PLAINTIFF'S EXHIBIT

CAP-1031

REPORT ON ASBESTOS/CEMENT PIPE USE IN THE CITY OF ABILENE, TEXAS

PREPARED FOR:

THE A/C PIPE PRODUCERS ASSOCIATION
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REPORT ON ASBESTOS/CEMENT PIPE USE

IN THE

CITY OF ABILENE, TEXAS

Introduction

The City of Abilene's Water Utilities Department is the seventh of ten systems studied as part of the Municipal Analysis Program of the A/C Pipe Producers Association. In this site visit, as well as the other nine, the objective was to investigate the use of A/C pipe from various perspectives in order to build a comprehensive data base. The broad functional categories covered by this fact-finding mission are as follows:

- o Institutional
- o Operational
  - Specification, Decisionmaking, and Procurement
  - Installation and Testing
  - Operation and Maintenance
  - Repair and Replacement
  - Detection and Prevention
- o Financial

Information was obtained in most of the categories listed above, and each is discussed in the report.

Background on the Abilene Site Visit

The site visit to Abilene was completed in one day on Monday, February 8. The reason for truncating the visit was due to the nature of the operation itself. The Water Utilities Director is Dwayne Hargesheimer, an efficient, matter of fact manager who had most information requested either in his office or nearby. Unlike visits to other systems in which time was split among several persons, a full 90 percent of the Abilene visit was spent with Hargesheimer himself. Near the end of the day, the purchasing agent and a long-time maintenance supervisor (James Cheek) also were interviewed.

Abilene officials ar not enthusiastic about the use of A/C pipe. They have used A/C predominantly since about 1960, but are now beginning to uy substantial amounts of PVC as well. In fact, Hargeshei er notes "developers are willing to pay as much as 15 percent more for PVC, due to greater ease of installation."

There was one intere ting anecdote heard in Abilene that is unique to the site vis ts. In the early 1960's, the Belgians tried to get on the Abile e bidders list. Abilene refused to buy the Belgian pipe and he Belgians sued. The suit went to court, and Johns-Manville assisted the city financially in its court fight. The judge r led in favor of Abilene; the reason is unknown.

Abilene has used for ign pipe. Like several California cities, they laid some Ja anese pipe in the mid-1960's.

Institutional and Organiz tional Information

Abilene has a strong city manager form of government. The current city manager s Ed Seegmiller. The water utility fund is an enterprise fun , separate from the general fund. According to Hargesheimer the water utility is operated "like a franchise." The utilit pays a franchise tax, it pays rent in city hall and pays for other services received. The city in turn pays for all wate use.

From 1960-80, the wa er utility did not float any bonds. In 1980, however, a $12.1 million bond issue was floated, the proceeds of which will be expended for sewer ($2.1 million) and various water improve ent projects ($10 million). The bonds are general obligat on, but will be paid for exclusively out of water revenues. A proximately $2 million of this total will be expended on pipel ne replacements.

The City of Abilene as a population of about 102,000 and growth is occurring a the rate of 2 percent annually. The water system has appr ximately 35,000 service connections, and this figure is growin at the rate of 2200 per year. The city supplies treated wat r to various customers outside the city limits under contrac , including Dyess Air Force Base, the Cities of Merkel and ye, and several unincorporated communities and rural wat r supply corporation.

The City depends on hree lakes for its primary source of water. These three la es, Abilene, Kirby, and Fort Phanton, are all manmade and have arthen dams which impound the water from surface runoff. The combined total capacity of these lakes is 27.3 billion gal ons when they are standing at spillway elevation. Abilene's wat r usage is about 19 mgd; peak demand is about 40 mgd. Average per capita usage is 171 gallons.

With regard to organization, the Water Utilities Department consists of seven divisions, four of which handle water production, treatment, distribution and administrative functions. The other three divisions handle wastewater collection, treatment and disposal. Organization charts for the Water Utilities Department and the Water Distribution Division are shown on the following pages. The present work force consists of 145 employees.

