CITY OF ASHLAND
COMPREHENSIVE WATER PLAN

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SECTION I
PLANNING DATA

1. STUDY AREA

The area included within this report includes all lands served by the City of Ashland water system. At the present time, nearly all of this land lies within the city limits of Ashland. Areas outside of the present city limits desiring water service are usually required to annex to the City. Though current development lies primarily within the city boundary, it is expected that some of the development that will occur between now and 2010 may be on lands outside of the City that will be annexed.

This update to the City's comprehensive water plan will outline improvements needed to serve existing and future growth within the City and will update the plan presented in the 1980 Water Plan for serving future development within the urban growth area around Ashland.

The present service area and major water system facilities are shown on Figure I-1. A detailed description of the water facilities in Ashland was included in the 1980 Comprehensive Plan.

2. POPULATION

The 1988 population of Ashland was approximately 16,130 and the growth rate since 1980 has been approximately 1 percent per year. The 1989 report, "City of Ashland, Water Supply Report", projected that the population of Ashland would increase approximately as shown in the first column in Table I-1.

Table I-1
Population Projections
City of Ashland

	1989 Projection[1]	*1991 Projection*
1990	16,700	16,294[2]
1995	18,600	17,450
2000	20,200	18,700
2005	22,000	20,000
2010	23,600	21,400

1 *From 1989 Report "City of Ashland Water Supply Report"*
2 *1990 Census Data*

The growth shown in Table I-1 is slightly higher than has been experienced during the mid-1980s when the economy of Oregon and the region appeared to be somewhat stagnant. Recently, however, economic growth in the region seems to be increasing again and the population growth may return to the levels contained in the projections. The 1990 census data indicated a population of 16,294. Recent updated data place the early 1991 population at approximately 16,700.

The City has recently used the census data to project a population of approximately 20,000 by 2005. An extrapolation of this projection yields a lower population estimate as shown in the last column of Table I-1. The two projections represent a high and low range of potential population growths for Ashland since the high projection is equal to the long-term historical growth of Ashland while the low projection approximates the more recent growth pattern.

3. WATER DEMANDS

Water demands for the City of Ashland can be expressed in terms of the annual supply of raw water as measured at the water treatment plant, the volume of treated water produced, the average annual supply delivered to the customers, or the highest daily, peak day or peak hour quantity required. The most recent water volume requirements for Ashland are shown in the 1989 Water Supply Report and can be used to plan for water supply features and water transmission and distribution facilities. These projections are based upon the "high" range for population. For planning purposes, a high range is appropriate though new facilities will only be constructed as the demands warrant.

The 1989 report presented the average annual volume of treated water that would be required in Ashland through the year 2010. Using the peaking factors presented in the 1980 Comprehensive Water Plan, the peak day and peak hour quantities can be estimated. The 1980 report determined that the ratio of the peak day volume to the average annual volume was approximately 2.6 and the ratio of peak hour to average annual was 3.6.

The peak day volumes are used primarily to size the water treatment facilities whereas the peak hour quantities are used to size water transmission, distribution, pumping, and storage facilities. Table I-2 presents estimates of the average annual, peak day, and peak hour quantities based upon the population projections shown above and assume that system losses continue to be approximately 25 percent of the delivered water.

Table I-2
Water System Demands
City of Ashland
(millions of gallons per day)

	1990	1995	2000	2005	2010
Average annual demand	3.62	4.04	4.44	4.77	5.10
Peak day demand	9.41	10.5	11.5	12.4	13.3
Peak hourly demand	13.0	14.5	16.0	17.2	18.4

4. WATER CONSERVATION

The projections in Table I-2 are based primarily upon operating statistics of water usage between 1980 and 1987 and do not reflect demands that may be experienced if a water conservation program is adopted. The City has appointed a staff person to head up water conservation efforts. A Consultant's draft report on potential elements of a water conservation plan is scheduled for submittal in March or April 1991. The demands shown in Table I-2 may need to be revised once a water conservation program is instituted and if a significant reduction in demands results from the effort.

The 1989 Water Supply Report showed that water conservation efforts could delay the need for additional new water supply sources by several years. Since most pipelines are needed primarily to serve new growth, it is unlikely that water conservation efforts will have a significant impact on the timing for their need. A major impact, however, could be a delay in the need for a major expansion the water treatment plant though a minor expansion and repairs are planned for 1991-1992.

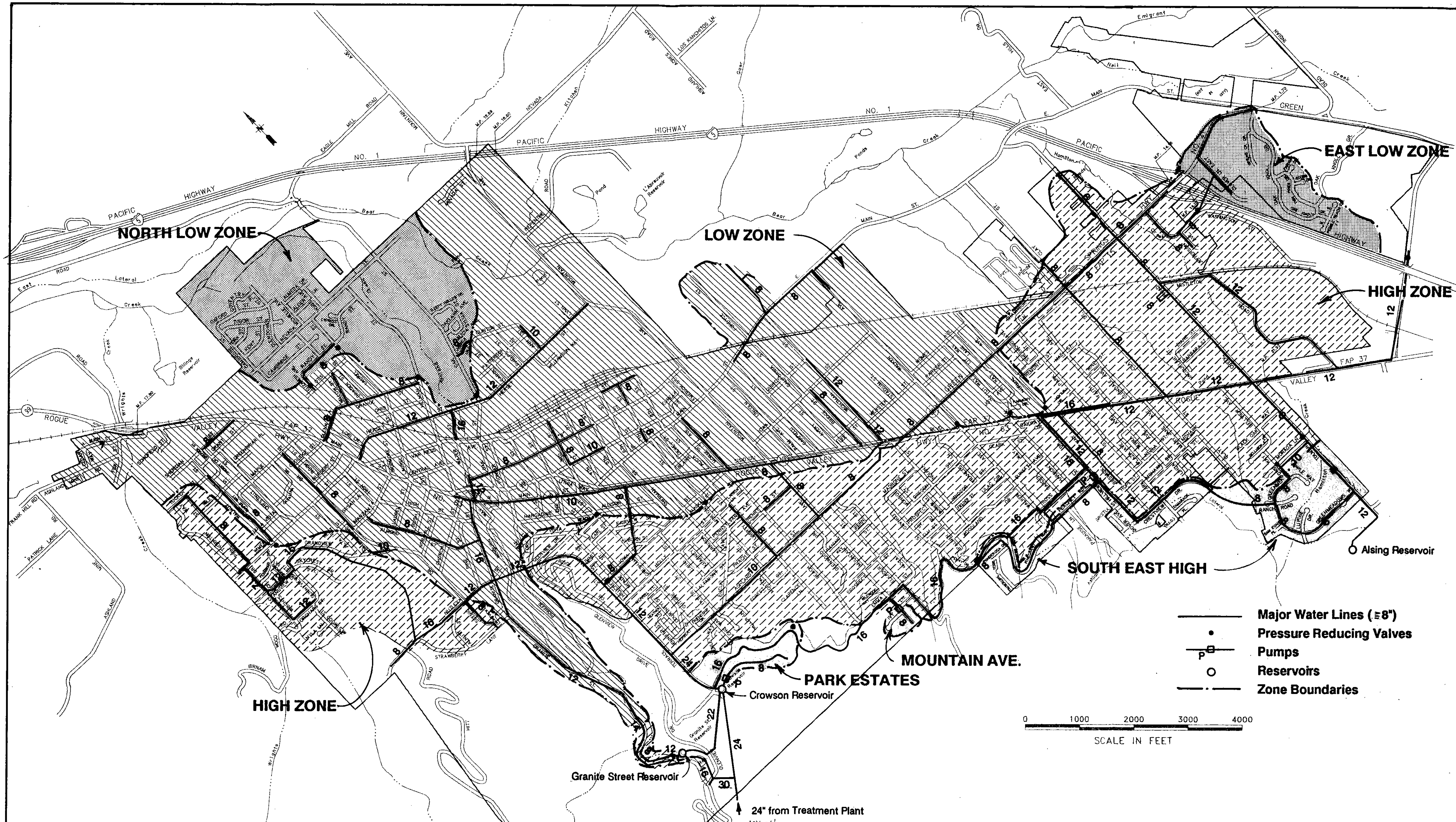


Figure I-1
City of Ashland
1990 Comprehensive Water Plan

EXISTING WATER SYSTEM

SECTION II

WATER TRANSMISSION AND DISTRIBUTION

1. EXISTING SYSTEM

a. Transmission

The major water transmission line in the water system leads from the water treatment plant on Ashland Creek to Crowson Reservoir. This line, a 24-inch steel pipe, was constructed in the 1920s and is the only source of water for the entire system. From Crowson Reservoir, three lines feed the distribution system. A 16-inch line follows the Talent Irrigation District right-of-way and serves the southeast portion of the City and the new Alsing Reservoir. A 10- inch line serves the central part of the City along Terrace Avenue and Ashland Avenue. A 12-inch line follows along Terrace Avenue, crosses Lithia Park, and serves the high zone in the northwest portion of the City. The 12-and 10-inch lines are both quite old and may need to be replaced or paralleled in the near future.

