ORDINANCE NO. 493

AN ORDINANCE ADOPTING A MORATORIUM ON PLANNING APPROVALS FOR LAND DEVELOPMENTS THROUGHOUT THE CITY OF WILSONVILLE DUE TO A LACK OF WATER SYSTEM CAPACITY; AND DECLARING AN EMERGENCY.

WHEREAS, the City of Wilsonville is a home rule city under the laws of the State of Oregon and has a duly acknowledged Comprehensive Land Use Plan; and

WHEREAS, the City's acknowledged Comprehensive Land Use Plan is intended to ensure that the rate of community growth and development does not exceed the community's ability to provide essential public services and facilities, including adequate water for domestic, irrigation, and fire-fighting purposes. The City's acknowledged Comprehensive Land Use Plan further provides that a continued source of water will be available to meet the City's growing needs into the future, but the City's acknowledged Comprehensive Land Use Plan is silent as to how the City is to provide water service without an adequate source of water, as is illustrated by its text:

(a) City Comprehensive Plan Objectives include:

3.1 Urban development should be allowed only in areas where necessary services can be provided.

3.4 Require that primary facilities be available or under construction prior to issuance of a building permit

(b) The City's acknowledged Comprehensive Plan policies also commit the City to provide water service that keeps pace with development:

3.2.1 The City shall review and, where necessary, update the Water System Master Plan to conform to the densities shown on the Comprehensive Plan and any subsequent amendments to the Plan.

a. All major water lines shall be extended in conformance to the line sizes indicated on the Master Plan and, at a minimum, provisions for system looping shall be made. If the type, scale, and/or location of a proposed development warrants maximum fire flows, the Planning Commission may require completion of a loop in conjunction with the development.

b. All line extensions shall be made at the cost of the developer or landowner of the property being served. When a major line is extended that is sized to provide service to lands other than those requiring the initial extension, the City may:

1. Authorize and administer formation of a Local Improvement District to allocate the cost of the line improvements to all properties benefiting from the extension; or

2. Authorize and administer a payback system whereby the initial developer may recover an equitable share of the cost of the

extension from benefiting property owners/developers as the properties are developed.

c. All line extension shall be extended the full frontage width of the property being served, so as to provide for further connection of adjoining properties.

d. All water lines shall be installed in accordance with the City's urbanization policies and Public Works Standards.

3.2.2 The City shall continue to develop, operate, and maintain a water system, including wells, pumps, and reservoirs, capable of serving all urban development within the incorporated City limits. The City shall also maintain the lines of the distribution system once they have been installed and accepted by the City (see Policy 3.2.1.b).

3.2.3 The City shall, through a Capital Improvements Program, plan and schedule major water system improvements needed to serve continued development, e.g., additional wells, pumps, and reservoirs.

WHEREAS, the City finds there is a demonstrated need to prevent a shortage of water for domestic and fire flow usage which would occur during the period of the proposed moratorium

commencing January 5, 1998, through the following six months and which justifies a moratorium pursuant to ORS 197.520(2) for new land development approvals; and

WHEREAS, based upon reasonably available information, the City makes the following findings in support of the above finding of demonstrated need:

(a) The extent of need beyond the estimated capacity of existing public water facilities expected to result from new land development, including identification of the current operating capacity, together with the portion of such capacity already committed to development, are as follows:

1. The development approvals as of November 26, 1997, together with present water users, are projected to use 7.41 million gallons per day (MGD) of water capacity on a maximum day as set forth in Exhibit A, attached hereto and incorporated herein; and

2. The City's source of water for City water uses is from eight wells which will produce 5.49 MGD on a maximum day after the new Boeckman well is equipped and connected to the system; and

3. The Boeckman well is the last well which the City is allowed by the State's Water Resources Department. However, the City has ground water rights of 13 cubic feet per second (cfs) and the current eight wells produce up to 9 cfs. This then appears to provide a paper option of drilling either deeper or more wells to provide additional capacity. But even if deeper or additional well(s) were allowed under the aforementioned rights and the doctrine of secondary appropriation, the aquifer level is declining at such a rate that any further ground water usage would threaten existing capacity both in the near term and the long term; and

4. The City experience with water conservation provides a reasonable expectation that a diligent effort at water conservation will reduce maximum day water demand by 1.19 MGD; and

5. A review of well production data indicates one well has been attributed with providing an additional 0.13 MGD which it has not produced, thereby reducing the calculation of overall water capacity demand by a like amount; and

6. The present reservoirs have a capacity of 5.9 MGD and the City has planned and funded an additional reservoir of 2.0 MGD to come on line in 1998, and it is projected that 0.6 MGD of maximum day water capacity can be satisfied by use of reservoir capacity while maintaining a safe fireflow reserve; and

7. The above combination of existing capacity, water conservation, well production calculations, and new reservoir capacity, provides a projected capacity of 7.41 MGD for maximum day usage; and

8. While market forces have caused development to occur at a faster rate than could be reasonably anticipated, there are still 715 acres of residential land, 399 acres of industrial land, and 82 acres of commercial land which are undeveloped and will need to be served by a projected 7.0 MGD of additional capacity, exclusive of the need to serve urban reserve areas or any prison complex in the future; and

9. The City has employed the consulting firm of Montgomery Watson to analyze viable alternatives for the City to provide the needed water capacity. A copy of Montgomery Watson's report, dated March, 1997, is made part of the public record, marked Exhibit B and incorporated by reference herein. In addition to the recitals above

and the aforementioned Montgomery Watson report, the City has taken the actions set forth in the Director of Public Works report, dated November 7, 1997, marked Exhibit C-1, made part of the public record. The City has been working towards a plan of correction and must do so pursuant to ORS 197.530. Any plan of correction must weigh and balance the different alternatives, the probable cost of each, what the best result for such expenditure will be given scarce dollars and the projected build-out capacity and water needs of such development, and the reasonable ability of the City to ultimately finance any such costs. But until a reasonable plan of correction can be developed, including adequate funding, the need for establishing a moratorium on new development based on lack of water capacity is clearly and convincingly demonstrated.

(b) The shortage of water affects the whole city. Wilsonville is not a large city, geographically including a total of approximately six square miles. Thus, the City finds that the moratorium is reasonably limited to the whole geographical area of the city;

(c) While there is some elasticity in the projected water demand within the developments approved, in that should a development not go forward within two years of its development approval it could, therefore, forfeit its development permit and free-up its demand on water capacity. The City cannot reasonably make projections based upon a developer not exercising an approved right. Nor can the City commit its reserves for fire safety to domestic use. In the past three years the City has experienced one fatal fire and at least one other fire that could have spread to other dwelling units if not for an adequate supply of water held in reserves.

Currently, the City has previously-approved projects for development which have not yet been built, totaling 230 single family dwelling units, 742 multi-family dwelling units, 350,000 square feet of commercial floor space, and 674,000 square feet of industrial floor space. This is sufficient to accommodate additional growth for approximately two years before significantly impacting other nearby communities. Nor is the moratorium intended to stop development approvals wherein there is no increased demand upon water capacity. Therefore, the housing and development needs of the City have been accommodated as much as possible by (1) having allowed development approvals to progress to the point that, if built, all capacity will be used, and (2) allowing development which will not increase demand upon water capacity. Moreover, in the event that any such development rights are forfeited which would otherwise use water capacity, it appears that the development of properties along the recently established local improvement district (LID) No. 12 should be given first priority in order to accommodate as much as possible the geographical area which most likely can provide the greatest additional housing and meet economic development needs, given the recent investment in major public improvements to serve this area by the property owners within LID No. 12; and

WHEREAS, pursuant to ORS 197.520(1)(a), the City has provided written notice to the Department of Land Conservation and Development on November 13, 1997, which is more than 45 days prior to the final public hearing for January 5, 1998, on this ordinance; and

WHEREAS, pursuant to ORS 197.520(1)(b), the City has made written findings justifying the need for the moratorium in accordance with ORS 197.520(2); and

WHEREAS, a duly noticed public hearing was conducted before the City's Planning Commission on December 10, 1997, after which the Planning Commission adopted Resolution

97PC03, recommending that the City Council enact a moratorium as provided in this ordinance; and

WHEREAS, pursuant to ORS 197.520(1)(c), on January 5, 1998, the City Council has held a duly noticed public hearing on declaring a moratorium based on the lack of water capacity to serve new development and the findings which support the moratorium.

NOW, THEREFORE, THE CITY OF WILSONVILLE ORDAINS AS FOLLOWS:

Section I: FINDINGS AND DETERMINATIONS

A. The City Council adopts the above recitals as findings and incorporates them by reference in support of this ordinance.

B. The Wilsonville City Council hereby determines that:

1. A moratorium based upon lack of water capacity for new development is declared. This moratorium shall not apply to a development which has a Stage II development approval set forth in Exhibit C-2 and otherwise complies with the City's laws, ordinances, rules and regulations. Unless otherwise set forth in this ordinance, no applications for land use approvals, shall be accepted or granted which will create an increased demand for water service during the moratorium period set forth below. Except, however, that those applications which have received Development Review Board approval subject to City Council review, or DRB recommendation for City Council approval, as of the effective date of this ordinance shall be reviewed by the City Council. New development shall include, but is not necessarily limited to, land partitions or

subdivisions, conditional use permits, variances, zone changes, phase II planned development approvals.

2. Applications for land use approvals may be allowed to go forward to development only where it is found by the City decision-makers, who are empowered by local ordinance to take action on development applications, that the development will not cause an increased demand for water service. Allowing developments which will not cause an increased demand for water to proceed is an additional accommodation to housing and economic needs. Also, the development of a public school that has no summer-school program and no summer irrigation of landscaping can be deemed to be a development that will not cause an increased demand for water service during that portion of the year when water shortages are critical. To the extent that Phase 3 of the Teufel Village (Village at Main Street) development was included as having Stage II approval in the City's water calculations shown in Exhibit C-2, it shall continue to be so accounted as it is inextricably woven into a settlement agreement and development agreement with the City and this area will accommodate additional housing and economic development needs. The development agreement with Capital Realty also affords Capital's Wilsonville Town Center project to receive similar treatment as Teufel Village and the Wilsonville Town Center project shall be included in Exhibit C-2 under Stage II approvals similar to Teufel Village, with 93,000 gallons per day Capital Realty indicated as the amount of water necessary for their buildout. The

City's approval of the Teufel Village development occurred at a time when water was projected to be available to the entire project. In the event an approved development forfeits its rights to water capacity, the first priority to such rights shall be given to the properties involved in LID #12, and to those other properties listed in Exhibit C-2 as "Projects with planning approval subject to availability of water," by order of the date of their completed development application on file with the City, and the City shall continue to process LID #12 development applications in order to establish their priority rights in order to accommodate to the greatest extent possible needed housing and economic development.

3. The West Linn - Wilsonville School District, having recently obtained voter approval of funding to construct an additional school in Wilsonville, shall be permitted to seek development approval to construct that school. Approval of that development application shall be contingent upon a development agreement between the City and the District, establishing a contract for the interruptible provision of water (allowing the City to curtail water to the school during the summer peak water-use months), precluding summer-school programs, and limiting the use of water for irrigation.
4. Allocations of water capacity based upon development approval shall not be transferred from one site to another. However, the capacity allocated to existing developments may be allocated to replacement uses on the same site, provided that no increase in water demand results.

5. The Community Development Director is authorized to determine the appropriate allocations of water to both existing and proposed developments. Further, the Community Development Director is directed to provide a plan for correction within 60 days of the enactment of this ordinance.
6. The Community Development Director and Public Works Director shall regularly report to the City Council on the effectiveness of water conservation efforts. In the event that the City's program to encourage water conservation proves to be more successful than anticipated, and the Community Development Director determines that such success warrants modification of the table shown as Exhibit A, the Community Development Director shall make the necessary changes and advise the City Council and the public accordingly.
7. Community Development Staff shall issue no permits for water system connections that are not specifically intended to serve developments that have received City land use approval, as specified in number 2, above.
8. The Development Review Board and City Planning staff are directed to ensure that landscaping plans include drought-tolerant plant species or otherwise minimize the demand for irrigation water.
9. Notwithstanding any other City requirements to the contrary, those developments listed in Exhibit C-2 as "Projects with planning approval subject to availability of water" shall have the effective time of their development approvals tolled (i.e., continued) beyond their two-year

expiration for a time equal to the duration of this moratorium, including any extension that may legally be granted.

10. In the event that the State of Oregon formally demands that the City provide water to a correctional facility, the City Attorney is authorized to file an action in Circuit Court, naming the State's Department of Corrections, and any parties whose property development rights to connect to City water would be jeopardized by the State's actions. Such action shall seek to have the Court determine who shall receive City water pending a resolution to the lack of capacity.
11. This moratorium shall expire six months from the date of its enactment unless otherwise extended in accordance with state law.

Section II. VALIDITY and SEVERABILITY

The validity of any section, clause, sentence or provision of this ordinance shall not affect the validity of any other provision of this ordinance which can be given effect without reference to the invalid part or parts.

Section III. EMERGENCY DECLARED

The matters contained herein concern the public health, welfare and safety. An emergency is hereby declared to exist, and this ordinance shall become immediately effective upon its passage by the City Council.

SUBMITTED to the Wilsonville City Council and read for the first and second time at a regular meeting thereof on the 5th day of January, 1998, commencing at the hour of 7 p.m. at the Wilsonville Community Center.

Sandra C. King
SANDRA C. KING, CMC, City Recorder

ENACTED by the Wilsonville City Council at a regular meeting thereof this 5th day of January, 1998, by the following votes:

YEAS: 5 NAYS: -0-

Sandra C. King
SANDRA C. KING, CMC, City Recorder

DATED and signed by the Mayor this 7th day of January, 1998.

Charlotte LeHan
CHARLOTTE LEHAN, Mayor

SUMMARY OF VOTES:

Mayor Lehan	Yes
Councilor Kirk	Yes
Councilor Luper	Yes
Councilor Helser	Yes
Councilor Barton	Yes

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Exhibit A

WATER ASSURANCE CHECK			
	Supply		
1/7/98	**January 1997 Report**	**October 1997 Status**	Jan 1998 Status
Production with new well	5.55 MGD	5.38 MGD	5.49 MGD
Use of reservoir to meet maximum day requirement	0.20 MGD	0.20 MGD	0.20 MGD
Continued voluntary reduction of max day demand by the top 10 irrigation users	0.41 MGD	0.41 MGD	0.41 MGD
Mandatory curtailment of irrigation to 2/3 of normal use	0.78 MGD	0.78 MGD	0.78 MGD
Reduction in "unaccounted for" water that has previously been identified	0.13 MGD	0.13 MGD	0.13 MGD
20% of new reservoir capacity	0 MGD	0.40 MGD	0.40 MGD
Source to be identified			0.09 MGD
Total	**7.07 MGD**	**7.30 MGD**	**7.50 MGD**
	Demand		
	January 1997 Report	**October 1997 Status**	**Jan 1998 Status**
Unconstrained maximum day consumption - Summer 1996	5.66 MGD	5.66 MGD	5.66 MGD
Approvals not included in summer 1996 consumption	1.36 MGD	1.61 MGD	1.84 MGD
Total	**6.99 MGD**	**7.27 MGD**	**7.50 MGD**
Available for future projects	**0.08 MGD**	**0.03 MGD**	**0.0 MGD**

City of
WILSONVILLE
in OREGON

30000 SW Town Center Loop E
Wilsonville, Oregon 97070
(503) 682-1011
(503) 682-1015 Fax
(503) 682-0843 TDD

MEMORANDUM

EXHIBIT C-1

DATE: NOVEMBER 7, 1997

TO: MIKE KOHLHOFF

FROM: JEFF BAUMAN JB

RE: WATER SUPPLY PLANNING

Over the past years, the city of Wilsonville has undertaken numerous steps to address future water supply needs. The following list identifies key activities that have occurred, with emphasis on planning and engineering studies that have occurred.

1989: Regional Providers Advisory Group
Technical staff representing 35 agencies (including Wilsonville) convened monthly to discuss/coordinate water supply issues of regional interest.

1991-92: "Water Source Options Study"
This engineering study represented Phase I of a regional planning effort. It evaluated 29 potential sources of water for the Portland/Vancouver metropolitan area. It concluded that 6 of these options merited further analysis. The study was conducted for the 35 agencies of the Regional Providers Advisory Group, which included the city of Wilsonville. The study was conducted by an engineering consulting team headed by CH2MHill.

1992 to present: Water conservation efforts and/or curtailment programs have been implemented every summer in Wilsonville (ranging from public education and requests for voluntary reduction in water usage, to mandatory restrictions during peak demand periods).

1992-94: Willamette River pilot plant
A pilot-scale water treatment facility was set up in Wilsonville to demonstrate how "raw water" from the Willamette River could be treated with readily available technologies to provide water which meets all federal and state drinking water standards. The project was conducted by the Tualatin Valley Water District, with support from the city of Wilsonville.

1993: Second Elligsen reservoir placed in service.

1993: Canyon Creek well placed in service.

1993-96: "Regional Water Supply Plan"
This engineering study represented Phase II of the regional planning effort. It evaluated the 6 most promising supply options in greater detail and concluded that a combination of sources (including the Willamette River) should be protected

and be available to meet future potable water needs of the region. The study was conducted by an engineering consulting team headed by Barakat & Chamberlin. Wilsonville was one of 28 agencies participating in this study.

1996: "Water Conservation and Management Plan"
This state-mandated report was prepared for Wilsonville by Montgomery Watson (consulting engineers). The report described the city's water resources, how to manage them efficiently, and forecasted future water supply needs of the city.

1996: "Willamette River Water Supply Study"
This engineering study evaluated potential service areas and water demands which might be served from a Willamette River water treatment plant. The lead agency for this study was the Canby Utility Board. The other participating agencies were: Wilsonville, Sherwood, Tigard, Tualatin Valley Water District, and Clackamas River Water District. The consulting engineer was Montgomery Watson.

1996: "Willamette River Water Treatment Plant Project Sizing and Regional Network Analysis"
This engineering study evaluated potential water treatment plant sites and water transmission line routes for supplying potable water from the Willamette River. The lead agency for this study was the city of Wilsonville. The other participating agencies were: Tigard, Sherwood, Tualatin, Tualatin Valley Water District, Canby Utility Board, and Clackamas River Water District. The consulting engineer was Montgomery Watson.

1996-97: "Clackamas Basin Water Treatment and Supply Options Study"
This engineering study evaluated alternative methods, sites, and transmission routes to develop additional water supply from the Clackamas River to meet future demand within the Clackamas sub-region - - and to potentially "export" water to other service areas (such as Wilsonville). The lead agency for this study was Clackamas River Water District. The other participating agencies were: South Fork Water Board, Oak Lodge Water District, Mt. Scott Water District, Damascus Water District, Gladstone, Lake Oswego, Milwaukie, Portland, and Wilsonville. The lead consulting firm was Black and Veatch.

1997: "Water Supply Study"
This engineering study evaluated alternative methods to meet the near-term and long-term water supply needs of the city of Wilsonville. It concluded that for Wilsonville, the least costly and most reliable future source of water would be the Willamette River. This study was conducted by Montgomery Watson (consulting engineers).

1997: "Washington County Supply Line Capacity Analysis"
This engineering study evaluated methods to divert water from the Trask/Tualatin and Bull Run water supplies to meet peak summer demand in portions of Washington County and in Wilsonville. The study pointed out that any such diversions would be interim in nature and would not address the long-term needs

of the participating agencies. The lead agency for this study was the city of Tigard. Other participating agencies included: Wilsonville, Tualatin, Sherwood, Portland, Tualatin Valley Water District, and Clackamas River Water District. The consulting engineer was Murray, Smith & Associates.

1997 (ongoing): Regional Water Providers Consortium
This group of 28 agencies is an outgrowth of the Regional Providers Advisory Group. All 28 agencies have endorsed the Regional Water Supply Plan, and have designated elected officials from their respective governing bodies to serve on the Regional Water Providers Consortium Board. Wilsonville Mayor Charlotte Lehan was elected Vice-Chair of this Board.

1997 (ongoing): Columbia-Willamette Water Conservation Coalition
Wilsonville has joined this group of 18 agencies which work cooperatively to establish conservation goals, provide public information/technical assistance, and evaluate the effectiveness of conservation efforts. Wilsonville Public Works Director Jeff Bauman serves on the "core team" (i.e., steering committee) of the Coalition.

in process: "Willamette River Water Treatment Plant Project Concept Design"
This engineering study is a detailed site analysis as well as technical/financial feasibility analysis of a Willamette water treatment plant designed to meet Wilsonville's long-term water supply needs. The study is scheduled to be completed in 1998. The consulting engineer is Montgomery Watson.

in process: Construction has begun on the Boeckman well, which should be in service by the summer of 1998.

in process: Bids are being solicited for construction of an additional reservoir (2 million gallon capacity) to be in service by the summer of 1998.

Water Requirements for Projects with Approval for Water

Update 1/7/98	Plng Ref	Maximum daily production in GPD
Commercial		
ACT III - built	95PC26	9,000
Canyon Creek Business Park (2 buildings)	97DB06	78,000
Chevron - built	96DR03	15,000
Fox Center-renewed	96DB23	22,000
Garden Center - built	96DR17/95PC29	1,000
WBC project-office	97DB19	89,000
Living Enrichment Center		61,000
Oriental Rug Store at TC - built	96DR05	4,000
Tarr Card Lock	97DB05	
Teufel	95PC27	172,000
Town Center, 3d Anchor		14,000
Unocal	96DB29	4,000
Willamette Inn Motel - Indoor Swimming Poo	97DB21	
WV Rental	96DB16/97DB29	1,000
Town Center-Phase III		93,000 *
Total Commercial		**563,000**
Industrial		
Artistic Auto body	96DB36	
CISCO-small whse exp- built	96DB01	3,000
Comm & Ind Park (Tim Knapp)	96DB34/97DB04	6,000
Deerfield Partn (Conway)Tk Term on Comm C	96DB15	10,000
Don Rasmussen Mercedes-Benz (update 7/3	97DB23/97DB01	6,000
Fullman Company	97DB20	9,000
GMC/Wentworth	97DB02	6,000
Jack Martin, Bldg B	94PC41	17,000
LeadTec	96DB30	8,000
Master Craft aka Cranston Machinery	96DR02	31,000
Nike Parking Expansion	97DB17	
Oregon Pacific Investment	96PC03	12,000
PGE Crew Center	96DB04	3,000
ProGrass - built	96DB18	9,000
Rebco - Ron Tonkin (1 year extension appro	95PC17	20,000
Sysco Continental Inc, Phase I - built	96DB37	2,000
Tektronix	97DB18	1,000
US Crane-expired	95PC22	
Utility Vault #2 - built	96DB12	
Total Industrial		**144,000**
Multifamily		
Greenhouse Estates-46 lots	96DB35	24,000

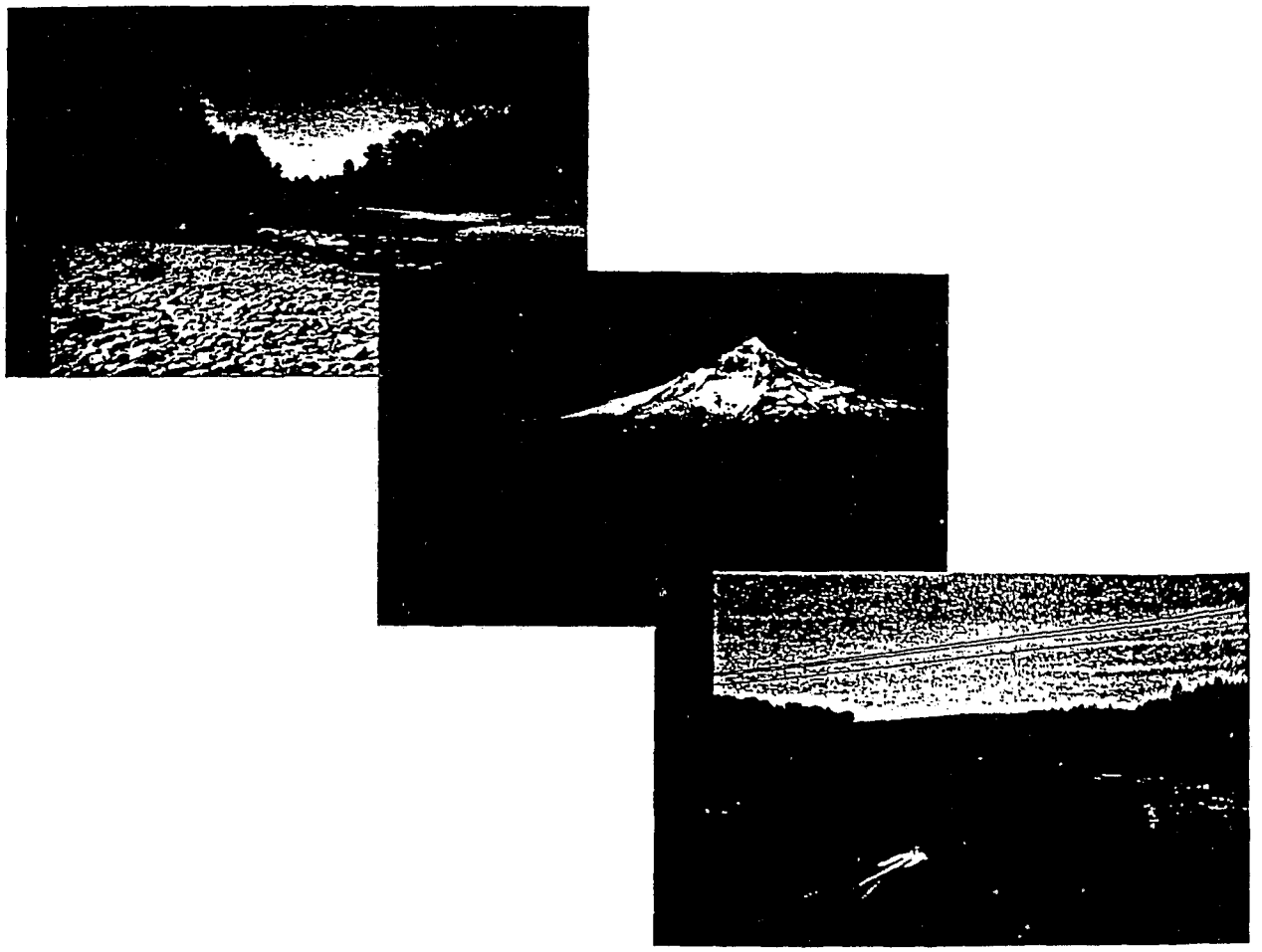
* Added per Council action adopting Ordinance on 1/5/98

Annex, CD Public, Water Production, Water-Recent Approvals

Water Requirements for Projects with Approval for Water

Update 1/7/98	Plng Ref	Maximum daily production in GPD
Hathaway	95PC06	162,000
Phoenix Inn-Gdfathered under Oil Can Henry	96PC04	29,000
Randall 372 apts on Canyon Creek	96DB24/97DB07	200,000
Teufel	95PC27 &97DB12	236,000
Vlahos Firs aka Carmon Oaks	97DB10	45,000
Wiedeman Senior Apartments	96DB13	29,000
Willamette Woods Senior Community (approx 96 units)	96DB28	52,000
Total Multifamily		**777,000**
Office		
Chamber/Visitors Center orig approval on 8/13/96 & revised	96DB05	6,000
NW LL Partn- office, Kinsman-Gfathered	96DB06	1,000
Total Office		**6,000**
Town Center Park	96DB05	**24,000**
Single Family		
Canyon Creek Meadows	95PC16	89,000
Hathaway	95PC06	21,000
Hummelt Phases I, II and III (total of all 3 pha	96DR13	124,000
Teufel (Stage II not appproved, but Pl Comm	95PC27	94,000
Total Single Family		**328,000**
Total		**1,842,000**
Projects with planning approval subject to availability of water		
LaPoint Center Chevron Station/Market	97DB28	4,000
Marcia's Vineyard - 126 Apartments (Needs Council approval)	97DB34	68,000
White Oak - 201 Apartments (Needs Council	97DB24	175,000
Willamette Valley Homes - being appealed	97DB30	4,000
Total with planning approval subject to availability of water		**251,000**

EXHIBIT B



City of Wilsonville

Water Supply Study
Final Report

March, 1997

MONTGOMERY WATSON

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MONTGOMERY WATSON

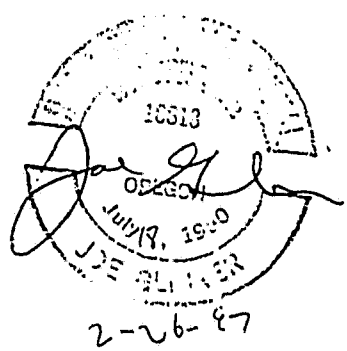
ACKNOWLEDGEMENTS

City of Wilsonville

Arlene Loble - City Manager
Jeff Bauman - Public Works Director
Mike Stone - City Engineer
George Croff - Water Crew Chief

Consultant Staff

Joe Glicker, P.E. - Project Manager
Pete Kreft, P.E. - Project Engineer
Becky Crockett
Becky Fowler, P.E.
Dana Ramer



PREFACE

The technical analysis contained in this report was conducted primarily during 1996. ***This report does not take into account the siting of a State of Oregon Corrections Facility (prison) in Wilsonville, which was proposed in late fall of 1996.*** As of the date of this report, there is insufficient information available to accurately forecast the municipal water demand what would be created by the proposed prison facility.

