Appendix D: Yamhill County Coordinated Population Forecast (Excerpt)

BEFORE THE BOARD OF COMMISSIONERS OF THE STATE OF OREGON

FOR THE COUNTY OF YAMHILL

SITTING FOR THE TRANSACTION OF COUNTY BUSINESS

In the Matter of Adopting a 20-year Coordinated Population Projection)
for Yamhill County and the 10 Municipalities Within Yamhill County) Ordinance 878
Pursuant to HB 2709 (ORS 195.036), Docket PA-01-11, Rescinding)
Ordinance 877)

THE BOARD OF COMMISSIONERS OF YAMHILL COUNTY, OREGON ("the Board") sat for the transaction of County business on November 8, 2012, Commissioners Leslie Lewis and Mary P. Stern being present, and Commissioner Kathy George being excused.

IT APPEARING TO THE BOARD that Yamhill County Planning Department applied for a Comprehensive Plan Amendment adopting a 20-year coordinated population projection for Yamhill County and the 10-municipalities within Yamhill County, as required by HB 2709, and

IT APPEARING TO THE BOARD that the Planning Commission heard this matter at a duly noticed public hearing on September 1, 2011, and voted unanimously 8-0 to recommend approval, and

IT APPEARING TO THE BOARD that on October 27, 2011 the Board convened a duly noticed public hearing, and then voted 3-0 to continue the application and direct Yamhill County Planning Staff to apply for a grant from DLCD to hire a consultant to develop a population forecast, and

IT APPEARING TO THE BOARD that DLCD awarded Yamhill County the grant, and Portland State University Population Research Center was hired to coordinate with Yamhill County and the 10-municipalities to develop a coordinated population forecast, and

IT APPEARING TO THE BOARD that on November 1, 2012, the Board held a continued public hearing, took testimony and voted 3-0 to approve the population forecast. NOW, THEREFORE,

IT IS HEREBY ORDAINED BY THE BOARD, that the application is approved as detailed in the Findings for Approval, Exhibit "A", incorporated into this Ordinance by this reference. The October 2012 report prepared by the Portland State University Population Research Center is appended as Exhibit "B" and is hereby incorporated into this Ordinance by this reference. Ordinance 877 is hereby rescinded.

DONE this 8th day of November, 2012, at McMinnville, Oregon.

ATTEST YAMHILL COUNTY BOARD OF COMMISSIONERS

B.O. 12-639

REBEKAH STERN DOLL
County Clerk

By Anne M Britt
Deputy Anne Britt

APPROVED AS TO FORM:

RICK SANAI, Yamhill County Counsel

Chair LESLIE LEWIS

Unavailable for signature
Commissioner KATHY GEORGE

Mary P Stern
Commissioner MARY P. STERN

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Accepted by Yamhill County
Board of Commissioners on
11/8/12 by Board Order
12-639

Appendix D

Yamhill County Ordinance 878 - Exhibit "B"

Population Forecasts for Yamhill County, its Cities and Unincorporated Area 2011-2035

Prepared by:
Population Research Center
College of Urban and Public Affairs
Portland State University

October 2012

Portland State University
Population Research Center

B.O. 12-639

Appendix D

Population Forecasts for Yamhill County, its Cities and Unincorporated Area
2011-2035

October 2012

Project Staff:

Risa Proehl, Population Estimates Program Manager
Vivian Siu, Research Analyst
Kevin Rancik, GIS Analyst

POPULATION FORECASTS FOR YAMHILL COUNTY, MCMINNVILLE AND NEWBERG

In the countywide forecast and the forecasts for McMinnville and Newberg, population growth will occur at a moderate pace or stronger throughout the forecast period. The rate and timing at which population will increase and the magnitude of growth differ slightly between the three geographies. Overall, the rates of population increase will become renewed after several years of slower growth that began at the end of the 2000s.

From 2011 to 2035, population increases in Yamhill County, McMinnville and Newberg range from 42 to 69 percent. Newberg is anticipated to undergo population increases at the fastest pace, followed by McMinnville (52 percent).

A summary of the forecast results are shown in Table 7 below. More detailed forecast results are included in Appendix 1.

Table 7. Population Forecast (Summarized)

Population Forecast	Census 2010	2011 (PRC est)	2020	2030	2035	2011-2035 Change		Average Annual Change	
						Number	Percent	Number	Percent
Yamhill County	99,193	99,851	115,220	134,204	142,830	42,980	43.0%	1,791	1.5%
McMinnville	32,648	32,808	38,430	46,171	49,983	17,175	52.4%	716	1.8%
Newberg	22,468	22,730	28,250	35,408	38,490	15,760	69.3%	657	2.2%

Table 10. Population Forecasts for Yamhill County's Smaller Cities and Unincorporated Area (Summarized)

Population Forecast	**Census 2010**	**2011 (PRC est)**	**2020**	**2030**	**2035**	**2011-2035 Change**		**Average Annual Change**	
						Number	**Percent**	**Number**	**Percent**
Amity	1,623	1,635	1,779	1,984	2,097	462	28.3%	19	1.0%
Carlton	2,007	2,036	2,247	2,669	2,890	854	41.9%	36	1.5%
Dayton	2,708	2,731	3,021	3,520	3,765	1,034	37.9%	43	1.3%
Dundee	3,162	3,210	3,772	4,592	4,985	1,774	55.3%	74	1.8%
Lafayette	3,742	3,745	4,394	5,349	5,797	2,053	54.8%	86	1.8%
Sheridan	6,164	6,228	7,276	8,366	8,657	2,429	39.0%	101	1.4%
Willamina (Yamhill County portion only)	1,180	1,180	1,285	1,375	1,426	246	20.8%	10	0.8%
Willamina (full)	2,046	2,055	2,179	2,295	2,361	307	14.9%	13	0.6%
Yamhill	1,024	1,037	1,217	1,352	1,403	366	35.3%	15	1.3%
Unincorporated Yamhill County[1]	22,467	22,510	23,436	23,418	23,338	828	3.7%	34	0.2%

[1] *The unincorporated figures exclude current city limits and UGBs as supplied by Yamhill County.*

Appendix D

Populations for Yamhill County, McMinnville, and Newberg

AREA	Historical →			Forecast →						
	2000*	2010	2011	2012	2015	2020	2025	2030	2032	2035
Yamhill County	84,992	99,193	99,851	100,708	105,220	115,108	124,509	134,204	137,590	142,830
McMinnville	26,286	32,648	32,808	33,045	34,757	38,430	42,283	46,171	47,659	49,983
Newberg	18,538	22,468	22,730	22,963	24,663	28,250	32,213	35,408	36,610	38,490

**Population for 2000 is allocated to current boundaries.*

Avg. Annual Change in #	Historical →		Forecast →				
AREA	**2000-2010**	**2010-2011**	**2012-2015**	**2015-2020**	**2020-2025**	**2025-2030**	**2030-2035**
Yamhill County	1,420	658	1,504	1,978	1,880	1,939	1,725
McMinnville	636	160	570	735	771	777	763
Newberg	393	262	567	718	793	639	616

Avg. Annual Growth Rate	Historical →		Forecast →				
AREA	**2000-2010**	**2010-2011**	**2012-2015**	**2015-2020**	**2020-2025**	**2025-2030**	**2030-2035**
Yamhill County	1.5%	0.7%	1.5%	1.8%	1.6%	1.5%	1.2%
McMinnville	2.2%	0.5%	1.7%	2.0%	1.9%	1.8%	1.6%
Newberg	1.9%	1.2%	2.4%	2.7%	2.6%	1.9%	1.7%

