ACKNOWLEDGEMENTS

Town of Yacolt, Washington
Mayor Ken Case

YACOLT WASTEWATER MANAGEMENT PROJECT
CITIZEN'S ADVISORY COMMITTEE

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Thank you to the Clark County Board of Commissioners, Clark County Community Development Department, Clark Public Utilities, Hazel Dell Sewer District and Washington Dept. of Ecology for assisting the Town of Yacolt with this project.

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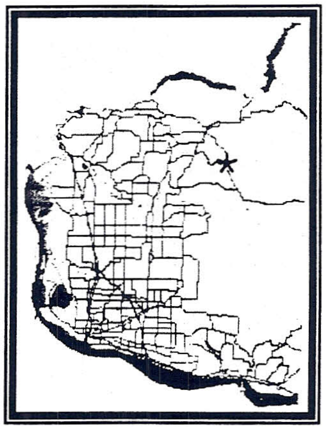

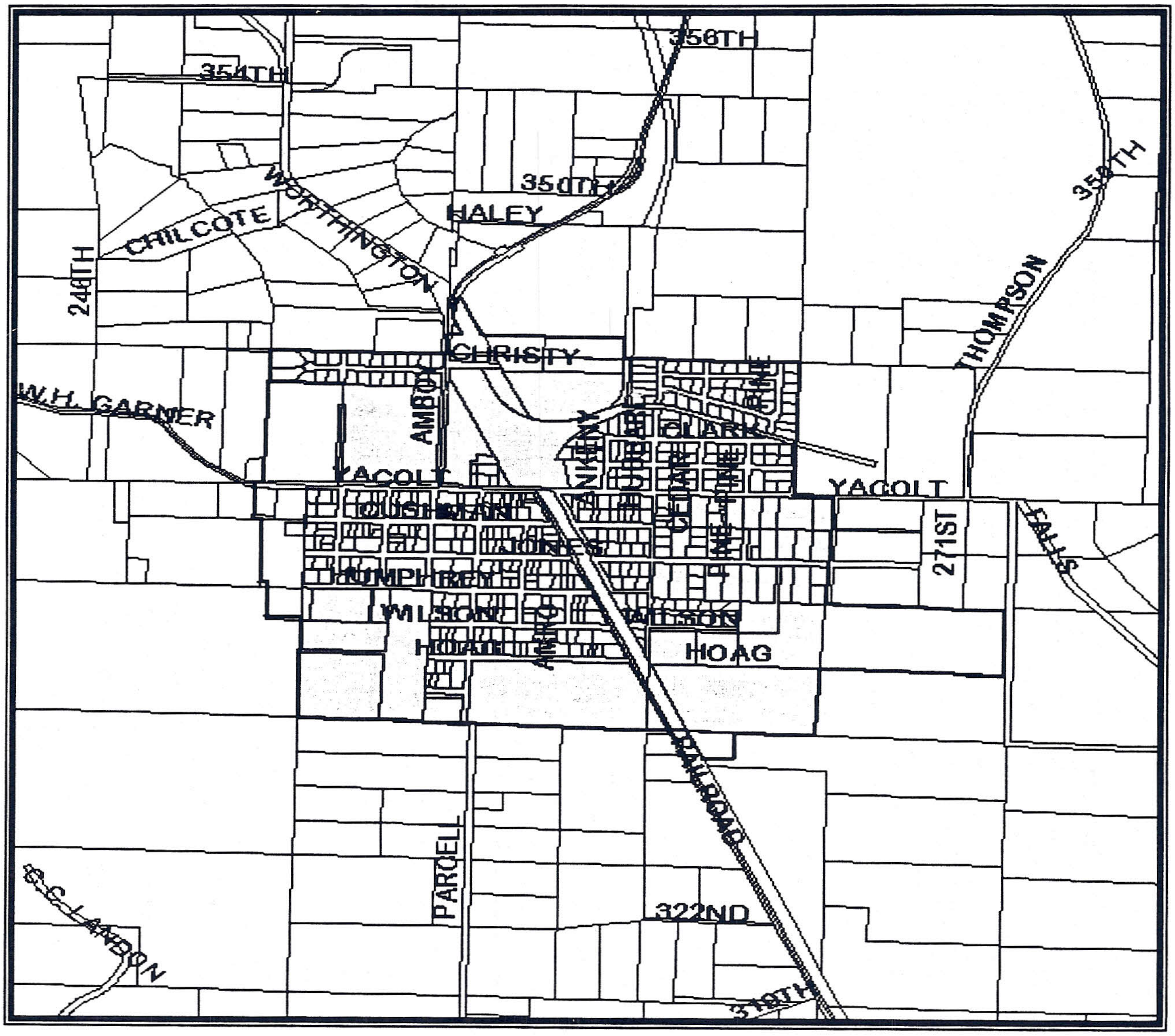

I. Summary

A. Introduction

The Town of Yacolt needs to consider centralized wastewater collection, treatment and disposal to meet its 1994 adopted Growth Management Act density requirements. While there are a variety of collection, treatment and disposal alternatives available, we recommend that the Town concentrate on the STEP/STEG system for collections. An analysis beyond the scope of this feasibility report is required to select the specific method of wastewater treatment and disposal. However, it seems that a package treatment plant would be most appropriate for the treatment requirements. As far as disposal we recommend that the water be used for a beneficial purpose such as irrigation, wetlands enhancement or groundwater recharge during the dry months and, <u>if permitted</u>, a discharge to surface water be used during the wet months. Low interest loans, bonds and possibly grants should be pursued to keep the cost of financing as low as possible.

In the spirit of interagency cooperation, Clark Public Utilities (CPU) agreed to provide technical assistance to the Town of Yacolt as a part of their Wastewater Management Project. This technical assistance is the preparation of a preliminary engineering feasibility analysis for several collection, treatment and disposal alternatives that the Town's Wastewater Management Committee may wish to consider in order to serve the community with a wastewater management system.