Other pending issues which could impact Wilsonville's future water supply include: decisions regarding the urban growth boundary and urban reserve designations; the nature and rate of future development approvals granted by the City of Wilsonville; and the results of a water transmission system analysis being jointly sponsored by a sub-regional group of water providers. These pending matters (individually or in combination) could accelerate or delay the phasing of alternatives presented in this report. The purpose of this report is to highlight the long-term technical, financial and policy choices Wilsonville faces as these pending issues are resolved.

EXECUTIVE SUMMARY

INTRODUCTION

The City of Wilsonville is a rapidly-growing community that has reached a crossroads with regards to its potable water supply. Projected demand for water will soon surpass the available supply. The City currently relies on local groundwater for 100 percent of its supply. The aquifer which provides this water has been classified by the Oregon Water Resources Department (OWRD) as "groundwater limited" because the water table is declining. OWRD will not allow Wilsonville to develop any new wells within the aquifer beyond the one currently under construction, and has requested that Wilsonville reduce its dependency on its groundwater as soon as practicable.

Over the past few years, the City has had to enforce certain conservation and curtailment measures each summer to ensure that its existing groundwater supply would be adequate to meet its basic water needs. Conservation and efficiency measures are by far the quickest and least expensive ways to reduce water demand. Optimistically, Wilsonville may be able to achieve and sustain a 20% reduction in per capita demand in this manner. However, peak demand is expected to increase up to 400% by the year 2050. Thus, continuing growth within the City, coupled with the inability of the existing groundwater supply to meet current and future needs, requires that a new source(s) of water be developed. Development of a new source will require construction of a water treatment plant and/or construction of a major new water transmission pipeline to bring water from elsewhere in the metropolitan region. Under any option, the costs will be tens of millions of dollars.

Since the 1970's, the City of Wilsonville has held approximately 19 million gallons per day (mgd) of water rights on the Willamette River. It has been the City's intent to eventually rely upon this water right to serve the City's water needs. This report reviews and analyzes all the alternative water sources currently available to Wilsonville which may be able to meet some or all of the City's needs, in order to determine how these sources compare to the Willamette River as the City's long-term source and whether or not it is now time to begin development of the City's water rights on the Willamette River.

EXISTING WATER SUPPLY

The City owns and operates seven wells. These seven wells provide a total pumping capacity of approximately 3,200 gpm (4.6 mgd). However, the reliable pumping capacity is only approximately 3.7 mgd because, as is typical in all water systems, there are occurrences when one or more of the well pumps must be out of service for maintenance or repairs. Peak day demands

have been as high as 4.95 mgd in 1994 and reached 4.86 mgd in 1995, even with water curtailment measures which substantially reduce water consumption. Wilsonville has enforced some conservation and curtailment requirements in each of the recent summers to ensure that the City could meet the required demands with the existing groundwater supply.

The City is currently in the process of adding an eighth well with an approximate pumping capacity of 0.9 mgd. This new well should be ready for operation by mid-1997. With the eighth well in service, the total pumping capacity will be approximately 5.5 mgd and the reliable pumping capacity will be 4.6 mgd with one of the largest wells out of service.

PROJECTED WATER DEMANDS

Water demand projections for Wilsonville and for the entire region were developed recently as part of the Regional Water Supply Study (RWSS). The peak day water demand for Wilsonville in the year 2050 was estimated to be approximately 18 mgd in the RWSS. That estimate was made based on population growth projections provided by METRO in 1995 for its 2040 planning project and on region-wide averages of water consumption patterns of different land use and water user classes. The RWSS estimate also assumed "naturally occurring conservation" (reduced water demand from structural changes such as low flow toilets and showerheads) and the dampening effects of water pricing structures on demand.

The City recently conducted its own projectiopn of future water demands. This projection was based on the METRO population and historical water use factors for domestic, irrigation and other uses.

The results of the City's estimated peak day water demand projections are shown in TableES-1. The values are modifications to the estimates developed in the RWSS. While the aggressive conservation measures assumed in the RWSS are still planned to occur, the differences in these planning demand projections account for modifications to the population forecasts by METRO since 1995; differences in water consumption patterns between Wilsonville and regionwide averages; and the potential requirement for Wilsonville to serve areas outside the existing urban growth boundary but within METRO's urban reserve study areas.

Also shown in Table ES-1 are the peak day demand estimates which were used for planning purposes to develop and analyze supply alternatives for this study. A faster rate of demand growth to the 2050 level of demand was assumed in this study so that the City of Wilsonville can be assured of a reliable water supply regardless of the rate of water demand growth. The City will, however, develop any new water supply only to the extent that it finds it actually must in order to meet the future water demands which actually occur.

This increase in demand is expected due to residential, commercial and industrial growth within the area served by the City. Even if the

lower forecasts of water demand in the RWSS were accurate, Wilsonville would still be faced with the immediate necessity of finding additional water supply.

TABLE ES-1
CITY OF WILSONVILLE
ESTIMATED WATER DEMANDS

Year	Estimated Peak Day Demand (mgd)	Planning Peak Day Demand (mgd)
2000	7	10
2010	10	15
2020	13	20
2050	23	25

LONG-TERM SUPPLY OBJECTIVES

The City of Wilsonville needs a new long-term water supply source. The City has adopted the planning horizon of the RWSS for its own supply planning. Thus, a long-term supply is one which is capable of satisfying the City's water supply needs to the year 2050. While there are many criteria which influence a supply decision, several stand out as key for the City of Wilsonville in selecting a supply option:

- ***Certainty.*** The City of Wilsonville needs a water supply plan that is truly capable of meeting its long-term supply needs. Water rights to support the water use must be available. There must be a reasonable level of assurance through contracts, intergovernmental agreements, or other mechanisms, that Wilsonville will be able to count on the water it needs being there when it is needed. If capital improvements will be needed over time to assure the availability of water, then Wilsonville must have a level of assurance that these improvements will in fact happen as required.

- ***Finished water quality.*** While different water sources may start out with different raw water qualities, Wilsonville must be assured that the quality of water which reaches its customers meets all federal and state drinking water standards for finished drinking water.

- ***Consistency with local and regional planning efforts.*** Wilsonville has endorsed the Regional Water Supply Plan and is a participating member of the Regional Water Providers Consortium. All water supply developments in the Portland area should be consistent with the regional framework established in the Regional Plan.

- ***Environmental Impacts.*** The environmental impacts of supply alternatives must be minimized to the extent possible.

- ***Costs.*** The costs of providing the supply, both capital and operating, must be minimized over the life of the project so that the City's responsibilities to its ratepayers are met.

POTENTIAL SOURCE OPTIONS

The surface water supply sources which were screened in the study for potential use were the Clackamas River, the City of Portland supply (a combination of the Bull Run River and the Columbia Southshore Wellfield), the Tualatin River/ Trask River, and the Willamette River. Entities which could potentially supply water from one or more of these sources include the South Fork Water Board, Clackamas River Water, the City of Portland, the Tualatin Valley Water District, and the Joint Water Commission, as well as the City of Wilsonville itself for the Willamette River. Figure ES-1 illustrates the location of each supply source.

With the exception of the Willamette River, these sources are existing, developed supplies in the region which have treatment and transmission facilities in place for the production and delivery of water, although not to the City of Wilsonville. The Willamette River is not currently developed as a municipal source within the metropolitan area. It is used as the main source of supply for the City of Corvallis, Oregon.

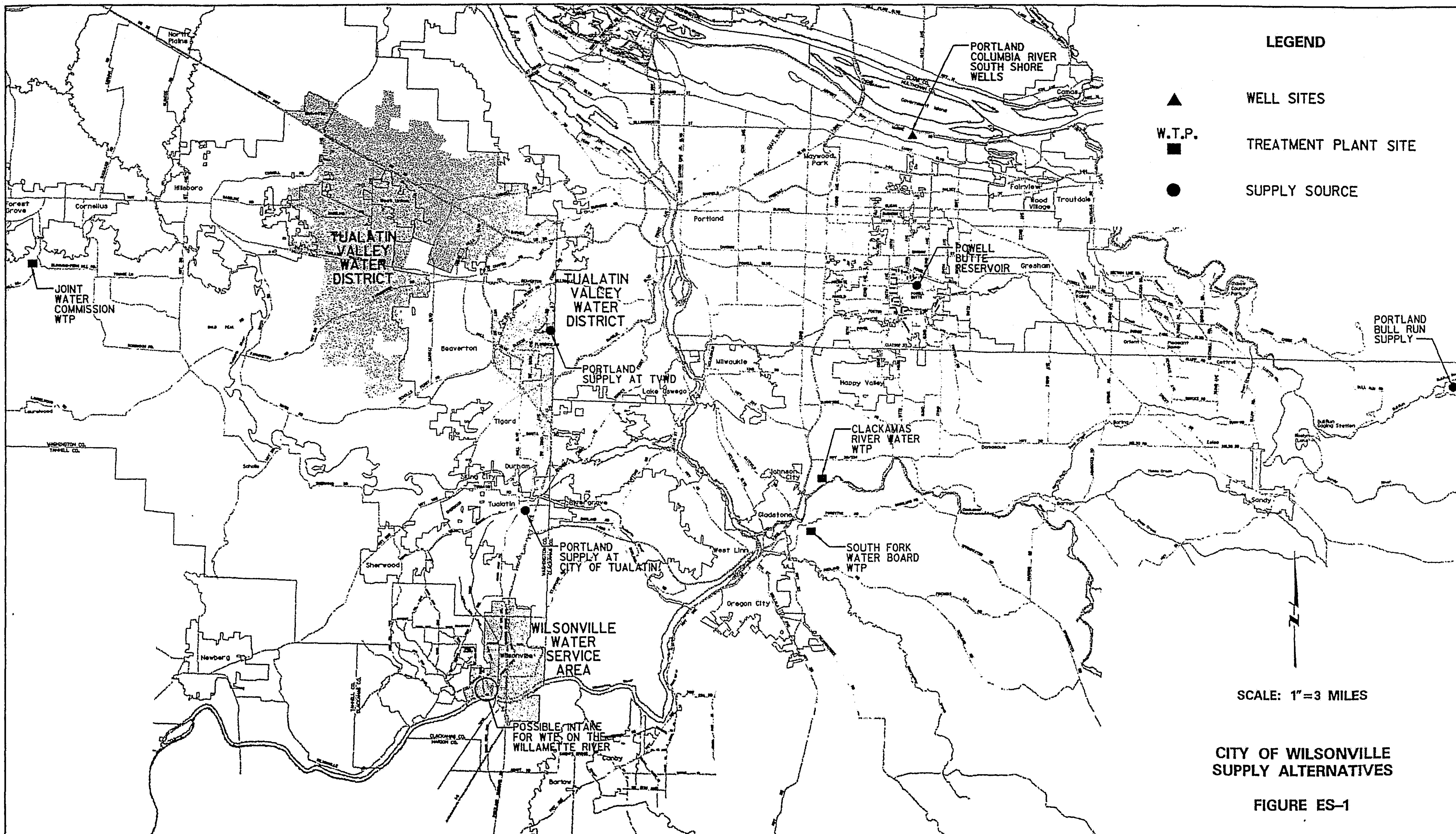
In addition to these sources, Aquifer Storage and Recovery (ASR) in conjunction with one of the surface water sources, and the continued use of the City's existing wells as a peaking source only, were evaluated. ASR is a water management practice whereby surface water is injected into and stored in underground aquifers when it is available (the winter), and then extracted for use when the demand is high (the summer). ASR by itself is not an adequate source, but could potentially be developed for use with one of the surface water sources as a means of providing peak season water demands at lower costs. While continued reliance on the City's existing groundwater system to meet all water needs would not be possible, it may be possible to use the wells to provide peaking capacity on a seasonal basis and to provide an emergency back-up in combination with some other source.

POTENTIAL SUPPLY SCENARIOS FOR WILSONVILLE

Scenario 1 - The Willamette River.

Under this option, the City of Wilsonville's needs would be provided primarily from the Willamette River, relying upon the City's own water rights on the River. The City would construct a new water treatment plant on the Willamette River immediately. The plant would be brought on-line by the year 2000. Initial plant capacity would be 10 mgd to serve the City's needs until 2010. A 5 mgd expansion would occur in 2010 and another 5 mgd expansion would occur in 2020 to bring the plant to an ultimate 20 mgd capacity. ASR or well improvements would occur in 2010 to assure 5 mgd of peak capacity from groundwater.

Development of the Willamette River provides a certain, long-term supply for the City of Wilsonville. The City would have the opportunity to continue the direct decision making, control and ownership of its water supply system with a Willamette River source. The City would not be dependent upon supply agreements or future



CITY OF WILSONVILLE
SUPPLY ALTERNATIVES

FIGURE ES-1

MONTGOMERY WATSON
Portland, Oregon

actions of other entities which would own and control the water supply. The City would be building equity in its own water system as it develops the Willamette source. The City's existing water rights on the Willamette River are sufficient to support a water treatment plant until at least the year 2050 and developing the source sooner rather than later will assure that the City's existing water right permit is utilized.

The quality of the raw Willamette River water is less than the quality of the raw, untreated Clackamas River, Trask River or Portland system sources. However, the treatment processes which are assumed for the Willamette are more stringent than for the other sources and will therefore result in a treated drinking water quality at the customer's tap which is as good or better than any other in the region. The treatment process for the Willamette includes ozone for disinfection of microbial contaminants, taste and odor control and oxidation of organic compounds. It also includes granular activated carbon (GAC) filter media to protect against trace organic compounds and tastes and odors. Even though the treatment process planned for a Willamette plant will be capable of handling any potential contaminants should they be found in the River, there remains public concerns about the potential for drinking water contamination when using the Willamette River.

Development of the Willamette as a source is consistent with the RWSS, which found it to be one of the source options for the region. There is potential for Wilsonville to partner with others in the sub-region who also have an interest in the Willamette as a source, particularly the City of Tigard, the City of Sherwood, the Tualatin Valley Water District, and possibly others. The RWSS also found that the environmental impacts of use of the Willamette as a source are likely to be equivalent or less than for the other options in the region.

Scenario 2 - Clackamas River/Willamette River.

Under this option, the City of Wilsonville would enter into a water supply agreement to obtain up to 20 mgd with one or more suppliers of water from the Clackamas River. This agreement would last until the year 2020. Possible agencies for such an agreement include the South Fork Water Board and Clackamas River Water. A pipeline and pump station to deliver water from a Clackamas treatment plant to Wilsonville would be constructed. Then, in 2020 when the Clackamas supplier could no longer provide water, Wilsonville would build a Willamette River water treatment plant at 20 mgd. It is assumed that the pipeline which was built to bring Clackamas River water to Wilsonville would then be sold or turned over to a regional entity or other user, and that Wilsonville will obtain a credit for the pipeline. ASR or well improvements would occur in 2010 to assure 5 mgd of peak capacity from groundwater.

In the long run, this scenario offers the same advantages as Scenario 1, because in the long run it is the Willamette River which is the source for the City of Wilsonville. In the interim, there are some differences, however. A long-term water supply contract with a Clackamas basin water supplier could potentially provide a certain

supply to around the year 2020. At that time, however, demand within the Clackamas Basin is projected to require the full use of the water rights by their holders to serve customers within the Clackamas Basin. While the supply was coming from the Clackamas, Wilsonville would have less direct control of its water supply and the cost of the delivered water; the City would delay developing equity in its water system until it began developing the Willamette; and the City's water right permit on the Willamette River would remain undeveloped for another 25 years.

The raw water quality of the Clackamas River is good and both the South Fork Water Board and Clackamas River Water treatment plants on the river have a history of providing high quality water which meets all drinking water standards. Use of the Clackamas River as a source is consistent with the RWSS, which found it to be a good source for additional development. When the City eventually develops the Willamette, there is likely to be other partners who will be interested in developing the Willamette as a source at that time.

The environmental impact associated with the pipeline bringing water from the Clackamas to Wilsonville should be limited to those of pipeline construction. While the amount of water being withdrawn from the Clackamas River to serve Wilsonville is small relative to the overall river flows, there is environmental concern about cumulative impacts of multi-agency withdrawals from the river. The U.S. Forest Service recently (June, 24, 1996 letter) expressed concerns that "increased withdrawals could have detrimental effects on recreationists and on the fisheries we have worked so hard to maintain and restore upstream" on the Clackamas River.

Scenario 3 - Portland System/Willamette River.

Under this option, a pipeline to bring water from the Portland system to Wilsonville by gravity would be constructed. The pipeline would be sized at 20 mgd and would be constructed to the current terminus of the 60-inch diameter Washington County Supply Line (WCSL) in the Tualatin Valley Water District (TVWD) service area. The City of Wilsonville would initially enter into a water supply agreement with TVWD to supply up to 7 mgd through the year 2005. The water delivered to Wilsonville from TVWD would be Portland system Bull Run and/or Columbia Southshore Wellfield water. TVWD would reduce its demand on the Portland system by utilizing more water from the Barney Reservoir on the Tualatin/Trask River system in order to provide the initial 7 mgd. Then, in 2005 Wilsonville would enter into an agreement with the City of Portland to provide up to 20 mgd to the year 2020. In the year 2020, a Willamette River water treatment plant would be constructed at 20 mgd. It is assumed that the pipeline which was built to bring water to Wilsonville would then be sold or turned over to a regional entity or other user, and that Wilsonville will obtain a credit for the pipeline. ASR or well improvements would occur in 2010 to assure 5 mgd of peak capacity from groundwater.

In the long run, this scenario offers the same advantages as Scenario 1, because in the long run it is the Willamette River which is the source

for the City of Wilsonville. In the interim, there are some differences, however. Portland has indicated it will not consider a long-term contract for Portland system water during peak demand periods until 2005 to 2007. Until then, Wilsonville must rely on shorter-term commitments with the Tualatin Valley Water District with the hope that a long-term arrangement will eventually be possible with Portland. Current contracts with Portland are on the basis of "surplus water". Under these contracts, there is no guarantee that curtailment will not be necessary during particularly dry summers. A pipeline to bring water from the north would have to be built to deliver the water from TVWD without certainty that a longer-term supply will be available. Once a longer-term contract is negotiated with Portland, then this option can provide a certain supply to support Wilsonville to the year 2020. While the supply was coming from the Portland system, Wilsonville would have less direct control of its water supply and the cost of the delivered water; the City would delay developing equity in its water system until it began developing the Willamette; and the City's water right permit on the Willamette River would remain undeveloped for another 25 years.

The quality of the water from the Portland system is good. The system has a history of meeting all drinking water regulations. Use of the Portland system is consistent with the RWSS. When Wilsonville eventually develops the Willamette, there are likely to be other partners who will be interested in developing the Willamette as a source at that time.

The environmental impact associated with the pipeline bringing water from the Portland system to Wilsonville should be limited to those of pipeline construction. Because the supply contract with Portland would only extend until 2020, it is assumed that Portland would not need to construct a new dam or other supply increment to provide a reliable supply to Wilsonville, and that therefore there is no greater environmental impact on the Bull Run than currently exists.

Scenario 4 - Portland System.

Under this option, a pipeline to bring water from the Portland system to Wilsonville by gravity would be constructed. The pipeline would be sized at 20 mgd and be constructed to the current terminus of the 60-inch diameter WCSL in the TVWD service area. The City of Wilsonville would initially enter into a water supply agreement with TVWD to supply up to 7 mgd through the year 2005. The water delivered to Wilsonville from TVWD would be Portland system Bull Run and/or Columbia Southshore Wellfield water. TVWD would reduce its demand on the Portland system by utilizing more water from the Barney Reservoir on the Tualatin/Trask River system in order to provide the initial 7 mgd. Then, in 2005 Wilsonville would enter into an agreement with the City of Portland to provide up to 20 mgd to the year 2050. In the year 2010, ASR or well improvements would occur to assure 5 mgd of peak capacity from groundwater. It is also assumed that in the year 2020, some major supply increment would be constructed on the Portland system to provide the capacity needed to assure a supply to the year 2050.

This scenario assumes a long-term relationship with the City of Portland for water supply. A long-term contract would be negotiated with Portland. Portland has indicated it will not consider a long-

term contract for Portland system water during peak demand periods until 2005 to 2007. Until then, Wilsonville must rely on shorter-term commitments with the Tualatin Valley Water District with the hope that a long-term arrangement will eventually be possible with Portland. Current contracts with Portland are on the basis of "surplus water". Under these contracts, there is no guarantee that curtailment will not be necessary during particularly dry summers. A pipeline to bring water from the north would have to be built to deliver the water from TVWD without certainty that a longer-term supply will be available. Once a longer-term contract is negotiated with Portland, then this option can provide a certain supply to support Wilsonville to the year 2050. Portland would have to eventually expand its water system to meet these supply requirements through construction of a new, third dam in the Bull Run, further development of its existing wellfield, or development of a new source. It is assumed that the negotiated contract with Portland would provide assurances that this will occur. Wilsonville would have less direct control of its water supply than it currently does and less control and certainty over the price of water purchased from Portland compared with Wilsonville having an ownership stake in its water supply. Wilsonville's water right permit on the Willamette River would remain undeveloped for another 50 years.

The quality of the water from the Portland system is good. The system has a history of meeting all drinking water regulations. Use of the Portland system is consistent with the RWSS.

The environmental impact associated with the pipeline bringing water from the Portland system to Wilsonville should be limited to those of pipeline construction. Because the supply contract with Portland would extend until 2050, it is assumed that Portland would need to construct a new dam or some other major water supply project to provide a reliable supply. According to the RWSS, the environmental impact of such a project is likely to be greater than the impact of withdrawals of water on the Willamette River near Wilsonville.

This Scenario increases Wilsonville's, and the region's long-term dependence on the Portland's Bull Run supply compared to Scenarios 1, 2 and 3. In emergency situations, the reliability of Wilsonville's supply in Scenarios 1, 2 and 3 may be greater because multiple sources of water are available to meet essential sub-regional needs.

SUMMARY OF EVALUATION OF THE SCENARIOS

A summary of the qualitative evaluation of the four scenarios against the long-term supply objectives as described above is shown in Table ES - 2. A qualitative, relative ranking system was used:

+ Rates highly against the other alternatives.
o Rates neutral against the other alternatives.
- Rates poorly against the other alternatives.

Evaluation of the non-economic long-term supply objectives for the City of Wilsonville favor development of the Willamette River as the primary long-term supply source.

A summary of the cost comparisons of the four scenarios is shown in Table ES - 3.

TABLE ES - 2
SUMMARY OF QUALITATIVE EVALUATION OF LONG-TERM, NON-ECONOMIC SUPPLY OBJECTIVES

SCENARIO	Certainty	Finished Water Quality	Planning Consistency	Environmental Impacts
1. Willamette	+	o	o	o
2. Clackamas / Willamette	o	o	o	-
3. Portland / Willamette	-	o	o	o
4. Portland	-	o	o	-

TABLE ES - 3
SUMMARY OF 2050 SUPPLY SCENARIOS COSTS

Scenario	Year 2000	Year 2010	Year 2020	Total 50 Year Present Worth
1. Willamette River	Capital : $22.5M O&M: $0.38/ccf	Capital : $7.4M O&M : $0.46/ccf	Capital : $6.3M O&M: $0.56/ccf	**$58.0M**
2. Clackamas River / Willamette River	Capital: $18.1M O&M: $0.62/ccf	Capital : $3.0M O&M: $0.83/ccf	Capital: $47.9M O&M: $0.56/ccf	**$78.1M**
3. Portland System / Willamette River	Capital: $24.6M O&M: $0.59/ccf	Capital: $2.7M O&M: $0.79/ccf	Capital: $42.5M O&M: $0.56/ccf	**$81.2M**
4. Portland System	Capital: $24.6M O&M: $0.59/ccf	Capital: $2.7M O&M: $0.79/ccf	Capital: Portland develops a supply increment ($100 - $250 million) causing a 25% increase in cost of purchased water O&M: $1.25/ccf	**$89.9M**

The combined total present worth of the

Willamette River Scenario is estimated to be $20 million less over the fifty year period than the next closest scenario. This scenario builds only one major facility - a water treatment plant. The initial capital cost of the water treatment plant is estimated at $22.5 million. The two scenarios which take supply through a pipeline for the first twenty years and then build a treatment plant have significantly larger total capital costs over the fifty year period because they build two large components. The lowest total operating and maintenance cost option is by far the Willamette River Scenario. It is almost $12 million less expensive in operations and maintenance costs over the fifty year period than the next closest scenario. Although the Portland System option also only builds one large system component over the fifty year period, the significantly higher operating costs of this scenario compared to the Willamette Scenario make its total present worth the highest of all the scenarios.

