. A change in land use can result in a change of storm runoff, increasing volumes and times of concentration up to two hundred percent in some cases.

HYDROLOGY

The quantity of storm water that will fall upon and run off of any given area is unknown and must be estimated. Estimates are based upon past historical experience which is recorded in the form of rainfall and stream flow records. The "Rational Method" is one of the most accepted and widely used procedure to determine storm water runoff for small to moderately sized drainage areas. The Rational Method will be used in this report to determine expected stream flows. Storm water flows in large streams and their tributaries are sometimes measured by gauging stations. These stations then record the actual storm water flow behavioral patterns.

Over very small areas, storms of major proportion may cause very little damage. Minor inconvenience can be expected from ponding on lawns and in the streets. The accumulated runoff from many small areas contributing to a major stream or playa lake can result in a major flood creating severe damage. For this reason, channels and structures located on larger streams must be designed to pass the greatest anticipated storm flow to be expected with a tolerable amount of damage. It is physically possible to provide drainage ways to accommodate, without overflowing, any size storm that could reasonably be expected to occur; however, it is not usually economically feasible to do so.

The risk of flood loss must be weighed against the cost of providing flood protection. Proper zoning and restriction of building within flood plains can substantially reduce expected flood loss along major streams. When considering smaller drainage areas, the cost of providing facilities for storms of extreme proportion becomes relatively large, while the possibility of intolerable loss becomes relatively smaller. For this reason it is usual and logical that drainage structures for smaller areas are designed with lower standards of protection than those applied in the design for larger areas.

The period of time in which a storm of known proportion will probably reoccur is referred to as a storm frequency. Storms of major proportion such as "100 year", "50 year" or some other time period does not mean that a storm of that proportion would not reoccur within 100 years, 50 years or whatever the time period may be. Two "100 year" storms could occur a week or a year apart or several could occur in a relatively short period, though the probability of their reoccurrence is remote. The meaning of the frequency designation for storm or floods would be better understood if expressed in terms of <u>probability</u>. That is, the chances are one in 100 that a storm of 100 years intensity (or greater) will occur in any given year. Similarly, the chances are one in 50 that a storm of 50 year or greater intensity will occur, or one in 25 that a storm of 25 year or greater intensity will occur. The probability is 1% (1 in 100) that a 100 year frequency storm will occur in any given year. On the other hand, the probability is 37% that there could be no 100 year storm in the 100 year period; or, the probability is 63% that there will be at least one. The procedures by which such figures as these are deduced from the study of past rainfall or stream flow records are those of statistical analysis. These procedures establish, from a study of random events which have happened in the past, the probability that similar events can be expected to happen in the future.

The following storm frequencies used as the basis of design in this report have been arrived at for the City of Plainview:

<u>Storm Drainage Facilities</u>	<u>Design Frequency</u>
Channel improvements and drainage structures for Running Water Draw	100 year
Channel improvements and drainage structures secondary tributaries	25-50 year with emergency 100 year overflow
Storm sewer system	10 year with emergency 100 year overflow
Storm sewer systems at low point or sag	25 year with 100 year overflow

The rate of intensity in which rainfall occurs is a major factor in determining the amount of storm water runoff. The intensity is expressed as the total accumulation of rainfall persisting at the same intensity for one hour. Rainfall of high intensity and lengthy time of duration occur at infrequent intervals. Rainfall intensity curves have been prepared from statistical studies of rainfall records and show the frequency in which a rainfall of a given intensity and duration may be expected to occur. These curves indicate decreasing rainfall rates with increasing time of duration and high rates of rainfall falling for short periods of time. Rainfall intensity data for the city of Plainview area is available from statistical data developed by the Texas Highway Department and the Weather bureau.

The time of concentration used in this report is defined as the time of flow from the most remote point of the watershed to the point at which the runoff is estimated. The two components comprising the time of concentration are the inlet time and the time required for the water to flow through the pipe or channel to the point of consideration. The inlet time includes the time required to saturate the soil to the point runoff will occur and the runoff time to the inlet. The land use for a particular area has a great influence on the velocity of the rainfall runoff before it reaches a street gutter or storm sewer. The runoff will travel several times as fast across a paved parking lot as it will across a well turfed lawn. In municipal areas the inlet time is seldom less than five minutes or more than twenty minutes. The inlet time is about five minutes for property zoned multiple family, retail, commercial or industrial. For property zoned for parks, school, single-family residential and duplex a ten minute inlet time is acceptable. The time of concentration is affected by the slope of the land, the amount of vegetation retarding flow , and the straightness of flow path. The following velocities are used in determination of the time of concentration:

Street Gutters	3 to 5 feet per second
Storm Sewers	6 to 10 feet per second
Open Channels (Sodded)	6 to 8 feet per second
Open Channels (Lined)	10 to 15 feet per second

For the design of a particular storm drainage facility, actual velocities should be estimated from known slopes of the pipe conduit, gutter, or channel. Runoff from rainfall occurs after all cracks and surface depressions of impervious areas are filled and the upper layers of exposed soil become saturated. The characteristics of the various surfaces and the degree of their imperviousness determines the ratio of runoff to rainfall which is quantified as the "Runoff Coefficient". The runoff coefficient, represented by "C" in the Rational Method formula, varies from almost total imperviousness on building roofs, parking lots and paved streets to 80% absorption on flat, sandy, turfed lawns. Normally, the type of land use determines the grouping for the runoff coefficient. Different soils exhibit different porosities. The absorption rate of a dense clay soil is several times less than a deep sandy soil. Dense vegetation retards runoff until it can be absorbed into the ground. Steep sloping land drains readily while flat land holds water in place. The runoff coefficient "C", is expressed as the percentage of rainfall which appears as runoff, and is defined for the appropriate land use as follows:

Commercial	0.80
Industrial	0.70
Local Business	0.60
Single Family Residential	0.50
Apartment	0.70
Park Areas	0.30
Undeveloped	0.20

RATIONAL METHOD

The Rational Method of calculating rainfall runoff is expressed as the formula:

$$Q = CIA$$

Where... Q = Storm flow in cubic feet per second (cfs)
C = Rainfall runoff coefficient
I = Intensity of rainfall in inches per hour
A = Drainage area in acres

Use of the Rational Method formula requires experience and judgment in the selection of values for the factors of rainfall intensity and the runoff coefficients. Weighted averages of various types of land use must be used to accurately estimate a suitable runoff coefficient (C) for a watershed area (A). The value of the factor for rainfall intensity (I) is determined by establishing the time of concentration which should be done with as much care as possible since the shorter time of concentration, the higher the intensity. With the selection of the "C" and "I" on a known watershed area "A", the quantity of storm flow "Q" is determined. The size of drainage structures can then be calculated to carry the known quantity of storm water runoff.

UNIT HYDROGRAPH METHOD

The Unit Hydrograph Method of calculating rainfall runoff uses past rainfall and stream flow data of an isolated storm. Reasonable uniform rainfall intensity is then developed to construct a unit hydrograph for a particular drainage area. Two identical storms over the same drainage area under identical conditions would be expected to have the same relationship of discharge versus time, or hydrograph of runoff. A unit hydrograph is the graph of a one (1) inch rainfall resulting from a storm of specific duration and drainage area, and it is from this hydrograph that the runoff from a storm of a particular duration and pattern can be predicted.

SEDIMENTATION

One of the major problems, and possibly one of the most frequently overlooked problems, associated with the urbanization of a rural watershed is the sedimentation resulting from erosion of exposed land incurred during the development period and the sedimentation resulting thereafter.

Erosion and subsequent sedimentation can be controlled within reasonable limits. The Department of Agriculture, and particularly the Soil Conservation Service, have for years developed expertise in the control of erosion and subsequent sedimentation as related to agricultural practices. It has only been within recent years that municipalities have given attention to the control of sedimentation as a result of urbanization.

Recommended principles to provide effective sediment control include:

1. The smallest practical area of land will be exposed at any one time during development.
2. When land is exposed, the exposure will be kept to the shortest practical period of time.
3. Temporary vegetation and/or mulching can be used to protect critical areas exposed during development.
4. Sediment basins should be installed and maintained to remove sediment from runoff waters for land undergoing development.
5. Provisions should be made to safely convey the increased runoff caused by changed soil and surface conditions.
6. Permanent vegetation should be established and erosion control structures should be installed in new unlined channels as soon as practical.
7. Any development plans should be fitted to the topography and soils so as to create the least erosion potential.
8. Whenever possible, natural vegetation should be retained and protected.

POLLUTION OF STORM WATER RUNOFF

An increasing problem today's cities are now being faced with is pollution from storm water runoff from urban areas. Principal investigations have been made by the U.S. Department of the Interior, Federal Water Quality Administration, and the Environmental Protection Agency.

Some of the above mentioned investigations concluded that the largest portion of runoff pollutants in urban areas resulted from the washout of materials deposited on impervious areas and drainage channel erosion. The degree to which such problems are pollution producing depends on geographic conditions and the extent of local development. In residential areas for example, the pollution produced per unit area increases with population density and/or the number of developed parcels.

The most obvious approach to the control of dispersed pollutants is the reduction of quantity and rate of runoff. Environmental policy in the form of regulations, procedures and performance standards is another common method of control. The City should provide open storage and drainage regulations for commercial and industrial areas, along with reliable street maintenance.

MANNING'S EQUATION

Manning's Equation can be utilized for the design of storm sewer conduit and open channels, and is defined as follows:

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$$

where

Q = discharge in cubic feet per second;
A = cross-sectional area of flow in square feet;
R = hydraulic radius in feet;
S = slope of the hydraulic gradient in feet per foot;
n = coefficient of roughness (n = 0.013 for new reinforced concrete pipe);

and $Q = AV$

where

Q = discharge in cubic feet per second;
A = cross-sectional area of flow in square feet;
V = velocity in feet per second

The factors of the formula are determined by the slope available, the estimated discharge, and the type and size of improvement to be used. The coefficient of roughness, or value of "n", depends upon the roughness of the material forming the pipe, bed or banks of the channel, irregularities and imperfections in the bed or banks, the vegetation along the channel, and various other considerations. Allowances must be made in the selection of "n" to allow for weed and tree growth or any maintenance problems which may occur. The assigning of a value of "n" for a proposed conduit is subject to considerable uncertainty as small differences in conditions of apparent minor importance may cause a change in the carrying capacity of a conduit. The value of "n" for the various types of conduit are given in the Table 7-1.

STORM DRAINAGE FACILITY STANDARDS

Any drainage project should be the subject of detailed design analysis, working within the framework of the City's engineering design criteria and ordinances. The recommendations in this report are based on standard practices for drainage system design.

Streets and Inlets

During the design storm, the quantity of storm water that is allowed to collect in the streets before being intercepted by a storm drainage system is referred to as the "spread of water". In determining the limitations for carrying storm water in the street, the ultimate development of the street shall be considered. Storm sewer inlets should be provided along streets at such intervals as are necessary to limit the depth of flow as follows:

TABLE 7-1

MANNING'S ROUGHNESS COEFFICIENTS (n)*

NATURAL STREAM CHANNELS	Min.	Max.
STREAMS		
A. Fairly regular section		
1. Some grass and weeds; little or no brush	0.030	0.035
2. Dense growth of weeds, depth of flow materially greater than weed height	0.035	0.050
3. Some weeds, light brush on banks	0.035	0.050
4. Some weeds, heavy brush on banks	0.050	0.070
5. Some weeds, dense willows on banks	0.060	0.080
6. For trees within channels with branches submerged at high stage, increase all values by	0.010	0.020
B. Irregular section with pools, slight channel meander, use 1A to 5A above, and increase all values by	0.010	0.020
FLOOD PLAIN (adjacent to natural streams)		
A. Pasture, no brush		
1. Short grass	0.030	0.035
2. Tall grass	0.035	0.050
B. Heavy weeds, scattered brush	0.050	0.070
C. Wooded	0.120	0.160
LINED CHANNELS		
1. Metal corrugated	0.021	0.024
2. Neat cement lined	0.012	0.018
3. Concrete	0.012	0.018
4. Cement rubble	0.017	0.030
GRASS COVERED SMALL CHANNELS, SHALLOW DEPTH		
1. No rank growth	0.035	0.045
2. Rank growth	0.040	0.050
UNLINED CHANNELS		
1. Earth, straight and uniform	0.017	0.025
2. Dredged	0.025	0.033
3. Winding and sluggish	0.022	0.030
4. Earth bottom, rubble sides	0.028	0.035
5. Grass cover; little or no brush	0.030	0.035

*n values taken from Handbook of Hydraulics, H.W. Kin

TABLE 7-1 (Cont.)

MANNING'S ROUGHNESS COEFFICIENTS (n)*

PIPE

		Max.	Min.
1.	Cast iron, coated	0.010	0.014
2.	Cast iron, uncoated	0.011	0.015
3.	Steel, corrugated	0.021	0.024
4.	Concrete	0.010	0.017
5.	Vitrified sewer pipe	0.010	0.017

*n values taken from Handbook of Hydraulics, H.W. King

Major Thoroughfares	-	One traffic lane in each direction to remain clear.
Collector Thoroughfare	-	One moving lane to remain clear.
Residential Streets	-	Six (6) inch depth of flow at curb, or no lanes completely clear.

The above recommendations are subject to local conditions and economic feasibility.

All curb inlets should be no less than eight (8) feet in opening width and grate inlets in streets are not recommended except in locations of restricted right-of-way. Ideally, inlets are located near street intersections at high point curb returns.

Storm Sewer Pipe and Culverts

The size and location of storm sewer conduits and culverts should be determined by a final design based upon a more detailed investigation of the area. It is recommended that the minimum size storm sewer or culvert be 18" in diameter. Generally, a smaller pipe will not carry sufficient water to relieve the street section of its flow. On the other hand, systems requiring a pipe larger than 54" in diameter is often more expensive than a lined channel. In the design of the storm sewer system, the elevation of the hydraulic gradient of the storm sewer should be a minimum of 1.5 feet below the elevation of the adjacent street gutter. Storm sewer pipe sizes should be so selected that the average velocity in the pipe will not exceed 15 feet per second nor less than 3 feet per second.

Open Channels

Except where intolerable flooding conditions are anticipated, it would be desirable, from an aesthetic standpoint to allow the streams to use their natural channels. Improvement would be limited to clearing out underbrush and sediment, minor corrective work where channel restrictions or irregularities occur, and drainage structures required at channel crossings. The scenic beauty of a properly cleared and maintained natural watercourse is a civic asset.

Unfortunately, many areas have natural channels that have become inadequate to carry the runoff from a highly developed area. These areas require storm sewer pipe, or channel modification to be built to carry the anticipated flow, depending upon the funds and right-of-way available. The size of these improvements is determined by the slope of the proposed improvement, the quantity of anticipated storm flow and the maximum velocity limits.

The improvement or modification of the existing watercourses for the purpose of containing their floodflows within defined channel limits will permit the closer approach of urban development to the stream. This saving of land area may be accomplished as a part of the development cost where economically

justified. It is suggested that all building floor levels be restricted to two (2) feet above the 100 year flood frequency. Figure 7-1 shows a typical flood plain cross section showing floodway and encroachment limit concepts.

Where additional flow area in the channel must be provided to hold flood waters within acceptable limits, the natural appearance is most nearly maintained by using an unlined earthen channel, preferably sodded with flat side slopes. It is also unusually more economical to use an unlined channel. The limitation on use of unlined channels is the maintenance of flow velocities in the channel low enough to prevent erosion. Low velocities require greater flow cross-sectional area, with resultant wider drainage easement of right-of-way to accommodate the larger channel. Velocities above about eight (8) feet per second should not be permitted in unlined sections. Where the natural channel gradients are steep enough to produce greater velocities, an unlined channel may be constructed with flatter slopes in successive "stair step" reaches, if some means of dissipating energy differential between the upper and lower reach is provided. Varying channel widths and configurations or holding ponds can also be utilized.

It is recommended for unlined channel improvements that a flat bottom with 3:1 side slopes be considered. This slope is sufficiently flat to permit the use of mowing equipment for maintenance. The unlined channels with a bottom width greater than thirty (30) feet should have a lined low flow section to control the flow that continues during low runoff periods. This will allow the water to maintain a minimum velocity, at low flow, to carry the silt in suspension. The unlined area of the bottom should slope toward the lined section allowing for drainage and ease of maintenance.

Design controls have to be provided to control erosion along and near the low flow sections. Concrete lining of the channel section provides better hydraulic efficiency because of the smooth surfaces and the protection afforded permits side slopes to be steeper, further increasing hydraulic efficiency of the section. Lining, therefore, both permits and produces higher flow velocities than occur in an unlined channel on the same slope. Velocities can be still further increased with a lined channel by taking full advantage of the available channel gradient, eliminating drop structures. The effect of increased velocities is to reduce the required flow area, right-of-way requirement, and excavation, with consequent reduction of quantities. These savings will generally be more than offset by the cost of lining. Lined channels are recommended in many of the developed areas where sufficient right-of-way cannot be obtained for unlined channels. These channels are recommended to have 2:1 side slopes.

Drainage right-of-way widths for all channels must be adequate to allow maintenance equipment to enter and travel along the easement. Figure 7-2 illustrates typical lined and unlined channel cross sections.

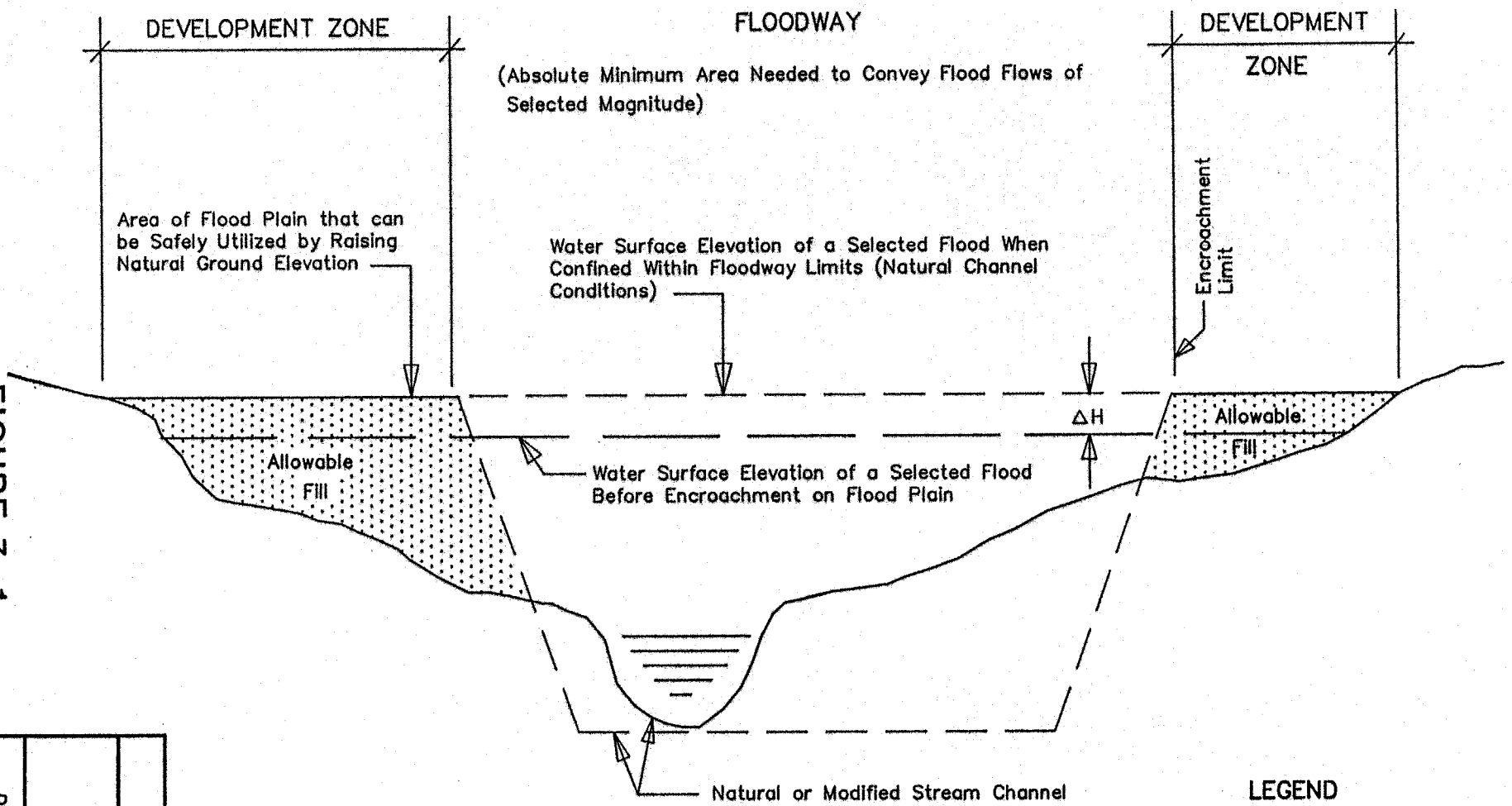


FIGURE 7-1

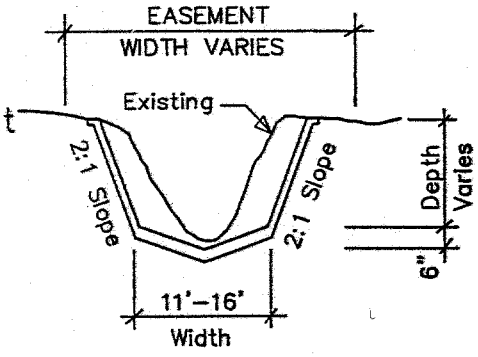
FLOOD PLAIN CROSS SECTION

SHOWING FLOODWAY & ENCROACHMENT LIMIT CONCEPTS

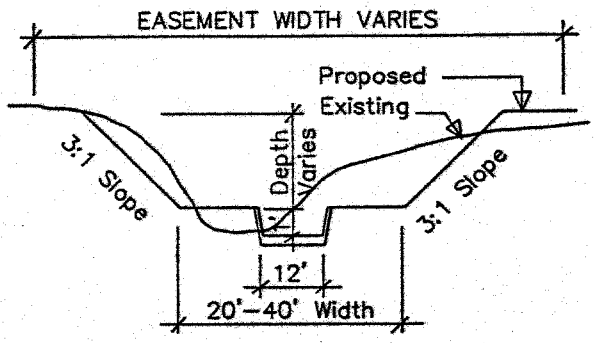
	DATE	FLOOD PLAIN CROSS SECTION	PLAINVIEW, TEXAS
	APPROVED		

NOTES:

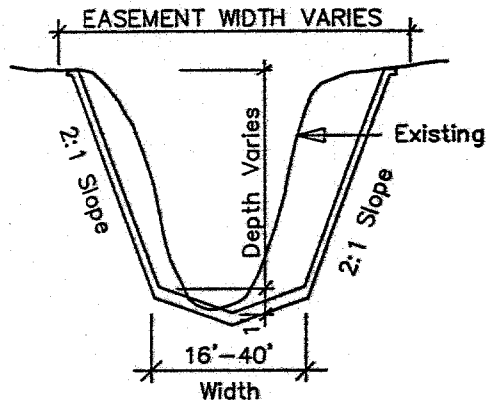
1. Ingress and egress ramp must be provided.
2. Channel must be sodded or mulched.
3. A 10' to 15' wide maintenance and access easement, an alley or a street shall be required parallel to one side of all drainage channel sections.



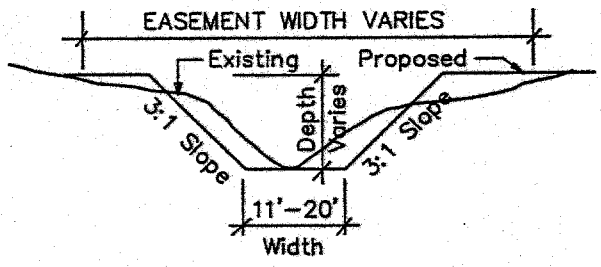
LINED CHANNEL



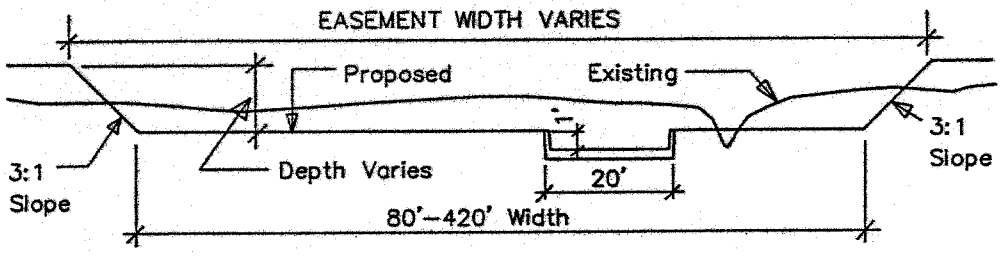
UNLINED CHANNEL



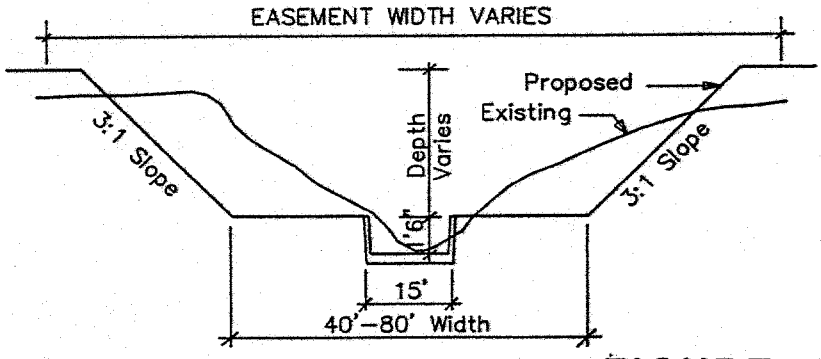
LINED CHANNEL



UNLINED CHANNEL



UNLINED CHANNEL



UNLINED CHANNEL

FIGURE 7-2

PLAINVIEW, TEXAS	
TYPICAL CHANNEL SECTIONS	
DATE	APPROVED

Storm Water Storage

Storage of excess urban storm runoff is one of the most promising methods available in preventing urban flood damage. With the use storm water storage, the time of concentration for some areas can be increased over one hundred percent.

Storm runoff storage with reduced release rates can hold downstream flood flows to within the safe conveyance capacity of the storm sewer and stream system. In most cases, it can be shown that storage is more economical than increasing downstream conveyance capacity. Storage facilities should be planned and designed to assure an effective and efficient operation and maintenance program.

Retention and detention are two generalized types of storm runoff storage used to control flooding. Retention storage refers to storm runoff collected and stored for a significant period and released or used after the storm runoff has ended. Retention storage usually consists of "wet reservoirs" which often have agricultural, recreational, and/or aesthetic value. Detention storage consists of reducing the rate of runoff for a short period of time to reduce peak flows by controlling the discharge through an outlet structure and by extending the period of runoff.

Storage can be classified by location as follows:

A. Rainfall Storage - The storage of water near the point of rainfall occurrence, usually accomplished by rooftop ponding, parking lot ponding, property line swale ponding, and small on-site ponds.
B. Runoff Storage - Water stored after storm runoff has accumulated significantly and begun to flow in a drainage system. Runoff storage is usually accomplished by off-stream storage, channel storage, or on-stream storage, or on-stream storage.

The storage of water in depressed open areas, reservoirs, playas, and on low lying recreation fields to which storm peak flows are routed is termed off-stream storage. It is usually characterized by a side channel spillway or overflow from the main channel.

Although all channels inherently store water, runoff hydraulic characteristics can be altered to reduce peak flows. Side channels that run essentially parallel to the main stream channel are also a means of temporarily storing water during excessive rainfall events.

The construction of an embankment across a channel so that a storage pond is formed represents on-stream storage. Spillway considerations are important to pass large floods exceeding the storage capacity. Properly protected roadway embankments are well suited for this purpose. For maximum land use

efficiency the design engineer should consult early with the Parks and Recreation Department of the City.

Making use of detention storage areas such as playas for parks and playing fields, satisfies two needs and reduces the cost of each. The mini-park concept, where small recreational areas are provided in neighborhoods within safe walking distances for children, can be a typical joint effort of the drainage design engineer and the planning and recreational staffs of the city. Provisions must be made for maintenance of such areas.

RELEVANT CLIMATOLOGICAL DATA

The climatological data for the Plainview area has been obtained from the National Oceanic and Atmospheric Administration (NOAA). The mean annual rainfall is 18.97 inches; mean annual snowfall, 10.8 inches; average annual temperature, 58.6 F. A breakdown of average precipitation by month for the period 1951-1987 is as follows:

MONTH	MEAN PRECIPITATION (INCHES)
January	.49
February	.66
March	.79
April	1.24
May	3.27
June	3.07
July	2.57
August	2.03
September	2.03
October	1.68
November	.64
December	.50
TOTAL	**18.97**

Rainfall is fairly evenly cyclic over the course of the year with the maximum occurring in May and June. Most of the precipitation occurs as a result of thunderstorms that produce heavy rainfall for brief periods of time resulting in larger rates and quantity of runoff than might otherwise be expected.

As a result of these rainfall patterns combined with the local topography, Plainview is subject to floods of significant magnitudes. The files of the *Plainview Daily Herald* indicates the following records of major flooding:

FLOOD (DATE/YEAR)	PEAK FLOW (CFS)	PEAK STAGE (FT)
1890	Second largest but no record	Second largest but no record
June 6, 1941	12,000	8.8
May 17, 1951	1,800	6.87
July 8, 1960	9,130	9.38
June 11, 1965	3,300	7.25
June 4, 1984	1,890	6.84

The gauging station is located on the downstream side of the Broadway Street bridge at Running Water Draw. The highest discharge at this location occurred on June 6, 1941. In 1890 a major flood may have been the second highest according to local residents, though no recorded data is available. The flood records for July of 1960 indicates the highest recorded flood stage; however, the storm freeway may have only been that of 40 year frequency.