Much of the base data that is used in this report has been extracted from *Yacolt Sewer Feasibility Study,* by Wallis Engineering, dated February 1997. This report does not attempt to duplicate the information in the aforementioned report. It is intended to be an addendum that discusses additional alternatives for community wastewater service.

B. Projected Growth in Yacolt

The 1999 estimated population within the Town limits is 935 people. The projected Year 2012 population of the Yacolt urban growth area is 1,448 people.

C. Existing System

Present sewage systems in the Town of Yacolt consist of approximately 360 residential single family systems with a septic tank and drainfield for most homes (Source: SWWHD records). If cesspools are encountered as part of the maintenance program, the Health District requires upgrading to a conforming system. In 1996, the Health District began sending maintenance notices to residents, and most systems have had a maintenance inspection and/or pumping.

The crux of the problem for Yacolt is that septic systems are applicable to rural densities, limited to 18,000 square foot lots for the soil type in Yacolt. Reaching urban densities, with 5,000 square foot lots, is not possible nor prudent using presently approved septic systems.

Many of the lots platted prior to 1994 are 5,000 square feet. The Southwest Washington Health District rules will allow 10,000 square foot for septic systems on pre-existing lots, while 18,000 square feet are required for new lots. Construction of a house, garage, with a primary and reserve septic system space on a 10,000 square foot lot proves to be a difficult endeavor. Runoff from 13,000 square foot lots in the new subdivision has created problems during heavier winter storm periods.

Septic systems in newer subdivisions with 13,000 square foot lots commonly have two compartment tanks and a designed system. Pressure distribution systems have been required for most new systems since 1996 due to the need for wellhead protection. The Health District instituted septic tank water tightness testing in 1997 for newly installed systems.

The Yacolt Primary School has a newer "Large On Site System" (LOSS) pressure distribution drainfield, approved and regulated by the Washington Department of Health. This system was designed for 825 people and total flow of 5,200 gallons per day.

D. Implementation of a Sewer Plan and Costs

It is not within the scope of this report to make conclusions regarding the whether or not a community-wide wastewater system should be constructed for the Town of Yacolt. That decision rests with the citizens and community leaders of Yacolt. Should the Town move forward, decide to design, and construct a wastewater collection, treatment and disposal system, and State funding is involved, it could be upwards of two to three years before any construction would begin.

The table below summarizes the capital construction costs for a treatment/disposal facility and collections system for the existing Town limits. The costs include engineering, permits and contingencies equal to 35%:

Table1: Summary of centralized wastewater treatment costs for recommended alternatives.

Component	Cost
Collection System Costs	$420,000
Treatment System Costs	$510,000
Disposal System Cost	$1,260,000
Average cost to Retrofit Onsite Systems	$1,000,000
Total[1]	**$3,190,000.00**

These capital costs with the addition of operations and maintenance costs could result in an overall monthly wastewater fee of approximately $52 to $62. After the debt service is paid in full, the overall charge could be reduced to that of operations and maintenance. A system development charge of somewhere between $1775 and $2600 should also be charged to each new residence or equivalent to recover oversized infrastructure and

[1] This amount is reduced to approximately $2,370,000 for the calculation of user fee. The remainder is included in the system develop charge.

additional capacity costs. The Town should pursue low interest loans, bonds and possibly grants to keep the cost of financing as low as possible.

II. Background

A. Growth Management Plan

In 1990, the Legislature adopted the State Growth Management Act to require comprehensive planning of certain high growth counties and cities. Clark County and its seven incorporated cities, including Yacolt, were required to establish Urban Growth Areas and Comprehensive Plan policies. Below is a brief timeline of the actions leading to the policies relevant to wastewater, land use and the growth of Yacolt.

November, 1994 -- "... the Clark County Planning Commission recommended to the Board of County Commissioners that: 1) the Urban Growth Area for the Town be consistent with that which is described in the exhibit of the Plan entitled Town of Yacolt Comprehensive Growth Management Plan for the Preferred Urban Growth Area, 2) *a program for installing public sewer be adopted by the Town with five years, and 3) the Land Use Element and the Urban Growth Boundary be reevaluated by the Town and Clark County, once it is assured that a public sewer system will be constructed; and...." (Italics added)*

November 21, 1994 -- The Town of Yacolt adopts the Comprehensive Growth Management Plan with inclusion of the recommendations of the Clark County Planning Commission.

December 21, 1994 -- The Board of County Commissioners adopts the county's Comprehensive Growth Management Plan, including Yacolt's Comprehensive Plan. Within the County's Comprehensive Plan Land Use Element is the following policy:

> "Policy 2.1.20 -- The Yacolt Urban Growth Boundary will be reevaluated by the County at such time as the Town of Yacolt develops a plan assuring that public sewer will be available."

January 3, 1995 – the Town Council passed Resolution 308, ratifying the adoption of the Comprehensive Growth Management Plan for the Town of Yacolt.

June 1, 1998 – Town Council appointed two members to serve on the Wastewater Management Project Citizen Advisory Committee. Other community members were solicited by an advertisement in the Battle Ground Reflector, personal contact by the Mayor and other council members. Representation was sought from a variety of interests -- school, businesses, environmental, residents and property owners in the community. The committee met twice a month for the first year to learn about Yacolt's drinking water, wastewater management options and costs as well as funding sources.

B. Public Involvement

The latest phase of public involvement on the Wastewater Management Project began in June 1998. However, prior to that time, several other events took place in order to explore the feasibility wastewater options.

In June 1998, a citizen's advisory committee was formed to address the wastewater issue. Representation includes town council members, citizens, the Yacolt public works director, a school district employee representing Yacolt Primary School and a representative from the Southwest Washington Health District. This committee has worked with the guidance and support of a representative from Clark County's Department of Community Development.

The Committee has also had the counsel of staff from Clark Public Utilities (CPU) and the Southwest Washington Health District (SWWHD). Staff members of the Department of Ecology who have offered invaluable advice have attended committee meetings.

There were two main goals of the committee:

- to address the Town's Comprehensive Plan and the State Growth Management Act and,
- to maintain the quality of Yacolt's drinking water.