The Transmission and Distribution System

Abilene's transmission and distribution system consists of approximately 660 miles of pipe, the majority of which is cast iron (400 miles). Transmission mains are cast steel cylinders. The largest main is the 39-inch steel lined with concrete line connecting the Ft. Phantom Hill Pumping Station and the Northeast Treatment Plant.

The Water distribution system is divided into two pressure zones. A schematic of the system as it existed in 1977, complete with maximum hour pressure contours is shown on page 6. Service pressure varies from 32-80 psi. One pressure zone has pressures of 30-58 psi; the second has pressures maintained between 58 and 80 psi.

Abilene has about 250 miles of A/C pipe, most of it 6 inches to 16 inches in diameter. Some 18-inch A/C is purchased for repair purposes. On the lower end, Hargesheimer will not buy 4-inch A/C because of its lack of beam strength.

There is a definite trend toward PVC use in Abilene. Although the system contains only 10 miles of PVC currently, old cast iron mains are being replaced with PVC C-900. Some PVC also is being used in water main extensions, both by city forces and developers.

Actual statistics reflect this trend. Installation figures for a 13-month period, January 1981 through January 1982 are shown below.

INSTALLATIONS
(January 1981 through January 1982)

Material	Size (inches) 2	4	6	8	10	12	14	16	Total
A/C	--	--	8984	5315	1641	4343	3214	1121	24,618
PVC	900	4418	1658	163	35	360	--	--	7,534
Cast Iron	--	9	--	--	--	--	--	--	9
Other	--	--	35	--	--	--	--	--	35
						TOTAL			32,196

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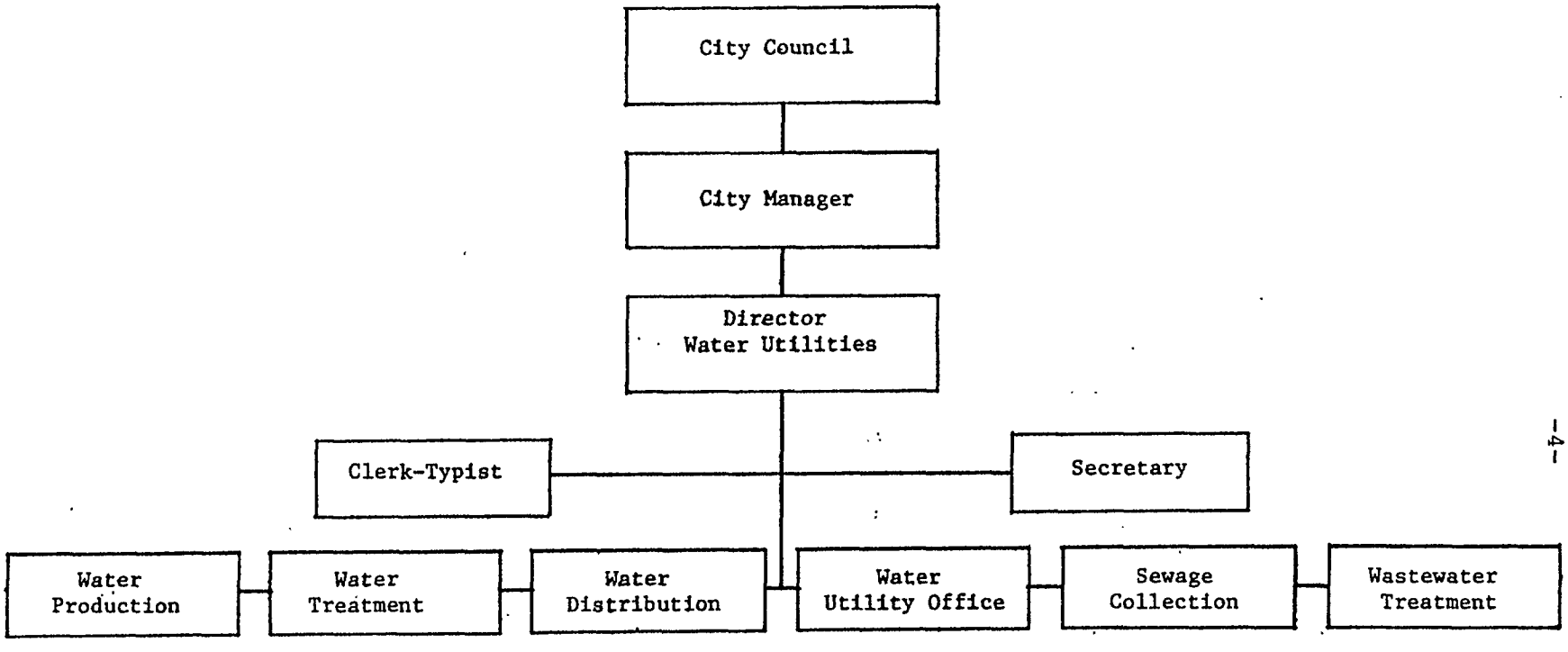