SHORT-TERM SUPPLY NEEDS

The earliest any of the long-term supply alternatives would be available to provide water to Wilsonville is approximately the year 2000. Even if a decision were made to immediately implement one of the long-term alternatives, it would take until then to plan, design, construct and start-up the required facilities. Therefore, no matter what long-term supply alternative is selected, Wilsonville will have to continue to deal with the fact that there is a limited water supply available for at least the next three years. The eighth well which will be on-line for the summer of 1997 will help to alleviate the current water supply shortfall. Other short-term water supply measures which could be used to meet the water shortfall which will occur between now and the year 2000 were also evaluated in this study.

The most readily available short-term supply measure is the continuation of temporary water use curtailment measures during periods of hot weather. (Conservation is a reduction in the amount of water used to achieve some beneficial purpose, while still achieving that purpose. In curtailment, the use of water is reduced such that the same beneficial purposes are no longer fully achieved.) While conservation is always appropriate, curtailment is a stop-gap measure. The advantage of the use of curtailment as a short-term supply measure is that it is relatively inexpensive for the City (only the operational costs for obtaining compliance during the curtailment period are incurred), it can be instituted quickly each year it is needed, and it serves to demonstrate the need for a new water supply. The disadvantages include that curtailment may cause economic loss and/or hardship to water customers and its continued use can serve to undermine confidence in the ability of the City to provide for the community's water needs. However, regardless of other short-term supply measures which may be undertaken, the City should be prepared to institute water curtailment measures as needed until a new long-term source is available.

Wilsonville is currently involved with other water providers at the sub-regional level in both the Clackamas River and the Willamette River basins to evaluate water availability, transmission ca-

pacities, and operational practices that could temporarily augment Wilsonville's water supply until a long-term supply source is developed. The most promising of these is a connection to the City of Tualatin. These near-term options do not meet the long-term needs of Wilsonville, nor are they designed to do so. Nonetheless, such measures may help address immediate shortages and may provide a useful intertie between Wilsonville and other nearby water providers.

RECOMMENDATIONS

To assure a long-term supply, the City of Wilsonville should:

- Identify and secure a site for the treatment plant and intake, develop a financing and implementation plan for the project, and conduct more detailed engineering studies to better define the project scope and costs.

- Initiate discussions with Oregon Water Resources Department regarding the continued use of the existing groundwater supply, and the possible implementation of ASR as a peaking source. Use of ASR and/or the wells will minimize both capital and operating costs of use of the Willamette River.

- Continue to work with other water purveyors who may be interested in developing the Willamette River as a source of supply. A jointly-owned and operated supply system would result in cost savings and operating efficiencies in addition to creating a new subregional or regional source of supply for the Portland metropolitan area which would improve overall regional water reliability.

To meet short-term water needs until a long-term source can be developed, the City of Wilsonville should:

- Have its eighth well operational by the summer of 1997.

- Rely upon temporary voluntary and mandatory curtailment to match demand to supply during periods of hot weather.

- Evaluate the availability of water, as well as the costs and benefits of temporarily augmenting Wilsonville's water supply by constructing a transmission line to the City of Tualatin. Such an intertie could also be useful for emergency purposes regardless of long-term supply strategies.

Once a long-term supply direction is established, Wilsonville should update the reservoir storage, transmission, and distribution elements of its Water Master Plan to reflect current estimates of future water demand. Wilsonville should continue its commitment to conservation, regardless of long-term water supply plans. Wilsonville should also remain an active participant in regional and subregional water supply planning efforts in order to take advantage of any possible opportunities for cost sharing of water supply development projects which may arise.

Section 1

INTRODUCTION

INTRODUCTION

The City of Wilsonville is a rapidly-growing community that has reached a crossroads with regards to its potable water supply. Projected demand for water will soon surpass the available supply. The City currently relies on local groundwater for 100 percent of its supply. The aquifer which provides this water has been classified by the Oregon Water Resources Department (OWRD) as "groundwater limited" because the water table is declining. OWRD will not allow Wilsonville to develop any new wells within the aquifer beyond the one currently under construction and has requested that Wilsonville reduce its dependency on this groundwater as soon as practicable.

Over the past few years, the City has had to enforce certain conservation and curtailment measures each summer to ensure that its existing groundwater supply would be adequate to meet its basic water needs. The continuing growth within the City, coupled with the inability of the existing groundwater supply to meet current and future needs, requires that a new source(s) of water be developed.

The last time the City reviewed its water supply needs was in a Water System Plan completed in 1986 and prepared by Westech Engineering. The 1986 Plan study concluded that "...the City should start, by 1995, seriously investigating the feasibility of developing a major surface water source". The study also concluded that the Willamette River was a likely choice for such a source.

Since the 1970's, the City of Wilsonville has held approximately 19 million gallons a day (mgd) of water rights on the Willamette River. It has been the City's intent to eventually rely upon this water right to serve the City's water needs. This report reviews and analyzes all the alternative water sources currently available to Wilsonville which may be able to meet some or all of the City's needs, in order to determine how these sources compare to the Willamette River as the City's long-term source and whether or not it is now time to begin development of the City's water rights on the Willamette River.

SCOPE

The Scope of Work for this study included the following:

- Identify and Evaluate the Feasibility of Alternative Water Supply Sources. These sources include:

    1. City of Portland Supply, either directly from Portland or from another entity such as the City of Tualatin

2. Clackamas River Supply, from Clackamas River Water or from South Fork Water Board, either directly or through "wheeling" arrangements with the City of Portland
3. Tualatin River/Trask River Supply from one of the Joint Water Commission members
4. Willamette River Supply, from a new water treatment plant
5. Aquifer Storage and Recovery (ASR), in conjunction with one of the surface water supplies listed above

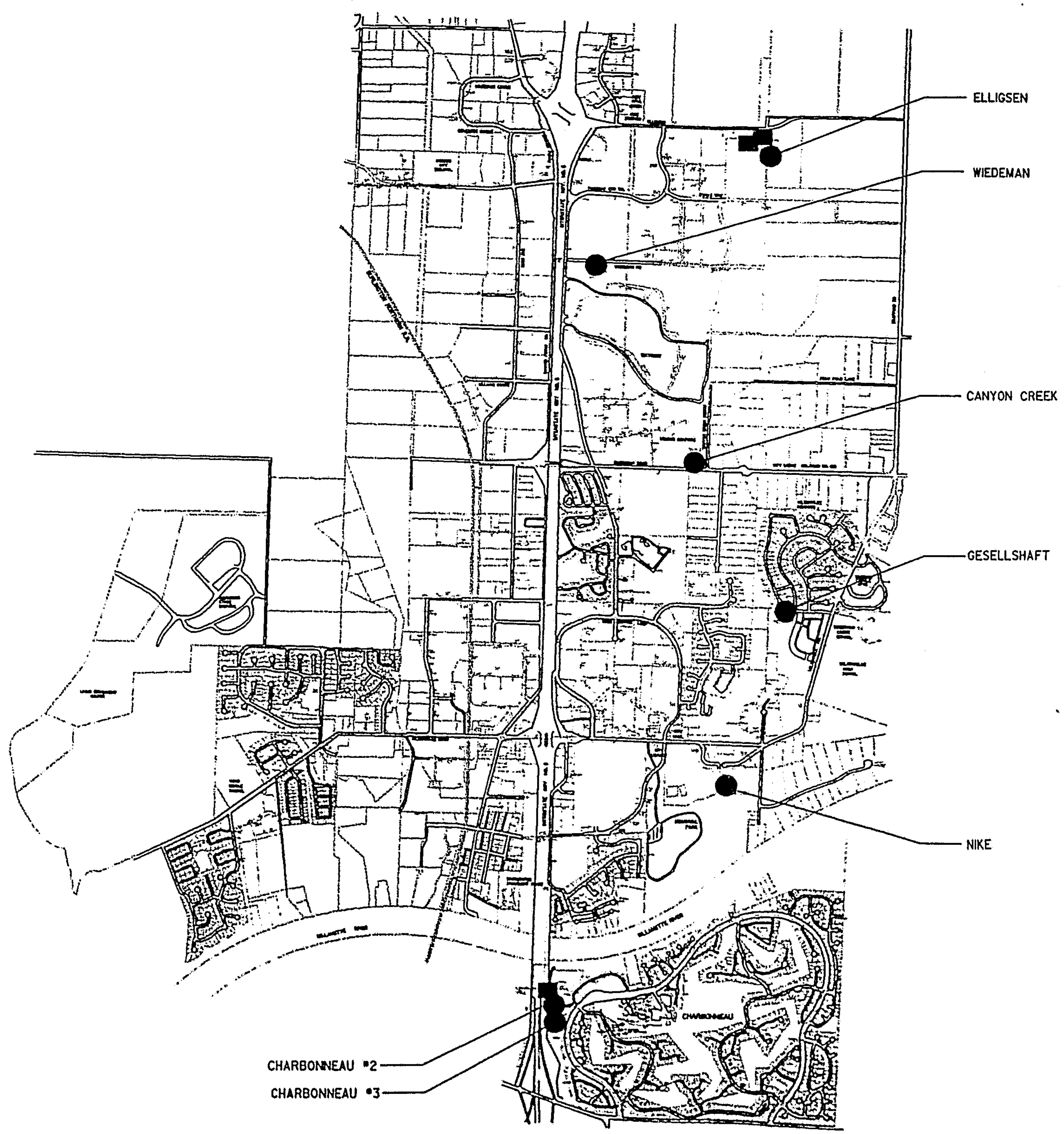
- Identify and Evaluate Short-Term Measures to Delay the Need to Develop an Alternative Source of Supply, including:

  1. Conservation
  2. Intertie with the City of Tualatin supply
  3. Purchase supply from another provider, if available
  4. Small-scale water treatment plant on the Willamette River
  5. New reservoir(s) to store excess water for peaking purposes
  6. Dual water usage

- Prepare a Document that Describes and Summarizes the Results of this Study

AUTHORIZATION

Montgomery Watson was authorized to complete this study for the City of Wilsonville under an Engineering Agreement signed on January 2, 1996.



LEGEND

● WELL

■ RESERVOIR

SCALE: 1" = 1 MILE

CITY OF WILSONVILLE

WATER MANAGEMENT CONSERVATION PLAN

FIGURE 2-1

MONTGOMERY WATSON
Portland, Oregon

Section 2

EXISTING WATER SYSTEM AND WATER DEMANDS

EXISTING WATER SYSTEM AND WATER DEMANDS

This section describes Wilsonville's existing water supply and storage facilities. Also, historical water demands are presented as well as estimates for future water demands. The estimated water demands provide the basis for determining the requirements for the alternative water supply sources.

EXISTING WATER SYSTEM

A plan map of Wilsonville's water system which illustrates major facilities and supply sources is shown in Figure 2-1. The City owns and operates seven wells with characteristics as shown in Table 2-1.

TABLE 2-1
CITY OF WILSONVILLE
SUMMARY OF WELL INFORMATION

Well Name	Current Pumping Capacity (gpm)	Year Constructed	Operating Depth (ft)
Charbonneau (#2 & #3)	335	1977	291 & 249
Weideman	630	1980	185
Stafford (Elligsen)	385	1970	422
Gesellshaft	630	1983	265
Nike	620	1984	360
Mentor (Canyon Creek)	570	1989	306

These seven wells provide a total pumping capacity of approximately 3,200 gpm (4.6 mgd). However, the City's reliable pumping capacity is only approximately 3.7 mgd because, as is typical in all water systems, there have been occurrences when one or more of the well pumps are out of service for maintenance or repairs. This has limited the ability to reliably produce sufficient water during the high demand periods.

The City is currently in the process of adding an eighth well with an approximate pumping capacity of 0.9 mgd. This new well should be in operation by mid-1997. The new well was permitted with OWRD prior to any restriction being placed on continued use of the aquifer. With the eighth well in service, the total pumping capacity will be approximately 5.5 mgd and the reliable pumping capacity will be 4.6 mgd with one of the largest wells out of service.

In addition to the production capacity from the wells, the City has three storage reservoirs including the East Stafford Reservoir (3.0 MG), the West Stafford Reservoir (2.2 MG) and the Charbonneau Reservoir (0.75 MG), with a total storage capacity of 5.95 MG. These reservoirs serve to provide some peaking capacity during the summer months, but the peaking ability of reservoirs is usually limited to short durations such as hours, not days.

In addition to the two wells and reservoir at the Charbonneau site, there are three booster pumps at the reservoir which are used to pump water into the distribution system. These three booster pumps have rated capacities of 500 gpm, 500 gpm and 250 gpm, respectively.

HISTORICAL WATER USAGE

Table 2-2 (on the following page) presents a summary of water production in the City for the period 1992 to 1995. This information was summarized from the City's daily, monthly and annual operating records. These values reflect only water production from each well and do not reflect water consumed from reservoir storage (i.e., reservoir drawdown during peak periods).

Water demands can vary widely from year to year depending on climatic conditions. Of the four years shown in Table 2-2, 1994 represents the highest water usage year. The peak day demand in 1994 was slightly less than 5 mgd. Peak day demands in 1996 (not shown) include at least one day at 4.8 mgd. That peak day demand represented the maximum pumping capacity of all of the existing wells. Peak demands in 1995 were less than in 1994 even though the City had more customers in 1995. The City has enforced some curtailment measures during these peak day periods which resulted in significant consumption reductions. The City estimates that water consumption dropped by as much as 20 percent when use restrictions were requested.

The severe drought conditions which were experienced throughout the region during 1992 resulted in peak demands during June instead of in July or August. Once announcements were made in the region informing the public about the severity of the drought, water usage patterns were significantly altered via conservation and curtailment.

TABLE 2-2
CITY OF WILSONVILLE
WATER PRODUCTION SUMMARY, 1992 TO 1995
(VALUES PRESENTED IN MGD)

Description	1992	1993	1994	1995
Peak Day	3.52 (June 19)	3.69 (August 3)	4.95 (July 20)	4.86 (August 2)
Peak Month	3.23 (June)	2.95 (August)	3.95 (July)	3.70 (July)
Peak Season*	2.69	2.61	3.34	3.19
Average Day	1.85	1.83	2.29	2.19
Minimum Month	1.00 (February)	1.28 (January)	1.40 (February)	1.42 (February)
Peak Day:Avg. Day	1.90	2.02	2.16	2.22
Peak Month:Avg. Day	1.75	1.61	1.72	1.69
Peak Season:Avg. Day	1.45	1.43	1.46	1.46

* Peak Season = June through September

The three ratios shown in Table 2-2 indicate that Wilsonville has been able to minimize its water demand peaks compared to other water purveyors in the region. Typically, peak day to average day ratios (peaking factors) within the region range from 2.2 to 3.0, peak month to average day ratios range from 1.7 to 2.2, and peak season to average day ratios range from 1.4 to 1.7. Wilsonville has enforced some conservation and curtailment requirements in each of the recent summers to ensure that the City could meet the required demands with the existing groundwater supply. The City will be forced to continue curtailment measures until a time when a new supply source can be brought on line. These curtailment measures are somewhat unpopular within the City, especially with citizens who feel that growth is creating the water shortages, and should not be expected to continue forever. Therefore, more typical peaking factors should be used in planning for the future water needs of the City.

From an historical perspective, Wilsonville's water use has increased dramatically in recent years as a direct result of increasing population and increasing industrial and commercial development. Table 2-3 summarizes water use data for 1975, 1980 and 1985. This data was presented in the City's Water System Plan dated November 1986 which was prepared by Westech Engineering.

Note that the peaking factors from 1975 to 1985 were significantly higher (2.3 to 3.0), and more typical of those usually found in the region, compared to the peaking factors during 1992 to 1995 (1.85 to 2.2). This is probably a direct result of stringent conservation/curtailment efforts enforced by the City in recent years due to the limited groundwater supply.

PROJECTED WATER DEMANDS

Water demand projections for Wilsonville and for the entire region were developed recently as part of the Regional Water Supply Study (RWSS). The peak day water demand for Wilsonville in the year 2050 was estimated to be approximately 18 mgd in the RWSS. That estimate was made based on population growth projections provided by METRO in 1995 for its 2040 planning project and on region-wide averages of water consumption patterns of different land use and water user classes. The RWSS estimate also assumed "naturally occurring conservation" (reduced water demand from structural changes such as low flow toilets and showerheads) and the dampening effects of water pricing structures on demand.

TABLE 2-3
CITY OF WILSONVILLE
WATER PRODUCTION SUMMARY, 1975 TO 1985
(VALUES PRESENTED IN MGD)

Description	1975	1980	1985
Peak Day	0.68 (Est.)	1.43	2.20
Peak Month	NA*	1.14	1.77
Average Day	0.23	0.61	0.79
Peak Day:Avg. Day	2.96	2.34	2.78
Peak Month:Avg. Day	NA*	1.87	2.24
Est. Population	1,230	2,920	3,700

* NA = Not Available

The City recently conducted its own projection of future water demands (Johansen, 1997). This projection was based on the METRO population and historical water use factors for domestic, irrigation and other uses.

The results of the City's water demand projections are shown in Table 2-4. The values are modifications to the estimates developed in the RWSS. While the aggressive conservation measures assumed in the RWSS are still planned to occur, the differences in these planning demand projections account for modifications to the population forecasts by METRO since 1995; differences in water consumption patterns between Wilsonville and region wide averages; and the potential requirement for Wilsonville to serve areas outside the existing urban growth boundary but within METRO's urban reserve study areas.

Also shown in Table 2-4 are the average and peak day demand estimates which were used for planning purposes to develop and analyze supply alternatives for this study. A faster rate of demand growth to the 2050 level of demand was assumed in this study so that the City of Wilsonville can be assured of a reliable water supply regardless of the rate of water demand growth. The City will, however, develop any new water supply only to the extent that it finds it actually must in order to meet the future water demands which actually occur.

This increase in demand is expected due to residential, commercial and industrial growth within the area served by the City. Even if the lower forecasts of water demand in the RWSS were accurate, Wilsonville would still be faced with the immediate necessity of finding additional water supply.

SUMMARY

Due to continued residential, industrial and commercial growth, water demands in Wilsonville are expected to increase well into the 21st century. The City's demand for water already is at or exceeds the available supply. The expected growth, coupled with the facts that the existing groundwater supply can not be expanded and that the City will have to curtail its use of local groundwater at some point in the future, will require a new source of potable water.

TABLE 2-4
CITY OF WILSONVILLE
ESTIMATED WATER DEMANDS

	ESTIMATED			PLANNING PURPOSES	
Year	Average Day Demand (mgd)	Peak Season Demand (mgd)	Peak Day Demand (mgd)	Peak Day Demand (mgd)	Average Day Demand (mgd)
2000	2.6	4.6	7	10	4.2
2010	3.8	6.7	10	15	3.8
2020	5.1	9.1	13	20	5.1
2050	9.2	16.4	23	25	9.2

Section 3

SUPPLY COMPONENTS

SUPPLY COMPONENTS

As described in Section 1, the study's scope included an evaluation of long-term water supply alternatives as well as a review of short-term measures which could be implemented provide more water for the immediate future. This section presents initial evaluations and concludes with a summary of supply components which were used to estimate costs. The cost estimates are presented in Section 4. Comparisons of the various supply scenarios are presented in Section 5.

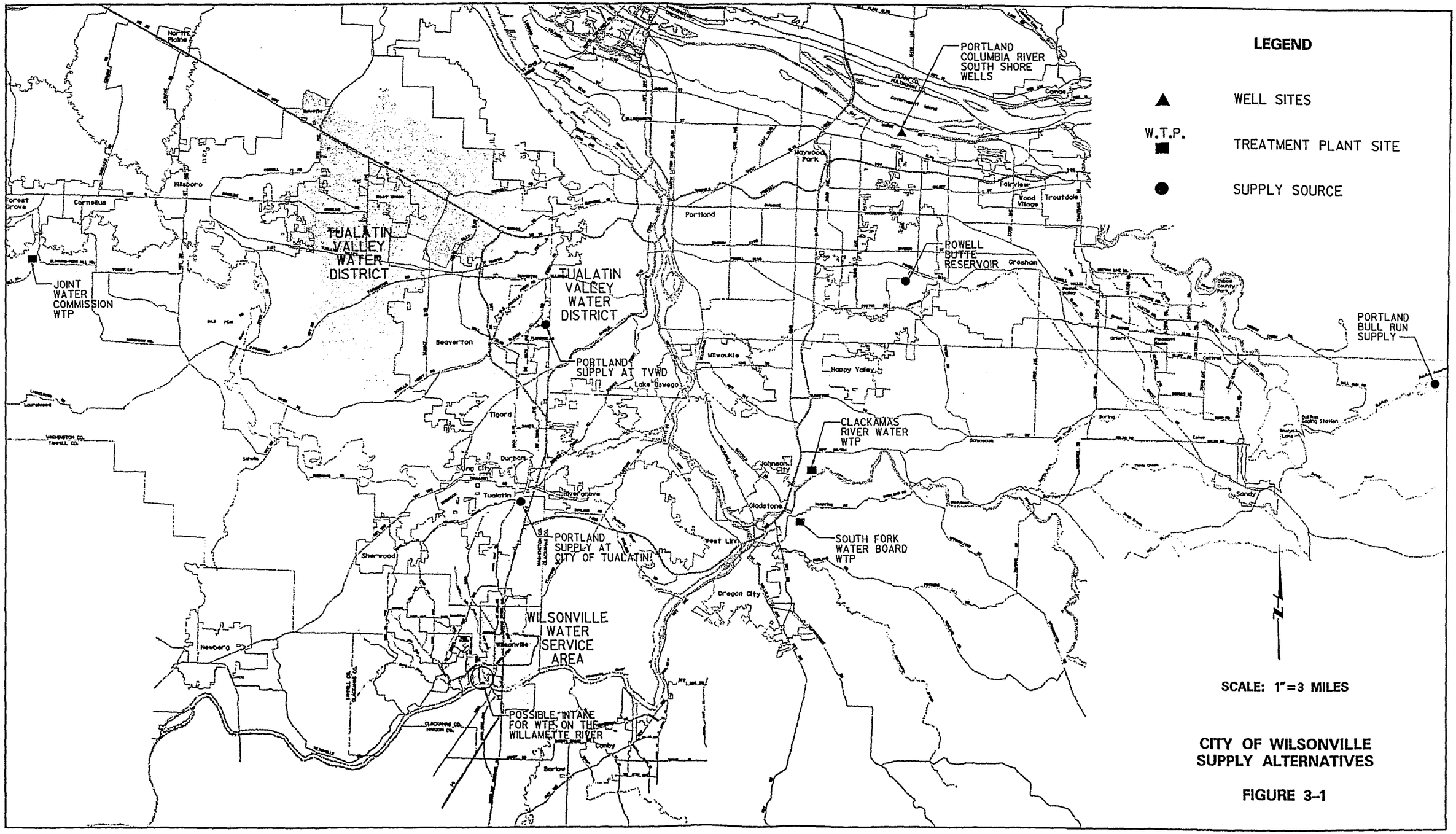
LONG-TERM SUPPLY ALTERNATIVES

The City of Wilsonville needs a new long-term water supply source. The City has adopted the planning horizon of the RWSS for its own supply planning. Thus, a long-term supply is one which is capable of satisfying the City's water supply needs to the year 2050. The components of a long-term water supply which were screened for potential use were:

- Clackamas River Supply from the South Fork Water Board (SFWB),
- Clackamas River Supply from Clackamas River Water (CRW), either direct or via the City of Portland,
- City of Portland Supply (Bull Run and Columbia River Southshore Wellfields) directly from Portland,
- City of Portland Supply (Bull Run and Columbia River Southshore Wellfields) via the City of Tualatin,
- City of Portland Supply (Bull Run and Columbia River Southshore Wellfields) via the Tualatin Valley Water District,
- Tualatin River/Trask River Supply from the Tualatin Valley Water District and the Joint Water Commission, and
- Willamette River Supply from a new water treatment plant.

Most of these sources are existing, developed supplies which have treatment and transmission facilities in place for the production and delivery of water, although not to the City of Wilsonville. The Willamette River is not currently developed as a municipal source within the metropolitan area. It is used as the main source of supply for the City of Corvallis, Oregon.

In addition to these sources, Aquifer Storage and Recovery (ASR) in conjunction with one of the surface water sources, the continued use of the City's existing wells as a peaking source only, and non-potable dual water systems were evaluated. ASR is a water management practice whereby surface is injected into and stored in underground aquifers when it is available (the winter), and then extracted for use when the



CITY OF WILSONVILLE SUPPLY ALTERNATIVES

FIGURE 3-1

MONTGOMERY WATSON
Portland, Oregon

demand is high (the summer). ASR by itself is not an adequate source, but could potentially be developed for use with one of the surface water sources as a means of providing peak season water demands at lower costs. While continued reliance on the City's existing 5 mgd groundwater system to meet all water needs would not be possible, it may be possible to use the wells in a diminished role to provide only peaking capacity on a seasonal basis in combination with some other source. A non-potable dual water system could also be used to reduce demand on the potable supply.

Figure 3-1 illustrates the location of each supply component. A description of each supply component is presented herein, including a discussion of the source, existing treatment and transmission facilities, and estimates of available supply quantities. Montgomery Watson held discussions with the purveyor of each developed source to gather information and to discuss the feasibility of expanding its supply system to serve Wilsonville.

CLACKAMAS RIVER SUPPLY FROM THE SOUTH FORK WATER BOARD

The South Fork Water Board (SFWB) was formed to supply water to the Cities of Oregon City and West Linn. The SFWB Board consists of council members from both cities with Oregon City having three voting members and West Linn having two voting members. The SFWB also provides surplus water to the southern portion of the Clackamas River Water (CRW) system as discussed below. The SFWB has the most-senior water rights on the Clackamas River for approximately 43 mgd.

The SFWB has a 20 mgd water treatment plant located on Hunter Avenue above the Clackamas River. Raw water is currently pumped from the river via an existing intake/pumping station located along Clackamas River Drive approximately one mile upstream of the confluence with the Willamette River. A new, larger intake/pump station was recently constructed approximately 500 feet downstream of the old intake because the river has changed courses and left the old intake in a vulnerable position with respect to being able to pump sufficient water in the summer, low flow periods. The SFWB also recently expanded and upgrading its Division Street Pump Station, which delivers water to most of Oregon City and West Linn. Treated water flows approximately three miles from the water treatment plant (WTP) by gravity to the Pump Station. These capital improvements cost approximately $5.5 million and have resulted in higher water rates to its customers.

Currently, the SFWB WTP is almost at full capacity. However, if CRW decides to stop receiving SFWB surplus water to serve the southern portion of its system as explained further below, or if SFWB expands its treatment plant, then there would be excess capacity available in the WTP. The current peak day demand for the southern portion of the service area is approximately 4 to 5 mgd. Also, the SFWB is anticipating an expansion of its WTP to 30 mgd in the next three to six years, depending on what CRW decides to do for service to the southern portion of its service area. Growth continues in Oregon City and West Linn, and even if CRW decides to discontinue receiving SFWB water, a WTP expansion prior to the year 2005 is likely.