There are four basic objectives for the Yacolt Wastewater Management Project Committee:

1. Identify the issues
2. Research the wastewater management alternatives
3. Make an informed decision on a wastewater management system that can realistically be funded and implemented.
4. Prepare a wastewater Capital Facilities Plan.

The following was done in the process of educating the public about the efforts of the Committee:

- Twice monthly, then monthly meeting were held of the Wastewater Management Project Committee.
- "The Yacolt Wastewater Gazette" was mailed to each household in the Town of Yacolt. To date three issues of the Gazette have been sent to residents.
- An opinion survey was included in the Gazette to which residents responded.
- Flyers and notices announcing upcoming meetings and events were posted and mailed to invite the public.
- Two public workshops were held to inform the community of the issues and wastewater management alternatives on November 5, 1998 and April 1, 1999 respectively. Another public meeting was held on November 18, 1999 to review this feasibility study. Public hearings will be held before the Town Council to adopt a final plan.

C. Agency Involvement

There has been interagency cooperation between Clark County Community Development, Clark Public Utilities (CPU), the SW Washington Health District, Hazel Dell Sewer District, Washington State Department of Ecology, and USDA Rural Development who have assisted in the Town's wastewater planning efforts and the preparation of this report. The Town will have to continue to pursue funding from various federal, state and local resources for planning, design, engineering and capital constructions.

III. Planning Criteria

A. General Description

The Town of Yacolt has been experiencing consistent nitrate levels in their water supply wells. Currently, the nitrate levels are not anywhere near the maximum contaminate level for safe drinking water, nor are they at levels requiring clean up; however, the nitrate levels may continue to increase as the town grows while still using conventional onsite sewage disposal. The levels have hovered between two (2) and three (3) PPM over the past several years. The DOE requires action be taken if levels reach 5 PPM or more. A health hazard exists at a level of 10 PPM.

As a part of the Towns' Comprehensive Plan, Yacolt's densities are planned to increase. Many existing lots in the town are 5,000 to 6,000 square feet in size. Residential zoning within the Town is R1-10 to R1-12.5, or 10,000 to 12,500 square feet. The minimum lot size that is required by the SWWHD for residential septic system placement is 18,000 square feet. Therefore, land utilization is not optimized to meet Growth Management Plan densities.

B. Statutory Requirements

The primary reason for a public wastewater management system in the Town of Yacolt is to meet the Growth Management Act density requirements. The Washington Department of Ecology's Design Manual with the supporting WAC and RCW requirements will be used in the design of any community-wide wastewater system.

C. Wastewater Flow Projections and Loading

The following tables summarize the design parameters needed for the various treatment and collection and disposal options.

Table 2: Basic Wastewater Design Parameters

Discharge Facility	Units	Unit Flow (gal/day)	Current (1999)		UGA Buildout (2012)	
			Quantity	Total Flow	Quantity	Total Flow
Dwellings	per Person	100	935	93,500	1,448	144,800
School	per Student	10	767	7,670	1,200	12,000
General Commercial	per Acre	750	6	4,500	50	37,500
Total				**105,670**		**194,300**

Table 3: Additional Design Parameters

Parameter	Units	Current Flow Estimate	UGA (2012) Flow Estimate
Total Average Flow	Gal/day	105,670	194,300
Peaking Factor		3	3
Total Peak Flow	Gal/day	317,010	582,900
Per Capitia BOD/TSS[2]	lb/day	0.2	0.2
Total Influent BOD/TSS[3]	lb/day	187	290

[2] BOD – Biological Oxygen Demand, TSS – Total Suspended Solids both are a measure of the strength of wastewater.

[3] If a interceptor tanks are used in conjunction with a small diameter system, a portion of the BOD/TSS load would remain in the tank until the periodic tank cleaning (pumping) occurs.

D. Related Plans and Agreements

In 1994, the Town of Yacolt prepared their *Comprehensive Growth Management Plan*. The Town adopted the Plan on November 21, 1994. The Clark County Board of Commissioners approved the plan in December 1994. The Yacolt Town Council, in Resolution 308 ratified the Plan on January 3, 1995.

The Resolution called for "...a program for installing a public sewer system be adopted by the Town within five years and that the Land Use Element and the Urban Growth Boundary be reevaluated by the Town and Clark County; once it is assured that a public sewer system will be constructed;..."

In 1996 the Town contracted with Wallis Engineering to prepare an Engineering Report that would discuss the feasibility of a public sewer system. In February 1997 the final report entitled *Yacolt Sewer Feasibility Study* was published. The report discusses background and existing conditions as well as several alternatives for public sewer. Additionally, the report discussed cost estimates for various alternatives (this report makes use of much of that data/analysis) and includes a recommendation for the continued use of on-site septic systems with the addition of the formation of a community maintenance program to oversee some or all of the maintenance functions.

The report concludes that nitrate pollution is not a public health or environmental threat in the short term and the cost of a public sewer system make it infeasible for the Town without substantial financial assistance.

Additionally the hydrogeology branch of the consulting firm Hart/Crowser prepared a report discussing the potential for groundwater contamination. The Hart/Crowser report was discussed in the report prepared by Wallis Engineering. In part, the Hart/Crowser report concluded that septic systems contributed to the nitrate levels in the groundwater, and not agricultural products. It also stated that "A predictive water quality assessment indicates that only modest additional growth can occur within Yacolt's Urban Growth Boundary before exceeding the calculated site-specific enforcement limit under the state Ground Water Quality Standards (GWQS). Because the GWQS are more stringent than health-based drinking water standards, violation of the GWQS serves only as indicator of water quality degradation and does not indicate a health risk."

Other studies and plans have addressed the issue of wastewater management. They include: *Wastewater Facilities Plan* (May 1976); *Delineation of Wellhead Protection Area*, US EPA Demonstration Project, Yacolt, WA by Applied Geotechnology, Inc., (April 8, 1992); and *Wellhead Protection Plan for the Town of Yacolt*, US EPA Demonstration Project, prepared under the auspices of the Clark County Neighbors, (July 7, 1993).