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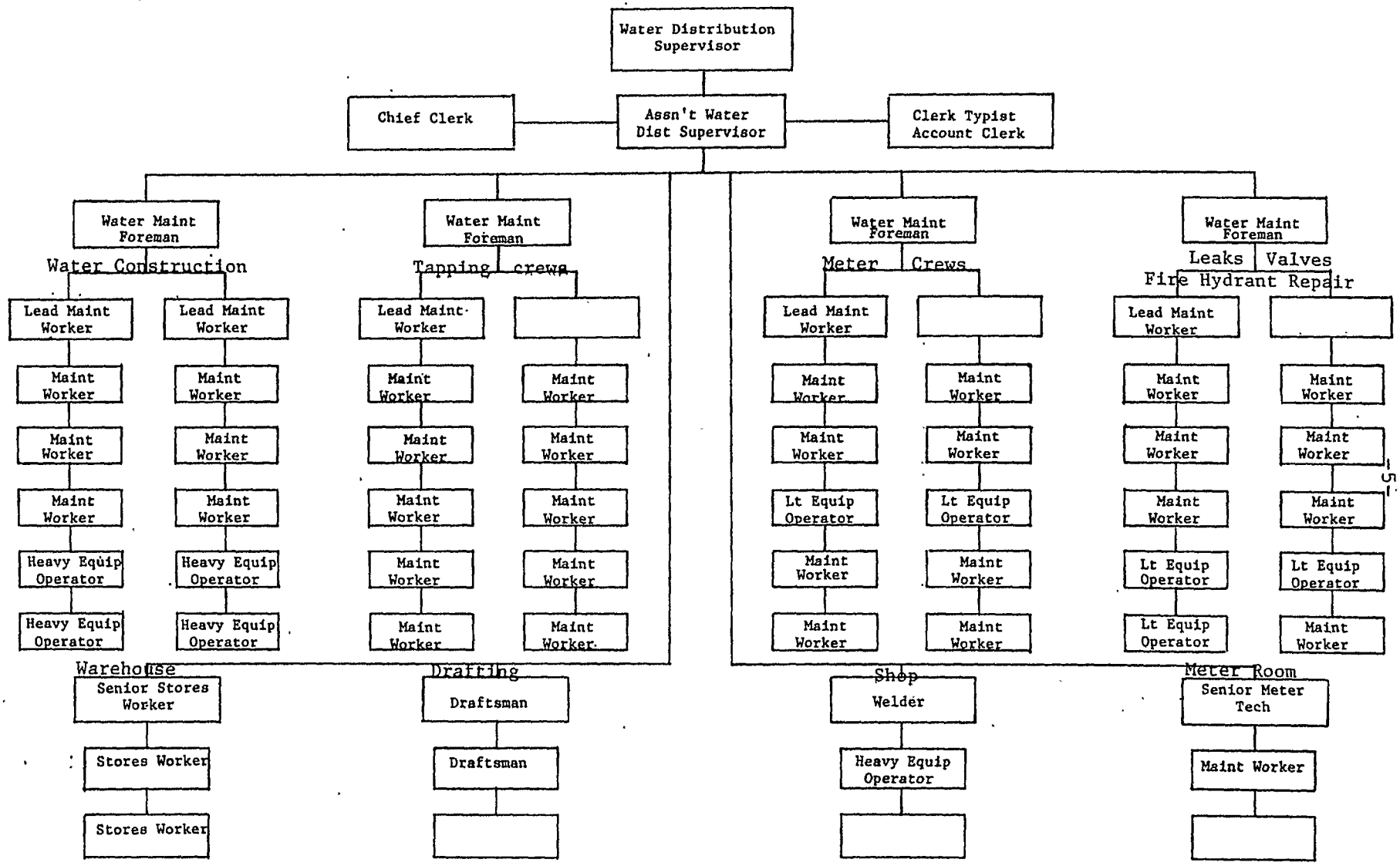