EXISTING DRAINAGE FACILITIES

The City of Plainview is located on the broad, flat high plains area of the Texas Panhandle along a natural drainage course identified as Running Water Draw. There are numerous low-lying areas called playa lakes, scattered throughout the region.

The local terrain slopes and drains toward Running Water Draw located in the southern portion of the City. There are areas in the northern section of the City where runoff drains into the nearby playa lakes until the lake becomes full. The overflow of these lakes then passes to lakes of succeedingly lower elevation before finally reaching the draw. The Corps of Engineers has recently completed their latest studies for revisions to the exact nature and limits of the 100-year flood boundaries in the Plainview area and have identified locations of potential flood risk. Due to the lack of Base Flood Elevations on Running Water Draw, there had been no previous updated Flood Boundary or Floodway Maps. Plate 7-1 depicts the flood hazard area as defined on the Flood Insurance Rate Map (Community - Panel Numbers 480275 0001 - 0008) prepared by the Federal Management Agency dated March 16, 1989.

As conditions currently exist, the 100-year flood boundary includes an area along Running Water Draw, and extends between and around various playa lakes. Encroachment in this flood boundary occurs in numerous locations. In

some cases, hazardous flooding can occur from storms of lesser frequencies than the 100 year storm. The City has identified the residential area near Utica Street between Sixteenth and Eighteenth Streets and the intersection of Tenth Street and Ennis Street as particular problem areas. In addition to these areas, there are large portions of the Frisco and Austin Heights vicinities which are in the flood hazard zone. There are large numbers of homes and businesses located adjacent to playa lakes and Running Water Draw which are at risk.

In recent years, channel improvements to Running Water Draw and its tributaries (particularly the channel to Frisco Lake) along with installation of various drainage structures have improved the overall conditions during low flow or flood periods. No significant affects on the 100-year flood zone resulted from this work.

Plainview's existing drainage structures along with selected major and numerous local drainage divides, both natural and man-made, are shown in detail on Plate 7-I.

A majority of City streets (approximately 90%) are constructed with concrete curbs and gutters. These streets carry a large portion of local runoff from low frequency storms. Runoff is transported in the streets and discharged into bar ditches, drainage channels, or playa lakes. Conditions of these curb and gutter sections and the drainage that they provide are generally good with the exception of a few areas. Many of the curb and gutter problems were identified near the Central Business District. Field surveys conducted during or immediately following several periods of moderate to light rainfall indicate that flooding in many streets can be characterized as a nuisance rather than a major hazard. Due to the upland condition and the flat plain on which most of Plainview was developed, the flow of runoff is interrupted if street grades become inconsistent or proper maintenance procedures are not followed. This results in ponding or minor localized flooding. Furthermore, future development, particularly to the north and west of the current Corporate Limits, will result in higher runoff coefficients and increased flow rates. These projected future increases will further impact those areas adjacent to Running Water Draw, and in particular, the areas along Fifth Street where the original Running Water Draw passed.

Several major and minor underground storm sewer systems exist in the City, mostly in and around the Central Business District. While these systems do provide some relief, most are antiquated, inadequate in size, and fail to meet today's minimum design standards. The curb inlets in systems built long ago are typically located in the middle of the curb radius at intersections with openings 30 inches long and 4 inches deep, in combination opening with a 20" x 30" grate. Most are inadequate for the purpose intended. Some of the inlets have been damaged and are filled with sediment and debris, thus further reducing the flow capacity. The storm sewer system includes vitrified tile and old reinforced concrete pipe, much of which has been deteriorated. In addition, street grades are designed such that many intersections exist as the low points, causing water to collect. No positive outlet exists from these

intersections. Dry weather evaporation tends to be the best source of water removal in these areas.

Those intersections of localized street ponding in the area of the Central Business District include: Eighth and Ash, Eighth and Broadway, Fifth and Broadway, Eleventh and Ash, and Eleventh and Broadway. Similar conditions of ponding in other parts of the City were found on Sixth (near Elm), Fourteenth (near Yonkers), Fresno (between Twenty-Sixth and Twenty-Eighth), Twenty-Fourth (near Quincy), and at the intersections along El Paso (between Seventeenth and Twenty-Eighth).

Localized flooding occurs on and to the west of Columbia Street between Fifteenth and Twenty-Fourth Streets because of the large amount of runoff that drains towards Curry Lake. The storm sewer facility currently in place on Columbia Street does not have the capacity to accomodate the flow of runoff in this area.

Drainage problems which exist on Fifth Street (State Highway 70) have been reduced in scale due to recent improvements completed by the Texas Highway Department.

PROPOSED DRAINAGE FACILITIES

A major flood study conducted by the U.S. Army Corps of Engineers in 1977 presented various plans for large scale flood control in and near the City of Plainview. The economic feasibility of these drainage improvements was addressed. The proposed plans included channel improvements to Running Water Draw, an east diversion channel and associated laterals, and upstream controls on Running Water Draw. All of these plans would significantly reduce the local 100-year flood plain. A previous Corps of Engineers report developed for this area had determined a positive benefit-cost ratio for specific portions of the plan; however, the December, 1977 report recommended a No Action alternative and indicated that Federal interest was not warranted.

Drainage studies were presented by Parkhill, Smith, and Cooper, Inc., in 1974 and 1979 which included portions of the Corps of Engineers flood control program along with proposed solutions to various other local drainage problems. The 1974 report did identify several alternative implementation orders for the Corp of Engineers long-range drainage improvements. The proposed storm drainage systems were located in the areas of U.S. Highway 70 (Fifth Street), the Central Business District, and North Columbia Street. The Community Development Drainage Study prepared in 1979 was designated as a guide for expenditures for the City's Community Development Funds and utilized information from the 1974 report to conclude the following improvement needs: (1) shaping and alignment of various portions of Running Water Draw, (2) channel improvements for tributaries, and (3) the installation of various culverts and local storm sewer systems throughout the plan area.

Those drainage improvements mentioned above in the 1974 and 1979 reports which have not been constructed or which are not currently in the design stage should generally remain applicable to the City's immediate and long-term drainage needs.

The location of several proposed drainage improvements are shown on Plate 7-2. These improvements are detailed along with estimated costs in Table 7-2. The recommended improvements outlined are listed in order of priority as part of a proposed five (5) year capital improvement. The actual implementation of these projects should occur as needs and funding dictates and could be incorporated as part of a possible overall Capital Improvements Program.

Those proposed drainage improvements that would reduce the 100-year floodplain or major flooding should be considered the highest priority because of the potential for reducing risk to citizens and property. At the same time, these improvements outlined are by far the most costly and would almost certainly require state or federal funds to realistically complete major portions of the recommended drainage facilities. Therefore, the various drainage improvements to Running Water Draw and specified channels should be considered separately from all proposed localized drainage structures and systems when prioritizing the 5-year program.

The specific proposed drainage improvements required to reduce major flooding are scaled down and modified compared to those originally set forth by the Corps of Engineers. Those improvements include, in order of priority: 1) channel improvements to Running Water Draw west from the Panhandle and Santa Fe Railroad to the City sewage treatment plant; 2) channel improvements (lined and unlined) to the tributary between Frisco Lake and Running Water Draw with associated drainage culverts; 3) underground storm sewer along the railroad between Curry Lake and Frisco Lake.

A detailed engineering study and design would be required for the exact nature and location of all channel improvements. Reference should be made to Figure 7-2 for general design considerations. New or upgraded reinforced concrete pipes or box culvert structures may be required under several streets along the proposed channels. The lateral drainage system from Curry Lake would be used for overflow purposes so that the storage capacities of the playas could be utilized while reducing the time and extent of flooding during moderate to low frequency rainfall. Drainage right-of-way will be required at various locations along the routes of the various improvements.

The above mentioned improvements are considered to be a more realistic benefit-cost alternative to the long range and complete recommendations presented by the Corps of Engineers.

Two overflow relief systems similar to that identified for Curry Lake are shown on Plate 7-2. One is an underground storm sewer extending from the playa in

TABLE 7-2A

PLAINVIEW, TEXAS

REGIONAL DRAINAGE IMPROVEMENTS*

5-YEAR PROGRAM

COST ESTIMATE

DESCRIPTION	UNIT OF MEASUREMENT	UNIT PRICE	ESTIMATED QUANTITY	ESTIMATED COST
1. Channel Improvements (Running Water Draw)				
R.O.W. Acquisition	L.S.	$100,000	1	$100,000
Channelization	L.F.	30	9200	276,000
Subtotal				**$376,000**
2. Channel Improvements (Frisco Lake to Running Water Draw)				
R.O.W. Acquisition	L.S.	$ 5,000	1	$5,000
Channelization	L.F.	30	2500	75,000
Concrete Lined Channel	L.F.	100	2600	260,000
48" R.C.P.	L.F.	60	100	6,000
Headwall		1,800	2	3,600
Subtotal				**$349,600**
3. Storm Sewer (Curry Lake to Frisco Lake)				
48' R.C.P.	L.F.	$ 60	4000	$240,000
Highway Crossing	L.F.	200	100	20,000
Headwall	EA	1,500	2	3,000
Subtotal				**$263,000**

*NOTE: Price for pipe includes pavement repair and utility adjustments.

TABLE 7-2A (Cont.)

PLAINVIEW, TEXAS

REGIONAL DRAINAGE IMPROVEMENTS*

5-YEAR PROGRAM

COST ESTIMATE

DESCRIPTION	UNIT OF MEASUREMENT	UNIT PRICE	ESTIMATED QUANTITY	ESTIMATED COST
4. Storm Sewer (Tenth St./Ennis St. to Running Water Draw)				
36" RCP	L.F.	$ 44	3400	$149,600
Highway Crossing	L.F.	400	100	40,000
Headwall	EA	1,200	2	2,400
Subtotal				**$192,000**
5. Storm Sewer (Turner Terrace Addition playa to Lakeside playa)				
R.O.W. Acquisition	L.S.	$5,000	1	5,000
48" R.C.P.	L.F.	60	3000	180,000
Highway Crossing	L.F.	200	100	20,000
Headwall	EA	1,500	2	3,000
Subtotal				**$208,000**
Subtotal Construction Cost				$1,385,600
Technical Services Cost (10%)				$ 138,560
Total Cost (Regional Drainage Improvements)				**$1,524,160**

*NOTE: Price for pipe includes pavement repair and utility adjustments.

TABLE 7-2B

PLAINVIEW, TEXAS

LOCAL DRAINAGE IMPROVEMENTS*

5-YEAR PROGRAM

COST ESTIMATE

DESCRIPTION	UNIT OF MEASUREMENT	UNIT PRICE	ESTIMATED QUANTITY	ESTIMATED COST
1. Storm Sewer (Columbia St.)				
24" R.C.P.	L.F.	$ 32	1400	$ 44,800
36" R.C.P.	L.F.	44	750	33,000
48" R.C.P.	L.F.	60	750	45,000
54" R.C.P.	L.F.	80	700	56,000
60" R.C.P.	L.F.	105	1100	115,500
10' Curb Inlet	EA	2,200	26	57,200
Highway Crossing	L.F.	200	80	16,000
Railroad Crossing	L.F.	200	100	20,000
Headwall	EA	2,000	1	2,000
Subtotal				**$389,500**
2. Storm Sewer (11th Street)				
24" R.C.P.	L.F.	$ 32	600	$ 19,200
36" R.C.P.	L.F.	44	500	22,000
48" R.C.P.	L.F.	60	700	42,000
10' Curb Inlet	EA	2,200	7	15,400
Railroad Crossing	L.F.	200	250	50,000
Headwall	EA	1,500	1	1,500
Subtotal				**$150,100**

*NOTE: Price for pipe includes pavement repair and utility adjustments.

TABLE 7-2B (Cont.)

PLAINVIEW, TEXAS

LOCAL DRAINAGE IMPROVEMENTS*

5-YEAR PROGRAM

COST ESTIMATE

DESCRIPTION	UNIT OF MEASUREMENT	UNIT PRICE	ESTIMATED QUANTITY	ESTIMATED COST
3. Storm Sewer (Quincy St./ 24th St.)				
24" R.C.P.	L.F.	$ 32	1500	$ 48,000
36" R.C.P.	L.F.	44	1600	70,400
10' Curb Inlet	EA	2,200	8	17,600
Highway Crossing	L.F.	200	60	12,000
Headwall	EA	1,200	1	1,200
Subtotal				**$149,200**
Subtotal Construction Cost				$688,800
Technical Services Cost (10%)				$ 68,880
Total Cost (Local Drainage Improvements)				$757,680
TOTAL ESTIMATED COST (5-YEAR PROGRAM)				**$2,281,840**

*NOTE: Price for pipe includes pavement repair and utility adjustments.

the Turner Terrace Addition with its outfall into the Lakeside playa to the east. The other is an underground storm sewer running south from the lake at Tenth Street and Ennis Street to Running Water Draw. A major underground storm sewer system is proposed to extend along Columbia Street between Fifteenth Street and Twenty-Fourth Street. Similar drainage systems have been previously recommended. This project may qualify for assistance from the State in conjunction with planned improvements along U. S. Highway 87. Storm sewer inlets would intercept much of the runoff currently entering Columbia Street flowing toward Curry Lake. The drainage system pipe proposed along the future extension of Sixteenth Street would transport this storm flow to a disposal point on the east side of Austin Street. These several improvements, along with all others, should all be coordinated with any proposed street construction at the same location.

In order to relieve localized flooding, and in conjunction with proposed future street improvement projects, a storm sewer system with inlets is recommended in the area of the intersection of Twenty-Fourth Street and Quincy Street. Discharge from this drainage system is available into the Lakeside playa with a connection extending south from Twenty-Fourth Street on Oakland Street.

A proposed storm sewer system extending along Eleventh Street from the north edge of the Central Business District should be designed to relieve the significant ponding that occurs at those various intersections in the area. An added benefit to this system can be achieved by oversizing the pipe system to carry flow for a future underground storm sewer to be extended into the northern section of the Central Business District near the railroad.

Most storm inlets in the Central Business District are damaged and inadequate in size to function properly. New inlets would not be practical in many locations until storm sewer pipes with adequate capacities are installed. The reconstruction of broken inlet tops and faces would improve the general appearance but would not significantly improve drainage. A future goal of the City should be to replace most of the old inlets and supplement the storm sewer pipe in the Central Business District.

Low-water crossings located on major thoroughfares should be replaced. In particular, those structures on Quincy Street and Joliet Street will require adequate drainage culverts to be constructed with corresponding proposed street improvements.

SOURCES OF FUNDING

Some of Plainview's local drainage improvements can be incorporated into a regular maintenance and replacement program. This approach will allow the scheduling of major maintenance, repairs, and replacements over several years, thereby minimizing budgetary impacts. With this approach, many of the needed improvements can be financed as needed through the annual budget of the City of Plainview. To the extent that limited funds are available,

specific improvements could be financed with local General Obligation (Tax) Bonds through the City and public support. In some cases, it may also be possible to obtain some assistance from the Texas Highway Department for drainage improvements in conjunction with their major thoroughfares inside the Corporate Limits. Another source of funds to be considered is aid administered by the Texas Department of Commerce Program. Finally, County funds may be made available on a shared basis from the Hale County Commissioners.

The flood study conducted by the U. S. Army Corps of Engineers in 1977 concluded that federal funds for major drainage improvements could not be justified at that time. With the expanded studies completed on the updated 100 year flood boundaries, revised recommendations could be forthcoming.

The City should continue its monitoring of possible funding programs which may be developed for Public Works facilities on both loan, and grant in-aid basis.

SECTION 8

WATER SYSTEM STUDY

SECTION 8
WATER SYSTEM STUDY

INTRODUCTION

The furnishing of adequate public utilities such as water and sanitary sewer facilities, is vital to Plainview's life and growth. It was the introduction of water piped under pressure and water-carried wastes disposal which made possible the urban concentrations of population as we know them today. The average citizen has come to expect water to be available, in the quantity desired, and gives no thought to the source of that water or the destination of the resulting wastes. The instant response to these demands requires considerable planning, effort, and investment in plants and equipment.

Most of a community's principal utilities are provided by the city itself, with the other services provided by private enterprise operating under a franchise from the city. The operating companies of these privately owned utilities are responsible for providing adequate and economical service, including extensions to new customers. The City has the responsibility to see that these utilities function properly by controlling operations and rates within the framework of Texas Law.

The Planning and Zoning Commission should be concerned with the proper relationship of the utility systems to each other, to the thoroughfare plan, and to the land use plan. The complexity of the utility systems increases greatly as they cover larger areas and serve increasing numbers of customers. A utilities plan will direct the City towards the efficient updating and expansion of Plainview's water and sewer systems.

Previous studies conducted for the City of Plainview and referenced in this report include:

Koch, Fowler, and Grafe, Incorporated, "Plainview Comprehensive Plan Report 5, Utilities", 1961.

Fowler and Grafe, Incorporated, "1985 Plainview Comprehensive Plan", 1963.

Parkhill, Smith, and Cooper, Incorporated, "Plainview, Texas Comprehensive Plan 1976-2000: Water Works System Engineering Report", 1976.

WATER SYSTEM PLANNING

To properly plan a future water system capable of providing the requirements of the projected community, it is necessary to evaluate the present system, including the water supply and distribution system network and its capability of providing service for the present and projected demands. The City must have a dependable water supply that will provide for all water demands, including domestic, industrial, and commercial, as well as an allowance of about 25 percent for distribution system leakage, fire fighting, and other unmetered uses. The present average usage throughout the United States is around 100 gallons per capita per day. In industrial cities with heavy industrial water consumption the average usage may be 300 gallons per capita per day or more.

Every city in Texas is rated on a key rate schedule by the Board of Insurance of Texas. This key rate is the basis for the charge made for fire insurance on improved property in the city. Planning for the water utility system must take into account the basis on which this key rate is computed as affected by the water works, which includes pumping facilities and fire flow pressures, water supply, ground level storage reservoirs, elevated storage, water distribution system and fire hydrants, and pumping station or stations. Other factors, such as the organization of the fire department, fire apparatus and enforcement of building laws, affect the key rate and must be considered in planning.

For the purpose of computing fire insurance key rates for cities in Texas, the State Board of Insurance has previously required a water supply of 130 gallons per capita per day. If this quantity is available, the City could avoid a key rate charge for deficiency in the water supply. If economically feasible it is desirable to provide this minimum capacity in planning the City water supply.

Most cities maintain pressure in the water distribution system by providing elevated water storage, preferably at some high topographical location or locations in the city. Water is pumped from ground storage reservoirs located at wells, a treatment plant, or delivery point, into the system to maintain a high level of water in the elevated tank and thus a high pressure in the system. A balanced system should provide pumps with capacity to supply the average daily consumption, with additional pumps which can put sufficient water into the system to meet the maximum daily demands and maintain the system pressure. To satisfy the peak hourly demands, water can be used from the elevated storage along with that provided by additional pumps. It is desirable to maintain not less than 60 pounds per square inch static pressure at any point in the system.

Water storage reservoirs in a water system provide water for three principal purposes: (1) to meet hourly demands which are in excess of water supply facilities; (2) to meet the increase in demand created during fire event; and (3) to meet the system demands during short interruptions of water supply. The Board of Insurance of Texas, has previously required 54.2 gallons of elevated water storage per capita, in addition to required ground level water storage of 130 gallons per person served by the water system. A penalty is charged for

the deficiency in a lesser storage capacity. Also, the City should be in compliance with current per service connection requirement of the State Department of Health for elevated storage.

Ground storage consists of a reservoir placed on or just below the ground surface. Water in a ground storage reservoir is treated and ready for use, but must be pumped from the reservoir into the distribution system with high service pumps. Ground storage is generally located at a water treatment plant, near a well site, or at a delivery point.

Elevated storage consists of a reservoir elevated above the area which it is to serve. This elevation can be accomplished via a tower type structure or a tank location on high ground. Water in this type reservoir is also treated and is ready for use. Due to its elevation above the ground there is sufficient pressure to flow the water into the distribution mains by gravity without pumping. However, the elevated storage tank must be filled from the source of supply via the pumping facilities.

Maximum hourly demands for water can be supplied in several ways. One method is to maintain pumping capacity at the source of supply sufficient to pump water at a rate high enough to supply the maximum hour demand. Another method is to supply water with pumps at the source of supply with capacity to meet the maximum daily consumption rate and to supply the higher maximum hourly demand by permitting water in the elevated tank to drain into the system during peak consumption hours. Either of these methods is acceptable practice; some combination of the two might be determined to be more economical. Experience has shown that the peak pumping capacity should be approximately 125 percent of the maximum daily demand.

Materials used in water system construction usually have a fairly long life, but will ultimately have to be replaced. In water system planning, attention should be given to the deterioration of any facilities which have served their purpose and which may be either too expensive to maintain or overly expensive to operate, and an efficient schedule of replacement developed.

In general, no water line less than six (6) inches in diameter should be installed. Lines should be sized to maintain proper pressure and flow rates at all locations. Consideration must be given to the location of water lines in relation to sanitary sewers and other public utilities. The proper provision and distribution of fire hydrants and valves is critical to the operation and maintenance of a water distribution system. Fire hydrants should be located and installed to conform with the Texas Board of Insurance requirements. Water valves should be placed such that no unnecessary interruptions occur over large areas when line repairs are made at any particular location.

The Texas Department of Health has set forth guidelines for the location, installation, and operation of water lines and all other water works utilities.

The type of treatment required for a municipal water supply is dependent upon the chemical and biological quality of water. Planning must include a study of and recommendations for improvements required to provide the treatment necessary to provide a safe and suitable water supply for the consumers.

In planning for a growing city, consideration must be given to the extension of the utility system into new areas as building construction progresses. Unless utility expansion is orderly and adequate, growth of the City into new areas cannot and will not occur. Building may not be completely stopped by failure to extend service into the new areas, but the character of the development that does occur is likely to be inferior and have an adverse effect on the City as a whole.

WATER CONSUMPTION

Water consumption records since 1956 for Plainview are shown in Table 8-1. Daily per capita consumption is high, despite few large industrial water users. This is partly due to local climate and low water rates. The largest demands for water other than the Plainview Ice Company, come from schools, Central Plains Regional Hospital, and the various irrigation systems.

The average daily per capita consumption over the past 30 years is 178 gallons. The historical records indicate that while overall demand increases, per capita demand is remaining steady or decreasing. The largest peak day demand on record was 11.5 million gallons in 1974, and the highest percent of peak day demand over daily average demand was 370% in 1957. Water demands for the area peak in July, and are at a minimum during the winter months.

Projected water supply requirements are presented in Table 8-2. It is anticipated that there will be no significant future changes in water consumption patterns. Future requirements were developed using projected population figures, an average daily demand of 180 gallons per capita, and a peak day demand factor of 250%.

WATER SUPPLY

The City of Plainview receives its water from two sources. For many years the City has entirely dependent on local wells for its water supply. In 1969, surface water began being purchased from the Canandian River Municipal Water Authority (CRMWA) and treated at the newly constructed City treatment plant. Tables 8-3 and 8-4 details water purchased and produced by Plainview in previous years. Table 8-5 breaks down CRMWA usage by Member City.

TABLE 8-1
PLAINVIEW, TEXAS
WATER CONSUMPTION

YEAR	POPULATION	TOTAL ANNUAL *CONSUMPTION (MG)	DAILY AVERAGE DEMAND (MG)	PEAK DAY DEMAND (MG)	AVERAGE DAILY PER CAPITA (GAL)
1956	16,864	1,301	3.56	8.9	212
1957	17,334	1,060	2.91	10.8	168
1958	17,804	1,085	2.79	9.2	167
1959	18,274	1,210	3.32	9.3	182
1960	18,735	1,170	3.21	9.4	171
1961	18,771	1,145	3.14	7.9	167
1962	18,807	1,310	3.58	8.8	190
1963	18,843	1,435	3.94	10.3	209
1964	18,879	1,550	4.25	10.9	225
1965	18,916	1,580	4.33	10.4	229
1966	18,952	1,325	3.63	10.0	192
1967	18,988	1,225	3.36	8.2	177
1968	19,024	1,080	2.95	8.3	155
1969	19,000	1,105	3.03	8.9	159
1970	19,096	1,295	3.55	9.2	186
1971	19,405	1,270	3.48	11.1	180
1972	19,714	1,215	3.32	10.2	169
1973	20,023	1,266	3.47	9.5	174
1974	20,332	1,342	3.68	11.5	181
1975	20,641	1,253	3.43	8.9	167
1976	20,950	1,355	3.71	9.1	178
1977	21,259	1,276	3.50	10.9	165
1978	21,568	1,478	4.05	10.8	188
1979	21,877	1,255	3.44	8.4	158
1980	22,187	1,468	4.02	10.1	182
1981	22,507	1,385	3.79	10.6	169
1982	22,827	1,408	3.86	8.7	170
1983	23,147	1,567	4.29	10.8	186
1984	23,467	1,453	3.98	9.2	170
1985	23,788	1,389	3.81	8.1	161

TABLE 8-2

PLAINVIEW, TEXAS

WATER SUPPLY REQUIREMENTS

YEAR	POP.	TOTAL ANNUAL DEMAND (MG)	DAILY AVERAGE DEMAND (MG)	PEAK DAY DEMAND (MG)	AVER. DAILY PER CAPITA DEMAND (GAL)
1988	24,749	1,624	4.45	11.1	180
1990	25,250	1,661	4.55	11.4	180
1995	27,050	1,778	4.87	12.2	180
2000	28,750	1,891	5.18	13.0	180
2005	31,350	2,059	5.64	14.1	180
2010	34,258	2,252	6.17	15.4	180
2020	37,800	2,482	6.80	17.0	180
2030	41,900	2,752	7.54	18.9	180
2040	44,100	2,898	7.94	19.9	180
2050	48,600	3,194	8.75	21.9	180

TABLE 8-3
PLAINVIEW, TEXAS
WATER PURCHASED AND PRODUCED

YEAR	CRMWA TRMT. PLANT (GAL)	CRMWA FOXLEY CATTLE CO./ CACTUS FEEDERS (GAL)	TOTAL CRMWA (GAL)	PRODUCED FROM WELLS (GAL)	TOTAL WATER (GAL)
1975	655,474,000	-	655,474,000	579,276,100	1,234,750,100
1976	627,481,100	-	627,481,100	727,736,800	1,355,217,900
1977	492,139,000	-	492,139,000	784,014,100	1,276,153,100
1978	604,471,000	-	604,471,000	873,230,900	1,477,701,900
1979	690,084,000	210,948,000	901,032,000	565,115,800	1,466,147,800
1980	757,693,000	181,844,000	939,537,000	709,976,800	1,649,513,800
1981	676,701,000	164,644,000	841,345,000	708,607,100	1,549,952,100
1982	609,072,000	199,905,000	808,977,000	798,857,700	1,607,834,700
1983	656,698,000	141,068,000	797,766,000	909,973,000	1,707,739,000
1984	672,509,000	137,059,000	809,568,000	780,627,000	1,590,195,000
1985	708,527,000	121,988,000	830,515,000	680,050,000	1,510,565,000
1986	603,282,000	100,243,000	703,525,000	816,587,000	1,520,112,000
1987	726,059,000	119,925,000	845,984,000	791,669,000	1,637,653,000

YEAR	PLAINVIEW WELLS	CRMWA	TOTAL	% LAKE WTR	PLAINVIEW ALLOCATION	% USED
65	1,574,552	0	1,574,552	0.00%	0	
66	1,325,000	0	1,325,000	0.00%	0	
67	1,224,201	0	1,224,201	0.00%	NA	
68	1,075,907	0	1,075,907	0.00%	10,717 ###	0.00%
69	723,194	379,124	1,102,318	34.39%	721,630	52.54%
70	694,649	625,523	1,320,172	47.38%	721,630	87.36%
71	620,255	637,298	1,257,553	50.68%	831,558	76.74%
72	520,511	678.376	1,198,887	56.58%	895,542	75.97%
73	813,285	456,343	1,269,628	35.94%	946,537	48.08%
74	647,957	692,393	1,340,350	51.66%	1,037,343	66.60%
75	579,277	655,474	1,234,751	53.09%	867,158	75.40%
76	727,732	627,481	1,355,213	46.30%	867,158	73.27%
77	784,014	492,139	1,276,153	38.56%	867,158	56.90%
78	873,230	604,471	1,477,701	40.91%	867,158	86.76%
79	565,117	905,418	1,470,535	61.57%	1,114,918	80.82%
80	709,977	939,537	1,649,514	56.96%	1,114,918	84.07%
81	708,608	841,345	1,549,953	54.28%	991,038	85.03%
82	799,859	808,977	1,607,835	50.31%	991,038	81.07%
83	909,673	671,214	1,580,887	42.46%	991,038	80.50%
84	780,627	809,568	1,590,195	50.91%	1,114,918	72.45%
85	680,050	830,515	1,510,565	54.98%	1,114,918	74.30%
86	816,587	703,525	1,520,112	46.28%	991,038	70.92%
87	791,669	845,984	1,637,653	51.66%	991,038	85.21%

SOURCE: CRMWA

TABLE 8-5

Member City	Normal Water Supply Million Gals	Normal Water Supply Ac. Feet	Percentage Share
Amarillo	12,438	38,170	37.058
Borger	1,864	5,720	5.549
Brownfield	736	2,260	2.198
Lamesa	733	2,250	2.179
Levelland	935	2,870	2.790
Lubbock	12,438	38,170	37.058
O'Donnell	94	290	0.278
Pampa	2,405	7,380	7.163
Plainview	1,238	3,800	3.691
Slaton	528	1,620	1.576
Tahoka	154	470	0.460
Totals	33,563	103,000	100.000

SOURCE: CRMWA

NOTES: #CRMWA RECORD ##ESTIMATED ###REVISED BY TRANSFER

Ground water in Plainview is obtained at depths of around 300 feet from the Ogallala Formation which is unconfined and recharged only from local precipitation. The aquifer is nearly 200 feet thick, in the Plainview area, and historical observations indicate the water level in the formation drops an average of about 2-3 feet per year (Figure 8-l). About 98 percent of the total ground water pumpage in the area is used for irrigation. Although the total amount of water pumped from the aquifer is expected to decrease in the future, the average annual recharge will continue to be less than anticipated water demands. As time goes by, the potential pumping rate in the Plainview area will decline to the extent that by the year 2020 most of the local aquifer will only have a projected potential yield of 500-800 gpm.