Conclusions of the above studies and plans indicate that:

- Yacolt's shallow, unconfined aquifer is only 20 feet below the surface and vulnerable to contamination. Pollutants enter via dry wells and individual subsurface sewage disposal systems.
- Yacolt depends on four (4) wells for public water supply. Nitrate readings most near the more developed areas of town have higher levels of contamination. The pattern indicates the source of contamination is septic systems, and not agricultural uses.
- In the Wellhead Protection Plan (July 1993), an associated study revealed the greatest risk to groundwater contamination is discharge from septic systems.[4]

IV. Existing Facilities

A. Septic Systems

The existing systems appear to be functioning adequately hydraulically and for pathogen removal. The primary concern at this time is preventing nitrate contamination of the groundwater. Conventional septic systems work on the organic nitrogen contained in human waste by converting much of the organic nitrogen to ammonia-nitrogen through decomposition (only about 5 percent of nitrogen is removed by treatment in a conventional septic tank). The ammonium ions are retained on the soil particles through cation attraction. If nitrifying bacteria are present and the soil does not contain enough clay particles, the ammonia ions are converted to nitrate, which is highly soluble in groundwater. This appears to be the case with the soils underlying Yacolt.

V. System Evaluation

In February 1997, Robert Wallis, PE, prepared a report detailing the feasibility of a sewer system for the Town of Yacolt. In its conclusions, this report stated that "...municipal wastewater collection and treatment facilities are not necessary to solve existing problems in Yacolt". And, "... establishment of a Community Maintenance Program is recommended..."

Septic systems may not be failing hydraulically or through inadequate pathogen removal, but the existing on-site systems may fail to denitrify the effluent prior to reaching groundwater. Currently there is not enough information to conclude that this failure to denitrify will cause the nitrate levels in the underlying aquifer to exceed health and safety limits.

Based on best management practices, the need to increase the Town's population and future expansion of the Urban Growth Boundary, as well as consistency with Town Council Resolution 308, it appears that a public sewer or other wastewater management system in the Town of Yacolt will be necessary.

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[4] Town of Yacolt Comprehensive Growth Management Plan, 1994 pp.48

VI. Collection System Alternatives

A. Conventional Gravity Sewers

The conventional gravity sewer collection is addressed and documented in the Wallis Report. The cost to install a conventional gravity sewer, including pump stations and laterals, was estimated at approximately $2.51 million.

B. Small Diameter

Small diameter sewers come in four basic varieties and include Septic Tank Effluent Pump (STEP), Septic Tank Effluent Gravity (STEG), Vacuum Sewers and Grinder Pump Systems. Of these four types, the STEP and/or STEG systems seem appropriate for the topography and existing conditions in Yacolt. Both the STEP and STEG systems use small diameter collector pipes and septic tanks. The STEP system adds a pump to the septic systems to compensate for variable topography.

The decision would have to be made during the design phase of this project on whether the existing septic tanks could be used with the addition of a pumping vault or whether the septic tanks would be replaced. These tanks are generally owned and maintained by the sewer provider and the individual property owner must grant an easement to the said provider for access and maintenance activities.

Advantages

Advantages of the STEP/STEG systems include a reduction in construction costs due to reduced pipe size, depth, and the elimination of manholes. Additional reduction in construction costs are due to the fact that the majority of the infrastructure is associated with the individual lot, reduction in infiltration, especially if the septic tanks are replaced and perhaps a reduction in final treatment costs, since solids remain in the septic tanks.