Appendix E

Excerpt from Public Facilities Chapter of Newberg Comprehensive Plan Text

TABLE IV-11
CAPITAL IMPROVEMENTS - WATER
NOVEMBER 9, 1990

PROJECT/LOCATION	ESTIMATED $ COST	ESTIMATED YEAR	SERVICE PROVIDER
1. Highway 219 - East Second St. to Sandoz Rd.	189,300	1991	2
2. Design Treatment Plant/Update Master Plan	100,000	1991	1
3. Wells in well field located in Marion County	135,000	1991	1
4. Reservoir - 4,000,000 gallon at storage site	585,000	1992	1
5. New Water Treatment on Wynooski Street	2,610,500	1992	1
6. River Rd. Loop (College St.-Waterfront Dr. - River St. - 11th St.)	170,800	1993	1,2
7. Springbrook Loop (E. 2nd St. and north to Hwy 99W)	440,000	1993	1,2,3
8. Springbrook Rd. - College St. Loop (Mountainview Dr. - Zimri Dr. west to College St.)	750,000	1995	1,3
9. Transmission Line 24" Across Bridge	307,100	1995	1
10. Water Treatment Plant Expansion	1,405,700	1997-99	1
11. Wells in well field located in Marion County	135,000	1999	1
12. Springbrook Rd. - Wilsonville Road Loop	672,000	2000	1,3
13. New Reservoir at storage site NE of City	585,000	2000	1
14. Wells in well field located in Marion County	585,000	2006	1

SERVICE PROVIDER:
1. CITY OF NEWBERG
2. LOCAL IMPROVEMENT DISTRICT
3. DEVELOPER

Water line loop systems described above as projects 7, 8, and 12 shall be located within the Newberg UGB. Reservoir projects 4 and 13 are planned on land designated VLDR and are permitted by conditional use. Well and transmission line projects 3, 9, 11, and 14 are planned on land designated for agricultural use and are permitted by administrative review under the Marion County zoning ordinance. All necessary permits from County authorities shall be obtained prior to development of the utility improvements.

There exist no alternative sites within the UGB or outside the UGB for the reservoir, well, or transmission line projects. The reservoir projects have been sited in areas which utilize existing transmission lines. The wells and new transmission line projects are located in an area where the City has an existing well field and transmission lines. These projects do not allow or

7 FACILITIES PLANNING FOR A NEW WATER TREATMENT PLANT

The City of Newberg's existing Water Treatment Plant (WTP) is located on an extremely small site with little space for future expansion. In addition, the existing WTP is recognized as having a limited remaining useful life, estimated to be 15 to 20 years in duration. The purpose of this section is to identify potentially viable process alternatives for a new treatment plant to treat the City's groundwater supply, to develop a site layout for the purpose of identifying space requirements for possible land purchase, review alternative sites selected by the City, and develop preliminary cost estimates for a new facility.

7.1 DESIGN CRITERIA

This section discusses the two key design criteria for selecting and sizing a new WTP; 1) hydraulic capacity and, 2) groundwater iron levels. These criteria are discussed below and summarized in Table 7.1.

TABLE 7.1 SUMMARY OF KEY DESIGN CRITERIA

Parameter	Value
Hydraulic	
Year 2027 Peak Day Demand	12 mgd
Initial Average Demand	3.5 mgd
Build-Out Capacity	23 mgd
Iron Concentration	
Average	4.0 mg/L
90th %tile	6.5 mg/L
Peak	12 mg/L
Treated	0.05 mg/L

Hydraulic Capacity. As discussed briefly in Section 6 and in more detail in Section 8, there are various scenarios which the City can consider for continuing to use the existing plant and for constructing a new plant. These scenarios result in different initial capacities of the new plant depending on when it is brought on-line and how long the initial constructed capacity is expected to last before the new plant requires expansion. For the purposes of this facilities plan, the new plant's initial capacity will be expected to last for 10 years after construction and that subsequent expansion will provide adequate capacity for another 15 years based on the City's water demand projections as presented in Section 2. For these purposes, the largest initial new plant capacity considered is 12 mgd for a scenario where the new plant would be brought on-line in 2015. Hence, Table 7.1 indicates a 12 mgd capacity to serve the City until at least 2027, but other capacities are also considered herein. Future discussions in this section focus on a 12 mgd initial plant capacity, but cost estimates are provided for smaller initial capacities also.

O&M costs should be based on the plant average flow in the first year of plant operation. Based on the demand projections, the estimated average daily demand in the Year 2012 is approximately 3.5 mgd increasing to about 5.6 mgd in the Year 2030.

While the initial plant capacity will be based on a 10-year projection, the total space requirements must be based on the ultimate system demands to ensure adequate space for future expansion. Based on the demand projections, the ultimate City demand at "build-out" is approximately 23 mgd.

Iron Concentrations. Historical iron levels in the City's wells were shown in Section 2. For the purposes of this Facilities Plan, it is assumed that future wells added to the system will have similar iron levels as those measured in the historical data. The current average iron concentration from the wellfield is approximately 4 mg/L and the peak observed level is 12 mg/L. A well-operated iron removal facility should consistently be able to reduce iron levels in the raw water to less than 0.05 mg/L in the treated water. This is well below the secondary MCL for iron of 0.3 mg/L. The plant should also be able to remove any dissolved manganese which is present in the groundwater.

7.2 TREATMENT ALTERNATIVES ANALYSIS

Dissolved iron in well water is typically removed through an oxidation step, followed by adequate contact time to allow the oxidation reactions to take place, followed by a conventional filtration process (rapid sand filters, dual media gravity filters, etc.). The oxidation step converts the iron to the solid form of iron hydroxide that can subsequently be removed in the filtration process. This describes the current process train at the existing WTP. Similar oxidation of manganese also occurs, but at a slower rate than iron.

Recent plant experience has demonstrated that the current process train places a significant strain on the filters. Current iron levels in the wells produce a substantial amount of solids that must be entirely removed in the filters. In the absence of a clarification process to remove solids prior to filtration, the filters can be quickly overloaded and require frequent backwashing. Short filter runs reduce plant efficiency, increase backwash volume and overwhelm the solids handling facilities. Section 6 reviews the costs and benefits of adding clarification to the existing plant.

There are two primary treatment process trains that are viable for treatment of the existing groundwater system and should be evaluated for a new WTP:

1. Oxidation → contact time → clarification → conventional granular filtration
2. Oxidation → contact time → submerged membrane filtration

Process train 1 is similar to the existing treatment plant but includes a clarification process to remove solids prior to filtration. Process train 2 combines the clarification and filtration process into a single membrane filtration process. The following section describes the various treatment alternatives and identifies processes that are appropriate for a new WTP. The section is organized by unit process.

7.2.1 Oxidation

Oxidation is required to convert the iron to iron hydroxide (and manganese to manganese dioxide) for subsequent removal through clarification and filtration. There are a number of oxidants that can oxidize iron; however, for the Newberg WTP, only two options are considered viable: aeration or chorine addition. For the purposes of sizing a new facility, it is assumed that the City will continue to use free chlorine for oxidation of iron. Chlorination requires less headloss, a smaller footprint, is easier to operate and incurs lower maintenance costs. However, aeration is a viable alternative for iron oxidation for a new facility if the City desires to store and add less chlorine than would be required for chlorine oxidation. Chlorine will still have to be added for final disinfection and for maintaining a residual in the distribution system.

An additional oxidation process that could be considered for a future treatment plant is “biologically assisted oxidation”. Infilco Degremont manufactures this proprietary process under the name “Ferazur”. In the process, iron-oxidizing bacteria excrete an enzyme, which catalyzes the oxidation rate of iron through aeration. This eliminates the need for a chemical oxidant and reduces the contact time necessary to complete the oxidation step. Further, the manufacturer claims that the floc formed in this process is much more “compact” than chemically-oxidized floc and thus less clogging to filters. Compact floc allows longer filter runs, higher filtration rates, less frequent backwashing, and results in lower solids production. The process is not very common in the US and there are currently only a small number of full-scale installations. Since this process is relatively new to the US, a pilot study would be recommended to prove its performance and to develop appropriate design criteria before it could be recommended for a new facility.

7.2.2 Contact Time

The contact time required for iron oxidation is based on several factors including the method of oxidation, the form of dissolved iron and the water pH. With chlorine oxidation, the rate of oxidation increases with increasing pH. In general, an oxidation pH of approximately 8.0 is considered optimum with diminishing returns at higher pH levels. Currently, the plant adds sodium hydroxide at the filter effluent to increase pH to approximately 7.5 for corrosion control prior to distribution. It is recommended that sodium hydroxide be added to the raw water prior to oxidation to reduce the volume required for the contact chamber. Assuming optimization of pH coupled with chlorine oxidation, a design detention time of 15 minutes is recommended.

