SECTION 3

WATERWORKS SYSTEM

3.1 INTRODUCTION

3.1.1 General

This section addresses the Town's water distribution system by formulating a set of design criteria and then assessing the system's ability to provide normal water demands and sufficient fire flows to comply with the Insurers' Advisory Organization's recommendations. It identifies water pressures and available fire flows at different locations under varying demands. Future development and demand conditions are also considered and the means (i.e. pumping, piping and network configuration) to accommodate them are outlined.

The capabilities of the existing waterworks system were first assessed and then recommendations are made for the facilities required to expand the supply and distribution systems in order to serve the lands contained within the study boundary.

3.1.2 Background Studies

Several existing reports were reviewed to provide supporting and background information.

The 1976 Report

Prior to 1976, several extensions to the waterworks had been made by the Town to accommodate increases in population. Planning reports and revisions to the Town's General Plan were carried out without a review of the waterworks systems for adequacy and conformance to accepted standards. Stanley Associates Engineering

Ltd. was requested to carry out a General Engineering Report to determine the adequacy of the existing servicing systems, and the need for extensions.

Existing future conditions were investigated based on a projected population of 6980 by 1995. Edson's per capita consumption data were reviewed and it was determined that per capita demand was growing and would continue to grow reaching a value of 455 lpcd by 1995.

The report presented recommendations with respect to immediate and future water sources, storage and distribution. Using the projected population growth, new wells should have been developed in 1976, 1980, 1986 and 1991 assuming an abstraction rate of 5 l/s. An immediate need for additional storage (1,700 m^3) was identified. It was also expected that a total storage of 5,500 m^3 would be required by 1995 (population of 6980). Several problem areas where existing watermains were not large enough were also identified. Recommendations were made regarding the construction of a ring main in order to service surrounding areas which were to be developed.

At present, the majority of the recommended improvements and additions have been implemented.

<u>The 1978 Report</u>

The Edson Annexation Study resulted in a proposal for a long range water system development program for the Town. The areas considered for annexation included the Hamlet of Glenwood, the Grande Prairie Trail Area, and Section 23-53-17-W5.

Edson's per capita consumption data were again reviewed in 1978 and, it was determined that the per capita demand would continue to grow to a maximum value of 455 lpcd around the year 2001. The population projecton estimated 11,500 people in Edson and the areas to be annexed by 2001.

This report indicated that it would be expensive to service the Grande Prairie Trail Area. It also indicated that there were no problems with supply or quality of water from the individual wells in this area. Therefore, only the Town of Edson and the

Hamlet of Glenwood were considered for water supply, storage and distribution. Similar to the 1976 report, recommendations were again made to implement wells in the upcoming years. New wells would be required in 1981, 1985, 1988, 1991, 1994 and 1998 assuming the wells to have a capacity of 7.6 l/s.

The existing storage in Edson was adequate for a population of 10,500. The Hamlet of Glenwood was found to have adequate fire protection for a residential fire demand of 60 l/s but not an industrial fire demand of 265 l/s. It was found that if the two systems could be connected then there would be adequate storage for 13,270 people. However, a 265 l/s fire pump and other control modifications would be required in Glenwood to deliver fire flows in industrial areas.

The report also commented on distribution system piping. A trunk main would be required in Glenwood in order to convey an industrial fire demand. Section 23, east of the Town's boundaries and south of the CNR tracks, could be connected to the existing system by boring under the tracks. The area in the north would require a booster station. The water main on 6th Avenue to service the NE of 22-53-17-5 (Repka Subdivision) was to be upgraded to a 250 mm in the 1976 report. If Section 23 is annexed, the 250 mm main would be inadequate.

At present, the water supply system in the Hamlet of Glenwood is not connected to the Town of Edson. There has been a 350 mm main installed along 6th Avenue.

3.2 DESIGN CRITERIA

3.2.1 Definition of Water Demands

Four critical rates of demand are normally used, along with required fire flows, in determining the adequacy of supply, storage and distribution facilities. These are:

a) The annual average day demand, determined by dividing the total annual consumption by 365 days. By dividing this rate by the population served, the annual average per capita per day demand is derived. These rates are used primarily as a basis for projections of total demand for licensing water supply sources, and in the preparation of financing and rate structures.

b) The maximum day demand is usually taken as the average of the five or ten consecutive days of maximum consumption in the year, but sometimes, as the single day of maximum consumption. In the latter method some checking is necessary to ensure that the record is not distorted by the random imposition of a fire-fighting demand or by an equipment malfunction. For purposes of projection, a ratio (based on past records) of maximum day demand to average day demand is normally used. The maximum day demand is usually used in determining the capacity of supply mains, treatment facilities, storage and in the sizing of pumping facilities that have balancing reservoirs in their distribution system. It is also used as the base flow in conjunction with fire flows to assess probable maximum demand capability.

c) The peak hour demand is the demand during the peak hour of the day of maximum consumption. Totalizer records are usually not detailed enough to allow this demand rate to be read directly. The rate is established either by review of more detailed water records (flow charts) or computed by a ratio, established by previous experience, of the peak hour demand to the maximum day demand. This rate is normally used in determining watermain sizes, capacity of storage facilities and for the sizing of pumping facilities that have no balancing reservoirs on the discharge side.

d) The minimum daily demand, for the purposes of this study, is the average demand during the period of the day of maximum consumption when reservoir filling is taking place and it must be combined with an estimate of duration. The demand rate and duration can be determined from flow charts but are usually determined empirically as a fraction of the maximum day demand. This condition is used in assessing capacities of supply lines and localized parts of the distribution system under reservoir filling conditions.

3.2.2 Per Capita Water Demands

This study has simulated the existing water distribution system and the system proposed to serve the ultimate population (i.e. the holding capacity of the Study Area). For the time period between 1981 and when the population reaches the ultimate, estimates of water demands are made in terms of population levels and not in terms of the number of years from present.

Historical average per capita day demand has been reviewed and a forecast of future per capita water consumption made. Per capita water consumption data has continued to indicate an increasing trend in recent years (Table 3.1 and Figure 3.1). This is likely a result of increased industrial and commercial activity and improving water distribution capabilities within the Town.

It has been assumed that new residential areas will have an average day demand of 330 litres per capita and new industrial areas will have an average day demand of 6600 litres per ha. Beyond this level it is difficult to accurately predict the water demands for the system and this study makes the assumption that composite per capita demand will remain constant at the 450 lpcd level.

3.2.3 Demand Ratio Determination

3.2.3.1 Water Records

Water for the Edson water distribution system is presently supplied by eight wells. The Town of Edson monitors the daily water production for each well. The annual average day demand and maximum month demand was extracted from the records for each year of data. Monthly water consumption for 1981 is the only data available for the well serving the Hamlet of Glenwood and this was not considered in determining demand ratios.