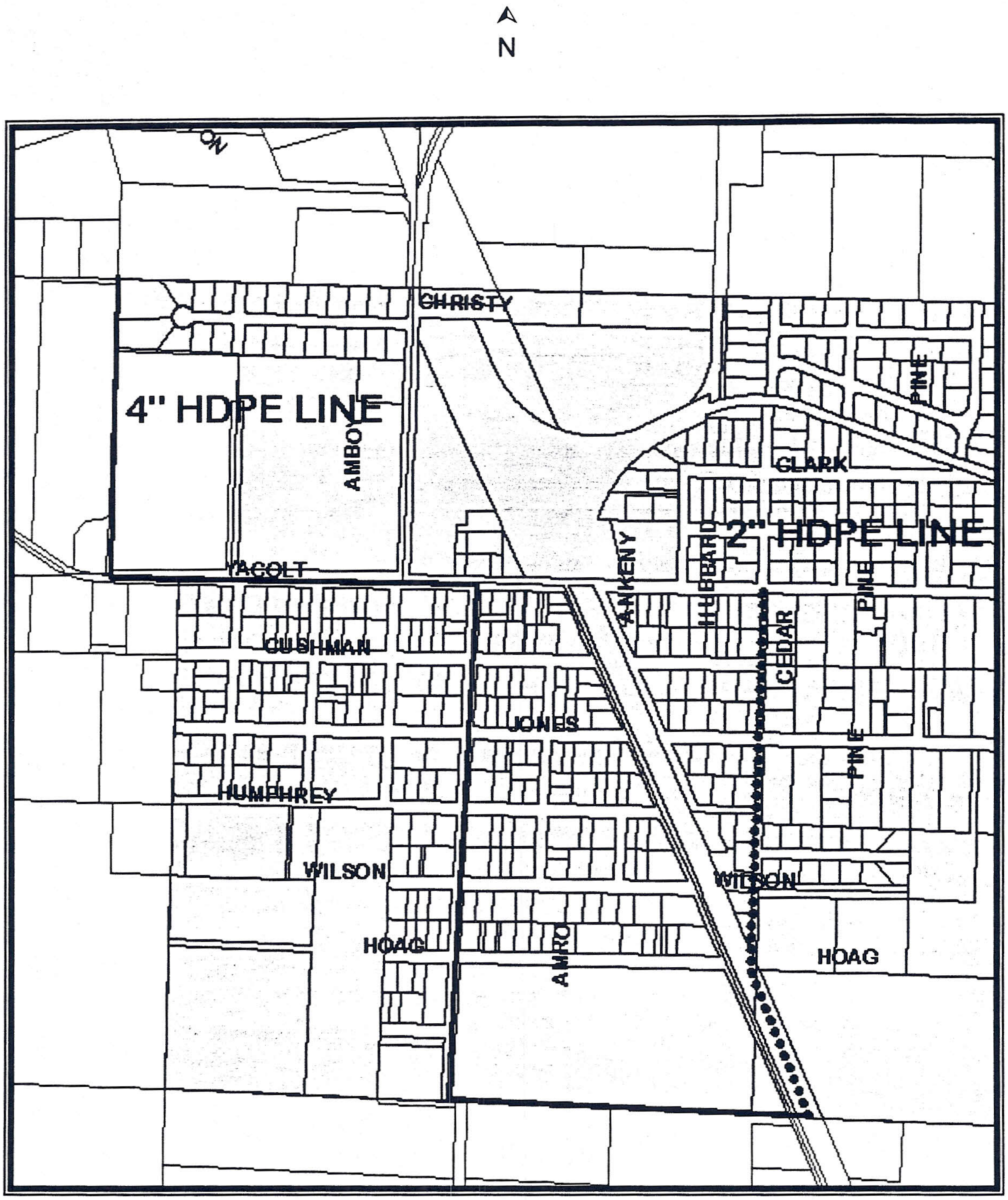
Disadvantages

Disadvantages of the STEP/STEG systems include a high level of maintenance staff involvement that may be required due to the mechanical nature of the system. The Operations and Maintenance costs can be higher than with a conventional gravity sewer. Typically, these higher costs are offset by lower costs elsewhere in the infrastructure. Such costs include the annual preventative maintenance calls required to each lot, septic tank pumping required every three to ten years and public education required regarding how to deal with emergencies. Emergencies are things like who to call, avoiding blockages and the reduction in inside water use for power failures with the STEP system.

The west side of the town could be served with a 4-inch High Density Polyethylene (HDPE) main line from West Christy Street south along the primary school to Yacolt Road, east to Parcel Avenue, south to the town limits, then east to a terminal manhole at NE Railroad Avenue. Two-inch HDPE pressure collector lines on the side streets would receive the effluent feeding that line. The east side of town could be served with a 4-inch HDPE main in Hubbard Avenue, south to Railroad Avenue.

The East and West systems would be tied together either at a manhole or lift station depending on topography. From there, the wastewater would flow into the headworks of the wastewater treatment plant.

SUGGESTED LINE SYSTEM DESIGN
Based on Topography of Town



The estimated construction cost could range from $290,000 - $400,000 depending on the amount of gravity versus pressure piping that would be required. See Table 3.

Table 4: Small Diameter Collection System Cost Estimate

Item #	Item	Units	Unit Cost		Quantity	Total Cost	
A	**West Side Construction**						
1	4" HDPE STEP Main	LF	$	10.60	3,800	$	40,280
2	3" HDPE STEP Main	LF	$	8.80	2,400	$	21,120
3	2" HDPE STEP Main	LF	$	4.25	10,600	$	45,050
4	Misc. Appurtenances	LS	$	25,000	1	$	25,000
	West Side Subtotal					$	131,450
	Engineering, Surveying, Contingency			35%		$	46,008
	West Side Total					**$**	**178,000**
B	**East Side Construction**						
1	4" HDPE STEG Main	LF	$	30.00	4,600	$	138,000
2	2" HDPE STEG Main	LF	$	4.25	9,800	$	41,650
	East Side Subtotal					$	179,650
	Engineering, Surveying, Contingency			35%		$	62,878
	East Side Total					**$**	**242,000**
	Small Diameter Sewer Total					**$**	**420,000**
C	**On-Site Conversion**						
1	Retrofit On-Site System	EA	$	1,500	360	$	540,000
1'	Replace On-Site System	EA	$	4,500	360	$	1,620,000

Note: Totals and subtotals have been rounded.

In addition to the construction of the infrastructure in the streets, each home would need to be evaluated for retrofit. This would range from the addition of an effluent chamber for a STEG-based system to the worst case of a leaking septic tank and the need for pumps in a STEP-based system. The property owner can pay these costs as the connections are made or may be eligible for lower interest financing of grants. Capital costs of onsite retrofit or replacement range from approximately $1,500 to $4,500 per residence (See above Table above, Section C).

VII. Wastewater Treatment Alternatives

A. Alternatives for Centralized Treatment

For the purposes of this report the location for the proposed wastewater treatment facility is the same as the location proposed in the Wallis Report, that is near the southwest corner of the town limits. Treatment options for the town range from highly mechanical and small footprint to low tech and large land requirement. The land requirement for treatment ranges from approximately two-to-twelve acres depending on the treatment method selected.

The method and level of wastewater treatment is dependent on the discharge point for the final effluent. For example, a discharge to the East Fork of the Lewis River would require a higher level of treatment than that of a discharge to a non-contact irrigation area. The basic types of wastewater treatment include Extended Aeration/Activated Sludge Plant (EA/AS), Sequencing Batch Reactors (SBR), Aerated Lagoon Treatment and Constructed Wetlands. The descriptions of the treatment processes in this report have been simplified.

1. Extended Aeration/Activated Sludge

The extended aeration/activated sludge EA/AS process consists of primary screening followed by activated sludge aeration, clarification with some sludge returned to the aeration tank and finally disaffection and discharge of final effluent. The EA/AS treatment plants are available in pre-engineered package plants in sizes that range from 50,000 to 1,000,000 gallons per day. The estimated wastewater flow from the Town of Yacolt ranges from 95,000 to 225,000 gallons per day (depending on population). This flow is well within the acceptable range of package wastewater treatment plants.

Key advantages of this process include reliability, with sufficient operator attention, relatively low initial cost; minimal land requirements, quick installation and the process can handle moderately high hydraulic shock loads without upset.

Some of the key disadvantages of this process include blower noise and odor potential (this can be mitigated with plant buffering and location), high power demand/costs, and the process requires a high level of operator involvement to maintain consistent discharge quality.