During the end of 1988 and the beginning of 1989 unofficial reports indicated that the ground water elevation at several locations in the Plainview area had levelled off or actually increased. This trend should be considered only temporary, resulting from a short term surge in recharge or decrease in withdrawal.

Table 8-6 lists the existing location and characteristics of City water well facilities. The 14 wells currently functioning have a total rated pumping capacity of 11,400 gpm (16.4 mgd), which is adequate for current demands and emergency service. Now that the City no longer relies exclusively on ground water, future withdrawals can be stabilized, and the wells can remain in service and produce at the current rate beyond the year 2000.

The primary source of water to Plainview is the surface water from the Canadian River at Lake Meredith. Untreated water from the CRMWA system is transported in an 18 inch line to ground storage at the City treatment plant. Surface water comprised about 40% of Plainview's total water supply in 1973. By 1975, this percentage increased to 53% at 655.5 million gallons for the year. In recent years, the total surface water consumption (726.1 million gallons in 1987) has increased while the CRMWA percentage of total supply (51.7% in 1987) actually decreased.

It should be noted that raw CRMWA water is supplied to a cattle feed lot at (Foxley Cattle Co./Cactus Feeders) in Swisher County. This supply can be discontinued at any time if the need arises, and as a result, should be excluded from the total City consumption.

Plainview's current Water Rights Contract with the CRMWA allows for 1,238 million gallons (3.4 mgd) of water to be obtained for a normal year. The current CRMWA supply system is capable of producing 4.15 mgd (1,515 million gallons per year), which is also the maximum capacity of the water treatment plant. The latest data available from the CRMWA indicates the safe yield of their system to Plainview is around 70% of 1,238 million gallons per year or 866.6 million gallons per year. During the years 1979 and 1980 allocations to CRMWA Member Cities were increased to 80%-90% because of the 1973-1981 drought resulting in low inflow and high evaporation rates at Lake Meredith.

Existing water production capacity for Plainview is summarized in Table 8-7. The total theoretical water production capacity is approximately 15.7 mgd, comprised of 123 mgd from water wells and 3.4 mgd from CRMWA surface water. The theoretical water production is compared to future peak water demands in Table 8-8. Using calculated daily peak demand from Table 8-2, a water supply deficiency would occur between 2010 and 2020. However, based on peak water usage in 1987, a deficiency might not occur until after 2020.

Based on data generated from Table 8-8, the City should pursue increased surface water rights between the year 2000-2010 along with those proposed additional water well facilities. Recharge wells are not practical at this time due to the liability involved in connection with the possible pollution of groundwater. Because water supply and demands can change over a period of years, it is recommended that detailed study of local supply be conducted around the year 2000.

A recent Texas Water Commission Report ("Ground Water Protection and Management Strategies in the Texas High Plains", March 1989) details various recommendations for managing ground water in the High Plains. Some of the control strategies include the following:

1.) Create underground water conservation districts.
2.) Monitor ground water changes such as water levels and quality and new well development.
3.) Undertake studies on ground water availability.
4.) Carry out demonstration projects such as secondary recovery of capillary ground water and other alternatives for increasing water resources.
5.) Delegate ground water protection programs such as the septic tank program to the districts.
6.) Collect fees from entities which export underground water from a district and do not help fund those district operations.
7.) Incorporate management and protection activities including the following:

   (a) consideration of well spacing regulations;
   (b) enforcement programs to ensure that abandoned wells are properly closed;
   (c) site evaluations before designing or approving individual septic systems;
   (d) public education programs to help property owners take an active part in ground water management;
   (e) promoting water conservation;
   (f) utilization of alternative septic system designs in situations where conventional systems are inappropriate; and
   (g) hydrogeological monitoring.

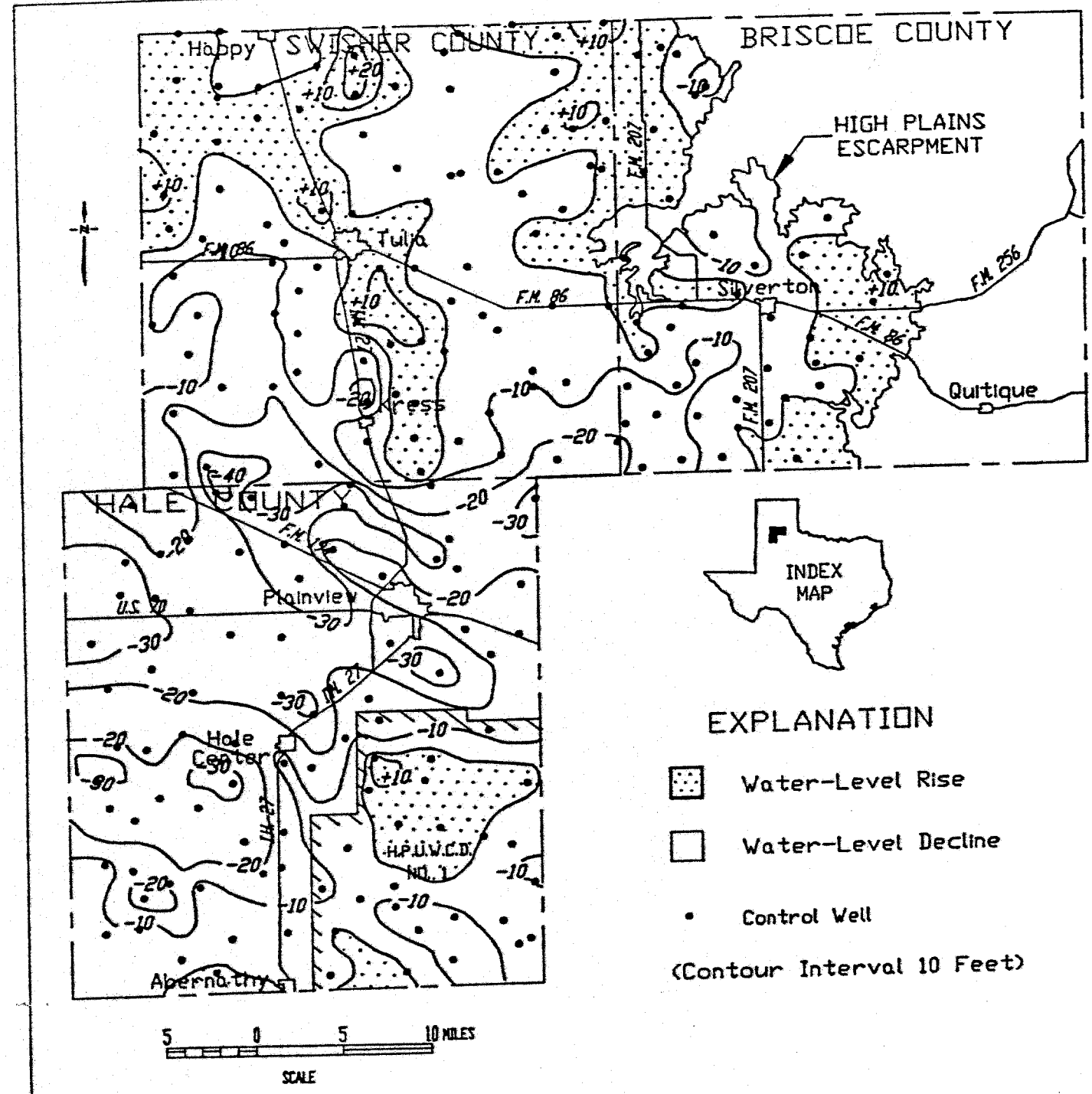


FIGURE 8-1

APPROXIMATE CHANGES IN WATER LEVELS 1980-1988

SOURCE: TEXAS DEPARTMENT OF WATER RESOURCES

TABLE 8-6

PLAINVIEW, TEXAS

WATER WELL FACILITIES

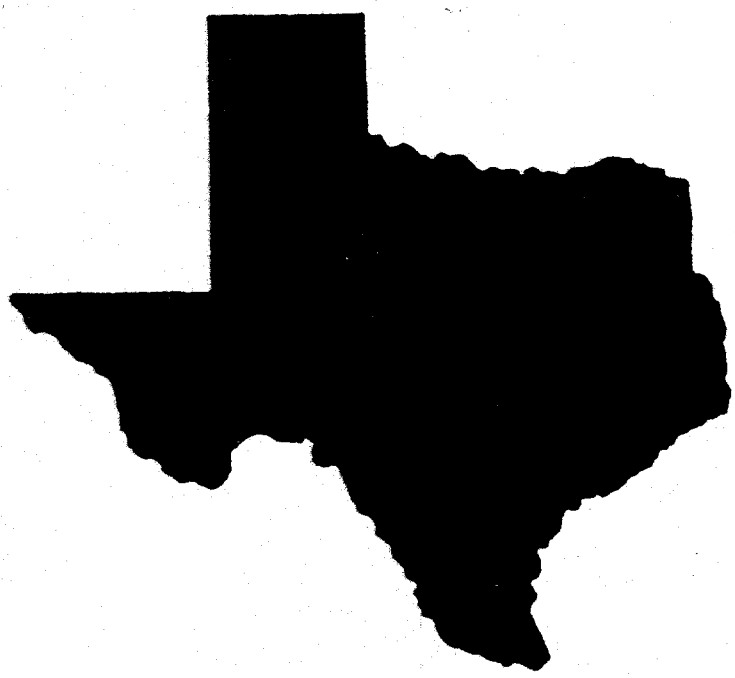
NO.	LOCATIO	RATED PUMPING CAPACITY (GPM)	DEPTH (FEET)	CONNECTION TO SYSTEM
1	12th and Utica	(Abandoned)		
2	11th and Smyth	(Abandoned)		
3	12th and Smyth	(Abandoned)		
4	14th and Baltimore	1,000 (New Well)	314	Pumps to System
5	7th and Beech	(Out of Service)	305	Ground Storage @ 7th & Elm
6	S.E. 10th and Date	750 (Standby)	303	Pumps to System
7	20th and Kokomo	700	322	Ground Storage @ 20th & Kokomo
8	21st and Houston	(Out of Service)	322	Ground Storage @ 20th & Kokomo
9	23rd and Kokomo	800	334	Ground Storage @ 20th & Kokomo
10	14th and Vernon	1,000 (Reconditioned**)	312	Ground Storage @ Smyth
11	16th and Milwaukee	800 (Reconditioned**)	312	Ground Storage @ 20th & Kokomo
12	23rd and Oakland	900	330	Ground Storage @ 20th & Kokomo
13	16th and Jefferson	1,000**	330	Ground Storage @ 16th & Holliday
14	20th and Ennis	1,000**	325	Ground Storage @ 16th & Holliday
15	7th and Elm	700	340	Ground Storage @ 7th & Elm
16	East Well on S.W. 3rd.	550	275	Ground Storage @ S.W. 3rd & Joliet
17	S.W. 3rd. and Joliet	600	285	Ground Storage @ S.W. 3rd & Joliet
18	West Well on S. W. 3rd.	600	283	Ground Storage @ S.W. 3rd & Joliet
19	Pecos Dr. & Highland Rd.	1,000 (New Well**)	364	Pumps to System

** SUBMERSIBLE PUMPS

TOTAL PUMPING RATE = 11,400 GPM OR 16.42 MILLION GALLONS PER DAY

THE CITY OF

PLAINVIEW, TEXAS



COMPREHENSIVE PLAN

1989-2010

VOLUME 2

TABLE 8-7

PLAINVIEW, TEXAS

EXISTING WATER PRODUCTION

Water Well Production	Capacity G.P.M.	Gal/day
Total pumping rate	11,400	16,416,000
Potential Daily Capacity (Design @ 18/24 per day) Subtotal		12,312,000
Surface Water Production		
Canadian River Municipal Water Authority through existing 18" line		3,400,000*
Potential Production of wells @ 18/24 and CRMWA in 18" line		15,712,000
Theoretical Volume Available		15,700,000

* This figure is representative of the present contracted amount for daily consumption. The current City water treatment plant has an operating capacity of 4 mgd, and the capability of receiving 4.2 mgd from the CRM.A and an additional 0.9 mgd waste water return supply.

TABLE 8-8

PLAINVIEW, TEXAS

PROJECTED WATER DEMAND

A	B	C	D	E	F	G
YEAR	POPULATION	DAILY AVERAGE DEMAND (GAL)	CALCULATED DAILY PEAK DEMAND (GAL)	ACTUAL DAILY PEAK DEMAND (GAL) (1)	CALCULATED PEAK DEFICIENCY (GAL) (2)(3)	ACTUAL PEAK DEFICIENCY (GAL)(2)(4)
1988	24,749	4,450,000	11,100,000	9,528,365	-	-
1990	25,250	4,550,000	11,400,000	9,721,250	-	-
1995	27,050	4,870,000	12,200,000	10,414,250	-	-
2000	28,750	5,180,000	13,000,000	11,068,750	-	-
2005	31,350	5,640,000	14,100,000	12,069,750	-	-
2010	34,258	6,170,000	15,400,000	13,189,330	-	-
2020	37,800	6,800,000	17,000,000	14,553,000	1,300,000	-
2030	41,900	7,540,000	18,900,000	16,131,500	3,200,000	431,500
2040	44,100	7,940,000	19,900,000	16,978,500	4,200,000	1,278,500
2050	48,600	8,750,000	21,900,000	18,711,000	6,200,000	3,011,000

(1) Based upon peak water usage established in 1987 on per customer usage.

(2) The theoretical volume of water available to the Plainview Water Distribution System utilizing existing wells and Canadian River Municipal Water Authority surface supply is 15,700,000 gallons per day. The peak deficiency is based upon the total available production.

(3) F = 15,700,000 - D

(4) G = 15,700,000 - E

WATER QUALITY

Water quality chemical analysis from the Texas Department of Health for the Plainview area can be found in the Appendix, and include samples for mixed local lake and well water, raw CRMWA water, the distribution system and a majority of the City's wells. There are various federal and state agencies which have established recommended standards for drinking water. The following is a list of recommended or maximum levels for common water supply constituents:

CONSTITUENT NAME	RECOMMENDED LEVEL
Chloride	250 mg/l
Fluoride	1.4-1.8 mg/l
Magnesium	125 mg/l
Nitrate (as N)	10 mg/l
Sulfate	250 mg/l
PH	7.0
Dissolved Solids	500 mg/l
Arsenic	0.05 mg/l
Barium	1 mg/l
Cadmium	0.01 mg/l
Chromium	0.10 mg/l
Copper	1.0 mg/l
Iron	0.3 mg/l
Lead	0.05 mg/l
Manganese	0.05 mg/l
Mercury	0.002 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
Zinc	5.00 mg/l

The local raw water supply is typically hard and test samples reveal high dissolved solids; however, most other constituents are generally within recommended standards. The water provided to local consumers is safe and of good quality, and the current method of treatment requires no significant improvement at this time. Proposed federal legislation is underway for a major desalinization project which would improve the quality of water for all areas served by the CRMWA.

A recent amendment (June, 1986) to the Federal Safe Drinking Water Act requires the use of lead free materials for the installation and repair of any public water system or plumbing system providing for human consumption. The Texas Department of Health revised the "Rules and Regulations for Public Water Systems" in the spring of 1988 to reflect the new lead ban. An important requirement of the new regulations is the public notification of the lead ban. Each public water system must notify those people who could be affected by lead in drinking water resulting from: 1) the lead content in the construction materials of the system and/or 2) the corrosiveness of water sufficient to cause leaking of lead from plumbing systems.

WATER TREATMENT PLANT

Untreated water supplied to the City of Plainview by the Canadian River Municipal Water Authority is treated at the City water treatment plant, opened in 1969, and located on 16th Street near Holiday Street. The existing treatment process is a system of coagulation, flocculation, sedimentation, filtration, and disinfection. The facility has an operating capacity of 4 mgd, and the capability of receiving 4.2 mgd from the CRMWA and an additional 0.9 mgd wastewater return supply.

The treatment plant consists of two solid contact clarifiers, four rapid sand filters, two sludge drying beds, centrifuge, ground storage with accompanying booster pump facilities, waste water tank, and chemical handling and feeding equipment. The control building includes monitor and control equipment, alarm system and displays, and complete laboratory facilities.

The condition and maintenance of existing plant facilities is excellent, and current component capacities are satisfactory for present and anticipated future demands.

EXISTING WATER SYSTEM FACILITIES

Plainview's existing water system facilities, including distribution lines, storage facilities, and water wells are mapped on Plate 8-1.

A computer analysis of the Plainview water pipe network was conducted by Parkhill, Smith, and Cooper, Inc. in 1976 using the Hardy Cross method. The information obtained included water quantities and pressures at various locations for given water demands. The analysis concluded that no significant improvements were required for the distribution network at that time. The existing water distribution system, consisting mostly of 6 inch and 8 inch lines fed from 10 inch or 12 inch mains, presently has no major deficiencies either from the standpoint of service or pressure. Several areas lack proper looping or adequate fire hydrants and valves. At this time, the most significant consideration for improvements should be for the projection of new lines into areas of future development, with the extensions of existing lines to help form the looped system.

Existing water storage facilities, with locations and storage capacities are shown in Table 8-9. Plainview currently has five ground storage facilities with a total capacity of 5 million gallons. All of these ground storage tanks are located in conjunction with City water wells. The City has five elevated storage tanks, providing a total capacity of 1.75 million gallons. A fairly even distribution of storage locations exists throughout the core of the City.

TABLE 8-9

PLAINVIEW, TEXAS

WATER STORAGE FACILITIES

LOCATION OF FACILITY (TYPE)	GROUND STORAGE (MG)	ELEVATED STORAGE (MG)
GROUND STORAGE:		
12th and Smyth (Concrete)	0.50	
20th and Kokomo (Steel)	1.00	
16th and Holliday (Concrete)	2.00	
7th and Elm (Concrete)	0.50	
S.W. 3rd and Joliet (Concrete)	1.00	
ELEVATED STORAGE:		
12th and Smyth (Steel)		0.25
7th and Beech (Steel)		0.20
14th and Baltimore (Steel)		0.30
S. Date and A.T.& S. R.R. (Steel)		0.50
N. Quincy and I.H. 27 (Steel)		0.50
TOTAL CAPACITIES	**5.00**	**1.75**

Table 8-10 presents past and future water storage requirements. Current ground storage capacity appears to be adequate beyond the year 2020. By 2005, an additional 250,000-500,000 gallons of elevated storage will be needed. As is the case with water wells, future ground and elevated storage locations to the west of Interstate Highway 27 should be taken under consideration.

TABLE 8-10

PLAINVIEW, TEXAS

WATER STORAGE REQUIREMENTS

YEAR	POPULATION	GROUND STORAGE REQUIREMENTS (MG) (1)	ELEVATED STORAGE (MG) (2)
1960	18,735	2.436	1.015
1970	19,096	2.482	1.035
1980	22,187	2.884	1.203
1988	24,749	3.217	1.342
1990	25,250	3.283	1.369
1995	27,050	3.517	1.466
2000	28,750	3.738	1.558
2005	31,350	4.076	1.699
2010	34,258	4.454	1.857
2020	37,800	4.914	2.049
2030	41,900	5.447	2.271
2040	44,100	5.733	2.390
2050	48,600	6.318	2.634

State Board of Insurance Requirements -

(1) Ground Storage Required: 130 gallons per person day

Suggested: One day storage equal to peak day use

(2) Elevated Storage Requirements: 54.2 Gallons per person per day

Existing City water wells, as listed in Table 8-6, produce from 550 gpm to 1000 gpm, and most pump directly to ground storage facilities. The City has abandoned three (3) wells near the ground storage at Smyth Street, while two (2) new wells have recently been added, and two (2) are currently out of service. Existing wells are generally located through the central eastwest portion of the City. The current location and spacing of wells is adequate for the existing City; however, new wells will have to be drilled periodically to replace existing wells or increase water supply, if necessary. Future sites should, if possible, include locations to the north of Twenty-Fourth Street, to the south of Southwest Third Street, and to the west of Interstate Highway 27.

Existing booster pump facilities are shown in Table 8-11 along with adjoining ground storage and well capacities. The pumps listed have a total capacity of 25,100 gpm while the total supply rate is only 13,760 gpm. This comparison shows that present pumping capacities are sufficient for both storage and well supply. Auxiliary power systems must be available to supply pumps in the case of a power failure.

PROPOSED WATER SYSTEM FACILITIES

The location of proposed water system improvements are shown on Plate 8-1. Part of these proposed future improvements are detailed in a five (5) year program as listed in Table 8-12, in order of priority, along with estimated costs. Table 8-13 is a detailed cost summary of the proposed five (5) year program. Beyond the recommended five (5) year program, Plate 8-1 should be used as a future water plan and a basis on which the City of Plainview can meet its future water demands depending on system needs and availability of funds.

Recommended distribution lines for the 5-year program include mostly larger (12") mains where development and service needs are expected in the near future, and proper looping and connections are necessary. In particular, locations along Interstate Highway 27 and Southwest Third Street appear to be most likely to require new lines.

Only a few local service lines are proposed in areas not currently being served by the City. The need for the replacement and expansion of local service lines in Plainview is very isolated and should be considered individually based on City policy and available funds. In undeveloped areas, new local distribution lines should be designed to conform to platting layout and land use needs.

Future water mains are also recommended as projected for the needs of anticipated development beyond the 5-year program. Most of the future lines conform to the proposed Thoroughfare and Land Use Plans, wherever possible, and extend to planning limits for growth that may reasonably be expected in the years to come.

TABLE 8-11

PLAINVIEW, TEXAS

BOOSTER PUMP STATION FACILITIES

PUMP NO.	PUMP CAP. (GPM)	CONNECTION SYSTEM	WELL NO.	SUPPLY RATE CAPACITY (GPM)
1	1,000	500,000 Gallon	10	1,000
2	1,000	Ground Storage		
3	1,000	12th & Smyth		
	3,000			
4	2,400	1,000,000 Gallon	7	700
5	1,250	Ground Storage	9	800
6	2,400	20th & Kokomo	11	800
	6,050		12	900
				3,200
7	1,600	2,000,000 Gallon	13	1,000
8	2,400	Ground Storage	14	1,000
9	3,700	16th & Holliday	WTP*	2,360
	7,700			4,360
10	1,000	500,000 Gallon	15	700
11	1,000	Ground Storage		
	2,000	7th & Elm		
12	1,800	1,000,000 Gallon	16	550
13	1,800	Ground Storage	17	600
	3,600	S.W. 3rd Street	18	600
				1,750
14	1,000	Pumps to System	4	1,000
15	750	Pumps to System	6	750
16	1,000	Pumps to system	19	1,000
	2,750			2,750
Total:	25,100 gpm		Total:	13,760 gpm

*Water Treatment Plant

TABLE 8-12

PLAINVIEW, TEXAS

WATER IMPROVEMENTS

5-YEAR PROGRAM COST ESTIMATE

PROJECT DESCRIPTION	ESTIMATED COST
1. 10" WATER LINE Ennis Street (3rd St. south to school)	$96,900
2. 12" WATER LINE 24th Street (Date St. to F.M. 400)	32,920
3. 16" & 12" WATER LINE Westridge Park Addition	53,160
4. 12" WATER LINE Quincy Street (W. 4th St. to S.W. 3rd. St.) S.W. 3rd. St. (Quincy St. to Joliet St.)	116,200
5. 12" WATER LINE I.H. 27 (S.H. 194 to Quincy St.)	172,020
6. 12" WATER LINE I.H. 27 (Near Mesa Verde Addition)	34,620
7. 1" WATER LINE F.M. 400 (24th St. to Campbell St.)	$74,100
8. 12" WATER LINE S.W. 3rd St. (Ennis St. to Quincy St.)	113,920
9. 12" WATER LINE Western Meadows Addition	197,240
10. 12" WATER LINE Industrial Blvd. (Joliet St. to U.S. 87) U. S. 87 (Industrial Blvd. to 29th St.)	141,600
Subtotal Construction Cost	$1,032,680
Technical Services Cost (10%)	$ 103,000
TOTAL ESTIMATED COST (5-YEAR PROGRAM)	**$ 1,135,680**

TABLE 8-13

PLAINVIEW, TEXAS
WATER IMPROVEMENTS*

5-YEAR PROGRAM COST SUMMARY

DESCRIPTION	MEASUREMENT	PRICE	QUANTITY	COST
12" Water Line	L.F.	$18	42,200	$759,600
10" Water Line	L.F.	16	1,680	25,600
6" Water Line	L.F.	12	2,040	24,480
12" Gate Valve	EA	800	68	54,400
10" Gate Valve	EA	700	3	2,100
6" Gate Valve	EA	500	77	38,500
Fire Hydrant	EA	1,000	71	71,000
Highway Bore	L.F.	75	760	57,000
Subtotal Construction Cost				$1,032,680
Technical Services Cost (10%)				$ 103,000
TOTAL ESTIMATED COST (5-YEAR PROGRAM)				**$1,135,680**

*NOTE: Price for pipe includes fittings, connections, pavement repair, and other anticipated pay items.

thickness of the sand, the better the porosity, and the greater the production capacity of the well.

A routine maintenance and inspection program by the City of Plainview of water system facilities should, as a minimum, include the following tasks at proper intervals: check pumps, check water wells (water depths, readings, etc.), collect water samples, check fire hydrant and water pressure, and inspect water storage tanks.

SOURCES OF FUNDING

Possible funding sources for proposed improvements to the Plainview water system would include Texas State Bonds issued through the Water Development Board, and Revenue Bonds or General Obligation (Tax) Bonds issued by the City. There appears to be little prospect for any type of federal grant for these improvements. Grant funds as might be available would be administered through the Texas Community Development Program based on a priority rating system conducted annually. If a regional system were under consideration by some such agency as the Canadian Municipal River Authority, funding might be possible through the sponsoring agency. However, this course is not open for purely local projects as considered herein.

SECTION 9

SEWER SYSTEM STUDY

SECTION 9
SEWER SYSTEM STUDY

SANITARY SEWER SYSTEM PLANNING

The development of a city is influenced greatly by the local topography or the "lay of the land". If the slope of a sewer line is flatter than the natural slope of the land, the sewer will be quite deep and expensive to construct; whereas if the slope of a sewer line is steeper than the slope of the land, the sewer line will "run out" of the ground and cannot be extended further. Sanitary sewers should be constructed, when possible, on a slope approximately parallel to the ground surface at a sufficient depth to serve the adjoining properties. If this pattern can be followed, the cost of construction of sewers can be minimized. Since construction cost often dictates the feasibility of providing service, it can influence the direction of development.

To properly prepare a plan for the future sanitary sewer system, the carrying capacity of the system to serve the existing and projected development of the planning area must then be studied and evaluated. Where severe over loading conditions occur, field studies must be made to ascertain what measures are needed to correct these problems.

There is a marked difference in the life of the various materials commonly used in the construction of sanitary sewer lines. The deterioration of some of these materials is accelerated by chemicals found in the sewage and/or surrounding soils. If deterioration has taken place, planning must provide for replacement, and this replacement must conform to the overall pattern planned for ultimate city development.

A sanitary sewer system plan must provide for the collection of the sanitary sewer waste from the residential, business, commercial, and industrial sections of the city. This system should be large enough to carry the sewage flow originating in the area served by each main, plus a nominal amount of infiltration. Infiltration can be minimized, although it can never be completely eliminated. Material and construction specifications for the city should be strict enough to keep infiltration at a minimum. The Planning and Zoning Commission and City Council, in approving plats, should be assured that the developer will provide quality construction.

Limits of drainage areas are determined by the topography; these in turn define the areas which can be served by certain sewer lines. In the preparation of a sewer system plan, the collection and transportation of sewage to sites for treatment in each drainage area must be considered in its relation to the city as a whole. Many cities are fortunate in that their topography and area of development afford gravity flow for the entire sewer system; others may require one or more sewage lift stations or pumping stations to transport the sewage from one drainage area to another. In some cities it has been advantageous, when development has taken place at the

upper end of a drainage area and it is not economically feasible to provide a long collection line at the time, to construct a lift station for use over a short period of years with the expectation and knowledge that it will be abandoned as development requires a trunk sewer from the lower end of the drainage area. The sewer system plan provides the criteria and general plan for sanitary sewer service to the present City.

Topography also affects the treatment plant facilities which the city maintains to treat the collected sewage. Some cities find it economical to have more than one sewage treatment plant; however, in most instances a central sewage treatment plant is most advantageous.

State laws administered by the Texas Department of Health, the Texas Water Commission, and the Environmental Protection Agency (E.P.A.) govern the degree of treatment which must be provided in treatment of water borne wastes discharged into streams. The plan must determine if the present sewage treatment plant can produce a final effluent of the quality required. If it cannot, recommendations must be made for meeting these requirements. The anticipated nature and quantity of sewage as estimated from the future land use development plan must be taken into account to determine whether sewage treatment plant improvements are needed.

INFILTRATION

Infiltration is that part of the sewage flow that comes from storm water runoff and ground water. This water enters the sewage collection system by leakage through faulty pipe joints, manholes, cracked pipe and any connections that may not be watertight. All sewage collection systems have some infiltration because it has not been found economically feasible to build and maintain a watertight sewer system, except in areas where the sewer mains are below the ground water table.