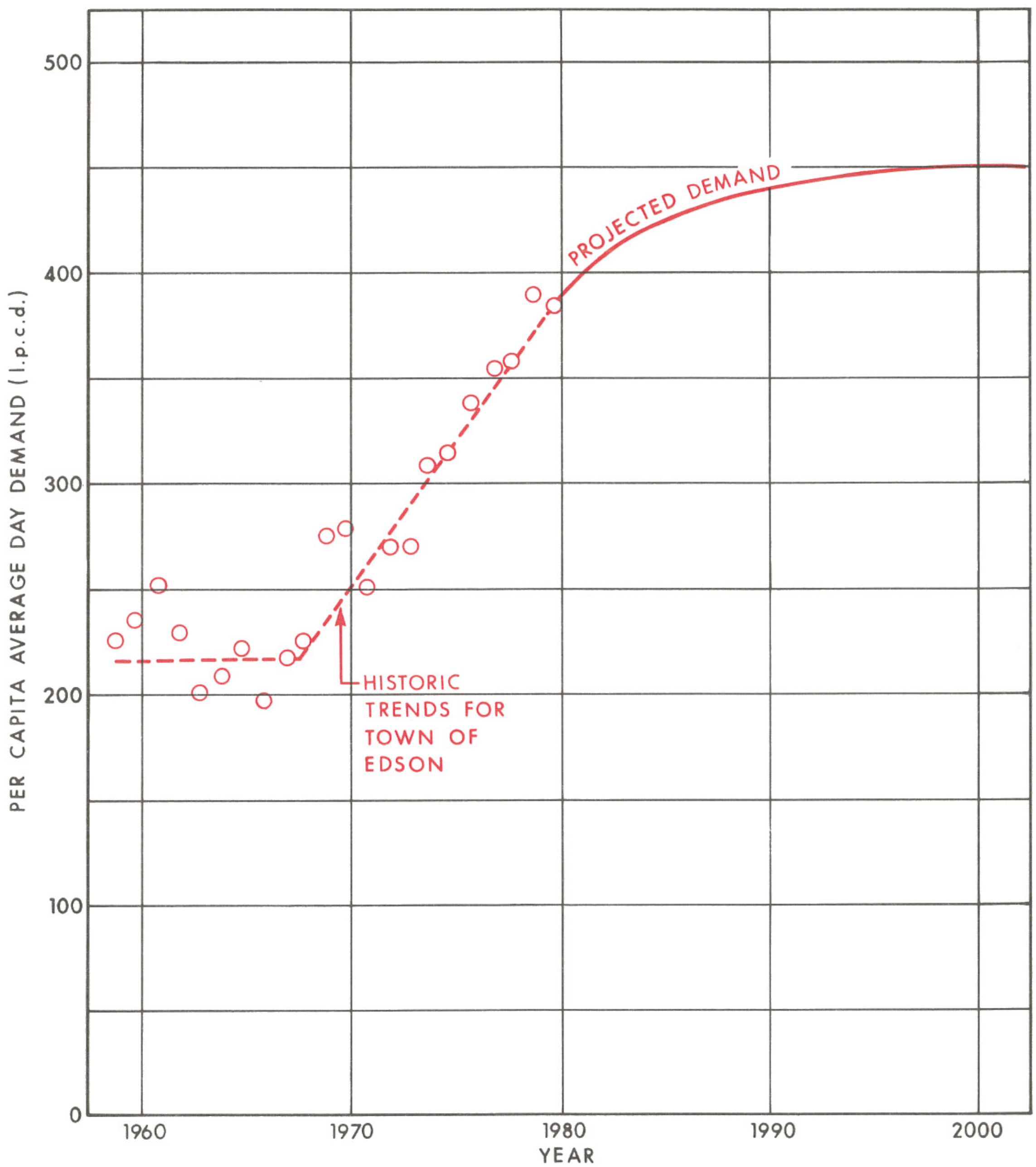


Figure 3.1
WATER DEMAND PROJECTIONS

3.2.3.2 Demand Ratios

Demand ratios are used as the basis for estimating future water demands for various design conditions. These demand conditions are in turn used in assessing the adequacy of supply, distribution and storage facilities.

The maximum day factor is the ratio of the maximum day demand to the average day demand for the same year.

A maximum day factor of 1.7 has been assumed for Edson. This value was used in the Edson Annexation Study (SAEL: 1978), and is similar to values in the order of 1.8 determined from records for Grande Prairie, Stony Plain, Camrose and Fort McMurray.

TABLE 3.1

HISTORIC AND PROJECTED POPULATION AND PER CAPITA WATER DEMAND FOR EDSON

Year	Population	Average Day Demand (lpcd)	Maximum Month Demand (lpcd)
1959	3227	228	N/A
1960	3248	236	N/A
61	3339	253	N/A
62	3453	229	N/A
63	3538	200	240
64	3643	208	267
65	3740	221	260
66	3943	196	235
67	3935	217	259
68	3817	225	277
69	3832	275	338
1970	3872	278	326
71	4051	251	285
72	4060	270	325
73	4095	271	313
74	4079	308	352
75	4111	315	368
76	4241	337	392
77	4448	353	400
78	5015	358	395
79	5403	389	449
1980	5671	385	458
81	6027	395	N/A
	8100	427	
	9200	442	
	10,200	448	
	11,500	450	
Ultimate	25,000	450	

Notes:

1. Historic populations are for area with the present town boundary. Figures were provided by Town of Edson.
2. Water consumption data was provided by Town of Edson Well Production records.

The peak hour factor is the ratio of peak hour demand to the maximum day demand. As there are no means to determine this ratio for Edson directly, the results of previous work must be used for an estimation. Previous studies have used values ranging from 1.5 to 2.2. Peak hour factors of 2.2, 1.8 and 1.8 have been determined in recent reviews of water records for St. Albert, Stony Plain, and Fort McMurray. A peak hour factor of 1.8 is used in this study.

The minimum daily factor is the ratio of the average demand for the period of reservoir filling during the maximum day to the average flow for that day. This ratio is usually 0.20 to 0.35. A factor of 0.35 is used in this study. In conjunction with the rate it is also necessary to know the duration of the period when reservoir replenishment occurs. This is generally in the order of six to eight hours.

To summarize the foregoing, this report adopts the water demands and ratios outlined in Table 3.2.

TABLE 3.2

WATER DEMAND RATIOS FOR EDSON

Condition	Demand Ratio
Annual Average Day Demand	395 to 450 lpcd
Maximum Day Demand	1.70 x average day demand
Peak Hour Demand	1.80 x maximum day demand (3.06 x average day demand)
Minimum Demand	0.35 x maximum day demand for 7 hours

3.2.4 Fire Flow Requirements

One probable maximum demand condition is the occurance of fire flows at critical points in the distribution system in conjunction with the maximum day demand. In 1977 the Insurer's Advisory Organization (formerly the Canadian Underwriter's Association) published a guide to recommended practice entitled "Water Supply for Public Fire Protection". There is a new (1981) Guide which now presents the information in SI units and has changed the recommendations only slightly.

The required fire flow for a building is determined using building type, size, materials of construction and proximity to other buildings. It must be possible to draw off the required fire flow at any point in the water distribution system and the largest required flow, if it is not an anomaly, determines the fire storage requirements.

In the analysis of the distribution system, fire flows of up to 265 l/s were simulated at various locations in the Town, representing major fires in those areas. A summary of some typical fire flow requirements are listed in Table 3.3.

3.2.5 Summary of Water Demands

The population projection, per capita consumption, demand ratio and fire flow criteria are combined to project water demands for the Town of Edson (Table 3.4). To be conservative, the maximum fire flow of 265 l/s is used. These projections can be used for estimating supply, storage, pumping and distribution requirements. The data can also be used for specific population and/or demand characteristics.

TABLE 3.3

FIRE FLOW REQUIREMENTS

(Typical)

	Type	Required Fire Flow (l/s)	(Igpm)	Required Duration of Fire Flow (hr)
1.	Residential (single family dwelling)	61-76	(800-1000)	1.5 to 1.75
2.	Residential (townhouse)	100-150	(1400-2000)	2
3.	Elementary School (non-combustible; 1 storey; 2300 m^2)	91	(1200)	2
4.	High School (fire resistive; 3 or more stories; 2300 m^2)	243	(3200)	3.2
5.	Typical Industrial Park (1 storey; well detached; light fire load; 3700 m^2)	228	(3000)	3.0
6.	Frame Warehouse (moderate fire load; 3700 m^2)	333	(4,400)	4.6
7.	Shopping Centre (non-combustible; 9300 m^2)	283	(3,600)	3.6

Note: From Insurers' Advisory Organization (1981).

TABLE 3.4

PRESENT AND PROJECTED WATER DEMANDS FOR EDSON

Year	Population	Average Day Demand (lpcd)	Annual Consumption (Ml)	Maximum Day Demand (l/s)	Peak Hour Demand (l/s)	Maximum Day & Fire (l/s)
1981	6027	395	0.868	47	85	312
Level 1	8100	427	1.26	68	122	333
Level 2	9200	442	1.48	80	144	345
Level 3	10,200	448	1.67	90	162	355
Level 4	11,500	450	1.89	102	183	367
Level 5	15,000	450	2.46	133	239	398
Ultimate	25,000	450	4.11	221	398	486

Notes:

1. Populations and average day demand are taken from Table 3.1.
2. Maximum day demand is taken as 1.7 times average day demand.
3. Peak hour demand is taken as 1.8 times maximum day demand.
4. Maximum fire flow is taken as 265 l/s.

3.2.6 Water Storage Requirements

In a waterworks system, storage is used to provide the following:

1. fire flows;
2. demand which exceeds the input capacity of the supply facilities;
3. emergency storage - to provide water during partial or total shutdown of the supply facilities.

The amount of storage required for fire protection is determined by the standards of the Insurers' Advisory Organization (1981). The maximum fire flow is to be supplied for a duration which is a function of the flow rate. For Edson the fire flow/duration is 265 l/s for 3.5 hours.

The storage requirements needed to assist in supplying peak demands when they exceed the supply rate may be determined theoretically by subtracting the supply capacity from the usage, during these periods. If the supply rate is assumed to be constant at maximum day demand then, more simplistically, the peak demand equalization requirements can be estimated from the flow rates in excess of maximum day demand during the peak period for the day. This storage quantity is usually found to be in the range of 15% - 30% of the maximum day demand with a commonly accepted value of 25%. As there are no flow chart data to be used in estimating the peak demand storage quantities, the value of 25% is assumed.