2. Sequencing Batch Reactor

The treatment process using sequencing batch reactors (SBR) is the same basic process as with EA/AS except the wastewater is processed in batches processed in sequence using a single tank (usually two tanks for continuous operation and redundancy). The process includes a fill phase, followed by aeration/mixing phase, then a settling phase and finally, the decant of the effluent phase.

Advantages of a SBR treatment plant include a simple to operate process that requires less operator attention, the process is capable of a high quality effluent and the treatment processes flexible allowing for nutrient (nitrogen) removal.

Disadvantages of a SBR treatment plant include some operational problems during the tank decant phase which have been reported. Although less operator attention is required, the staff must be highly skilled to maintain the controls and process in addition to the inspection and maintenance

3. *Aerated Lagoon*

Aerated lagoon systems are designed to treat wastewater on a continuous basis and are one of the most frequently used forms of wastewater treatment in the United States. These treatment systems are typically multi-cellular, 10 feet in depth and are designed to take between four-to-ten days for the wastewater to flow through the lagoon system. Aeration can be provided with mechanical surface aerators or blowers and diffusers. Additional provisions would need to be considered for the containment of the fifty-percent exceedance of the winter rainfall level within the lagoon, approximately an additional 5-6 feet in available freeboard. It is likely that the effluent from an aerated lagoon could not be discharged to a surface water body, i.e. the East Fork of the Lewis River.

Advantages of an aerated lagoon are minimal operation skills are required, low construction capital costs and a minimum of solids disposal (could be as infrequent as every 10-20 years or more with STEP systems).

Disadvantages of an aerated lagoon are their large land area requirements and associated cost and the process will probably not meet the stringent surface water discharge requirement. Additionally, the process would not be able to provide for nutrient removal.

4. *Constructed Wetlands*

Like natural wetlands, constructed wetlands for wastewater treatment are lands where water surface is near or above the ground surface to maintain saturated soil conditions and promote related vegetation. There are two different types of constructed wetlands, 1) a free surface wetland (FSW) where the wastewater flows through a relatively shallow pond; and 2) a sub-surface flow (SF) wetland where the wastewater flows subsurface through a gravel bed. Both types include a barrier to prevent groundwater contamination.

Advantages of constructed wetlands are similar to those of the aerated lagoon and may be able to provide nutrient removal.

Disadvantages of constructed wetlands are similar to those of the aerated lagoon and the process may not be able to provide for nutrient removal without harvesting plant material.

The use of constructed wetlands may be more appropriate for a polishing process and for disposal rather than for primary and secondary treatment.

B. Alternatives for Onsite Treatment

1. On-site Treatment/On-site Disposal

There are onsite alternatives available other than the conventional septic tank leachfield system, such as a rotating biological contractor (RBC) system or aerobic systems, with denitrification, filtration system and disinfecting system.

An advantage of the " backyard treatment plant" would be that there is no up front cost to the Town and the systems could retrofit existing systems as they fail. New development could construct cluster systems for an economy of scale.

Disadvantages include higher maintenance costs due to "windshield time" and an overall higher community cost than a regional system. Modified onsite treatment and disposal options probably would not meet the requirements under the GMA for higher land use densities.

2. On-site Treatment with Community Disposal

This would be a combination of the on-site treatment with a small-diameter collection system and a community disposal area. This method may be able to meet the goals of the growth plan of the Town and be "permitted" by the Washington Department of Ecology.

Both of these alternatives would require professional maintenance, and would require the formation of a Maintenance Management Entity that would provide said maintenance of the system or the Town could contract with a private maintenance company. One of the suppliers of the backyard treatment plant requires the maintenance contract prior to installation. Table 4 below summarizes the estimated order of magnitude costs for the various alternatives. Assumptions include land cost at $80,000 per acre, a 35 percent factor for contingency, design, surveying and administration. Additionally, the land requirement includes a 100-foot buffer and six months worth of storage for the pond options.

Table 5: Summary of Various Treatment Process Costs

Process	Construction Cost Existing Pop.	Construction Cost (Buildout)	Land Required (Acre) Buildout	Total Land Cost	Total Capital Cost Existing	Total Capital Cost Buildout
Sequencing Batch Reactor	$350,000	$450,000	2	$160,000	$510,000	$610,000
Activated Sludge[5]	$298,000	$298,000	2	$160,000	$458,000	$458,000
Constructed Wetlands[6]	$290,592.50	$534,325	19	$1,520,000	$1,912,299	$2,241,338
Onsite Treatment with Community Disposal	$2,040,836.91	$3,752,575	N/A		$2,755,129	$5,065,976
Aerated Lagoon	$264,175.00	$485,750	17.5	$1,400,000	$1,756,636	$2,055,762
Advanced Onsite Treatment	$1,587,317.60	$2,918,669	N/A		$2,142,878	$3,940,203

[5] Conventional Activated Sludge plant, for denitrification adds approximately 30 percent to construction cost.

[6] Grayed processes not recommended

C. Effluent Disposal

1. Slow Rate Land Application for Irrigation

This disposal method involves intermittent application of secondary wastewater for irrigation. The amount of wastewater that could be applied is based upon the soil infiltration rate, the crop being irrigated and the evaporation rate. Typically, this method can be used only six months a year and the wastewater would need to be stored for the remaining six months or non-growing season. Land requirements could range from 10-to-50 acres depending on actual infiltration rates and crops selected. This method could be combined with a surface water discharge during the winter months if the effluent is of sufficient quality.

2. Subsurface Infiltration

Not unlike the typical onsite system, treated wastewater is infiltrated into the soil and the underlying groundwater, with the soil providing polishing of the wastewater prior to discharge into the groundwater. Treatment would need to include nitrogen removal as part of the treatment process. Processes that could include nutrient removal include the SBR, EA/AS and perhaps some forms of wetland treatment. To optimize for nitrogen removal the application period would range from 7-9 days with a rest period of 12-16 days and alternating application areas. The expected infiltration rate in the soils around Yacolt ranges from 0.63 - 2 in/hr. The infiltration area could range from 6 to 12 acres including area for a redundant infiltration area. The final area requirement would depend on actual infiltration rates. The use of the land for subsurface disposal does not preclude its use for other purposes, such as parks, golf courses, ball fields or other recreational uses.