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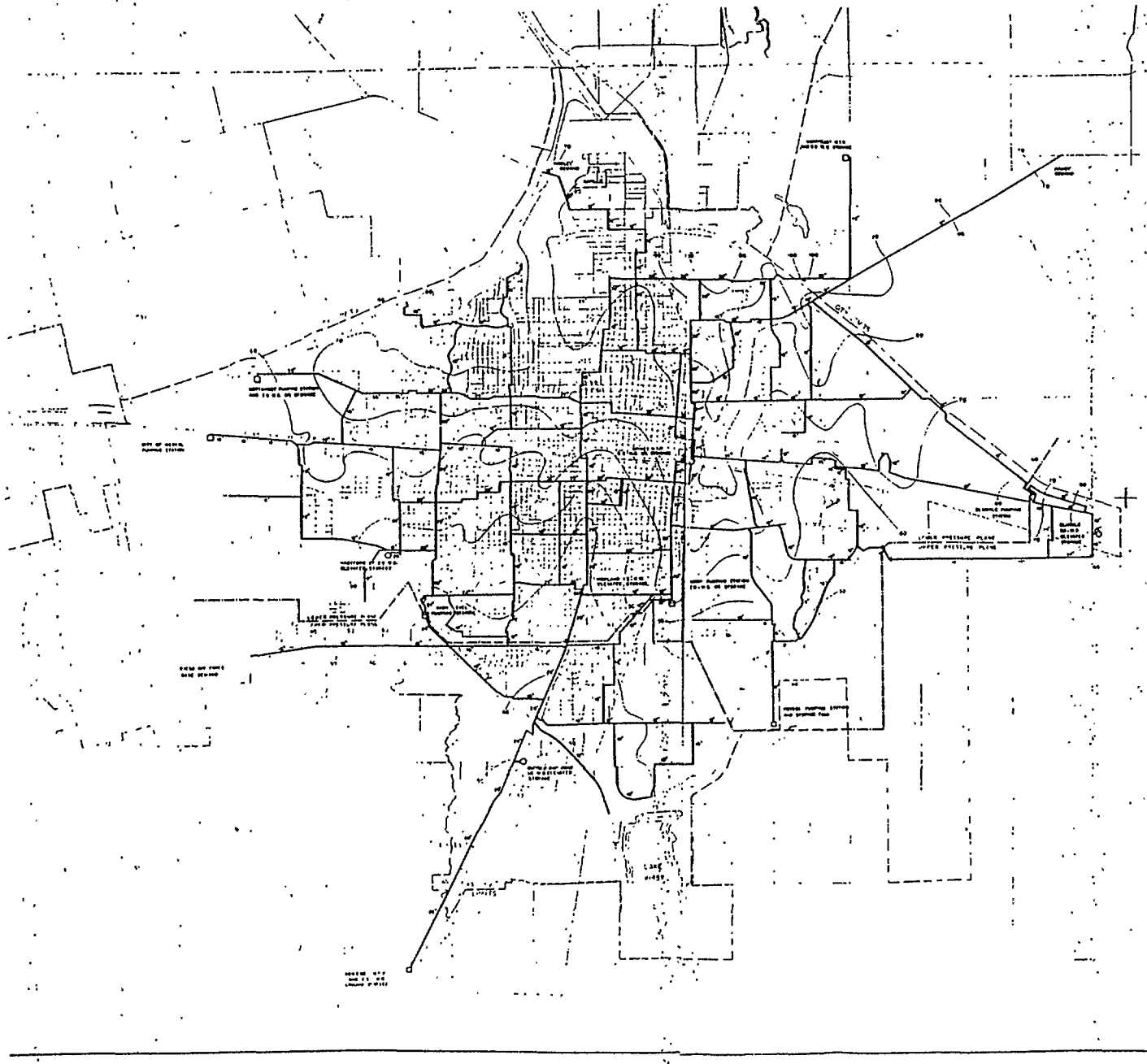