7.2.3 Clarification

There are a significant number of clarification options for treatment of high iron water. Processes that could be used in this application include the following:

- Conventional or High- Rate Horizontal Sedimentation Basin
- Actiflo
- Dissolved Air Flotation (DAF)

- Two-stage filtration
- Sludge Blanket or Reactor Clarifiers

Conventional and High-Rate Horizontal-Flow Sedimentation. Conventional horizontal-flow sedimentation basins are the most commonly designed sedimentation process and consist of long narrow basins, which allow solids to settle as water travels the length of the basin. Typical surface loading rates for conventional horizontal flow basins range from approximately 0.5 to 1.0 gpm/sf. Inclined plates (e.g. Lamella plates) or tubes can be added to conventional sedimentation basins to increase the surface area available for solids removal, thereby increasing the allowable surface loading rate through the basin. Typical surface loading rates for the area covered by tubes or plates range from approximately 2 to 4 gpm/sf, reducing the necessary basin area up to 2- to 3-fold as compared to a conventional sedimentation process. Unlike most solids in surface water treatment, iron hydroxide floc is very light and does not settle well. In order to create a settleable floc, it would be necessary to add a flocculant aid to “weigh” the floc down. In addition, gravity sedimentation of a lightweight floc requires a significant amount of space. Long basins with low surface loading rates would be required to provide time for the floc to settle. These basins require a significant amount of space and are typically more expensive than other higher rate processes available. Therefore, conventional sedimentation would not be recommended for a new facility.

Actiflo. The Actiflo process combines flocculation/sedimentation process into a single unit and allows significantly higher surface loading rates than conventional processes. In the Actiflo process, microsand (50 to 100 µm diameter), coagulant and polymer are injected into the influent water. The chemicals and microsand combine in the flocculation process to form a heavy floc, which readily settles in the downstream clarification process. Floc collected from the clarification process is pumped through a hydrocyclone where the microsand is separated from the remainder of the floc. The separated microsand is recycled back into the basin while the floc is diverted to solids treatment (e.g., lagoons). While Actiflo is an acceptable treatment option for a new facility, there are lower cost options (both construction and operating) available to remove iron solids from the water that contain less mechanical equipment and are easier to operate. Therefore, Actiflo would not be recommended for a new facility.

Dissolved Air Flotation (DAF). Dissolved air flotation uses tiny air bubbles to create buoyant floc which float to the surface of the basin. The process is typically used in applications where a lightweight floc is formed or if there is significant algae in the source water. A sidestream of clarified water is saturated with air in a pressure vessel and is then recirculated to the head of the basin where it is mixed with the influent water. The pressurized water releases tiny air bubbles in the basin which adhere to the influent floc material causing the floc to float to the basin surface. The surface sludge, called “float, is continuously removed from the basin by rotating surface skimmers. The float is discharged into a channel where it is diverted to the solids handling facilities. Clarified water from the basin is captured in perforated pipes located near the bottom of the basin. DAF is a viable option for removal of the lightweight iron hydroxide floc formed during iron oxidation and should be considered for a future WTP.

Two-stage Filtration. The two-stage filtration process was developed many years ago and has been used for over 15 years in the United States, mostly in “package plant” applications. The process consists of oxidation followed by two stages of filtration. The first filtration stage is considered a “roughing” filter, which captures approximately 80 percent of solids on the coarse media. The high-rate, roughing filter usually contains upflow buoyant media and combines the flocculation and clarification process into a single unit. Large-sized buoyant media is placed in a basin and flocculation is achieved by the “microturbulence” created as the water passes through the media. The flocculated material adheres and accumulates to the surface of the buoyant media and is periodically removed through backwashing.

These types of processes are sometimes called “contact clarifiers” and when combined with filtration, the process is called “contact filtration” or “two-stage filtration”. These types of processes can be operated at loading rates up to 10 gpm/sf providing significant space savings. The second stage of filtration usually consists of down-flow multimedia gravity filtration at rates from 4 to 6 gpm/sf. The basins must be operated at 50 to 100% of their design capacity to perform effectively. Typically, contact filtration is suitable for waters with turbidity levels up to 50 NTU. Two-stage filtration would be an appropriate process for treatment of the well supply and should be considered for a future facility.

Sludge Blanket or Reactor Clarifiers. Sludge Blanket and Reactor Clarifiers are upflow units, are very compact and are pre-engineered by equipment manufacturers. Both of these processes rely on contact of the influent flow with a pre-formed layer of sludge held in suspension by balancing upward flow with weighted floc. Sludge blanket clarifiers and reactor-clarifiers are appropriate for systems with steady water quality and relatively constant flow rates. Rapid changes in either of these parameters can upset the balance in the reactor. Since it is likely that the City will not operate the plant 24 hours per day, neither of these processes is recommended for a new facility. It may also be difficult to create a heavy enough floc to properly operate within the clarifier due to the light ferric hydroxide floc formed by iron oxidation.

7.2.4 Filtration

Granular media filtration would be used if a conventional filtration process including clarification was selected. Submerged membranes, if selected, would replace the clarification and granular media filtration processes. Both granular media and submerged membrane filtration are discussed in this section.

Granular Media Filtration. The existing filters at the WTP are tri-media containing layers of anthracite, sand and garnet. The trimedia filter is typically found in older plants and is not commonly used in modern plants. Standard dual media granular filters containing a bed of anthracite media over a shallow bed of sand are recommended for a new WTP. Dual media filters have been shown to provide similar removal efficiencies as tri-media filters while reducing the rate of headloss accumulation observed with smaller sized trimedia filters. Based on pilot experience, a relatively deep media bed containing approximately 4 to 5 feet of anthracite over 12 inches of sand should be sufficient to allow filtration rates up to 8 gpm/sf with one filter out of service and 6 gpm/sf with all filters in service. The deeper media allows higher filtration rates which reduces the surface area required for filtration and lowers construction costs. For a 12 mgd treatment plant, four dual-media filters are recommended. Four filters balance the hydraulic impact to the plant when one filter is out of service for backwashing with the cost of filter construction.

Submerged Membrane Filtration. Submerged membranes differ from more conventional pressure membranes in that water is suctioned through the membrane rather than pumped. Cartridges of membranes are submerged in a basin and pumps are used to provide a slight vacuum to suction the flow. The membrane basin contains a series of air diffusers on the basin bottom, which keeps solids in suspension and prevents them from adhering to the membrane surface. Since the process is operated at relatively low pressures and solids do not clog the surface, this type of membrane can treat waters with significantly higher solids content than traditional pressure membrane filters. For treatment of the well water, an oxidation and contact time step would be required ahead of the membrane filters. The oxidized iron solids would then flow to the membrane basin where the finished water is suctioned through the membrane and the solids are continuously “bled” from the basin and diverted to the solids handling facilities. Approximately every 15 minutes, a pulse of water is backfed through the membrane for approximately 30 seconds to dislodge any solids from the surface.

Membrane filtration is gaining increased popularity in the U.S. market. Membrane technology is developing quickly resulting in lower cost equipment and smaller space requirements and will continue to develop in the future achieving further improvements. Membrane systems are typically fully automated and require minimal operator attention. Submerged membrane technology is an appropriate technology for treatment of the well water. The process requires the smallest footprint of all of the options available and construction costs have been decreasing to the point that membranes would be very competitive with a conventional treatment plant.

7.3 SUMMARY OF TREATMENT ALTERNATIVES

Table 7.2 provides a summary of potentially viable treatment alternatives for a new WTP facility for the City of Newberg. As shown, there are a number of viable process alternatives to treat the high iron levels in the groundwater supply. For a conventional treatment plant, a treatment sequence of chlorination, contact time, DAF and granular filtration would produce excellent water quality. A roughing filter (first stage of two-stage filtration) could replace the DAF process in this sequence without compromising performance. For a more automated and easier to operate facility, a treatment sequence of chlorination, contact time and submerged membranes would best meet the City’s objectives. As the City moves closer to constructing a new facility, a detailed comparison of each of these alternatives will help the City to select the most appropriate facility to meet their objectives.

