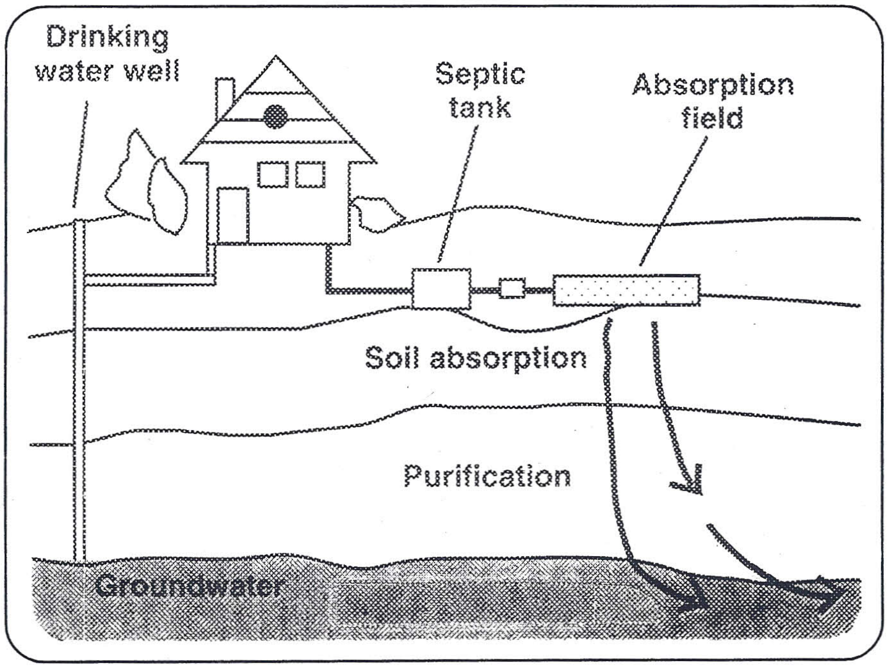
YACOLT SEWER FEASIBILITY STUDY

for

TOWN OF YACOLT WASHINGTON



February 1997

W.E. # 859

WALLIS ENGINEERING

Yacolt Sewer Feasibility Study

for

Town of Yacolt, Washington

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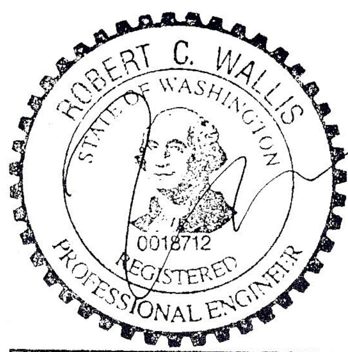

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EXPIRES JUNE 7, 1998

W.E. # 859

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Yacolt Sewer Feasibility Study

Acknowledgment

We appreciate the help and support of the Town of Yacolt Staff and Southwest Washington Health District in preparing the Yacolt Sewer Feasibility Study.

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YACOLT SEWER FEASIBILITY STUDY

EXECUTIVE SUMMARY

Sewer service in the Town of Yacolt is currently provided by private on-site systems using septic tanks and drainfields. This study was completed to evaluate the feasibility of constructing a public sewer system to serve the community. Issues considered as a part of the study included problems with the existing systems, the need for a public sewer system, alternative wastewater treatment and collection systems, and the costs and funding options for a public system.

Conclusions

The conclusions of the study are as follows. A more detailed discussion follows each conclusion:

1. Existing septic system problems are minimal and do not appear to be concentrated in any specific geographic area. Current use of individual septic systems does not appear to be posing a threat to ground or surface waters at this time.

The existing septic systems in Yacolt appear to be functioning properly, providing an acceptable means of treating wastewater and protecting the environment. In the last ten years there have been 27 septic system problems recorded by the health district. These do not appear to be concentrated in any specific geographic area. The concentration of nitrate in the groundwater, the only significant pollutant that properly designed septic systems contribute, is very low. Small amounts of nitrate in the groundwater are acceptable, but large amounts can have adverse effects on human health and the environment.

Although septic systems do have an impact on groundwater in Yacolt, these impacts are relatively minor, and do not pose significant risks. Nitrate levels in the groundwater are currently well within federal standards for water quality and the Town's water supply consistently produces high quality drinking water.

2. It is likely that continued reliance upon private septic systems will result in violations of water quality standards when the population reaches approximately 1,400. The consequences of this may include future limits upon growth within the existing growth boundary and prevention of expansion of the current growth boundary.