LEGEND

- EXISTING PIPELINES
- CHANGES IN PIPELINE DIAMETER
- CLOSED GATE VALVE
- PIPELINE CROSSING WITHOUT CONNECTING
- EXISTING PUMPING FACILITIES
- EXISTING STORAGE FACILITIES
- MAXIMUM HOUR PRESSURE CONTOURS IN P.S.I
- PRESSURE PLANE BOUNDARY

CITY OF
ABILENE, TEXAS

1977
WATER DISTRIBUTION SYSTE

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PVC installations during this period accounted for 23.4 percent of total, while A/C accounted for 76.5 percent. The majority of PVC installed was in 2-6 inch; however, more than 500 feet of 8-12 inch pipe was installed. PVC is approved for use in the 4-16 inch size range.

PVC also has become extremely competitive from an initial cost standpoint in smaller sizes. The latest competitive bid figures had A/C at $2.34 per linear foot and PVC C-900 at $2.41 per linear foot for 6-inch pipe.

OPERATIONS

Specification, Decisionmaking, and Procurement

Purchase specifications for water pressure pipe are developed by the utilities director, depending heavily on AWWA and ASTM specs. Installation and construction specifications are developed by the city's engineering department, a division of public works. The water department specifies materials and the parameters of the job, but development and final approvals come from the city engineer.

The purchasing specification for A/C, shown on page 8, is short and simple. An annual contract is awarded; only the quantities part of the specifications changes in a given year. As can be noted, the amount contracted for in 1980 was 27,250 feet; 66 percent of this total was for 6- and 8-inch pipe. The annual budget for pipe purchases is about $250,000. Class 150 pipe is purchased except in the 4-inch size. This was an attempt to obtain more beam strength. However, in 1981, no 4-inch A/C was purchased. Although the specifications do not include a list of acceptable bidders, only the three U.S. manufacturers are allowed to bid. CAPCO has been the successful bidder in the past two years.

With regard to design considerations, the primary external consideration is soil conditions. The soils in and around the city are predominantly clay and caliche. Primary internal design considerations appear to be fire flow and service pressure. Hargesheimer explicitly stated, however, that design decisions are based on "results and price."

Hargesheimer personally makes decisions on pipe purchases with respect to quantities and construction materials. There are no so-called consumer constraints. Hargesheimer can remember only one phone call regarding pipe materials.

SPECIFICATIONS FOR ASBESTOS CEMENT FLUID-TITE PRESSURE WATER PIPE

All pipe must meet AWWA Specification C-400, Federal Specification SS-P-351-A and A. S. T. M. C-296 and D1869 or latest revision thereof.

1. All pipe must be tested within Continental United States.
2. All pipe must be Class 150 with the exception of 4 inch which shall be Class 200 with a standard length of 13 feet with a plus or minus tolerance of 1 inch.
3. All machined nipples will be ordered as needed by the City.
4. All pipe must be supplied with couplings, rubber gaskets and solvent necessary for installation.
5. Pipe will be ordered as needed with a minimum order of one truck load for a period of one year from date of contract.
6. Quantities for bids shall be:

   250 Ft. of 4 inch - 200 Lb. Class

   10,000 Ft. of 6 inch - 150 Lb. Class

   8,000 Ft. of 8 inch - 150 Lb. Class

   2,000 Ft. of 10 inch - 150 Lb. Class

   2,000 Ft. of 12 inch - 150 Lb. Class

   5,000 Ft. of 14 inch - 150 Lb. Class

A/C is purchased for two reasons: competitive price and non-corrosivity. The Director also feels A/C "expands and contracts as conditions dictate, resulting in fewer breaks. He believes cast iron is more rigid. The Director notes that "he can't fault the asbestos/cement in our system too much." Too many breaks resulting in increased maintenance problems coupled with price of cast iron led to the initial use of A/C around 1960.