Table 7.2 Summary of Viable and Recommended Treatment Alternatives

Process	***Effectiveness***	***Recommended?***
Oxidation		
Aeration	+	
Chlorination	+	Yes
Biologically-Aided Aeration	Unknown	
Contactor	+	Yes
Clarification		
Conventional/High Rate Conv.	o	
Actiflo	+	
Dissolved Air Flotation	+	Yes
Two-Stage Filtration	+	Yes
Reactor/Sludge Blanket Clarifier	-	
Filtration		
Granular Media Filters	+	Yes
Submerged Membrane	+	Yes

7.4 ANCILLARY FACILITIES:

This section discusses the options and recommendations for the following ancillary water treatment facilities:

- Solids Handling
- Clearwell
- Chemical Feed
- High Service Pumping
- Administration/Laboratory Building

7.4.1 Solids Handling

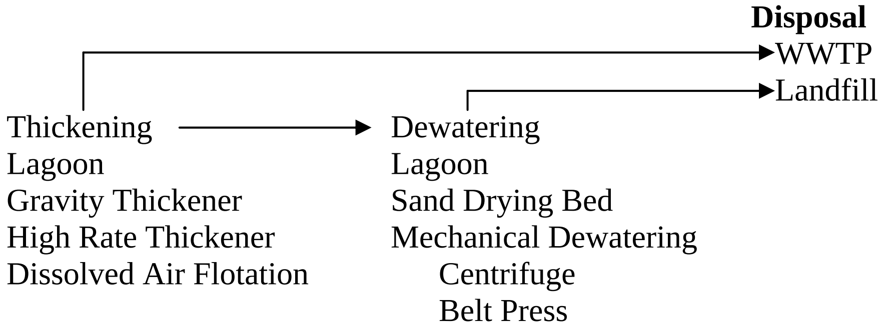
Estimated Sludge Production. Assuming an initial average daily flow rate of 3.5 mgd and 4 mg/L iron, approximately 280 pounds per day (ppd) of dry solids will be produced or about 50 dry tons per year. If the solids are dewatered to a minimum of 15%, 50 dry tons of sludge is equivalent to approximately 335 wet tons. At design capacity, average daily sludge production is estimated to increase to approximately 400 ppd (dry) or 75 dry tons annually (500 wet tons).

Solids Handling Processes. The type of solids handling processes selected for a new facility will depend largely on the method of disposal. The two available options are landfill disposal or delivering solids to the wastewater treatment plant (WWTP). Assuming that the WWTP has sufficient solids and hydraulic capacity, disposal to the sanitary sewer is the least expensive option and requires the smallest footprint. Many WWTPs find iron floc to be beneficial to the plant performance by enhancing primary clarification and improving phosphorous removal. Water treatment solids streams can be pumped directly the WWTP, or more commonly, are thickened to approximately 2 to 4 %

solids and stored in an equalization basin prior to discharge to the WWTP. Thickening and equalization substantially reduces the pumping and piping capacity needed to divert solids and reduces the hydraulic load to the wastewater plant. Currently, the existing WTP stores backwash solids in a lagoon and as required, suctions the thickened sludge from the basin and hauls it to the WWTP for treatment and disposal. For the purposes of this facilities plan, it is assumed that the City will be able to continue to discharge solids to the WWTP from a new WTP. However, space should be provided at the new site for future dewatering facilities if the WWTP is no longer able to accept the sludge and the City is forced to haul solids to a landfill.

If sludge must be hauled to a landfill, the sludge must be thickened and dewatered to a minimum of approximately 15% solids. Either a mechanical dewatering process such as belt filter press or centrifuge or a gravity dewatering process such as sludge lagoons or sand drying beds could be used. In the Portland region, most WTPs combine the thickening and dewatering process in sludge lagoons and either haul the sludge cake to a landfill or dispose of the sludge on-site. At the new plant in Wilsonville, a gravity sludge thickener and centrifuge facility were required because the WWTP did not have sufficient solids handling capacity to accept the sludge and there was insufficient space for a sludge lagoon system. Mechanical dewatering systems are typically only used for very large plants or plants with significant space constraints where WWTP disposal is not a viable option. For estimating future space requirements, space should be provided for the potential future addition of sludge lagoons. Figure 7.1 provides a schematic of the solids handling and disposal options available.

Figure 7.1
Solids Handling Process Options



7.4.2 Clearwell

On-site, finished water storage (clearwell) can be used to provide plant flow equalization, emergency storage during plant shutdowns, a source of backwash water, disinfection contact time, and serve as a wetwell for finished water pumping. Most plant upsets or major equipment failures can be resolved in approximately two to four hours, thus the absolute minimum recommended clearwell volume needed for emergency plant shutdowns is two hours storage at the design flow rate. At the initial design capacity of 12 mgd, 2 hours of storage requires a 1 MG clearwell. Thus, the absolute minimum recommended clearwell volume for the new plant is 1 MG, noting that additional on-site storage would provide greater operational flexibility and a longer buffer period during plant shut-downs. At ultimate capacity of 23 mgd, a minimum of 2 MG storage is recommended.

The initial clearwell should contain two separate compartments of equal volume to allow periodic cleaning. A rectangular shaped clearwell (as opposed to circular) is recommended to minimize space requirements and facilitate future expansion.

7.4.3 Finished Water Pump Station

For the purposes of this Facilities Plan, it is assumed that the finished water pumps will be vertical turbine and will be located on the deck of the clearwell. This is typically the most economical design for finished water pumping and reduces the total space requirement by eliminating the need for a separate pump building. The pump station will also house the backwash pumps, for gravity filtration options.

7.4.4 Chemical Feed Facilities

Four chemical feed systems are recommended for the new treatment plant:

Chlorine. Chlorine can be delivered in either a liquid (sodium hypochlorite) or gaseous (chlorine gas) form or hypochlorite can be generated on-site. Either on-site hypochlorite generation (0.8%) or delivered sodium hypochlorite (12.5% maximum) is recommended for use at the new WTP. Both options provide a higher degree of safety than with transport and storage of ton cylinders of compressed chlorine gas and eliminate the need to comply with UFC requirements for storage of a hazardous gas (chlorine scrubber room with ventilation). For the purposes of this Facilities Plan, it is assumed that delivered hypochlorite will be used. Hypochlorite can be stored in HDPE tanks and fed with chemical metering pumps. Special consideration must be given to the design of the system to allow the escape of oxygen gas that is a byproduct of hypochlorite decay.

Sodium Hydroxide. Sodium hydroxide is recommended to increase the pH of the raw water to increase the rate of iron oxidation and thereby reduce the required size of the contact chamber. Sodium hydroxide can also be added to the finished water if necessary to adjust the pH prior to distribution. Sodium hydroxide can be purchased as either a 25% or 50% solution. The 50% solution is less expensive per pound of caustic and requires smaller capacity pumps and tanks to store and feed chemical but it has a freezing point of approximately 55 F. If 50% sodium hydroxide is delivered, it would either have to be stored and fed at temperatures above 55 F or it would have to be diluted on-site to approximately 25% upon delivery. The freezing point of 25% sodium hydroxide is 0°F, so no special precautions need to be made for storing it in a warm environment. It is recommended that the 50% solution be provided and stored in indoors with adequate heating and ventilation to maintain a minimum of 60°F. However, the chemical storage and feed equipment should be designed to allow for dilution if needed.

Solids Handling Polymer. The thickening process typically requires addition of a high molecular weight anionic or nonionic polymer to aid in sedimentation. Polymers can be purchased in both liquid and dry forms. The dry form can either be batched manually or fed with an automated dry feeder. Liquid filter aid can be stored in tanks, totes or drums and fed with a chemical metering pump. Liquid polymer addition requires the least operator attention and maintenance and based on the volume required, is recommended for this application. It is assumed that the polymer will be stored in delivered 55 gallon drums or totes.