Storage for emergency supply is commonly taken to be 15% of average day consumption. However, this must be assessed in light of supply security conditions. Water supplies which might be vulnerable to an interuption in service (e.g. a break in a supply line) would require more storage. Since Edson's supply is the sum of many independent sources, the minimum emergency requirement is satisfactory.

A summary of the criteria used for estimating reservoir storage requirements for standard operational considerations in Edson are:

- peak storage (25% of maximum day)

- fire flow storage (265 l/s for 3.5 hrs.)
- emergency storage (15% of average day)

3.2.7 Water Distribution Piping

3.2.7.1 Pipe Material Commonly Used

Cast iron was one of the first and most common materials used for water distribution system piping in modern history. It is still found in use today. Steel pipe was first used to convey water in North America in the 1850's. These materials were successfully used for decades, however, they had one shortcoming - their hydraulic performance deteriorated with age due to internal corrosion and tuberculation. This problem has been overcome by the use of cement mortar linings which are centrifugally spun onto the internal surface of the pipe. This practice has been successful to the extent that cement mortar is, by far, the commonest lining for metal pipes.

In recent years new materials have been introduced which have their own advantages and disadvantages with respect to economics, strength, flexibility, hydraulic performance and corrosion resistance. Asbestos cement pipe was introduced to North America from Italy in the early 1930's and ductile iron pipe was first used in the mid 1950's. In the 1960's plastic piping was introduced. Polyvinyl chloride distribution pipe specifications were first published by the American Water Work Association (AWWA) in 1976. There are no AWWA standards for polyethylene distribution pipe but it is also sometimes used for this purpose. In Canada, polyethylene pipe is manufactured in accordance with Candian Standards Association (CSA) specifications.

3.2.7.2 Inside Diameters of Common Types and Classes of Pipe

For hydraulic calculations the internal diameter of the pipe should be used. The inside diameters of several types of pipe (and classes of pipe) are listed in Table 3.5.

TABLE 3.5

INSIDE DIAMETERS FOR VARIOUS TYPES OF PIPE

Nominal Diameter	Asbestos Cement		Ductile Iron	Cast Iron	Steel-Standard	Polyvinyl Chloride	
	Class 100	Class 150	Class 50	Class 50	Wall Thickness	Class 100	Class 150
100	-	100	109[2]	104	102	112	108
150	152	149	162	156	154	161	156
200	203	199	216	209	203	211	204
250	250	254	267	260	255	259	251
300	297	305	319	311	305	308	298
350	345	356	372	364	337	-	-
400	394	406	425	415	387	-	-
450	457	457	478	468	438	-	-

Note: 1. All diameters are in mm.

2. 100 mm pipe is Class 51.

3.2.7.3 Roughness Coefficients (Hazen - Williams)

Hydraulic calculations to determine the friction loss in water distribution system piping require an estimate of the roughness coefficient for the individual pipes. The most important factors in determining the roughness coefficients for the piping are the age, the internal wall condition and the material. A common formula used for head loss calculations is the Hazen - Williams equation.

The roughness of unlined metal pipes such as cast iron, ductile iron and steel increases with age due to internal corrosion and tuberculation. Pipe materials such as asbestos cement, polyvinyl chloride and polyethylene and cement mortar lined pipes are not subject to tuberculation and, therefore, their roughness is expected to be constant with respect to time.

Table 3.6 provides a list of Hazen - Williams roughness coefficients (C) for common types of pipe materials. The first set of values for each material result from laboratory measurements on ideal lengths of pipe where no losses except for those from the internal wall roughness are expected. The second set of values for roughness coefficients are those recommended by the pipe manufacturers for transmission lines. The reduced values of "C" represent a conservative estimate of roughness accounting for the statistical variation of measured roughnesses. For network analysis a further reduction is necessary to account for valves, bends, and other fittings and for sedimentation. Sedimentation is more likley to be a problem in distribution piping with lower flow velocities.

TABLE 3.6

PIPE TYPES & THEIR ROUGHNESS COEFFICIENTS

Material	Tests on New Material	Pipeline Design	Used for Network Analysis
Polyvinyl Chloride (PVC)	150-160	150	135
Polyethylene (PE)	150-155	140	130
Asbestos Cement (AC)	140-165	140	125
Cement Mortar Lining - Centrifugally Spun	135-150	135	125
Ductile Iron (DI) - unlined	*	130/87**	120/80
Cast Iron (CI) - unlined	*	130/87**	120/80
Steel (welded) - unlined	*	120/84**	110/75

Note: Roughness coefficients are Hazen - Williams C.

* Roughness coefficient is dependent on age for unlined pipe

** Values shown are for when new and when about 30 years old.

3.3 WATER SUPPLY AND PUMPING FACILITIES

3.3.1 Ground Water Supply

Water is presently supplied to the Town of Edson from eight wells located within the Study Area. Table 3.7 is a summary of water levels and sumping rates in all operational wells.

Wells No. 2A and 3 are founded in the Paskapoo sandstone, which in the Edson area has a fairly high transmissivity (2.2 x 10^{-4} m^2/s), but low available drawdown. These are old wells and the piezometric surface has been drawn down through years of useage.

Wells No. 8, 9A, 11 and 12 are founded in the Edson Channel gravels, which in some locations have a higher transmissivity (2.4 x 10^{-3} m^{-2}/s) than the Paskapoo sandstone, but also have low available draw down.

Wells No. 14 and 15 are founded in the Paskapoo sandstone below the Edson Channel gravels. The sandstone and gravel aquifers appear to be hydraulically connected with a system transmissivity in the order of 2.3 x 10^{-2} m^2/s. The sandstone is recharged from the Channel gravels. But the sandstone itself shows a much higher transmissivity than is general in the Edson area and it is though that this is due to connected fractures. This combination of highly permeable saturated gravel overlying and connected to a highly fractured sandstone may be relatively rare within the lateral confines of the Edson Channel. A similar situation was not found in a well about 1100 m east of Well No. 14.

Unless this special combination of physical conditions can be found in other locations within the Edson Channel Aquifer, the average capacity of a well in the Paskaproo or in the Edson Channel will probably not exceed 5 to 7 l/s over a long term.

In general, the most economical combination of supply and storage is obtained when the supply rate is equal to the maximum day demand. The present and projected design supply rate requirements of the Town's distribution system are presented in Table 3.8. Using the projected maximum day demand, it is estimated that a minimum of 20-25 wells and possibly up to 45 wells would be required to supply water for the ultimate population. Table 3.8 also shows when additional wells would be required, assuming each new well to be capable of supplying 10 l/s.

Additional wells to provide standby capacity should also be developed to cover periods when longest producing well is not operational.

3.3.2 Groundwater Quality

Generally the quality of the groundwater supplies is such that the water can be used without treatment other than chlorination for domestic purposes. Water from the Paskapoo Sandstone shows some iron content but not over the 0.3 mg/l limit. The water is also quite hard but still within acceptable limits. Water from the Edson Channel is also quite hard but within acceptable limits.

Chlorination is provided at all of the wells . The 20 minute contact time recommended by Alberta Environment cannot be maintained at present. This is a potential problem for many of the wells because they discharge directly into the distribution system and are located very close to service connections. Bacterial contamination is currently not a problem in Edson's wells however should it develop at some time in the future, modification to the system will be required to ensure adequate sterilization takes place.

3.3.3 Well Pumps

The existing well pumps are all high speed (3,600 RPM) vertical turbines with the pump setting depth being in the order of 30 metres. Problems experienced with these pumps have resulted in up to four of the nine pumps being inoperative at once for a period of months.