A line from Granite Street Reservoir, varying in size from 12- to 16-inches, leads from the reservoir to the low zone.

b. Distribution

The water distribution system is comprised primarily of 8-inch and smaller water lines constructed with ductile iron, cast iron, and steel with a few 12-inch lines. The system includes seven different pressure zones, three of which are served by booster pumping stations. The boundaries of the various pressure zones and the major water lines are shown on Figure I-1.

The "high" zone serves the majority of the higher elevation lands in Ashland and is fed directly from Crowson Reservoir. This zone is split by Lithia Park with the western portion of the zone fed by the 12-inch line which crosses the park. The easterly portion is fed by the 10-inch line along Ashland Street and the 16-inch line which follows the Talent Irrigation District canal.

The "low" zone includes most of the City below the high zone and is served by water from Granite Street Reservoir and from the high zone through pressure reducing valves (PRVs) or several small lines which act to reduce pressures. Granite Street Reservoir can act either as a regulating reservoir which floats on the system or can be refilled from Crowson Reservoir.

The "southeast high" zone is supplied from the new Alsing Reservoir off of Tolman Creek Road. Alsing Reservoir is located about 100 feet higher than Crowson Reservoir such that water must be pumped into its pressure zone through a pump station located on Hillview Drive. Water for this zone is supplied to the pump station from the 16-inch line which originates at Crowson Reservoir.

The "north low" zone is located in the north central portion of the City and is fed through pressure reducing valves from the low zone. Except during high demand periods, the majority of the flow to this zone is fed through a line on Oak Street.

An "east low" zone is located south and west of Interstate 5 and is fed from the high zone through a pressure reducing valve. This zone will eventually be expanded and be a part of the low zone.

There are presently two separate zones which are fed by pumps that provide water from the high zone to developments located south of the TID canal. The Park Estates and Mountain Avenue pumps serve areas that eventually could be expanded and combined and could be served by the southeast zone from Alsing Reservoir.

The highest elevations of the hydraulic grade line for each of these zones is shown in Table II-1.

Table II-1
Hydraulic Grade Elevations
City of Ashland

High Zone	2428
Low Zone	2173
Southeast High	2560
Park Estates	2540
Mountain Avenue	2540
North Low	1997
East Low	2200

Flow between the high zone and the low zone is regulated by PRVs and several small diameter water lines. The PRVs have multiple settings that control flows during normal operations but will allow higher volumes during high demand periods or during a fire event. The locations of the PRVs are shown on Figure I-1.

c. *Storage Reservoirs*

The water distribution system has three major reservoirs that are used for emergency storage and to supply water to the system during peak demand periods. Crowson Reservoir, serving the high zone, has a capacity of 2.16 million gallons (MG) and operates between elevations 2408 and 2428. Granite Street Reservoir has a capacity of 2 MG, can be filled from Crowson Reservoir or the low zone, and operated between elevations 2143 and 2173. The third reservoir, the new 2 MG Alsing Reservoir, serves the southeast high zone, and operates between the elevations of 2530 and 2560. Alsing Reservoir is filled by a manually operated 30 hp pump located on Hillview Drive which receives most of its water through the 16-inch line from Crowson Reservoir.

The location of each of these reservoirs is shown on Figure I-1.

d. *System losses*

Water system losses (unaccounted-for-water) have been a continual concern for Ashland. Since the last water plan was completed in 1980, losses have ranged from 21 to 38 percent per year and have averaged approximately 29 percent. Though inaccuracies in meter reading and unmeasured usage impact the loss rate, high operating pressures as well as the age and condition of steel pipe in the distribution system are also felt to be major contributors. A water audit may be appropriate and could be considered as part of the upcoming water conservation efforts.

2. SYSTEM ANALYSIS

a. *Transmission/Distribution*

The Ashland water system was modeled by R. W. Beck and Associates in 1980 as part of the comprehensive water plan prepared in that year. The system was originally modeled using a R. W. Beck proprietary model; as part of this update of the comprehensive plan, the model was converted to the University of Kentucky hydraulic simulation model (KYPIPE). The model was further updated through the addition of new pipes, pumping stations, valves, pressure reducing stations and reservoirs that have been constructed since 1980. In addition, water demands were revised to reflect predicted 1990 water usage.

The model for 1990 was run to determine if the resultant pressures and flows were consistent with those experienced in the Ashland system. Once the model was modified to reflect the existing system, the water demands for the year 2000 were entered into the model. As necessary, new waterlines were added to the system or existing lines were increased in size. Several existing water lines have experienced numerous leaks and breaks and are scheduled for replacement before 2000. These lines were also added to the model if the sizes change from what presently exists.

Three major criteria were used to evaluate the effectiveness of the proposed 1990 system. These criteria are:

1. Minimum operating pressures throughout the system should not fall below 40 psi during the peak hourly demands which occur during the year.

2. Maximum pipeline velocities should generally not exceed about 5 to 6 feet per second.

3. Minimum pressures during the occurrence of a major fire should not drop below 20 psi. Sufficient storage should be available to meet peak day demands and fire demands simultaneously.

The analysis indicates that a number of new water transmission and distribution lines should be proposed for construction during the 1990-2000 time period. Each proposed new project is described below and shown on Figure II-1.