Currently, septic systems in Yacolt are adding nitrate to the groundwater at a rate that is safe and corresponds with water quality standards. With the Town population expanding, however, the level of nitrate will increase. The recently completed groundwater study has concluded that, as the Town's population reaches approximately 1,400, the nitrate levels will increase at a rate which will violate groundwater quality standards. This could create a moratorium situation.

It is unknown when a sewage system will become necessary, since predictions for population growth in Yacolt vary widely. Over the last couple of years, the population has grown at approximately 3%. Some people have predicted that the growth rate will be as high as 7% over the next ten years. A sewer system to prevent significant groundwater quality degradation in Yacolt will probably not be necessary for the next 10-20 years.

The lack of a municipal sewage system has limited the amount of growth that can occur in Yacolt. The current urban growth boundary set by the County coincides with the Town's corporate limits. The major reason for setting this boundary is concern over the lack of a sewage system. If the Town were to have a municipal sewage system, it would be easier to expand its growth boundary. It would also allow property to develop at greater density than the current limit of three houses per acre.

3. For the Town to grow beyond 1,400 people, a sewer system would likely be required. Depending on grant availability, this would cost each household $20-$250 per month for operation and debt retirement. If the system is largely grant funded, the monthly costs would be closer to the $20 figure. This study concludes that the construction of a public sewer system at this time is not feasible due to the cost.

Several alternative plans for providing public sewer service to the community were developed and evaluated. The plan which was determined to be the most cost-effective includes a system of gravity sewers and a central wastewater treatment plant. The cost for constructing this system is estimated to be $6,392,500.

The amount of the total construction cost that would have to be paid for by the local community would depend upon the amount of grant funds available. Currently, the prospects for grant funding of a public sewer system do not appear good. This relates to the fact that there are considerably less grant funds available than there has been in the past, as well as the fact that there are no imminent threats to public health. Local ratepayers would have to pay the cost of constructing and operating the public sewer system. The cost of operation would be approximately $20 per month, but could be more depending upon how many households connect to the system. The local share of the construction cost would depend upon the amount of grant funds available. With no grant funds, the cost for retiring the construction debt would be about $250 per month. Depending upon the amount of grant funds available, this $250 per month cost would be reduced accordingly. The monthly cost per household would thus vary from about $20 per month to $250 month, depending upon the availability of grant funding.

In light of the low probability that significant grant funds could be obtained, this study concludes that the high cost of a public sewer system makes it prohibitively expensive.

4. A community maintenance program for septic systems may enable the community to grow well beyond a population of 1,400 without construction of a sewer system. Such a program would involve a monthly assessment (between $3 and $6 per month) to pay the cost of monitoring existing system performance and increased oversight of new system installation. This study concludes that the Town should pursue the feasibility of implementing a community maintenance program at this time.

This study concludes that the Town should attempt to implement a community maintenance program. By establishing an organization to oversee the installation and maintenance of septic systems, the failure rate of new systems would decrease and the performance of existing systems would improve. A community maintenance program could possibly enable expansion of the current growth boundary, as well as increase the maximum population before which water quality standards would be violated.

5. The continued reliance upon septic systems may impact the type of job creation within the community due to the possibility of preventing industries from locating in Yacolt. If the City were to implement a community maintenance program, it would enhance the ability of the community to attract commercial and industrial development in the absence of a public sewer system.

The lack of public sewers could conceivably prevent some businesses or industries from locating in Yacolt. Whether or not this would actually occur is difficult to predict. It would depend upon the type of commercial/industrial establishment that was interested in the area, and the availability of land. The following very general information may provide an indication of how significant the lack of public sewers is upon commercial/industrial development in Yacolt:

a. Most of the light manufacturing industries on the fringe of the Portland Metropolitan Area do not discharge significant quantities of industrial wastewater. Generally, wastewater that is discharged from these facilities is domestic in nature, meaning that it is from their restrooms and cafeteria. A typical light manufacturing facility employing 50 people generates an amount of wastewater equivalent to about four or five single family residences. This means that a light manufacturing facility with 50 employees would require about ½ acre of land for its septic tank and drainfield.

b. A typical small restaurant with a seating capacity of about 30, discharges about the same amount of wastewater as do four or five single family residences. Such a restaurant would require about ½ acre of land for a septic tank and drainfield.

One of the advantages of a community maintenance program is that it would provide a mechanism by which a small commercial or industrial area could be served by a community drainfield owned and operated by the Town. As such, a community maintenance program could enhance the ability of the Town to attract an industry or commercial activity which might otherwise be discouraged from locating in the community.