TABLE 3.7

GROUNDWATER WELL PUMP DATA

Well Number	Ground Level (m)	Water Levels (m) measured from ground level Static	Drawdown	Flow (l/s)	Source Aquifer	Comments
2A	932.4	4.3	24.1	3.8	Paskapoo Sandstone	
3	938.8	10.4	19.8	6.1	Paskapoo Sandstone	Pumps directly to reservoir on 11th Avenue and 50th street
8	906.3	26.5	34.8	3.4	Edson Channel	Pump to be replaced
9A	905.0	25.3	33.5	3.8	Edson Channel	Pump to be replaced
11	908.7	28.9	34.2	3.8	Edson Channel	Pump to be replaced
12	909.6	24.0	26.1	7.6	Edson Channel	Pump to be replaced
14	914.0	32.0	33.1	18.9	Edson Channel	
15	914.0	33.5	39.0	15.2	Edson Channel	
Glenwood	917.0	31.1	31.6	4.6	Edson Channel	Pumps directly into ground level reservoir which services Glenwood

Notes:
1. All pumps are vertical turbine.
2. Wells 2A, 8, 9A, 11 and 12 have 8 5/8" outside diameter casing. Well 3 has a 10" outside diameter casing.
3. Flows based on discharge HGL of 966 m

TABLE 3.8

REQUIREMENTS FOR FUTURE GROUNDWATER SUPPLY

Year	Population	Maximum Day Demand (l/s)	Comments
1981	6027	47	Existing pumping capacity of 67 l/s
	7600	60	A back up well is required.
	7700	63	Assume Glenwood and Edson
	7850	65	are connected.
	7950	66	
	8100	68	An additional well is required. *
	8350	71	
	8500	73	
	8750	75	
	9000	78	An additional well is required.
	9200	80	
	9400	82	
	9600	84	
	9780	86	
	9950	88	An additional well is required.
	10,200	90	
	10,450	92	
	10,700	95	
	10,950	97	An additional well is required.
	11,250	100	
	11,500	102	
	15,000		
	25,000	221	A total of 25 wells may be necessary.

Notes:

1. Glenwood and Edson are assumed to be interconnected.
2. Future wells will be assumed to provide 10 l/s (130 Igpm)
3. New wells will be required much more frequently if 10 l/s wells are not available.

Damage is being caused to both the shaftings and the pumps and may be due to excessive vibrations and stresses within the pump assembly. These problems can be a result of the long shaft settings and their high speed operation. Allowable "out-of-plumb" tolerances required for vertical turbine pumps are more difficult to meet in deeper wells due to soil and drilling conditions. When this occurs, stresses are created in the columns an shafts.

As an alternative to the vertical turbine pumps, submersible pumps could be used. The bowl assemblies for the two types of pumps are identical thereby allowing existing parts to be reused if desired. The pump speed would remain at 3,600 RPM but the shafting would be eliminated thereby reducing potential vibrational problems.

The capital cost for the basic submersible pump and motor is more expensive than that for the vertical turbine but when considering deep wells and the shafting and column costs are added in, the total cost of the submersible pump assembly becomes approximately 30 percent less than that of the vertical turbine pump. Installation costs are also less expensive for the submersible pump. It is therefore suggested that submersible pumps could be considered as an alternative in any new well or replacement pump installations.

3.3.4 Future Supply Considerations

It may not be possible to obtain water at a supply rate which is equal to or greater than maximum day demand for the ultimate population from groundwater sources.

Expansion of the existing groundwater supply system will require the addition of extra waterwells at increasing distances from Edson. At present only three wells produce yields at rates of 7.16 l/s or more and there are no guarantees that yields approaching 10 l/s may be readily available within a short distance of Edson.

Although it is expected that existing wells or new ones close to the Town will provide sufficient capacity for several years it should be pointed out that water levels are generally declining because of overpumping of groundwater. The long-term viability of the current source of supply is open to question. Therefore, an evaluation of groundwater as a source of supply should be undertaken within the near future. Such a study should examine:

1) the long-term potential for extracting more groundwater from wells located within or close to the Town.

2) why current yields from gravel in the Edson Aquifer do not meet those estimated by Neilson (1969).

3) the possibility of artificially rechanging the Edson Aquifer with water from the McLeod River.

4) the feasibility of obtaining future water requirements from wells located some distance from Town.

5) the efficiency of the current system of wells both in terms of their construction and their mutual effect on pumping levels.

This study should be integrated with a preliminary assessment of supply from the McLeod River in order that a development plan can be formulated.

For the purposes of this report, the scenario used was that all water would ultimately be obtained from the McLeod River. Two of several many locations were selected to be modled as supply points to the system. These locations were selected as typical examples and are shown on Figure 3.2, 3.3 and 3.4.

In addition to an intake structure, it would also be necessary to construct a supply line, pumphouse facilities, raw water reservoir and water treatment facilities should the McLeod River become a viable source of water. The location of its input into the system should be considered.

Alternative #1 examined in this study involved the supply line from the river connecting to the distribution system at approximately the location of the Glenwood Reservoir and Pumphouse. This alternative would have definite advantages from a distribution point of view since it would deliver water close to the centre of the distribution system simplifying the distribution piping required.

Alternative #2 involved the supply line from the river passing through the eastern portions of the study area and connecting into the distribution system possibly near Bear Lake Road and 6th Avenue. This alternative would have advantages from a supply point of view since it is closer to the River.

A detailed examination of sources and their connection points, other than wells, was not addressed in this study. The scenarios noted above were developed in order to analyse the distribution system under different conditions and therefore make it as flexible as possible.

The assumption that maximum day demand for the Study Area will be supplied from either of two locations is the most conservative method for sizing trunk mains in the lower pressure zone. Pipe sizing in Zone 2 will not be significantly affected by the source of supply.

3.4 RESERVOIR STORAGE

3.4.1 Existing Storage Facilities

The existing water storage facilities in the Town of Edson and in Glenwood consist of the following:

	Reservoir	Volume	Location
1.	Elevated steel tank	270 m^3	50 St. & 11 Ave
2.	Underground concrete Reservoir	455 m^3	50 St. & 11 Ave
3.	Steel Above Ground Reservoir	2120 m^3	Grande Prairie Trail
4.	Concrete Above Ground Reservoir	3410 m^3	Grande Prairie Trail
5.	Concrete Underground Reservoir	700 m^3	Wilmore Park Road & 3rd Avenue (Glenwood)
	TOTAL STORAGE	6955 m^3	

Water levels in reservoirs #1, 3 & 4 determine the system static hydralic grade line. Reservoir #2 must be pumped up to the elevated tank (Reservoir #1) before the water it stores can be of benefit to the system. The Glenwood reservoir (Reservoir #5) currently is not connected to the Edson system and feeds only the Glenwood distribution system through its service pumps.

3.4.2 Quantity of Storage Required

The criteria for determining the water storage requirements in the Town of Edson have been presented in Section 3.2.6. The storage requirements for the whole system have been projected to a population of 25,000 and beyond and these quantities are shown in Table 3.9. The existing storage in Edson is 6255 m^3 excluding the Glenwood Tank. Examination of the total requirements indicates that all the existing reservoirs have sufficient storage capacity for a population in excess of nearly 15,000.

The two reservoirs at 50 St. & 11 Ave may eventually have to be phased out and abandoned. The cost of renovations to the pumping stations may not be warranted. These tanks are small and are not significant when assessing storage volumes at the larger population levels. Before any major renovations or upgrading of these

TABLE 3.9

PRESENT AND PROJECTED WATER STORAGE REQUIREMENTS

Year	Population	Maximum Day Demand (l/s)	Distribution Equalization m^3	Emergency Storage m^3	Fire Storage m^3	Recommended Storage m^3	Excess or (Deficiency) Storage m^3
Consider system as a whole:							
1981	6,027	47	1,020	360	3,340	4,720	1,535 See Note 1
Level 1	8,100	68	1,470	520	3,340	5,330	1,625 See Note 2
Level 2	9,200	80	1,730	610	3,340	5,680	1,275
Level 3	10,200	90	1,940	690	3,340	5,970	985
Level 4	11,500	102	2,200	780	3,340	6,320	635
Level 5	15,000	133	2,870	1,010	3,340	7,220	(265)
Ultimate	25,000	221	4,770	1,690	3,340	9,800	(4,270) See Note 3

Notes:

1. Existing storage in Edson is 6,255 m^3.
2. Assuming Glenwood is annexed to Edson, there is additional storage equal to 700 m^3.
3. Ultimate system will abandon all existing reservoirs except the two on Grande Prairie Trail (Storage equal to 5,530 m^3).
4. Fire storage should be sufficient to supply 265 l/s for 3.5 hours.

facilities is undertaken there should be on an economic analysis comparing the cost of the proposed work to their benefit to the waterworks system. If these reservoirs continue to be economical to operate and remain in service, they will provide an additional safety factor in the system.

The estimate of the storage requirements for the ultimate population within the Study Area indicate that an additional 4270 m^3 of storage is required. The two reservoirs on 50th Street and 11th Avenue and the reservoir servicing Glenwood are excluded from the computations because of their small capacity.

A review of the topography of the Study Area shows that the area should be broken up into three pressure zones. A more detailed description of the pressure zones follows later in section 3.5.2.2. The separation of the Study Area into pressure zones is an important factor when considering the location of future reservoirs within the system. The majority of the existing Town of Edson will be in the lower Zone 1. The water supply wells are also located in this Zone. A Booster Station will therefore be required to pump the water from Zone 1 into Zone 2 & 3 in order to supply these areas.