Abilene officials have only one request to make of the industry. Hargesheimer noted CAPCO uses 0-rings that do not require water pressure for sealing the joint whereas Johns-Manville and CertainTeed rings do. The CAPCO rings are "harder to hit home," however. The Director would like to see this inconsistency resolved, preferably by making the 0-rings sealable without water pressure, but with less difficulty than currently experienced with CAPCO rings.

Installation and Testing

Most of the pipe installed in Abilene for main extensions is laid by contractors acting on behalf of developers. City forces make all repairs in addition to handling some main replacement. To illustrate the point, during the one-year period, October 1980 to September 1981. developers or their contractors installed 8.6 miles (81.5%) of pipe while city forces laid 1.95 miles (18.5%).

As noted earlier, construction specifications are developed by the public works department. The specs currently are being revised; thus, neither a copy of the new specs nor the old ones was available.

Water pressure pipe is installed in alleys, which are small service ways between streets. More than 95 percent of the city has its utility lines installed in these alleys. This is a concept not encountered in the other nine systems visited.

Abilene's city forces are "very careful" in the handling of A/C, noting if the chain is placed in the middle of the pipe, breaks can occur. The depth of cover is 30 inches from finished grade. The frost line in Abilene is 18 inches.

The Director believes strongly that the key to successful A/C use is proper bedding. Special precautions are taken to keep the pipe level and not "hump it." In caliche soils, aggregate or rock is used as bedding materials. Normally a very fine sand similar to a beach type sand is used. An advantage of this type sand is the ease in digging whether it is wet, dry, or cold.

Backfill materials, depending on conditions, range from native materials to sand, buckshot (very small rock), or "bend fines" obtained from a local rock crushing operation. Compaction typically is accomplished through jetting or flooding.

Abilene can only be termed very lax in the areas of pressure testing and disinfection. They have not pressure tested for 15 years, and their policy regarding disinfection is that they "just flush until they get a chlorine residual." City engineers do inspect developers work. The greatest installation difficulty is getting the pipe laid right. Most pipe is actually installed by "wetbacks."

The Director is not familiar with "Recommended Work Practices for A/C Pipe." It is recommended that he be sent a dozen copies.

Installation costs for 6- and 8-inch A/C are running about $10.25 per foot, excluding paving and engineering. Assuming that paving costs $3 per foot and engineering 10 percent of costs, total installation costs amount to $14.60 per foot. This figure is based on one developer job which cost $465,411 for the installation of 8.6 miles of pipe. The city has estimated costs of installation by city forces at approximately $11 per foot for 6- and 8-inch pipe.

Tapping is accomplished by Mueller tapping machines of the non-purging variety. Little detail was made available on specific procedures.

Operation and Maintenance

Mainbreaks

Most mainbreaks in Abilene are cast iron breaks occurring at the bell. The majority are bell joint leaks in leadite joints of 4-, 6-, and 8-inch pipe. Abilene also has had some joint leaks on PVC pipe. Officials feel that most of their breaks are caused by temperature changes and increased system pressure in the summer months, resulting from increased demand.

The Abilene area receives an average of 21 inches of rainfall annually. Heavy rainfalls are experienced in September and October. However, officials feel more breaks result from dry-hot and dry-cold weather than wet-cold.

A/C pipe failures occur infrequently. These are usually beam breaks. Hargesheimer could not recall any A/C breaks, but reckoned as how they may get one per month. An inspection of January 1982 recrods revealed 80 leaks or breaks; only 4 of 80 or 5 percent were in A/C.

Water department records show that the following leaks were repaired in past years:

Year	Number of Leaks
1970	423
1971	476
1972	410
1973	444
1974	542
1975	413
1976	477
1977	437
1978	638
1979	750
1980	600
1981	677

Over the past four years, the highest number of breaks occurred in December/January or July/August, bearing out the belief that most breaks take place in dry-cold and dry-hot periods. The data which defy explanation are total number of leaks. Since old, leaky cast iron mains are being replaced, one would expect the total number of leaks to decrease as new pipe is installed.