6. The community is divided on it's perception of the need for a public sewer system.

A survey regarding the sewer issue was sent to all property owners within the Yacolt area. Of the 60 respondents (about 20% of the total mailed out), about half felt that a community-wide sewer system was needed, and about half felt that a community-wide sewer system was not needed.

Alternatives for the Town of Yacolt

Basically, the Town has three options for the immediate future; 1) growth with the addition of a sewage system, 2) growth with the continued reliance on septic systems, and 3) no growth. If the Town decides to implement the second option, growth can only occur until such time as groundwater quality is significantly impacted. The potential for growth can be augmented, however, with an improved maintenance and education program for septic systems. There are thus four alternatives for the Town:

1. Community Collection and Treatment System

2. Community Maintenance Program with Public Ownership of Cluster Systems

3. Continued Reliance Upon On-Site Systems with a Community Maintenance Program

4. Continued Reliance Upon On-Site Systems without a Community Maintenance Program (No Action)

The above alternatives are described in more detail below, including the costs associated with each alternative. This is followed by the recommendations of the study.

1. Community Collection and Treatment System

There are several types of both collection and treatment systems available for use in the Town. There are basically two options for the collection system; 1) conventional gravity sewers, and unconventional sewers using pressure sewers or small diameter gravity sewers. For the unconventional sewer system options, a septic tank will have to be installed in each lot. Generally, existing septic tanks have to be replaced due to potential leakage.

The choice of collection system in Yacolt depends upon the ultimate density of the community. Where average lot sizes are less than 15,000 square feet, conventional gravity sewers are more cost effective. Where lot sizes are larger than 15,000 square feet, unconventional sewers are more cost effective. In light of the current zoning of 12,500 square feet in the community, this study concludes that conventional gravity sewers are the preferred option in Yacolt.

As with sewer collection systems, there are several alternative types of treatment systems. For Yacolt, this study concludes that a sequencing batch reactor (SBR) process is the most cost effective. This type of treatment process can cost effectively remove nitrate from the wastewater. Effluent land application was chosen as the most feasible means of disposal.

The cost of the community collection and treatment system is estimated at $6,392,500. The costs to the individual homeowner connecting to the system would depend upon two items: 1) how many homes connect (share in the cost), and 2) the availability of grant money. With the entire community connected and 75% grant funding, the annual cost for debt retirement to each homeowner would be $450 ($37.50/month). With only 25% of the homes connected, and 25% grant funding, the annual cost to each homeowner would be $2,381 ($198.42/month).

Monthly sewer rates would have to pay for the cost of maintenance, and to retire debt, as discussed above. The cost for maintenance would depend upon the number of connections. Monthly maintenance costs with 500 connections are estimated to be $23 per home. Monthly maintenance costs with 1,000 connections are estimated to be $21 per home. If monthly sewer rates also paid the cost of debt retirement, the rates would increase accordingly. With a sewer system entirely grant funded, monthly costs would be in the $20-$25 range. As the percentage of local funds increases, monthly costs would increase accordingly, up to a theoretical limit of approximately $250 per month.

2. Community Maintenance Program with Public Ownership of Cluster Systems

In this alternative, commercial establishments and areas that are not suitable for on-site systems would be served by cluster systems. The study concluded that there are several portions of the study area that are suited for this type of system. These cluster areas would be served by individual septic tanks discharging to community drainfields. A recirculating sand filter could be installed to provide pretreatment prior to disposal to the drainfield. Also, a sand filter will reduce the size of the drainfield, which will reduce the land requirement.

3. Continued Reliance Upon On-Site Systems with a Community Maintenance Program

Under this alternative, the only change from the current situation is that a community maintenance program would be established. A community maintenance program would keep the ownership of on-site systems in private hands, but place their operation under the jurisdiction of a public agency. This program could have three primary components: 1) provide relevant information to the public through a program of public education; 2) provide incentives for proper on-site system management and maintenance; and 3) establish the basis for regulatory oversight to enforce compliance with regulations.

The advantage of a community maintenance program is that it helps on-site systems to function properly with a significant degree of reliability. While most individuals who own on-site systems operate them properly, in any area there are usually some individuals who do not. A small minority of the total group, by failing to operate their systems properly, can cause significant environmental and public health problems. If all of the on-site systems are under the operational control of an agency, it greatly reduces the probability that there will be problems. At a small cost, significant benefits are often achieved.