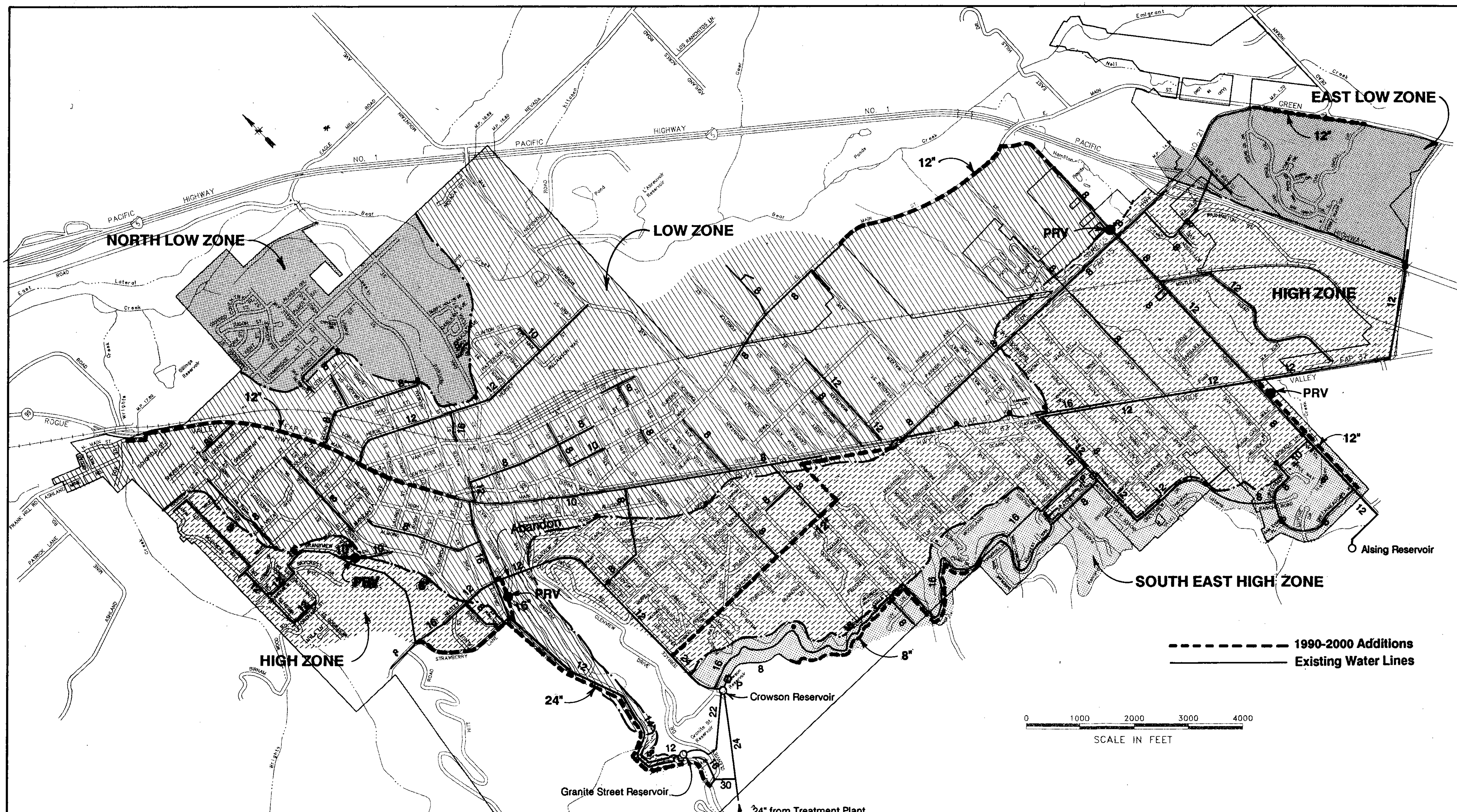


Figure II-1
City of Ashland
1990 Comprehensive Water Plan

PROPOSED SYSTEM ADDITIONS

- A 24-inch line is proposed to be constructed along Granite Street and Strawberry Lane from the vicinity of the Granite Street Reservoir to Ditch Road. This line was proposed in the 1980 plan (1991-A-1) though the alignment was different than proposed here. The new alignment should be less costly to build and maintain as it follows existing street alignments rather than along a rugged, abandoned canal right-of-way.

- A 12-inch line along North Main Street from Church Street to Fox Street. This line will supplement (or replace) existing 4- and 6-inch lines. The new line will increase pressures in the northwest end of the City and significantly increase fire fighting potential along North Main Street. The line will also provide excess capacity to allow future growth in this area.

- A 12-inch line on Ashland Street between Terrace Street and Siskiyou Blvd. to replace a 10-inch line constructed in the early 1900s. The line is subject to a high rate of breaks and has been planned for replacement for several years.

- An 8-inch line from the vicinity of Park Estates to an existing line near Ponderosa Drive. This line would lie above the alignment of the TID Canal and would serve developments above the canal. This line would be fed from Alsing Reservoir and would allow development to occur up to approximately elevation 2390. This will also allow the pumping station on Mountain Avenue to be removed and will increase the volume of water served from Alsing Reservoir. The Park Estates pump at Crowson Reservoir should remain as a backup supply to the area. This proposed project is one of several possible options for providing service to this area.

- A 12-inch line should be constructed along East Main Street from Walker Avenue to its intersection with Tolman Creek Road and then north along Tolman to the end of the existing 8-inch line near the Tolman Creek Mobile Home Park. A pressure reducing valve would be installed on the existing 8-inch line just north of Highway 66 to reduce pressures in this area. This entire area would then be part of the low zone.

- A 12-inch line along Highway 66 from Oak Knoll Drive to the future extension of Oak Knoll Drive. This line will eventually be extended to connect with a 12-inch line on Crowson Road.

- An 8-inch line with a pressure reducing valve that will connect the high zone in the northwest portion of the City with the low zone in the vicinity of Scenic Drive and Grandview. This line will replace an existing 3-inch line and will allow more water to be fed into the north end of the City from the high zone.

b. Northwest Moratorium Area

The 24-inch line along Granite and Strawberry Lane is designed to increase the supply of water to the higher elevations in the Northwest area of the city. This area is growing rapidly as infilling continues to occur in areas where infrastructure is already in place. The 24-inch line will replace the 12-inch line constructed in 1924 that is currently serving the area.

The new alignment for the 24-inch line is considered to be favorable over the alignment proposed in the 1980 plan because of a probable savings in construction costs and better access for maintenance activities. Though the alignment is slightly longer than the alignment shown in 1980, the cost savings due to the roughness of the terrain along the 1980 alignment would more than offset the additional length.

The "Northwest Moratorium Area" was established in the 1980s to delineate the area which cannot presently be served by gravity from the water system. As water demands increase in the Northwest part of the City, friction losses lower the elevation where homes can be served with adequate pressure. Figure II-2 shows the present limits of the Northwest Moratorium Area. Areas above this line (El 2274 at Strawberry Lane to 2269 at Orchard Street) cannot be served at the present time. This line decreases approximately 1.5 feet in elevation per year.

Once the proposed 24-inch line is constructed, adequate water will be available to this area. As described in the 1980 Water Plan, a booster pump station and reservoir will be needed to serve this area. The area will accommodate a population of approximately 1,400 people at full development. A reservoir with a capacity of 500,000 gallons will be needed to serve the entire area. The reservoir should be built in stages or perhaps operated at a partial capacity until substantial development occurs.

c. Storage

The City of Ashland currently has three 2-MG reservoirs in its system (Crowson, Granite Street, and Alsing) which provide equalizing, emergency, and fire protection storage. The analysis indicates that this is sufficient for at least the next ten years. As will be discussed in a later section, the 2 million gallons in storage available at Alsing is over double what is presently required and due to the slow turnover time in the reservoir, it is difficult to maintain a chlorine residual in the system near the reservoir. The reservoir is being maintained at about the 1 million gallon level and should be kept at or below this level until demands increase.

d. Fire Demands

Fire protection guidelines prescribe that flow rates be made available for designated time periods. The flow rates vary depending upon factors such as the type of occupancy, structure type, the availability of sprinklers, building heights, etc. The duration of flow availability is dependent upon the flow quantity and is shown in Table II-2.