SFWB staff have expressed interest in serving water to Wilsonville and SFWB has recently begun a Master Plan study which is looking at the potential to sell water to new customers. While there is some doubt as to whether the ultimate (year 2050) water needs of Wilsonville could be served by the SFWB (discussed below), this alternative appears to have some promise as a long-term supply for the City of Wilsonville. Therefore, it was analyzed further in this report for comparison with other alternatives.

In order to deliver SFWB water to Wilsonville, a new pumping station at the existing Division Street Pump Station and a new pipeline would be required. The preliminary assumptions used to estimate costs are presented later in this section. In order to estimate annual O&M costs, a wholesale water rate of $0.55 per 100 cubic feet was assumed based on the approximate current rate which both Oregon City and West Linn pay for SFWB water.

CLACKAMAS RIVER SUPPLY FROM CLACKAMAS RIVER WATER

Clackamas River Water (CRW) was recently created by the merger of the former Clackamas Water District and the former Clairmont Water District. It has a 30 mgd water treatment plant located on the northern side of the Clackamas River approximately three miles upstream of the confluence with the Willamette River. Currently, Clackamas River Water supplies water to itself, the Oak Lodge Water District, the Mt. Scott Water District and the City of Gladstone. The former Clairmont Water District system is located on the southern side of the Clackamas River and continues to be supplied surplus water from the South Fork Water Board's water treatment plant located in Oregon City. CRW has 32.6 mgd of permitted water rights on the Clackamas River and has applied for 96 mgd more.

Over the past few years, the highest maximum day production from the water treatment plant was 25 mgd. CRW expects that the plant's 30 mgd capacity will be utilized in the near future if all the current customers continue to be served from the plant, and some expansion of its treatment plant capabilities would be needed.

There are a number of on-going projects within the CRW service area which may, however, affect the ability and desire of CRW to supply water to the City of Wilsonville. Oak Lodge and Mt. Scott, both existing customers of CRW, have plans to build a new 8.5 mgd slow sand filter plant on the south side of the Clackamas River by the summer of 1997. Oak Lodge has been studying and planning this facility for over eight years. If the new slow sand plant does get constructed, then the existing CRW WTP would not need to produce as much water as it currently does, and the need for new CRW WTP capacity would obviously be delayed. In such a case, CRW would have approximately 6 additional mgd of peak capacity surplus water available for Wilsonville (beyond the current 5 mgd capacity which has not been used in the plant), depending on how it decides to serve the southern portion of the CRW service area in the future.

CRW is currently preparing a Water System Master Plan and a Water Treatment Plant Study to plan for its future needs. The southern portion

of the CRW service area, which currently purchases surplus water from the SFWB WTP, may receive CRW WTP water in the near future.

CRW is also leading a subregional planning effort in the Clackamas River basin. Draft results from the first phase of this study, completed in the summer of 1996, indicates that future water needs within the Clackamas basin will exceed the available senior water rights in the basin some time between the year 2015 and 2040. The second phase of the study, due to be completed in the spring of 1997, will look at potential transfers to and from service areas, such as the City of Wilsonville, which are outside the Clackamas basin. It is possible that these planning efforts will result in construction of a new water treatment plant adjacent to the existing CRW plant by the year 2000.

CRW could also make water available to the City of Wilsonville through some type of "wheeling" agreement with the City of Portland. Under this scenario, CRW water would be supplied to the City of Portland through existing connections between these systems. That would then free Portland system water for delivery to Wilsonville, via one of the potential delivery mechanisms discussed below. During the public review process for the Regional Water Supply Plan, Portland City Council indicated a policy preference to provide only Bull Run water to City of Portland customers except during emergency conditions. This type of wheeling arrangement would obviously require agreement by the City of Portland and modification to the existing City of Portland policy preference.

CRW has expressed an interest in evaluating the feasibility of serving water to Wilsonville from its WTP. It is understood that the existing WTP would not be able to serve all of Wilsonville's ultimate water needs to the year 2050, but if all water rights in the Clackamas basin were fully developed, some water would be available for export to at least the year 2030. If Wilsonville were to continue to receive CRW water for many years, it would eventually have to participate in the new WTP which CRW is currently planning. CRW may also be willing to financially support a part of the capital facilities needed to serve Wilsonville, such as a pipeline, depending on certain arrangements. The proposed pipeline could become part of a regional transmission network which could possibly benefit a number of water providers in the southern part of the region. CRW would presumably want Wilsonville to enter into a long-term supply agreement, perhaps for as long as 20 years, if this alternative were selected as Wilsonville's long-term supply source.

Just as with SFWB, while there is doubt as to whether the ultimate (year 2050) water needs of Wilsonville could be served by CRW, this alternative appears to have some promise as a long-term supply for the City of Wilsonville. Therefore, it was analyzed further in this report for comparison with other alternatives.

In order to deliver CRW water to Wilsonville, a pumping station at the CRW WTP and a pipeline would be required. The preliminary assumptions used to estimate costs are presented later in this section. In order to estimate annual O&M costs, a wholesale water rate of $0.45 per 100 cubic

feet was assumed based on the current rate which Oak Lodge WD pays for CRW water.

CITY OF PORTLAND SUPPLY DIRECTLY FROM PORTLAND

The City of Portland's water system is the largest in the metropolitan area and supplies water to many wholesale customers outside of the Portland city limits. Among Portland's wholesale customers are the City of Gresham, Rockwood PUD, the Tualatin Valley Water District, the City of Tigard and the City of Tualatin.

Portland is supplied water from the Bull Run Watershed and from groundwater wells along the South Shore of the Columbia River in Northeast Portland. The Bull Run Supply has a maximum delivery capacity of approximately 215 mgd. The groundwater system has a maximum delivery capacity of approximately 90 mgd and its use is typically limited to periods when the Bull Run Supply can not provide adequate flow. Historically, the groundwater system has been purely an emergency and peaking supply, but its use may increase in the future as the region's water demands continue to increase. During the recent flooding in February 1996, the groundwater supply was the only source available to Portland because the unfiltered Bull Run Supply was shut down due to excessive turbidity.

Treatment of the Bull Run Supply consists of chlorination at the Headworks and ammoniation at Lusted Hill before the water enters the 50 MG Powell Butte Reservoir in mid-Multnomah County. Beginning in 1997, Bull Run water will also be treated with sodium hydroxide at Lusted Hill to raise the pH and to reduce its corrosivity. The groundwater, when in use, is chlorinated and enters Powell Butte Reservoir, where it mixes with Bull Run water. The quality of the Bull Run Supply and the groundwater supply are quite different. Bull Run water is a very soft, low mineral water typical of most Cascade surface water supplies. The groundwater is harder and more mineralized than Bull Run, more similar to Wilsonville's current water supply.

From Powell Butte, water is served to areas outside the City of Portland on the western side of the Willamette River via the 60-inch diameter Washington County Supply Pipeline. This pipeline was built in 1983 to provide a gravity supply (without pumping) west of the Portland Hills. The pipeline's terminus is in the City of Tualatin, where its size is reduced to 36-inch diameter.

Portland has indicated that it is "...not, at this time, willing to establish new contracts to sell water wholesale during the peak season (i.e., mid-June to mid-October)" to the City of Wilsonville (see May 9, 1996 letter in Appendix). Portland has indicated that during negotiations with existing wholesale customers whose contracts expire between 2004 and 2007, it will assess the possibility of serving new wholesale customers. If Wilsonville is able to defer making a long-term supply decision until Portland can assess the possibility of serving new wholesale customers, and if Portland then decides it can serve them, Wilsonville may then be able to have more serious discussions with Portland about water from its system. It is unlikely that such discussions could begin for several years, however. If a long-term agreement could be reached

at a future date, significant system improvements would still have to be made (ie, a new pipeline) to be able to deliver the required flows to Wilsonville.

Portland did indicate that there is considerable water available from its system during non-peak months. If there was some way for Wilsonville to be able to implement a supply scenario whereby only non-peak Portland water was needed (such as in conjunction with ASR), then it may be possible to make such arrangements. However, this does not appear to be a viable option right now for Wilsonville due to the relatively-high projected peak day demands (10 mgd in 2000, 20 mgd in 2010) and the as-of-yet unproven ability of ASR to be able to store and produce these quantities of water.

Based on Portland's position, this option was not be considered as a long-term supply alternative for further analysis in this report.

CITY OF PORTLAND SUPPLY FROM CITY OF TUALATIN AND/OR FROM TVWD

As mentioned above, the City of Tualatin and the Tualatin Valley Water District (TVWD) receive most or all of their potable water from the City of Portland via the Washington County Supply Pipeline. Each of these entities is discussed in relation to its potential ability to serve Portland water to Wilsonville.

CITY OF TUALATIN

Tualatin receives all of its potable water from the City of Portland. A 36-inch diameter pipeline delivers this water to the intersection of 80th and Florence. Tualatin can take up to 10.8 mgd of supply from the Washington County Supply Pipeline. The City's current peak day demand is approximately 5.5 mgd and its average day demand is approximately 2 mgd. Tualatin estimates that its ultimate peak day demand will be 14.3 mgd at "buildout" within the City limits.

At least in the short-term, Tualatin may have 3 to 5 mgd of peak day supply available for use by another entity such as the City of Wilsonville. Discussions with City of Tualatin staff suggest that such a short-term arrangement might be feasible assuming it is approved by the City of Portland.

Tualatin and the City of Sherwood have recently taken a similar supply approach. Tualatin has agreed to provide Sherwood with some of its excess Portland supply capacity. Portland has approved an agreement whereby Sherwood is allowed to take up to 1 mgd from Tualatin with an upper total volume limit of 49 MG during the Bull Run Reservoir drawdown period which can vary from year to year. Sherwood constructed a four mile long, 24-inch diameter pipeline to deliver water from Tualatin to Sherwood.

While Tualatin currently has some excess capacity that may be available for Wilsonville, the quantity would be limited compared to Wilsonville's needs. It is highly unlikely that this excess capacity will be available for many more

years due to expected growth within Tualatin's service area. Hence, any supply option from the City of Tualatin could only be considered a short-term measure. Also, if the City of Wilsonville were to attempt to make such a short-term supply arrangement with Tualatin, the City of Portland would have to approve the arrangement and could possibly limit the available supply to something similar to the Tualatin-Sherwood arrangement. This option was not be considered as a long-term supply alternative for further analysis in this report.

Potential supply interties between Tualatin and Wilsonville could be made at 80th and Florence (this would require a pipeline south to Wilsonville) or between the reservoirs near the Tualatin-Wilsonville boundary.

TVWD

The Tualatin Valley Water District currently receives a large portion of its water from the City of Portland via the Washington County Supply Pipeline. TVWD has recently become a member of the Joint Water Commission (JWC) and is taking some of its supply from the JWC Water Treatment Plant located south of Forest Grove along the Tualatin River. Other JWC members include the City of Hillsboro, the City of Beaverton and the City of Forest Grove.

Until TVWD became a member of JWC, it would not have been able to even consider supplying any surplus Portland water to Wilsonville. However, because the JWC WTP is currently being expanded from 40 mgd to 70 mgd (to be completed in July 1997), TVWD might be able to utilize more JWC water in the short-term and provide some excess Portland water to Wilsonville. It may be possible for TVWD to provide up to 5 mgd of peak supply capacity from its Portland supply at Bradley Corners. A pipeline would have to be constructed from this point south to serve Wilsonville. TVWD estimates that this capacity would be available to Wilsonville until the year 2002 +/-. TVWD is currently in the process of developing firm estimates of the available water.

This option was not be considered as a long-term supply alternative for further analysis in this report. It could be coupled with other elements to bridge the short-term gap until a more long-term solution could be brought on line. Portland would have to approve of such a plan.

TUALATIN RIVER/TRASK RIVER SUPPLY FROM THE JOINT WATER COMMISSION

As mentioned above, the Joint Water Commission has a water treatment plant on the Tualatin River south of Forest Grove. The plant treats water pumped from the Tualatin River which includes released water from Barney Reservoir (located in the Trask River headwaters) as well as natural streamflows in the Tualatin River basin. The supply, treatment and delivery system is currently being expanded including an enlargement of Barney Reservoir, an increase in the WTP capacity from 40 mgd to 70 mgd, and the proposed construction of 10 miles of a new 72-inch diameter pipeline (called the Northern Transmission Pipeline). JWC members include Hillsboro, Beaverton, Forest Grove and TVWD.

There is no available capacity in the existing or expanded JWC supply system which could be used for Wilsonville, either in the short-term or in the long-term. This is not a viable option for Wilsonville. However, as mentioned above, TVWD might be able to temporarily provide Wilsonville with a part of its Portland supply if it were to take more JWC water.

WILLAMETTE RIVER SUPPLY

Currently, no Portland metropolitan area water providers use the Willamette River for potable water supply. The City of Corvallis has used the Willamette River as its main source of supply for many years and is currently expanding its Taylor WTP from 14 mgd to 21 mgd to meet its growing water needs.

The Willamette River has been the focus of much attention during the conduct of the Regional Water Supply Study. It remains as one of the recommended alternative supply sources for the region to meet the growing water needs of this area. TVWD, which holds approximately 130 mgd of water rights on the Willamette River, conducted a pilot plant study in Wilsonville in 1994 to determine the treatment requirements for this supply. TVWD completed two years of raw water quality monitoring of the river to establish baseline data. TVWD also prepared a preliminary water treatment plant layout for the Willamette River supply on 40 acres of the Wilsonville Tract site as part of its proposal to the Division of State Lands to purchase that property.

Wilsonville holds approximately 19 mgd of water rights on the Willamette River. The City of Wilsonville evaluated the river as a potential source of supply in its 1986 Water Supply Plan. At that time, it was determined that implementing additional groundwater wells was a much less costly supply alternative compared to developing a new river supply. However, the Study also acknowledged that the City's groundwater supply was limited in capacity and that the Willamette River would need to be seriously considered as a supply source in the mid-1990's if growth and water demands continued as projected, which they have.

A new supply from the Willamette River would require the construction of an intake/pump station at the riverside, a raw water pipeline, a water treatment plant, a finished water pump station and a finished water pipeline. Wilsonville has two options for developing the Willamette River as a source of supply. The City can construct and operate its own water supply system or it can become a participant in a regional or sub-regional supply system. A multi-agency facility would probably result in lower overall costs to the City due to economies of scale. There are other water providers within the region who have an interest in possibly developing the Willamette River as a source of supply, some with more immediate needs and some with potential future needs.

Six of those interested entities, including Wilsonville, recently completed the "Willamette River Water Supply Study" which was finalized in March 1996. This study was conducted by Montgomery Watson for the Canby Utility Board, Clackamas River Water, the City of Sherwood, the City of Tigard, the Tualatin Valley Water District and the City of Wilsonville. Planning level

estimates of required facilities and costs were developed in that study to assist each of the entities in determining the feasibility of using this potential new supply source for their current and future needs. The information developed for that report was used in this study to evaluate the Willamette River as a potential supply source for Wilsonville.

AQUIFER STORAGE AND RECOVERY (ASR) AS A PEAKING SOURCE

ASR is a supplemental supply alternative which has received significant attention within the region and throughout the Pacific Northwest in recent years. Surplus water is injected and stored in a suitable aquifer during the non-peak season and then is extracted during the peak season. This type of operation takes advantage of the abundant surface water typically available in the fall, winter and spring and is able to reduce the size of transmission and treatment facilities. The Regional Water Supply Study included possible ASR systems in both eastern Multnomah County and in eastern Washington County as potential supply options to provide up to 20 mgd of peaking capacity. The Joint Water Commission is currently evaluating the feasibility of ASR for its members' needs in the Cooper/Bull Mountain area. The City of Salem is currently developing an ASR system to supplement its Santiam River source and expects to develop 10 to 20 mgd of peaking and emergency supply using this technology.

ASR is an attractive alternative for Wilsonville because of the City's existing use of groundwater. The fact that the aquifer under the City is declining, according to OWRD, suggests that there is available storage capacity in the aquifer to inject treated surface water and withdraw it as needed during the peak season. Implementing ASR may allow the water levels in the aquifer to increase over time which would be seen as a benefit by most interested parties. However, to develop ASR as a supply source requires significant testing and analysis. It is likely that the actual water to be injected will have to be "pilot-tested" similar to what the City of Salem completed to prove to that this process is indeed viable at this site.

ASR is attractive to many water providers because it can provide peaking capacity at a lower cost compared to providing peaking capacity directly from a surface water supply. If the surface water supply is the only source (without ASR), then the water treatment and supply systems must be sized for peak day flow requirements. However, if an ASR system is used in conjunction with a surface water supply, then the surface water supply and treatment components can be sized to provide peak season (approximately) flow requirements which are considerably less than peak day flow requirements. Any demands above the peak season demands would be provided by the ASR system. During the non-peak season, excess treated water is injected into the aquifer in quantities sufficient to provide enough peaking capacity for the following peak season. Dual-purpose well systems capable of injecting water into the aquifer as well as pumping water from the aquifer need to be constructed for this purpose.

As an example of how ASR could benefit the City of Wilsonville, the estimated peak day capacity needed for the year 2010 is approximately 15 mgd. All of this capacity could be provided by a surface water source such as the Willamette River. Or, if ASR were proven to be successful, it could be sized to provide 5 mgd of peak capacity and, therefore, the Willamette River source would only have to be sized to provide 10 mgd of capacity instead of 15 mgd. This would represent a 33 percent reduction in the surface water source capacity which would result in significant capital cost savings.

For the purposes of this study, ASR was assumed to be a viable alternative for use as a peaking supply in conjunction with another surface water source. Of course, the use of ASR would have to be proven at some point in the future before it could be implemented. Further details of the assumptions used to evaluate ASR are contained in a later part of this section.

USE OF EXISTING GROUNDWATER AS A PEAKING SOURCE

The City of Wilsonville has been using native groundwater as its only water supply source for over 25 years. As explained earlier, the groundwater levels in the Wilsonville area are declining and OWRD has requested that the City eliminate the use of groundwater altogether. However, it may be possible for the City to reduce, rather than completely eliminate, the use of native groundwater and still provide significant improvements in the groundwater levels. In this manner, groundwater would only be pumped during the peak season, similar to an ASR operation, and would significantly reduce the total amount of water being pumped each year compared to today's pumping rates.

For example, the average annual volume of groundwater pumped by Wilsonville during 1994 and 1995 was approximately 817 MG/year. If a new surface water supply was available that would eliminate the need to pump groundwater except to provide in excess of the peak season demands, then the approximate annual pumping volume during 1994 and 1995 would have been 70 MG/year, a reduction of approximately 92 percent in the volume of groundwater pumped. Of course, as overall demands continue to increase in Wilsonville, the amount of groundwater which would have to be pumped under this kind of scenario to meet peak demands may also have to be increased.

The continued use of existing groundwater as a peaking supply is included as an alternative for further evaluation in this report. If this appears to be feasible or economically attractive, then further discussions with OWRD would have to be held to verify its long-term use.

DUAL WATER USAGE

The use of reclaimed wastewater, or the use of untreated Willamette River water for irrigation and other non-potable uses is becoming a larger component of some water supply systems, especially in the Southwest USA. Reclaimed water or non-potable water can significantly reduce demands on potable water systems if implemented at a large-enough scale. It may be possible for the City of Wilsonville to implement a

significant reclaimed water system to reduce its use of potable water for non-potable needs. Since a large portion of Wilsonville's summertime water demands are for irrigation purposes, a dual-use system for some or all of its large irrigation customers may be feasible. The cost of developing a reclaimed water system, to operate in parallel with a potable water system, can be as high or higher than developing a potable water source, and therefore this approach is not as attractive for Wilsonville as either ASR or use of its existing wells for peaking purposes. There are also significant questions of compatibility of reclaimed water systems with public health regulations in Oregon. While the City may want to investigate the possible use of these systems for irrigation purposes in the long-run, they cannot today be considered feasible as a long-term supply. Use of a dual water system would also not alleviate the need to develop another potable water supply.

SUMMARY

The following long-term supply components were recommended for further initial evaluation and comparison in this report:

1. Clackamas River from SFWB
2. Clackamas River from CRW
3. Willamette River - New Source
4. Aquifer Storage and Recovery in Conjunction with a Surface Water Supply
5. Continued Use of Groundwater in Conjunction with a Surface Water Supply

Use of Portland water directly from the City of Portland does not appear to be a viable long-term supply alternative for the City of Wilsonville due to Portland's reluctance to discuss or offer any new long-term supply agreements until new contracts are developed. Portland may be ready to discuss new agreements in five to ten years. Use of Portland water from either the City of Tualatin or from TVWD offer only short-term supply options. Use of Joint Water Commission water is not an option for Wilsonville.

SHORT-TERM SUPPLY MEASURES

The earliest any of the long-term supply alternatives would be available to provide water to Wilsonville is approximately the year 2000. Even if a decision were made to immediately implement one of the long-term alternatives, it would take until then to plan, design, construct and start-up the required facilities. Therefore, no matter what long-term supply alternative is selected, Wilsonville will have to continue to deal with the fact that there is a limited water supply available for at least the next three years. The eighth well which will be on-line for the summer of 1997 will help to alleviate the current water supply shortfall. Other short-term water supply measures which could be used to meet the water shortfall which will occur between now and the year 2000 were also evaluated in this study. These additional short-term measures include:

- Curtailment
- An intertie with the City of Tualatin supply
- Purchase of supply from another provider, if available

- Small-scale water treatment plant on the Willamette River
- Additional reservoir(s) to store excess water for peaking purposes

CURTAILMENT

The most readily available short-term supply measure is the continuation of temporary water use curtailment measures during periods of hot weather. (Conservation is a reduction in the amount of water used to achieve some beneficial purpose, while still achieving that purpose. In curtailment, the use of water is reduced such that the same beneficial purposes are not fully achieved. For example, conservation is using more efficient lawn watering. Curtailment is stopping lawn watering altogether.) While conservation is always appropriate, curtailment is a stop-gap measure. In recent years, the City has employed both voluntary and mandatory water use curtailment to assure that demand does not exceed supply. In some hot spells, the City has been able to reduce water consumption enough through voluntary curtailments by its 30 largest users. In other periods, the City has had to go to more community wide curtailments. The advantage of the use of curtailment as a short-term supply measure is that it is relatively inexpensive for the City (only the operational costs for obtaining compliance during the curtailment period are incurred), it can be instituted quickly each year it is needed, and it serves to demonstrate the need for a new water supply. The disadvantages include that curtailment may cause economic loss and/or hardship to water customers and its continued use can serve to undermine confidence in the ability of the City to provide for the community's water needs. However, regardless of other short-term supply measures which may be undertaken, the City should be prepared to institute water curtailment measures as needed until a new long-term source is available.

Wilsonville recently prepared a Water Management and Conservation Plan (Montgomery Watson, April, 1996) as required by OWRD. The plan outlines in detail the measures which Wilsonville has and will implement to conserve water because it uses a groundwater supply. The City has taken aggressive steps to ensure that its available water supply remains adequate. Even after a new source of supply is developed, conservation measures should continue to be part of Wilsonville's water supply practices.

INTERTIE WITH THE CITY OF TUALATIN

As explained previously, the City of Tualatin currently has excess capacity in its Portland supply system. The amount of this excess will continue to decrease as Tualatin grows. However, for the next three to five years, it appears as though Tualatin might be able to spare 3 to 5 mgd of peak supply depending on the types of summers during that time period. Whether this amount of water could be made available to Wilsonville would depend on Tualatin and Portland.

There are two locations where this excess water could be made available from Tualatin. The largest volume of water would be available at the terminus of the 36-inch pipeline at 80th and Florence. In order for Wilsonville to be able to

access this water, a new 4-mile long pipeline (approximate length) would have to be constructed. Tualatin is in the process of building a 24-inch southerly extension pipeline from 80th and Florence to Boones Ferry Road and Sargent. It may be possible for Wilsonville to connect at this point which would result in a shorter pipeline (approximately 3 miles).

Construction of a more-costly pipeline from Wilsonville to Tualatin to provide a larger quantity of water may not be a cost-effective solution to meet short-term needs unless other entities participate in its costs. This pipeline could potentially serve in the long run as the transmission pipeline from a future Willamette River WTP in Wilsonville (if built), but its size would have to be carefully evaluated to ensure that it would serve the future needs of all participants. This pipeline could also possibly serve as a transmission pipeline to Wilsonville from a future City of Portland supply, but as mentioned above, there is little guarantee that this supply would ever be made available to Wilsonville.

The other location where excess Tualatin water may be available is at the southerly boundary of Tualatin, where it has a 0.8 MG reservoir (Frobase) which is relatively close to Wilsonville's 2.2 MG and 3.0 MG reservoirs. It may be possible to construct an intertie between the two reservoirs which would allow gravity flow to Wilsonville, but a pumping station is more-likely required to ensure reliable delivery at all times. The quantity of water which would be available to Wilsonville at this point would be limited to Tualatin's pump station capacity and its water demands in the reservoir's service area, but is approximated at 1 mgd peak. It may be possible to make other improvements or modifications to the Tualatin system to accommodate greater flows to Wilsonville, but no information is available as to whether that would be feasible.

PURCHASE SUPPLY FROM ANOTHER PROVIDER

The only other provider besides the City of Tualatin which might be able to provide Wilsonville with a short-term water supply is TVWD. As mentioned above, TVWD could possibly use more JWC water for the next few years (until 2002 +/-), and provide Wilsonville with a share of its Portland supply. Of course, this arrangement would have to be agreeable with other JWC members as well as the City of Portland.

In order to receive this water, a pipeline would have to be constructed from the former Metzger Water District area in the vicinity of Bradley Corners. This pipeline would be longer than a pipeline from the City of Tualatin (approximately 6 miles versus 4 miles), and would therefore be more expensive to construct. However, it appears that TVWD may be able to offer up to 5 mgd of peak supply for this duration which is more than what Tualatin may be able to offer.

As mentioned above, a new pipeline from the north to Wilsonville could potentially serve in the long run as the transmission pipeline from a future Willamette River WTP in Wilsonville (if built), but its size would have to be carefully evaluated to ensure that it would serve the future needs of all possible participants. This pipeline

could also possibly serve as a transmission pipeline to Wilsonville from a future City of Portland supply.

As an example of the potential pipeline costs, it was assumed that this pipeline would be used to deliver Portland water to Wilsonville from the City of Tualatin and from the Tualatin Valley Water District (TVWD). In order to be conservative, it was also assumed that this pipeline would eventually be used to deliver treated Willamette River (from a WTP located in Wilsonville) to Sherwood, Tualatin, Tigard and to TVWD. Hence, the pipeline was sized for the higher long-term flows from Wilsonville rather than the smaller short-term flows to Wilsonville. These maximum day flows were assumed to be 25 mgd to Wilsonville, 20 mgd to Tigard and 5 mgd to Sherwood/ Tualatin and 10 mgd to TVWD. The new pipeline was assumed to initially connect to the two Wilsonville reservoirs on Elligsen Road, but could also be connected to a new 5 MG reservoir mentioned below if located at a suitable site.

Table 3-1 is a summary of the various reaches of the new pipeline and the estimated construction and project costs for each reach.