The quantity of infiltration in an existing sanitary sewer system is difficult to determine without extensive tests and measurements of the flows at various intervals of time. It has been found that the average quantities of infiltration are so difficult to measure that it becomes impractical, in most cases, to attempt to do so. In general, infiltration inflow is greatest during periods of heavy rainfall, thereby increasing the sewage flows. From the tests that have been performed in many systems comparable to the Plainview system, the average rates of infiltration were found to be in a range of approximately 500 to 1500 gallons per acre per day (gpad). It is important that all future plans and specifications for sewer improvements contain a clause limiting the amount of infiltration which will be tolerated and that all subdividers and persons charged with the inspection and acceptance of house sewer connections enforce the requirements of this clause. It is recommended that the Plainview Standard Construction Specifications require all new lines to be tested and that the maximum limits of infiltration is 200 gallons per inch of pipe per mile of length per 24 hours.

MUNICIPAL SEWAGE

Untreated municipal wastewater contains both the chemical constituents present in the water supply prior to use and those added during use. There are also many complex organic substances present, including nitrogenous materials, and bacteria and viruses, some of which may be pathogenic.

Organic material which is added to a water supply during use is commonly measured in terms of the amount of oxygen required by aerobic bacteria to decompose or stabilize this material. The unit of this measure is the biochemical oxygen demand (BOD) commonly expressed in mg/l or pounds per day. Thus, the higher the percentage of BOD removal during waste treatment the less oxygen demand required to stabilize the remaining degradable organic material in the wastewater after it is discharged into a natural water course. The per-capita contribution of BOD to a municipal water supply during its use varies widely among municipalities. Generally, the per-capita contribution ranges between 0.1 and 0.25 pounds per day.

Methods of treating municipal waste waters are commonly classified as primary, secondary, and tertiary or advanced waste treatment. Primary treatment generally consists of removal of floating and suspended material by mechanical or chemical processes. Essentially, none of the refractory constituents are removed by primary treatment, and on the average only about 35% of the BOD is removed.

Secondary treatment generally provides some means of satisfying more of the oxygen demand of the wastewater prior to discharge, and is usually preceded by primary treatment and often followed by chlorination to reduce bacteria and possible virus. Conventional secondary treatment removes an average of about 80% to 85% of the BOD although relative efficiency of plant operation may substantially reduce or increase this percentage.

Wastewaters provided secondary treatment are presently generally considered to be adequately treated, although as is the case with primary treatment, refractory constituents such as chloride, sulfate, and soluble non-biodegradable organic material are not reduced by most conventional secondary treatment processes.

In most conventional secondary treatment systems concentrations of nitrogen and phosphorous are not significantly reduced. However, studies involving innovations in routine operation of conventional secondary treatment plants have indicated that in some cases nitrogen and phosphorous removal can be increased. Both nitrogen and phosphorous serve as nutrients for biological growth in stream and reservoirs, which when excessive, may produce general nuisance conditions, further deplete oxygen from the water and create taste and odor problems in water supplies.

Tertiary or "advanced" waste treatment may include a wide variety of techniques designed either for a general high degree of pollutant removal or for the removal of a specific pollutant or pollutants where severe conditions of stream pollution might exist below wastewater outfalls from conventional waste treatment facilities.

SEWAGE TREATMENT PLANT

The Plainview Municipal Wastewater Treatment Plant, constructed near the southeast Corporate Limits in the early 1960's, is a trickling filter-solids contact process. The plant has been recently updated to meet the requirements set forth by the State of Texas.

The existing treatment process is a system of screening, comminution, clarification, anaerobic digestion, filtration, and disinfection. The facility has an operating capacity of 3.1 mgd, with the capability of handling peak flows up to 6 mgd.

The treatment plant consists of a comminutor, Parshall flume, mechanical grit chamber, two primary clarifiers, primary and secondary digesters, aerator with clarifier, sludge drying beds, two trickling filters, rapid-mix and aeration basin, two secondary clarifiers, chlorine contact basin, and all associated pump facilities. The control building containing monitor and control equipment, chemical and storage building, blower building and chlorine storage rack, are located together at the plant entrance.

Feeders installed for the use of alum and/or polymers in the solids contact process are not being used at this time. Dried sludge is disposed of in the municipal sanitary landfill and the treated effluent is discharged into Running Water Draw adjacent to the plant.

The condition, maintenance, and capacity of the existing plant facilities are adequate for current flow demands. From a maintenance standpoint, the chlorine rack location is troublesome due to the configuration of the plant driveway and the associated difficulties with truck loading and unloading.

State regulations require that when a treatment plant reaches 75 percent of design capacity, engineering and technical studies should begin to determine projected future treatment processes, line locations, discharge requirements, etc. At 90 percent of design capacity, construction efforts on the treatment plant should be underway by the responsible City or Authority. Projected wastewater flows indicate that the Plainview Treatment Plant will reach 75 percent of design capacity around 1995 and 90 percent of capacity by 2000. Plant updates and expansions which may be necessary will also be dependent on present and future standards set forth for discharged sewage effluent.

Selected characteristics of local sewage include the following:

	Raw Sewage	Treated Sewage
Avg. BOD5 (Maximum month of 1987)	297 mg/l	18 mg/l
Avg. TSS (Maximum month of 1987)	199 mg/l	19 mg/l
pH Minimum/Maximum		6.8/8.4
D.O., Minimum/Maximum		4.1/11.9 mg/l
Annual Average Flow/Day	2.2 MGD	
Maximum Monthly Average Flow/Day	2.6 MGD	
Minimum Flow/Day, 1987	1.2 MGD	
Maximum Flow/Day, 1987	3.0 MGD	

INDUSTRIAL WASTES

Industrial waste is comprised of the discharge from establishments engaged in the various aspects of processing or producing some material or product. Many times, this type of waste is of a nature that requires special processes and equipment for sufficient treatment before it can be safely discharged. When this type of waste is allowed into a sewer system at full strength and in appreciable quantities, the pipelines and equipment can suffer damage, and the chemical-biological composition of the sewage entering the treatment plant often necessitates changes in the treatment operations. Unlike domestic sewage, which usually has fairly constant characteristics, industrial wastes will vary according to the type of industrial process, time of day, day of the week, season of the year, volume of business and numerous other conditions. At the present, the City of Plainview does not have any significant amounts of industrial wastes that would be of a concern in the normal treatment process. Inspection and testing programs are provided by the City. It is recommended, however, that the City continue to review the State requirements for treating the effluent wastes that would be discharged from any industries which may desire to locate in the City in the future. The City has an industrial waste ordinance which includes among its requirements the pretreatment of industrial wastes prior to their discharge into the City's collection system.

SOIL CHARACTERISTICS

The Plainview area is characterized by noncalcareous clay loams and fine sandy loams identified in three soil series/associations: Pullman-Olton, Pullman, and Mansker-Bippus-Berda. The three soil associations range in depth from 70-90 inches, have high water capacity, and slow to moderate permeability. The relatively low expansive properties of the local soils will not create the major sewer joint damage associated with some high shrink-swell clays.

During periods of high precipitation, infiltration can be a problem, particularly in pipes within a few feet of the surface. The greatest number of

inflow areas will probably occur in house service lines and shallow mains near the extremities of the gravity flow system.

DESIGN CRITERIA

The criteria used to determine wastewater system needs are based upon the standards as established by the Texas Department of Health and Texas Water Commission. These standards along with projected population estimates and future land use determine the size and location of sanitary sewer facilities to adequately service the planning area.

The capacity of a sanitary sewer interceptor or outfall line should be calculated based upon the peak flow rate. Peak flow is the highest two-hour flow expected to be encountered under any operational condition. Laterals and minor sewer lines should be designed with flows equivalent to four (4) times the average daily flow. Table 9-1 illustrates parameters generally accepted for the design of sewer systems.

TABLE 9-1

DESIGN PARAMETERS

Source	Remarks	Daily Sewage Flow Gallons Per Person	Sewage Strength mg/l BOD5
Municipality	Residential	100	200
Subdivision	Residential	100	200
Trailer Park Transient	2.5 persons per trailer	50	300
Mobile Home Park	3 persons per trailer	75	200
School with Cafeteria	With showers Without showers	20 15	300 300
Recreational Parks	Overnight User Day User	30 5	200 100
Office Building or Factory		20	300
Motel		50	300
Restaurant	Per Meal	5	600
Hospital	Per Bed	200	300
Nursing Home	Per Bed	100	300

Another criteria used to estimate average daily sewage flow is 2000 gallons per day per acre for residential development and 3000 gallons per day per acre for commercial development, when detailed specific data is unavailable.

No sanitary sewer lines should be less than six (6) inches in diameter. All sewers should have sufficient slopes to maintain a velocity when flowing full of not less than two (2.0) feet per second. Table 9-2 illustrates minimum acceptable slopes based on a Mannings roughness factor of 0.013.

TABLE 9-2

MINIMUM DESIGN SLOPES (N=0.013)

Size of Pipe In Inches I.D.	Fall in Feet Per 100 Feet of Sewer
6	0.50
8	0.33
10	0.25
12	0.20
15	0.15
18	0.11
21	0.09
24	0.08
27	0.06
30	0.055
33	0.05
36	0.045
39	0.04

Flow through a closed conduit can be calculated using Manning's Formula

$$V = \frac{1.486}{n} \times A \times R^{2/3} \times S^{1/2}$$

V = velocity in feet per second
N = coefficient of roughness of the pipe
R = hydraulic radius, which is a ratio of the welted perimeter of the pipe to the area of the pipe.
S = slope of the pipe in decimal feet

Table 9-2 utilizes a coefficient of roughness equal to 0.013. This value is an average value for older sewer systems with a higher coefficient of roughness. The coefficient represents the ease at which a liquid can travel over a surface. The smoother the surface, the lower the coefficient of roughness.

Polyvinyl Chloride (PVC) sewer pipe is the common medium used for sanitary sewer systems today and most likely to be used throughout the planning

period. PVC has a lower coefficient of roughness (0.011 to 0.009). Table 9-3 gives minimum slopes based upon a Manning's roughness factor of 0.011.

TABLE 9-3

MINIMUM DESIGN SLOPES (n=0.011)

Size of Pipe In Inches I.D.	Fall in Feet Per 100 Feet of Sewer
6	0.35
8	0.24
10	0.18
12	0.14
15	0.10
18	0.08
21	0.07
24	0.06
27	0.05
30	0.04
33	0.04
36	0.03
39	0.03

Slopes should be maintained to achieve a minimum velocity of two (2) feet per second (fps) and a maximum velocity of ten (10) fps. Where velocities greater than ten (10) fps are attained, special provisions should be made to protect against displacement by erosion and shock.

Special provisions should be made for all collection lines located near reservoirs and streams. Septic tanks should be avoided within two thousand (2000) feet of any surface water.

Manholes should be spaced approximately five hundred (500) feet apart but may be increased depending on the City's available maintenance equipment. Brick manholes are not recommended due to the possibility of infiltration.

Sanitary sewer force mains should maintain velocities in the range of two (2) to five (5) feet per second, include air relief valves and provisions to allow lines to be flushed. It is recommended that force mains should be a minimum of four (4) inches in diameter.

All commercial services should be connected to a manhole and be a minimum of six (6) inches in diameter. Single-family structures should be served with at least four (4) inch line and multi-family services should be a minimum of six (6) inches in diameter.

Sanitary sewer lift station sites should give consideration to accessibility, potential nuisance aspects, and flooding. Stations should be located as remotely as possible from populated areas. All pumps should be of the non-clog design, be capable of passing 2-1/2" inch diameter spheres and have not less than 3 inch suction and discharge. The pump capacity should be capable of handling the peak flow with the largest pump out of service. System curves should be developed to illustrate the performance of pumps operating alone or in combination. Elapsed time meters should be required for all new stations and installed in old stations.

Safeguards to prevent discharge of untreated or inadequately treated wastes during electrical power failures should be maintained. Types of safeguards include alternate electrical power sources, standby electrical generators, retention facilities and portable generators or pumps.

WASTEWATER FLOW

Assuming the relationship between metered water consumption rate and sewage flow remains locally constant in the future, it is expected that approximately 90-100 gallons per capita per day will be returned as sewage over the next 20 years. However, due to state design standards, up to 110 gallons per capita per day will be used as the estimated average sewage flow, excluding any allowances for infiltration, for the planning period outlined herein. Currently, the annual average daily flow is 2.2 mgd.

Table 9-4 shows estimated future wastewater flows for the City of Plainview.

The peak domestic sewage flows for the mains can be determined by establishing a ratio between the peak and the average flows, depending upon the size of the drainage area and the population served by the sewer main. This ratio is a maximum for small areas with an estimated population of 1,000 people or less, and gradually decreases as the size of the area to be served increases. An average ratio of 150% is commonly used for evaluations of the overall system. The peak flows through the mains should not only be based on the anticipated maximum domestic sewage flows, but they should also include sufficient allowances for infiltration. The peak infiltration for the City of Plainview has been estimated at 250 gallons per acre per day, for the future lines.

EXISTING SANITARY SEWER SYSTEM

Plainview's existing sanitary sewer facilities, including sewer lines, manholes, cleanouts and lift stations are displayed on Plate 9-1.

Sewage from the City of Plainview is collected by a network of mostly 6" sewer mains and laterals with several 10"-18" trunk lines and transported to the Sewage Treatment Plant near the southeast Corporate Limits in two 12"-24"

TABLE 9-4

PLAINVIEW, TEXAS

FUTURE WASTEWATER FLOW

YEAR	POPULATION	TOTAL ANNUAL VOLUME (M.G.)	AVERAGE DAILY VOLUME (M.G.)
1988	24,749	814	2.23
1990	25,250	829	2.27
1995	27,050	938	2.57
2000	28,750	1,051	2.88
2005	31,350	1,201	3.29
2010	34,258	1,376	3.77
2020	37,800	1,518	4.16
2030	41,900	1,683	4.61
2040	44,100	1,770	4.85
2050	48,600	1,953	5.35

interceptors running along either side of Running Water Draw. The locations and estimated capacities of the City's major trunk lines are as follows:

LOCATION	LINE SIZE	EST. CAPACITY
East including Frisco and Austin Heights	10"-12"	0.7-1.0 MGD
Southeast	12"-15"	1.0-1.6 MGD
Central, Northwest to Western Meadows Addition	10"-18"	0.7-2.2 MGD
West Central	10"-12"	0.7-1.0 MGD
West (North)	12"	1.0 MGD
West (Ridge Crest Addition)	12"	1.0 MGD
West (Westridge Addition)	12"	1.0 MGD

Virtually all developed areas within the existing corporate limits are now served by city sewer. Many of the old lines are vitrified clay pipe, although most remain in working condition. Joint leakage occurs at some locations and during heavy rainfall infiltration will increase system flow.

Due to the flat topography and assuming gravity lines are designed properly, the need for lift stations in the area is minimal. All lift stations do have multiple pump systems; however, not all stations have emergency bypass connections, an alternative power supply, or overflow alarm. As development occurs, pumping capacity and facility components may have to be updated to handle future peak flows.

A major lift station is located on the interceptor running to the treatment plant. Several other lift stations are required at various locations in the system and are detailed in Tables 9-5 through 9-10.

It appears that a majority of development requiring new sewer lines in the near future will occur: 1) West/Northwest along Interstate Highway 27 and near northern industrial development; 2) South near the new school site and proposed industrial uses in the vicinity of the airport.

Existing sewer lines serving the Western Meadows Addition are shallow and the trunk line servicing the area appears to be near capacity, making northern extensions difficult. As a result, any significant industrial growth to the north of State Highway 194 will almost certainly require the construction of new trunk lines. Only low flow discharge in the immediate area could be served with the existing system.

TABLE 9-5

CITY OF PLAINVIEW

LIFT STATION INVENTORY

LIFT STATION: SOUTH MILWEE

Location:	S.E. Fifth Street and Milwee Street
Installation:	Contractor Built (1968)
Pump Description:	1-3" Variable Speed Vertical Non-Clog, 2-4" Variable Speed Non-Clog, Operating in Parallel
Rated Capacity:	1,000 G.P.M., 3,000 G.P.M., 5,350 G.P.M.
Rated Head:	35 Feet, 38 Feet, 45 Feet
Facility:	Inlet Pipe to Wet Well, F.L.=3,323.67; 18" Force Main to Outfall Line, 4,400' East

TABLE 9-6

CITY OF PLAINVIEW

LIFT STATION INVENTORY

LIFT STATION:	FRESNO
Location:	Alley North of 26th Street at Fresno Street
Installation:	1961, 1975
Pump Description:	2-Pneumatic Ejectors in Brick Dry Well
Rated Capacity:	50 G.P.M.
Rated Head:	25 Feet
Facility:	4" Diam. Inlets, F.L. Elev. Inlet Manhole=3,362.10; 6" Diam. Force Main into 8" Gravity Line across street.

TABLE 9-7

CITY OF PLAINVIEW

LIFT STATION INVENTORY

LIFT STATION:	SOUTH COLUMBIA
Location:	South Columbia Street at St. Louis Street
Installation:	Tex-Vit Factory Built (1965)
Pump Description:	2-Pneumatic Ejectors
Rated Capacity:	50 G.P.M.
Rated Head:	25 Feet
Facility:	4" Diam. Inlet, F.L. Elev. Inlet Manhole=3,348.58; 4" Diam. Discharge Pipe to Adjacent Manhole, F.L.=3,362.74

TABLE 9-8

CITY OF PLAINVIEW

LIFT STATION INVENTORY

LIFT STATION:	NORTH JOLIET
Location:	35th Street and Joliet Street
Installation:	Davco Factory Built (1980)
Pump Description:	2-Pneumatic Ejectors Rated Capacity: 100 G.P.M.
Rated Head:	35 Feet
Facility:	8" Inlet, C.L. Elev = 3,361.50; 6" Force Main to manhole on 37th Street at 650' East of Quincy

TABLE 9-9

CITY OF PLAINVIEW

LIFT STATION INVENTORY

LIFT STATION:	JUNIPER
Location:	East 3rd Street at Juniper Street
Installation:	Contractor Built (1987)
Pump Description:	3-3" Variable Speed Vertical Non-Clog (40 H.P., 1150 R.P.M.)
Rated Capacity:	1,100 G.P.M., 1,200 G.P.M.
Rated Head:	82 Feet, 75 Feet
Facility:	20" Diam. Inlet Pipe to Wet Well,FL=3,326.20; 12" Diam. Force Main to 21" Outfall Line

TABLE 9-10

CITY OF PLAINVIEW

LIFT STATION INVENTORY

LIFT STATION:	FRISCO
Location:	Drake Street near Winchell Street Installation: Tex-Vit Factory Built (1960)
Pump Description:	2-4" Vertical Non-Clog (7.5 H.P., 1150 R.P.M.)
Rated Capacity:	200 G.P.M.
Rated Head:	45 Feet
Facility:	8" Diam. Inlet, F.L. Elev. = 3,332.00; 6" Diam. Force Main

PROPOSED SANITARY SEWER SYSTEM FACILITIES

The location of proposed sanitary sewer system improvements are shown on Plate 9-1. Part of these proposed future improvements are detailed in a five (5) year program as listed in Table 9-8, in order of priority, along with estimated costs. Beyond the recommended five (5) year program, Plate 9-1 should be used as a future sewer plan and a basis on which the City of Plainview can meet its sewage collection needs depending on development patterns and availability of funds.

Recommended sewer lines for the 5-year program include mostly larger 10 inch mains where development and service needs are expected in the near future, and relief of overloaded systems are necessary.

Only a few local collection lines are proposed in areas not currently being served by the City. The need for the replacement and extension of local sewer lines in Plainview is very isolated and should be considered individually based on City policy and available funds.

Future sewer trunk lines are also recommended as projected for the needs of anticipated development beyond the 5-year program. Most of the future trunk lines conform to local topography, wherever possible, and extend to planning limits for growth that may reasonably be expected in the years to come. In undeveloped areas, all new lines will be designed to conform to platting layout and land use needs. A proposed 18 inch relief main from the Fresno Street Lift Station is of critical importance to the existing collection system and is currently under consideration by the city.

A majority of the proposed 5-year improvements is devoted to a new large trunk line designed to serve the east, north, and northwest portions of the City. In particular, this line is necessary for the expected future industrial developement to the west of Interstate Highway 27 which cannot be served with the capacity of the existing central trunk lines. The proposed trunk lines is recommended to be constructed at least to a stub-out point on the west side of Interstate Highway 27 where utilization can reasonably be expected for collection systems in future development. In addition, many existing lines can be connected, resulting in more evenly distributed flow and the possible discontinued use of some lines and/or lift stations. The exact location of the proposed line and highway bore will vary depending on topography, service needs, and route availability. The proposed line location has been identified to allow for gravity flow to the maximum extent possible. Detailed engineering investigations will determine the need for lift stations, if any.

TABLE 9-11

PLAINVIEW, TEXAS

SANITARY SEWER IMPROVEMENTS

5-YEAR PROGRAM

COST ESTIMATE

PROJECT DESCRIPTION	ESTIMATED COST
1. 12" SEWER LINE Holliday Street (3rd St. south to school)	$25,200
2. 8" SEWER LINE Fresno Street (Fresno Lift Station to 24th St.) 24th Street (Fresno St. to Joliet St.) and Joliet Street (24th St. to 14th St.)	168,900
3. 8" & 6" SEWER LINE Westridge Park Addition	40,500
4. 15" SEWER LINE Running Water Draw (I.H. 27 to Westridge Rd.)	87,000
5. EAST TRUNK LINE (Juniper Lift Station to I.H. 27) See Plate SS-2	1,023,300
Subtotal Construction Cost	$1,344,900
Technical Services Cost (10%)	134,000
TOTAL ESTIMATED COST (5-YEAR PROGRAM)	**$1,478,900**

SOURCES OF FUNDING

Possible sources of funding for Plainview sanitary sewer system improvements would include federal grants (EPA) grants administered through the Texas Water Development Board or the Texas Community Development Program, and General Obligation (Tax) Bonds issued by the City. Assessments could also be levied against future developers or industries moving into the area. Revenue bonds could also be issued based on projected revenue from monthly billings to water customers. The prospects for participation in a regional system seem remote at this time, but should be reexamined in conjunction with any long range future planning.

SECTION 10

SOLID WASTE DISPOSAL

SECTION 10
SOLID WASTE DISPOSAL

INTRODUCTION

The concern of most people for solid waste ends at the sidewalk, curb, or alley fence. Collection and disposal of solid waste is a major public service, vital to the public health, safety, and welfare. The City of Plainview provides the municipal service of solid waste disposal. The amount of waste generated (about 6 pounds daily per capita), compared with the decreasing availability of land for solid waste disposal purposes is a serious problem. A system that devotes over 90 percent of its activity to manual labor and disposes over 80 percent of its collected material by open dumping and filling is wasteful.

The traditional methods of disposal are constantly being improved in light of the increasing populations. Technological advancements in the field of solid waste disposal are being explored on a national level. Collection improvements involving solid waste pipelines, pneumatic tube systems, and underground conveyor-belt tubeways are being tested in different areas. Efficient methods of incineration are being investigated. Many of the innovations available today do not offer total solutions because of still remaining technological and economic problems associated with waste materials.

Litter is a significant concern of city officials and citizens alike. Improvements regarding the practicality and economics of recycling will aid to reduce the problems of disposal and litter. A regional system concept through Hale County should assist in directing the City's future solid waste disposal. With rapid changes taking place in technology, and with stricter requirements being imposed on disposal by regulating agencies, care should be exercised to assure that costly improvements to the Plainview solid waste disposal program are not added only to be outmoded before capital recovery is available.

The City of Plainview should pursue the solid waste program of management in a way to promote the conservation of natural resources. The program should provide that disposal does not adversely affect the City's environment nor restrict its land use activities. The cost of solid waste disposal should be minimized and equitably distributed to those people using the system. Measures should be taken to control the amount of generated waste at the source. When volume is reduced, then the life of the sanitary landfills is extended. Every individual (person and business) directly contributes to the volume of solid waste. An increased awareness by both private and public antities would help to reduce the bulk volume presently requiring solid waste disposal.

SOLID WASTE CONSTITUENTS

Solid wastes are usually measured by the cubic yard and consist of those goods and products which can no longer be used productively and society feels that it must dispose of. Today, less than 10 percent of wastes are reclaimed for productive use. The following is a general EPA analysis of solid waste constituents:

CONSTITUENT	% OF TOTAL
Paper	32.8
Glass	9.9
Metal (88% Ferrous, 8% Aluminum, 4% Other)	9.3
Plastics	3.7
Rubber and Leather	2.7
Textiles	1.4
Wood	3.6
Food Wastes	16.6
Yard Wastes	18.5
Miscellaneous Inorganic Wastes	1.5
	100%

Classifications of refuse components can vary from both a legal and practical standpoint. Some common refuse classifications with a description of each are as follows:

REFUSE CLASSIFICATION	DESCRIPTION
Rubbish	Misc. waste matter resulting from housekeeping and ordinary mercantile enterprises (paper, glass, metals, rubber,plastics, etc.)
Garbage	All waste incident to and resulting from the use, preparation, and storage of food.
Bulky Waste	Articles of such dimensions that are not normally collected with domestic waste (furniture, appliances, etc.)
Industrial or Manufacturing Waste	Waste resulting from industrial or manufacturing processing.
Construction Waste	Waste resulting from building construction, demolition, repairs, or fires, including excavation.
Tree Waste	Waste resulting from the removal, pruning, or trimming of trees and shrubs (branches, limbs, trunks, stumps, etc.)
Sludges	Undigested solids from sewage treatment processes.

Other refuse types include animals, vehicle parts, and incineration particles.

SOLID WASTE COLLECTION

Most cities have garbage collected by a municipally operated refuse services which are, in general, more economical than those under private management.

In order to obtain the highest possible efficiency in cost and service, the following considerations and measures should be taken in the planning of a collection program:

1. Effective storage of refuse at collection sites.
2. Placement of refuse containers at the curb or alley line.
3. Use of plastic or paper bags to hold refuse.
4. Binding yard waste into separate bundles.
5. Development of more efficient collection routes.
6. Adoption of improved collection equipment.
7. Development of refuse-transfer facilities.

Collection routes and schedules are also critical in an efficient collection program. The E.P.A. has developed guidelines for the routing of individual trucks and collection crews including:

1. Confine each route to an area that is as compact as possible. Do not fragment or overlap routes.

2. Equalize the workload so that the collection and haul time for each route are reasonably equal.

3. Start the collection route as close to the maintenance garage as possible, taking into account heavily traveled and one-way streets.

4. Avoid collections on heavily traveled streets during hours of heavy traffic.

5. If the area has predominantly one-way streets, start the route at the upper end of the area, looping around the cross streets.

6. Include dead-end streets in the collection area of the streets that they intersect.

7. If possible, start the collection in a hilly area at the point of highest elevation. Collect on both sides of the street while the vehicle is moving downhill. This procedure aids safety, reduces wear on the vehicle, and conserves gas and oil.

8 If practicable, start all routes at the highest elevation in the district.

9. To the extent, schedule route turns in a right-hand direction. This is especially important for one-person trucks with the driver at the right-hand side.

10. For collection from both sides of the street at the same time, schedule the routes with long, straight paths across the grids before looping back, generally with clockwise turns.

LITTER CONTROL AND COLLECTION

The City should be aware of litter problems that occur in the area. Litter includes not only paper, bottles and other roadside discardables, but also abandoned automobiles and rejected appliances, scattered throughout the area. Parking lots and roadside areas are specific locations that tend to receive litter.

The City should provide increased enforcement of existing ordinances on litter violation. Fines for littering must be reasonable and well enforced. The City should study the merit of providing more litter receptacles at intersections, shopping areas, exits from parking lots and other strategic areas.

The City should actively pursue a policy of recycling. Publicizing the existence of a central disposal site and offering fair compensation, may encourage public acceptance.

The City should encourage the use of garbage bags, to help prevent the occurrence of litter after collection, until some improved process is developed. The local container receptacles in residential areas will also reduce litter, and increase efficiency of solid waste collection.

REFUSE RECYCLING

In some cases, municipal recycling has not been a significant factor in reducing the amount of solid waste. The problem rests with the difficulty of securing markets for recycled material. Separating and processing discarded waste is expensive. Present technology and tax structures are geared to and favor the use of primary materials. Immediate changes in attitudes as well as production and consumption habits must be developed and adopted by the public.

The City should provide the leadership role in promoting recycling as a primary method of solid waste treatment. This should be done by developing economic incentives at the local level and developing a market for recyclable material.

The City should encourage the separation of refuse as a way to reduce waste generation. A newspaper collection program should be investigated and placed in operation. Receptacles could be placed at specific locations throughout the area to receive paper, glass, and cans for collection and recycling.

SOLID WASTE DISPOSAL

Sanitary landfills continue to be the most common and practical method of disposal of solid waste in our society today. The sanitary landfill method is economical when properly managed, and no health or pollution problems should exist with respect to site location.

Incineration is one of the oldest disposal processes, and is still used in many American and Canadian cities for the electricity that can be generated from the waste heat. However, incinerators have suffered in recent years because of increasingly strict air quality codes.

Milling, shredding, bailing, and pyrolysis are other methods which can help provide a least partial disposal of certain types of refuse.

COOPERATIVE PROGRAM

All cities in the Plainview area are faced with problems of one kind or another in disposing of their solid wastes. The scarcity and high cost of city land for disposal sites is critical. For smaller municipalities, the expensive equipment and skilled management personnel necessary for good landfill operations may be prohibitive, in certain instances. The City of Plainview should work with other communities in Hale County to the maximum extent possible.

A regional analysis of solid waste disposal problems and potential future disposal plans should be conducted. Data should be studied concerning the suitability of various terrains for disposal, costs of various systems of collecting/transporting/transferring waste, and facility design criteria.

The City should participate in inter-governmental planning and programs for cooperative disposal of solid waste and future solid waste disposal sites.