The cost of pumping water to higher HGLs in the upper zones cannot be avoided. But, if water can be put into storage in the upper zones at low flow rates the power cost will be less than that entailed in pumping at peak hour or at fire plus maximum day demand rates to these zones. So there is some advantage to locating a storage tank on sufficiently high ground to allow gravity service at operational HGL. in Zone 2. If this storage facility is large enough (6,840 m^3), all of Zone 2 would be capable of providing fire flows and peak flows by gravity without depending upon booster pumping from Zone 1.

A more conservative evaluation of the projected storage requirements would therefore take into account the various pressure zones. Table 3.10 shows values for ultimate storage when the pressure zones are considered independently. The values for additional storage requirements assume that the existing reservoirs at 50 Street and 11 Avenue and in Glenwood are not in service. This would allow each pressure zone to act more independently and not have to rely so heavily on the Booster Station.

TOWN OF EDSON
General Engineering Study
1982

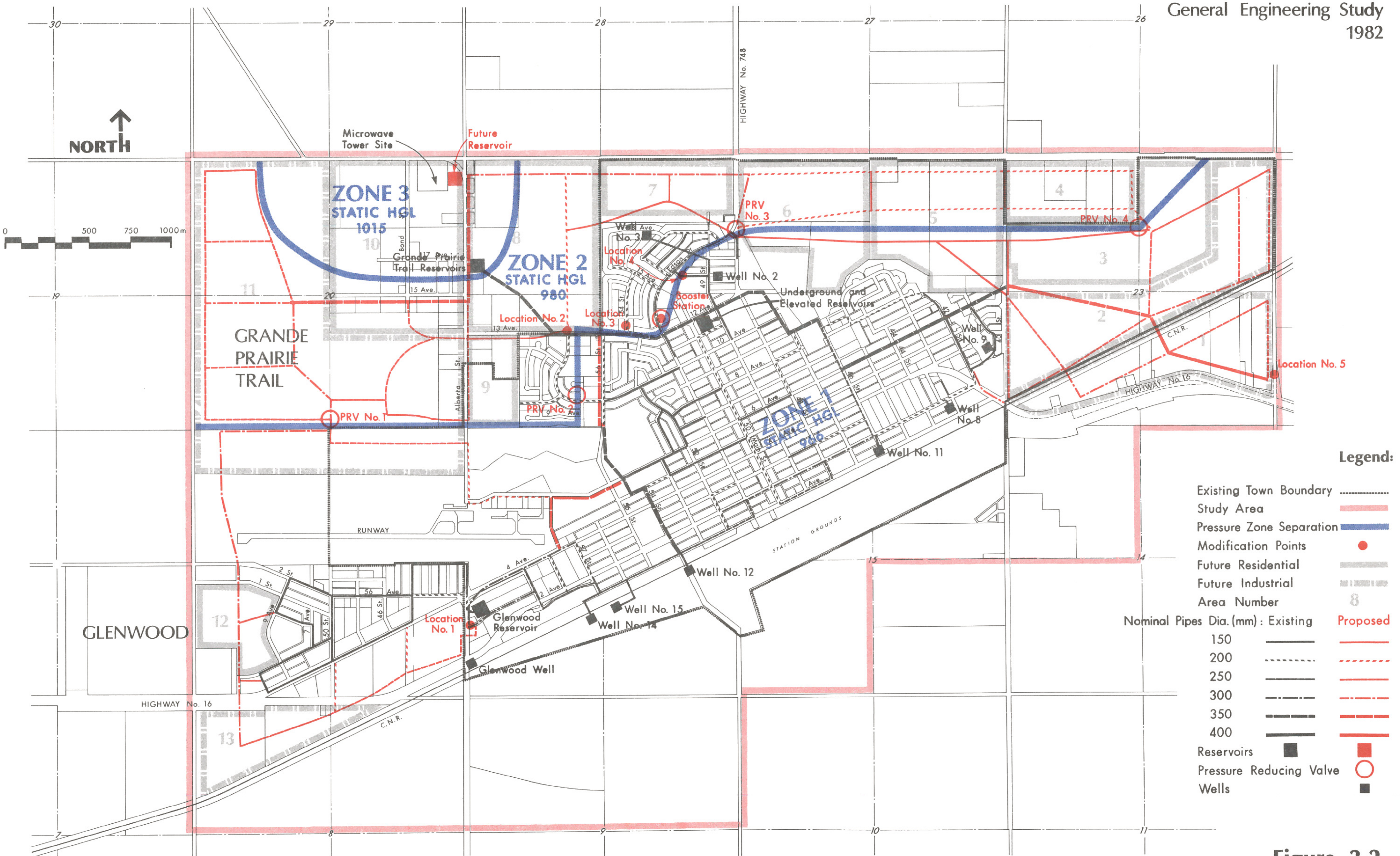


Figure 3.2

WATER DISTRIBUTION SYSTEM

Stanley
STANLEY ASSOCIATES ENGINEERING LTD.

The reservoir to serve Zone 2 and Zone 3 should be located on top of the hill in the Grande Prairie Trail Area adjacent to the microwave tower. The highest ground level in the area is about 975.5 m and the top water level in the reservoir was assumed to be 980 m. This would require a ground level concrete reservoir be constructed with a storage volume of about 6840 m^3. Table 3.10 indicates a deficiency of about 790 m^3 in reservoir storage for Zone 1 ultimately. No further additions to Zone 1 storage are required since water from Zone 2 is readily available by way of pressure reducing stations.

Additional storage will not be required for some time. The level of independance between Zone 1 and 2 is a decision which will require more detailed analysis once the extend and direction of new development is defined at the time when added storage becomes necessary.

However, assessing the situation qualitatively, the location of a new storage facility at the Microwave Tower Site has considerable merit when the water supply enters the distribution system from the southeast on the opposite side of Town from the major demand centres and the storage site. Gravity feed to the distribution system is preferred over booster pumping not only from the viewpoint of reliability but also because of lower power cost. The demand factor in power cost is important when booster pumps have to operate at peak hour or fire flow plus maximum day demand rates instead of maximum day rates.

About 2500 m^3 more storage is required to provide zone independence and the cost of this may well be warranted.

Based on these considerations it was assumed, in carrying out analysis of the system that a new storage facility of 6,840 m^3 capacity is provided on elevated ground at the Microwave site in Zone 3.

TABLE 3.10

PROJECTED WATER STORAGE REQUIREMENTS FOR EACH PRESSURE ZONE

	Population	Distribution Equalization m^3	Emergency Storage m^3	Fire Storage m^3	Required Storage m^3	Storage Deficiency
Consider two zones independently:						
Zone 1						
Ultimate	11,500 (Approx)	2,200	780	3,340	6,320	(790)
Zone 2 and 3						
Ultimate	13,500 (Approx)	2,590	910	3,340	6,840	(6,840)

Notes:

1. Ultimate system will phase out all existing reservoirs except the two on Grande Prairie Trail (Storage equal to 5,530 m^3).
2. Fire storage should be sufficient to supply 265 l/s for 3.5 hours.

3.5 ASSESSMENT OF DISTRIBUTION SYSTEM COMPONENTS

3.5.1 General

In this section the components of the Edson water distribution system are assessed for their adequacy to meet the projected requirements. To assist in this, the present (1981) and ultimate configurations are described and are used in computer simulations of the system. The computer program used in the simulations is called HYDA.L. It is an expanded version of another program called FLOW, developed by Mr. A.G. Fowler, P. Eng. from the University of British Columbia. The program was run utilizing the facilities at the University of Alberta in Edmonton.

3.5.2 Existing System

3.5.2.1 Description

For the purposes of simulating the existing system, all trunk mains which are presently in the system and those which will be placed in the near future were included. The existing system consists of asbestos cement, PVC and ductile iron piping. Most of the existing pipes with diameters of less than 150 mm were not included in the computer simulations, since they do not pass large flows. In addition, the pumps at wells 8, 9A, 11, and 12 are to be replaced with new pumps during the next overhauling. Therefore, the flow characteristics of the new pumps were used in the simulation of these wells; the existing pump curves were used for the other wells. Figure 3.2 illustrates the existing system which was analysed.

3.5.2.2 Results of the Computer Analysis

Several computer runs were carried out to determine the system's performance under peak hour demand, night filling and various fire flow conditions. Both peak hour demand and night filling conditions assumed that the largest pump (at well 14) was not operational as this would put the most stress on the system. The remaining wells were still able to supply maximum day demand to the system. For the simulations of fire flow conditions all well pumps were assumed to be operational.

