

APPENDIX S

LOW PRESSURE STUDY

CITY OF MILTON
LOW PRESSURE STUDY

OCTOBER 2005
G&O #04893

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CHAPTER 1

INTRODUCTION

The City has received several complaints of low water pressure from a relatively defined region of City's water service area in the last several years. The region is generally located near the center of the 434 Pressure Zone and is bounded by Taylor Street to the south, Milton Way to the north, 15th Avenue to the west and the zone break between the 434 Pressure Zone and the 520 Pressure Zone (just west of 23rd Avenue) to the east. The City reports that the low pressure problems have been reported specifically from households located within a neighborhood known as Goat Hill as indicated on Figure 1.

The homes in the specific area where the complaints have originated are generally of newer construction, indicating that the pressure problems are not a result of tuberculated service lines or interior plumbing. Some of the houses are two stories, resulting in lower pressures seen at fixtures on upper levels.

ANALYSIS OF THE PROBLEM

As a result of the customer complaints, City staff have collected data on localized pressures in the region in question, and throughout the rest of the water system. Representative data is shown in Table 1.

TABLE 1

Field Pressure Data

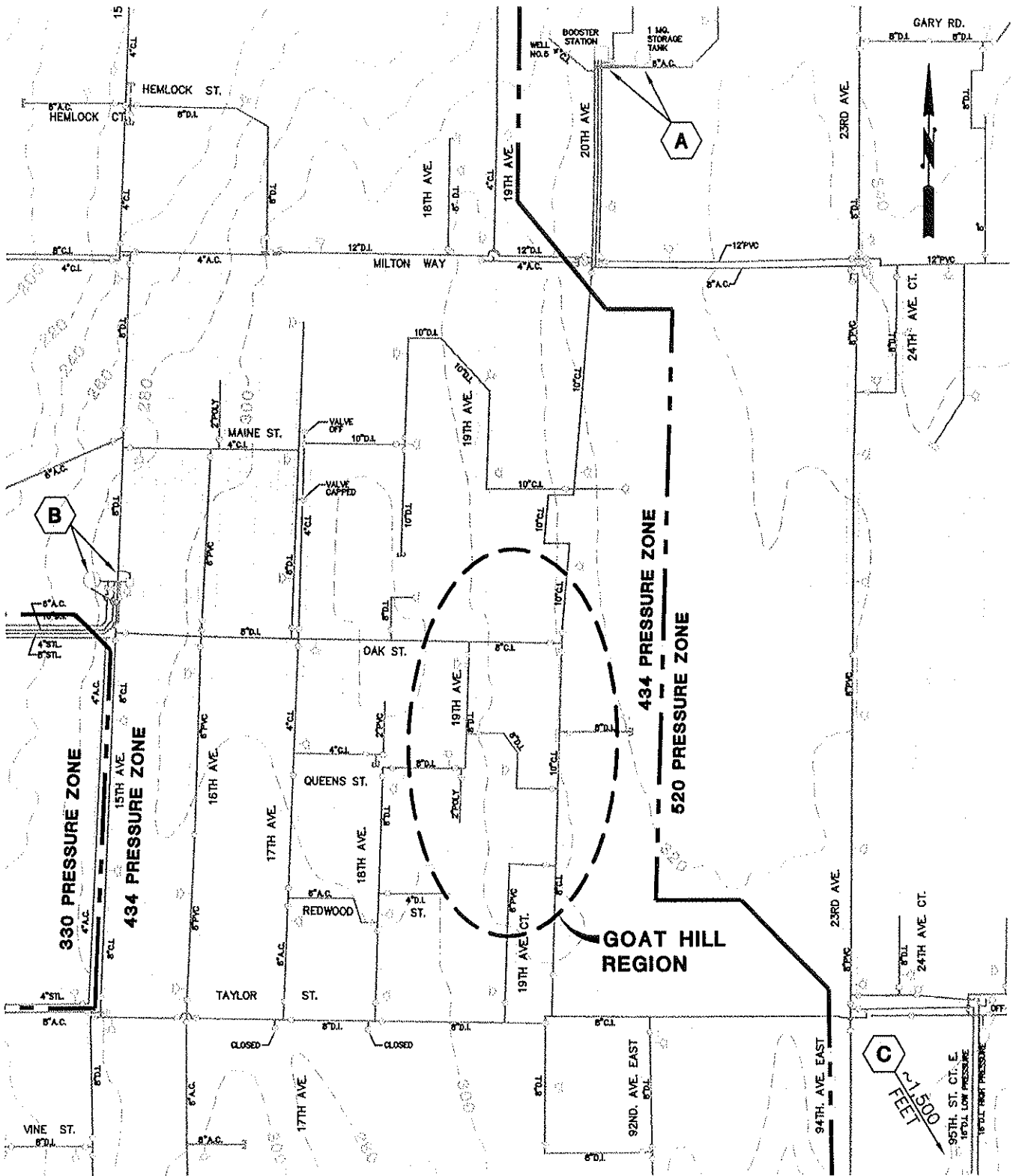
Location	Pressure ⁽¹⁾	Pressure ⁽²⁾
Intersection of 19 th Avenue and Oak Street	40 psi	45 psi
Intersection of 17 th Avenue and Queens Street	44 psi	50 psi
Intersection of 19 th Avenue Ct. and Taylor Street	41 psi	46 psi
Intersection of 15 th Avenue and Taylor Street	56 psi	60 psi
Intersection of 16 th Avenue and Vine Street	50 psi	55 psi