Filter Aid Polymer (Granular Media Filtration Only). Addition of filter aid is recommended to enhance filter production and turbidity removal if a granular media filtration process is selected. Filter aid polymers are similar to solids handling polymers and can be purchased in either liquid or dry forms. Based on the low doses required, it is assumed that the filter aid will be stored in delivered 55 gallon drums or larger totes.

7.4.5 Administrative/Laboratory Space

The following minimum administrative space is recommended for a new 12 mgd WTP:

Control Room	250 s.f.
Laboratory	750 s.f.
Maintenance/Storage Area	750 s.f.
Conference/Lunch Room	300 s.f.
Offices (2)	300 s.f.
Toilet/Lockers/Showers (2)	1000 s.f.
Mechanical Room	200 s.f.
Electrical Equipment	200 s.f.
Total Minimum Useable Area	3,750 s.f.

7.5 WTP SITE LAYOUT

The approximate space required for the 12 mgd WTP, including room for future expansion to 23 mgd, is 3.0 acres. As a point of reference, the existing WTP sits on approximately 1.25 acres and has an ultimate capacity of about 10 MGD.

There are five potential sites available for locating the new facility based on a City survey of available land in the general vicinity of the existing WTP. These sites are identified as A through E on Figure 7.2. Table 7.3 provides a summary of the characteristics of each site. Usable area refers to land area located above the flood plain. All of the sites have sufficient useable space to locate the new WTP including room for expansion to 23 MGD. However, the topography of Site B appears to be not well suited for construction of a new WTP; most of the site is on a slope or in a low-lying area. Sites A, B, C and D are all located at an elevation similar to the existing treatment plant and therefore, minimal reduction in well pumping capacity would be expected. However, Site E is about 20 to 30 feet higher than the existing site and a noticeable reduction in well capacity would need to be accounted for if a plant was located at this site. Site D is within the proposed transportation bypass route for the City. Site A is closest to the wellfield, requiring fewer pipeline upgrades for a new raw water supply. It has good

Appendix E

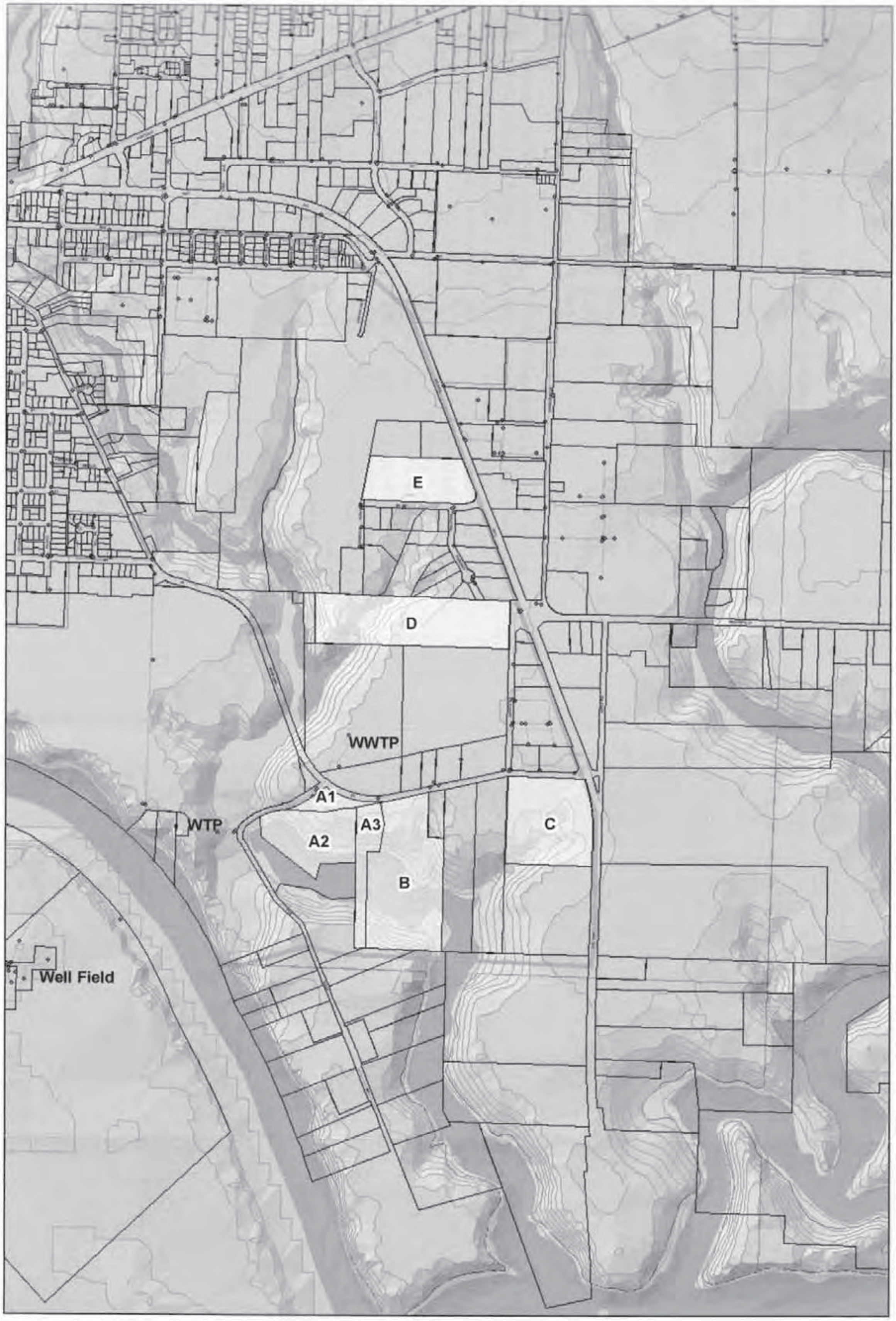


FIGURE 7.2
POTENTIAL SITES
FOR NEW WATER
TREATMENT PLANT

Map created by Jan Wolf 2/02
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access to Wynooski Street, which would make chemical deliveries more efficient and safe. In addition, it is not in a residential area, and is very close to the WWTP. The proximity of the two facilities is also an advantage.

TABLE 7.3 SUMMARY OF AVAILABLE SITES FOR NEW WATER TREATMENT PLANT

Site	Size (Ac)	Useable Size (Ac)	Average Elevation (ft)	UGB Designation
Site A				
A1	0.5	0.5	150	Commercial
A2	4.4	1.19	128	Commercial
A3	8.01	3.25	130	Commercial
Site B	19.27	14.16	128	Commercial
Site C	14.4	12.5	138	Commercial
Site D	16.52	11.36	140	Industrial
Site E	10.0	10.0	160	Industrial

Due to constructability, accessibility and hydraulic considerations as well as proximity to the wellfield, Site A appears to be best-suited for use as a WTP site and is recommended. SP Newsprint currently owns Site A, including all three parcels. It is recommended that the City pursue purchase of this property as soon as it is feasible. Based on an appraisal performed in 2001 by Ron Woodard for the Morland property (Site D), the estimated cost for Site A is $311,313 in 2001 dollars (calculated on a per acre basis).

A WTP layout was prepared on Site A to ensure that this site is appropriate for a future WTP. A 12 MGD conventional filtration plant utilizing dissolved air flotation was selected for a site layout since this treatment train requires the largest footprint of the recommended alternatives. Thus, it represents a conservative estimate of the space needed for a new plant. Figure 7.3 shows the layout of the new facility overlaid on the City's preferred site. Facilities shown on the site include:

- Three, Parallel Contact Basins with Baffle Walls
- Three, Parallel DAF basins
- Four, Granular Media Filters
- 1 MG Clearwell with High Service Pump Station
- 1 Backwash Equalization Basin
- 1 Solids Thickener and Pump Station
- Administration Building Including Chemical Feed Facilities

Space is also shown for future expansion that would include the following additional facilities:

- Three Sludge Lagoons

- One Additional Sludge Thickener
- Four Additional Filters
- Three Additional Contact Basins
- Three Additional DAF Basins

As shown, the acreage of this site is adequate to accommodate a WTP. However, potential site constraints will need to be evaluated prior to a decision on land purchase. Potential site constraints such as wetlands/drainages, FEMA floodplain boundaries, threatened and endangered species and habitat, zoning requirements and hazardous waste contamination from prior uses can significantly limit the actual acreage available for plant construction. A reconnaissance level evaluation to determine the potential for these types of site constraints should be completed prior to purchase.