3. Surface Water Discharge

A surface water discharge for treated wastewater was once the simplest method for wastewater disposal when adjacent to receiving water. In today's climate, a surface water discharge for secondarily treated wastewater would be nearly impossible. In addition to biological stabilization, the wastewater would likely require treatment for nitrogen removal, coagulation and filtration for turbidity and perhaps cooling. Surface water discharge is not recommended due to these stringent requirements. Additionally surface water discharge is a waste of water that could be put to beneficial use in the basin such as groundwater recharge or irrigation.

The following table summarizes the estimated cost of the disposal options:

Table 6: Disposal system cost summary

Disposal Option	**Units**	**Quantity**	**Unit Price***	**Total Price**
Outfall Pipe[7] (24" Diameter RCP)	lf	400	$ 150	$ 60,000
Infiltration area	Ac	12	$ 100,000	$ 1,200,000
Irrigation	Ac	50	$ 90,000	$ 4,500,000

*Note: Includes both land at $80K/acre and construction/grading costs

[7] Using a surface water discharge would greatly increase the treatment requirements and costs and may not be permitted by regulatory agencies.

D. Solids Handling

With every process discussed in this report there is the need to handle residual solids. Even with the current on-site systems, the tanks must be pumped periodically and the solids treated and reused or disposed of.

The processes available to the Town for the size of the wastewater treatment system proposed include hauling waste solids for treatment by others, thickening of the solids and hauling, and treatment of the solids on site.

The options for treatment on site includes lime stabilization or digestion followed by thickening. The thickening would require some sort of a mechanical process due to the wet climatic conditions experienced in the Town of Yacolt. Even with treatment the solids must be either disposed of or put to some beneficial use.

In disposal, the treated, dried biosolids are used for daily cover in a sanitary landfill or, as in the case of the City of Vancouver, the untreated dewatered biosolids are incinerated. Beneficial uses of biosolids mainly consist of some sort of soil amendment process. Regulations restrict where and when biosolids can be used, depending on the level of treatment and pathogen reduction. The application areas range from placement in tree farms and grazing areas to application on fields growing crops for human consumption.

E. Site Locations

The site proposed for a centralized wastewater treatment system is in the southeast corner of the Town of Yacolt. This location is the same location as proposed by the previous report by Wallis Engineering.

VIII. Recommended Improvements

A. Collections System

The Town should consider the use of a small diameter collections system such as the STEP/STEG system described earlier. The use of a small-diameter collections system will minimize the disruption to the existing residents and street infrastructure. Although the operating costs may be a little higher than with a conventional gravity sewer, the installation cost is significantly lower. This lower installation cost, along with the other benefits of a small-diameter wastewater collection system, make it the ideal choice for Yacolt.

B. Treatment System

The use of a package wastewater treatment plant in either the SBR or the extended aeration configuration should be used to provide treatment of the town's wastewater. These package plans are the most flexible in terms of phased construction, financing and construction/site preparation requirements. At this level of evaluation the costs of the equipment is almost equal, but the SBR plant provides the most operational flexibility, while the extended aeration plant can be simpler to operate.

C. Disposal/Reuse

It is recommended that a site for subsurface infiltration basis be selected to dispose of treated wastewater by infiltration into the soil and the underlying groundwater. The soil provides polishing of the wastewater prior to discharge into the groundwater. The infiltration area could range from 6 to 12 acres including area for a redundant infiltration area. The final area requirement would depend on actual infiltration rates. The use of the land for subsurface disposal does not preclude its use for other purposes, such as parks, golf courses, ball fields or other recreational uses.

In addition to the infiltration site, it is recommended that the wastewater system operating organization pursue the reuse of the treated wastewater for irrigation, wetland rehabilitation or other beneficial uses in order to conserve potable water for higher uses.

D. Solids Handling

All wastewater treatment processes generate residual solids that must consider disposal. The solids can be treated at the wastewater treatment plant through lime stabilization or digestion. As an alternative to on-site treatment, many small wastewater facilities contract with other larger wastewater treatment facilities for treatment. This contract treatment may require some dewatering to keep transportation costs low. It makes best economic sense that the town of Yacolt contracts out it biosolids treatment and disposal.

If a small-diameter collection system were selected, then the solids in the interceptor tanks would need to be periodically pumped. It is recommended that the inceptor tanks be inspected annually and that solids be pumped from the STEP/STEG tanks as required (typically every three to ten years). These septic tank solids would be treated in the same process as the residual solids from the treatment plant.

IX. Implementation and Financing

A. Project Phasing, Schedule and Costs

The phasing of the construction of a wastewater collection, treatment and disposal facility for an existing and future population is a difficult strategy. While collections system can be easily phased, it is not economical to have an ever-expanding treatment facility. If the package wastewater treatment plant were the selected option, then it would make economic sense to purchase enough capacity for the projected build-out of the town. This is due to savings in delivery, setup and startup.

B. Operations and Maintenance

Operations and maintenance could be provided in a number of ways including the following:

- Operations and maintenance by the Town of Yacolt.
- Contract operations by a private or public organization.
- Private organizations include for example Environmental Operating Systems (EOS), who provide contract treatment operations for the City of Vancouver.
- Other public agencies could provide operations for a wastewater system.

In Clark County, the appropriate agencies may be either Clark Public Utilities or Hazel Dell Sewer District. The wastewater collections, treatment and disposal system for the Town could also be owned and operated by separate ownership from the Town

For the purposes of this report, the operations and maintenance costs would be approximately the same for each of the scenarios ranging from $15 - $25 per month depending on the treatment or disposal options decided upon.

C. Funding Alternatives

Funding of a wastewater collections, treatment, and disposal system for an existing developed area is a difficult proposition. Unfortunately, gone are the days of large grant funds from either the State or Federal Governments. Today, the limited grant money that is available is distributed as "seed" money. Those that are successful in receiving grant monies have needs that are either short term special projects or projects that have a mechanism for long term funding.