(1) Data collected by City staff on April 4, 2005 at 10:00 a.m. 15th Ave. Booster Station pumps on; 2.0 MG Reservoir at 47 feet of 70 feet; 1.0 MG Reservoir at 69 feet of 75 feet.

(2) Data collected by City staff on April 7, 2005 at 10:00 a.m. 15th Ave. Booster Station pumps off; 2.0 MG Reservoir at 63 feet of 70 feet; 1.0 MG Reservoir at 73.5 feet of 75 feet.

A pressure logging instrument was also placed on the Goat Hill hydrant for approximately 5 days. The data recorded showed average pressures between 37 and 47 psi with instantaneous pressure differential spikes varying by as much as 15 psi.


Hydraulic modeling was performed to evaluate the water service performance of the Goat Hill region. The modeling was run under two different scenarios. One with the 15th Avenue



- A** 20TH AVE. BOOSTER STATION AND 1.0 MG RESERVOIR
- B** 15TH AVE. BOOSTER STATION AND RESERVOIR
- C** 2.0 MG RESERVOIR AND BOOSTER STATION

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FIGURE 1
STUDY AREA


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APPROX. SCALE: 1" = 500'

Booster Station pumps on and the reservoir levels in the low range, and one with the 15th Avenue Booster Station pumps off and reservoir levels in the high range. Results from the modeling in the areas corresponding to the data the City has collected is shown in Table 2.

TABLE 2

Modeling Data

Location	Pressure⁽¹⁾	Pressure⁽²⁾
Intersection of 19 th Avenue and Oak Street	39.2 psi	43.7 psi
Intersection of 17 th Avenue and Queens Street	44.6 psi	49.0 psi
Intersection of 19 th Avenue Ct. and Taylor Street	39.3 psi	43.7 psi
Intersection of 15 th Avenue and Taylor Street	52.4 psi	56.8 psi

(1) Modeling scenario included 15th Avenue Booster Station pumps on; 2.0 MG Reservoir at 47 feet of 70 feet; 1.0 MG Reservoir at 57 feet of 75 feet.

(2) Modeling scenario included 15th Avenue Booster Station pumps off; 2.0 MG Reservoir at 57 feet of 70 feet; 1.0 MG Reservoir at 67 feet of 75 feet.

These modeling results indicate the hydraulic model is within ± 3 percent of the data collected by City staff in the field. For hydraulic water system modeling, this is considered to be within the acceptable range of accuracy.

Based on the modeling of several different scenarios (varying booster station operation and reservoir levels), results appear to indicate water service to the region in question is adequate to meet the Washington State requirement of 30 psi under maximum day demands. The lowest pressures in the area noted during the modeling are approximately 34 psi and they occur on the 8-inch ductile iron waterline between 19th Avenue and 20th Avenue just east of Queens Street. This area is the region known as Goat Hill. These two pressure readings occur at Nodes 26 and 28 in the model and were obtained under maximum day demands, with the 15th Avenue Booster Station pumps on, with the 2.0 MG Reservoir at 47 feet of 70 feet and with the 1.0 MG Reservoir at 57 feet of 75 feet.