It is difficult to estimate what Wilsonville's portion of these costs would be. Obviously, the other agencies who would eventually receive Willamette River water from this pipeline should contribute based on their future use of the pipeline. As a starting point for comparison purposes, assume that Wilsonville would need to construct a 16-inch pipeline all the way to TVWD for the purposes of delivering 5 mgd of Portland water. The estimated construction cost of this smaller pipeline is approximately $4.0 million and the estimated project cost is $5.6 million which includes a 40% allowance for engineering, construction management, administrative and legal costs, and contingencies.

Such a pipeline would requires further study and evaluation. It may be possible to deliver Portland water to Wilsonville without building the pipeline reach all the way to TVWD. In that case, the costs would be significantly less due to elimination of approximately 3 miles of pipeline.

TABLE 3-1
SUMMARY OF POTENTIAL PIPELINES

Pipeline Reach	Length and Diameter	Estimated Project Cost
Wilsonville to Tualatin/ Sherwood	4.5 miles of 42"	$8.4 million
Tualatin/Sherwood to Tigard	2.0 miles of 36"	$3.2 million
Tigard to TVWD	3.0 miles of 24"	$2.8 million
Totals	**NA**	**$14.4 million**

SMALL-SCALE WATER TREATMENT PLANT ON THE WILLAMETTE RIVER

Following completion of the one-year pilot plant study conducted by TVWD, there has been some discussion of building and operating a small-scale, but larger than pilot-scale, water treatment plant to demonstrate that the recommended treatment processes are acceptable for full-scale implementation. The nominal capacity of such a plant would probably be 1 to 2 mgd. Demonstration plants have been constructed and operated by a number of the country's water providers, including Contra Costa (California) Water District and the Los Angeles Department of Water and Power, prior to the design and construction of full-scale water treatment plants. If such a demonstration plant were built, then the City of Wilsonville could potentially use it to provide supplemental water for its system as long as it continued to operate.

A demonstration plant could be constructed and started up in a relatively short period of time, perhaps within one year, which would serve as a short-term supply until a long-term solution was implemented. Various entities interested in the Willamette River as a potential supply source, including TVWD, have expressed an interest is financially supporting a demonstration treatment plant depending on its cost, location and purpose.

The estimated construction cost for a 2 mgd demonstration plant is $2.2 million. This cost does not include land purchase. The estimated project cost is $3.1 million which includes a 40% allowance for engineering, construction management, administrative and legal costs, and contingencies. For this estimate, it was assumed that the facility would be located on land adjacent to the river near the site where the pilot plant trailer was located. The facility would include a small intake facility with raw water pumps, a 10-inch raw water pipeline, a small operations/control building, a modular water treatment plant including ozone generation and contactors, floc/sed basins, dual media (GAC/sand) filters, a 150,000 gallon clearwell, finished water pumps and a 10-inch finished water pipeline to connect to the City's 14-inch pipeline along lower Boone's Ferry Road south of Wilsonville Road.

ADDITIONAL RESERVOIR STORAGE CAPACITY

Above-ground reservoir storage is typically used to provide short-duration peak demands (such as peak hour demands) as well as emergency fire flow demands. Reservoirs are not usually a means to provide peak day demands because of the relatively large storage volumes required. It is more-economical to provide peak day demands from the supply source (ie, wells or water treatment plant) rather than from storage.

In Wilsonville's situation, constructing a new, large reservoir(s) might be able to provide a small measure of relief in meeting peak demands. However, the reservoir(s) would have to provide at least 5 MG of storage (equal to one day of storage at 5 mgd peak day flow) to be of any significant benefit. If constructed initially for peaking, it would eventually serve as normal storage as the City's water demands increase

over time. The City will have to add new storage reservoirs over time in any event, so constructing a new reservoir(s) at this time would not be considered a "waste" of money.

It was assumed that this reservoir would be an above-ground structure on an unidentified site. Material options include steel and circular prestressed concrete. A steel tank will cost less to construct than a prestressed tank, but will have higher O&M costs due to painting requirements. The estimated construction cost for a 5 MG prestressed tank is $2.3 million on a relatively flat, non-rock surface, including minor site work and some piping and valving. This cost does not include land purchase. The estimated project cost is $3.2 million which includes a 40% allowance for engineering, construction management, administrative and legal costs, and contingencies. The City should review the planned construction of new reservoirs as part of its established CIP.

SUMMARY

There are a few short-term measures which the City of Wilsonville could implement to provide some water while a new long-term source is developed.

BASIS FOR INITIAL LONG-TERM ALTERNATIVES ANALYSIS

Improvements required for an existing or new source to provide a long-term water supply to the City of Wilsonville were identified in order to better understand the costs and other impacts.

Each of the long-term supply alternatives identified above was reviewed in terms of the necessary improvements and the following initial alternatives were developed:

1.A South Fork Water Board Supply without Groundwater or ASR
1.B South Fork Water Board Using Existing Groundwater for Peaking
1.C South Fork Water Board Using ASR for Peaking
2.A Clackamas River Water Supply Without Groundwater or ASR
2.B Clackamas River Water Supply Using Existing Groundwater for Peaking
2.C Clackamas River Water Supply Using ASR for Peaking
3.A Water Treatment Plant on the Willamette River (City-Owned) without Groundwater or ASR
3.B Water Treatment Plant on the Willamette River (City-Owned) Using Existing Groundwater for Peaking
3.C Water Treatment Plant on the Willamette River (City-Owned) Using ASR for Peaking
4.A Water Treatment Plant on the Willamette River (Jointly-Owned) without Groundwater or ASR
4.B Water Treatment Plant on the Willamette River (Jointly-Owned) Using Existing Groundwater for Peaking
4.C Water Treatment Plant on the Willamette River (Jointly-Owned) Using ASR for Peaking

The three "stand-alone" alternatives which were selected for evaluation and comparison include the existing South Fork Water Board supply, the existing Clackamas River Water supply and a

new supply from the Willamette River. The use of either the existing groundwater supply or ASR were included as sub-alternatives to all of the stand-alone options since they can provide peaking capacity, but can not serve as a supply alternative by themselves. The Willamette River supply was separated into two alternatives to distinguish the facilities and costs between a City-Owned facility and a Jointly-Owned facility. As mentioned previously, there are a number of other water providers besides Wilsonville which are investigating the use of the Willamette River as a source of supply and they could possibly become partners with the City in a sub-regional or regional supply system.

As stated previously, it is unlikely that either of the Clackamas River supply alternatives can provide Wilsonville with its ultimate water needs to the year 2050. However, either SFWB or CRW may be able to provide sufficient water to Wilsonville for the next 10 to 30 years. Hence, it was decided to include these two alternatives for further analysis.

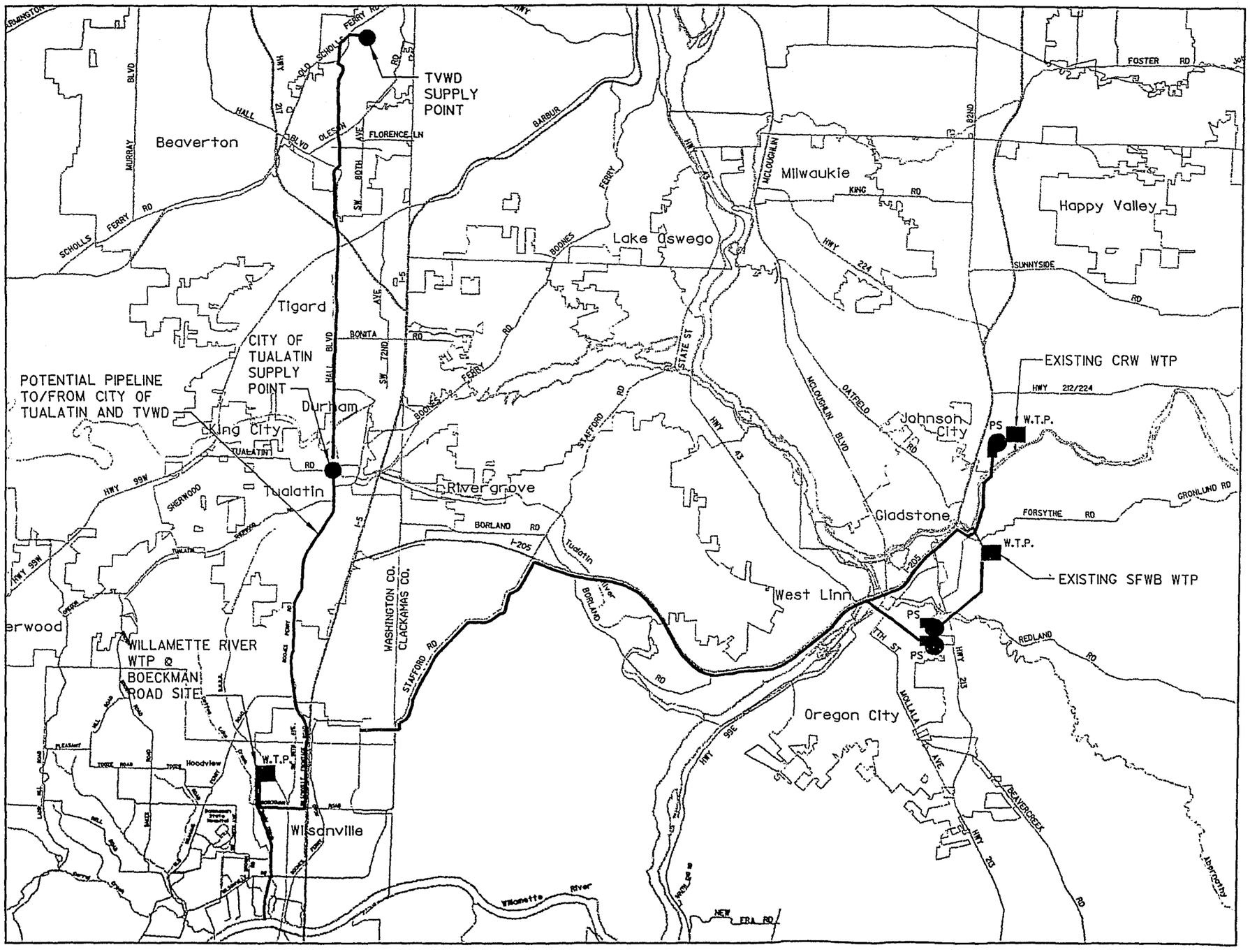
CAPACITY AND STAGING OF FACILITIES

Initial and ultimate supply capacities for each of the alternatives were developed in order to describe the physical characteristics of the supply scenarios. Cost estimates for these alternatives are presented in Section 4 and the alternatives are compared in Section 5. For the purposes of this report, it was assumed that water would be available for any of the supply alternatives beginning in the year 2000. Hence, the estimated water demands for that period were used as a starting point to develop the initial supply capacities. A peak day demand requirement of 25 mgd for the year 2050 was selected as the ultimate project capacity.

The initial (year 2000) peak day capacity recommended for construction was 15 mgd, which represents the estimated peak day demand in the year 2010. Because the estimated peak day demand in the year 2000 was estimated to be 10 mgd, it is prudent to construct more capacity initially to allow for demands to increase in the future without needing another expansion immediately.

Table 3-2 presents a summary of the physical characteristics of each supply alternative. Figure 3-2 presents a map showing the proposed location of the various alternatives' facilities. For Alternatives 1 and 2, the required new facilities include a pump station and a long transmission pipeline from either the SFWB or CRW facilities. The pump station was sized to initially deliver either 15 mgd or 10 mgd, depending on whether groundwater or ASR were being used for peaking. The pump stations were sized to deliver water from an elevation of 320 feet (SFWB) or 280 feet (CRW) to an elevation of 400 feet at Wilsonville's reservoirs. The pipeline from either CRW or SFWB was sized for the ultimate delivery capacity, either 25 mgd or 20 mgd depending on whether groundwater or ASR were being used for peaking.

Only one general pipeline alignment from either SFWB or CRW to Wilsonville is shown on Figure 3-2. This alignment was assumed to cross the Willamette River near or along the I-205 bridge



LEGEND

- SUPPLY POINT
- W.T.P. — EXIST. TREATMENT PLANT SITE
- W.T.P. — NEW TREATMENT PLANT SITE
- P.S. — EXIST. PUMP STATION
- P.S. — NEW PUMP STATION
- EXISTING WATER PIPELINE
- NEW WATER PIPELINE
- EXIST. RAW WATER PIPELINE
- NEW RAW WATER PIPELINE

N

SCALE: 1"=8,000'

CITY OF WILSONVILLE

WATER SUPPLY STUDY
LONG TERM
ALTERNATIVE SUPPLY OPTIONS

FIGURE 3-2

MONTGOMERY WATSON
Portland, Oregon

FILE: /usr2/proj/wrs/proj/wsfig3-2.dgn
JOB No.

TABLE 3-2
CITY OF WILSONVILLE
WATER SUPPLY STUDY
PHYSICAL CHARACTERISTICS OF SELECTED LONG-TERM SUPPLY ALTERNATIVES

Scenario Number	Description	Maximum Day Capacity (mgd) (Initial&Ultimate)	River Intake Capacity (mgd)	Raw Water Pump Station (Installed Hp)	Raw Water Pipeline (Length and Dia.)	Initial WTP Capacity (mgd)	Finished Water Pump Station (Installed Hp)	Finished Water Pipeline (Dia. and Length)	ASR Wells (Number and Capacity)
1.A	SFWB w/o GW or ASR	15, 25	0	0	0	0	790	12 miles of 36"	0
1.B	SFWB with Existing GW	10, 20 (SFWB) 5, 5 (GW)	0	0	0	0	525	12 miles of 33"	0
1.C	SFWB with 5 mgd ASR	10, 20 (SFWB) 5, 5 (ASR)	0	0	0	0	525	12 miles of 33"	5 @ 700 gpm ea
2.A	CRW w/o GW or ASR	15, 25	0	0	0	0	1,100	15 miles of 36"	0
2.B	CRW with Existing GW	10, 20 (CRW) 5, 5 (GW)	0	0	0	0	735	15 miles of 33"	0
2.C	CRW with 5 mgd ASR	10, 20 (CRW) 5, 5 (ASR)	0	0	0	0	735	15 miles of 33"	5 @ 700 gpm ea
3.A	WRWTP (City) w/o GW or ASR	15, 25	25	500	10,000' of 36"	15	1,000	3,700' of 36"	0
3.B	WRWTP (City) with Existing GW	10, 20 (WTP) 5,5 (GW)	20	400	10,000' of 33"	10	700	3,700' of 33"	0
3.C	WRWTP (City) with 5 mgd ASR	10, 20 (WTP) 5,5 (ASR)	20	400	10,000' of 33"	10	700	3,700' of 33"	5 @ 700 gpm ea
4.A	WRWTP (Joint) w/o GW or ASR	15, 25 (City) 30, 60 (Joint)	60	1,000	10,000' of 51"	30	2,000	3,700' of 51" 25,000' of 42" 10,000' of 39"	0
4.B	WRWTP (Joint) with Existing GW	10, 20 (WTP-City) 25, 55 (WTP-Joint) 5,5 (GW)	55	900	10,000' of 48"	25	1,800	3,700' of 48" 25,000' of 42" 10,000' of 39"	0
4.C	WRWTP (Joint) with 5 mgd ASR	10, 20 (WTP-City) 25, 55 (WTP-Joint) 5,5 (ASR)	55	900	10,000' of 48"	25	1,800	3,700' of 48" 25,000' of 42" 10,000' of 39"	5 @ 700 gpm ea

and then follow I-205 to Stafford Road and then to the Elligsen Road reservoirs. This route may not in fact be feasible due to the nature of the geology in the area. There are other pipeline alignments which could be considered, but they would have to be researched in more detail beyond the scope of this project. One general alignment was considered sufficient at this stage in order to estimate pipeline costs.

For the Willamette River alternatives, there are various facility components which would be required to develop this new source including:

- River Intake and Raw Water Pumping Station
- Raw Water Pipeline
- Water Treatment Plant Including On-Site Clearwell Storage and Land Purchase
- Finished Water Pumping Station at the Water Treatment Plant
- Finished Water Pipeline to Wilsonville and to other Points of Delivery if a Jointly-Owned Plant

More information regarding the different aspects of a new Willamette River supply scenario, and facility sizing criteria, are included in the recently-completed "Willamette River Water Supply Study" referenced previously. For a City-Owned facility, the initial capacity of the raw water pump station, water treatment plant and finished water pump station were sized for either 15 mgd or 10 mgd, depending on whether groundwater or ASR were being used for peaking. The raw water intake, raw water pipeline and finished water pipeline were sized for either 25 mgd or 20 mgd (ultimate capacity), again depending on whether groundwater or ASR were being used for peaking.

Besides Wilsonville, other possible near-term participants in a jointly-owned facility include the City of Tigard, the City of Sherwood and the City of Tualatin. Other possible long-term participants include the Tualatin Valley Water District, Clackamas River Water and the Canby Utility Board. For a jointly-owned facility, it was conservatively assumed that the ultimate supply capacity was either 60 mgd or 55 mgd depending on whether groundwater or ASR were being used for peaking. Construction of a jointly-owned facility would result in lower costs to the City of Wilsonville due to economies of scale and efficiencies of operation. In reality, if a Willamette River supply is eventually constructed, it may be sized for an ultimate capacity of up to 100 mgd (the regional deficit in supply to the year 2050 as identified in the Regional Water Supply Study) or 150 mgd (the amount of municipal water rights which are considered sufficiently senior to rely upon in low flow conditions) to meet many participants' future needs. In such a case, the actual costs to Wilsonville may be lower than those presented in this report.

Total project costs, including construction costs, contingencies, engineering, administration and other related costs, were estimated for the potential improvements. Annual O&M costs and annualized costs (amortized project costs plus O&M costs) were also estimated to compare the approximate unit costs of water for the various alternatives. These cost estimates should be considered "planning level" and were prepared from information and engineering data available at the time of the estimate. The final costs of any of the projects, if selected for implementation, will depend the actual labor and material costs,

competitive market conditions, final project scope, implementation schedule, and other variable factors as they occur. As a result, the final project costs will vary from the estimates presented herein.

USE OF EITHER GROUNDWATER OR ASR

As sub-alternatives, the use of existing groundwater and ASR were included to provide peaking capacity and to reduce the size and costs of the surface water supply systems. The initial and ultimate capacity available for peaking was assumed to be 5 mgd for both options. The current installed capacity of the existing groundwater system is approximately 5 mgd and will increase to approximately 6 mgd with the completion of Wilsonville's eighth well.

The use of ASR as a peaking source is currently undocumented in Wilsonville, but it is assumed that this concept would become feasible at some point in time. ASR would only be allowed through rigorous testing and development by the City in conjunction with OWRD and OHD approval processes. An ASR system would have to be pilot-tested using the proposed injection water, so this could not be accomplished until the selected long-term supply alternative is implemented.

For the purposes of this report, the initial and ultimate capacity of an ASR system was estimated at 5 mgd to match the existing groundwater capacity. Five new ASR injection/recovery wells, each rated at a pumping capacity of 700 gpm (1 mgd), were included in the facilities. It was assumed that the existing groundwater wells could not be used as ASR wells. However, it may be possible to develop ASR to a greater ultimate peaking capacity than 5 mgd depending on aquifer characteristics and, if feasible, would therefore reduce the size of the ultimate surface water supply capacity even further than shown in this report.

Section 4

PRELIMINARY COST ESTIMATES

Planning-level construction and operation and maintenance (O&M) costs were estimated for each initial long-term supply alternative identified in Section 3. The basis for these estimates was also provided in Section 3. In addition, annualized costs were estimated to compare approximate unit costs of water for the various supply alternatives. Section 5 provides a comparison of these alternatives including factors other than cost.

These cost estimates were prepared from information and engineering data available at the time of the estimate. The final costs of any of the projects, if selected for implementation, will depend on the actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors as they occur. As a result, the final project costs will vary from the estimates presented herein. The estimates are useful for relative comparisons of costs of alternative projects, but are not definitive predictions of the costs of any specific project. Project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

These cost estimates and comparisons also do not consider the variability in other issues concerning the level of service which are potentially inherent between alternative projects. The overall water system reliability, relationship to a regional system, the need for other improvements in the City's system, and other level of service factors could vary between the alternatives presented in this report. However, no effort has been made to identify or quantify these potential differences.

CONSTRUCTION COSTS AND PROJECT COSTS

Construction costs were estimated for each component using Montgomery Watson cost curves for recent projects. Other construction cost data, if pertinent and available, was used to verify and confirm the estimates. The cost estimates presented in this report are for planning purposes and should be considered accurate only at that level. They were developed assuming a traditional project consisting of design, bid/award, and construction by a licensed contractor using commonly accepted means and methods. The cost estimates are referenced to an Engineering News Record (ENR) construction cost index of 5,800 in the Seattle/Portland area. The estimated cost of the facilities should be expected to change along with the accuracy of the estimate as the project, if one is selected for implementation, proceeds into preliminary design and final design. The average of the contractors' bids received should fall within the a range of +/- 30 percent of the estimate after adjustment for changes in the ENR index.

An allowance of 40 percent was added to the construction cost to estimate the total project cost (also referred to as capital cost) for each scenario. This allowance includes contingencies, engineering, construction management, administrative and legal costs. The allowance for contingencies covers items such as variations in the project configuration developed during preliminary design and final design, unforeseen site conditions encountered during construction, and reasonable project changes during construction. The contingency allowance does not include major process additions or additional costs resulting from permit mitigation requirements, such as off-site roadway improvements or wetlands enhancement.

Most of the costs which were used for the Willamette River supply options were developed as part of the "Willamette River Water Supply Study" referenced earlier. For this report's analysis, it was assumed that a water treatment plant would be located on industrial zoned property within the City limits, near the "Jack property" site. Further investigations are required to either confirm that the any particular site is acceptable and available. Pipeline and pump station costs for the SFWB and CRW supply alternatives were estimated from the information presented in Section 3. The pipeline costs from either SFWB or CRW include a Willamette River crossing.

Table 4-1 presents summaries of the estimated construction costs and total project costs for each of the four supply alternatives. The costs for the sub-alternatives which include the use of groundwater or ASR for peaking capacity are also included. The basis for these estimates were shown in Table 3-2 and in Figure 3-2. Unit costs, presented in terms of dollars per gallon per day of initial supply capacity ($/gpd), are also presented to assist in the comparison of the costs between different scenarios.

There are some major conclusions which are apparent based upon these estimates:

- Project costs are lower for a SFWB supply compared to a CRW supply due to the shorter length of pipeline required to deliver the water to Wilsonville.

- Project costs are approximately 20 percent lower for a jointly-owned Willamette River WTP compared to a City-owned WTP due to economies of scale.

- For any alternative, the project costs are lower when using the existing groundwater supply for peaking compared to using the surface water source for peaking because the existing groundwater wells are already in service.

- The use of ASR with either the SFWB supply or the CRW supply results in similar capital costs compared to not using ASR for peaking. However, the use of ASR with a Willamette River WTP results in project cost savings of 15 percent to 20 percent compared to costs for peaking with the new river source.

- Two alternatives have the lowest overall project costs - 1) the SFWB supply option

TABLE 4-1
CITY OF WILSONVILLE
WATER SUPPLY STUDY
CAPITAL COST EXTIMATE ($MILLIONS)

Option Number	Description	Maximum Day Capacity (mgd) (Initial&Ultimate)	River Intake & Pump Station Cost	Raw Water Pipeline Cost	Water Treatment Plant Cost	Finished Water Pump Station Cost	Finished Water Pipeline Cost	ASR Cost	Construction Cost Subtotal	Contingencies, Engr. & Admin. 40%	Total Project Cost	Unit Cost ($/gpd)
1.A	SFWB Supply w/o GW or ASR	15,25	0	0	0	0.7	13.5	0	[illegible]	5.7	[illegible]	1.33
1.B	SFWB Supply plus Exist. GW	10,20 5,5	0	0	0	0.5	12.4	0	[illegible]	5.2	[illegible]	1.20
1.C	SFWB Supply plus ASR	10,20 5,5	0	0	0	0.5	12.4	1.8	[illegible]	5.9	[illegible]	1.37
2.A	CRW Supply w/o GW or ASR	15,25	0	0	0	0.8	17	0	[illegible]	7.1	[illegible]	1.66
2.B	CRW Supply plus Exist. GW	10,20 5,5	0	0	0	0.6	15.6	0	[illegible]	6.5	[illegible]	1.51
2.C	CRW Supply plus ASR	10,20 5,5	0	0	0	0.6	15.6	1.8	[illegible]	7.2	[illegible]	1.68
3.A	Willamette River WTP (City-Owned)	15,25	2.9	2.1	14.2	1.5	0.8	0	[illegible]	8.6	[illegible]	2.01
3.B	Willamette River WTP (City-Owned) plus Exist. GW	10,20 5,5	2.2	2	10.1	1.1	0.7	0	[illegible]	6.4	[illegible]	1.50
3.C	Willamette River WTP (City-Owned) plus ASR	10,20 5,5	2.2	2	10.1	1.1	0.7	1.8	[illegible]	7.2	[illegible]	1.67
4.A	Willamette River WTP(Jointly-Owned)	15,25 (City) *30,60 (Total)**	2.7 *5.5*	1.2 *2.9*	12 *24*	1.2 *2.7*	0.6 *10.3*	0 *0*	[illegible]	7.1 *18.2*	[illegible]	1.65 *2.12*
4.B	Willamette River WTP(Jointly-Owned) plus Exist. GW	10,20 (City) *25,55 (Total)** 5,5 (City)	2 *5*	1 *2.7*	8.5 *21*	0.9 *2.4*	0.5 *9.3*	0 *0*	[illegible]	5.2 *16.2*	[illegible]	1.20 *2.26*
4.C	Willamette River WTP(Jointly-Owned) plus ASR	10,20 (City) *25,55 (Total)** 5,5 (City)	2 *5*	1 *2.7*	8.5 *21*	0.9 *2.4*	0.5 *9.3*	1.8 *0*	[illegible]	5.9 *16.2*	[illegible]	1.37 *2.26*

* The costs shown in italics are the total estimated costs for the jointly-owned WTP. The costs shown without italics are the assumed costs to Wilsonville as part of the total cost.

and 2) a jointly-owned Willamette River supply option. Both of these options result in total estimated project costs of $18 million to $20 million, if existing groundwater or ASR are using for peaking, to deliver an initial peak day supply capacity of 15 mgd.

O&M COSTS

Planning-level O&M costs were also estimated within the range of +/- 30 percent. An annual average flow of 4.2 mgd was assumed for the year 2000 based on information presented in Section 2. Major O&M components included:

- Purchased Water Costs (For Alternatives 1 and 2)
- ASR or Groundwater Well Costs
- Labor;
- Power;
- Chemicals (for Alternatives 3 and 4);
- Sludge Disposal (for Alternatives 3 and 4); and
- Maintenance/Supplies

Contingencies of 20 percent were also added to the O&M costs to allow for other unknown cost items. It should be noted that the O&M cost estimates presented herein would be typical of the first year of operating costs and should not be considered an average over the operating life of the project (i.e., no adjustments for inflation of O&M costs in future years or reduced unit costs as average production from the plant increases, have been included in the estimates).