C-Factor

Freese and Nichols Consulting Engineers conducted a municipal water system analysis for the city in 1978. As part of this analysis, the Hazen-Williams coefficient (C-Factor) was determined for 10 locations within the distribution system.

C-Factors determined were unusually high, ranging from 43 in a section of 20-inch cast iron to 180 in a section of 12-inch A/C. The C-Factor for five sections of cast iron averaged 87 while the five data points for A/C averaged 152.6. Freese and Nichols officials, believing an error had been made, rechecked each test point and derived the same figures. A comparison of results is shown on page 12.

Repair Costs and Practices

An inspection of leak repair records (a practice initiated only recently) for October and November of 1981 reveals average costs of $1097 per leak repair for 102 leaks. This includes labor, equipment, and paving.

Abilene fields four repair crews, one to service actual main breaks and three crews to repair leaks. Most leaks are repaired by applying a leak clamp. When a section of cast iron must be replaced, PVC is used to make the repair because they have the same outside diameter. Only those repairs in

Comparison of "C" Factor Results

Test	Size (in)	Type of Pipe	Pipe Age (Yrs.)	Avg. Vel. (fps)	Flow Rate MGD	Loss Ft. per 1000	"C" Test
1	10	C.I.	18	2.29	0.81	2.41	121
2	20	C.I.	52	2.75	3.84	10.36	43
3	20	C.I.	14	2.18	3.04	4.25	55
4	12	C.I.	18	5.20	2.64	5.82	152
5	12	A.C.	18	4.55	2.31	4.13	160
6	12	C.I.	24	2.72	1.38	1.78	151
7	12	A.C.	9	4.11	2.09	3.02	172
8	12	A.C.	6	2.98	1.51	1.54	180
9	12	A.C.	21	2.84	1.44	1.49	173
10	18	A.C.	28	2.10	2.40	2.33	78

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12-inch or smaller sizes are made with PVC. A/C sections presumably are replaced with A/C.

Aggressiveness Index

Hargesheimer is very familiar with the aggressiveness index. Abilene uses the Langelier index as a measurement of corrosiveness; they maintain an index of 1.0-1.3. A typical analysis of treated water from the City's Northeast Plant shows an alkalinity of 48 mg/l, hardness of 108 mg/l, and a pH of 9.9. From this data, an aggressiveness index of 13.36 can be calculated.

Other Repair Problems

Abilene is experiencing problems with service connections in its polybutylene service lines. Quite a few breaks at the corporation stops have occurred--similar to the severe problems experienced in San Antonio.

Leak Detection

Abilene does not have a leak detection program. They do not feel a program is needed since leaks in their right clay soils usually show up on the surface. Unaccounted for water in the system is estimated at 10 percent.

Main Replacement

Unlike almost all other systems studied, Abilene does not appear to have a consistent long-term main replacement program. They have a program but it is planned on a year-to-year basis rather than long term as is the case of San Diego and Houston. The main replacement program is "based on need." Abilene has identified some 2-, 3-, and 4-inch problem lines, and they have been placed on the docket for replacement. Replacement of these small lines is with PVC Class 200 pipe. The replacement level planned is about $2 million over the next two years. About $500,000 will be spent in replacing steel lined with concrete transmission lines; the remaining $1.5 million will be split between smaller (PVC) main replacement and larger size (8-12 inch) A/C replacement

FINANCIAL

Because of a change in the method of accounting for transfers to debt service, the water and sewer enterprise fund posted a "loss" in fiscal year 1980-81. Upon closer inspection of the income statement and balance sheets, the Abilene utility is in excellent financial condition--as are most of the systems studied. The debt service coverage ratio has ranged from 3.54 to 5.47 over the past three years, about three times the industry

average. Even more impressive is the retained earnings level which stands at $18.3 million. Long-term debt amounts to $5.4 million. Compared to total assets of $43.4 million, an excellent debt-asset ratio of 0.12 can be derived. Many eastern public utilities would envy this financial position.