LANDFILL DESIGN AND OPERATING PROCEDURES

Land availability and cost plays a large role in any landfill site location. The increasing scarcity of land in municipal areas is an important issue in terms of site location criteria. The City must also consider the environmental and public sensitivity of contemplated disposal sites. Disposal sites should be located no closer than 10,000 feet to any runway used by turbo jet aircraft and no closer than 5,000 feet to any runway used by piston-engine aircraft.

All landfills within four (4) miles of an airport should be critically evaluated to determine if any incompatibility exists. Disposal sites should not be located in such a position as to place a runway between the landfill and bird feeding, watering, or rotating areas.

The Texas Department of Health has set forth a complete solid waste guidelines in "Municipal Solid Waste Management Regulations".

A future landfill in the Plainview area will probably be located on flat topography and thus be operated utilizing the trench method. In the trench method, solid wastes will be spread and compacted evenly by repeated passage of a compactor or a bulldozer used at the site. Each layer should be compacted to a maximum thickness of about two (2) feet and this process should be continued to the end of the day's operation. Each trench should be approximately twenty-four (24) feet wide. All solid wastes deposited daily will be completely covered with a clay material available at the site. The cover material should be well compacted to prevent insect and rodent problems and blowing papers and plastics. The cover material should be a minimum of six (6) inches thick. The dirt previously mixed with the refuse will not be used as a cover material. A final cover of clay material should be placed three (3) feet over the entire surface of each cell within five (5) days of the last placement of refuse in that cell. When the complete site is filled, a layer of clay will be added to slope the site at about one percent grade. When this sloping is finished, the area should be plated over with hulled bermuda grass seed. This type of grass cover will utilize from 22 to 60 inches of water per year per acre. The average rainfall for this area is within this range, so that little if any water should be available as an excess for infiltration into the fill itself. Vegetation cover would be useful in preventing erosion of the sloped surface.

Some difficulties have been reported in the past with trying to grow cover crops on sanitary landfills. The principal cause for this seems to be that escaping gases affect some of the plant roots. For this reason, and the fact that an impervious cover material is being utilized, a provision should be made in an attempt to control the location of the escape of the gases produced. These gases are primarily carbon dioxide and methane, that are produced by the decomposition of the refuse.

If an escape for gas through the landfill cover is not provided, these gases will tend to move laterally through the earth adjacent to the landfill. In many cases, methane has collected in closed places and have been responsible for explosions or fires. Unless vented to the atmosphere, the carbon dioxide generated will tend to increase the hardness of the water through reaction with carbonate rocks. Since the movement of gas through a porous media depends upon pressure gradients, proper venting will effectively eliminate unwanted migration.

The marking of each cell of the landfill site is important. The proposed system should consist of post markers established along the centerline of each cell. This will assist for years to come in determining the exact location of each cell.

The excess soil developed from the trench operation should be stockpiled for future use.

The rate of solid waste disposal and operation life of the site should be estimated based upon available information from the City and the Texas Department of Health. The estimated solid waste generated per year should be combined into a total average for a five (5) year time period.

The leachates from sanitary landfills are high in biological and chemical oxygen demand, chlorides, iron, and nitrates. Leachates will not be produced by a landfill until the refuse has reached saturation of field capacity and require much external water being added to the refuse in the fill. The primary mechanisms of leachate production are solution, diffusion, osmosis, and mechanical transport of materials. Solution is the most important of these mechanisms. Any water which enters the refuse after it has reached field capacity must displace an equal amount of liquid which has been in contact with the refuse. The displaced water will be contaminated with materials leached from the refuse. The average moisture content of mixed refuse varies but is usually about 35%, leaving room for additional moisture before field capacity is reached and leaching begins. This would be about 40 gallons per cubic yard of refuse with cans, bottles, boxes, and large and bulky items removed to bring the refuse mass to field capacity. The best method of leachate prevention is to prevent water contact with refuse by sealing the top, sides, and bottom of the fill. Surface waters should be drained from the site. Vegetation cover, such as bermuda grass, will utilize much of the water that is bound in the soil layer at the top of the fill.

Gas vents should provide for the proper venting of any gases that are generated in the landfill operation. The length of the vent should be long enough to extend to the bottom of the lower cell of the landfill pit. The upper area which is not slotted, is to allow for the proper sealing of the surface with the final cover, without letting any surface rainfall water into the underground cells.

Fire protection will be provided by the City Fire Department, which consists of full-time firemen at two separate fire stations along with pieces of equipment including tank and pumper trucks. No open burning of solid waste will be allowed. Proper all-weather access roads will have to be provided into the solid waste site.

An attendant should be on duty during operating hours to direct the unloading of refuse. Access to the site should be limited and appropriate signs should be posted to indicate where vehicles are to unload. The unloading operation should be confined to as small an area as possible.

Wire fencing or screening should be provided at the operating area to catch all windblown materials. The fencing should be portable and may be moved in

conjunction with the filling operation. All windblown material resulting from the operation should be collected and returned to the disposal site by the attendant on duty at the site.

Hazardous materials should not and will not be disposed of at the municipal solid waste site. This would include, but not be limited to, empty commercial toxic chemical containers, industrial waste chemicals, sewage liquids, radioactive materials, infectious waste, etc.

Large and bulky items and demolition wastes should be buried only on the portion of the site in the area reserved for this type of material.

No salvaging or scavenging should be permitted at the municipal landfill site.

A landfill is to be designed to rapidly process and dispose of the refuse delivered to the site. No waste should be left on the site in excess of twenty-four (24) hours prior to processing.

The proposed landfill could be used on completion and closure as a field for growing crops or cattle grazing. The City could also use this area for future park and open space improvements.

EXISTING SANITARY LANDFILL

The Plainview Sanitary Landfill occupies a 406 acre section of the Running Water Draw Regional Park and is located south of Fifth Street between Joliet Street and Columbia Street. Primary access is provided from Joliet Street. Figure 10-1 shows the current landfill boundary layout.

The existing landfill consists of 249 acres to the north and 157 acres to the south of a drainage easement for Running Water Draw. Although dumping should not theoretically encroach the banks of the Running Water Draw diversion channel, site investigations revealed a considerable amount of garbage and trash within the limits of the channel area. This problem is of considerable concern in regards to the current landfill operation. In addition, the entire existing landfill boundary exists within the most recently delineated 100-year flood boundary.

The existing landfill is located less than 2,000 feet from the Hale County Airport runway. This is a violation of the current Texas Department of Health regulations for municipal solid waste management. The site location operates as a pre-existing condition and is protected due to the time the landfill was installed. This location is one that should be a continuous caution for a low-flying aircraft due to possible bird flight; however, there have been no problems reported or recorded with bird activity in the area.

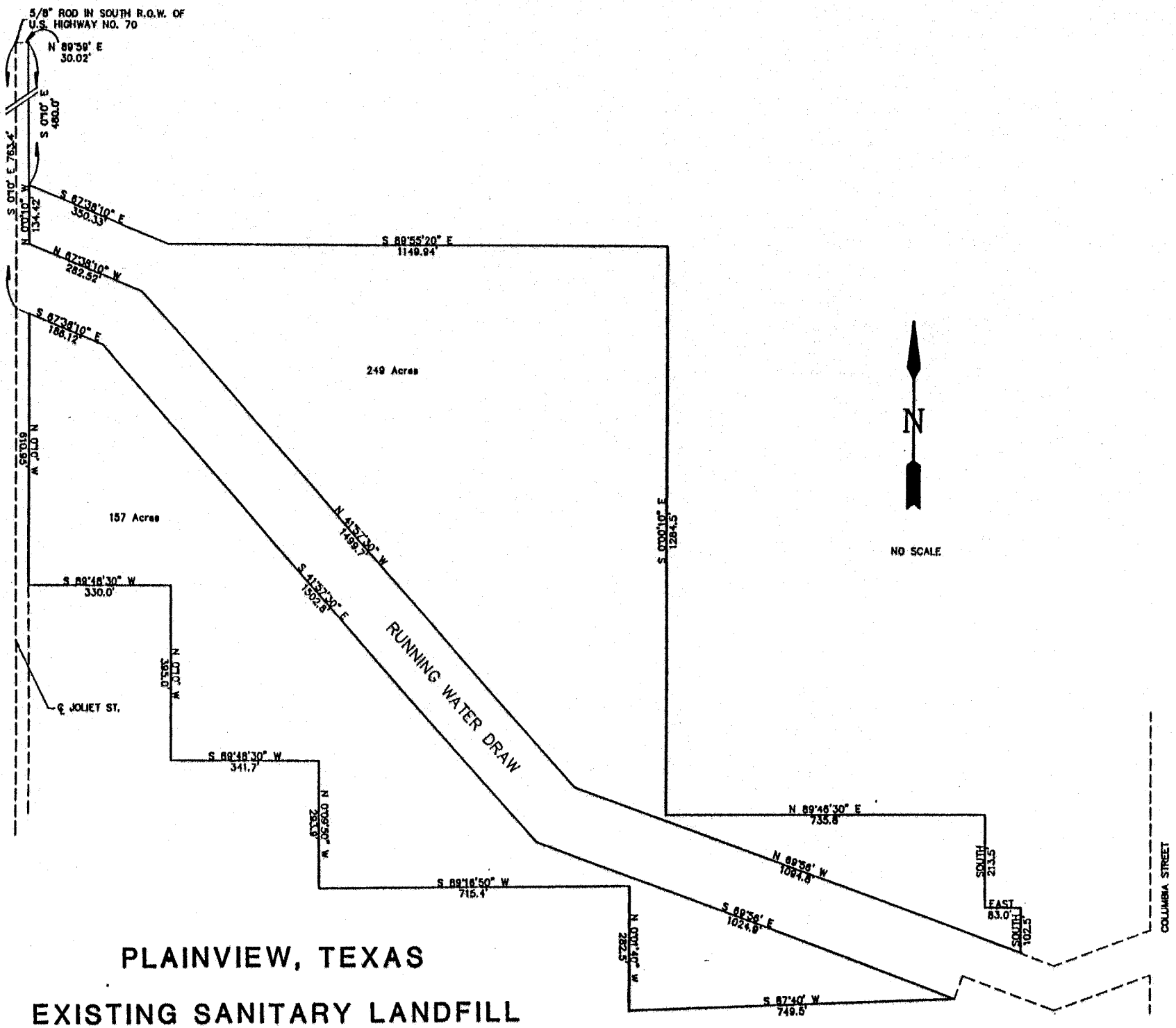


FIGURE 10-1

PLAINVIEW, TEXAS

EXISTING SANITARY LANDFILL

Large screening fences have been constructed along the northern edge at the site to protect adjacent development along the south side of Fifth Street. However, those smaller fences located to the southwest are inadequate to prevent windblown trash from escaping the premises, particularly in the vicinity of the nearby Plainview Cemetery.

There are no identified operating water wells within 500 feet of the existing landfill boundary as regulated by the Texas Department of Health. The nearest operating well is Well No. 17 located at Southwest Third Street near Joliet Street. Well No. 17 and two other wells are connected to the ground storage located at Southwest Third Street. The water table for these wells does not appear to be threatened by the existing sanitary landfill conditions. Included in the appendix are laboratory results of test bores obtained from various locations within the landfill boundary.

The existing landfill was permitted when the Health Department's regulations were much less stringent. Relatively few soil test borings were required at that time and little emphasis was placed on the exact permeability of the material in which garbage was being buried. Through the last 15 years Texas Department of Health regulations have evolved on a regular basis and updated biannually to become very comprehensive and demanding of permittees in order to prevent contamination of ground water and surface water, or any other element of the environment. All cities in the State of Texas have been faced with more expensive and difficult operational measures as these regulations evolved.

Those permittees who have been able to continue operation in existing sites, that did not previously have to meet such stringent criteria, have been forced to go through a very tedious self educational program. These cities with older operations face more budgetary commitments and are required to meet these expensive standards. Although the life expectancy of the existing Plainview site is not an immediate problem, various operational and site location aspects are becoming troublesome. Time is critical for a new site to be selected and permitted, due to the extended permitting and development process required.

SOLID WASTE DISPOSAL PLAN

The City of Plainview is currently in the process of preparing site development plans and the permitting of a new solid waste disposal facility and/or sanitary landfill. Location and actual purchase of an option or fee simple title could take several months. The permitting procedure may take at least 12 months so that a planning period of two years to acquire a suitable site and obtain a permit should be allowed. The current permitting procedure involves preparation of a site development plan by an engineer, with numerous exhibits, data sheets, soil testing borings, review by the State, and the process ends with a formal public hearing. The hearing is conducted according to standard administrative hearing rules much the same as a court

trial. Any affected opposing parties may enter testimony at the public hearing and may provide any and all expert witnesses desired to counter the City's proposal. The final decision is made by the Health Department Commissioner on whether or not to issue a permit for the new landfill. It can easily be seen that development of the operating plan for the site must be a very thorough and accurate one, requiring the services of a soils testing laboratory, a professional design engineer experienced in landfill operations, a groundwater hydrologist, and a very qualified and competent attorney. The City must be very definite and certain of its actions before purchasing any required property.

The location of a new site should be determined after a search of all available information on soil outcroppings in the area, and after preliminary and detailed soils boring of that site. Suitability of the soil is probably the most important criteria on which a permit decision is made. The presence of and the contamination to groundwater could be a primary point of opposition if organized parties counter the City's proposal. Access and view from public highways and roads, adjacent land use, and surface water patterns in the area will all be items of concern in this permitting procedure.

It is calculated that a minimum of 50 acres should be acquired by the City, but it is recommended that a larger size be considered. The entire site would not have to be permitted at one time, but could be permitted in reasonable phases. A 50 acre minimum size was calculated based on six pounds per capita per day of garbage generation by 50,000 population, and delivery to the landfill of 500 pounds per cubic yard density; 33% of the total fill being soil cover, 30% of the site being wasted by roads, creeks, buffer zones, utility line easements and other obstacles, and a 20 foot best case depth of excavation.

It is projected that a 50 acre tract first phase aquisition used as described above would last about 15 years.

Detailed feasibility studies will have to be conducted to determine the proper disposal site. It is recommended that alternate disposal sites by selected in the southeastern quadrant of the City.

One possible tract of land which is identified would be that area located south of U.S. Highway 70, north of the Sewage Treatment Plant and east of the unpaved county road. This area would be located out of the delineated 100-year flood boundary and access to the area is good via U.S. Highway 70. Improvements to the county road will be necessary to support increased traffic loads under adverse weather conditions.

Possible alternate locations include areas to the south of the Sewage Treatment Plant or other tracts south of U.S. Highway 70, and east of the county road. This area is located at a distance away from the Airport to clear flight path restrictions.

Expenses for permitting has, in recent years, amounted to approximately $100,000 up to $200,000 for a Type I permit such as required for Plainview. The fee will include the coordination of all soils, hydrology, and related engineering specialists, surveying of the site for preparation of site plan, preparation of the application review processes with the Health Department Engineers, review with the City's attorney for education and preparation of testimony at the public hearing, testimony at the public hearing, and assistance in the preparation of briefs and responses to briefs if the application is opposed. As Health Department regulations evolve to become more strict as a result of litigation by opposition parties against cities and the State itself, the number of experts and specialists required to develop a permit application which will succeed will necessarily increase. The total expenses can become large and will obviously have to increase, as regulations become more restrictive.

LOCATION RESTRICTIONS

Under the new standards currently facing cities the location of landfills will be controlled by criteria that are not significantly different from those existing. These are generally identified as selections of a site remote to an airport, outside of the 100-year flood plain, wells, or geological fault zones, and within areas where the soils limit migration of waters (heavy clay).

CLOSURE OF EXISTING FACILITIES

Once a new site is obtained, permitted, and opened for operation, the existing landfill site must be closed according to the various regulations.

A closure plan must be prepared and submitted to the State Department of Health for approval. This plan must address leachate, explosive gases, cover and maintenance of the overall project site, drainage controls, erosion due to stream flows adjacent to the site, etc., all of which are described in the regulations.

The first phase of the post-closure care period will be for a thirty (30) year time period. During this period of time, the operator must maintain a continuous routine maintenance of the final cover, continue the treatment of any leachate or ground water, and monitoring of any landfill gasses discharge from the site.

The second phase of the post-closure care will require the operator to continue the groundwater and landfill gas monitoring. The State will establish the length of monitoring periods, type of monitor well, sampling procedure, and maintain activities required.

SECTION 11
FACILITIES

INTRODUCTION

The planning for and the provision of community facilities are two important components of the Comprehensive Plan. Community facilities planning involves the analysis of existing facilities and a forecast of the overall future needs for these facilities in each neighborhood and in the City as a whole. This study of community facilities includes schools, parks, outdoor recreational facilities, indoor social and cultural services, public administration and service buildings, and additional public buildings and community facilities which must be provided. Community facilities play an important role in the maintenance of property values and in making the City more livable and desirable.

Community facilities are of two basic types: those which are provided within the boundaries of a specific neighborhood and are especially designed and located to serve that particular neighborhood, and those which are provided to serve a series of neighborhoods, or the entire City.

In the field of community facilities, various national planning standards have been developed by authorities for the various elements of a city's community facilities plan. One of the basic goals in all municipal planning is the creation of desirable residential neighborhoods wherein all urban facilities and requirements are provided. The majority of the neighborhood community facilities are provided and operated by agencies of the local government and are the responsibility of the City's governing body.

Community facilities studies are normally evaluated in two phases. First, existing facilities must be reviewed and analyzed and standards to govern the future improvements must be developed; secondly, the development of future needs and requirements for each type of community facility is formulated using a general summary of the standards and requirements of the various community facilities and an analysis of the age characteristics of the anticipated population. These investigations will determine the recommended area, space, and location requirements of the numerous community services and the means of determining future requirements of each area based upon projected population characteristics. The proper development of any city is dependent upon the provision of adequate parks, schools, and public buildings.

Previous community facility studies conducted for the City of Plainview and referenced in the report include:

Koch, Fowler, and Grafe, Incorporated, "Plainview Comprehensive Plan Report 6, Facilities", 1961.

Fowler and Grafe, Incorporated,
"1985 Plainview Comprehensive Plan",
1963.

Chevaliar and Musiak,
"Running Water Draw Regional Park Development Plan and Report",
1967.

James W. Kitchen and Herman K. Smith II, (Texas Tech University), "Master Plan for the development of Parks and Recreation, City of Plainview, Texas", 1980.

L. James Robison and Associates,
"A Comprehensive Study of Existing Facilities and Building Needs for the Plainview Independent School District",
1988.

Many factors influence the type and size of the community facility projects. The needs for facilities and services is constantly changing because of facilities which are used most effectively on a shared basis and because of the growing need of city services and the complexity of urban life. The need for neighborhood facilities will be affected both by the broad trends caused by changing times and the local factors which govern the services required by a specific population.

Standards for accessibility to community facilities are based on avoidance of fatigue, protection from traffic and other accident hazards, and positive encouragement to the use of facilities. In the low and medium income urban neighborhoods, accessibility generally is based on walking distance. Driving cannot be considered a substitute; for, in many cases, a family car must be used by the employed members of the household and is not always available for daily shopping or taking children to school. Access by driving is considered tolerable under certain circumstances if public transportation is available or, in the case of schools, if special transportation is provided.

PLANNING OF PUBLIC BUILDINGS

The provision of governmental and other essential public services to a community requires the proper distribution, location, and facility design of all public buildings. Like all community facilities, public buildings can be categorized as either those providing for a section of the City and therefore being distributed in the various areas being served or those situated at a central or optimum location in order to serve the entire City. After the type of facility needed is determined, the location and size of the facility is then selected by the evaluation of the community or part of the community to be served, the character of the land area involved, and the applicable access standards.

The site and type of public buildings to be selected are generally the responsibility of the government or agency that will occupy the building. However, in most cities, the Planning and Zoning Commission and the City Council must review and approve the location of all public buildings on behalf

of the community they represent. The locations selected should conform to the City's Comprehensive and Zoning Plans.

Compatible central public buildings under the authority of the same government or agency are often grouped together in or near the same location, which can make providing services more economical and convenient. One disadvantage to grouping public buildings is the difficulty in obtaining larger tracts of land, particularly in the central business district. Most new municipal centers are now being built on the edge of the city's established central business district.

The location and character of any proposed public building should be the subject of a detailed design analysis, working within the framework of the City's Zoning and Comprehensive Plan.. The following general recommendations are based on standard practices for some common public buildings and facilities:

CITY HALL

All municipal administrative and related offices are commonly grouped together in one building or group of buildings located near the center of the City's business activity and thoroughfare system. These municipal offices should be accessible to other public and private offices and all the citizens of the community. Often City Hall is adjoined by police and/or fire stations, a central library, and a variety of other public buildings.

As a minimum, the municipal administration building should provide about 0.5 square feet per capita and at least 250 square feet per employee; however, it should be noted that different jobs require different space and each work space needed can vary depending on the size of the City being served. Adequate parking for both employees and visitors is also critical. Parking needs for special occasions, and large Public Hearings may exceed the normal requirement, thus requiring the use of adjacent facilities to accomodate the special infrequent needs. As a focal point for the entire City, emphasis should be placed on the architectural appearance and composition of the City Hall.

MAINTENANCE BUILDINGS

Maintenance buildings for public works facilities and equipment usually serve a variety of functions including storage and maintenance of vehicles and equipment, fuel depot, warehouse for materials and supplies, a command post and gathering place for personnel. A maintenance building should be a functional complex, constructed to minimize noise and unsightliness, with efficient grounds lay-out, materials-handling, and building-area allocations. Maintenance facilities should be located with compatible land uses (usually industrial areas) and so as to minimize excessive and unproductive travel for vehicles and equipment. The amount of land should be the equivalent of 0.25 acres per 1,000 persons with 750 square feet of buildings per 1,000 persons.

FIRE STATIONS

Fire stations are highly specialized facilities, which must be located and designed to provide the greatest service and efficiency possible. Fire stations are critical to the health, safety, and general welfare of the public, and their adequacy affects insurance rates for all structures within the community.

The City Land Use Map provides the basis for measuring needs for fire protection. The thoroughfare and freeway system is also significant in relation to fire station location because of the impacts on access. In general, an engine company should be located within one (1) mile of each high value district (commercial or industrial), within 1-1/2 miles of standard residential districts, and within 4 miles of sparsely built-up areas. A ladder company should be within 1-1/4 miles of high value districts. Facilities should be considered to accommodate 1.5 men per 1,000 persons.

Standards for fire station sites vary considerably; however, all sites should be large enough to provide adequate station set back and space for parking and drills. Central or remote special drill sites for the entire City should be considered in some instances.

POLICE STATIONS

Police stations are similar to fire stations in location requirements and are often combined in one facility particularly near a city's municipal building. Like fire stations, branch police station locations are desirable as service areas grow larger; however, each police station can serve a larger radius.

The normal service area of a police station is 2-1/2 to 3 miles for communities of average densities.

Police stations should be located near intersections of major thoroughfares and usually require 1/2 to 1 acre sites.

LIBRARIES

A library system is generally provided through a municipally sponsored public library and the creation of a Public Library Board. In all likelihood, such action would result in one main library in a central location which would be easily accessible to all the area residents and would be supplemented by small branch libraries throughout the community. The City's public libraries can be maintained by public or private funds. In a smaller city, normally one central library location is found. In the suburban type community, the branch library system is usually developed. A main library should be located on a minimum one (1) acre site. The following are example standards for main library facilities:

Population	Volumes Per Capita	No. of Seats Per 1,000 Population	Total Sq. Ft. Per Capita
Under 10,000	3.50-5.00	10	0.7-0.80
10,000-35,000	2.75-3.00	05	0.6-0.65
35,000-100,000	2.50-2.75	03	0.5-0.60

Source: Joseph L. Wheeler and Herbert Goldhor, Practical Administration of Public Libraries (New York: Harper and Row, 1962) p. 554.

HEALTH SERVICE FACILITIES

Residents of a community should have, at the neighborhood or district level, convenient access to health services, and to general hospital facilities. General hospital facilities should be available at the ratio of at least 4 beds per 1,000 persons. Inadequate hospital capacity within a city creates many problems related to the future growth and well-being of the community. Usually, many small private hospitals or clinic-type hospitals and medical centers for treatment only are developed within the community. However, adequate major hospital equipment and services of the nature needed to serve the present population and anticipated future population is extremely important in community planning. The provision of full-scale general hospitals must be included in the community's urban structure, developed through either private or public means, so that the full range of required facilities can be provided.

District hospitals should be located to be accessible from all major thoroughfares on a minimum 15 acre site and such that no conflicts arise due to traffic, noise, etc. The size of the site chosen must be ample to accommodate short and long term parking.

Today's modern neighborhood shopping center makes provisions for medical and dental offices, and the larger clinic-hospital operations normally locate within or adjoining these shopping areas; but, these are not to be considered as a substitute for the general full-service hospital which is needed within the community.

The ever changing age of our population combined with the cost of medical care facilities has placed a large burden upon communities like Plainview. Liability for medical care and treatment have created conditions which are difficult for small to medium size community medical care units to manage. The community must continue to support the medical care provided in Plainview.

AIRPORTS

The planning of airport facilities within the structure of the community's Comprehensive Plan is not applicable to every community. Central cities and suburban communities in metropolitan areas normally have air transportation facilities provided on a regional basis. In the smaller city, the development of airport facilities depends on many factors including, the nearness to metropolitan areas, potential air traffic to be generated from the area, and the prospects of the profit and loss operation of the airport itself. An airport which has been carefully located, planned, developed, and maintained can become as vital a factor in stabilizing and enhancing land values as any other civic improvement. Moreover, the convenience and utility of an airport forms part of any orderly coordinated community plan. In choosing an airport site, many factors must be considered since not only is the immediate area affected, but also land located in line with the runways, for a considerable distance.

EXISTING PUBLIC BUILDINGS

The City of Plainview currently operates several buildings and facilities including the City Hall, police and fire stations, service center, and public library. Additional community services are also provided by both public (County, State, combination) and private organizations in buildings located throughout the area.

The following is an inventory and overview of significant public buildings in the Plainview area:

City Hall - The Plainview municipal building is located at Broadway and Ninth Street in the northern Central Business District. The building (5,542 square feet) contains municipal, administrative, legal, accounting, planning, code enforcement, public works, and engineering offices, and City Council chambers.

The existing structure is sound, and constructed to conform to the Civil Defense Standards with one story underground. The facility, including the building and site space, is inadequate to accommodate the present staff and projected future growth. Office space and arrangement for some employees is not adequate, in particular for the City Attorney. Off-street parking for citizens can be a problem during certain busy periods and for events such as public meetings, and hearings conducted by the Planning and Zoning Commission and City Council.

Access to City employees in the basement of the structure is difficult, particularly for the elderly and handicapped, because no elevators are available. Municipal Court is currently held in the City Council chamber, which is ill-suited for the purpose.

City Maintenance Building- The Plainview maintenance building/storage site is located on Eighteenth Street between Columbia Street and El Paso Street. This facility serves as the service center for City vehicles and equipment, and as offices for the water and sewer department, sanitation department, and department of streets and traffic safety (with sign shop). A separate storage barn and welding shop are also located on the site. Approximately 40 employees work out of the facility.

Sanitation equipment, street repair materials, and other miscellaneous City property are stored on the grounds.

The main building is a functional and aesthetically pleasing structure, though some conflict exists with surrounding land uses. Some foundation problems have been identified at this facility. A combination of evaporation and refrigeration cooling is used for the building, which may reduce efficiency and create higher energy costs. In the service center, a special lift for heavy equipment is needed and should be acquired.

Parking at the facility is somewhat of a problem for employees. Currently, a lot on the south side of Eighteenth Street is used as employee parking which cannot be accommodated on the site.

Fire Stations - Plainview has fire stations located on Sixth Street near Beech Street and on the corner of Quincy Street and Tenth Street. The Quincy Street station (2 bay garage), which was originally built as a substation, currently serves as the administrative office and actually has more fire personnel than the station in the Central Business District (3 bay garage).

In general, the downtown station serves locations to the east of Joliet Street and the Quincy Street station serves locations to the west of Joliet Street. In practice, both stations will make runs to the other district depending on the equipment and personnel needed and/or available, at a specific call.

With the growth of the City in a westward direction, the location of the Quincy Street station has become questionable in its service capabilities and efficiency. Areas to the northwest and southwest are well outside service radius standards. Some run times from the Quincy Street station can be as high as fifteen minutes under certain conditions. In addition, the number of calls answered by the Quincy Street station are increasing rapidly, while the number of Sixth Street station calls have remained constant.

From an operational standpoint, the most critical identified problem exists at the Quincy station where living and locker facilities are too small and inadequate to serve for the number of personnel on duty per shift.

Police Station - The Plainview Police Station is located next to the Municipal Building on Ninth Street near Austin Street. The police station currently has approximately 30 employees (20 officers) and also serves as the office for the Municipal Judge.

The structure is functional; however, the size of the department has outgrown the space in the building which is 3,490 square feet. There are no adequate training or meeting facilities available. At the present time, the public library and Quincy Street fire station are utilized by the police for overflow space for meeting and training purposes. In addition to adequate meeting and training facilities, more and larger offices should be provided on a priority basis.

No heating or air conditioning facilities are available to the property room.

Library- The Unger Memorial Library is located at the corner of Broadway and Ninth Street. The building has approximately 9,000 square feet of floor space and contains about 40,000 volumes. Additional building area and parking spaces are necessary to meet current standards.

The condition of the existing library structure is excellent. A major facility deficiency is that no elevator exists to access the balcony and basement areas. This restriction places an undue burden on the elderly and handicapped in regards to their ability to use the existing facility.

Miscellaneous City Buildings - The Girl Scouts, United Way, and the Women's Club of Plainview currently occupy City owned buildings on Joliet Street near Fifth Street.