Peak Hour Demand

The minimum pressure during peak hour demand conditions was 310 kPa which occurred at 15th Avenue and 54 Street. The maximum pressure under similar conditions was 590 kPa at 3rd Avenue and 42 Street. These pressures are within the operational criteria limits of 80 kPa to 630 kPa.

Reservoir Filling

Under night filling conditions with all the reservoirs trying to fill continuously it was determined that they could not be filled during 8 hours. However, if the reservoirs located on 11th Avenue and 50th Street could be valved shut after they have been filled, then the two reservoirs on Grande Prairie Trail could be filled. The elevated steel tank on 11th Avenue and 50th Street could be filled in much less than 8 hours from either the distribution system or by the transfer pump which pumps from the concrete reservoir at the same location.

Fire Flow Plus Maximum Day Demand

The area of minimum pressure during peak hour demand (15th Avenue and 54th Street) was investigated to determine the flow available during a fire. This area is residential and according to the Insurers' Advisory Organization (1981) should have a fire flow of about 91 l/s available during maximum day demand while maintaining a residual pressure of 140 kPa. A computer run revealed that a fire flow in excess of 91 l/s was available. This simulation also assumed that the pump at Well #14 was not operational.

A fire flow simulation in the downtown area (3rd Avenue and 50th Street) similar to that examined during the 1976 study revealed that a fire flow of 228 l/s was available. Fire flow simulations at the existing east and west boundaries revealed flows that are less than those recommended by I.A.O. criteria for industrial areas. Only 150 l/s is available at 3rd Avenue and 42nd Street and 160 l/s is available on the opposite side of Town at 3rd Avenue.

TOWN OF EDSON
General Engineering Study
1982

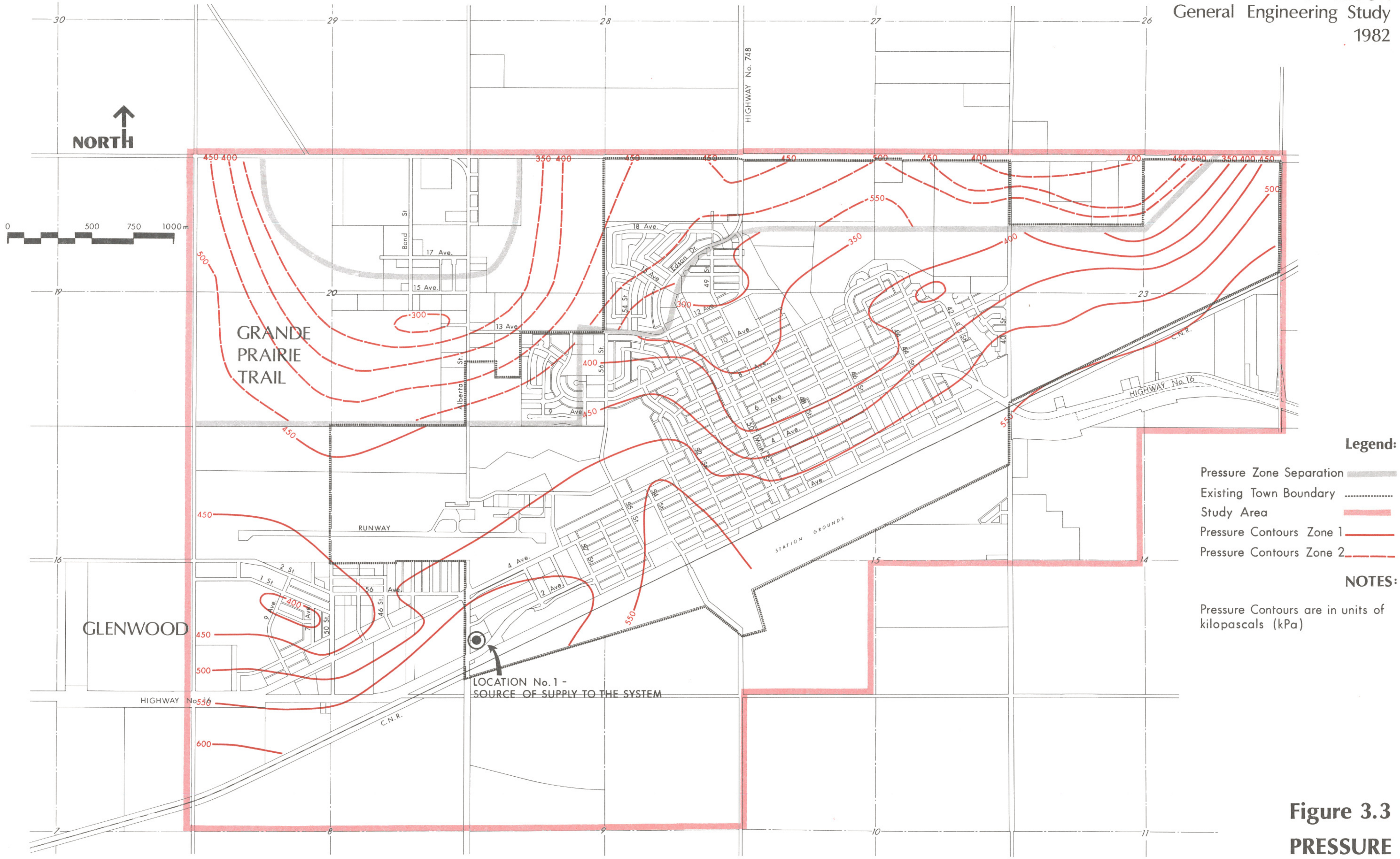


Figure 3.3

PRESSURE CONTOURS FOR ULTIMATE PEAK HOUR DEMAND

Stanley
STANLEY ASSOCIATES ENGINEERING LTD.

The results of these computer simulations are in line with the results given by the previous reports (SAEL: 1976 and 1978).

The existing system has a significant amount of pipe which has a diameter of less than 150 mm. It is unlikely that sufficient fire flows can be obtained from hydrants connected to these water mains. Replacement of these small mains with larger ones may be required to obtain sufficient fire flows from hydrants connected to the smaller pipes.

3.5.3 Ultimate System

3.5.3.1 Description

The purpose of the computer simulations of the ultimate water distribution system was to establish trunk main sizes which will be required to service land to be developed ultimately within the Study Area. Figure 3.2 shows the ultimate waterworks required.

The topography of the Study Area consists of rolling land which slopes moderately in the southerly direction. Ground elevations (geodetic) in the Town of Edson range from a low of 900 m in the south to a high of 975 m in the northwest.

Ground elevations in most of the study area were determined from topograhic mapping in Imperial units with 2 foot contour intervals. This detailed topographic mapping did not include the area in the northwest part of the study area so therefore elevations were interpolated from N.T.S. mapping in Imperial units with fifty foot contour intervals.

A review of the topography of the study area indicated that the area should be broken up into three pressure zones.

Pressure Zone 1

The existing water distribution system is a single pressure zone. The service pressures are controlled by two ground level reservoirs located on Grande Prairie Trail and a water tower located at 50 Street and 11 Avenue (Figure 3.2). Water is supplied directly to the distribution system by seven groundwater wells located throughout the distribution system. An eighth well is located on 18th Avenue and 53 Street, and discharges to a ground level reservoir next to the water tower; water is relayed to the tower by means of a transfer pump station.