Regardless of the modeling results, there is the potential for limited instances during peak demand periods that the pressures in the area would approach the 30 psi minimum limitation. These times could be interpreted by residents of the area as low water pressure service and may elicit complaints to City Staff. As mentioned above, this circumstance would be increased in homes greater than one story. Not including local losses through service meters and residential plumbing, fixtures located in a 10-foot high second story could see pressures, approximately 4 psi less than fixtures at ground level.

CHAPTER 2

520 PRESSURE ZONE EXTENSION

Water service in the Goat Hill region meets minimum state requirements. However, increasing system pressures in the area to provide an improved level of service could be done by extending the 520 Pressure Zone to include the area in question.

Based on review of the water system in the area, the likely boundaries of the extended pressure zone would be 16th Avenue to the west, Taylor Street to the south, and Milton Way to the north. This proposed zone extension is illustrated on Figure 2. Modifications to the valve cluster at the existing 434 Pressure Zone and 520 Pressure Zone intertie (near the 1.0 MG Reservoir) would allow 520 Pressure Zone water to be fed to the new area. The water would be fed through the existing 10-inch cast iron waterline that heads south from the valve cluster as shown on Figure 3.

The modifications would include installing a new check valve zone break in the 10-inch ductile iron waterline that crosses Milton Way, and removing the existing 8-inch check valve from the 8-inch asbestos cement waterline that runs along Milton Way from the east.

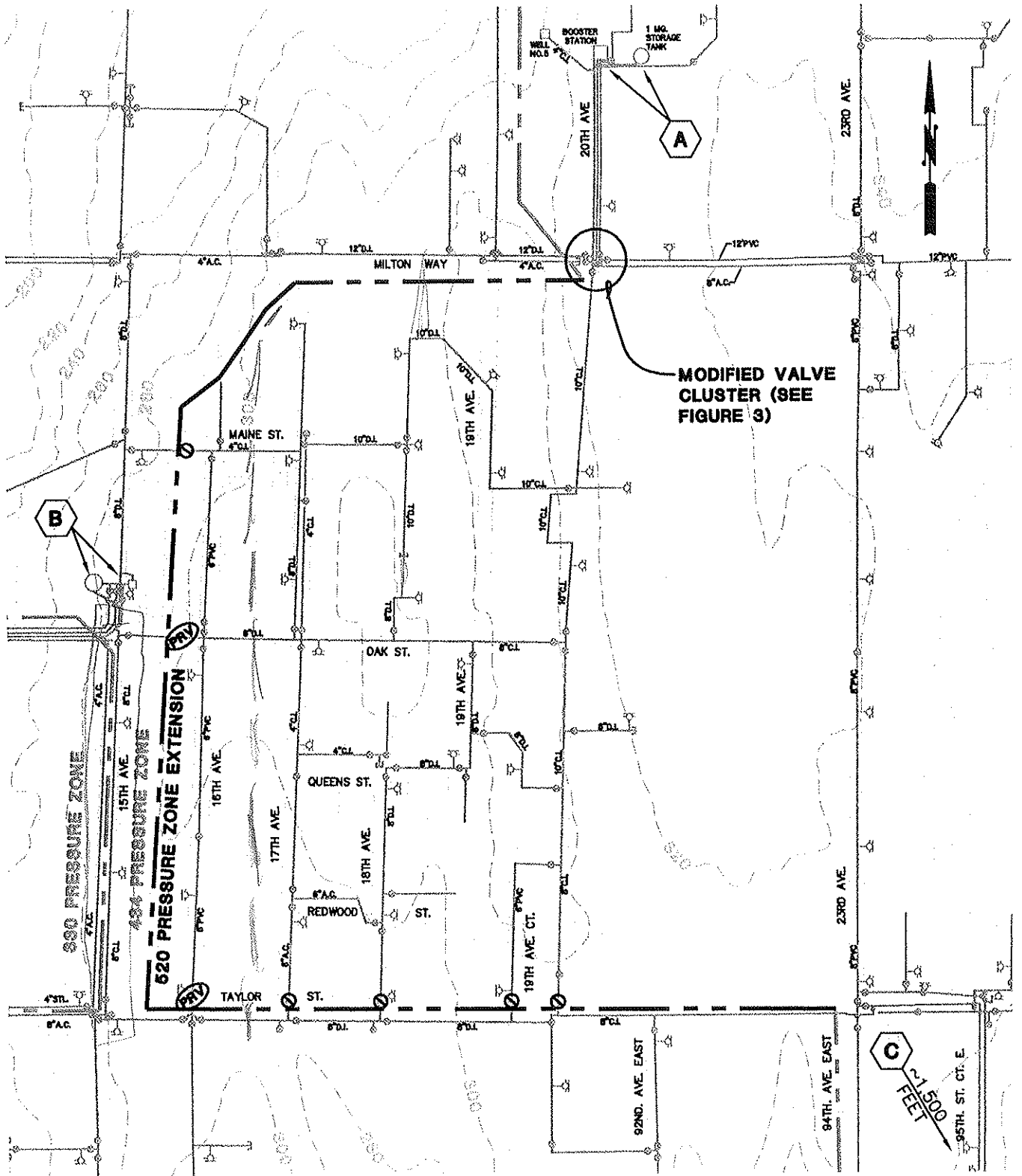
The existing distribution piping along Milton Way to the west and along Taylor Street would remain in the 434 Pressure Zone. Several new zone breaks would need to be created to separate the new 520 Zone distribution piping from the 434 Zone piping. Locations of these breaks would be as follows and as shown on Figure 2:

- In the 4-inch cast iron branch at 15th Avenue and Maine Street
- In the 8-inch ductile iron branch at 15th Avenue and Oak Street
- In the 8-inch PVC branch at Taylor Street and 16th Avenue
- In the 6-inch A.C. branch at Taylor Street and 17th Avenue
- In the 8-inch D.I. branch at Taylor Street and 18th Avenue
- In the 6-inch PVC branch at Taylor Street and 19th Avenue Court
- In the 8-inch C.I. branch at Taylor Street just to the north of the 19th Avenue Court development

Zone breaks at these locations could be accomplished by one of several options:

- Close existing branch valves.
- Remove section of pipe.
- Close existing branch valves and install 3/4 inch bypass.

The least cost and non-permanent option would be to close existing valves on the waterline branches located at the intersections. This option would create a dead-end line at each closed valve and would not provide any positive indication of the zone break at




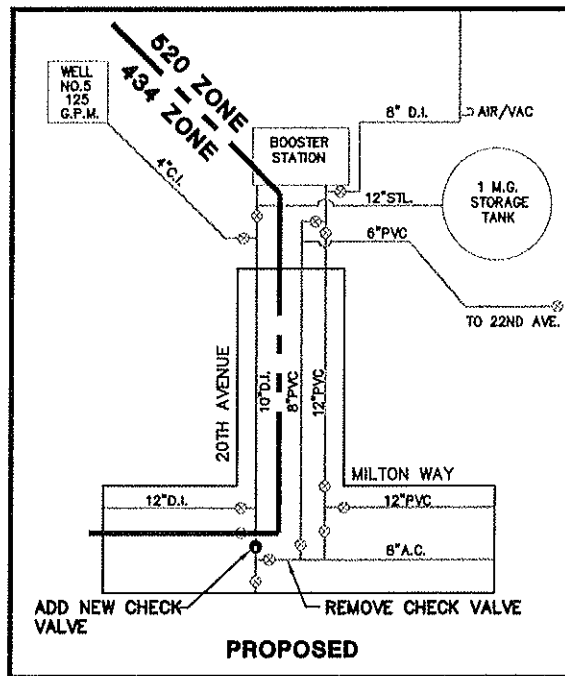
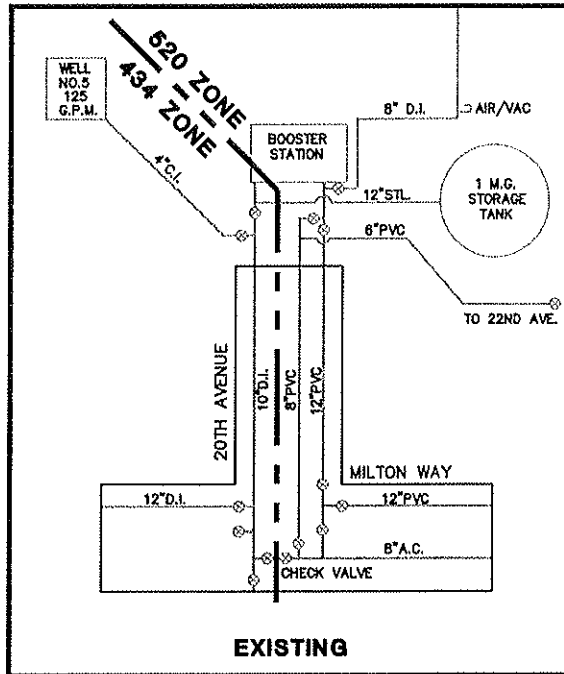
- A** 20TH AVE. BOOSTER STATION AND 1.0 MG RESERVOIR
- B** 15TH AVE. BOOSTER STATION AND RESERVOIR
- C** 2.0 MG RESERVOIR AND BOOSTER STATION
- PRV** NEW PRV STATION
- ⊙** NEW ZONE BREAK