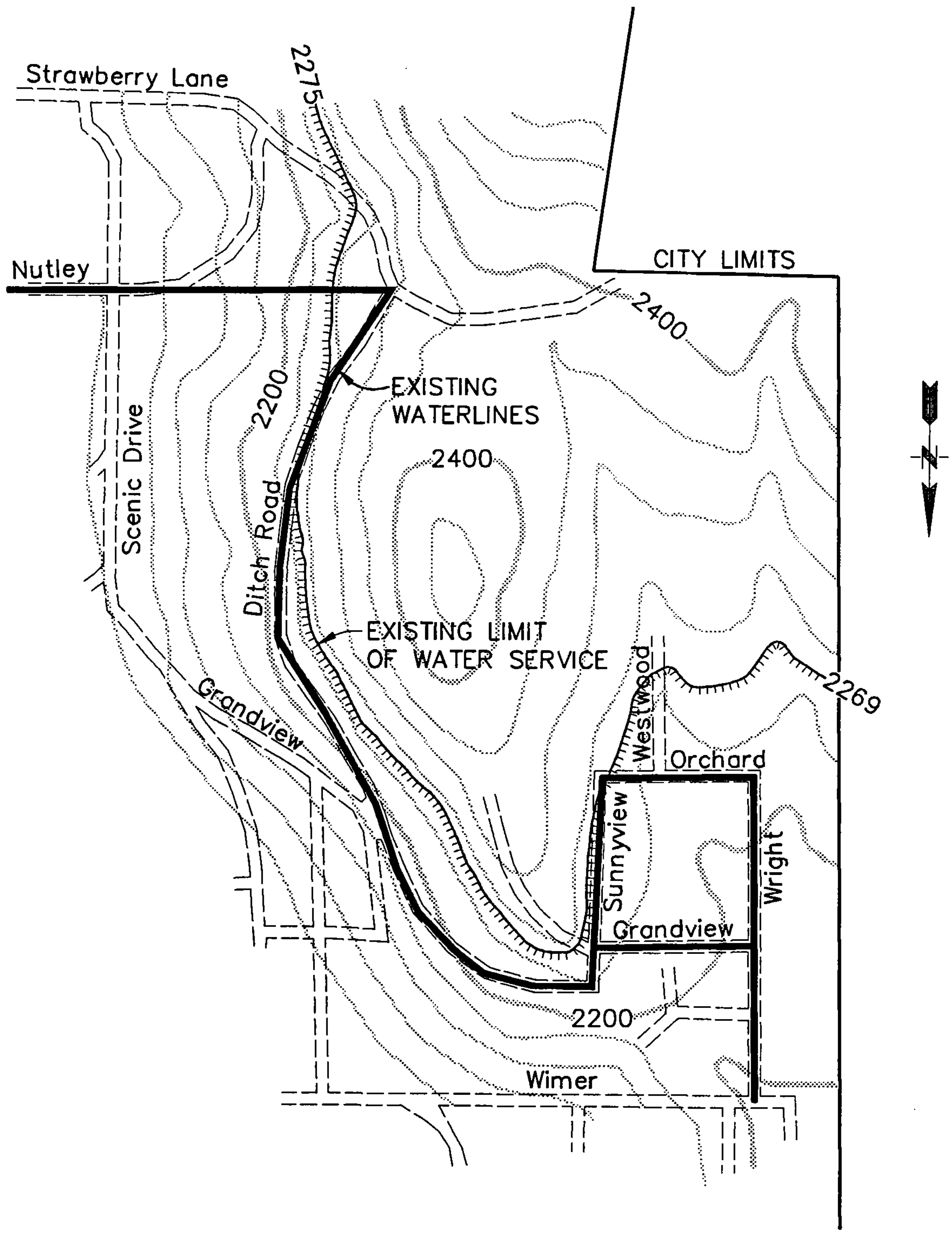


Figure II-2
CITY OF ASHLAND
1990 COMPREHENSIVE WATER PLAN

NORTHWEST MORATORIUM AREA

Table II-2
Recommended Fire Flow Durations(1)

Required Fire Flow-gpm	Duration-hours
2500 or less	2
3000 to 3500	3
4000 to 12,000	4

(1) From AWWA M31, Distribution System Requirements for Fire Protection

As discussed above, there are a number of factors which enter into the establishment of fire flow requirements. AWWA Manual M31 presents three separate methods which have been used to calculate fire flow rates for different classes of structures and occupancies. Though it is not possible to calculate specific numerical criteria for buildings in Ashland within the scope of this study, it is possible to adopt general numbers that can used in evaluating the capability of the Ashland water system to meet fire protection needs. The following table, Table II-3, presents the suggested criteria that has been used to evaluate the system.

Table II-3
Suggested Fire Flow Rates

	Flow Rate, gpm
Residential	
over 100 feet between buildings	500
31 to 100 feet between buildings	750
11 to 30 feet between buildings	1000
less than 11 feet	1500
Apartment Complexes	2500
Commercial Buildings	3000
Schools and Institutions	3500
Industries (Croman Mill)	4000

The above fire flow criteria were used in the computer model of the system at a number of locations in Ashland. The modeling led to several conclusions:

- ❑ Providing adequate fire flows to the areas along Main Street, Highway 66, and Siskiyou Avenue will result in unacceptably low pressures in many of the higher elevations in Ashland.

- ❑ In order to provide 3000 to 4000 gpm to the downtown area and the Croman Mill, greater capacity is needed is needed in the lines leading from Crowson and Alsing Reservoirs.

- ❑ Many residential areas currently served by 4-inch or less pipes will not meet the desired fire flow criteria.

Four specific projects are recommended for construction to alleviate these potential low pressure problems during the occurrence of a major fire.

- Increased fire protection to the downtown area can be accomplished in conjunction with the new 24-inch line that will be constructed to the northwest portion of the City. A 16-inch line and pressure reducing valve should be constructed along Granite Street between Strawberry and Nutley. The PRV would open only when it sensed low pressures in the existing 16-inch line.

- A 12-inch line should be constructed along Tolman Creek Road from Green Meadows Way to Siskiyou Ave and a pressure reducing valve installed. The line will increase fire flow capability along Siskiyou Avenue and at the Croman Mill.

- The higher elevation homes in an area roughly bounded by Woodland, Elm, Leonard, and Palmer Avenues should be connected to the southeast high zone that is fed from Alsing Reservoir. The area also will have to be valved off from the lower zone that presently feeds it.

- The area roughly bounded by Mountain Ave, Elkader Street, Emma Street, and Ivy Lane should also be connected to the southeast high system fed by Alsing Reservoir and valved off from the lower zone. The present pump station on Mountain should be removed once the connections are made and the line from Alsing Reservoir extended to Mountain Avenue.

Each of the above projects will improve fire flows in the affected areas and will improve pressures during peak demand periods in the higher elevations of the City. Ashland still has many miles of 4-inch water lines throughout the City. These lines are capable of supplying residential demands but are usually inadequate to meet fire flow requirements. Six-inch lines are the minimum recommended size for new residential construction while the minimum line size for non-residential areas is usually 8-inch. As funds are available and in conjunction with other public works improvements, these 4-inch lines should be systematically replaced.

3. CAPITAL IMPROVEMENT PROGRAM

The City of Ashland maintains an ongoing program of capital improvements to expand and improve the water system. Most of the major facilities recommended in the 1980 Comprehensive Water Plan have been constructed by the City and the existing water system is capable of meeting its water service commitments.

The previous sections have identified a number of major capital improvement projects that should be constructed between 1990 and 2000. As noted, the listed projects are the major facilities that must be constructed to meet the growth in demands or are replacements for existing facilities that may have passed their useful life. There undoubtedly will be a number of minor projects that will also be needed to replace small lines or may be needed to extend service to areas adjacent to existing lines. The City is encouraged to continue to budget monies annually for these projects since they will not be included in the Comprehensive Water Plan.

The major facilities recommended for construction have been prioritized based upon information available to the Consultant, present growth patterns, and our judgement as to the need for various projects. Each project is needed within the 10-year period though there is some room for modifications to the proposed schedule. Table II-4 lists the projects recommended for construction, the estimated costs, and the approximate date of construction. The estimated costs include direct construction costs, engineering, construction inspection, and various administrative costs.

The engineering, inspection, and administrative costs are estimated to equal approximately 30 percent of the construction cost. In addition, a 15 percent contingency has been added to allow for potential changed conditions. All costs are based on 1990 construction costs levels and have not been adjusted to the estimated date of construction to account for inflation.

Table II-4
Capital Improvement Program
Ashland Water Facilities
1990-2000

Year	Location	Description	Costs
1992	Strawberry Ln. and Granite Street	24" line from vicinity of Granite Street Reservoir to 16" line serving northwest high zone. L=7,260 feet	$930,000
1993	Ashland Street	Replace existing 10" line with 12" line. L=8,000 feet	470,000
1994	Granite Street between Strawberry and Nutley St.	Install 16-inch line and PRV L=750 feet	60,000
1995	Scenic Drive and Grandview Dr.	Remove existing 3" line and replace with 10" line and install PRV. L=700 feet	83,000
1995	Highway 66	Install 12" line at Oak Knoll Drive. L=2,100 feet.	140,000
1996	North Main Street	Construct 12" from Granite Street to Fox Street. L=5,500 feet.	280,000
1997	TID Alignment from Park Estates to Pinecrest Terrace	Install 8" line from Park Estates to Mountain Avenue. L=2,760 feet	100,000
		Install 8" line from Mountain Ave. to Pinecrest Terrace. L=3,680 feet	152,000
1998	East Main Street and Tolman Cr. Rd.	Install 12" line from Walker Ave. to end of existing 8" line and install PRV. L=5,200 feet.	240,000
1999	Tolman Road	Install 12" line from Green Meadows Way to Siskiyou Ave. L=2,730 feet	145,000

SECTION III

WATER QUALITY

1. EXISTING CONDITIONS

a. Water Treatment Plant

The source of the raw water for the City of Ashland Water Supply System is Ashland Creek and Talent Irrigation District water during the summer months. A small dam was constructed on each fork of Ashland Creek in 1909 to divert water for power production and to provide domestic water for the higher sections of the City. In 1928, Hosler Dam was constructed below the confluence of the two forks and now provides water to the power generation facility located about a mile downstream of the dam.