Miscellaneous Public and Semi-Public Buildings - The Plainview Country Club Clubhouse, the various churches and schools, and several motels are available for meetings and gatherings, of larger groups, although restrictions may be placed on their use. The use of these facilities serve a vital function for the Plainview area but their availability creates potential conflicts for scheduling that will require coordination.

County Court House - The Hale County Courthouse is located on the square in downtown Plainview surrounded by Fifth, Sixth, Broadway, and Ash Streets. Additional off-street parking needed for the facility and should be a concern to the City because of the impact on surrounding businesses and traffic flow.

County Service Center - The Ollie Liner Center serves as a Hale County Service Center, located on U. S. Highway 87 just southeast of the airport.

Post Office - The Plainview Post Office is located on Eighth Street and Ash Street. The lack of adequate off-street parking for the public, causes traffic congestion in the area. This is a major deficiency related to the facility.

A small lot located to the south of the building is used for Post Office vehicle storage and loading/unloading. Employee parking is provided behind the Post Office and in a lot to the west with access from Broadway Street. The only available public parking immediately available to the post office is in the form of on-street angle parking located on Ash Street in front of the building.This area, at the present time, is not sufficient during the peak hours of service in the early morning, noon and late afternoon when congestion of traffic occurs. The relocated drive-by mail drops do allow for the movement of traffic and convenience to the public.

Hospital - Central Plains Regional Hospital is located on Twenty-Fourth Street between the Dimmit Highway and Xenia Street. This facility provides services to 9 counties, has 150 beds, and a staff of approximately 40 doctors. Four nursing homes in the area provide an additional 300 beds. Other related facilities located in the area include the Central Plains Mental Health/Mental Retardation Center and the South Plains Health Provider Organization.

Chamber of Commerce - The Chamber of Commerce is located on Fifth Street just to the west of Frisco Street. This facility has a large meeting room and is available for gatherings and meetings on a schedule basis.

City/County Airport - The Hale County Airport is located south of Southwest Third Street between Columbia Street (U.S. 87) and Quincy Street. This facility has a complete control tower, terminal, etc. The potential for the extension of runway length does exist facilities thru proper zoning, noise and height ordinances.

Health Center - The Plainview/Hale County Health Department is located on the corner of Ash Street and Tenth Street. The interior layout of the building is poor and such that patient privacy is minimal.

Highway Department - The Texas Department of Highways and Public Transportation has a facility located on U. S. Highway 87 south of Plainview.

Employment Commission - The Texas Employment Commission is located on the corner of Broadway Street and Eleventh Street.

Department of Public Safety - The Texas Department of Public Safety is located on U. S. Highway 87 at Blankney Boulevard, which is the entrance to the airport.

College - Wayland Baptist University is located north of Sixth Street between Quincy Street and Yonkers Street. Associated facilities include Harrel Auditorium, Hutcherson Physical Education Center, Mabee Regional Heritage Center (Llano Estacado Museum), and Van Howeling Library.

PUBLIC BUILDING PLAN

Determining current inadequacies in public buildings and making plans for the future is critical. However, analyzing those needs and formulating specific solutions based solely on a given set of standards can be difficult. Local and situational criteria should sometimes be considered with a certain amount of flexibility. A policy and plan of this nature should be accounted for in any recommendations for public buildings. Plate 11-1 displays graphically the major components of the Public Buildings Plan.

The provision of adequate facilities for municipal administration should be a high priority. In recent years, the City has explored several alternatives, the most promising of which is a plan that includes the acquisition of a vacant bank building located on Baltimore Street between Fifth Street and Sixth Street to serve as the new municipal office.

The existing bank structure is sound, relatively new, and aesthetically pleasing. Increased space for parking is available and existing drive-through facilities would make transactions with the City Water and Tax Department more convenient for citizens. In order to make the bank building completely functional some internal modifications and/or structural additions will be required. It is recommended that acquisition and development of this site should be started on a priority basis. The initial building space should contain 12,000-14,000 square feet with possible expansion space as the need requires.

The existing City Hall facility would be ideal for municipal court and additional police facilities. The judge's chambers could be moved into the existing office of the Mayor or City Manager. The existing City Council chamber, which is presently used as Municipal Court, should be modified internally to a more standard courtroom setup. The remainder of the ground floor could be used for police and court administration or the possible relocation of the Plainview/Hale County Health Department. The basement can provide other required space for police related functions (offices, storage, meeting rooms/classrooms, etc).

Another possible alternative for a municipal complex would be to utilize all or part of the vacant area adjacent to the municipal building/police station for additional building and parking space. In this case, the existing municipal building could be utilized in a similar fashion as mentioned above.

The City maintenance facility should be reviewed periodically to assure productive and orderly operation. Accommodations must be made to isolate the facility from the surrounding low-density residential land use. As a minimum, a screening wall or fence should be erected conforming to City's Zoning Ordinance requirements. The installation of additional maintenance and support equipment, material storage, and various minor upgrades are required; however, it is assumed the present site is to continue to be used into the forseeable future.

In 1981, plans were set forth for a proposed civic center for the City, but financing was rejected by citizens in a bond election. A major portion of the proposed facility included a convention center complex with arena, auditorium, and meeting rooms. The complex plan which was eventually considered covered 40,410 square feet with seating space for 2,572 persons for athletic events and an additional 1,200 for meetings. In a feasibility study conducted by a Chamber of Commerce Civic Center Committee, three-fourths of those residents responding to a random questionnaire indicated that Plainview needed a civic center. It is apparent that a need does exist for a facility of this type which could be used for basketball games, graduation commencements, concerts, large meetings, etc. It is recommended that the City continue to pursue a future civic center which could meet the needs of the community at such time as the project receives the approval and financial backing of the citizens of Plainview. A proposed location for the civic center is the area between Columbia and Broadway near Third Street, which is aesthetically pleasing, with room for parking and does provide for excellent access. In addition, such an activity center would greatly enhance the adjacent southern Central Business District area.

Considering Plainview's recent growth pattern, the locations of the existing fire stations are no longer considered adequate for the area to be served effectively. In particular, the Quincy Street station cannot efficiently serve the anticipated future development to the west and north. It is recommended that either a third station be opened at a site to the west of Interstate Highway 27 or that the Quincy Street station be relocated to a site in the area of the City water treatment plant and Hood Park near Eighteenth Street and Jefferson Street. The adjacent area is primarily residential and could pose some potential problems in the form a neighborhood opposition.

The previously mentioned 1981 bond program also included a proposed third fire station in the Hood Park area. However, the current need for a fire station located in the western portion of the City is compelling. Despite the added cost of a third station, or the relocation of the Quincy Street station, and additional material and equipment to staff an alternate site, some of that added cost could be offset by a reduction in fire insurance premiums paid by all citizens of Plainview from an adjusted key rate.

Assuming the potential move of some police and court facilities into the existing City Hall, the police station can be internally modified for a more efficient use with the additional space. Although one police station is acceptable at the present time, branch police or substations may become necessary as future expansion dictates. No direct justification for branch police and fire stations is available at the present time.

The Unger Memorial Library should adequately serve the Plainview community in the future, assuming that an eventual building expansion of about 8,000 square feet is provided along with the addition of an elevator and an increased parking area. The current main library is well located and supports the Central Business District. Restrictions may exist for an increase in site size which would also limit building space additions. No branch libraries are required or justified at this time. Bookmobiles could be used as an alternate method of access at schools, shopping centers, etc.

The City has no direct authority over the remainder of the public buildings in Plainview. Continual cooperation with County, State, and Federal Government, and private enterprises must be maintained to assure citizens the best and most efficient public service possible. For example, the City should provide assistance in obtaining additional off-street parking along and near Ash Street for the U.S. Post Office as noted in the Central Business District Plan.

The Post Office facilities should remain in the Central Business District area in order to further limit the decline of the area. Postal facilities are used by all the area citizens on a daily basis and form a central focal point from which to build and expand. The City should utilize all their available resources to insure the Central Post Office remains in the downtown area.

PARK AND RECREATION PLANNING

As a city grows and becomes fully developed, a plan for parks and recreational facilities becomes crucial to the vitality and well-being of a community and its citizens. Recreation areas and open space contribute to a desirable neighborhood and city-wide environment.

A Park and Recreation Plan should be used as a guide for the sizing and location of facilities for the existing City and projected future development.

The various types of recreation facilities to be considered differ in function, size, and design, and include the following:

Neighborhood Playgrounds
Neighborhood Parks
Community Parks, Play fields, and Recreational Facilities
Indoor, Social, and Cultural Facilities,
City-wide Community Facilities
Regional Parks

Table 8-1 can be used as a comparative general guide to the selection of various park sites.

OUTDOOR RECREATIONAL FACILITIES

Outdoor recreational facilities are generally considered in two categories:

Active: includes neighborhood playgrounds, district play fields and city-wide facilities such as swimming pools, golf courses, etc.,

TABLE 11-1

PLAINVIEW, TEXAS

PARK CRITERIA

TYPE OF PARK	ACRES/1,000 POPULATION	SIZE OF SITE(ACRES) IDEAL	SIZE OF SITE(ACRES) MINIMUM	RADIUS OF AREA SERVED (MILES)
Neighborhood Playgrounds	1.5	4	2	0.5
Neighborhood Parks	2.5	10	5	0.5
Playfields	1.5	1.5	1.0	1.5
Community Parks	3.5	100	40	2.0
Regional Parks	15.0	500-1,000	Varies	10.0

SOURCE: The committee of the Hygiene of Housing, APHA

Passive: includes neighborhood parks, community parks, regional parks, and various special types of city parks.

Outdoor recreational facilities to be included in residential developments are neighborhood playgrounds and neighborhood parks. Outdoor recreation helps to relieve the nervous strain of urban life. Furthermore, the opportunities provided for group recreation are helpful in fostering good social relationships. Neighborhood parks should be for all age groups. Special emphasis is placed on serving mothers with small children, the aged, and families. These groups need outdoor recreational facilities close to home much more so than older children and working adults who are less bound to the neighborhoods.

Standard sizes of active recreational areas have been well established and widely accepted, at least in theory. Few standards have as yet been developed as to the space for passive recreation areas. In the past, the tendency has been to develop a few large outlying parks while to ignoring the needs of those who live at remote or far distances from these parks. The active use of the remote facilities thus limits their use to occasional or special function purposes. The generally accepted goal for city-wide combination of all types of recreational space is 10 acres per 1,000 persons.

The responsibility for the provision and operation of outdoor recreation facilities usually rests with the City Department of Parks and Recreation. Responsibility for acquisition, maintenance, and supervision of playgrounds is often more clearly defined and more regularly assumed than for neighborhood parks. This can be attributed to the lack of adopted standards for neighborhood parks, insufficient park funds in city budgets, and inadequate realization of the public responsibility for neighborhood parks.

City parks should be publicly acquired, developed and properly equipped and maintained. Arrangements for park maintenance should be considered at the early stage of development. It is not uncommon to see an empty weed-covered lot, designated and donated as a park by the original land owner, but never developed or maintained for park use by the community.

NEIGHBORHOOD PLAYGROUNDS

The neighborhood playground is the chief outdoor center for elementary school-age children. Equipment should be of a type which permits a wide range of normal play activities. The playground should also be a place where the pre-school children can play in a protected area under the supervision of a parent or older child and where high school children and adults can enjoy games that require little space. The playground area should provide most of the following:

a. Small space for pre-school children.
b. Playground area and equipment for older children.
c. Open space for informal play.
d. Surfaced area for court games such as tennis, handball, shuffleboard, volleyball, etc.
e. Field games such as softball, soccer, touch football, mass games. (Unlighted)

f. Area for crafts, dramatics, games.
g. Spray pool or other water activity area. (Limited in size)
h. Shelter building with sanitary facilities.
i. Water fountains.

Playground sizes are limited by the minimum area which will accommodate the layout for required activities and by the maximum number of children who can conveniently participate in all activities.

The smallest playground which can accommodate adequate equipment and activity space is about two (2) acres. Although there is a minimum tolerable standard for small playground developments, when no nearby supervised playground exists in the area, some small children's play space should be provided as well as providing enough flat open area for informal play and for outdoor games. Six (6) acres is considered the maximum size for a standard playground. Where the neighborhood population exceeds 5,000 persons, two playgrounds should be provided to serve the area. However, where an elementary school serves more than 5,000 persons, and it is impractical to provide two standard playgrounds; the additional area may be provided either by adding to the school playground or by providing additional play spaces with less than full equipment. In either case, the total play area should not be less than about 200 square feet per family.

Topography will have a considerable effect on the location of the playground as it requires a fairly level and well-drained area. Finished grades should not exceed two (2) percent in those places where organized sports are carried on. The minimum slope for drainage should not fall below 0.5 percent. The playground area should be fully surrounded by fencing or other effective barriers to eliminate the possibilities of a small child running into the street section.

A safe playground surface important for protection of the children from injury. Surfaces of the general play area should be resilient, dust free, and quick drying. Sod is the best media for avoiding injury but may be difficult to maintain under heavy use. Concrete surfaces should definitely be regarded as hazardous. Relatively safe surfaces which are easily maintained, standards used in determining area needs should reflect the special importance of parks in areas of high population density or areas of high gross ground coverage.

In one or two family developments where the private lot area per family is 1/4 acre or more, neighborhood park facilities may not be as critical as in multiple family areas of higher density development where no open space or park facilities are provided in the development, park requirements should be double those in than for single family development. In other words, a single family area of 3,000 persons should have 6 acres of park and an apartment area of 3,000 persons should have 12 acres of park.

Adequate protection against hazards should be provided. Paths should be well-lighted for night safety, especially if there are steps or steep slopes, and no major street should cross the park. Security both to facilities and individuals in parks continue to be of great concern for all communities.

As stated previously, it is more economical for the citizens of the community to combine the elementary school and the neighborhood playground areas. It is

also possible to combine a neighborhood park with the neighborhood playground and elementary school. In many cases, the combination of the three provides a better neighborhood design since the more quiet park area can provide a buffer-zone between the playground and the residential section. Many facilities can be located interchangeably and permit flexibility in the overall layout. The use of park areas as buffers between business, shopping, and other non-residential districts reduces the total area needed and is quite acceptable if park functions are not impaired because of the adjoining use.

The basic underlying approach to all comprehensive planning within the city is the "Neighborhood Unit Theory". The combined elementary school, neighborhood park, and playground is the very essence of the "Neighborhood Theory". It would be difficult to develop a satisfactory neighborhood without a combined school and neighborhood park as the neighborhood center. By combining elementary school, neighborhood park, and playground on one land area, portions of the school may serve community needs and indoor recreational requirements and portions of the park area may serve part of the school,s recreational program. The combined park and school then truly serves as a neighborhood center. The arrangements of school facilities in Plainview has been altered due to the count system and relocation of students across City. However, when possible, utilization of the joint facilities is beneficial to all parties.

COMMUNITY PARKS, PLAY FIELDS, AND RECREATIONAL FACILITIES

The main determination of area needed for community park facilities is the prevailing relationship between the land allocated throughout the City for park, school, and recreational activities and the requirements of the anticipated population for a full range of park facilities for all age groups represented. A community park location is generally determined by the availability of appropriated land areas and the suitability of the land for urban development. Usually, some natural feature such as a stream, wooded area, lake or unusual topographic feature influences the selection of a large park site. In some cases, land areas which are subject to flooding and which cannot be developed economically for other types of urban use can be coordinated into the community's park system. However, land areas of this nature should be carefully evaluated to make certain that the land can serve the community as a park and can fit into the overall park plan. In many cases, such land areas are a burden to the developer, and in consideration of the City's expense of the original improvement as well as the year to year maintenance, the land involved can be acquired by the City at a very nominal or token amount.

The minimum size of a community park should be twenty (20) acres; however, an ideal size is typically around one hundred (100) acres. Adequate off-street parking must be made available, in accordance to the area of the park, recreation facilities available, and the size of the community area served.

It is necessary to provide recreational facilities such as the district play fields, which would include facilities for baseball, softball, basketball, football, volleyball, swimming pool, handball courts, shuffleboard and a community building or field house in addition to the neighborhood playgrounds. In many communities, the district play field is combined with the junior high or senior high school of the area.

The following general criteria can be used for the analysis of the most common recreational facilities:

FACILITY	CRITERIA
Baseball Field (Lighted)	1 Each/3,000 Persons
Baseball Field (Unlighted)	1 Each/5,000 Persons
Soccer Fields	2 Each/ 5,000 Persons
Tennis Courts	1 Each/2,000 Persons
Golf Course	1 Hole/2,000 Persons
Swimming Pool	450 S.F./1,000 Persons
Recreational Center (Major)	1 Each/15,000 Persons
Recreational Center (Minor)	1 Each/30,000 Persons

INDOOR SOCIAL AND CULTURAL FACILITIES

Indoor social, cultural, and recreational facilities supplement dwelling facilities and provide opportunities for various group activity. Services and organizations for which space may be required in the neighborhood include:

SOCIAL SERVICE: Vocational and employment guidance, child guidance, family and marriage counseling, Boy and Girl Scouts, Consumer groups, Parent-Teacher Association, Community Chest Organization, and service clubs.

RELIGION: Adult worship and religious training for youth with provisions for the major faiths and denominations that are represented in the neighborhood population.

LITERATURE AND THE ARTS: Library, art exhibits, lectures, noncommercial movies, musical programs, and groups or classes for participation in the arts.

RECREATION: Dances and events sponsored by neighborhood organizations, indoor sports and games.

In order to meet the space requirements for the social and cultural activities, most of the following will be needed:

A. Small rooms for meetings and classes.
B. Assembly rooms with stage for large meetings, movies, theatrical and musical performances, and indoor recreation such as dances.
C. Small game rooms including equipment for indoor games.

D. Reading and exhibit rooms.
E. Kitchen for preparation of refreshments or for cooking classes.
F. Workshop for classes in arts and crafts.
G. Office and storage space for organizations participating in activities.

These needs may be met throughout the community in various ways and the provision will differ from neighborhood to neighborhood. Many of the churches and schools in the community provide facilities for Boy and Girl Scout programs and other similar activities. Meeting rooms for service clubs and other civic and professional organizations are sometimes provided by the restaurants or motels within the community and on numerous occasions, the auditoriums of the various schools are used for public meetings and other community activities.

Neighborhood churches serving, in part, as recreational and educational centers, play an important role not only in the religious but also in the social and cultural life of the community. Because of the variations in religious interests, it is impossible to predict the number and types of churches that will be developed in the community. However, religious authorities consider it reasonable to plan one church for every 700 families. A lot of not less than 3/4 of an acre should be reserved for each church building as the minimum. Church sites can range from 2 - 3 acres to 10 - 12 acres, depending on the membership and the number of activities to be incorporated into the building program. Parking requirements are a major concern with large church facilities. Combination parking areas for church facilities do prove useful if the adjacent business establishment is closed during the church service.

Many of the previously mentioned services which fill the indoor social and cultural requirements of the community are provided by private means and are,therefore, not the direct responsibility of the city, with the possible exception of public library branches, community buildings, youth centers, or other specialized facilities which are not provided through private interest.

CITY-WIDE COMMUNITY FACILITIES

There are several community 'features which serve a larger area than one neighborhood and, therefore, are classified as city-wide community facilities. These include the municipal golf course, civic centers, the library, Y.M.C.A., etc. So that these city-wide facilities are located properly, study and analysis of the entire community or a series of neighborhood combinations is necessary since some of the above facilities can serve the entire community and are singular in their existence while several of a certain other facility might be necessary to serve the community adequately.

After the type of facility needed is determined, the location and size of the facility is then determined by the evaluation of the community or part of the community to be served, the character of the land area involved, and the access standards applicable.

REGIONAL PARKS

A regional park provides specialized recreation not available in smaller parks, such as hiking, camping, boating, etc., on large tracts preserved in so far as possible in their natural state. If properly planned, the regional park can combine scenic features and natural beauty with various recreational structures and facilities. Hiking, bridle, or bike trails are often provided, particularly with associated parkways or linear parks. Roads are necessary for access, but should be limited, particularly in certain areas.

The size of a regional park, and the area served can vary greatly. The park area may be combined with a preserve or reservation and consist of several thousand acres. In other cases, a smaller scenic park may be designed to serve basically an individual city or county. The Texas Parks and Wildlife Department should be considered as a possible joint sponsor of a facility of this type.

EXISTING PARK AND RECREATIONAL FACILITIES

The City of Plainview currently has approximately 357.40 acres of park land available which is listed on Table 11-2 and shown on Plate 11-2. Of the total park area around 114 acres is developed as standard park facilities. In addition, there are 8.63 acres of small non-park areas maintained and a considerable amount of school property which serves as neighborhood playgrounds/parks. The Plainview Municipal Golf Course, which is maintained by the Country Club Association, occupies 130 acres. The total combined area of all park and recreational facilities is over 400 acres (excluding golf course).

In categorical terms, Plainview has two (2) community parks (Broadway and Givens - 87.50 acres) and one (1) regional park (Running Water Draw - 204.50 acres), with the remaining park area being neighborhood parks (65.40 acres). Portions of the boundary of Running Water Draw Regional Park function more as a community park, providing area for sports fields and recreation facilities utilized by local citizens. Each elementary school in the City provides an additional 2-10 acres of neighborhood park/playground area. Thunderbird Elementary School and Stoneham Park provide the only genuine park/school combination in the City. The "non- park" area subject to flooding located near Tenth and Ennis Streets is another significant area of local open space.

Allocations of open space for neighborhood parks are needed for that area located west of Interstate Highway 27. These facilities should have access by those residents in existing and anticipated future development.

Most of the existing City's park area is located in the floodplain of Running Water Draw and the various playa lakes on land which cannot otherwise be developed. Running Water Draw, in particular, provides the natural setting ideal for park area and associated greenbelt system. This park can be developed into a more intense use area when funds are available. The use of a linear connection trail and open space system in this park would greatly enhance its serviceability.

TABLE 11-2

PLAINVIEW, TEXAS

EXISTING CITY PARKS AND RECREATION FACILITIES

PARK	(1) PARK TYPE	AREA (ACRES)	BASEBALL/SOFTBALL LIGHTED/UNLIGHTED	MULTI-PURPOSE ATHLETIC FIELD	MULTI-PURPOSE PAVED PAD/COURT	TENNIS COURT	SWIMMING POOL
FRISCO	N	7.3	0/0	1	0	0	1 (2)
E. E. GIVENS	C	33.20	0/1	1	0	0	1 (2)
STONEHAM	N	10.00	0/2	2	1	1	0
LAKESIDE	N	24.80	0/0	0	0	0	0
BROADWAY	C	54.30	4/7	13	0	0	0
7TH STREET	N	10.20	0/1	1	0	0	0
RUNNING WATER DRAW	R	204.50	3/1	5	2	1	0
M. B. HOOD	N	8.50	0/1	1	1	2	1
UTICA	N	4.60	0/1	1	1	0	0
TOTAL		357.40	7/15	25	5	4	3

(1) N - Neighborhood Park
C - Community Park
R - Regional Park

(2) Currently Not Open to the Public

The City's overall park acreage and distribution should be sufficient when compared to accepted standards (Table 11-I) and projected requirements as shown in Table 11-3. It should be noted that Frisco, E.E. Givens, and Lakeside Parks are largely undeveloped with few or no recreational facilities, and the facilities at Utica Park are in poor condition.

Although a wide variety of recreational facilities do exist in Plainview, some are short of equipment, unevenly distributed, or in poor overall condition. A general breakdown of the frequently used facilities available to the public is listed in Table 11-2. A more detailed inventory can be found in a 1980 study by Texas Tech University ("Master Plan for the Development of Parks and Recreation" - James W. Kitchen and Herman K. Smith II).

Compared to current and future needs (Table 11-3), a considerable deficiency exists in the numbers of tennis courts and swimming pools available to serve the citizens. Moreover, a telephone survey of citizens conducted as part of the above mentioned 1980 Texas Tech University study showed the three most needed facilities in Plainview were tennis courts, swimming pools, and basketball courts. Soccer games are popular and require large play fields to accommodate the growing number of children following this sport.

Only one swimming pool (approximately 1,500 square feet), located at Hood Park is currently open to the public and problems have occurred with the operation of the pool on an annual basis. Other swimming pools associated with City parks are either closed or in a state of disrepair. A privately owned pool located at the American Legion which was open to the public has recently been closed. The swimming pool at the Plainview Country Club is available to non-members for a nominal fee. The YMCA has swimming facilities which are only open to members.

There are a total of eight (8) tennis courts available to the public in Plainview (including two (2) each at Coronado and Estacado Junior High Schools), which is well below recommended standards.

Many citizens and organizations make use of public school facilities such as tennis courts, basketball and volleyball courts, and various athlete fields. They help to supplement the public sector facilities.

Although numerous baseball backstops exist on multi-purpose athlete fields, there are few lighted infields designed specifically for softball, Little league, etc., with bleachers and rest rooms. The continual demand on a seasonal basis requires lighted sports fields for league play.

Community centers are located at Broadway Park and Running Water Draw Regional Park (Rotary). The Senior Citizens Association has a center on a tract donated by the City next to Utica Park.

Plainview Country Club has an 18 hole golf course and private club facilities for parties, banquets and other activities. The YMCA has two (2) branches with exercise and recreation facilities for members.

Up until the mid - 1970's the City of Plainview had a Director of Parks, Recreation, and Advanced Planning, and an active Park Development and Recreation Program. At that point the City Council determined that the costs

TABLE 11-3

PLAINVIEW, TEXAS

FUTURE PARK AND FACILITY REQUIREMENTS

	1989	1995	2000	2005	2010	2020
Population	25,250	27,050	28,750	31,350	34,258	37,800
Neighborhood Parks (Acres)	50.50	54.10	57.50	62.70	68.52	75.60
Community Parks (Acres)	88.38	94.68	100.63	109.73	119.90	132.30
Regional Parks (Acres)	378.75	405.75	431.25	470.25	514.35	567.00
Playfields (Acres)	37.88	40.58	43.13	47.03	51.39	56.70
Baseball Field (Lighted)	9	10	10	11	12	13
Baseball Field (Unlighted)	6	6	6	7	7	8
Tennis Courts	13	14	15	16	18	19
Swimming Pools (S.F.)	11,363	12,173	12,938	14,108	15,417	17,010
Rec. Center (Major)	1	1	1	1	1	1
Rec. Center (Minor)	2	2	2	3	3	3
Golf Course (Holes)	18	18	18	18	18	27

TABLES 11-4

PLAINVIEW, TEXAS

PROPOSED PARK AND RECREATION FACILITIES

	1990	1995	2000	2005	2010	2020
Population	25,250	27,050	28,750	31,350	34,258	37,800
Neighborhood (Acres)	-	-	10	-	10	-
Community Parks (Acres)	-	-	-	50	-	-
Regional Parks (Acres)	-	50	50	50	50	50
Playfields	2	2	2	2	3	3
Baseball Field (Lighted)	1	1	1	1	1	1
Baseball Field (Unlighted)	-	-	-	-	-	-
Tennis Courts	2	2	2	2	1	1
Swimming Pools	1	-	1	-	-	-
Rec. Center (Major)	-	-	1	-	-	-
Rec. Center (Minor)	-	-	-	1	0	0
Golf Course (Holes)	-	-	-	-	-	9

associated with the development and maintenance of parks could no longer be justified. As a result, the Recreation Department was disbanded and the Director of Parks job was done away with. Today, private clubs and associations are primarily responsible for the organization of sports and recreation activities. If a Director of Parks and Recreation is reinstalled, that person should be closely associated with all school, county and other area recreational programs which require organization and schedule of various league play.

PARKS AND RECREATION PLAN

At the present time the overall acreage of parks and open space in Plainview is adequate for city-wide needs. Of greater concern is the maintenance of these existing parks and the provision of recreational facilities in proper number and distribution. Even if future projections (Table 11-4) indicate the need for more park land, such future acquisition is practical only if supported by citizens and local government, and when all the existing park area is properly maintained and fully utilized.

The development of Running Water Draw as a regional park should be the primary future acquisition of park land in the City. Plate 11-2 outlines those areas proposed for Running Water Draw Regional Park, which generally coincide with those set forth by a 1967 plan by Chevalier and Musiak ("Running Water Draw Regional Park: Development Plan and Report"). A linear park along Running Water Draw will beautify the City and provide possible recreation areas for all citizens. In addition, the open space will assist the City's flooding problems.

The boundary of the proposed park primarily encompasses the recently delineated 100-year flood plain, and should be kept in its natural state, whenever possible. That portion of the park between Joliet Street and Columbia Street is within the boundary of the existing Plainview Sanitary Landfill and cannot be utilized until a new landfill site is developed. It is recommended that part of the area between Columbia Street and Broadway Street be reserved for a possible future civic center site which would be expected to provide much of the City's indoor social and cultural needs not provided by existing recreation centers and other city-wide community facilities.

Considering the flat, open topography and central location of the Running Water Draw floodplain, the Regional Park boundary can also be used for community park and neighborhood park/playground Westridge Addition and much needed additional community recreational facilities could be located in the park area to the west of Interstate Highway 27. Similar conditions exist north of Southwest Third Street for anticipated development to the south. As previously identified this area will allow for a recreational trail system to extend the entire length form west to east through Plainview along Running Water Draw. It is concluded that Running Water Draw Park can serve not only as a small scale regional park, but also for sites of neighborhood parks and playgrounds, community parks, and city-wide facilities.

Future neighborhood parks are proposed for the Western Meadows Addition in association with an elementary school site and near the Mesa Verde Addition as

shown in Plate 11-2. As mentioned previously, any type of large scale expansion of the existing local park system will not be necessary. However, the RESERVATION of open space in developing areas should be maintained.

The proposed recreation facilities in Table 11-4 are general in nature, but should be considered as a minimum to meet area demands. New and updated facilities such those listed in Table 11-4 should be the highest priority of the plan because they represent the greatest need to the City. Emphasis should be placed on sound cost effective fiscal approach and cost/benefit ratios to provide innovative planning for recreation facilities.