These estimates do not include any costs for purchase of raw water from the Willamette River. Although there has been regional and statewide discussion of reallocating federal Willamette River storage costs to municipal users of water, it was assumed for this study that there would be no raw water costs due to the relatively-small flows under consideration herein. This assumption should be verified in future work.

For supply options from SFWB or CRW, the major O&M costs are for purchasing water from the provider and for pumping the water to Wilsonville. For water provided by SFWB, a wholesale water rate of $0.55 per 100 cubic feet was assumed based on the current rate which Oregon City and West Linn pay. For water provided by CRW, a wholesale water rate of $0.45 per 100 cubic feet was assumed based on the current rate which Oak Lodge Water District pays. For both of these supply options, a 10 percent discount in water rates was used for the groundwater and ASR options because less water would be used to meet peak season demands. If ASR and groundwater were to be capable of providing all peak season needs beyond the average needs (i.e., a constant rate of water is taken from CRW or SFWB year-round), then the water rate discount could be as much as 30-40 percent. However, the assumed capacity of the groundwater or ASR system in this analysis does not allow for this to occur. The assumed wholesale water rates are an area of great uncertainty at this point in time. The rates used for the estimates should probably be considered on the low side as they reflect current rates and could possibly be higher if Wilsonville enters serious negotiations with either entity.

For a Willamette River WTP, most O&M costs are dependent upon annual plant production. However, labor costs are more dependent on utility staffing practices, wage and benefit practices and facilities O&M needs. For this analysis, labor costs were estimated to be $250,000 per year for initial treatment plant capacities up to 15 mgd and $350,000 per year for initial plant capacities up to 30 mgd based upon historical data and recent estimates made for treatment and supply facilities for similar size and type of facilities. These labor cost estimates also include operation and maintenance requirements for pumping stations.

Power costs were estimated assuming fixed and variable (depending upon plant production) power loads. Based upon an analysis of the impact of the various types of charges from PGE (the assumed power provider), an annual average energy cost of $0.050 per kw-hr was used for this report. Major power consumers include pumping stations, ozonation systems and auxiliary treatment plant equipment. Pump efficiencies were estimated at 80 percent. For this analysis, it was assumed that the ozone would be produced from air, hence the ozone generating costs would be power costs. However, a detailed analysis would have to be conducted during the preliminary design phase to determine the most cost-effective ozone installation and operating approach. It may be more economical to use a pure-oxygen based ozonation system instead of air. If pure-oxygen were used, it could be produced on-site with a separation facility or purchased as liquid oxygen.

The power costs include ozone generation, based upon an average applied dose of 1.5 mg/L, plus all other in-plant power requirements. The maximum ozone dose (2.5 mg/L) and average ozone dose (1.5 mg/L) used in this analysis were estimates based on pilot plant testing.

Chemical costs were estimated based upon chemical dosages that were developed as part of the Willamette River Pilot Plant Study conducted for the Tualatin Valley Water District. Major chemicals included in the estimate were alum (coagulant), cationic polymer (coagulant aid), anionic polymer (filter aid and solids dewatering aid), chlorine (disinfection), ammonia (disinfection), lime (pH adjustment and corrosion control) and carbon dioxide (pH adjustment and corrosion control). The following list summarizes the estimated chemical doses and costs:

- Alum = 15 mg/L @ $0.085/lb
- Cationic polymer = 1.5 mg/L @ $0.90/lb
- Anionic/Nonionic polymer = 0.01 mg/L @ $1.60/lb
- Chlorine = 2.0 mg/L @ $0.17/lb; Ammonia = 0.5 mg/L @ $0.30/lb
- Lime = 8 mg/L @ $0.05/lb
- Carbon dioxide = 5 mg/L @ $0.05/lb

Residual (sludge) disposal costs were estimated based upon hauling dewatered sludge to a landfill using average turbidity levels and coagulant dosages to estimate solids production. A total cost of $100 per wet ton, assuming 25 percent solids, was used including handling, treatment and disposal. Disposal assumed a 50 mile roundtrip transport for hauling of sludge to a landfill.

Maintenance/supplies costs were estimated at 2.5 percent per year of the equipment portion of new construction costs. Typically, equipment (pumps, process equipment, chemical feed systems, HVAC, electrical motors, instrumentation, valving) construction costs in new pumping and treatment facilities average about 40 to 50 percent of the total construction cost. Hence, the maintenance/supplies costs were estimated at 1.25 percent per year of the overall construction cost for water treatment and pumping facilities. These estimated costs typically include labor and materials costs required for routine maintenance and repairs. A Willamette River treatment plant is recommended to use GAC filter media for a variety of purposes including taste and odor control and adsorption of trace synthetic organic chemicals (SOCs). It was assumed that one-fifth of the media would be replaced each year (service life of five years), although the replacement would not be necessary during the first 3 to 5 years of the water treatment plant's operations. GAC costs were assumed to be $1.00 per pound and these replacement costs were included in the maintenance/supplies category.

Table 4-2 presents summaries of the estimated O&M costs for each of the supply alternatives. Unit costs, presented in terms of dollars per million gallons used ($/MG), are also presented to assist in the comparison of the costs between different alternatives. As mentioned previously, it was assumed that the average day consumption rate was 4.2 mgd for the year 2000.

There are some major conclusions which are apparent based upon these estimates:

- O&M costs are lower for a CRW supply compared to a SFWB supply due to the lower assumed wholesale water rate.
- O&M costs for any Willamette River WTP option are lower than either the SFWB supply or the CRW supply.
- O&M costs are approximately 15 percent lower for a jointly-owned Willamette River WTP compared to a City-owned WTP due to economies of scale and general efficiencies in operations.
- For any alternative, the O&M costs are lower when using the existing groundwater supply for peaking compared to using the surface water source for peaking.
- The use of ASR does not result in significantly lower O&M costs compared to peaking with the surface source because the same amount of water over the entire year still needs to be purchased or produced from the surface source.
- The lowest overall O&M cost is for a jointly-owned Willamette River supply option.

RELATIVE ECONOMIC ATTRACTIVENESS OF INITIAL LONG-TERM ALTERNATIVES

The City of Wilsonville's initial long-term supply alternatives were compared to determine their relative economic attractiveness. It should be noted that the economic analysis did not consider

Table 4-2
CITY OF WILSONVILLE
WATER SUPPLY STUDY
ANNUAL O&M COST ESTIMATE ($thousands per year)

Scenario Number	Maximum Day Capacity (mgd)	Assumed Annual Average Usage (mgd) In Year 2000	Purchased Water	ASR or Well Costs	Labor	Power		Chemicals	Sludge Disposal	Maintenance/Supplies		20% Contingencies	[illegible]	Unit Cost ($/MG Used)
						Pumping	WTP			Pumping	WTP			
1.A	15	4.2	1,130	0	5	60	0	0	0	6	0	240	[illegible]	940
1.B	15	4.2	880	40	5	50	0	0	0	6	0	196	[illegible]	768
1.C	15	4.2	1,050	45	5	60	0	0	0	6	0	233	[illegible]	913
2.A	15	4.2	925	0	5	65	0	0	0	7	0	200	[illegible]	784
2.B	15	4.2	720	40	5	55	0	0	0	7	0	165	[illegible]	647
2.C	15	4.2	860	45	5	65	0	0	0	7	0	196	[illegible]	769
3.A	15	4.2	0	0	250	125	31	42	17	50	150	133	[illegible]	521
3.B	15	4.2	0	40	250	110	28	36	15	45	125	130	[illegible]	508
3.C	15	4.2	0	45	250	130	32	43	18	50	135	141	[illegible]	550
4.A	15 (City)	4.2	0	0	175	135	30	40	16	40	125	112	[illegible]	439
	*30 (Total)**	*9.0*	*0*	*0*	*350*	*295*	*65*	*90*	*36*	*80*	*250*	*233*	[illegible]	*426*
4.B	10 (City)	4.2	0	40	150	110	28	36	15	45	125	110	[illegible]	430
	*25 (Total)**	*8.0*	*0*	*0*	*350*	*395*	*90*	*120*	*48*	*65*	*275*	*269*	[illegible]	*552*
4.C	10 (City)	4.2	0	45	150	130	32	43	18	45	130	119	[illegible]	464
	*25 (Total)**	*9.5*	*0*	*0*	*350*	*260*	*60*	*80*	*40*	*50*	*225*	*213*	[illegible]	*369*

*The costs shown in italicsare the total estimated costs for the jointly-owned WTP. The costs shown without italicsare the assumed costs to Wilsonville as part of the total cost.

other aspects of the alternatives, such as their various abilities to meet supply quantity, system reliability, regional or subregional acceptance, or other level-of-service considerations.

The options were compared on an annualized cost basis. A capital recovery factor (based on a 20-year life at 6 percent) was applied to the initial project costs to derive an equivalent uniform annual capital cost value for each option. This value was added to the estimated first year O&M costs of the options to determine the total annualized cost of each option for the purposes of this comparison. By dividing the annualized cost by the average annual quantity of water used, a relative unit cost was determined.

It is important to note that the unit cost figures thus derived do not represent estimates of the total cost of water under each scenario. The numbers do not include costs such as general and administration costs, or costs to finance the construction such as bond counsel, financial advisor and underwriter spread. Further, the numbers do not reflect the fact that annual O&M costs will probably increase over time due to general inflation. Because the annualized capital costs will be fixed over the life of the bond repayment (and thus do account for inflation), this approach may bias the analysis towards those options which are less capital intensive, such as the SFWB and CRW supply alternatives. The six percent interest rate used to analyze capital costs represents a typical current bond sale interest rate. However, the dollars which will be used to repay the bonds will be inflated dollars.

Table 4-3 presents the annualized costs along with the unit costs for each of the supply scenarios. The unit costs are presented in dollars per million gallons produced ($/MG) and in dollars per 100 cubic feet produced ($/ccf) based on the 4.2 mgd annual average water consumption in the year 2000. It is important to mention again that these unit costs do not reflect what the actual cost of water will be, but they are useful for comparison purposes.

The annualized cost analyses confirm the major conclusions of the project cost and O&M cost summaries. The use of existing groundwater for peaking results in lower annualized costs. The use of ASR for peaking can result in lower annualized costs compared to peaking with the surface water source. The cost of providing water from either SFWB or CRW will be similar to the costs of a City-owned Willamette River supply facility. A jointly-owned Willamette River supply facility will cost the City approximately 20 percent less than a City-owned supply. The lowest annualized unit cost of any of the alternatives is $1,461 per MG ($1.09 per 100 cubic feet) for a jointly-owned Willamette River supply using existing groundwater for peaking. If ASR is used as the peaking source with a jointly-owned Willamette River supply instead of the existing groundwater, then the unit cost is approximately $1,635 per MG ($1.22 per 100 cubic feet).

For any of the Willamette River supply alternatives, it is important to note that the capital costs represent 70 to 75 percent of the annualized costs. The unit costs presented in Table 4-3 are based on the assumed annual average consumption rate of 4.2 mgd in the first year of operation (year 2000). However, the proposed facilities were sized at 15 mgd to provide for peak day

Table 4-3
CITY OF WILSONVILLE
WATER SUPPLY STUDY
ANNUALIZED COSTS ($thousands per year)

Option Number	Assumed Annual Average Useage (mgd) in Year 2000	Equivalent Uniform Annual Capital Costs	Annual O&M Costs	Total Estimated Annual Costs	Unit Cost ($/MG)	Unit Cost ($/ccf)
1.A	4.2	1,735	1,441	[illegible]	2,072	1.55
1.B	4.2	1,580	1,177	[illegible]	1,798	1.35
1.C	4.2	1,800	1,399	[illegible]	2,087	1.56
2.A	4.2	2,170	1,202	[illegible]	2,200	1.65
2.B	4.2	1,980	992	[illegible]	1,939	1.45
2.C	4.2	2,195	1,178	[illegible]	2,200	1.65
3.A	4.2	2,625	798	[illegible]	2,233	1.67
3.B	4.2	1,960	779	[illegible]	1,787	1.34
3.C	4.2	2,190	844	[illegible]	1,979	1.48
4.A	4.2	2,160	673	[illegible]	1,848	1.38
4.B	4.2	1,580	659	[illegible]	1,461	1.09
4.C	4.2	1,795	712	[illegible]	1,635	1.22

production capacity through the year 2010 to allow for growth and increased water consumption. Assuming that the annual average consumption rate increases to 6.5 mgd by the year 2010, then the unit costs to produce this water will decrease by approximately 25 percent since the annualized capital costs remain the same over the life of the project. Much of the initial investment in a Willamette River supply option will allow for increased water production as required and will provide for lower unit costs over time as production increases. The SFWB or CRW supply options do not provide for as much unit cost decrease over time because a higher percentage of the annualized cost is for annual O&M costs, primarily purchased water. This cost issue should be explored in more detail if Wilsonville decides to pursue a supply option from SFWB or CRW. More discussion of the O&M cost considerations is given in the following section.

"PACKAGES" OF SHORT-TERM AND LONG-TERM OPTIONS

As indicated in Section 3, there are several short-term solutions to the City of Wilsonville's water needs. One possible approach for the City is to implement these short-term solutions in a way which then would fit within a long-term water supply planning strategy.

The most likely short-term option for Wilsonville which meets the criteria of conforming to long-term regional strategies is the purchase of additional supply from the north, from either the City of Tualatin or from the Tualatin Valley Water District (TVWD), or from both. Both Tualatin and TVWD have excess water available for the next few years as their continued growth catches up with their available supplies. The water supplied to Wilsonville from either Tualatin or TVWD would be Bull Run water. Its availability in this scenario would be subject to the agreement of the City of Portland.

If this short-term supply proves to be acceptable, it may open a window of opportunity by extending Wilsonville's decision-making process long enough to allow it to be considered for a long-term supply contract from some provider. This long-term water could be made available to Wilsonville via "wheeling" arrangements between TVWD, the Joint Water Commission, the City of Portland, the South Fork Water Board and/or Clackamas River Water.

A new water supply from the north to Wilsonville would require the construction of a new pipeline. From a long-range planning perspective, this pipeline (if sized properly) could possibly be used to deliver Willamette River water to the north in the future if that source is eventually developed. Hence, it could be feasible for Wilsonville to consider a short-term supply from the north which would also fit into the regional long-range water supply planning perspective.

This approach of a combination of short-term water from northerly provider(s) along with a long-term solution to Wilsonville's water supply needs can be compared with a the direct long-term development approach, such as the Willamette River.

PLANNING ASSUMPTIONS

All water supply options must satisfy the estimated water supply needs for the City of Wilsonville. Table 2-4 presented Wilsonville's estimated water demands.

Using the assumptions that the existing wells will be used for peak season only, and that the firm capacity of the existing wells will be 5 mgd, any new water source for the City must be sized to meet peak day demands minus 5 mgd. It is further assumed that in order to maintain this capacity, investment in an aquifer storage and recovery (ASR) program or other well improvements will be needed by the year 2010. The needed capacity of a new source over time under these assumptions is shown in Table 4-4.

TABLE 4-4
CITY OF WILSONVILLE
SOURCE DEVELOPMENT NEEDS

Year	Source Development Needs (mgd)
2000	5
2010	10
2020	15
2050	20

The information in Table 4-4 provides the basis for developing water supply scenarios for Wilsonville's particular situation. In order to meet estimated peak day demands, a minimum of 5 mgd from a new source is required by the year 2000, 10 mgd would be required by the year 2010 and 15 mgd would be required by the year 2020. Preferably, any new source development would be conducted incrementally to provide excess capacity to allow water demands to continue to increase over a certain time period (i.e., by the year 2000, provide in excess of 5 mgd (say 10 mgd) of new source to allow demands to increase over time without having to increase capacity immediately).

COMBINED SHORT-TERM / LONG-TERM ALTERNATIVES

Five specific alternatives which combine short-term and long-term approaches were identified. These alternatives are:

A. Direct Development of the Willamette River Immediately

This is the base case option. Under this option, the City of Wilsonville's needs would be provided from the Willamette River. The City would construct a new water treatment plant on the Willamette River immediately. The plant would be brought on-line by the year 2000. Initial plant capacity would be 10 mgd to serve the City's needs until 2010. A 5 mgd expansion would occur in 2010 and a another 5 mgd expansion would occur in 2020 to bring the plant to an ultimate 20 mgd capacity. ASR or well improvements would occur in 2010.

A1. Smaller Immediate Direct Development of the Willamette River

This alternative is a modifies Alternative 1 by setting the initial plant capacity at 5 mgd to serve the City's needs until approximately 2005. This alternative seeks to reduce the initial capital outlay for the project. Five mgd expansions

would occur in 2005, 2010 and 2020 to bring the ultimate plant capacity to 20 mgd. ASR or well improvements would also occur in 2010.

Both Alternative A and A1 would have to be constructed initially to provide for the ultimate plant flow of 20 mgd including intake, raw water pump station, raw water pipeline, general plant support facilities and piping, finished water pump station and the finished water pipeline. Therefore, the construction costs for an initial 5 mgd plant would not be proportionally less than the costs for an initial 10 mgd plant.

Alternative A1 requires successive expansions over a relatively short period of time. Because the City's peak day flow is estimated to be approximately 10 mgd in the year 2000, another 5 mgd plant expansion would have to be planned almost immediately after the initial plant construction is completed. Assuming water demands increase as projected from the year 2000 to 2005, this means that the City may have to enact conservation measures again until the plant expansion is completed.

B. Pipeline to the North Immediately - Sized for Long-term Needs

Under this option, the City of Wilsonville's long-term needs would be provided by a pipeline to deliver water from the north. The pipeline would be sized solely to meet the City of Wilsonville's long-term demands which are 20 mgd. The pipeline would run from the termination of the 60-inch diameter Portland-Washington County Supply line and would be put into service by the year 2000. The pipeline size was assumed to be 39-inch diameter. ASR or well improvements would occur in 2010.

C. Smaller Pipeline to the North Immediately, Willamette WTP Later

Under this option, the short-term needs of the City of Wilsonville would be provided from the north, but long-term needs would be provided from the Willamette River. A pipeline would again be constructed to the north. However, it would only be sized to provide Wilsonville's short-term needs of approximately 5 mgd. The assumed pipeline size was 20-inch diameter and it would be connected at the City of Tualatin's terminus of the 30-inch diameter Washington County Supply line. In order to deliver up to 5 mgd to Wilsonville under all conditions, it was also assumed that a booster pump station would be required because of probable hydraulic limitations in the 30-inch pipeline. A water treatment plant on the Willamette would then be constructed in approximately the year 2005 at 10 mgd initial capacity, at which time the 20" pipeline and pump station would become emergency facilities only. Expansions to the water treatment plant of 5 mgd each would occur in 2010 and 2020 to bring total capacity to 20 mgd. ASR or well improvements would occur in the year 2010.

D. Smaller Pipeline to the North Immediately, Larger Pipeline to the North Later

Under this option, the City of Wilsonville's short-term needs would be provided by a smaller pipeline from the north as explained in Alternative C including a booster pump station. Then, once

long-term arrangements for water supply from the north were completed, a larger pipeline to serve the long-term needs would be constructed. As described previously, the initial pipeline would be 20-inch diameter and would be connected in the City of Tualatin along with a booster pump station. Then, in 2005, a new 39-inch diameter pipeline would be constructed from the 60-inch Washington County Supply line to Wilsonville to bring the ultimate capacity to 20 mgd. ASR or well improvements would occur in the year 2010.

ECONOMIC COMPARISONS OF COMBINATION OPTIONS

A present worth analysis of the five alternatives listed above was conducted to compare their economic attractiveness. The present worth analysis was conducted using the following assumptions:

- Evaluation period (n) = 20 years
- Interest rate (i) = 6% per year
- Inflation rate (g) = 3% per year

TABLE 4-5
CITY OF WILSONVILLE
SUMMARY OF PROJECT ALTERNATIVES
AND CAPITAL COSTS

ALTERNATIVE	YEAR 2000	YEAR 2005	YEAR 2010	YEAR 2020
A. Willamette River WTP	10 mgd initial = $22.5M	None	5 mgd expansion = $4.7M, ASR/Wells = $2.7M	5 mgd expansion = $6.3M
A1. Willamette River WTP	5 mgd initial = $19.5M	5 mgd expansion = $4.1M	5 mgd expansion = $4.7M, ASR/Wells = $2.7M	5 mgd expansion = $6.3M
B. Large Pipeline	39-inch to 60-inch WCSL = $24.6M	None	ASR/Wells = $2.7M	None
C. Small Pipeline/ WTP	20-inch to Tualatin + PS = $5.0M	10 mgd WTP initial = $26.1M	5 mgd expansion = $4.7M, ASR/Wells = $2.7M	5 mgd expansion = $6.3M
D. Small Pipeline/ Large Pipeline	20-inch to Tualatin + PS = $5.0M	33-inch to Tualatin + 39-inch to 60-inch WCSL = $27.3M	ASR/Wells = $2.7M	None

Table 4-5 presents a summary of the timeframe and capital (project) costs of the various elements of each supply alternative. The capital costs shown for future expenditures are the estimated actual costs at that time and were adjusted for inflation. The capital costs include construction costs plus a 40 percent adjustment for engineering, management, legal and contingencies.

Note: Capital costs shown for each year were adjusted for inflation at 3% per year compared to year 2000 costs.

Annual operation and maintenance (O&M) costs were also included in the present worth analysis to provide a complete comparison of each alternative. The following unit O&M costs were assumed for this analysis:

- Willamette River WTP = $0.38 per 100 cubic feet
- Imported Water = $0.50 per 100 cubic feet

The Willamette River WTP O&M cost includes all costs for operating and maintaining the water treatment and delivery systems. The $0.38/ccf unit cost was estimated for the first year of operation at an annual average production rate of 4.2 mgd and will likely decrease over time as production increases to meet growing demand.

Annual operation and maintenance (O&M) costs for Alternative A1 were assumed to be the same as for Alternative A using a unit water cost of $0.38 per 100 cubic feet which doesn't change over time. However, the actual unit cost of water during the first few years of operation will probably be higher than $0.38/ccf because of lower plant production and economies of scale.

The $0.50/ccf unit cost for imported water from the north was estimated based on the current rate that Portland charges TVWD for water (approximately $0.55/ccf). The unit price was discounted slightly to account for the fact that Wilsonville would use less water for peaking purposes because it can relay on wells or ASR for up to 5 mgd of supply.

For all scenarios, the unit O&M costs were assumed to remain constant over the evaluation period. Inflation was not included in the analysis for simplicity purposes at this level of evaluation. Therefore, the only increase in O&M costs over time is due to the increase in water demand (water sales) over time. The average annual water usage was estimated to increase linearly over the first 20 years (from 2000 to 2020) at 5% per year and then was estimated to increase at 1% per year over the next 30 years from 2020 to 2050.

Table 4-6 presents a summary of the present worth analysis of each alternative including capital costs and annual O&M costs.

TABLE 4-6
CITY OF WILSONVILLE
PRESENT WORTH COMPARISON
OF ALTERNATIVES

ALTERNATIVE	INITIAL CAPITAL OUTLAY	PRESENT WORTH OF TOTAL CAPITAL COSTS	20 YEAR PRESENT WORTH OF O&M COSTS	TOTAL PRESENT WORTH
A. Willamette River WTP	$22.5M	$28.6M	$11.4M	$40.0M
A1. Willamette River WTP	$19.5M	$28.8M	$11.4M	$40.2M
B. Large Pipeline	$24.6M	$26.1M	$16.3M	$42.4M
C. Small Pipeline/ WTP	$5.0M	$30.6M	$11.6M	$42.2M
D. Small Pipeline/ Large Pipeline	$5.0M	$26.9M	$16.4M	$43.3M

The analysis indicates that the option with the lowest present worth is the Willamette River option. However, the range in total present worth of all the options from lowest to highest is only 10%. Options based on a pipeline to the north without a treatment plant have the lowest present worth for capital costs alone. However, the lower operating costs of the options with a Willamette water treatment plant result in a lower total present worth for these options.

SENSITIVITY OF THE PRESENT WORTH ANALYSIS

The present worth analysis is sensitive to some of the assumptions which were used in making the analysis. Of primary importance is the difference in operating costs which were assumed between the Willamette River plant ($0.38 per 100 cubic feet) and the water from the north ($0.50 per 100 cubic feet). If the O&M costs were in fact higher by 10-15 percent for the Willamette River water treatment plant than assumed in this analysis and the costs of purchased water remained as assumed, then the present worth of the pipeline options would be less than that of the plant options. There are a number of factors which make it unlikely that this is the case.

- The assumed O&M costs for the Willamette River WTP include a 20% contingency. The assumed O&M costs are significantly higher than those which other water treatment plants operating in the region actually experience, including the Clackamas River Water plant and Joint Water Commission plant.

- As the average production rate of the plant increases with time (due to increased demand over time), the expected unit production costs of the plant will go down since many of the components of the O&M costs are relatively fixed. However, this analysis assumed instead that the unit O&M costs will remain constant.

- The only O&M costs which were assumed for the pipeline alternatives was the cost of purchased water. Some other O&M costs are likely to be incurred for the pipeline option.

- The assumed cost for purchased water was assumed to remain constant over the analysis period. Increased costs for capacity increases needed to serve Wilsonville or to meet future drinking water regulations which would ultimately be reflected in the cost of purchased water are not included in this analysis. In fact, the cost of purchased water in the region over the last ten years has risen at a rate greater than the rate of inflation due to increased costs associated with new regulations and other new required water program elements.

Some other factors which could affect the relative economic attractiveness of the options include:

- The analysis was done based upon a 20 year period. If a 50 year period was used, then the Willamette River options with lower O&M costs would be even more favorable compared to the pipeline alternatives.

- The useful life of a pipeline may be considered to be greater than that of a water treatment plant. One could assume a salvage value for the pipeline at the end of the analysis period to account for this remaining useful life. Doing so, however, will not change the relative present worth analysis of the options because the salvage value comes so late in the analysis period.

- Inflation was accounted for with the capital costs but not for the O&M costs. If inflation was considered for O&M costs as well, the Willamette River options with lower O&M costs will be more favored compared to higher O&M cost options.

Considering these comments, it is likely that developing a Willamette River water treatment plant will in fact result in the lowest total present worth cost for the City of Wilsonville. However, other factors must be considered in the decision analysis. Some of these factors are discussed in Section 5.

Section 5

EVALUATION OF INITIAL ALTERNATIVES

The long-term supply components were evaluated against a specific list of relevant criteria. The short-term supply measures and the "packages" of short-term and long-term measures were also evaluated and compared.

LONG-TERM SUPPLY COMPONENTS

The remaining long-term supply options based on the discussion in Section 4 are the Clackamas River supplies or the Willamette River. Each of the four specific alternatives which were identified were evaluated using a number of criteria: A wide range of potential criteria could be used to evaluate and compare the alternatives. Eleven criteria were selected as most appropriate for this level of analysis as listed below:

- Certainty of Supply,
- Water Rights,
- Water Quality,
- Environmental Impacts,
- Consistency with Local and Regional Planning Efforts,
- Project (Capital) Costs,
- Comparative Annualized Costs.
- Timing of Supply Implementation,
- Opportunity for City Ownership of the Supply System,
- Water Supply Agreements and Contract Provisions, and
- Compatibility with Short-Term Supply Measures,

A brief discussion of each alternative is presented for each of the individual criteria. Following these discussions is a summary table which includes the alternatives and their relative rankings for each criteria. A qualitative ranking system was used which included:

+ (rates highly against other alternatives),
o (rates neutral against other alternatives, and
- (rates poorly against other alternatives).