7.6 WTP COST ESTIMATE

Budget level estimates for a new WTP were prepared and are shown in Table 7.4. It is normally expected that an estimate of this type would be accurate within plus 30 percent or minus 15 percent of the actual cost. As a reference, the current 20 City ENR CCI for the Seattle Region is 7,560 (Feb 2002). The total estimated construction cost for a 12 mgd conventional water treatment plant is approximately $11.5 million. Typically, construction costs for new WTPs fall in the range of $0.85 to $1.25 per gallon depending on process complexity and site specific conditions. The $0.96 per gallon used for this estimate falls within the lower range of typical costs and reflects a lower level of process complexity. An additional 40% was added to the construction cost to account for design, construction management services, administration, legal services, and contingencies bringing the total estimated project cost of a new plant to just over $16 million.

TABLE 7.4 COST ESTIMATE FOR NEW 12 MGD CONVENTIONAL WTP

Item	**Construction Cost**
Yard Piping*	$ 1,740,000
Site Civil Work	$ 1,044,000
Administration Building	$ 550,000
Chemical Feed Facilities	$ 290,000
Flocculation Basins	$ 490,000
Dissolved Air Flotation Basins	$ 975,000
Deep Bed Filters w/ Air Scour	$ 1,820,000
1 MG Clearwell	$ 570,000
Finished Water Pump Station	$ 930,000
Backwash Equalization	$ 580,000
Sludge Thickener and Pump Station	$ 250,000
Electrical/Instrumentation (@ 20%)	$ 2,280,000
Construction Sub-Total	**$ 11,500,000**
Contingencies, Engineering and CM, Admin (@ 40%)	$ 4,600,000
TOTAL CAPITAL COST* **	**$ 16,100,000**

* Does not include raw and finished water pipelines which are site specific. Transmission System Costs are presented in Table 7.5.

** Does not include land acquisition costs.

***Costs are in 2002 dollars

Based on this estimate for a new 12 mgd WTP, project cost estimates were also developed for smaller initial capacities if a new WTP is constructed earlier than 2015. The estimated project costs for these smaller capacities are:

- 9 mgd initial capacity = $12.9 million
- 5 mgd initial capacity = $8.4 million

The cost of Raw Water Transmission and Finished Water Transmission are specific to the site selected for the new WTP. Of the five potential sites selected by the City, transmission costs for only A, B, and C were evaluated since they represent the most desirable options according to the City. Each of these sites is located along or near the existing 18-inch finished water transmission pipeline extending east from the existing WTP to Wynooski Rd. The new plant should be able to connect to this existing 18-inch line and deliver the initial treated water plant capacity of 12 mgd with flow splitting to the west (back through the pipe towards the existing WTP) and also to the east. Based on preliminary hydraulic calculations, this approach should have a transmission capacity of 11 to 14 mgd. The City will need to conduct additional hydraulic modeling to determine the exact capacity, and this will also be affected by possible improvements to the distribution system in the future. No additional finished water transmission piping should be necessary for the foreseeable future, and therefore **no costs are included for finished water transmission piping in this analysis**.

However, a new 30-inch raw water transmission line will be required to deliver well water from the existing WTP to the new site. A 30-inch pipeline was selected to be capable of delivering the ultimate maximum capacity of 23 mgd such that additional raw water piping would not have to be added in the future. This new raw water pipeline was assumed to follow the alignment of the existing 18-inch finished water transmission pipeline from the existing WTP to Wynooski Road. [Note: It is assumed that the cost of a new 24-inch River Crossing for future expanded well supply is already accounted for in the City's CIP and is not included herein.]

Table 7.5 provides a summary of the estimated construction and project costs for the new 30-inch Raw Water Transmission Pipeline required to each of the three potential WTP sites. Depending on location, the raw water transmission costs add an additional $500,000 to $1.0 million to the total project cost of the new plant. A 30% allowance is included in the project costs for the pipeline which is lower than the 40% allowance used for the WTP costs. These costs do not include property acquisition and/or easement costs.

TABLE 7.5 SUMMARY OF ESTIMATED RAW WATER TRANSMISSION COSTS

WTP Location	30" Raw Water Pipeline (ft)	Construction Cost ($)	Project Cost ($)
Site A	2,000	$400,000	$520,000
Site B	2,900	$580,000	$750,000
Site C	4,100	$820,000	$1,060,000

Further discussion regarding the site options for a new WTP is required to determine the desired location. Obviously, Site A would have lower raw water pipeline costs because of its proximity to the existing WTP and wellfield. Sites A and B are closer to the City's WWTP which has potential benefits from a solids handling perspective if the WWTP continues to accept WTP solids.

Appendix E

MEMORANDUM

Date: May 24, 2010

To: Newberg Urban Area Management Commission

From: Howard Hamilton
Newberg Public Works Director

RE: Future water treatment plant needs and site evaluation

Newberg's existing water treatment plant is located on an extremely small site that is accessible only through the SP Newsprint plant. The site size and location preclude any further capacity expansion opportunities at that site.

In order to evaluate future needs for and alternatives for the treatment plant, in 2002 Newberg staff, along with MWH, developed the "City of Newberg Water Treatment Facilities Plan." The Newberg City Council adopted this plan on June 7, 2002 through Resolution 2002-2365.

The adopted plan identifies the need to construct a new 12 mgd water treatment plant, including room for future expansion to 23 mgd. The plan identified a need for approximately 3.0 acres to accommodate this "conventional" plant. See Page 7-10 of the plan.

The plan evaluated several optional sites for this new treatment plant. The plan ultimately recommended locating a future plant on three parcels on the south side of Wynooski Road just east of Dog Ridge Road (3229-202, 500 & 600). The plan included a conceptual layout of such a plant on this site. This site is even more crucial since the parallel river crossing pipe surfaces there.

Since adoption in 2002, Newberg staff has continued to work to implement the plan. This included further analysis of the proposed water treatment plant site. This analysis showed that the proposed site had more topographic constraints and less suitable land than estimated in the treatment plant plan. See the attached map. Staff concluded that, in order to site the plant at that location, Newberg would need to acquire an additional parcel to the east (3229-400). Together these four parcels include about 3.5 buildable acres of land. Staff has prepared a conceptual layout of the plant on these parcels, and has found that the needed 3.0 acre treatment plant site likely could be accommodated on these parcels. Of special consideration is the remote possibility that one or more wells could be classed as "under surface water influence" requiring addition treatment beyond the "conventional" plant classification and this would require an additional 0.25 acres.

In addition, the South Industrial Master Plan, adopted by the Newberg City Council by Resolution 2009-2872 on November 2, 2009, identifies a need for a sanitary sewer pump station in the vicinity of the site. This would require approximately 0.25 acres of land. Thus, it is likely this also could be accommodated on the four Wynooski parcels.

The City of Newberg has entered into a purchase agreement with SP Newsprint to acquire these parcels.