Prior to 1948, screening and chlorination were the only treatment given to Ashland Creek water. Then, in 1948, a rapid sand filtration plant was built adjacent to the power generating facility utilizing alum as a coagulant and lime for pH control. The water treatment plant was converted from a rapid sand filtration plant to a high rate filtration plant in the mid-1960s. This modification was completed by expanding the treatment capacity beyond the existing 7 million gallons per day (MGD). The capacity of the new facility was 12.5 MGD, with capability for expansion up to 25 MGD.

The high rate filtration plant continues utilizing alum as a coagulant to aid settling and lime for pH control. During early operation of the new facility, the filter backwash water was discharged directly to Ashland Creek, with no treatment other than sedimentation in the original Granite Street impoundment.

The treatment process now consists of flocculation, sedimentation, filtration and disinfection. Water flows into the treatment plant after it is diverted from the generator, directly from the creek supply or from the TID inter-tie or some combination of all three sources. The water flows into a flash mixing tank, then to the flocculation and sedimentation basins. A chlorine solution is fed immediately ahead of the flocculation tanks. The chlorine feed is manually adjusted in response to the water temperature.

Following flocculation and sedimentation, the water flows through the filter beds in the treatment plant and then into a 168,000 gallon clearwell where the water is chlorinated. Water flows by gravity into Crowson Reservoir and the distribution system. A schematic of the treatment process is shown in Figure III-1.

Alum, soda ash, aluminum sulfate, and activated carbon can be mixed with the raw water in the flash mixing tank as part of the treatment process to aid in the removal of solid particles and other contaminates. The activated carbon is used only when TID water is included in the system or the color is high. Color may be the result of organic matter, manganese, copper or iron in the water. The activated carbon absorbs the organic material in the raw TID water which removes the water color. Mechanical flocculators were installed upstream of the sedimentation basins. Solids settling out in the sedimentation basin are mechanically removed from the bottom by a drag mechanism. Sediment from the flocculation chamber, sedimentation basins, and the filter backwash waste is piped to the sludge lagoon.

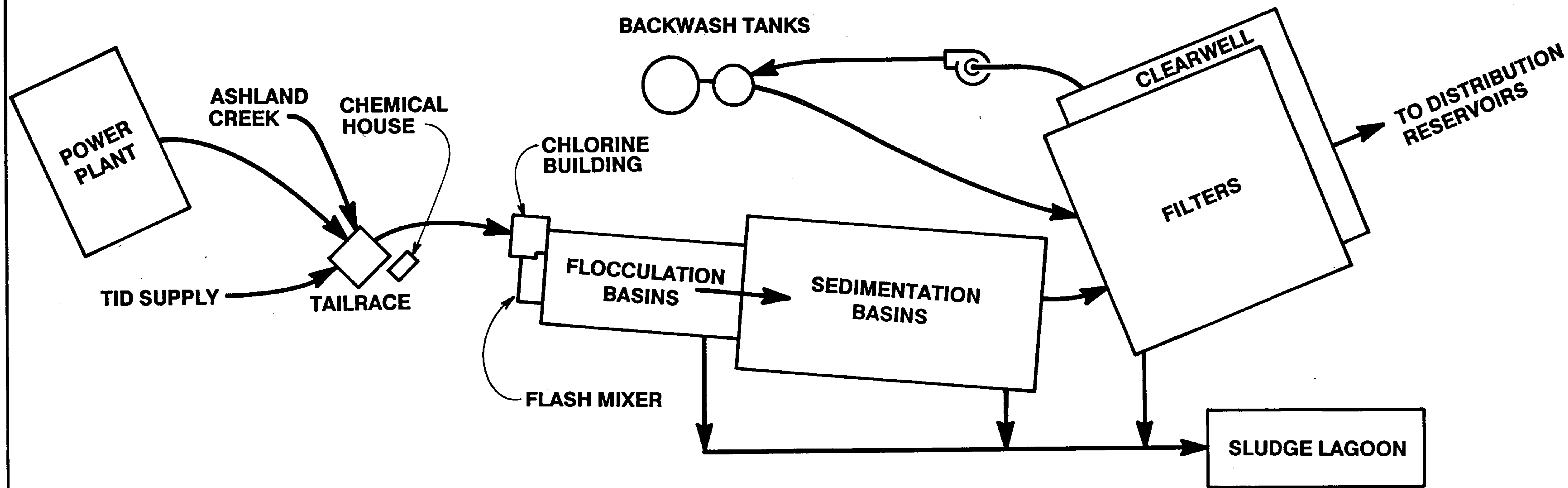


Figure III-1
City of Ashland
1990 Comprehensive Water Plan

WATER TREATMENT SCHEMATIC

The six filters contain a dual media filter material of sand and anthracite coal. These filters remove the remaining particles in the water before it enters the clearwell. Backwash water for the filters is pumped from the clearwell.

Water is supplied to Crowson Reservoir via a 24 inch-diameter transmission pipeline from the treatment plant. The pipeline flows from the clear well of the water treatment plant through 6,000 feet of steel pipe.

Administration and laboratory facilities are located in the control building. The laboratory has the necessary equipment to conduct routine water quality analysis. All of the records prior to 1990 were developed and maintained manually. A microcomputer was installed in early 1990 and is now used for generating reports and for storing data. This information can and will be used for a variety of purposes including inventory, process control, and maintenance.

The water treatment plant produces water that meets State and Federal water quality standards. The treatment standards are changing as a result of implementation of the 1986 amendments to the Federal Safe Drinking Water Act by EPA and the Oregon State Department of Health. Since not all of the rules and regulations have been issued, it is necessary to anticipate the impact on the Ashland existing water treatment facilities and making recommendations for future treatment improvements in this 1990 Comprehensive Water Plan.

b. Plant Performance and Finish Water Quality

The Safe Drinking Water Act (SDWA) was signed into law on December 16, 1974 and was one of the first legislative acts that addressed the water quality of a public water system. This Act was extensively modified by the 1986 SDWA Amendments. The 1986 Act requires EPA to promulgate a series of regulations which set forth standards for protecting sources of supply and treating water supplies to assure the quality of the water. Some of these regulations that are of particular interest include filtration, trihalomethanes, disinfection, and turbidity. The EPA is also required to establish maximum contaminant levels (MCL) for 83 contaminants which may have an adverse effect on public health and promulgate National Primary Drinking Water Regulations. According to the law, the contaminants and MCLs are required to be reviewed and the standards revised as appropriate at least every three years.

Most states are responsible for the primary enforcement of these standards. Each state with primacy is required to adopt drinking water standards no less stringent than the national primary drinking water standards and to establish regulations for enforcement of the standards. Oregon State Health Department (OSHD) has the responsibility for adopting and enforcing drinking water standards for the State of Oregon.

With the passage of the amendments to the Federal Water Pollution Control Act (PL 92-500) in 1972, discharge of the filter backwash water to Ashland Creek was no longer acceptable. In 1978, the City constructed a backwash water settling basin near the filter plant to remove accumulated sediments prior to discharge to Ashland Creek. Discharge of the backwash water supernatant is controlled by an NPDES permit which was renewed in early 1991.