CERTAINTY OF SUPPLY

Each of the four alternatives is capable of providing water to Wilsonville to meet its long-term needs with varying degrees of certainty. For the existing, developed systems (SFWB and CRW), the provider's willingness and ability to work with Wilsonville to provide a firm, long-term water supply to Wilsonville represents the certainty of supply. For the currently undeveloped Willamette River, certainty of supply relates to the potential for successful development of the supply. The subalternatives which include the use of existing groundwater and ASR may make various supplies more certain because they would reduce the peak capacity requirements of the surface water supplies.

For both SFWB and CRW, their existing facilities may have the ability to provide the quantities of water required by Wilsonville in the year 2000, but probably not in the year 2010. But, they are both capable of providing adequate water for Wilsonville in the year 2010, and possibly beyond, if their existing treatment facilities are expanded. There is doubt that either SFWB or CRW could provide the year 2050 demands required by Wilsonville, however, under any circumstance.

While the Willamette River supply is currently undeveloped, if such a supply system was developed, it would provide a greater degree of supply certainty, especially for the year 2050 demands. The certainty of supply for either a City-owned or a jointly-owned Willamette River facility is considered equal.

WATER RIGHTS

Each of the four alternatives has water rights issues associated with the delivery of water to Wilsonville. The inability to use or acquire water rights may make an alternative unfeasible or unattractive. If purchasing water from another water purveyor, the water rights issue becomes a matter of evaluating the provider's ability to meet the contractual obligations to Wilsonville.

The City of Wilsonville and the Tualatin Valley Water District hold significant water rights for the Willamette River. The City currently holds 19 mgd of water rights and TVWD holds near 150 mgd. A Willamette River supply option would put Wilsonville in the best water rights position.

The SFWB holds 43 mgd of water rights on the Clackamas River. Currently, SFWB has used up to 19 mgd, including providing surplus supply to the southern portion of CRW. SFWB has the most senior water rights on the Clackamas River. SFWB may not have enough water rights to serve all the ultimate (year 2050) water needs of Oregon City, West Linn and Wilsonville combined.

Clackamas River Water holds 32.6 mgd of permitted water rights on the Clackamas River and has applied for 96 mgd more. If CRW is successful in obtaining the additional water rights, it may be in a better water rights position than SFWB to assure Wilsonville that it would be able to supply the City's water needs to 2050, but negotiations would have to be held between CRW and Wilsonville to determine if CRW would make some of its water rights available to Wilsonville. Recently, the U.S. Forest Service has raised concerns about the impact on fisheries of increased withdrawals of water from the Clackamas River (see letter dated June 24, 1996 in Appendix A-2). The implications, if any, of this concern on the potential for future water rights approvals on the Clackamas River is unknown.

Any of the sub-alternatives which include ASR would require certain water rights issues to be resolved prior to full-scale implementation. If either a Clackamas River supply is intended to be used for ASR, then it may take more time to resolve the water rights issues compared to a Willamette River supply due to the inter-basin exchange that would occur.

WATER QUALITY

This criteria could be divided into both raw water quality and treated water quality. However, the basic issue regarding water quality is whether the alternative supplies can meet existing and predicted future water quality criteria (both State and Federal) for drinking water.

The quality of the raw, untreated, Willamette River water is less than the quality of the raw, untreated Clackamas River sources. However, all of the options can supply high quality treated drinking water with the appropriate water treatment processes. The treatment processes which is assumed for the Willamette is more stringent than for the Clackamas River. It includes ozone for disinfection of microbial contaminants, taste and odor control and oxidation of organic compounds and granular activated carbon filter media to protect against trace organic compounds and tastes and odors. Even though the treatment process planned for a Willamette plant will be capable of handling any potential contaminants should they be found in the River, there remains public concerns about the potential for drinking water contamination when using the River.

ENVIRONMENTAL IMPACTS

Environmental impacts associated with obtaining water from either the SFWB or CRW would consist primarily of those impacts resulting from the pipeline construction. Typically, pipeline construction impacts are temporary. The landscape is disturbed while the pipe is being laid in the ground. However, most pipeline corridors, provided they are strategically placed, return to their pre-construction habitat over time. An exception to this is in cases where the corridor requires removal of trees. It is expected that tree removal would occur to connect Wilsonville to either of the Clackamas River supplies.

The impacts of water withdrawal on either the Willamette River or the Clackamas River may be considered small in view of the relatively small quantity of water that Wilsonville would require in comparison to the volume of water in these two rivers. However, cumulative environmental impacts associated with multi-agency withdrawals may be a factor for both sources. The Regional Water Supply Study found that the overall environmental impacts of development of the Willamette River as a drinking water source were less than for the other sources considered.

Development of the Willamette River source would require land clearance for the treatment plant. However, if the site for the plant is on industrial land within Wilsonville, it would be expected that this impact would occur anyway as businesses continue to seek and develop the available industrial land base in the City. Also, the construction of a river intake/pump station would have some temporary construction impacts.

Development of ASR or using existing groundwater for peaking is expected to have minimal environmental impacts. The RWSP included an evaluation for a regional (up to 20 mgd) ASR project(s) and concluded that the environmental impacts would be negligible provided a good pilot testing program coupled with adequately placed monitoring wells were conducted.

CONSISTENCY WITH LOCAL AND REGIONAL PLANNING EFFORTS

The recommendations of the Regional Water Supply Study include options for expanding the existing Clackamas River supply and developing the Willamette River as a new supply, depending on the needs of the various participants. The Regional Study also supports development of ASR where feasible. From this perspective, all of the alternatives are consistent with regional planning efforts.

None of the alternatives appear to conflict with any City of Wilsonville or sub-regional planning efforts.

PROJECT (CAPITAL) COSTS

The estimated project (capital) costs were presented in Section 4. In general, a jointly-owned Willamette River supply or the SFWB supply will result in the lowest project costs of any of the alternatives. The Clackamas River Water supply and a City-owned Willamette River supply have the highest project costs. In reviewing the estimated costs, one should recall that the accuracy of the estimates at this planning stage is +/- 30 percent. Given this accuracy, most of the cost estimates can be considered similar.

The use of existing groundwater as a peaking supply significantly reduces the project costs of any alternative. The use of ASR also can reduce project costs for a Willamette River supply facility.

The lowest total estimated project cost is $18.1 million for Alternative 1.B (SFWB supply with existing groundwater) and Alternative 4.B (jointly-owned Willamette River supply with existing groundwater).

COMPARATIVE ANNUALIZED COSTS

Section 4 presented the estimated comparative annualized costs for each alternative. The alternatives were compared on an annualized cost basis. A capital recovery factor (based on a 20-year life at 6 percent) was applied to the initial project costs to derive an equivalent uniform annual capital cost value for each option. This value was added to the estimated first year O&M costs of the options to determine the total annualized cost of each option for the purposes of this comparison. By dividing the annualized cost by the average annual quantity of water used, a relative unit cost was determined.

It is important to note that the unit cost figures thus derived do not represent estimates of the total cost of water under each scenario. The numbers do not include costs such as general and administration costs, or costs to finance the construction such as bond counsel, financial advisor and underwriter spread. Further, the numbers do not reflect the fact that annual O&M costs will probably increase over time due to general inflation. Because the annualized capital costs will be fixed over the life of the bond repayment (and thus do account for inflation), this approach may bias the analysis towards those options which are less capital intensive, such as the SFWB and CRW supply alternatives. The six percent interest rate used to analyze capital costs

represents a typical current bond sale interest rate. However, the dollars which will be used to repay the bonds will be inflated dollars.

In general, a jointly-owned Willamette River supply will result in the lowest annualized costs of any of the alternatives. The other three alternatives will have similar annualized costs which are 10 percent to 20 percent higher compared to Alternative 4.

The use of existing groundwater as a peaking supply significantly reduces the annualized costs of any alternative. The use of ASR also can reduce annualized costs for a Willamette River supply facility.

The lowest estimated annualized cost is $2.24 million per year for Alternative 4.B (jointly-owned Willamette River supply with existing groundwater). This amount equates to a unit cost of $1,461 per million gallons produced ($1.09 per 100 cubic feet produced) assuming an annual average flow of 4.2 mgd in the year 2000. The unit costs for a new Willamette River supply should decrease as water production increases beyond the year 2000.

TIMING OF SUPPLY IMPLEMENTATION

This criteria is based on the assumption that Wilsonville will make a long-term supply decision during 1996 and will begin implementation actions soon thereafter. The SFWB and CRW supply alternatives could be operational in 2 to 3 years depending on how long negotiations with the selected purveyor take. It might be possible to speed implementation of the CRW supply if the City of Portland would temporarily take CRW water in its system through an existing connection in exchange for providing Bull Run water to Wilsonville.

A Willamette River supply could be operational in 3 to 4 years. A City-owned facility could probably be brought on line sooner that a jointly-owned facility due to the multi-agency negotiations which would need to occur before proceeding with implementation of a jointly-owned facility.

Any alternative which includes ASR as a peaking supply would not be able to be fully developed for at least two years beyond the operational date for the surface water supply, if ASR proves to be technically feasible. Pilot testing would need to be conducted with the actual water proposed for full-scale injection and recovery. Other preliminary design, planning issues and regulatory issues would also need to be resolved in that time frame.

OPPORTUNITY FOR CITY OWNERSHIP OF THE SUPPLY SYSTEM

Certain supply alternatives give Wilsonville the opportunity for an ownership interest in the supply system. It may be of benefit to Wilsonville to gain an equity interest in its water supply, treatment and delivery systems.

Either of the Willamette River alternatives offer the City an equity position in the supply system. Currently, it is uncertain if Wilsonville could obtain part-ownership in either the SFWB or CRW supply systems. It may be possible to negotiate

such an agreement with either entity, but the chances of this happening are not currently understood. None of the current wholesale customers of either SFWB or CRW have an equity position.

WATER SUPPLY AGREEMENTS AND CONTRACT PROVISIONS

It is to Wilsonville's advantage to pursue and enter into a water service contract that provides the City and the potential provider with the fairest contract provisions. The City currently does not have any existing supply contracts with any other water providers.

A City-owned Willamette River supply system would not require a contract for service. If a jointly-owned Willamette River supply system were developed, it is expected that Wilsonville would secure a supply agreement as part of the development process that met the City's needs. If either SFWB or CRW were to supply water to Wilsonville, then a special supply agreement would have to be developed.

COMPATABILITY WITH SHORT-TERM SUPPLY MEASURES

Due to the time it will take to bring any of the long-term supply alternatives into full operation, the City may have to implement some short-term measures over the next few years to be able to reliably provide water to its customers as growth continues.

Conservation and curtailment methods are certainly compatible with any of the alternatives. Any short-term measure which would bring a new source of water into the system which would not be used in the long-term could create some concerns. For example, if an intertie with the City of Tualatin and/or TVWD is created which brings Portland water (mostly from the Bull Run supply) into Wilsonville, it could be problematic to switch to another water supply, either from the Willamette River or from the Clackamas River, at some later date. Likewise, if a small-scale WTP on the Willamette River were brought on line to serve as a short-term supply, and then a long-term supply from the Clackamas River were eventually used, there could be some issues to deal with. So, any new supply from an outside source has the potential for creating some difficulties in this respect.

If Wilsonville were to construct additional reservoir storage, this would not create a compatibility concern.

SUMMARY OF COMPARISON

Table 5-1 presents a summary of the evaluation and comparison of long-term supply alternatives for the City of Wilsonville. The summary table includes all evaluation criteria discussed in this section. As discussed previously, a qualitative ranking system was used which included:

+ (rates highly against other alternatives),
o (rates neutral against other alternatives, and
- (rates poorly against other alternatives).

This ranking system was used for all non-cost criteria. The actual estimated project costs and

TABLE 5-1
CITY OF WILSONVILLE
EVALUATION OF SUPPLY ALTERNATIVES

Evaluation Criteria	1.A	1.B	1.C	2.A	2.B	2.C	3.A	3.B	3.C	4.A	4.B	4.C
Certainty of Supply	o	o	o	o	o	+	+	+	+	+	+	
City Ownership	-	-	-	-	-	-	+	+	+	+	+	+
Water Supply Agreements	o	o	o	o	o	o	+	+	+	+	+	+
Water Rights	-	-	-	o	o	o	+	+	+	+	+	+
Water Quality	o	o	o	o	o	o	o	o	o	o	o	o
Environmental Impacts	-	-	-	-	-	-	o	o	o	-	-	-
Consistency with Other Planning	o	o	o	o	o	o	o	o	o	o	o	o
Implementation Timing	+	+	o	+	+	o	o	o	o	o	o	o
Compatability with Short-Term Measures	o	o	o	o	o	o	o	o	o	o	o	o
Project Costs ($M)	19.9	18.1	20.6	24.9	22.7	25.2	30.1	22.5	25.1	24.8	18.1	20.6
Annualized Costs ($M/yr)	3.18	2.76	3.20	3.37	2.97	3.37	3.42	2.74	3.03	2.83	2.24	2.51

annualized costs for each alternative are shown in the table also.

Evaluation of most of the non-economic criteria favor development of the Willamette River as the long-term supply for the City of Wilsonville. The Willamette River option provides a certain, long-term supply for the City. The City's existing water rights on the Willamette River are sufficient to support a treatment plant until at least the year 2050. Existing water rights on the Clackamas River are capable of supporting supply for Wilsonville until some time between 2020 and 2040. They are not able to support supply to the year 2050. The City would have the opportunity to continue the direct control and ownership of its water supply system with a Willamette River source. The City would not be dependent upon supply agreements or future actions of other entities which would own and control the water supply.

The environmental impacts of use of the Willamette as a source are likely to be equivalent or less than for the other options. All of the options are consistent with the long-term plan developed in the Regional Water Supply Study. They just each build the long-term components of the plan, either a portion of a regional pipeline network or the treatment plant, in a different order.

The quality of the raw, untreated, Willamette River water is less than the quality of the raw,

untreated Clackamas River sources. However, all of the options can supply high quality treated drinking water with the appropriate water treatment processes. Even though the treatment process planned for a Willamette plant will be capable of handling any potential contaminants should they be found in the River, there remains public concerns about the potential for drinking water contamination when using the River.

The economic analysis indicates that the option with the lowest total cost for the City of Wilsonville is development of a Willamette River Water Treatment Plant. Combining the treatment plant with the use of ASR or the existing groundwater for peaking purposes will result in the lowest cost option.

SHORT-TERM SUPPLY MEASURES

Even if the City of Wilsonville decides to implement a long-term water supply alternative as soon as possible, it may still need to develop measures which will ensure that its existing groundwater supply can provide its needs for the next two to four years. Conservation and curtailment should continue to be the "backbone" of the City's short-term supply measures to cover the existing supply deficit until a new source can be developed.

Any short-term supply measures which the City of Wilsonville undertakes should be consistent with the direction for its long-term water supply. If a long-term supply decision can be made, then the $3 to $5 million dollar cost of most of the short-term supply measures are not justifiable.

However, a low-cost interconnection near the northerly City limits could be made between the City's two large reservoirs and the City of Tualatin's 0.8 MG Frobase Reservoir which may be able to deliver as much as 1 mgd of peaking supply for the next couple of years. Because system interties between adjoining water providers have long-term value as emergency connections to provide greater overall water supply reliability, they are particularly recommended whenever they can be economically achieved as a consequence of fulfilling other purposes.

If it appears that a long-term supply decision can not be made until 1997 or later, then Wilsonville should consider either developing a more-costly intertie between the City of Tualatin and/or TVWD or constructing and operating a small-scale (1 to 2 mgd) demonstration water treatment. The total project cost could be as high as $5.6 million for a 16-inch diameter pipeline sized to deliver approximately 5 mgd of peak capacity from TVWD. The total project cost of the demonstration facility to allow it to deliver water to Wilsonville's distribution system is estimated at $3.1 million for a 2 mgd plant.

If in reviewing distribution system needs, the City were to decide to construction of a new, large storage reservoir(s), then such a reservoir would also serve as a short-term peaking supply. At a minimum, 5 MG of new storage is recommended for this purpose at an approximate total project cost of $3.2 million, assuming one new reservoir.

"PACKAGES" OF SHORT-TERM AND LONG-TERM OPTIONS

As indicated in Section 4, one possible approach for the City is to implement short-term water supply solutions in a way which then would fit within a long-term water supply planning strategy. Under this approach, excess water available for the next few years from the north, from either the City of Tualatin, the Tualatin Valley Water District (TVWD) or from both, would be purchased. This would then allow negotiation of perhaps a 20 to 30 year supply contract from some provider. This longer term water could be made available to Wilsonville via "wheeling" arrangements between TVWD, the Joint Water Commission, the City of Portland, the South Fork Water Board and/or Clackamas River Water. Then, perhaps at the end of the 20 to 30 year supply contract, a Willamette River Water Treatment Plant would be constructed in Wilsonville, probably on a regional or subregional basis. Wilsonville would then be served by this plant. The pipeline which was used to bring water to Wilsonville would then be used to send water from the Willamette plant back to the north.

The analysis in Section 4 indicated that the long-term costs which the City of Wilsonville would pay in such a "packaged" approach is likely to be at least 10% higher than for the phased construction of a Willamette Water Treatment Plant. The long-term supply picture for the City would be less certain and the City would have less opportunity for direct control or ownership of its water supply under the packaged approach because the City would be dependent upon supply agreements and future actions of other entities which would own and control the water supply. Both the packaged approach and a Willamette River Water Treatment Plant can supply high quality drinking water. Both are consistent with the long-term Regional Water Supply Plan. They just each build the long-term components of the plan, a portion of a regional pipeline network and the treatment plant, in a different order. Thus, based on these overall evaluation criteria, the development of the Willamette River as a supply source still appears to be the best alternative for the City of Wilsonville.

Section 6

MONTGOMERY WATSON

EVALUATION OF 50-YEAR SCENARIOS

Based on the information developed in the preceding Sections, a final long-term supply analysis was conducted.

LONG-TERM SUPPLY OBJECTIVES

The City of Wilsonville needs a new long-term water supply source. The City has adopted the planning horizon of the RWSS for its own supply planning. Thus, a long-term supply is one which is capable of satisfying the City's water supply needs to the year 2050. While there are many criteria which influence a supply decision, several stand out as key for the City of Wilsonville in selecting a supply option:

Certainty . The City of Wilsonville needs a water supply plan that is truly capable of meeting its long-term supply needs. Water rights to support the water use must be available. There must be a reasonable level of assurance through contracts, intergovernmental agreements, or other mechanisms, that Wilsonville will be able to count on the water it needs being there when it is needed. If capital improvements will be needed over time to assure the availability of water, then Wilsonville must have a level of assurance that these improvements will in fact happen as required.

Finished water quality. While different water sources may start out with different raw water qualities, Wilsonville must be assured that the quality of water which reaches its customers meets all federal and state drinking water standards for finished water quality.

Consistency with local and regional planning efforts. Wilsonville has endorsed the Regional Water Supply Plan and is a participating member of the Regional Water Providers Consortium. All water supply developments in the Portland area should be consistent with the regional framework established in the regional Plan.

Environmental Impacts. The environmental impacts of supply alternatives must be minimized to the extent possible.

Costs. The costs of providing the supply, both capital and operating, must be minimized over the life of the project so that the City's responsibilities to its ratepayers are met.

POTENTIAL SOURCE OPTIONS

The surface water supply sources which were screened in the study for potential use were the Clackamas River, the City of Portland supply (a combination of the Bull Run River and the Columbia Southshore Wellfield), the Tualatin River/ Trask River, and the Willamette River. Entities which could potentially supply water from one or

more of these sources included the South Fork Water Board, Clackamas River Water, the City of Portland, the Tualatin Valley Water District, and the Joint Water Commission, as well as the City of Wilsonville itself for the Willamette River.

As indicated in earlier sections, existing water rights on the Clackamas River are only capable of supporting a supply for Wilsonville until some time between 2020 and 2030. By that time, demand is projected to require full use of these rights by their holders to serve their customers within the Clackamas Basin. Use of Portland system water is not currently a viable long-term supply alternative for the City of Wilsonville. Portland has indicated (letter dated May 9, 1996) that it is "...not, at this time, willing to establish new contracts to sell water wholesale during the peak season (i.e., mid-June to mid-October)". Portland has indicated that during negotiations with existing wholesale customers whose contracts expire between 2004 and 2007, it will assess the possibility of serving new long-term wholesale customers on the system.

For a final analysis of potential supply scenarios, the constraints were modified in two ways. First, all alternatives were placed on an even basis by requiring them each to provide supply to the year 2050. Whatever facilities were needed to accomplish that goal were included in the scenario. Second, it was assumed a long-term contract with the Portland system could eventually be negotiated. With these modifications, four different final potential scenarios to provide a water supply to the City of Wilsonville to the year 2050 were considered. These alternatives are summarized in Table 6 - 1. The timing of the capital improvements required for each scenario, along with the estimated costs of those capital improvements in the years they occur, are shown in the table. The scenarios are described more fully below.

TABLE 6 - 1
SUMMARY OF FINAL 2050 SUPPLY SCENARIOS WITH CAPITAL COSTS

SCENARIO	YEAR 2000	YEAR 2010	YEAR 2020
1. Willamette River	10 mgd initial WTP = $22.5M	5 mgd WTP expansion = $4.7M; ASR/Wells = $2.7M	5 mgd WTP expansion = $6.3M
2. Clackamas River/ Willamette River	20 mgd pipeline (33-inch) to SFWB/CRW + 10 mgd initial PS= $18.1M	5 mgd PS expansion = $0.3M; ASR/Wells = $2.7M	20 mgd WTP = $61.4M; pipeline salvage value =$13.5M (credit)
3. Portland System/ Willamette River	20 mgd pipeline (39-inch) to 60-inch WCSL = $24.6M	ASR/Wells = $2.7M	20 mgd WTP = $61.4M; pipeline salvage value =$18.9M (credit)
4. Portland System	20 mgd pipeline (39-inch) to 60-inchWCSL = $24.6M	ASR/Wells = $2.7M	None by Wilsonville (Portland develops supply increment)

Note: Capital costs shown for each year were adjusted for inflation at 3% per year compared to year 2000 costs.

Scenario 1 - The Willamette River.

Under this option, the City of Wilsonville's needs would be provided primarily from the Willamette River, relying upon the City's own water rights on the River. The City would construct a new water treatment plant on the Willamette River immediately. The plant would be brought on-line by the year 2000. Initial plant capacity would be 10 mgd to serve the City's needs until 2010. A 5 mgd expansion would occur in 2010 and another 5 mgd expansion would occur in 2020 to bring the plant to an ultimate 20 mgd capacity. ASR or well improvements would occur in 2010 to assure 5 mgd of peak capacity from groundwater.

Scenario 2 - Clackamas River/Willamette River.

Under this option, the City of Wilsonville would enter into a water supply agreement to obtain up to 20 mgd with one or more suppliers of water from the Clackamas River. This agreement would last until the year 2020. Possible agencies for such an agreement include the South Fork Water Board and Clackamas River Water. A pipeline and pump station to deliver water from a Clackamas treatment plant to Wilsonville would be constructed. Then, in 2020 when the Clackamas supplier could no longer provide water, Wilsonville would build a Willamette River water treatment plant at 20 mgd. It is assumed that the pipeline which was built to bring Clackamas River water to Wilsonville would then be sold or turned over to a regional entity or other user, and that Wilsonville will obtain a credit for the pipeline. ASR or well improvements would occur in 2010 to assure 5 mgd of peak capacity from groundwater.

Scenario 3 - Portland System/Willamette River.

Under this option, a pipeline to bring water from the Portland system to Wilsonville by gravity would be constructed. The pipeline would be sized at 20 mgd and would be constructed to the current terminus of the 60-inch diameter Washington County Supply Line (WCSL) in the Tualatin Valley Water District (TVWD) service area. The City of Wilsonville would initially enter into a water supply agreement with TVWD to supply up to 7 mgd through the year 2005. The water delivered to Wilsonville from TVWD would be Portland system Bull Run and/or Columbia Southshore Wellfield water. TVWD would reduce its demand on the Portland system by utilizing more water from the Barney Reservoir on the Tualatin/Trask River system in order to provide the initial 7 mgd. Then, in 2005 Wilsonville would enter into an agreement with the City of Portland to provide up to 20 mgd to the year 2020. In the year 2020, a Willamette River water treatment plant would be constructed at 20 mgd. It is assumed that the pipeline which was built to bring water to Wilsonville would then be sold or turned over to a regional entity or other user, and that Wilsonville will obtain a credit for the pipeline. ASR or well improvements would occur in 2010 to assure 5 mgd of peak capacity from groundwater.

Scenario 4 - Portland System.

Under this option, a pipeline to bring water from the Portland system to Wilsonville by gravity would be constructed. The pipeline would be sized at 20 mgd and be constructed to the current terminus of the 60-inch diameter WCSL in the TVWD service area. The City of Wilsonville would initially enter into a water supply agreement with TVWD to supply up to 7 mgd through the year 2005. The water delivered to Wilsonville from TVWD would be Portland system Bull Run and/or Columbia Southshore Wellfield water. TVWD would reduce its demand on the Portland system by utilizing more water from the Barney Reservoir on the Tualatin/Trask River system in order to provide the initial 7 mgd. Then, in 2005 Wilsonville would enter into an agreement with the City of Portland to provide up to 20 mgd to the year 2050. In the year 2010, ASR or well improvements would occur to assure 5 mgd of peak capacity from groundwater. It is also assumed that in the year 2020, some major supply increment would be constructed on the Portland system to provide the capacity needed to assure a supply to the year 2050.

EVALUATION OF OPTIONS - NON-ECONOMIC OBJECTIVES

Each of the four source options capable of providing a long-term supply for Wilsonville were evaluated against the long-term supply objectives. A summary of the evaluation is shown in Table 6 - 2. A qualitative, relative ranking system is used:

+ Rates highly against the other alternatives.
o Rates neutral against the other alternatives.
- Rates poorly against the other alternatives.

Scenario 1. The Willamette River Option

Development of the Willamette River provides a certain, long-term supply for the City of Wilsonville. The City would have the opportunity to continue the direct decision making, control and ownership of its water supply system with a Willamette River source. The City would not be dependent upon supply agreements or future actions of other entities which would own and

TABLE 6 - 2
SUMMARY OF QUALITATIVE EVALUATION OF LONG-TERM, NON-ECONOMIC SUPPLY OBJECTIVES

SCENARIO	CERTAINTY	FINISHED WATER QUALITY	PLANNING CONSISTENCY	ENVIRONMENTAL IMPACTS
1. Willamette	+	o	o	o
2. Clackamas / Willamette	o	o	o	-
3. Portland / Willamette	-	o	o	o
4. Portland	-	o	o	

control the water supply. The City would be building equity in its own water system as it develops the Willamette source. The City's existing water rights on the Willamette River are sufficient to support a water treatment plant until at least the year 2050 and developing the source sooner rather than later will assure that the City's existing water right permit is utilized.