Potential sources of funding include the following:

- Washington State Department of Ecology
- USDA Rural Development Assistance
- Community Development Block Grant Funds
- Centennial Clean Water Fund

D. Funding Recommendations

The following table summarizes the Capital Construction Costs for a treatment and disposal facility and collections system for the area within the existing Town Limits:

Table7: Summary of Centralized Wastewater Treatment Costs for Recommended Alternatives.

Component	Cost
Collection System Costs	$420,000
Treatment System Costs	$510,000
Disposal System Cost	$1,260,000
Average cost to Retrofit onsite systems	$1,000,000
Total[8]	$3,190,000.00

The costs include engineering, permits and contingencies equal to 35%, assuming debt financing of the capital costs and system development charges for a buy-in to the available capacity and their share of the existing infrastructure. Additionally, new development would be responsible for constructing the collections system required to serve the development. This results in an annual cost per residence, or equivalent charge of approximately $440 per year or $37 per month. When operations and maintenance costs are added in the overall monthly costs, they could range from approximately $52 to $62 per month. Of course, low interest loans, bonds and possibly grants should be pursued to keep the cost of financing as low as possible.

System development charges for new development of between $1775 and $2,600, would be necessary, depending on the amount of the existing infrastructure costs that will be recovered per new equivalent residence, in addition to onsite and collections system construction costs.

Just for comparison, the repair of an existing septic system runs approximately $5,200.

E. Process

The process to get from development of a Capital Facilities Plan to actual construction of a wastewater management system is a long one. This report culminates a first step of public involvement in the decision making process. The Citizen's Advisory Committee has reviewed the information available on what issues face the town with regard to wastewater management, water quality, septic systems and future growth and development. Two general community meetings were held to share this information and to gather feedback. One more public meeting was held in November 1999 to present this feasibility study / engineering report.

The next steps involve grant writing to solicit funds to have a full capital facilities plan done. At the suggestion of the State Dept. of Ecology, the Town has extended the deadline for producing a capital facilities plan until December 31, 2002. That will give them time for securing funds, writing the plan, SEPA review, review and approval by the DOE, procurement of loan and grant funds for pre-construction design and engineering, then construction of the system. The Town will also have to make a determination on how maintenance and operations costs will be covered.

[8] This amount is reduced to approximately $2,370,000 for the calculation of user fees. The remainder is included in the system develop charge.

The success of this project depends upon the efforts of the citizens of Yacolt to work together toward acceptance of the need to preserve water quality and the inevitable growth of the town. It also depends on the Towns' efforts to secure funding and follow up in development of the Capital Facilities Plan and eventual construction of a wastewater management system.

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Prepared for
The Town of Yacolt

January 4, 1996
J-4234

EXECUTIVE SUMMARY

This report presents the findings of the Yacolt Hydrogeologic Study conducted between December 1994 and December 1995. The principal objectives of the study were to evaluate physical hydrogeologic conditions and existing groundwater quality in the Town of Yacolt's water supply aquifer (Yacolt Aquifer) to assist the Town of Yacolt and Clark County in determining whether upgrading the Town's wastewater treatment method from on-site septics to sewer and a wastewater treatment plant is warranted. The primary findings of the study were as follows:

- During most of the year, a groundwater divide exists in the Yacolt Aquifer beneath the Town. Groundwater flows from the divide to the north toward Cedar Creek and to the south down the valley. During the driest month(s), the groundwater divide disappears and flow is toward the south from Cedar Creek.

- Cedar Creek is in direct hydraulic connection with the Yacolt Aquifer throughout the year. For most of the year, Yacolt and Weaver Creeks are in connection with the aquifer only in the southern portion of the valley. As the water table rises during the wet season, more of the creeks' upstream lengths come into contact with the water table.

- Previous delineations of the Wellhead Protection Area (WHPA) being principally east and west of the Town's water supply wells, with inclusion of the upland surface water drainage areas east and west of the valley for management purposes, is appropriate. Inclusion of the area north of Cedar Creek is likely overly conservative. With the benefit of a better understanding of groundwater flow directions, the Town water supply wells' capture zones are less extensive than previously determined.

- Groundwater quality beneath the Town meets drinking water standards, but does show impact attributable to septic discharge. Nitrate concentrations detected in the Town's water supply wells haven't changed appreciably over the period of monitoring since 1984 even though the Town's population has increased approximately 50 percent in that time. Therefore, groundwater quality should pose no threat to public health for the near future.

- A predictive water quality assessment indicates that only modest additional growth can occur within Yacolt's Urban Growth Boundary before exceeding the calculated site-specific enforcement limit under the state Ground Water Quality Standards (GWQS). Because the GWQS are more stringent than health-based drinking water standards, violation

of the GWQS serves only as indicator of water quality degradation and does not indicate a health risk.

- Assuming current projections for residential growth in Yacolt are reasonable, our evaluations indicate that transition from individual septics to sewer with a centralized wastewater treatment plant would offset predicted potential water quality impacts. Because existing groundwater quality is acceptable for drinking water and should remain so, Yacolt should have a reasonable time horizon of several years to complete a transition from septic to sewer.

- In the event that Yacolt does transition to sewer, the GWQS would require that effluent from a wastewater treatment plant (WWTP) be treated adequately such that it would not degrade groundwater quality upon discharge. Therefore, its location could be based on logistical considerations rather than potential impacts to the Town's wells. Use of a WWTP would not adversely impact the amount of recharge to the Yacolt Aquifer, since septic discharge represents only a small portion of the overall recharge.

- The existing monitoring wells installed for this study can be maintained for future water level and water quality monitoring in the Town's water supply aquifer. Although MW-2 did go dry during the driest months of the study, it remains a useful monitoring point throughout most of the year. In the event that the wells interfere with future construction or other activities, they would need to be decommissioned by a licensed well driller in accordance with Chapter 173-160-560 WAC (Abandonment of Resource Protection Wells).