Figure III-2

CITY OF ASHLAND
1990 COMPREHENSIVE WATER PLAN

PEAK RAW WATER

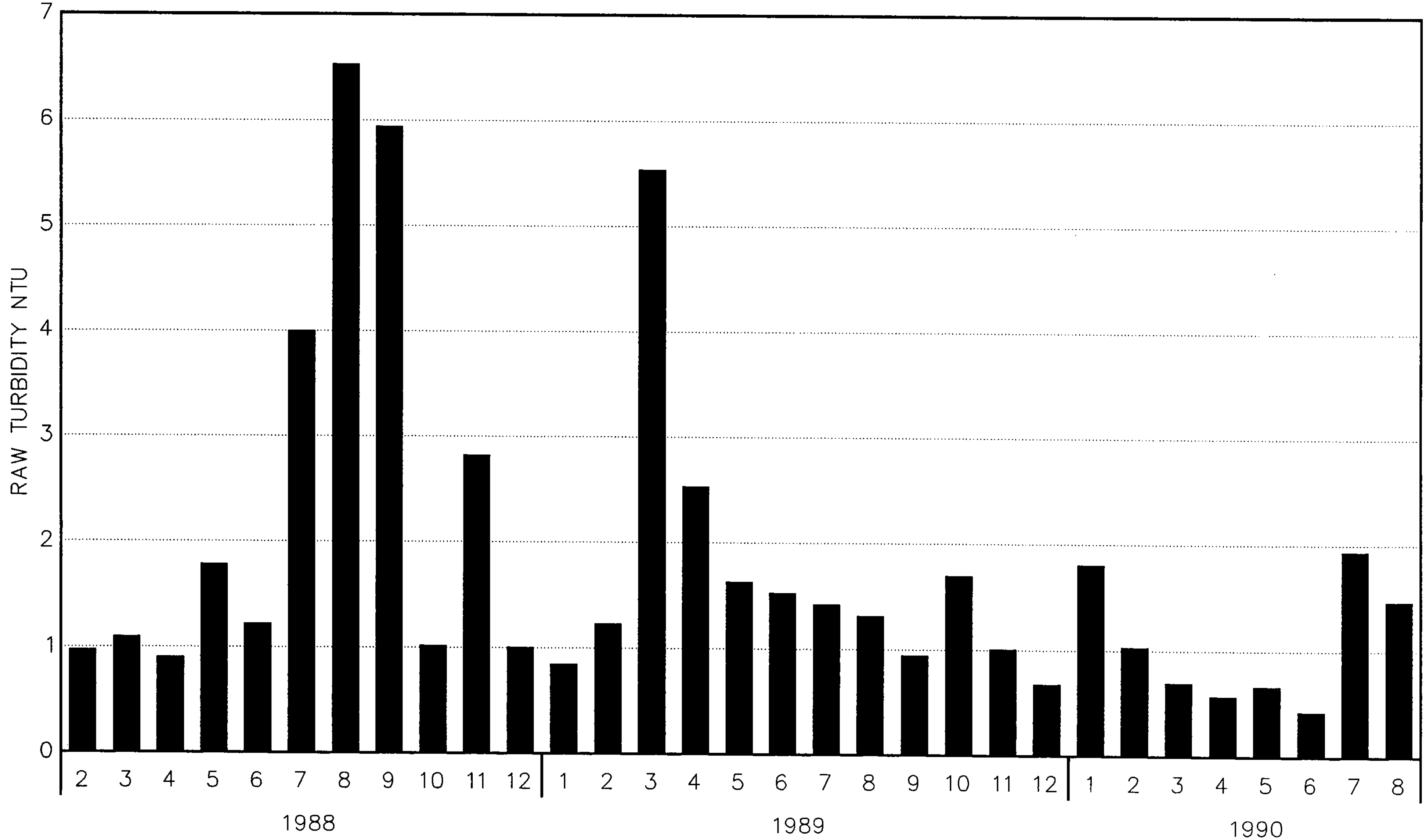
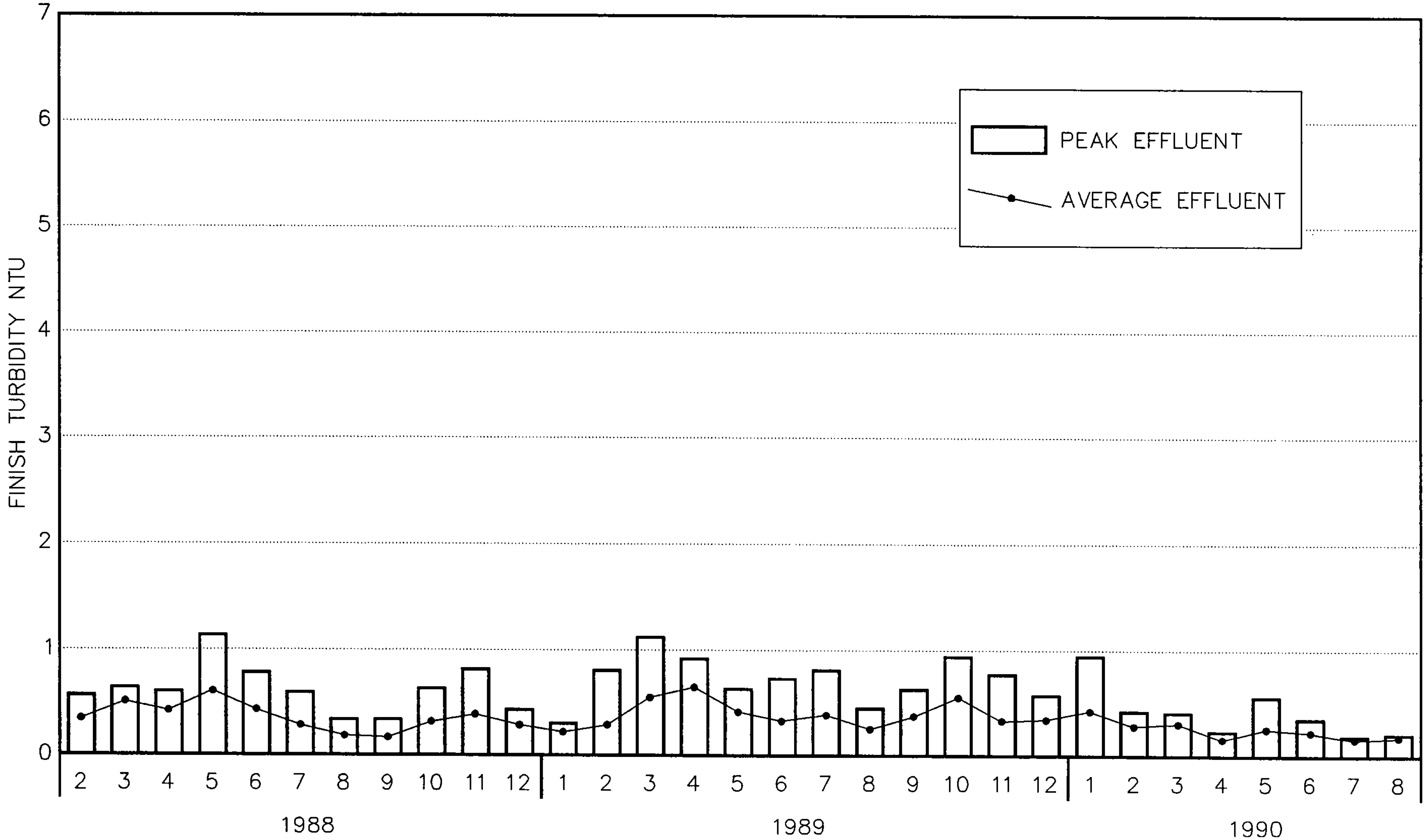


Figure III-3
CITY OF ASHLAND
1990 COMPREHENSIVE WATER PLAN

PEAK AND AVERAGE FINISH WATER



(3) Disinfection

All surface water systems are now required to have disinfection. EPA and OSHD are in the process of developing regulations for disinfection which could affect the City's treatment process. The new regulations may limit chlorine application concentrations for disinfection because of a concern over disinfectant by-products.

The OSHD proposed disinfection standards that are being developed will require a minimum chlorine residual of 0.2 mg/l be maintained in water supplied to the distribution system. The EPA Guidance Manual recommends that a disinfectant residual of at least 0.2 mg/l be maintained throughout the distribution system. It also specifies required "CT" times, which is the product of the disinfectant concentration in mg/l and the time of contact (in minutes) to ensure adequate time to remove viruses, etc. The City will need to demonstrate that the CT value for the water system meets the proposed disinfection requirements.