The City of Abilene's bond rating is A1 (Moody's Investor Service) and AA (Standard and Poor's). At times, the Water Utilities Department elects to float revenue bonds and therefore has a rating as well. Its rating is A (Moody's) and AA (Standard and Poor's).

Comparative bid data for A/C and PVC pipe were obtained. For the most recent bid, dated December 29, 1981, the City contracted to purchase 55,000 linear feet of A/C and 5000 feet of PVC. Complete bid data are shown on page 15. Note the November 20, 1979 unit prices displayed. A/C prices have actually decreased by 5-10 percent over a three-year period. By contrast, PVC prices have decreased markedly, by 26 percent in the 6-inch size and 22.3 percent in the 12-inch size. Given the fact that PVC has gained a "foothold" in Abilene, do these figures represent a reduction in production costs or a "loss leader" for the industry?

Conclusions

Of the ten systems visited, Abilene shows the greatest trend away from A/C toward PVC. Purchases by the City are based on "results and price"--and the PVC prices, as illustrated above, are only marginally higher. The problem is exacerbated by developer preferences for PVC; the Water Director noted they are willing to spend 15 percent more for plastic pipe.

Equally as alarming is the fact that Abilene is extremely pleased with A/C's performance. Mainbreaks are rare, the average C-Factor is above 140, and initial costs have decreased over a three-year period. Also, city forces are confident they hold the key to successful A/C use--careful bedding. Abilene officials recommend we refer San Antonio to them and they would "show San Antone how to lay A/C pipe."

Although Abilene is a relatively small customer (compared to Houston or San Antonio), battle lines have been drawn and the A/C industry must respond if Abilene is to be retained as a customer. Substantial PR, attention and technical assistance could go a long way toward securing this key account.

CITY OF ABILENE, TEXAS
PURCHASING DEPT.

Tabulation of Bids

DEPARTMENT: Water Department — Bid #491
TIME OF OPENING: 10:00 a.m. — DATE OF OPENING: 12-29-81

ITEM	DESCRIPTION	Trans-Tex Supply Co. P. O. Box 188 Arlington, TX 76011 UNIT PRICE	Johns-Mansville Sales Corporation P. O. Box 7622 Midland, TX 79703 U.P.	C & C Municipal Sup. P. O. Box 5435 Lubbock, TX 79417 U.P.	Bowles & Edens Supply Company P. O. Box 47085 Dallas, TX 75247 U.P.	The Rohan Company P. O. Box 7337 Waco, TX 76710 U.P.	Nov 29, 1979 U.P.	U.P.
	ASBESTOS CEMENT PIPE:							
1	6" 20,000 ft.	2 25	2 39	2 34	2 25	45000 00 2 25	2 52	
2	8" 15,000 ft.	3 39	3 32	3 24	3 28	49200 3 28	3 66	
3	10" 8,000 ft.	5 15	4 99	4 88	5 15	41200 5 15	5 36	
4	12" 4,000 ft.	6 59	6 54	6 40	6 55	26,000 6 70	6 98	
5	14" 4,000 ft.	9 23	8 86	18 67	9 21	36800 9 21	9 21	
6	16" 4,000 ft.	11 38	11 18	~~10 93~~ 10.85	10 70	42800 00 10 70	11 36	
	C900-75 Pipe, Class 150 DR-18:							
7	6" 2,000 ft.	2 45	2 48	2 41	2 45	4900 00 2 45	3 26	
8	8" 1,000 ft.	4 25	4 05	3 93	4 00	4 00	4 98	
9	10" 1,000 ft.	6 32	5 98	5 79	6 10	6100 00 6 10	7 61	
10	12" 1,000 ft.	8 91	8 37	8 11	8 75	8750 00 8 75	10 44	
		1 yr from 24 mos.	60 mos. from 18 mos. d.c. 24%	6 mos. from 24%	1 yr from 24%	1 yr from 15%		
		210,311.50	267,208.00	261,090.00	264,990.00	265,570.00		

TABULATED & PREPARED BY: | DATE OF AWARD: | AWARDED TO:

CAPCO JEN 0023514