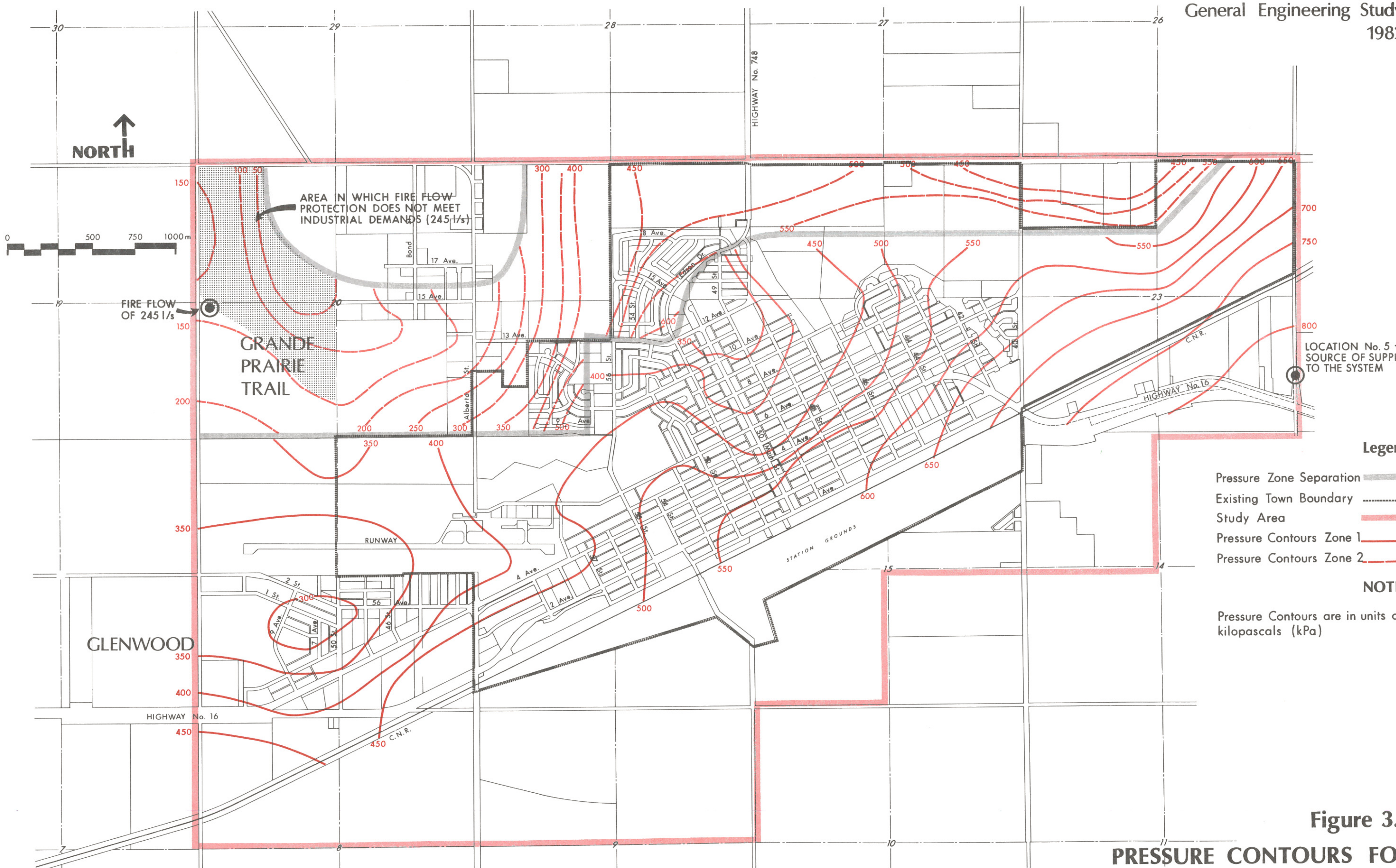
Static pressure in the distribution system ranges from 310 kPa to 590 kPa. A small portion of the existing service area in the northwest is above elevation 935 m (static pressure 280 kPa) and should be in a higher pressure zone.

Pressure Zone 2

In order to provide water to the higher lands within the Study Area, it is necessary to raise the hydraulic grade line (HGL). Since Zone 1 should not have any further HGL increases imposed on it and since additional reservoir storage will be required for Edson eventually, a new reservoir has been proposed with a top water level of 980 m to be located adjacent to the microwave tower in the northwest corner of the Study Area. This reservoir would provide water at acceptable pressures to the higher areas. A line has been drawn in Figure 3.2 which more or less follows the 935 m contour which will separate pressure zones 1 and 2. The HGL setting of the four pressure reducing stations would permit water to flow from Zone 2 to 1 only during fires or other very demand periods in Zone 1, but prevent passage of water during normal demand periods.

All pressure reducing stations should have an HGL setting of 962 m, except the station located in the northeast corner of the Study Area. Its HGL setting should be 955 m. A booster station at Edson Drive and 13th Avenue, equipped with two duty pumps and a single standby pump, would provide maximum day demand flow rates (120 l/s for ultimate population) to Zones 2 & 3. This location was selected as it required the least amount of additional piping to connect it to the main trunk mains in Zone 1 and in Zone 2 making it the least expensive.

TOWN OF EDSON
General Engineering Study
1982



Legend:

- Pressure Zone Separation
- Existing Town Boundary
- Study Area
- Pressure Contours Zone 1
- Pressure Contours Zone 2

NOTES:

Pressure Contours are in units of kilopascals (kPa)

Figure 3.4

PRESSURE CONTOURS FOR INDUSTRIAL FIRE FLOW IN ULTIMATE SYSTEM

Stanley
STANLEY ASSOCIATES ENGINEERING LTD.

Pressure Zone 3 (Grande Prairie Trail Area)

There is a significant amount of area in the upper pressure zone which could not be supplied directly with water at acceptable pressures due to its ground elevation. This area includes the bulk of the quarter section, referred to as the Grande Prairie Trail Area, and portions of the quarter sections to the east and west which lie above elevation 950 m. In order to provide water to this area, it would be necessary to provide a booster pump which could draw water from the proposed reservoir at the microwave tower site.

Overall Conditions

The overall ultimate system model assumes that only the two reservoirs on Grande Prairie Trail are retained for storage in Zone 1 and the two reservoirs at 11th Avenue and 50th Street and the reservoir and pumphouse servicing Glenwood are assumed to be abandoned.

Pipe flows were assessed using Asbestos Cement pipe as its flow conditions are more critical than plastic pipes such as PVC.

Pipe sizes are affected by the location(s) of the source of water supply. It was assumed that eventually the groundwater supply will be replaced by a McLeod River source as discussed earlier in Section 3.3.4. The computer simulations assumed that all water was supplied from either of two alternative locations. The pipe sizes in Zones 2 & 3 are not affected by the location of the water supply assuming that the maximum day demand is supplied by the booster station and distribution equalization water is supplied by the reservoir in Zone 2. However, the sizes of pipes located in Zone 1 are dependent on the location of water supply. Therefore peak hour demand and night filling conditions were simulated twice assuming the two locations for supply and pipe sizes conservatively chosen to keep both options viable. Figure 3.3 shows the pressure contours for peak hour demand with water being supplied to the system at the Alternative 1 source connection point (Glenwood Reservoir location).

For fire simulations, the supply location that was most remote from the fire was assumed to be the one that was operational. This assumption would also provide the most conservative method for sizing of pipes.

3.5.3.2 Results of the Computer Analysis

Several computer runs were carried out to determine if fire flows of 91 l/s plus maximum day demand were available in residential areas and 265 l/s plus maximum day demand were available in light industrial areas. The conditions which governed pipe size selection generally occurred when simulating the fire flow requirements as this was a higher flow condition than peak hour demand.

The computer runs revealed that all fire flow requirements, with the exception of the proposed industrial area in the northwest corner of the Study Area, could be satisfied. It was determined that 265 l/s could not be achieved in this area without major increases in pipe sizes. This appeared uneconomical considering the area is undeveloped at this time and that developers moving into this area could easily reduce the fire flow demands required by their buildings at the time of construction. It was determined that a fire flow of 245 l/s could be achieved through the majority of the area with reasonable trunk main sizing. This industrial area is located on high ground and Figure 3.4 shows the pressure contours resulting from a fire flow requirement of 245 l/s with water being supplied from the east end of Edson at Alternative #2 supply connection point. This figure also shows the area in this industrial section which cannot be serviced by a fire flow of 245 l/s. Larger diameter pipes will not alleviate this problem and this area should have development restricted to uses with low fire flow requirements until Zone 3 is developed.

In Pressure Zone 1, as the service area expands to the far southeast across the CN tracks there are areas of lower elevation which will be serviced with system static pressures as high as 855 kPa. This pressure can be probably tolerated by the distribution system and service connections although it is at the high end of the normal design range for domestic water supply systems. Individual property owners may want to install a pressure reducing valve on their services.

The additional piping required for the ultimate water distribution system is shown on Figure 3.2. The sizes and locations of the proposed trunk mains can be incorporated into the planning and construction of the waterworks for future subdivision developments. The twinning of only one section of pipe is required to upgrade existing piping for the ultimate water distribution system. On 56th Street between 13th Avenue and 9th Avenue, an existing 200 mm diameter pipe connects two 350 mm trunk mains. For the ultimate system, if the water is supplied from the McLeod River through either of the two proposed locations, then this 200 mm pipe should be twinned with a 350 mm pipe. Easement could be obtained along west side of 56 Street to help reduce the cost of reconstructing 56 Street.