The detention time will be measured from the time the disinfectant is added to the time it takes to get to the first house on the distribution system. The CT can be calculated theoretically for a pipeline. However, in reservoirs, the contact time should be determined by tracer studies. Conservative estimates of the contact time in a reservoir can be estimated but they will not account for any short circuiting that may be occurring in the reservoir.

The City of Ashland has a fairly large amount of storage available in the water distribution system. Longer storage time increases the contact time of the chlorine and is effective in meeting the required CT values as long as water passes through the reservoirs before reaching the first customers. Although most waters do presently pass through either Crowson or Granite Street reservoirs and probably receive sufficient contact time, flows can bypass the reservoirs. If they do, they may not attain the required CT values.

Since the typical travel time for the chlorine through the system is high due to the available storage, the chlorine residual in the remote reaches of the system may be low. Low residuals in the remote reaches of most systems can be corrected by (1) routinely flushing or cleaning of the pipes, (2) flushing and disinfecting the portions of the system where a residual is not maintained, and (3) installing one or more chlorine injection facilities within the distribution system. The apparent low residuals in the southeast portion of the Ashland system present some slightly different options and will be discussed in a later section.

The use of chlorine alone may not be a viable disinfectant option for keeping a chlorine residual throughout the system. Other disinfectants such as ozone, chlorine dioxide and chloramines may need to be looked at. Ozone is the strongest disinfectant; however, equipment used to generate it is relatively expensive and complex to operate. Chloramines are less effective as a primary disinfectant than are free chlorine, chlorine dioxide and ozonation. They are ideal for systems that have no potential sources of human enteric viruses in the watershed. Coos Bay Water System, scheduled to be completed by the end of 1990, will be using chloramines as their primary disinfectant.

The CT values in the proposed disinfection regulations needed to achieve identical bacterial/viral kill under similar conditions are as follows:

	"CT"
Ozone	1
Chlorine dioxide	14
Chlorine	67
Chloramines	750

Chlorine dioxide has become a viable alternative to chlorine in many applications because it does not cause the formations of TTHM's. Although there is insufficient evidence to determine health risks caused by chlorine dioxide at this time, the EPA is limiting the maximum application of chlorine dioxide to 1 mg/l as a precautionary measure until more information becomes available on any toxicological effects. It is possible the dosage may change when more information becomes available. As a point of interest, France has allowed the use of chlorine dioxide at dosage concentrations of 1.5-2.0 ppm since 1966 without apparent adverse health effects.

Current Federal regulations require total trihalomethane (TTHM) concentration in finish water to be 100 ppb or less. There is the possibility that the regulatory TTHM concentrations could be reduced to 50 ppb in the near future. During the 1988-1989 time period, TTHM were tested a total of eight times in the Ashland water treatment plant. The average finish water TTHM concentrations were approximately 40 ppb while the peak TTHM concentration observed was 64.8 ppb in May 1989.

Color measurements were compared with the corresponding results of the TTHM samples.

Date	TTHM (ppb)	Color (color units)	Conditions
7/26/88	12	0-1	No precipitation
8/3/88	12	0-2	No precipitation
11/14/88	34	6-7	Recent rainfall activities
5/16/88	38	8-12	
9/19/88	40	0	TID water
2/16/89	52	8-9	Recent rainfall activities
2/8/88	53	4	
5/15/89	65	5-7	Recent rainfall activities

It appears that high color and presence of TTHM occur when the raw water is turbid from either precipitation in the watershed or when TID water is used to meet the system demands. In either case, the plant adds alum and soda ash to the treatment process which has proven to effectively reduce turbidities.

If TTHM's become a problem, the TTHM precursors (organic compounds) could be removed by feeding powdered activated carbon, which the plant is capable of doing. Pretreatment disinfection, to prevent microbial growths from occurring in the flocculators/sedimentation/filtration process, would have to be provided by a non-TTHM forming disinfectant such as chlorine dioxide.

(4) Organic/Inorganic Contaminants

During the past two years, Ashland has tested its raw water three times for volatile organics, organics and the EPA/OSHD primary drinking water parameters (inorganics and some additional tests). Results of these tests are included in Appendix A. Current Federal law required the following test schedule:

❑ inorganics	every year
❑ chlorinated hydrocarbons	every 3 years
❑ volatile organics	every 5 years
❑ radionuclide	every 4 years

Ashland has not conducted the test for chlorinated hydrocarbons during the past two years; therefore, it cannot be determined if there is a problem. Ashland has complied with the other current mandated test schedule and we are not aware of any problems in the samples taken.

(5) Lead and Copper

The August 18, 1988 Federal Register included a proposed rule for lead and copper concentrations in public water systems. The existing primary standards include a MCL for lead of 0.05 mg/l while copper is currently a secondary standard with an MCL of 1 mg/l. The proposed rule includes MCLs for lead and copper (0.005 mg/l and 1.3 mg/l), respectively, as measured at the entry point to the distribution system) and regulations for treatment techniques in controlling these contaminants and their by-products. The level of copper and lead in Ashland's raw water appears to be below the proposed MCLs. However, the final rule has not been promulgated and options which could require monitoring at the consumers tap are still under consideration.

Exposures to high levels of lead can cause adverse affects related to the circulatory system, the nervous system, the kidneys, and reproductive and cardiovascular systems. High concentrations of lead can also affect growth and development. Lead in the drinking water occurs from either the water source or corrosion and leaching of plumbing materials in the water distribution system.

Treatment techniques to minimize lead and copper in source water include coagulation/filtration, ion exchange, lime softening, and reverse osmosis. The presence of lead and copper as corrosion by-products is influenced by the pH and alkalinity of the water. Water with a pH higher than 8.0 is less corrosive toward lead and copper than those below 8.0.

Under the proposed rules, improved treatment techniques would be required if a system failed to meet specified levels in any of the targeted samples. A system is in compliance if the lead concentration is less than or equal to 0.010 mg/l, the copper concentration 1.3 mg/l or less in a minimum of 95% of the targeted samples and pH values greater than or equal to 8.0 following the same criteria. If any of the three levels are not met, a public water system would have to improve treatment or add corrosion control to the water treatment.

(6) Coliform Bacteria

The MCLs have been established based on the number of monthly samples taken, which in turn depends on the population the system services. The OSHD is proposing to change the requirements from a specific number of coliforms allowed per sample to simply reflect the presence or absence of coliforms. This new regulation would have little impact on Ashland's operation as coliforms have not been detected in their system. If coliforms are detected, the new regulations will have a more extensive reporting process than the current regulations.

(7) System Control

The Ashland water treatment plant is operated manually by the operators at the treatment facility 24 hours a day during the summer months and 16 hours per day the remainder of the year. The plant operators turn pumps on and off and make other adjustments in the plant operation in response to system demands. The equipment has been replaced as they wear out and many of the controls are manually operated with some newer controls being pneumatic.

The instrumentation generally consists of various alarms (chlorine status, pressure, etc.) and monitoring devices. Flow (raw and treated water), clearwell level and chlorine cylinder bank weight are some of the more significant parameters that are continuously monitored. The readout of these instruments is in the control building.

The monitoring devices located in the control building are not used for control since actual control is manual. This type of control is relatively easy to achieve because the raw water input and finished water output are monitored. The chemical feeders are all manually set according to the desired dosage based on temperature, pH, and flow rate.

(8) Conclusions

The water quality and treatment performance records currently maintained by Ashland's water treatment plant personnel indicate that contaminant levels are less than the established MCLs. Using activated carbon and alum during high color days and when TID water is present should ensure that the proposed 0.5 NTU turbidity limit can be met. Insufficient data exist to determine the presence of chlorine residual throughout the distribution system. Reducing the turbidity and making sure the chlorine residual is present are key factors in removing pathogenic organisms and viruses.

c. *Chlorine Residual in Distribution System*

As discussed in a previous section, the water supplied to the City of Ashland system receives chlorination as its primary means of disinfection. Chlorine is added at the water treatment plant in sufficient quantities to provide a chlorine residual throughout the system. However, since construction of the Alsing Reservoir in the southeast corner of the water system, low chlorine residuals have been suspected in this area although there is very little data to confirm actual residual levels in the system.