APPROX. SCALE: 1" = 500'

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FIGURE 2
520 ZONE EXTENSION


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FIGURE 3
VALVE MODIFICATIONS



that location (other than the closed valve). For this reason, this option would require care in documentation, both in City base maps and in the field, for future operations and maintenance of the water system in this area.

Alternatively, a more permanent and fail-safe option would be to remove a short section of pipe at each location and cap the remaining pipe ends. This would be a moderate cost option and would also create dead-end lines at each location, but would provide a zone break that could not be compromised.

The problem of dead-end lines could be mitigated by installing a 3/4-inch bypass line and valve around the closed valves. The bypass valves would be left in an open position to allow a constant flow through the zone break. Furthermore, this option would provide indication in the field of the nature of the water system below grade, i.e. two valve boxes located in parallel, one with a 2-inch operating nut and one with a 3/4-inch globe valve.

Table 3 provides preliminary construction costs for the 520 Pressure Zone extension. The base costs reflect the first option for the zone break locations. Also included are additive costs for the other two options. Alternatively, any combination of these options could be implemented in the field based on the City's comfort level with dead-end lines and the documentation of the zone breaks.

TABLE 3

Preliminary Construction Costs

No.	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	\$ 8,250.00	\$ 8,250.00
2	Traffic Control; Multiple Sites	1	LS	\$ 6,500.00	\$ 6,500.00
3	Modifications @ 420 Zone Tie-In	1	LS	\$ 6,000.00	\$ 6,000.00
4	Pressure Reducing Station (3 Inch)	2	EA	\$35,000.00	\$35,000.00
5	Close Existing Branch Valves	5	EA	\$ 0.00	\$ 0.00

Subtotal.....	\$ 90,750.00
State of Washington Sales Tax @ 8.8%.....	\$ 7,986.00
Contingency (15%).....	\$ 14,810.44
Total Estimated Construction Cost.....	\$113,546.44

Additive Items

No.	Description	Quantity	Unit	Unit Price	Amount
A1	Remove Pipe Section and Cap	5	EA	\$ 2,000.00	\$10,000.00
A2	3/4 Inch Bypass Loops	5	EA	\$ 3,500.00	\$17,500.00

FIRE FLOW

The hydraulic model was used to confirm the fire flow at the school which is located within the proposed 520 Pressure Zone extension. The model indicated fire flow exceeds the 2,500 gpm requirement as set forth in the *Comprehensive Water System Plan*.

RESERVOIR MODIFICATIONS

During investigations for the low pressure issues, City staff indicated that there is an apparent water imbalance between the two reservoirs serving the 434 Pressure Zone: the 1.0 MG Reservoir and the 2.0 MG Reservoir. Reservoir pressure data collected in April 2005 indicates the water in the 1.0 MG Reservoir does not turn over on a regular basis. For every 500,000 gallons of water turned over in the 2.0 MG Reservoir, approximately 80,000 gallons are turned over in the 1.0 MG Reservoir.

From a water quality standpoint, the City is concerned that water is not withdrawn from the 1.0 MG Reservoir frequently enough to maintain the freshness of the stored water. This is of particular concern when water is not withdrawn for several days at a time. The following modifications to the operations of the booster stations and reservoirs could help alleviate this issue.

The level controls within the 2.0 MG Reservoir control the on/off operation of the 15th Avenue Booster Station. Currently, the system is set to call the booster pumps on when the water level in the reservoir reaches 47 feet, and it calls the pumps off once the water level reaches 67 feet. Currently, the booster station at the 2.0 MG Reservoir serves as the lead booster station for serving the 520 Pressure Zone. The City has plans to revise the system operation scheme to make the 20th Avenue Booster Station the lead booster station due to cheaper power costs available at this site. This action will provide additional turn-over in the 1.0 MG Reservoir due to increased use of the 20th Avenue Booster Station. During operation of the booster station, the nearby altitude valve serving the reservoir should open due to the pressure drop created by pump intake. It is recommended the City verify this as they make the above modifications to the booster station control and start-up.