Appendix E

Last Update: Friday, July 31, 2009
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101' ELV is 100 Year Flood Elevation

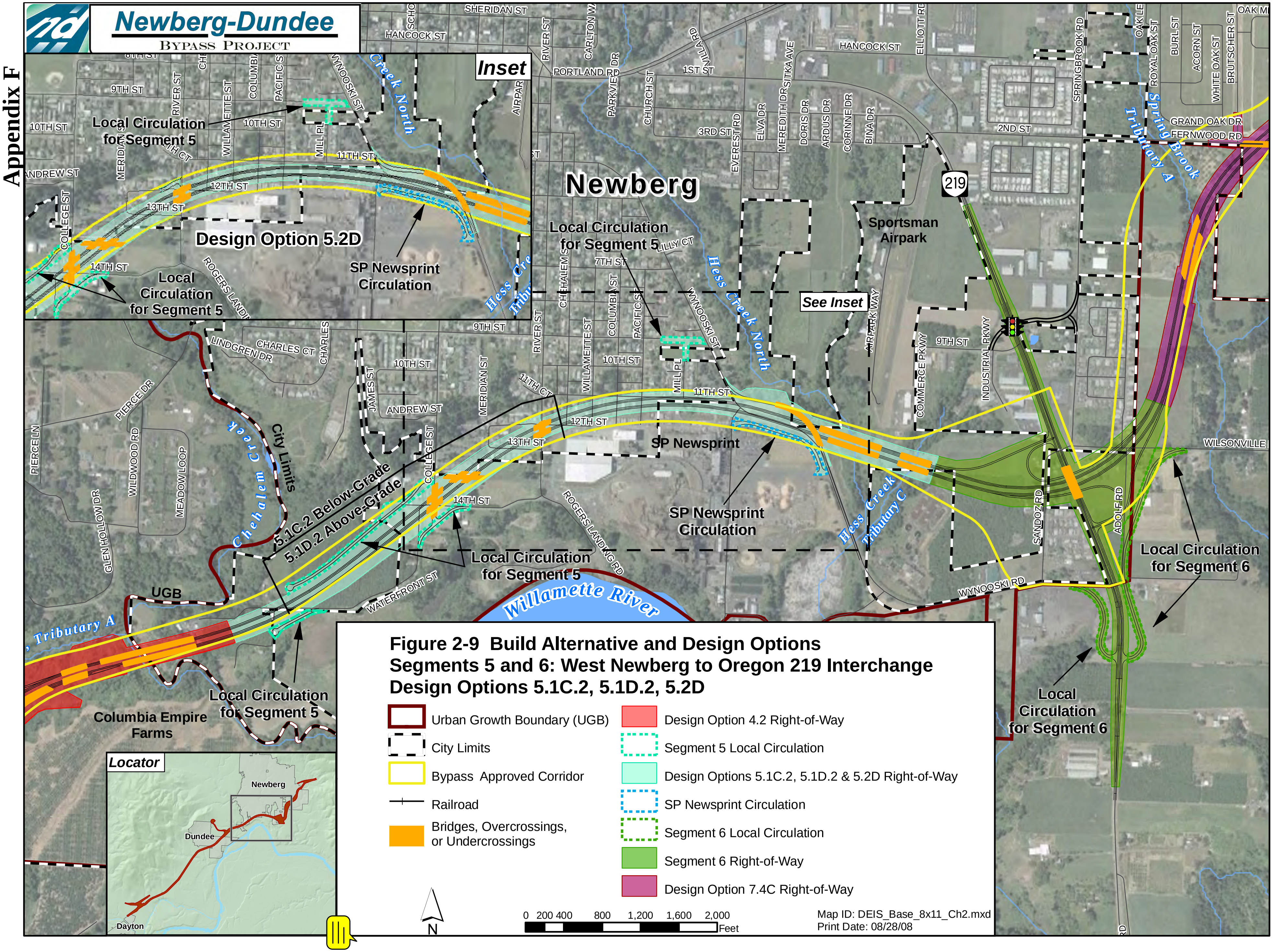


Figure 2-9 Build Alternative and Design Options Segments 5 and 6: West Newberg to Oregon 219 Interchange Design Options 5.1C.2, 5.1D.2, 5.2D

See Note for Design Option Descriptions

TRANSPORTATION PLAN

The access and circulation component of the plan identifies connections for multiple modes to the City's existing and planned transportation system. The plan provides for the needs of multiple users including trucks, automobiles, pedestrians, and bicyclists. The alignments and designations identified in the plan area are conceptual and subject to further study.

Vehicular Circulation

Vehicular circulation is provided for via both existing and new facilities. The district's transportation network is planned around the anticipated Newberg-Dundee Bypass while recognizing that it may be some time before the facility is constructed. Highway 219 is planned as the primary north-south roadway connection into and through the district. The minimum spacing for a new intersection with Highway 219 is approximately 1,600 feet from the identified Bypass interchange. An interim (Pre-Bypass) connection into the area is identified along Highway 219 across from the current Wynooski Road intersection. When the Bypass is constructed, it will require the realignment of Wynooski Road and move the Wynooski Road/Highway 219 intersection further south out of the Bypass interchange area.

The master plan layout shows Wynooski Road realigned to provide a new intersection midway along Highway 219 that will serve as the district's primary access. Wynooski Road and future Street "C" are planned as the primary east-west roadway connection. Inherent in the design is the flexibility to extend Street "C" eastward over Springbrook Creek and continue as a new Wilsonville Road alignment. This would provide a direct route into the plan area, but would also require an expensive new bridge crossing with environmental impacts. This new connection should be studied in more detail to determine if the benefits of the new connection justify the fiscal and environmental impacts.

Street "A" is designed as an internal north-south collector that provides access into individual development sites, provides a connection to Wilsonville Road, and a connection to parklands located south of the area. Several optional local streets are delineated internal to the district as possible future connections and service accessways. Finally, the roadway network is designed to position streets adjacent to conservation areas in order to create recreational access and project an attractive district streetscape.

Proposed Master Plan Transportation System

Street Name	Functional Classification	Future Improvement Plans
State Highway 219	Minor Arterial	5 lanes
Wilsonville Rd	Minor Arterial	3 lanes
Wynooski Rd	Major Collector	3 lanes
Street "A"	Minor Collector	2 Lanes
Street "B"	Local	2-Lanes
Street "C"	Minor Collector*	2-Lanes

*Street "C" has the potential to be expanded to a Minor Arterial if Wilsonville Road is realigned to cross Springbrook Creek and continue at this roadway.