Four pressure reducing stations are required for the ultimate system. Their locations are shown on Figure 3.2. Their purpose is to provide an interconnection between pressure zones, while preventing excessive water pressures in the lower zone. None of the pressure reducing stations would normally pass water during peak hour demand conditions. Their purpose in this system is to assist in providing fire flows to areas in Zone 1. The operation of these pressure reducing stations will be controlled by the hydraulic grade line (HGL) setting. All pressure reducing stations, should have an HGL setting of 962 m except the one in the northeast corner of the Study Area. That one should be set at 955 m. Table 3.11 lists the specific locations where special attention must be focused in order to implement Zone 2. These locations are also shown on Fig. 3.2.

3.5.3.3 Glenwood Distribution Pumping Facilities

One of the first modifications to the Edson water distribution system involves the connection with the Glenwood water distribution system. The existing reservoir and pumphouse facilities in Glenwood may be abandoned when the ultimate water distribution system is implemented. However, there will be a considerable period of time before the ultimate system is complete and therefore this section addresses the interconnection of the two existing systems for the interim.

TABLE 3.11

LOCATIONS WHERE SPECIAL ATTENTION IS REQUIRED WHEN IMPLEMENTING PRESSURE ZONE 2 AND THE ULTIMATE SYSTEM (REFER TO FIGURE 3.2)

Location	Description
1	At Wilmore Park Road (Government Road Allowance) and 3rd Avenue - Edson's water distribution system will connect here to the Glenwood system - Glenwood Reservoir and Pumphouse located here may ultimately be abandoned - Possible future connection point for a supply line from the McLeod River (Alternative #1)
2	At 13 Avenue and West Haven Drive - the 200 mm main on West Haven Drive is to be disconnected from the 350 mm feeder main from the Grande Prairie Trail Reservoirs and extended across 13 Avenue for future extension to the north
3	At 13 Avenue and 54 Street - the main on 54 Street is to be disconnected (or valved to remain closed) from the 350 mm main on 13 Avenue
4	At Edson Drive and 17 Avenue on the east side of Edson Drive - the main between Edson Drive and 17 Avenue should be disconnected (or valve to remain closed)
5	At Southeast corner of the Study Area - possible future connection point for a supply line from the McLeod River (Alternative #2)
PRV #1	In the new western development area - Pressure Reducing Valve with HGL setting of 962 m
PRV #2	On West Haven Drive at 57 Street - Pressure Reducing Valve with HGL setting of 962 m
PRV #3	At 48 Street and Edson Drive - Pressure Reducing Valve with HGL setting of 962 m
PRV #4	In the new Development Area in northeast section of the study area - Pressure Reducing Valve with HGL setting of 955 m
Booster Station	On the East Side of Edson Drive north of 13 Avenue - Ground level pumping station required to pump from Pressure Zone 1 at maximum day demand to Pressure Zone 2

TABLE 3.12

GLENWOOD RESERVOIR/PUMPHOUSE DATA

Pump No.	Power KW(HP)	Type of Pump	Pump Speed rpm	Discharge @ 49 m TDH l/s	Discharge @ 47 m TDH l/s	Discharge @ 42 m TDH l/s
Service Pumps:						
1 & 2	5.6 (7.5) (Electric)	Peerless 7 LB	1,800	5.7	7.6	9.2
				Discharge @ 73 M TDH l/s	Discharge @ 49 m TDH l/s	Discharge @ 40 m TDH l/s
Fire Pump:		Peerless 12 LB	1,800	31.5	48.6	52.7

Notes:

1. Reservoir
   - Capacity 700 m^3
   - Overflow level 916 m (assumed)
   - Minimum water level 913 m (assumed)
2. Pressure Gauge Elevation 917 m (assumed)
3. Pressure Relief Setting 966 m (assumed)

Water is presently supplied to the Glenwood reservoir from a single ground water well. Two distribution pumps and one fire pump have a total capacity of about 60 l/s at a total dynamic head (TDH)[1] of 40 m (i.e. the operating pressure of the pumps). Table 3.12 provides some details of the existing Glenwood reservoir and pumphouse data.

The water consumption records for Glenwood (1981) provided by Alberta Department of Municipal Affairs indicate a daily demand ranging from 1.56 to 2.40 l/s based on monthly total demands. The duty pumps are adequate to supply this demand. The present pressure relief setting of the service pumps is 490 kPa. The design maximum day demand when the area in Glenwood becomes fully developed is 13 l/s.

In the previous engineering report (SAEL: 1978), it was stated that "The Hamlet of Glenwood ... does have sufficient pumping capacity to meet the demands of a residential fire and does not have either the pumping capacity or the storage to meet a light industrial fire. The connection of Glenwood to the Edson system would solve the storage problems but a high capacity fire pump will be required in the Glenwood Pumphouse".

The controlling HGL of the existing Edson water distribution system and the ultimate Zone 1 is 966 m. This is similar to the HGL of Glenwood and therefore the pressures in the system would not be significantly effected by interconnection. However, the existing duty pumps in Glenwood are operating at the back of the performance curve and therefore the pumping station is sensitive to changes in system HGL. The suitability of these duty pumps should be assessed during interconnection since the exact elevations were not available at the time of writing this report. The existing pumps and motors could accommodate larger impellers to increase the flow.

The Glenwood reservoir and pumphouse should be retained as a water source and backup or emergency facility at least until the upper pressure zone (Zone 2) is implemented (i.e. the new reservoir at the north end of the study area and the western pressure reducing station). When the ultimate water distribution system is completed

---

1 Total dynamic head (TDH) refers to the vertical distances which a pump can force water at a given flow rate.

the Glenwood facilities may be abandoned if desired. In the interim, if they are used as backup facilities they should be operated frequently to prevent the water in the reservoir from stagnating.

3.5.3.4 Summary

It is important to note that this report only addresses the existing and ultimate water distribution systems. In order to best determine the phasing of the expansion of the distribution system required to serve the ultimate area, it will be necessary to consider each proposed addition independently.

The pipe sizes shown for the ultimate system indicate the required capacity. This capacity may be developed in stages if economy dictates, but ultimate needs should always be kept in mind when assessing staging alternatives.

3.6 COST ESTIMATES

Cost Estimates have been prepared for the trunk mains required in each development area which forms part of the ultimate system as shown on Figure 3.2.

The trunk mains and other facilities required to serve any individual parcel which may be developed ahead of the ultimate waterworks system being constructed, will require a separate review and appraisal.

3.7 CONCLUSIONS

The following conclusions have been drawn from this study:

1. A review of the groundwater potential is currently underway in an attempt to locate a high producing well for development in 1982.

2. The time can be forseen when wells alone can no longer continue to be economically competitive as the only source of water for Edson.

3. The current reservoir storage in the Edson are is adequate to serve a population of nearly 15,000.

4. The two reservoirs at 50 Street and 11 Avenue and the Glenwood Reservoir and Pumphouse may not be feasible to upgrade for use in the ultimate system and the Town may eventually want to phase them out of service.

5. The distribution system has been operated as one pressure zone in the past but must now move to ward establishing three pressure zones in order to serve the total Study Area, ultimately.

3.8 RECOMMENDATIONS

As a result of this study and our investigations we recommend the following:

1. The Town proceed to secure the sites recommended for the Water Booster Station on Edson Drive and the proposed reservoir in Grande Prairie Trail near the microwave tower.

2. Adopt in principle the overall servicing concept presented in this report.

3. Proceed to construct the Booster Station with pumps sized on an interim basis.

4. Proceed to construct Pressure Reducing Valve No. 3 at the north end of 48 Street and Edson Drive.

5. Develop one new high capacity well or two smaller ones.

6. Review the long term Water Supply situation as it relates to the remaining groundwater supply potential in the area and to the McLeod River.

7. Proceed with construction of the proposed Trunk Mains and associated PRV's on an as required basis in accordance with the recommended water system concept.

TABLE 3.13

SUMMARY OF WATER SYSTEM ESTIMATED COSTS

	Development Areas	Water Trunk Main Costs
Trunk Mains for:	1	575,000
	2	1,103,000
	3	359,000
	4	310,000
	5	533,000
	6	456,000
	7	421,000
	8	601,000
	9	139,000
	11	2,496,000
	12	293,000
	13	484,000
	Sub Total	7,770,000
Reservoir		845,000
Booster Station for Zone 2		325,000
Booster in Zone 3 (Area 10)		325,000
	TOTAL	$9,265,000

Note

(1) Water Supply costs (eg new wells) are not included

(2) Estimates are based on Nov. 1981 construction costs and include 30% allowance for engineering & contingencies.

(3) The distribution piping for Development Area 10 (Grande Prairie Trail) has not been assessed.