In order for Plainview to upgrade park system services, the City will have to look outside its own operating budget and personnel for assistance. The following is a list of possible strategies to aid the City in providing citizens with a desired level of park and recreation facilities:

1. Increased use of volunteers, particularly with providing recreational services such as those for senior citizens, children, athletic facilities, and special programs at the recreation centers will allow for service at a reduced cost. Besides technical services, volunteer individuals and organizations could join forces to help provide maintenance and upkeep of certain parks and facilities.

2. Fees for the use of facilities such as lighted ball fields, swimming pools, recreation centers, etc., should be constantly updated and funds from those fees should be returned directly to the park and recreation program.

3. The City should continue a policy to plan and work with non-City operated agencies and the School District for the organization of activities (athletic and non-athletic) and the use of facilities.

4. In order to aid the acquisition of new park land, federal grants should be applied for, donations should be encouraged, and both long and short term lease agreements should be considered.

SCHOOL PLANNING

The responsibility for an adequate school system falls upon the School Board and includes not only the site location and the development of the physical improvements, but also the school system's administration, curriculum, and financing. The City has the authority to approve or disapprove plats involving the subdivision of land, and because the School Board is responsible for the acquisition of sites for new school facilities, the activities of the two groups must be coordinated. Since school facilities are such an important part of the overall community facilities plan, and because they play such a key role in community life, it is extremely important that a workable plan to coordinate the activities of the municipal authorities and the School Board be developed. Land acquired in the initial stages of development can normally be purchased for considerably less than land acquired after development has occurred.

When the City considers preliminary plats proposing the subdivision of vacant land, the school needs of the area should be considered. Each proposal for subdivision should be reviewed carefully prior to its approval to make certain that the requirements of the Major Thoroughfare Plan regarding arterial and collector thoroughfares are complied with and that the basic street pattern proposed is coordinated with the existing pattern. If a new area is involved, the proposal should ascertain that the adjoining vacant land can later be properly subdivided and developed. The circulation aspect of school development is of paramount importance to the proper function of a school facility. It is desirable that school site selection be made at the time the preliminary plat is being considered and when the basic street system, which will ultimately serve the area, is in the planning stages.

In terms of educational and administrative requirements, the school authorities are unquestionably best qualified to select school sites, delineate school districts and decide when new school facilities should be provided. However, school sites should be coordinated with other features of the community's Comprehensive Plan, particularly zoning, major thoroughfares, parks, and recreational needs. In planning the school facilities for any community, local standards are usually observed, and the future needs must be based on some set of standards in order to determine future space and area requirements for schools. The state has mandated a 22-1 student-teacher ratio for kindergarten through the fourth grade.

An elementary school, by the nature of its operation, should be the focal point of the neighborhood. There is merit in considering combining schools with other related facilities for multiple use. This could include the combination of elementary schools and playgrounds which saves duplication. of facilities and space. The combining of facilities requires coordination between the local recreational groups and the school authorities. Planning such a layout also requires consideration of access standards, since requirements for playgrounds are more restricted than those for schools. The elementary school may be used in part for adult education and indoor social and cultural activities. Many communities find this to be the most economical way of providing this activity space. Using elementary schools for activities of this nature may require special office space and storage areas; therefore, such requirements should be taken into consideration in the design and building of the schools if they are to be used for such a dual purpose.

The land area requirements for elementary schools are determined largely by figuring the building area, setback from the street, and the area needed for lawns, service drives, parking space, and outdoor recreation. If no neighborhood playground is located next to the school, the school site itself should contain definite provisions for outdoor play space.

Nursery and some kindergarten facilities may not be provided for by the local authorities but are handled by private individuals or agencies who are required to be licensed by state law. The location of these nurseries and kindergartens are of paramount importance since so many families have both parents working. The facilities should be located close to the homes they serve and are permitted in most zoning ordinances by special permit or as a special use. Whether or not such facilities are to be located in a neighborhood generally depends on the attitude of the adjoining property owners since they

are the ones who would be most seriously affected by the utilization of residential property for kindergarten or nursery activity. Such facilities are permitted only after giving notice to adjoining property owners and after public hearings.

Junior and senior high schools should be provided on a district rather than a neighborhood basis because of the higher enrollment required and the less stringent access requirements.

CRITERIA FOR SCHOOL FACILITIES

Responsibility for the actual location of schools will be with the Plainview Independent School District. Within the planning period, new schools will be needed and it is the responsibility of both the School District and the City to assure that adequate school sites are available, with adequate access and safe utilities.

An example criteria for spatial location and facilities for public schools is found in Table 11-5.

An elementary school site is ideally between 10 and 14 acres with a building and parking area of about 3 acres, located near the center of a residential area and near or adjacent to other community facilities. The school site should be served by at least two streets (one collector) and accessible from dwelling units without crossing any major thoroughfare.

The site for a junior high or middle school should be about 25 acres with 5 acres of building and parking coverage. A middle school can best be served by a street system completely around the area, with one street being a collector or major thoroughfare.

High school sites can vary greatly, but average around 35 acres. Building and parking coverage will be at least 10 acres, depending on the parking required for students. A high school is usually on or near a major thoroughfare for easy access. The site should be adequately screened from noise or objectionable land uses, and is often located adjacent to a park area.

EXISTING SCHOOL FACILITIES

The Plainview Independent School District currently operates six elementary schools, (including La Mesa, opening in the Fall of 1989) four intermediate schools, one high school, two vocational schools, one adult education facility, a service center (402 N. Date), and administration building (912 Portland). The School District has approximately 350 teachers with a total annual budget of nearly $19,000,000. Existing School facilities are detailed on Tables 11-6 and 11-7. The general locations of schools are shown on Plate 11-3. Several other school structures have been sold or are currently not in use. A study conducted by L. James Robison and Associates ("A Comprehensive Study of Existing Facilities and Building Needs for the Plainview Independent School District") contains a detailed analysis of each existing school structure. Most of

TABLE 11-5

CRITERIA FOR SPATIAL LOCATION AND FACILITIES

FOR PUBLIC SCHOOL

I. Travel Distance from Homes to School

A. Elementary - One-half to Three-fourths Mile Radius
B. Junior - One to One and One-half Mile Radius
C. Senior High - Two to Three Mile Radius

II. Location

A.	Elementary -	Centrally in the Residential Neighborhood so that children do not have to cross major arteries to reach them.
B.	Junior High -	On Collector or Major Thoroughfare, convenient to several neighborhoods.
C.	Senior High -	On Major Thoroughfare, to effectively serve large areas.

III. Desirable Capacity

A.	Elementary -	400 to 800 Students
B.	Junior High -	700 to 1,500 Students
C.	Senior High -	1,000 to 2,000 Students

IV. Desirable Areas for School Sites and Related Park Facilities.

A.	Elementary -	Minimum of 5 acres plus an additional 1 acre per 100 Students
B.	Junior High -	Minimum of 20 acres plus an additional 1 acre per 100 Students over 500
C.	Senior High -	30-40 Acres

SOURCE: American Public Health Association, Compton California, General Plan by Wilsey, Ham and Blair National Council on School House Consruction Urban Land Use Planning, F. Stuart Chapin, Jr.

TABLE 11-6

PLAINVIEW, TEXAS

EXISTING SCHOOLS (SPRING, 1989)

School	1989 Enrollment	Capacity	No. of Classrooms	Site Area (Acres)
High School 1501 Quincy	1,403	2,010	67	14.5
Extacado 2200 W. 20th	431	780	26	36.0
Coronado (7th) 2501 Joliet	452	600	28	10.3
Ash (6th) 908 Ash	427	600	22	6.0
Lakeside (5th) 1800 Joliet	468	630	21	9.0
College Hill (K-4th) 707 Canyon	619	516	26	12.0
Edgemere (K-4th) 2601 W. 21st	637	550	24	7.0
Highland (K-4th) 1707 W. 11th	662	440	20	3.5
Hillcrest (K-4th) 315 Alpine	452	440	14	12.0
Thunderbird (K-4th) 1200 W. 32nd	484	472	24	15.0
TOTALS 1989 ENROLLMENT	6,035			
OTHER Houston (Voc.) 1201 Galveston		690	23	4.9
Lamar (Voc.) 506. E. 4th			20	6.5
Central (Audit Ed.) 1103 Baltimore			3	3.5

* NOTE: La Mesa Elementary (Capacity - 669) to open in the Fall of 1989.

TABLE 11-7

PLAINVIEW, TEXAS

EXISTING SCHOOL FACILITIES

School	Library	Audi-torium	Cafe-teria	Aud./ Caf.	Shops	Gym	Field House Athletic Fields
High School	X	X	X		X	X	
Estacado	X			X	X	X	X (2) inc. Stadium
Coronado	X			X	X	X	
Ash	X			X		X	
Lakeside	X			X			
College Hill	X			X			
Edgemere	X			X			
Highland	X			X			
Hillcrest	X			X			
Thunderbird	X			X			
Houston	X	X			X	X(2)	

the school structures were constructed before 1960. Some renovation, expansion and alterations have been undertaken on most buildings.

In the Plainview school system, grades K-4 attend neighborhood elementary schools. Each of the next four grades (5, 6, 7 and 8) are assigned to an individual middle school. The high school complex includes all grades 9-12. Table 11-8 shows recent enrollment breakdowns for each grade level of the school system.

The elementary schools within the P.I.S.D. (La Mesa, College Hill, Edgemere, Highland, Hillcrest, and Thunderbird) do not serve as strictly neighborhood schools. In order to achieve a racial balance and use all facilities in the most efficient manner possible, boundary lines have been designated for zones of attendance for each schools as shown on Plate 11-3. As a result of this plan, some children will have to be transported by bus to attend elementary schools in other parts of the City even though they may live within a short walking distance of their neighborhood schools. Each elementary school is also assigned certain rural bus routes for outlying areas served by the P.I.S.D.

The new La Mesa Elementary School will be located on a 14.46 acre tract on Ennis Street near Southwest Third Street. This location was chosen over another site reserved for a future school in the Western Meadows Addition in northwest Plainview because of better access and the City's current population distribution.

All of the existing elementary schools have a library and cafeteria-auditorium and most have "underground multi-purpose rooms" which can be used for tornado shelters.

The Middle Schools (Estacado, Coronado, Ash, and Lakeside) are generally larger structures which include industrial shops and gym facilities. Estacado Junior High, with the largest campus area (36 acres), is equipped with the most complete athletic facilities, including two field houses, two practice fields, and the City Stadium.

High School Grades 9-12 attend Plainview High School, with a facility capacity of 2,010 students. This complex is located on an extremely small campus site of 14.5 acres on Quincy Street near Sixteenth Street. The high school includes a library, auditorium, cafeteria, shops, various vocational facilities, and two gyms. The athletic fields located at Estacado Junior High are utilized by the High School programs due to the lack of area and space at the High School site.

PROPOSED SCHOOL PLAN

The primary purpose of a general school plan is to help coordinate the school facilities with an orderly development into the city service, transportation and land utilization programs. The required future schools and proposed site locations for new schools will require service from police, fire, and water and sewer utilities, street access, solid waste disposal, and neighborhood acceptance.

Based on future population projections and present school enrollments, Table 11-9 has been prepared, which shows the estimated future school enrollments

TABLE 11-8

PLAINVIEW, TEXAS

GRADE LEVEL ENROLLMENT

YEAR	82-83	83-84	84-85	85-86	86-87	87-88
PK	-	-	-	-	171	148
K	423	461	448	458	542	563
1	587	555	607	579	566	611
2	515	494	464	528	538	502
3	509	487	458	468	523	541
4	441	506	445	446	474	503
5	467	436	489	463	463	451
6	491	463	433	445	459	456
7	500	485	467	413	473	456
8	450	467	467	441	395	439
9	457	418	454	457	484	466
10	379	389	388	420	378	363
11	361	357	328	331	334	330
12	312	304	296	280	254	302
TOTAL	5,892	5,822	5,724	5,729	6,054	6,131

Source: L. James Robison & Associates, "A Comprehensive Study of Existing Facilities and Building Needs for the Plainview Independent School District," 1988.

TABLE 11-9

PLAINVIEW, TEXAS

PROJECTED SCHOOL ENROLLMENT

YEAR	POPULATION	ELEMENTARY (KINDEERGARTEN) THROUGH 4TH	MIDDLE (5TH, 6TH, 7TH, 8TH)	HIGH SCHOOL (9TH - 12TH)	TOTAL
1989-90	25,250	2,992	1,791	1,442	6,225
1995	27,050	3,182	1,918	1,545	6,645
2000	28,750	3,343	2,010	1,579	6,950
2005	31,350	3,603	2,162	1,742	7,507
2010	34,258	3,892	2,330	1,652	8,074
2020	37,800	4,247	2,536	1,989	8,772

for elementary grades (K-4), middle school grades (5, 6, 7, and 8), and the high school. No attempt has been made to break down the enrollment for each school or attendance zone since the boundaries are generally arbitrary, and subject to regular updates by the school administration. Using these estimates, the Plainview school system will need two additional elementary schools by the year 2020. The phasing of the total number of school facilities to serve the district are shown in Table 11-10. The locations of the future school sites are identified on Plate 11-3. The future sites shown are general in nature and not intended to identify an exact location. Primary considerations in locating the future schools have included projected locations of land development, arterial and collector street locations, neighborhood units, land use, and the availability of a suitable site served by public utilities.

If standard requirements currently utilized in school planning are strictly observed another elementary school will be required by the year 2000. This facility will be in addition to the recent construction of La Mesa Elementary. This requirement is due to the fact that the existing elementary schools appear to all have been operating near or above capacity. A suggested location for the next school facility would be at the site in the Western Meadows Addition currently reserved by the P.I.S.D. for future use. Most of the elements required for a school facility are available now. Some utilities and roadways would require extension to accommodate the site.

A second elementary school will be required sometime between the year 2005 and 2010. This additional facility is proposed in the area near the Mesa Verde Addition, also west of Interstate Highway 27.

Although no new middle or high school complex will be required in the foreseeable future, structural renovations or expansions may be needed. In addition, there may be justification in the future for the School District to relocate the high school to a more desirable and larger site. In the event the high school is moved to another location, the existing structure could be converted to a middle school at such time as more middle school capacity is neccessary or one of the existing middle school buildings/sites becomes clearly inadequate. Furthermore, the vacated middle school could then be closed or possibly become an elementary school.

It is recommended that the City of Plainview incorporate the following as means of coordination between the City and the School District: 1) A copy of an updated Base Map and Zoning Map should be furnished to the School District each year; 2) Notices of applications for rezoning should be sent to the School District; 3) Preliminary and final subdivision plats should be sent to the School District for comment. These measures will assist in the proper location of future schools and also help to protect those currently existing.

TABLE 11-10

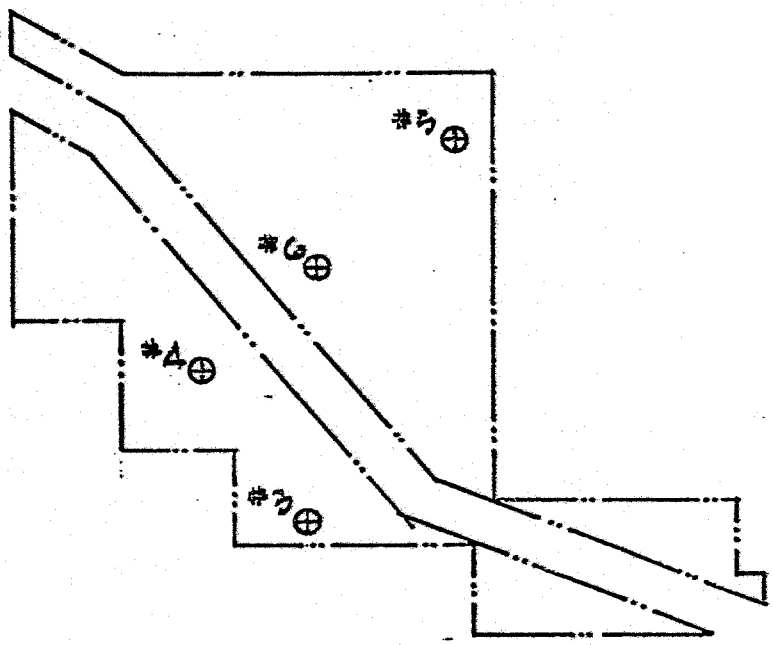
PLAINVIEW, TEXAS

PROPOSED SCHOOL FACILITIES

NUMBER OF SCHOOL FACILITIES NEEDED

YEAR	TOTAL ELEMENTARY	NEW ELEMENTARY	TOTAL MIDDLE	NEW MIDDLE	TOTAL HIGH SCHOOL	NEW HIGH SCHOOL
1989-90	6	-	4	-	1	-
1995	7	1	4	0	1	0
2000	7	0	4	0	1	0
2005	7	0	4	0	1	0
2010	8	1	4	0	1	0
2020	8	0	4	0	1	0

NORTH



SCALE: 1" = 600'

TEST BORING LOCATIONS	
WILLIAMSON PITS PLAINVIEW, TEXAS	
TEXAS TESTING LABORATORIES DALLAS, TEXAS	
CITY OF PLAINVIEW	
DATE: 11 SEP 73	DWG. NO. 1109

WATER ANALYSIS REPORT
TEXAS DEPARTMENT OF HEALTH
DIVISION OF WATER HYGIENE
1100 WEST 49 TH STREET
AUSTIN, TEXAS 78756

PLAINVIEW PUBLIC WATER SYSTEM

P O BOX 1870
PLAINVIEW TX 79072

WATER SUPPLY #: 0950004
LABORATORY NO: EP701457
SAMPLE TYPE: DISTRIBUTION

COLLECTOR REMARKS:
SOURCE:
DATE COLLECTED 11/17/86 DATE RECEIVED 11/19/86 DATE REPORTED 2/24/87

CONSTITUENT NAME		RESULT	UNITS	+/-
Calcium		53	mg/l	
Chloride		206	mg/l	
Fluoride		1.6	mg/l	
Magnesium		27	mg/l	
Nitrate (as N)		0.35	mg/l	
Sodium		193	mg/l	
Sulfate		161	mg/l	
Total Hardness/CaCO3		246	mg/l	
pH		7.9		
Dil.Conduct(umhos/cm)		1530		
Tot. Alka. as CaCO3		211	mg/l	
Bicarbonate		257	mg/l	
Carbonate		0	mg/l	
Dissolved solids		777	mg/l	
P. Alkalinity /CaCO3		0	mg/l	
Arsenic	<	0.010	mg/l	
Barium	<	0.50	mg/l	
Cadmium	<	0.005	mg/l	
Chromium	<	0.02	mg/l	
Copper	<	0.02	mg/l	
Iron	<	0.02	mg/l	
Lead	<	0.02	mg/l	
Manganese	<	0.02	mg/l	
Mercury	<	0.0002	mg/l	
Selenium	<	0.002	mg/l	
Silver	<	0.01	mg/l	
Zinc	<	0.02	mg/l	
Endrin			mg/l	
NOT TESTED - OTHER				
Lindane			mg/l	
NOT TESTED - OTHER				
Methoxychlor			mg/l	
NOT TESTED - OTHER				
Toxaphene			mg/l	
NOT TESTED - OTHER				
2,4-D			mg/l	

Community Water Supply Chemical Analysis Report

Texas Department of Health — Division of Water Hygiene
1100 West 49th Street Austin, Texas 78756-3192

nd Report To:
CITY OF PLAINVIEW
P.O. BOX 1870
PLAINVIEW, TEXAS 79072

NAME OF WATER SUPPLY:
PLAINVIEW, CITY OF
Water Supply I.D. No. 0950004 (1-7)
County HALE

MPLE TYPE
✓ Distribution
Plant Discharge
Raw Supply
Other

IF FROM WELL
Depth _____ ft.
Age _____ yrs.
Well No. _____

IF SURFACE SUPPLY
Name of Source
LAKE MEREDITH-CRMWA & WELLS

REMARKS: LAST CHEMICAL 1-18-84 20E + 1QT.

Shannon G. Gray, P.E. PHR 2
(Signature)

Date Collected 1 / 14 / 85 (31-36)

oratory N EP6-1314 (10-13) (17-20) Date Received NOV 15 1985 (10-13) Date Reported JAN 03 '86 (17-20)

(10-13) SAMPLE NO.: EP6-1314 (17-20)			
16	Calcium	mg/l	59
31	Magnesium	mg/l	25
32	Sodium	mg/l	189
29	Carbonate 127	mg/l	0
28	Bicarbonate	mg/l	260
35	Sulfate	mg/l	159
17	Chloride	mg/l	200
45	Fluoride	mg/l	1.6
40	Nitrate (asN)	mg/l	.33
70	Dissolved solids		771
71	Phenolphthalein Alkalinity as CaCO3	mg/l	0
77	Total Alkalinity as CaCO3	mg/l	213
75	Total Hardness as CaCO3	mg/l	251
25	pH		7.9
26	Diluted Conductance Micromhos/cm.		1494

Potassium 8 mg/L

15	Total Hardness as $CaCO_3$	____	mg/l
25	pH	____	
26	Diluted Conductance Micromhos/cm.	____	

SAMPLE NO. EP6-1314

(10-13)		(17-20)	
1005	ARSENIC	<0.01	mg/l
1010	BARIUM	<0.5	mg/l
1015	CADMIUM	<0.005	mg/l
1020	CHROMIUM	<0.02	mg/l
1022	COPPER	<0.02	mg/l
1028	IRON	<0.02	mg/l
1030	LEAD	<0.02	mg/l
1032	MANGANESE	<0.02	mg/l
1035	MERCURY	<0.0002	mg/l
1045	SELENIUM	<0.004	mg/l
1050	SILVER	<0.01	mg/l
1095	ZINC	<0.02	mg/l

2005	Endrin	<0.00002	mg/l
2010	Lindane	<0.00003	mg/l
2015	Methoxychlor	<0.005	mg/l
2020	Toxaphene	<0.005	mg/l
2105	2, 4-D	<0.020	mg/l
2110	2, 4, 5-TP	<0.005	mg/l

4

JUN 5 1986

WATER ANALYSIS REPORT
TEXAS DEPARTMENT OF HEALTH
DIVISION OF WATER HYGIENE
1100 WEST 49 TH STREET
AUSTIN, TEXAS 78756

CANADIAN RIVER MUN. WATER AUTH.
C.R.M.W.A.
P.O. BOX 99
SANFORD TX 79078

WATER SUPPLY #:
LABORATORY NO: EP603879
SAMPLE TYPE: RAW SAMPLE

COLLECTOR REMARKS:
SOURCE: BATES AREA
DATE COLLECTED 04/01/86 DATE RECEIVED 04/03/86 DATE REPORTED 05/20/86

CONSTITUENT NAME	RESULT	UNITS	+/-
Calcium	60.	mg/l	
Chloride	375.	mg/l	
Fluoride	0.8	mg/l	
Magnesium	25.	mg/l	
Nitrate (as N)	0.02	mg/l	
Sodium	341.	mg/l	
Sulphate	277.	mg/l	
Total Hardness/CaCO3	254.	mg/l	
pH	8.4		
Dil.Conduct(umhos/cm)	2400.		
Tot. Alka. as CaCO3	185.	mg/l	
Bicarbonate	221.	mg/l	
Carbonate	2.	mg/l	
Dissolved solids	1196.	mg/l	
P. Alkalinity /CaCO3	2.	mg/l	
Iron	14.20	mg/l	
Manganese	0.29	mg/l	

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No.
Work No. 6031(JAC86-87)1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrum Rm.

County 095 HALE
State Well No. 11-51-
City Well No. 4
Long 101-42-53
Lat 34-11-43
Date Collected 04-26-87

Owner City of Plainview ✓ Send copy to owner Sample No. By JD Jones
Address P.O. Box 1890 Plainview ATTN: WATER SUPT Well Location
Date Drilled 6-2-82 Depth 316 ft. WBF Casing
Source (type of well) Turbine
Producing intervals Water level 1 ft. Sample depth ft.
Sampled after pumping hrs. Yield GPM meas. est. Temperature °F °C
Point of collection Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use D. S. Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7 0779 Date Received MAY 08 '87 Date Reported MAY 15 '87

WATER ANALYSIS
Date: 051287

State Well No: 11-51- Sample No: FB7-779

	MG/L	ME/L		MG/L	ME/L
Silica: 00955:	54		Carbonate: 00445:	0	0
Calcium: 00915:	50	2.54	Bicarbonate: 00440:	331	5.42
Magnesium: 00925:	42	3.44	Sulfate: 0094A:	38	.79
Sodium: 00930:	36	1.57	Chloride: 00940:	50	1.41
Potassium: 00935:	9.0	.23	Fluoride: 00950:	2.6	.14
T. Cations		7.78	Nitrate as NO3: 71851:	8.02	.13
Manganese: 01055:		%Na	T. Anions		7.89
			pH: 00403:	8.2	
Boron: 01020:		SAR			
			TDS(Calc): 70301:	453	
Total Iron: 01045:		RSC	P. Alk.: 00415:	0	
Other			T. Alk.: 00410:	271	
(Specific Cond.: 00095:	655		T. Hardness: 00900:	299	

Calculated Conductance (micromhos/cm3)
5.5 x148=814

Ammonia-N: 00610:
Nitrite-N: 00615:
Nitrate-N: 00620:
OrganicNitrogen: 00605:

Items will be analyzed if checked.

TWDB 0811 (Rev.02 27 86)

Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

Organization No. 422 Lab No.
Work No. 6031 (IAC 86-87) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrom Rm.

County 095 HALE
State Well No. 11-51-
City Well No. 7
1
Date Collected 04-26-87

INT - 34-12-02N
long - 101-43-01

Owner City of Plainview Send copy to owner Sample No. By A.B. Jones
Address P.O. Box 1870 Plainview PTN WATER SUPT Well Location
Date Drilled 1953 Depth 322 ft. WBF Ogallala
Source (type of well)
Producing intervals Water level ft. Sample depth ft.
Sampled after pumping 5min hrs. Yield GPM meas. est. Temperature °F °C
Point of collection Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use P.S Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7-0773
Date Received MAY 08 '87
Date Reported MAY 15 87

WATER ANALYSIS
Date: 051287
Sample No: EB7-773

rate Well No: 11-51-

	MG/L	ME/L		MG/L	ME/L
Silica: 00955:	32		Carbonate: 00445:	0	0
Calcium: 00915:	52	2.60	Bicarbonate: 00440:	267	4.38
Magnesium: 00925:	31	2.52	Sulfate: 00946:	149	3.10
Sodium: 00930:	185	8.04	Chloride: 00940:	208	5.86
Potassium: 00935:	7.0	.18	Fluoride: 00950:	1.7	.09
T. Cations		13.34	Nitrate as NO3: 71851:	1.68	.03
Manganese: 01055:		%Na	T. Anions		13.46
			pH: 00403:	8.2	
Boron: 01020:		SAR			
			TDS(Calc): 70301:	798	
Total Iron: 01045:		RSC	P. Alk.: 00415:	0	
ther			T. Alk.: 00410:	219	
Specific Cond.: 00095:	1133		T. Hardness: 00900:	256	

luted Conductance (micromhos/cm3)
10 x152 =1520

Ammonia-N: 00610:
Nitrite-N: 00615:
Nitrate-N: 00620:
OrganicNitrogen: 00605:

items will be analyzed if checked.

TWDB-0811 (Rev.02-27-86)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No.
Work No. 6031 (TAC 86-87) 1575

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Ina Nordstrom Rm.

long - 101-43-53
lat - 34-12-04

County 095 Hale
State Well No. 11-51-
Well No. 9
Date Collected 04-06-87

Owner City of Plainview ☑ Send copy to owner Sample No. By JD Jones
Address P.O. Box 1270 Plainview ATTN WATER SUPT Well Location
Date Drilled 1957 Depth 324 ft. WBF Ogallala Source (type of well)
Producing intervals Water level ft. Sample depth ft.
Sampled after pumping 5min hrs. Yield GPM meas. est. Temperature °F °C
Point of collection Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use P.S. Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7-0772 Date Received MAY 08 '87 Date Reported MAY 15 '87

WATER ANALYSIS
State Well No:11-51- Date:051487 Sample No:EB7-772

	MG/L	ME/L		MG/L	ME/L
Silica:00955:	32		Carbonate:00445:	0	0
Calcium:00915:	52	2.61	Bicarbonate:00440:	279	4.58
Magnesium:00925:	31	2.57	Sulfate:00946:	153	3.19
Sodium:00930:	189	8.22	Chloride:00940:	214	6.03
Potassium:00935:	7.0	.18	Fluoride:00950:	1.7	.09
T. Cations		13.58	Nitrate as NO3:71851:	1.68	.03
Manganese:01055:		%Na	T. Anions		13.92
			pH:00403:	7.7	
Boron:01020:		SAR			
			TDS(Calc):70301:	819	
Total Iron:01045:		RSC	P. Alk.:00415:	0	
Hg:			T. Alk.:00410:	229	
Specific Cond.:00095:	1140		T. Hardness:00900:	259	

Enter Conductance (micromhos/cm3)
10 x155 =1550

Ammonia-N:00610:
Nitrite-N:00615:
Nitrate-N:00620:
OrganicNitrogen:00605:

Items will be analyzed if checked.

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 1171 Lab No.
Work No. 6021 (TAC 76-87) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrum Rm.