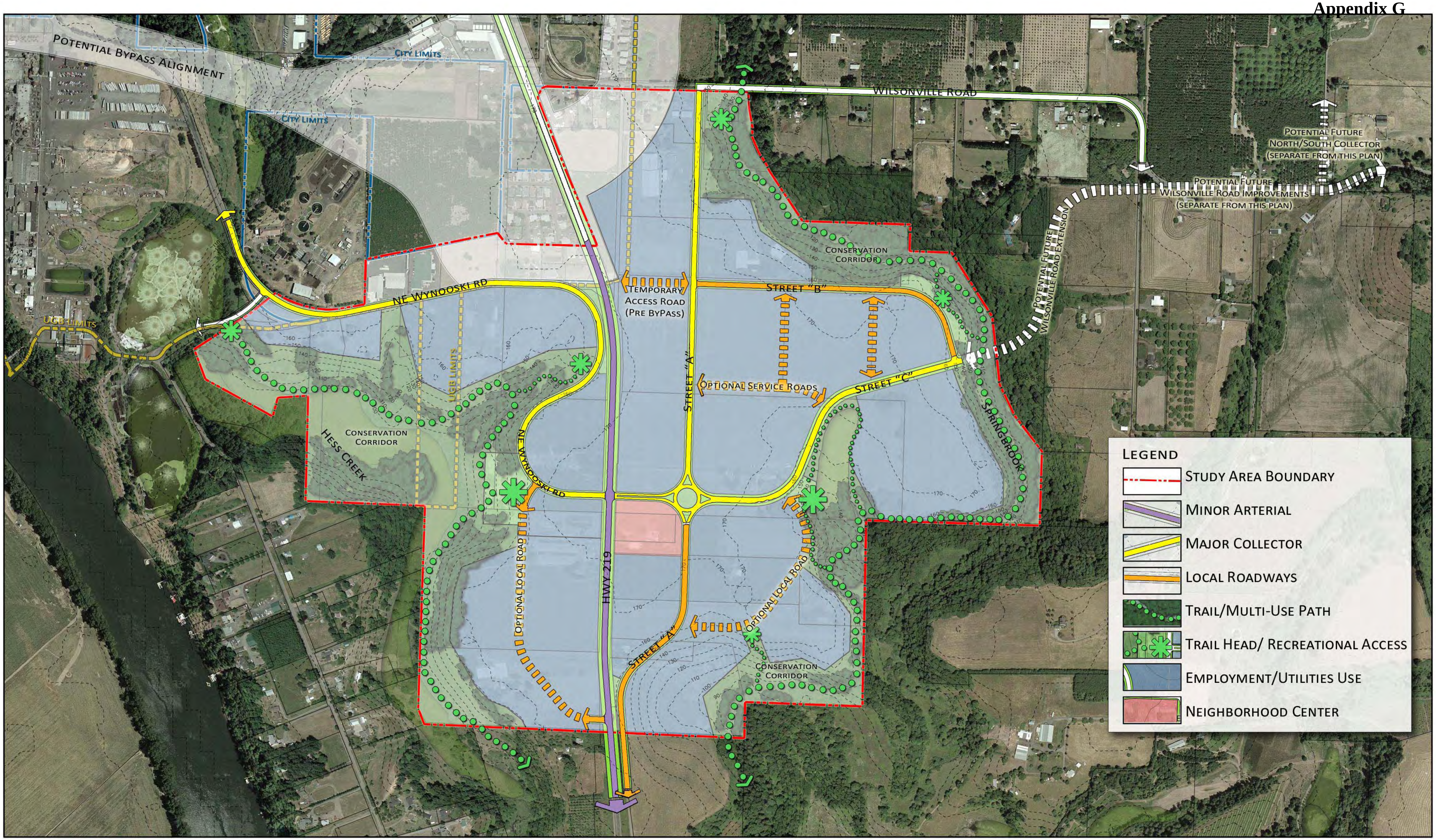
Pedestrian & Bicycle Circulation

The plan envisions that pedestrian and bicycle traffic will be accommodated and encouraged within the plan district area. It's envisioned that all streets will be improved and constructed to safely and comfortably accommodate these users. In addition, the plan illustrates a trail/multi-use path network within the conservation corridors. This network is intended to connect to an existing and future regional network in and around the plan area. It is envisioned that the trail network will function as a recreational amenity and serve as an alternative transportation mode to and from the employment areas.

Design Elements

The plan envisions creating and adopting specific roadway design standards for the plan district. The street designs are intended to include pedestrian amenities, aesthetic features and practical mobility considerations that are unique to a successful industrial/employment district. Additionally, the plan envisions certain sustainability elements be included in the roadway design to manage stormwater runoff and ensure water quality. The district roadway designs should address and accommodate the following fundamentals:

- Safely and effectively accommodate semi-truck and industrial vehicles
- Provide pedestrian sidewalks and/or multi-use paths along all roadways. Use curb-tight sidewalk design on internal roadways to improve pedestrian visibility on narrower streets
- Plan for bicycle traffic on district roadways. Provide designated bicycle lanes or multi-use paths along higher order streets and plan for shared facilities on local internal streets
- Establish a streetscape design that identifies the district as a unique part of the community including uniform landscaping and streetscape elements
- Incorporate stormwater management/water quality facilities into roadway design
- Limit pavement and asphalt width



Newberg South Industrial Area Master Plan

Conceptual Plan - Preferred Alternative - Transportation Plan

Newberg, Oregon

SCALE: IN FEET
0 150 300 600
DATE: 17 June, 2009

W R G
DESIGN INC.

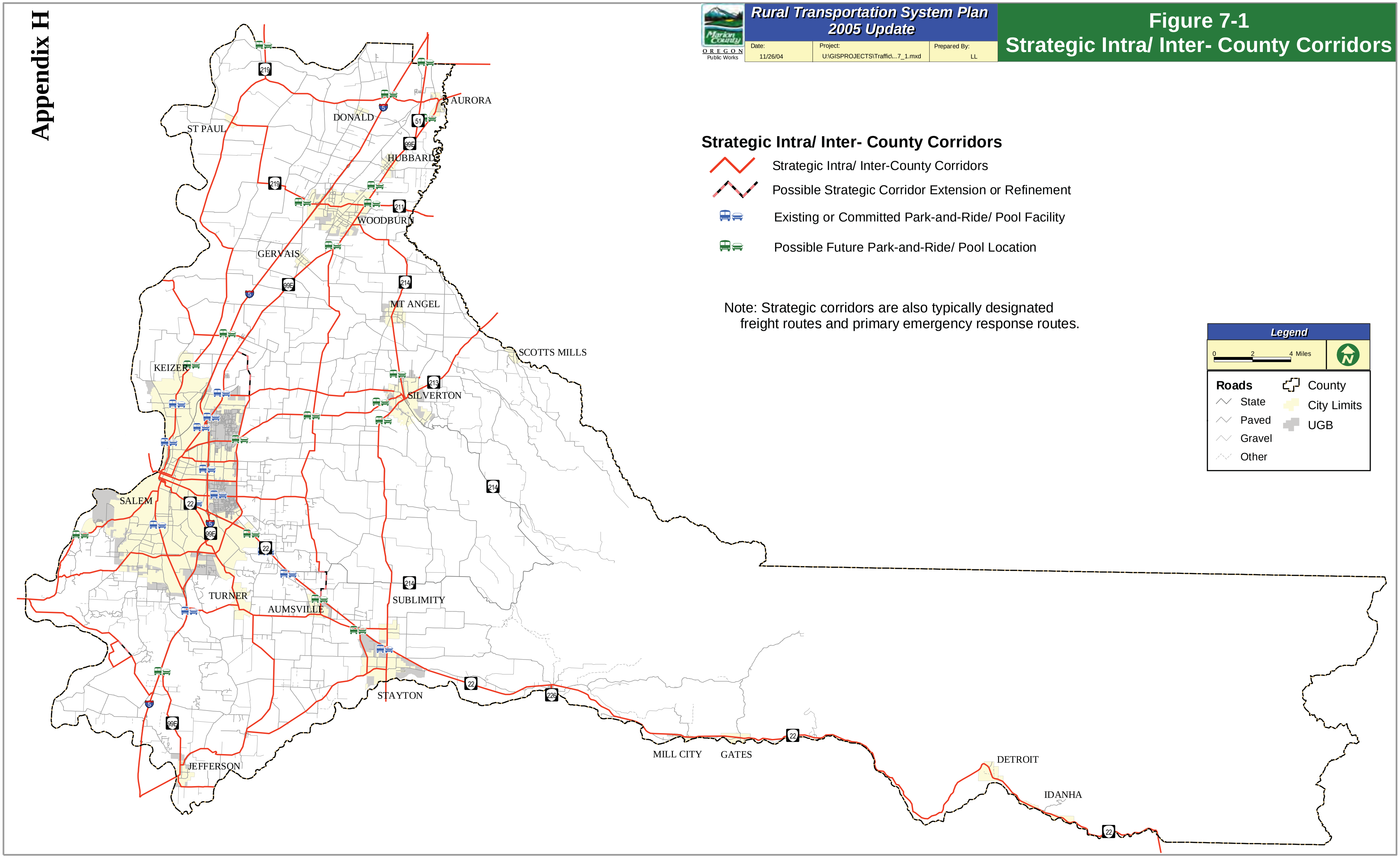
Appendix H

Rural Transportation System Plan
2005 Update

Date:	Project:	Prepared By:
11/26/04	U:\GISPROJECTS\Traffic\...7_1.mxd	LL

OREGON
Public Works

Figure 7-1
Strategic Intra/ Inter- County Corridors



Strategic Intra/ Inter- County Corridors

- Strategic Intra/ Inter-County Corridors
- Possible Strategic Corridor Extension or Refinement
- Existing or Committed Park-and-Ride/ Pool Facility
- Possible Future Park-and-Ride/ Pool Location

Note: Strategic corridors are also typically designated freight routes and primary emergency response routes.

Legend

0 2 4 Miles

Roads
- State
- Paved
- Gravel
- Other

- County
- City Limits
- UGB