The quality of the raw Willamette River water is less than the quality of the raw, untreated Clackamas River, Trask River, or Portland system sources. However, the treatment processes which are assumed for the Willamette are more stringent than for the other sources and will therefore result in a treated drinking water quality at the customer's tap which is as good or better than any other in the region. The treatment process for the Willamette includes ozone for disinfection of microbial contaminants, taste and odor control and oxidation of organic compounds. It also includes granular activated carbon (GAC) filter media to protect against trace organic compounds and tastes and odors. Even though the treatment process planned for a Willamette plant will be capable of handling any potential contaminants should they be found in the River, there remains public concerns about the potential for drinking water contamination when using the Willamette River.

Development of the Willamette as a source is consistent with the RWSS, which found it to be one of the source options for the region. There is potential for Wilsonville to partner with others in the sub-region who also have an interest in the Willamette as a source, particularly the City of Tigard, the City of Sherwood, the Tualatin Valley Water District, and possibly others. The RWSS also found that the environmental impacts of use of the Willamette as a source are likely to be equivalent or less than for the other options in the region.

Scenario 2. Clackamas River / Willamette River

In the long run, this scenario offers the same advantages as Scenario 1, because in the long run it is the Willamette River which is the source for the City of Wilsonville. In the interim, there are some differences, however. A long-term water supply contract with a Clackamas basin water supplier could potentially provide a certain supply to around the year 2020. At that time, however, demand within the Clackamas Basin is projected to require the full use of the water rights by their holders to serve customers within the Clackamas Basin. While the supply was coming from the Clackamas, Wilsonville would have less direct control of its water supply and the cost of the delivered water; the City would delay developing equity in its water system until it began developing the Willamette; and the City's water right permit on the Willamette River would remain undeveloped for another 25 years.

The raw water quality of the Clackamas River is good and both the South Fork Water Board and Clackamas River Water treatment plants on the river have a history of providing high quality water which meets all drinking water standards. Use of the Clackamas River as a source is consistent with the RWSS, which found it to be a good source for additional development. When the City eventually develops the Willamette, there is

likely to be other partners who will be interested in developing the Willamette as a source at that time.

The environmental impact associated with the pipeline bringing water from the Clackamas to Wilsonville should be limited to those of pipeline construction. While the amount of water being withdrawn from the Clackamas River to serve Wilsonville is small relative to the overall river flows, there is environmental concern about cumulative impacts of multi-agency withdrawals from the river. The U.S. Forest Service recently (June, 24, 1996 letter) expressed concerns that "increased withdrawals could have detrimental effects on recreationists and on the fisheries we have worked so hard to maintain and restore upstream" on the Clackamas River.

Scenario 3. Portland System / Willamette River

In the long run, this scenario offers the same advantages as Scenario 1, because in the long run it is the Willamette River which is the source for the City of Wilsonville. In the interim, there are some differences, however. Portland has indicated it will not consider a long-term contract for Portland system water during peak demand periods until 2005 to 2007. Until then, Wilsonville must rely on shorter-term commitments with the Tualatin Valley Water District with the hope that a long-term arrangement will eventually be possible with Portland. Current contracts with Portland are on the basis of "surplus water". Under these contracts, there is no guarantee that curtailment will not be necessary during particularly dry summers. A pipeline to bring water from the north would have to be built to deliver the water from TVWD without certainty that a longer-term supply will be available. Once a longer-term contract is negotiated with Portland, then this option can provide a certain supply to support Wilsonville to the year 2020. While the supply was coming from the Portland system, Wilsonville would have less direct control of its water supply and the cost of the delivered water; the City would delay developing equity in its water system until it began developing the Willamette; and the City's water right permit on the Willamette River would remain undeveloped for another 25 years.

The quality of the water from the Portland system is good. The system has a history of meeting a drinking water regulations. Use of the Portland system is consistent with the RWSS. When Wilsonville eventually develops the Willamette, there are likely to be other partners who will be interested in developing the Willamette as a source at that time.

The environmental impact associated with the pipeline bringing water from the Portland system to Wilsonville should be limited to those of pipeline construction. Because the supply contract with Portland would only extend until 2020, it is assumed that Portland would not need to construct a new dam or other supply increment to provide a reliable supply to Wilsonville, and that therefore there is no greater environmental impact on the Bull Run than currently exists.

Scenario 4 - Portland System

This scenario assumes a long-term relationship with the City of Portland for water supply. A long-term contract would be negotiated with Portland. Portland has indicated it will not consider a long-

term contract for Portland system water during peak demand periods until 2005 to 2007. Until then, Wilsonville must rely on shorter-term commitments with the Tualatin Valley Water District with the hope that a long-term arrangement will eventually be possible with Portland. Current contracts with Portland are on the basis of "surplus water". Under these contracts, there is no guarantee that curtailment will not be necessary during particularly dry summers. A pipeline to bring water from the north would have to be built to deliver the water from TVWD without certainty that a longer-term supply will be available. Once a longer-term contract is negotiated with Portland, then this option can provide a certain supply to support Wilsonville to the year 2050. Portland would have to eventually expand its water system to meet these supply requirements through construction of a new, third dam in the Bull Run, further development of its existing wellfield, or development of a new source. It is assumed that the negotiated contract with Portland would provide assurances that this will occur. Wilsonville would have less direct control of its water supply than it currently does and less control and certainty over the price of water purchased from Portland compared with Wilsonville having an ownership stake in its water supply. Wilsonville's water right permit on the Willamette River would remain undeveloped for another 50 years.

The quality of the water from the Portland system is good. The system has a history of meeting a drinking water regulations. Use of the Portland system is consistent with the RWSS.

The environmental impact associated with the pipeline bringing water from the Portland system to Wilsonville should be limited to those of pipeline construction. Because the supply contract with Portland would extend until 2050, it is assumed that Portland would need to construct a new dam or some other major water supply project to provide a reliable supply. According to the RWSS, the environmental impact of such a project is likely to be greater than the impact of withdrawals of water on the Willamette River near Wilsonville.

EVALUATION OF OPTIONS - ECONOMIC OBJECTIVES

Economic criteria were evaluated using estimated planning-level capital and operation and maintenance (O&M) costs for each viable, long-term supply alternative. These cost estimates were prepared from information and engineering data available at the time of the estimate. The final costs of any of the projects, if selected for implementation, will depend on the actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors as they occur. As a result, the final project costs will vary from the estimates presented herein. The estimates are useful for relative comparisons of costs of alternative projects, but are not definitive predictions of the costs of any specific project. Project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

Cost were evaluated from the perspectives of initial capital cost of the scenario, total present worth of all capital requirements over the fifty year period of the scenario, total present worth of the operations and maintenance costs of the scenario over the fifty year period, and total present worth of the combined capital and operation and maintenance costs. The interest rate assumed for the present worth analysis was 6 percent.

The estimated capital costs are shown in Table 6 - 1. The capital costs shown for future facilities were the estimated actual costs at that future date. To obtain estimates of the capital costs of projects in future years, the year 2000 costs for the project were inflated 3 percent per year to the year in which the facility would be built. The capital costs include construction costs plus a 40 percent adjustment for engineering, management, legal, administrative, and contingencies.

Table 6 - 3 summarizes the operating and maintenance cost assumptions used in the analysis.

Included in the operations and maintenance costs for all scenarios is the cost of operating wells for peak season demand at 5 mgd. The operating and maintenance costs for Scenarios 2, 3 and 4 include the costs for purchased water. It is assumed that the initial cost of purchased water in the year 2000 is $0.60/ccf. This is based on current (1996) typical wholesale water costs of about $0.55/ccf from the likely potential suppliers. Operation and maintenance costs shown for each year were adjusted for inflation at 3% per year compared to year 2000 costs. The operation and maintenance costs for Scenario 2 also includes the costs for operation and maintenance of a pump station which would be required to bring Clackamas River water to Wilsonville. The cost of purchased water under Scenario 4 was assumed to increase by 25 percent in year 2020. This is due to the expected need for Portland to develop some new supply increment (new Bull Run dam, wellfield expansion, or other new source) in order to reliably supply Wilsonville to the year 2050., Operating and maintenance costs

TABLE 6 - 3
SUMMARY OF O&M COST ASSUMPTIONS
FOR FINAL SCENARIOS

SCENARIO	YEAR 2000	YEAR 2010	YEAR 2020
1. Willamette River	Initial O&M cost = $0.38/ccf @ 4.2 mgd avg. usage	O&M cost = $0.46/ccf @ 6.3 mgd avg. usage	O&M cost = $0.56/ccf @ 8.4 mgd avg. usage
2. Clackamas River/ Willamette River	Initial O&M cost = $0.62/ccf @ 4.2 mgd avg. usage	O&M cost = $0.83/ccf @ 6.3 mgd avg. usage	O&M cost = $0.56/ccf @ 8.4 mgd avg. usage
3. Portland System/ Willamette River	Initial O&M cost = $0.59/ccf @ 4.2 mgd avg. usage	O&M cost = $0.79/ccf @ 6.3 mgd avg. usage	O&M cost = $0.56/ccf @ 8.4 mgd avg. usage
4. Portland System	Initial O&M cost = $0.59/ccf @ 4.2 mgd avg. usage	O&M cost = $0.79/ccf @ 6.3 mgd avg. usage	O&M cost = $1.25/ccf @ 8.4 mgd avg. usage

for water produced by a Willamette River water treatment plant were assumed to initially be $0.38/ccf and to increase by 3 percent per year with inflation. They were also assumed to decrease by 1 percent per year due to the increased operating efficiency as more water is produced from the plant. This results from spreading those costs which are fixed regardless of the amount of water produced each year (such as labor), over a larger amount of produced water.

Based on these capital and operating assumptions, Table 6 - 4 summarizes the economic criteria analysis. The lowest initial capital outlay scenario is one which brings Clackamas River water to Wilsonville. Next lowest initial capital outlay is development of a Willamette River water treatment plant. The two scenarios which bring Portland System water have the highest initial capital outlay.

The lowest total capital outlay over the fifty year timetable, however, is development of a Willamette River water treatment plant, followed closely by long-term reliance on the Portland System. This is because these scenarios each build only one major facility - a treatment plant in the Willamette River Scenario and a pipeline in the Portland system scenario. The two scenarios which build both pipelines and treatment plants over the fifty year timetable have significantly larger total capital costs over the period.

The lowest total operating and maintenance cost option is by far the Willamette River Scenario. It is almost $12 million less expensive in operation and maintenance costs over the fifty year period than the next closest scenario. As a result, the combined total present worth of the Willamette River Scenario is estimated to be $20 million less expensive over the fifty year period than the next closest scenario, which is the Clackamas River / Willamette River Scenario.

TABLE 6-4
PRESENT WORTH COMPARISON
OF FINAL SCENARIOS

ALTERNATIVE	INITIAL CAPITAL OUTLAY	PRESENT WORTH OF TOTAL CAPITAL COSTS	50 YEAR PRESENT WORTH OF O&M COSTS	TOTAL PRESENT WORTH
1. Willamette River WTP	$22.5M	$28.6M	$29.4M	$58.0M
2. Clackamas River Supply/Willamette River WTP	$18.1M	$34.7M	$43.4M	$78.1M
3. Portland Supply//Willamette River WTP	$24.6M	$39.3M	$41.9M	$81.2M
4. Portland Supply	$24.6M	$26.1M	$63.8M	$89.9M

The cost analysis is sensitive to some of the assumptions which were used in making the analysis. Of primary importance is the difference in operating costs which were assumed between a Willamette River water treatment plant (initially, $0.38 per 100 cubic feet) and purchased water from the Portland system or a Clackamas River water supplier (initially, $0.60 per 100 cubic feet). However, for the cost analysis to result in a different leading option, the initial cost of purchased water would have to drop to below $0.38/ccf for Scenarios 2 and 3 and to close to that for Scenario 4. Such a low purchased water price is highly unlikely. Even if the inflation rate for purchased water was assumed to be zero, that is, the cost of purchased water did not increase for fifty years, the Willamette River option would still be less expensive. Thus, it is very likely that the Willamette treatment plant option will indeed be the least costly option relative to the other alternatives for the City of Wilsonville.

SUMMARY OF EVALUATION

Evaluation of most of the non-economic objectives for a long-term supply source for the City of Wilsonville favor development of the Willamette River, using the City's existing water right permit on the River. The economic analysis also indicates that the option with the lowest total cost for the City of Wilsonville is development of a Willamette River Water Treatment Plant.

Section 7

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Based on the information contained in this report, the following conclusions can be drawn about a long-term water supply for the City of Wilsonville.

BACKGROUND

- The City continues to grow and water demands continue to increase from all sectors including residential, commercial and industrial. Projected peak day demands are estimated to be as much as 10 mgd in the year 2000, 15 mgd in the year 2010, 20 mgd in the year 2020 and 25 mgd in the year 2050.

- The City's existing groundwater system can not meet current water demands without the City enforcing curtailment measures. These measures have been successful during the past few years in minimizing water usage, but can not be relied upon as a long-term supply.

- The Oregon Water Resources Department (OWRD) has declared the aquifer which the City currently uses as "groundwater limited" and will not allow any new wells to be installed except for the eighth well which is already being planned for installation by mid-1997. Also, OWRD has requested that the City eventually reduce its use of groundwater.

LONG-TERM SUPPLY ALTERNATIVES

- There are three possible supply sources which the City can currently consider for implementation. These source options are a Clackamas River supply from either the South Fork Water Board or from Clackamas River Water, or a new Willamette River supply. The City of Portland is not currently in a position to discuss long-term supply options with Wilsonville and is not expected to be in such a position for at least five years and possibly not until the year 2005. The Joint Water Commission has no ability to provide Wilsonville with a long-term supply.

- The lowest cost long-term supply alternative is a jointly-owned Willamette River water supply facility with a water treatment plant located within Wilsonville. Most likely partners include the City of Tigard, the City of Sherwood or the Tualatin Valley Water District. The City of Tualatin, Clackamas River Water and the Canby Utility Board all also have interests in the Willamette as a source. Most other non-cost evaluation criteria also favor a new Willamette River supply.

- The timing to implement any of the long-term supply alternatives depends on how quickly the City desires to move, and will also depend on how quickly any required inter-agency agreements can be developed. If any of the long-term supply alternatives were selected for implementation immediately, the soonest any could be made operational is approximately 3 years. Short-term supply measures to provide water until the long-term supply is on-line will be needed.

- The use of Aquifer Storage and Recovery (ASR) is a potential peaking supply alternative which could reduce costs significantly and would improve the status of the City's aquifer. Its applicability would have to be demonstrated after the selected long-term supply alternative is brought on-line.

- The City's existing groundwater supply could also be used as a peaking source only in conjunction with a long-term supply in order to reduce costs. This use would have to be approved by OWRD, and could be tied into the development of an ASR program.

A dual-use water system which provides irrigation water via reclaimed wastewater or untreated Willamette River water could reduce long-term demands on the potable water system. This option is likely to be more expensive than use of ASR or the existing groundwater and has other regulatory hurdles, however.

RECOMMENDATIONS

Evaluation of most of the non-economic objectives for a long-term supply source for the City of Wilsonville favor development of the Willamette River, using the City's existing water right permit on the River. The economic analysis also indicates that the option with the lowest total cost for the City of Wilsonville is development of a Willamette River Water Treatment Plant.

Thus, to assure a long-term supply, the City of Wilsonville should:

- Identify and secure a site for the treatment plant and intake, develop a financing and implementation plan for the project, and conduct more detailed engineering studies to better define the project scope and costs.

- Initiate discussions with Oregon Water Resources Department regarding the continued use of the existing groundwater supply, and the possible implementation of ASR as a peaking source. Use of ASR and/or the wells will minimize both capital and operating costs of use of the Willamette River.

- Continue to work with other water purveyors who may be interested in developing the Willamette River as a source of supply. A jointly-owned and operated supply system would result in cost savings and operating efficiencies in addition to creating a new sub-regional or regional source of supply for the Portland metropolitan area

which would improve overall regional water reliability.

If the Willamette River supply does not come to fruition, Wilsonville should consider turning to either the Clackamas River providers or the Portland system. Wilsonville should also reconsider these sources instead of the Willamette River if the suppliers can provide cost incentives or cost sharing proposals which would make them more economically attractive to Wilsonville than the Willamette River option. If the City does turn to one of the Clackamas sources, then Wilsonville should either be prepared to develop the Willamette River source in the future or determine that it will be able in the future to negotiate a supply contract with the City of Portland for Bull Run water, in order to provide a supply when water is no longer available from the Clackamas basin.

To meet short-term water needs until a long-term source can be developed, the City of Wilsonville should:

Have its eighth well operational by the summer of 1997.

- Rely upon temporary voluntary and mandatory curtailment to match demand to supply during periods of hot weather.

- Evaluate the availability of water, as well as the costs and benefits of temporarily augmenting Wilsonville's water supply by constructing a transmission line to the City of Tualatin. Such an intertie could also be useful for emergency purposes regardless of long-term supply strategies.

Once a long-term supply direction is established, Wilsonville should update the reservoir storage, transmission, and distribution elements of its Water Master Plan to reflect current estimates of future water demand. Wilsonville should continue its commitment to conservation, regardless of long-term water supply plans. Wilsonville should also remain an active participant in regional and subregional water supply planning efforts in order to take advantage of any possible opportunities for cost sharing of water supply development projects which may arise.

Appendix A

APPENDIX A

REFERENCES

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Appendix B

APPENDIX B

LIST OF ABBREVIATIONS

ASR	Aquifer Storage and Recovery
ccf	100 Cubic Feet
cfs	Cubic Feet Per Second
CIP	Capital Improvements Program
CRW	Clackamas River Water
DSL	Division of State Lands
ENR	Engineering News Record
GAC	Granular Activated Carbon
gpd	Gallons per Day
gpm	Gallons per Minute
GW	Groundwater
HGL	Hydraulic Grade Line
Hp	Horsepower
HVAC	Heating, Ventilating, and Air-Conditioning
JWC	Joint Water Commission
Kw-hr	Kilowatt-hour
lb	Pound
MG	Million Gallons
mgd	Million Gallons per Day
mg/L	Milligrams per Liter
OHD	Oregon Health Division
OWRD	Oregon Water Resources Department
O&M	Operation and Maintenance
PGE	Portland General Electric
RWSP	Regional Water Supply Plan
RWSS	Regional Water Supply Study
SFWB	South Fork Water Board
SOCs	Synthetic Organic Chemicals
TVWD	Tualatin Valley Water District
TDH	Total Dynamic Head
WCSL	Washington County Supply Line
WD	Water District
WTP	Water Treatment Plant

Appendix C

APPENDIX C

CITY OF
PORTLAND, OREGON
BUREAU OF WATER WORKS

Mike Lindberg, Commissioner
Michael F. Rosenberger, Administrator
1120 S.W. 5th Avenue
Portland, Oregon 97204-1926
Information (503) 823-7404
Fax (503) 823-6133
TDD (503) 823-6868

May 9, 1996

CITY OF WILSONVILLE
JUN 5 1996
RECEIVED

BG 3.3.3

Mr. Jeff Bauman
Public Works Director
City of Wilsonville
30000 SW Town Center Loop E
Wilsonville, OR 97070

Dear Mr. Bauman:

We have reviewed your letter of March 15, 1996 and the supplementary information provided to Jim Doane. Thank you for your interest in contracting to purchase water from the Portland water supply system. Currently, Portland can offer to provide water to Wilsonville each year from about mid-October to mid-June. We are not, at this time, willing to establish new contracts to sell water wholesale during the peak season (i.e., mid-June to mid-October).

There are several reasons for this approach. First, Portland's highest priority is to provide a reliable source of supply to its current customers. During recent discussions concerning the prospective added load of the City of Sherwood, the Water Bureau analyzed the reliability of the Portland system in meeting our current customer demand. We are confident that the City system can reliably supply water to the current retail customers and 19 wholesale customers. However, we are not comfortable in adding Wilsonville's projected peak season demand at this time.

Second, Portland's wholesale customer contracts will come to term between 2004 and 2007. Beginning shortly, the Bureau, in consultation with the wholesale customers, will be evaluating the options for renewing the contracts or modifying them, including the potential that some current customers may develop other sources of supply. The contract evaluation/negotiation process will be carried out in consideration of the Regional Water Supply Plan and other key factors (e.g., outcome of Metro Region 2040 process). In addition, we will be assessing the possibility of serving new wholesale customers during the contract reevaluation process. Until this evaluation process is complete, we feel that it would be inappropriate to establish new long-term wholesale contracts for peak season supply.

Supplying water to Wilsonville generally from mid to late October to mid to late June (outside the peak season) may be of benefit

in providing water for an aquifer storage and recovery (ASR) system. You could use Bull Run system water for your customers and for groundwater recharge most of the year and use your wells (recovering the mostly Bull Run System water) for water from about mid-June until mid-October.

The closest existing point of connection between our two systems would probably be through the City of Tualatin. The City of Tualatin may be amenable to such an arrangement, as they have recently agreed (in conjunction with the Tualatin Valley Water District) to provide Bull Run System water to the City of Sherwood. You should discuss the issue of interconnection with the City of Tualatin, TVWD and others who might be impacted. We would be glad to assist in these discussions. Issues to be considered include the overall capacity and allocation of the Washington County Supply Line and the capacity of the existing line serving the City of Tualatin.

We appreciate your inquiry about contracting to purchase water from the Bull Run System, and we hope to be able to serve your needs in the future. When the current wholesale contracts are renegotiated and the future needs of our current customers are known, we may be able to offer the City of Wilsonville firm commitments to Bull Run System water during the drawdown period.

If you have any questions, please don't hesitate to contact me, Lorna Stickel (823-7502) or Jim Doane (823-7505).

Sincerely,

Michael F. Rosenberger
Administrator

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cc: Wholesale Group

United States Department of Agriculture
Forest Service
Mt. Hood National Forest
2955 NW Division St.
Gresham, OR 97030
(503) 666-0700
FAX # (503) 666-0641

File Code: 2520

Date: 06/24/96

Lorna Stickel
City of Portland, Water Bureau
1120 SW 5th, 6th Floor
Portland, OR 97204

Dear Lorna:

I want to sincerely thank you, Roberta, and Dale for stopping by the office on April 8th. I think the direct communication is valuable as we search for ways to support each other and work together.

I was encouraged to see the revised Regional Water Supply Plan you sent over. It is evident that your team has given much thought to balancing environmental impacts with supplying sufficient potable water to the Metro area. The increased emphasis on water conservation is also very encouraging; we support both voluntary and required conservation methods.

There are three main areas that cause the Forest concern--

First, the revised Preliminary Study identifies the Clackamas River as the next major source to tap for additional water, with plans to draw approximately 140MGD out of the river. Increased withdrawals could have detrimental effects on recreationists and on the fisheries we have worked so hard to maintain and restore upstream. While we understand that permits would be necessary for some of the additional withdrawals, the total amount withdrawn and the the location of the withdrawals could have serious environmental and social implications. Our experience in the Bull Run-- the current total dewatering of the Bull Run River, which comprises 26% of the entire Sandy River System-- is a reminder of where this could ultimately lead without a commitment from the water providers and users to not propose those kinds of actions.

Second, our discussion of source water protection and the City's current posture of total exclusion of the public from the Bull Run River drainage as necessary for protection causes me great concern. It is my belief, that if the Clackamas becomes a primary source for Metro water supplies, current use of the Clackamas system for recreation and other uses could be challenged. If history is any indicator, without any scientific reasons, the water providers could be pressured to curtail or eliminate many of these uses. There will be costs and benefits from eliminating the public or other uses and we recommend they both be disclosed.

We realize that the Water Bureau does not intend to either dewater the Clackamas or keep the public out, but based on our experiences with the Bull Run and user groups who have had goals very different from those established in PL 95-200, we feel our concerns are real, and not "crying wolf."

United States Department of Agriculture
Forest Service
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2955 NW Division St.
Gresham, OR 97030
(503) 666-0700
FAX # (503) 666-0641

File Code: 2520

Date: 06/24/96

Lorna Stickel
City of Portland, Water Bureau
1120 SW 5th, 6th Floor
Portland, OR 97204

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There are three main areas that cause the Forest concern--

First, the revised Preliminary Study identifies the Clackamas River as the next major source to tap for additional water, with plans to draw approximately 140MGD out of the river. Increased withdrawals could have detrimental effects on recreationists and on the fisheries we have worked so hard to maintain and restore upstream. While we understand that permits would be necessary for some of the additional withdrawals, the total amount withdrawn and the the location of the withdrawals could have serious environmental and social implications. Our experience in the Bull Run-- the current total dewatering of the Bull Run River, which comprises 26% of the entire Sandy River System-- is a reminder of where this could ultimately lead without a commitment from the water providers and users to not propose those kinds of actions.

Second, our discussion of source water protection and the City's current posture of total exclusion of the public from the Bull Run River drainage as necessary for protection causes me great concern. It is my belief, that if the Clackamas becomes a primary source for Metro water supplies, current use of the Clackamas system for recreation and other uses could be challenged. If history is any indicator, without any scientific reasons, the water providers could be pressured to curtail or eliminate many of these uses. There will be costs and benefits from eliminating the public or other uses and we recommend they both be disclosed.

We realize that the Water Bureau does not intend to either dewater the Clackamas or keep the public out, but based on our experiences with the Bull Run and user groups who have had goals very different from those established in PL 95-200, we feel our concerns are real, and not "crying wolf."

Third, the report does not discuss the opportunities the Metro area has to more fully utilize the existing reservoir storage by the addition of filtration to the Bull Run system. You mentioned the cost of doing this and the belief that this would add 34MGD/day to the supply. The additional 3.5-4.0 billion gallons available with filtration would increase the water available from storage by 35-40%, a substantial additional supply. If the costs of my first and second concerns are fully recognized, I believe the relative cost of filtration in the Bull Run System looks much more attractive.

We also appreciate the Bureau's concerns about the current system's vulnerability to fires, earth quakes, volcanoes, etc.

We agree that the Willamette River should be left "on the table" as a possible future source. If cleaned up, it could offer the best alternative source at the lowest cost and least environmental impact. I think if science and economics are considered along with a commitment to clean up the Willamette, it should remain high on the priority list.

Let me conclude by stating that the Mt. Hood staff stands ready to assist you in your effort to complete this plan. I think the consortium of water providers is an excellent idea. We can also help you reach out to a wide public audience, which is one of the stated objectives of the plan. I suggest we bring the plan to the attention of organizations like the Confederated Tribes of Warm Springs, the Northwest Forestry Association, and several local recreation groups we work with, in addition to the organizations you have already involved-- the Pacific Rivers Council, The Northwest Steelheaders, Oregon Trout, Oregon Dept. of Fish and Wildlife You might also ask the Willamette Province Advisory Committee if they would like to see the Plan before it is finalized.

Sincerely,

Roberta A Moltzen

ROBERTA A. MOLTZEN
Forest Supervisor