County 095 Hale
State Well No. 11-51-
City Well No. 11
Date Collected 04-26-87

Owner City of Plainview ✓ Send copy to owner Sample No. By JD Jones
Address P.O. Box 1870 PLAINVIEW TX ATTN WATER SUPT Well Location
Date Drilled 1-59 Depth 323 ft. WBF Not Reported
Producing intervals Water level ft. Sample depth ft.
Source (type of well) Surface
Sampled after pumping 5 min hrs. Yield GPM meas. est. Temperature °F °C
Point of collection hyd at well Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use P.S Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. FB7 0775 Date Received MAY 08 '87 Date Reported MAY 15 '87

WATER ANALYSIS
Date: 051487
Sample No: FB7-775

State Well No: 11-51-

	MG/L	ME/L
Silica: 00955:	65	
Calcium: 00915:	43	2.18
Magnesium: 00925:	37	3.04
Sodium: 00930:	34	1.48
Potassium: 00935:	8.0	.20
T. Cations		6.90
Manganese: 01055:		
Boron: 01020:		
Total Iron: 01045:		
Specific Cond.: 00095:	580	

Calculated Conductance (micromhos/cm3)
4.5 x15A=702
Items will be analyzed if checked.

	MG/L	ME/L
Carbonate: 00445:	0	0
Bicarbonate: 00440:	309	5.06
Sulfate: 00946:	32	.67
Chloride: 00940:	36	1.01
Fluoride: 00950:	3.2	.17
Nitrate as NO3: 71851:	4.14	.1
T. Anions		7.01
pH: 00403:	8.2	
TDS (Calc): 70301:	417	
P. Alk.: 00415:	0	
T. Alk.: 00410:	253	
T. Hardness: 00900:	241	

SAR
RSC
SBR
Ammonia-N: 00610:
Nitrite-N: 00615:
Nitrate-N: 00620:
Organic Nitrogen: 00605:

TWDB 0811 (Rev.02-27-86)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

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1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No. ____
Work No. 6031 (IAC 86-87) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: [illegible] Rm. ____

County 095 Hale
State Well No. 11-51-
City Well No. 12
Date Collected 04-[illegible]-[illegible]

Owner City of Plainview ____ Send copy to owner Sample No. ____ By [illegible]
Address P.O. Box 1870 Plainview TX Attn Water Supt. Well Location ____
Date Drilled 6-63 Depth 330 ft. WBF Ogallala Source (type of well) [illegible]
Producing intervals ____ Water level ____ ft. Sample depth ____ ft.
Sampled after pumping ____ hrs. Yield ____ GPM meas./est. Temperature ____ °F ____ °C
Point of collection hyd at well Appearance ☑ clear ☐ turbid ☐ colored ☐ other
Use P.S. Remarks ____

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7 0776 Date Received MAY 08 '87 Date Reported MAY 15 '87

WATER ANALYSIS
Date:051287
State Well No:11-51-
Sample No:EB7-776

	MG/L	ME/L
Silica:00955:	31	
Calcium:00915:	52	2.63
Magnesium:00925:	31	2.53
Sodium:00930:	196	8.52
Potassium:00935:	7.0	.18
T.Cations		13.86
Manganese:01055:		
Boron:01020:		
Total Iron:01045		

%Na ______
SAR ______
RSC ______

	MG/L	ME/L
Carbonate:00445:	0	0
Bicarbonate:00440:	265	4.34
Sulfate:00946:	159	3.31
Chloride:00940:	223	6.29
Fluoride:00950:	1.7	.09
Nitrate as NO3:71851:	1.64	.03
T. Anions		14.06
pH:00403:	8.1	
TDS(Calc):70301:	833	
P. Alk.:00415:	0	
T. Alk.:00410:	217	
T. Hardness:00900:	259	
Ammonia-N:00610:		
Nitrite-N:00615:		
Nitrate-N:00620:		
OrganicNitrogen:00605:		

Specific Cond.:00095: 1164
Temp Conductance (micromhos/cm3)
=1606
[illegible] analyzed if checked.

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No.
Work No. 6031 (IAC 86-87) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrom Rm.

LAT-34-11-53
LONG 101-44-12

County 095 Hale
State Well No. 11-51-
City Well No. 13
Date Collected 04-06-87

Owner City of Plainview ✓ Send copy to owner Sample No. By J.D. Jones
Address P.O. Box 1870 Plainview TX ATTN WATER SUPT Well Location
Date Drilled 1917 Depth 330 ft. WBF Ogallala Source (type of well) Symm
Producing intervals Water level ft. Sample depth ft.
Sampled after pumping hrs. Yield GPM meas. est. Temperature °F °C
Point of collection hdat well Appearance ☒ clear ☐ turbid ☐ colored ☐ other
Use PS Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7 0778 Date Received MAY 08 '87 Date Reported MAY 15 '87

State well No: 11-51-

Sample No: EB7-778

WATER ANALYSIS
Date: 051287

	MG/L	ME/L		MG/L	ME/L
Silica: 00955:	56		Carbonate: 00445:	0	0
Calcium: 00915:	47	2.38	Bicarbonate: 00440:	334	5.50
Magnesium: 00925:	35	2.86	Sulfate: 00946:	34	.71
Sodium: 00930:	39	1.70	Chloride: 00940:	30	.85
Potassium: 00935:	7.0	.18	Fluoride: 00950:	2.6	.14
T. Cations		7.11	Nitrate as NO3: 71851:	3.01	.05
Manganese: 01055:		%Na	T. Anions		7.24
Boron: 01020:		SAR	pH: 00403:	8.2	
Total Iron: 01045:		RSC	TDS(Calc): 70301:	419	
Other			P. Alk.: 00415:	0	
(Specific Cond.: 00095:		595	T. Alk.: 00410:	275	
Diluted Conductance (micromhos/cm3)			T. Hardness: 00900:	262	
5 x145 =725					
Items will be analyzed if checked.			Ammonia-N: 00610:		
			Nitrite-N: 00615:		
			Nitrate-N: 00620:		
			Organic Nitrogen: 00605:		

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Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

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1100 West 49th Street
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TWDB ONLY
Organization No. 422 Lab No.
Work No. 6031 (IAC 86-87) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrom Rm.

County 095 Hale
State Well No. 11-51-
City Well No. 14
Date Collected 04-26-87

Owner City of Plainview Send copy to owner Sample No. By J.D. Jones
Address P.O. Box 1870 Plainview TX ATTN: WATER SUPT Well Location
Date Drilled 1968 Depth 325 ft. WBF Ogallala Source (type of well)
Producing intervals Water level ft. Sample depth ft.
Sampled after pumping 5 min hrs. Yield GPM meas. est. Temperature °F °C
Point of collection hydrant well Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use P.S. Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7 0781 Date Received MAY 08 '87 Date Reported MAY 15 '87

State Well No:11-51-

WATER ANALYSIS
Date:051287

Sample No:EB7-781

	MG/L	ME/L
Silica:00955:	54	
Calcium:00915:	50	2.53
Magnesium:00925:	35	2.89
Sodium:00930:	42	1.83
Potassium:00935:	8.0	.20
T. Cations		7.45
Manganese:01055:		
Boron:01020:		
Tota. Iron:01045:		
Other		
(Specific Cond.:00095:		625

Cation Conductance (micromhos/cm3)
5 x153 =765
Items will be analyzed if checked.

ME/L
%Na
SAR
RSC

	MG/L	ME/L
Carbonate:00445:	0	0
Bicarbonate:00440:	329	5.40
Sulfate:00946:	38	.79
Chloride:00940:	43	1.21
Fluoride:00950:	2.5	.13
Nitrate as NO3:71851:	2.7	.04
T. Anions		7.58
pH:00403:	8.2	
TDS(Calc):70301:	440	
P. Alk.:00415:	0	
T. Alk.:00410:	270	
T. Hardness:00900:	271	
Ammonia-N:00610:		
Nitrite-N:00615:		
Nitrate-N:00620:		
OrganicNitrogen:00605:		

TWDB-0811 (Rev.02-27-86)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
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TWDB ONLY
Organization No. 4122 Lab No.
Work No. (4231 CTHC 86-87) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrum Rm. ____

County 095 Hale
State Well No. 111-51-
City Well No. 15
Date Collected 04-26-87
Owner City of Plainview
Send copy to owner Sample No. By JO Jones
Address P.O Box 1870 Plainview TX
Well Location
Date Drilled 1-37 Depth 191.5 ft. WBF Ogallala
Source (type of well)
Producing intervals Water level 1 ft. Sample depth ft.
Sampled after pumping hrs. Yield GPM meas. est. Temperature °F °
Point of collection Appearance ☐ clear ☐ turbid ☐ colored ☐ oth
Use PS Remarks

(FOR LABORATORY USE ONLY)

Laboratory No. FB7 - 0780
Date Received MAY 08 '87
Date Reported MAY 15 '87

CHEMICAL ANALYSIS

rate Well No:NONE

WATER ANALYSIS
Date:051287

Sample No:FB7-780

	MG/L	ME/L
Silica:00955:	53	
Calcium:00915:	43	2.16
Magnesium:00925:	30	2.46
Sodium:00930:	50	2.17
Potassium:00935:	8.0	.20
T.Cations		7.00
Manganese:01055:		
%Na		
Boron:01020:		
SAR		
Total Iron:01045:		
RSC		
Other		
(Specific Cond.:00025:		587
Luten Conductance (micromhos/cm3)		
5 x143		=715

Items will be analyzed if checked.

	MG/L	ME/L
Carbonate:00445:	0	0
Bicarbonate:00440:	331	5.42
Sulfate:00946:	31	.65
Chloride:00940:	30	.85
Fluoride:00950:	2.6	.14
Nitrate as NO3:71851:	6.16	.1
T. Anions		7.15
pH:00403:	8.3	
TDS(Calc):70301:	416	
P. Alk.:00415:	0	
T. Alk.:00410:	271	
T. Hardness:00900:	231	
Ammonia-N:00610:		
Nitrite-N:00615:		
Nitrate-N:00620:		
OrganicNitrogen:00605:		

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No.
Work No. 6031 (IAC 86-89) 1685

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrum Rm.

County 095 Hale
State Well No.
City Well No. 16
Date Collected 04-16-87

Owner City of Plainview ✓ Send copy to owner Sample No. By JD-Torres
Address P.O. Box 1870 Plainview TX Well Location
Date Drilled N.A. Depth 340 ft. WBF Fm Ogallala Source (type of well) Turbine
Producing intervals Water level 1 ft. Sample depth ft.
Sampled after pumping hrs. Yield GPM meas. est. Temperature °F °C
Point of collection Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use P.S. Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7 0787 Date Received MAY 08 '87 Date Reported MAY 15 '87

WATER ANALYSIS
Date: 051287

Data well No: NONE Sample No: EB7-787

	MG/L	ME/L		MG/L	ME/L
Silica: 00955:	53		Carbonate: 00445:	0	0
Calcium: 00915:	67	3.36	Bicarbonate: 00440:	326	5.34
Magnesium: 00925:	40	3.30	Sulfate: 00946:	63	1.31
Sodium: 00930:	40	1.74	Chloride: 00940:	64	1.80
Potassium: 00935:	9.0	.23	Fluoride: 00950:	.2.8	.15
T. Cations		8.63	Nitrate as NO3: 71851:	5.36	.09
Hardness: 01055:		%Na	T. Anions		8.69
			pH: 00403:	8.1	
Boron: 01020:		SAR			
			TDS(Calc): 70301:	565	
Total Iron: 01045:		RSC	P. Alk.: 00415:	0	
Other			T. Alk.: 00410:	267	
(Specific Cond.: 00095:		719	T. Hardness: 00900:	333	

(Unitsed Conductance (Micromhos/cm3)
A x153 =918

Items will be analyzed if checked.

Ammonia-N: 00610:
Nitrite-N: 00615:
Nitrate-N: 00620:
OrganicNitrogen: 00605:

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Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No.
Work No. 6031 (JAC 86-87) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrom Rm. ____

County 095 Nolan
State Well No. 11-51-
City Well No. 10
Date Collected 04-26-87

Owner No of Plainview ___ Send copy to owner Sample No. By D.D. Jones
Address [illegible] Well Location
Date Drilled ____ Depth 301 ft. WBF Ogallala Source (type of well) Sump
Producing intervals ____ Water level ____ ft. Sample depth ____ ft.
Sampled after pumping 5 min hrs. Yield ____ GPM meas. est. Temperature ____ °F ____ °C
Point of collection ____ Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use PS Remarks ____

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. FB7-0786 Date Received MAY 08 '87 Date Reported MAY 15 '87

WATER ANALYSIS

State Well No:11-51- Date:051287 Sample No:FB7-786

	MG/L	ME/L		MG/L	ME/L
Silica:00955:	66		Carbonate:00445:	4	.16
Calcium:00915:	53	2.66	Bicarbonate:00440:	399	6.54
Magnesium:00925:	45	3.72	Sulfate:00946:	30	.63
Sodium:00930:	40	1.74	Chloride:00940:	31	.87
Potassium:00935:	8.0	.20	Fluoride:00950:	2.7	.14
T.Cations		8.32	Nitrate as NO3:71851:	4.61	.07
Manganese:01055:		%Na ____	T. Anions		8.42
			pH:00403:	8.4	
Boron:01020:		SAR ____			
			TDS(Calc):70301:	482	
Total Iron:01045:		RSC ____	P. Alk.:00415:	4	
			T. Alk.:00410:	335	
Other ____					
(Specific Cond.:00095:		670	T. Hardness:00900:	319	

Diluted Conductance (micromhos/cm3)
5.5 x152=836

Ammonia-N:00610:
Nitrite-N:00615:
Nitrate-N:00620:
OrganicNitrogen:00605:

_ items will be analyzed if checked.

TWDB-0811 (Rev.02-27-86)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No.
Work No. 6031 (IAL #1-37) 1585

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrum Rm.

County 095 Hale
State Well No. [ ]-[ ]-[ ]
City Well No. 17
Date Collected 04-26-87

Owner City of Plainview — Send copy to owner Sample No. By J.D. Jones
Address PO Box 1890 Plainview TX Well Location
Date Drilled 7-3-1-? Depth 3?? ft. WBF Source (type of well)
Producing intervals Water level ft. Sample depth ft.
Sampled after pumping hrs. Yield GPM meas./est. Temperature °F °C
Point of collection Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use P.S Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. FB7 0785 Date Received MAY 08 '87 Date Reported MAY 15 '87

WATER ANALYSIS
Date:051287

State Well No:NONE Sample No:FB7-785

	MG/L	ME/L		MG/L	ME/L
Silica:00955:	51		Carbonate:00445:	3	.12
Calcium:00915:	61	3.04	Bicarbonate:00440:	312	5.12
Magnesium:00925:	37	3.08	Sulfate:00946:	53	1.10
Sodium:00930:	42	1.83	Chloride:00940:	59	1.66
Potassium:00935:	8.0	.20	Fluoride:00950:	2.8	.15
T.Cations		8.17	Nitrate as NO3:71851:	3.94	.06
Manganese:01055:		%Na	T. Anions		8.22
			pH:00403:	8.4	
Boron:01020:		SAR			
			TDS(Calc):70301:	476	
Total Iron:01045:		RSC	P. Alk.:00415:	3	
			T. Alk.:00410:	262	
Specific Cond.:00095:		682	T. Hardness:00900:	307	

Specific Conductance (micromhos/cm3)
=864
These will be analyzed if checked.

Ammonia-N:00610:
Nitrite-N:00615:
Nitrate-N:00620:
OrganicNitrogen:00605:

TWDB 0811 (Rev.02 27-86)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
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TWDB ONLY

Organization No. 422 Lab No.

Work No. 6031 (IAC 86-87) 1555

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:

Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711

Attn: E. Nordstrom Rm.

Lat 34 11 32
Long 101 42 54

County 095 Hale

State Well No.

City Well No. 18

Date Collected 04-26-87

Owner City of Plainview — Send copy to owner — Sample No. — By JD Jones

Address P.O. Box 1270 Plainview TX — Well Location

Date Drilled — Depth 228 ft. WBF Gallatin — Source (type of well) Turbine

Producing intervals — Water level — ft. Sample depth — ft.

Sampled after pumping — hrs. Yield — GPM meas. est. — Temperature °F °C

Point of collection — Appearance ☐ clear ☐ turbid ☐ colored ☐ other

Use P.S — Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. FB7-0782

Date Received MAY 08 '87

Date Reported MAY 15 '87

WATER ANALYSIS
Date: 051287

State Well No: NONE

Sample No: FB7-782

	MG/L	ME/L		MG/L	ME/L
Silica: 00955:	54		Carbonate: 00445:	0	0
Calcium: 00915:	78	3.92	Bicarbonate: 00440:	353	5.78
Magnesium: 00925:	46	3.78	Sulfate: 00946:	79	1.65
Sodium: 00930:	41	1.78	Chloride: 00940:	77	2.17
Potassium: 00935:	9.0	.23	Fluoride: 00950:	2.7	.14
T. Cations		9.71	Nitrate as NO3: 71851:	7.58	.12
Manganese: 01055:			T. Anions		9.86
		%Na	pH: 00403:	8.2	
Boron: 01020:		SAR			
			TDS(Calc): 70301:	568	
Total Iron: 01045:		RSC	P. Alk.: 00415:	0	
Other			T. Alk.: 00410:	289	
(Specific Cond.: 00095:	797		T. Hardness: 00900:	385	

Dluted Conductance (micromhos/cm3)
7 x 149 = 1043

_ items will be analyzed if checked.

Ammonia-N: 00610:
Nitrite-N: 00615:
Nitrate-N: 00620:
OrganicNitrogen: 00605:

TWDB-0811 (Rev.02-27-86)

Typewrite (Black ribbon) or Print Plainly
(soft pencil or black ink)
Do not use ball point pen

Texas Department of Health Laboratories
1100 West 49th Street
Austin, Texas 78756

TWDB ONLY
Organization No. 422 Lab No.
Work No. 603/IAC86-87)1575

CHEMICAL WATER ANALYSIS REPORT

Send Reply To:
Water Availability Data and Studies Section
Texas Water Development Board
Stephen F. Austin Building
1700 Congress Ave.
Austin, Texas 78711
Attn: Phil Nordstrom Rm.

County 095 Hale
State Well No.
City Well No. 14
Date Collected 04-15-87

Owner City of Plainview — Send copy to owner — Sample No. — By
Address P.O. Box 1870 Plainview TX — Well Location
Date Drilled 7-15-83 Depth 363 ft. WBF Unknown — Source (type of well) Grnd
Producing intervals — Water level — ft. Sample depth — ft.
Sampled after pumping — hrs. Yield — GPM meas. est. — Temperature °F °C
Point of collection — Appearance ☐ clear ☐ turbid ☐ colored ☐ other
Use P.S Remarks

(FOR LABORATORY USE ONLY)

CHEMICAL ANALYSIS

Laboratory No. EB7-0783 Date Received MAY 08 '87 Date Reported MAY 15 '87

State Well No:NONE

WATER ANALYSIS
Date:051287

Sample No:EB7-783

	MG/L	ME/L
Silica:00955:	49	
Calcium:00915:	50	2.50
Magnesium:00925:	39	3.22
Sodium:00930:	43	1.87
Potassium:00935:	9.0	.23
T.Cations		7.82
Manganese:01055:		
Boron:01020:		
Total Iron:01045:		
Other		
(Specific Cond.:00095:	647	

%Na
SAR
RSC

	MG/L	ME/L
Carbonate:00445:	0	0
Bicarbonate:00440:	337	5.52
Sulfate:00946:	54	1.13
Chloride:00940:	40	1.13
Fluoride:00950:	2.4	.13
Nitrate as NO3:71851:	1.51	.02
T. Anions		7.92
pH:00403:	8.3	
TDS(Calc):70301:	454	
P. Alk.:00415:	0	
T. Alk.:00410:	276	
T. Hardness:00900:	286	

Ammonia-N:00610:
Nitrite-N:00615:
Nitrate-N:00620:
OrganicNitrogen:00605:

Diluted Conductance (micromhos/cm3)
5.5 x147=808
Items will be analyzed if checked.

TWDB 0811 (Rev.02-27-86)

CONSTANT HEAD PERMEABILITY TEST

PROJECT: Sanitary Landfill Site — JOB NO. 73.1109

FOR: City of Plainview — SEPTEMBER 10, 1973

Test Boring	Depth Feet	Soil Description	Class.	Dry Unit Wt. pcf	Water Content Start %	Water Content End %	Permeability cm/sec.	Permeability ft/yr.
3	4	Brown & red sandy clay w/calcareous particles	CL	111.8*	17.3	17.3	2.17×10^{-9}	2.25×10^{-3}
4	4	Brown & red clayey sand w/calcareous particles	SC	103.0*	19.8	19.8	4.74×10^{-8}	4.91×10^{-2}
5	4	Tan & red clayey sand w/calcareous particles	SC	103.0*	21.7	21.7	8.53×10^{-8}	8.84×10^{-2}
6	4	Tan & red clayey sand w/calcareous particles	SC	103.0*	24.8	24.8	4.20×10^{-7}	4.35×10^{-1}

* Remolded sample at approximate in-place unit weight.

TEXAS TESTING LABORATORIES

SUMMARY OF LABORATORY TEST RESULTS

JOB NO. 73.1109

DATE 9/4/73

BORING NO.	DEPTH FEET	SOIL DESCRIPTION	WATER CONTENT %	DRY UNIT WT. psf	Qu tsf	STRAIN %	LAT. PRESS. psi	FAILURE MODE
3	0	SANDY CLAY-brown, w/ calcareous particles (CL)						
3	4	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
3	9	CLAYEY SAND-brown & red, (SC)						
3	14	CLAYEY SAND-brown & red, (SC)						
3	19	CLAYEY SAND-brown & red, (SC)						
3	24	SANDY CLAY-brown & red, (CL)						
3	29	CLAYEY SAND-brown & red, (SC)						
3	34	CLAYEY SAND-brown & red, (SC)						
3	39	CLAYEY SAND-brown & red, (SC)						
3	44	CLAYEY SAND-brown & red, (SC)						

TEXAS TESTING LABORATORIES

SUMMARY OF LABORATORY TEST RESULTS

JOB NO. 73.1109 DATE 9/4/73

BORING NO.	DEPTH FEET	SOIL DESCRIPTION	WATER CONTENT %	DRY UNIT WT. psf	Qu tsf	STRAIN %	LAT. PRESS. psi	FAILURE MODE
4	0	CLAYEY SAND-brown, w/ calcareous particles (SC)						
4	4	CLAYEY SAND-brown & red, w/ calcareous particles (SC)						
4	9	SANDY CLAY-brown & red, (CL)						
4	14	SANDY CLAY-brown & red, (CL)						
4	19	SANDY CLAY-brown & red, (CL)						
4	24	CLAYEY SAND-brown & red, (SC)						
4	29	CLAYEY SAND-brown & red, (SC)						
4	34	CLAYEY SAND-brown & red, (SC)						
4	39	CLAYEY SAND-brown & red, (SC)						
4	44	CLAYEY SAND-brown & red, (SC)						

TEXAS TESTING LABORATORIES

SUMMARY OF LABORATORY TEST RESULTS

JOB NO. 73.1109

DATE 9/4/73

BORING NO.	DEPTH FEET	SOIL DESCRIPTION	WATER CONTENT %	DRY UNIT WT. psf	Qu tsf	STRAIN %	LAT. PRESS. psi	FAILURE MODE
6	0	SILTY CLAY-dark brown, (CL)						
6	4	CLAYEY SAND-tan & red, w/ calcareous particles (SC)						
6	9	CLAYEY SAND-tan & red, w/ calcareous particles (SC)						
6	14	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
6	19	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
6	24	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
6	29	CLAYEY SAND-brown & red, (SC)						
6	34	CLAYEY SAND-brown & red, (SC)						

TEXAS TESTING LABORATORIES

SUMMARY OF LABORATORY TEST RESULTS

JOB NO. 73.1109

DATE 9/4/73

BORING NO.	DEPTH FEET	SOIL DESCRIPTION	WATER CONTENT %	DRY UNIT WT. psf	Qu tsf	STRAIN %	LAT. PRESS. psi	FAILURE MODE
5	0	SANDY CLAY-dark brown, (CL)						
5	4	CLAYEY SAND-tan & red, w/ calcareous particles (SC)						
5	9	CLAYEY SAND-tan & red, w/ calcareous particles (SC)						
5	14	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
5	19	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
5	24	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
5	29	SANDY CLAY-brown & red, w/ calcareous particles (CL)						
5	34	SANDY CLAY-brown & red, w/ calcareous particles (CL)						

TEXAS TESTING LABORATORIES

SUMMARY OF LABORATORY TEST RESULTS

JOB NO. 73.1109 DATE 9/5/73

BORING NO.	DEPTH FEET	SOIL DESCRIPTION		LIQUID LIMIT %	LINEAR SHRINKAGE %	PLASTICITY INDEX %
3	4	SANDY CLAY-brown & red, w/ calcareous particles	(CL)	36	10.3	14
				Minus #200 = 58.7%		
4	4	CLAYEY SAND-tan & red, w/ calcareous particles	(SC)	32	6.2	7
				Minus #200 = 45.3%		
5	4	CLAYEY SAND-tan & red, w/ calcareous particles	(SC)	26	5.2	5
				Minus #200 = 34.5%		
6	4	CLAYEY SAND-brown & red, w/ calcareous particles	(SC)	32	7.4	9
				Minus #200 = 45.4%		

TEXAS TESTING LABORATORIES

TEXAS TESTING LABORATORIES, INC.

LOG OF BORING

PROJECT: Sanitary Landfill
FOR: City of Plainview

BORING NO: 3
LOCATION: Williamson Pit-South

DATE: 8/29/73 JOB NO: 73.1109 BORING TYPE: Hollow Stem Auger
DRILLER: Houston SOIL ENGINEER: Hooper GROUND ELEV: 3319.0

LEGEND

S-SHELBY TUBE D-DENISON BARREL P-PENETRATION TEST J-JAR
C-CORE B-PENETRATION SAMPLE N-NO RECOVERY
▽-STATIC WATER TABLE ▼-HYDROSTATIC WATER TABLE

DEPTH IN FEET	SAMPLE TYPE & SAMPLE NO.	PENETROMETER READING, TSF	BLOWS/FOOT	DESCRIPTION OF STRATUM
	S			Pinkish Red Clayey Sand with Caliche Chips, Dense & Moist — 3.5'
5	B			Red Clayey Sand, Dense & Dry — 7'
10	B			Red Sand, Dense & Dry — 17'
15	B			
20	B			Red Clayey Sand, with Thin Layers of Caliche, Hard & Dry — 31'
25	B			
30	B			
35	B			Red Sand, Dense & Dry
40	B			
45	B			End of Boring 45'

TEXAS TESTING LABORATORIES, INC.

LOG OF BORING

PROJECT: Sanitary Landfill
FOR: City of Plainview

BORING NO: 4
LOCATION: Williamson Pit-South

DATE: 8/29/73 JOB NO: 73.1109 BORING TYPE: Hollow Stem Auger
DRILLER: Houston SOIL ENGINEER: Hooper GROUND ELEV: 3315.1

LEGEND

S-SHELBY TUBE D-DENISON BARREL P-PENETRATION TEST J-JAR
-CORE -PENETRATION SAMPLE -NO RECOVERY
▽-STATIC WATER TABLE ▽-HYDROSTATIC WATER TABLE

DEPTH IN FEET	SAMPLE TYPE & SAMPLE NO.	PENETROMETER READING, TSF	BLOWS/FOOT	DESCRIPTION OF STRATUM
	B			Light Brown Clayey Sand, Loose & Dry
				2'
5	B			Red Clayey Sand, Dense & Dry
10	B			
15	B			
20	B			
25	B			
				27'
30	B			Red Sand, Dense & Dry
35	B			
40	B			
45	B			End of Boring 45'

T AS TESTING LABORATORIES, I

LOG OF BORING

PROJECT: Sanitary Landfill
FOR: City of Plainview

BORING NO: 5
LOCATION: Williamson Pit-North

DATE: 8/29/73 JOB NO: 73.1109 BORING TYPE: Hollow Stem Auger
DRILLER: Houston SOIL ENGINEER: Hooper GROUND ELEV: 3322.4

LEGEND

S-SHELBY TUBE D-DENISON BARREL P-PENETRATION TEST J-JAR
C-CORE X-PENETRATION SAMPLE /-NO RECOVERY
▽-STATIC WATER TABLE ▼-HYDROSTATIC WATER TABLE

DEPTH IN FEET	SAMPLE TYPE & SAMPLE NO.	PENETROMETER READING, TSF	BLOWS/FOOT	DESCRIPTION OF STRATUM	
	B			Brown Sandy Clay, Hard & Dry	6"
				Tan Limestone with Thin Layers of Red Clayey Sand	3'
5	B			Red Sand, Dense & Dry	
10	B				
					13'
15	B			Red Clayey Sand, Dense & Dry	
					17'
20	B			Red Sandy Clay, Hard & Dry	
25	B				
30	B				
					31'
35	B			Red Clayey Sand, Hard & Dry	
				End of Boring 35'	

T AS TESTING LABORATORIES, I

LOG OF BORING

PROJECT: Sanitary Landfill
FOR: City of Plainview

BORING NO: 6
LOCATION: Williamson Pit-North

DATE: 8/29/73 JOB NO: 73.1109 BORING TYPE: Hollow Stem Auger
DRILLER: Houston SOIL ENGINEER: Hooper GROUND ELEV: 3320.1

LEGEND

S-SHELBY TUBE D-DENISON BARREL P-PENETRATION TEST J-JAR
C-CORE P-PENETRATION SAMPLE N-NO RECOVERY
▽-STATIC WATER TABLE ▽-HYDROSTATIC WATER TABLE

DEPTH IN FEET	SAMPLE TYPE & SAMPLE NO.	PENETROMETER READING, TSF	BLOWS/FOOT	DESCRIPTION OF STRATUM
	S			Brown Sandy Clay, Hard & Dry — 2'
5	B			Red Sand, Dense & Dry
10	B			
15	B			— 15'
				Red Sandy Clay, Hard & Dry
20	B			— 22.5'
				Red Clayey Sand, Dense & Dry
25	B			
30	B			
35	B			End of Boring 35'