The 1986 Safe Drinking Water Act Amendments and subsequent regulations prescribe specific contacts times for various disinfectants, state that the minimum residual entering the distribution system cannot be less than 0.2 mg/l for greater than four hours, and that a residual cannot be absent in more than 5 percent of the samples for two consecutive months in the distribution system. The regulations further prescribe the number and frequency of samples that should be taken and reporting requirements.

There appear to be several factors which may be contributing to low residual values within the Ashland water system. The major factor appears to be the amount of time water is stored within the system before it is delivered to customers in the southeast portion of the City. Water is stored temporarily in Crowson Reservoir before it is transmitted to the southeast area of the City. Since nearly all of the 3 million gallons per day average annual demand passes through the 2 million gallon reservoir, the average detention time in Crowson is approximately 16 hours. Under present operating procedures, the average annual demand on the Alsing Reservoir is probably less than 300,000 gallons per day. Since Alsing Reservoir also has 2 million gallons of storage, the average detention time may be between 6 and 7 days.

The relatively low demands in the portion of the city served by the Alsing Reservoir also results in very low velocities within the distribution system. The resultant long detention times within the distribution system may also contribute to the low chlorine residuals.

Once the water leaves the treatment plant, a number of factors contribute to the chlorine reduction. Major factors typically include time, temperature, pipeline materials, and the quality of the water itself. Poorer quality waters, for instance, will tend to deplete the chlorine quantities at an increased rate. The operating records for the water treatment plant indicate that the chlorine residual leaving the plant is in the order of 0.4 to 0.6 mg/l. This level may be sufficient to meet applicable criteria prescribed by the regulations but it is generally less than the level maintained by many water treatment plants. A level of 1.0 to 2.0 mg/l is not an uncommon chlorine residual leaving water treatment plants. This may be a factor in the low residual found in the extremities of the system. Since increasing the chlorine residual may also increase TTHM's, close monitoring may be needed to arrive at an optimum chlorine residual.

2. CAPITAL IMPROVEMENT PLAN

a. Treatment Plant Improvements

As part of the analysis performed in evaluating the recommended water supply system improvements, the unit processes within the water treatment plant were evaluated. Recommended improvements, numerically identified by feature, are summarized below. The costs of these improvements are summarized in Table III-1 as a Capital Improvement Program for the Treatment Plant.

Table III-1
Capital Improvement Program
Ashland Water Treatment Plant

Year	Description	Costs
1991	Tracer studies; treatment plant reservoir system	$5,000 - 20,000
1991-1992	Safety improvements grating deluge system	$8,000 - 15,000
1993	Hydraulic and process investigation	$18,000
1994	Instrumentation and controls study	$5,000 - 15,000

(1) Physical Plant

The plant structures appear generally to be in sufficiently good condition to provide service for another 10 to 20 years with some renovation. Some of the mechanical equipment, electrical systems, and instrumentation should be replaced with equipment that will allow the operators to monitor proposed operating conditions and to modify the treatment process to meet new State and Federal water quality standards.

The existing manual control operation is simple and appears to be effective for the Ashland treatment plant. It may be possible to conserve energy and chemicals by closer, continuous, automatic control. However, any savings could be offset by capital and maintenance costs for the control system.

Control systems vary in sophistication from simple manual systems to highly complex computer controlled systems. It is difficult to establish a level of instrumentation and automatic control appropriate for a given situation without considering all the aspects (degree of sophistication of controls, cost-effectiveness of the control system, availability of skilled personnel to operate and maintain the system currently and in the future, etc). A study is recommended to consider these issues prior to initiating extensive improvements. The study should also consider operational needs for the distribution system.

(2) Disinfection

Pretreatment with a disinfectant is required to prevent algae and slime growth in the treatment plant tankage and filters. Disinfection is required prior to discharge to the distribution system. A tracer study is recommended to determine the CT value of the disinfectant both as it enters the system and throughout the system. If the CT values are lower than allowed, some modifications to the disinfection process at the plant may be required. The tracer study should interface with the investigation of distribution system chlorine residuals.

(3) Safety Issues

The site visits revealed some safety items in the chlorination room and hand rails were missing on some of the walkways. The plant personnel indicated an eyewash station was not required by the State. Some states have recently been requiring scrubbing systems to neutralize the chlorine gas. Although the chlorine room meets the current code requirements, changes in the fire code may require modifications as much as $60,000. Hand rails and safety grating should be checked to make sure they meet OSHA requirements.

(4) Corroded piping

As part of the overall maintenance of the plant, corroded pipes, defective values, and leak stains should be investigated and replaced. These maintenance items are clearly being done throughout the plant on a routine basis. Specific piping, valving and related materials are not addressed here but a budget of $5,000 to $10,000 is recommended annually.

(5) Head loss indicators

The head loss indicators on the filter beds appeared to be worn and should be replaced. New indicators are recommended; specific types should be evaluated in the instrumentation study recommended above.

(6) Space limitations

Because of its location in the Ashland Creek Canyon, there is little room for expansion of the treatment plant. Currently, the plant can produce 12.5 MGD and demands are expected to exceed this capacity by about 2005. In light of Ashland's need to develop additional firm water supplies within the next 5 to 10 years, it is recommended that the present treatment plant continue to be used until its capacity is reached. At that time, a study will be required to identify the plant's capacity to meet current drinking water regulations, costs to expand the plant, and alternative locations and desirability of constructing a new plant. It should be at least 10 years before this study is needed.

b. Disinfection Modifications

There appear to be a number of factors which contribute to the low residual chlorine levels in the southeast portion of the service area. A very detailed study and sampling program may be needed to pinpoint the specific causes of the depletion and to develop alternative measures to improve chlorine levels. However, there may be a few relatively inexpensive actions that can be taken by the City prior to undertaking a major study of the problem and implementing expensive solutions. Suggested first phase actions include:

(1) Increase the chlorine residual leaving the water treatment plant. Higher levels of chlorine can be injected during the treatment process and the residuals in the distribution system observed. Chlorine levels should be monitored at various points in the system and not just in the areas where low residuals have been noted. High levels throughout the system may not be acceptable solutions to an isolated problem in one area of the system. This effort should be coordinated with the tracer study recommended above.

(2) Reduce the storage levels in Alsing Reservoir. The modeling efforts indicate that only about 500,000 gallons of storage is needed in Alsing Reservoir under early 1990 conditions, including fire protection storage. By 2000, only about a million gallons will be needed. Consequently, reducing the storage in Alsing Reservoir to about 500,000 gallons will reduce operating pressures slightly but will reduce residence times to a little over a day.

These two recommendations can be tried at very little cost to the City and hence may be inexpensive solutions to the problem. If these actions do not produce the desired results, a second set of alternatives can be tried:

(3) Bypass Crowson Reservoir with the 16-inch pipeline which serves the southeast area. The 16-inch pipeline constructed in 1976 is fed directly from Crowson Reservoir and cannot be served directly from the water treatment plant. It may be feasible to construct a connection between the 16-inch line and the 24-inch line from the treatment plant and hence reduce the detention time by about 16 hours. Since this option may reduce the CT values for water service in the southeast portion of the City, new CT values should be calculated before proceeding.

(4) Increase demands on Alsing Reservoir. Increasing the amount of water delivered directly from Alsing Reservoir will result in a decrease in residence time and hence an increase in the chlorine residual. This can be done by selectively closing valves in the distribution system or by constructing minor connections and valve

closures. Valve closures in the 12-inch and 16-inch lines on lower Hillview Drive, for instance, appear to increase the demands for water from Alsing by about 100,000 gallons per day. Likewise, it may be possible to feed water from the southeast high zone into the high zone near Woodland Drive and Leonard Street through minor pipeline connections and valve closures.

If the above actions do not correct the chlorine residual problems presently being experienced, it will probably be necessary to construct a rechlorination station in the vicinity of Alsing Reservoir. A preliminary design study will be needed to determine if chlorine should be added in the system and the design parameters that should be used for the facility. It probably will be necessary to add chlorine (or other disinfectant) on the influent line into the reservoir so that the recommended contact time can be obtained.