In many cases, on-site systems are appropriate for an area, and yet community sewer systems are forced upon the community simply because a small minority of the community fail to maintain their systems, or the local health department fails to exercise due diligence in enforcing regulations. However, in such cases, the establishment of a community maintenance program would likely allow the continued use of on-site systems, with the end result a significant cost savings to the public.

As part of the maintenance program, a long-term water quality monitoring plan should be implemented for purposes of determining the impacts of on-site wastewater disposal systems upon both surface and ground water.

4. Continued Reliance Upon On-Site Systems Without a Community Maintenance Program

This is a "no action" alternative. The community would continue to grow with new development served by individual septic tanks. Potential future problems would include elevated nitrates in the drinking water, and limits upon growth.

Recommendations

The sewer feasibility study concludes that municipal wastewater collection and treatment facilities are not necessary to solve existing problems in Yacolt. The soils in the study area are generally well suited for use as septic tank drainfields and existing homes in the community are experiencing very few septic tank failures.

Although the community of Yacolt should continue to rely upon on-site systems for wastewater treatment and disposal, this study concludes that continuing to rely on private maintenance of these on-site systems is unacceptable for the community's long-term needs. Establishment of a Community Maintenance Program is recommended to oversee some or all of the maintenance functions of on-site systems.

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SECTION 1

INTRODUCTION

Study Purpose

The purposes of this study are: 1) to identify the implications of continued reliance upon on-site wastewater treatment and disposal systems in the community of Yacolt, Washington; 2) evaluate the need for a publicly owned collection and treatment system to serve the community; 3) develop and evaluate alternative wastewater collection and treatment approaches that will meet the community's future wastewater treatment and disposal needs; 4) identify costs and funding options for those alternatives; 5) select the plan which will best meet the needs of the community; and 6) present the conceptual design for the selected plan.

Conclusions and Recommendations

1. Existing soils in the study area are well-suited for use as septic tank drainfields. Existing homes in the community are experiencing very few septic tank failures. These problems are not in any specific geographic area, suggesting that the failures are a consequence of poor design or maintenance, and not a result of inadequate soil properties. Municipal wastewater collection and treatment facilities are not necessary to solve existing problems.

2. Although the study area totals 1,050 acres a smaller service area was selected as the most likely area that would be served by a publicly owned collection and treatment system. This area, designated as the Phase 1 Service Area, is the area within the current Town limits and totals 316 acres. Within these limits the zoning includes 223 acres residential, 40 acres commercial, 19 acres public facility, and 34 acres parks and open space.

3. The study area population is currently estimated at 990 people. It is projected to be 1,471 in the year 2016 at moderate growth, and 2,393 at high growth. The population of the Phase 1 Service Area is currently estimated at 860, and is projected to be 1,278 in the year 2016 at moderate growth and 1,890 at high growth (build-out). Service area wastewater flows are currently estimated at 95,700 gallons per day, and are projected to be 137,500 gallons per day in the year 2016 at moderate growth, and 224,200 gallons per day at high growth. These flows include wastewater from the school and the commercial area, in addition to domestic wastewater.

4. At some point, the Town may elect to significantly expand the Town limits or increase density.

Under the Growth Management Act, the continued reliance upon septic tanks under private maintenance would no longer be acceptable for the community's long-term growth. Eventually, nitrate levels in the groundwater may significantly impact groundwater quality and the Town's drinking water supply. One possible solution to this problem is for the Town to treat the drinking water, instead of installing a collection sewer system.

5. Four alternatives were developed and evaluated for serving the long-term wastewater disposal needs of the community. These were: 1) community collection and treatment system; 2) community septic maintenance program with public ownership of cluster systems; 3) continued reliance upon private on-site systems with a community maintenance program and increased regulatory oversight by the Town; and 4) continued reliance upon on-site systems without community maintenance program (i.e., no action).

6. For Alternative #1, different wastewater collection systems were evaluated. In addition to conventional gravity sewers, two unconventional systems were evaluated: Variable Grade Sewers (VGS) and pressure sewers. A collection system based upon conventional gravity sewers was deemed to be the most appropriate for the study area due to the zoning density and area topography.

7. For Alternative #1, different types of wastewater treatment systems were evaluated. A sequencing batch reactor was selected as the preferred alternative. This system relies upon mechanical equipment to provide treatment commonly referred to as advanced secondary treatment. Under this alternative, wastewater would be disposed of by irrigation following disinfection.

8. The recommended alternative for meeting the community's long-term wastewater disposal needs is Alternative #3 - Continued Reliance Upon On-Site systems with a Community Maintenance Program. The maintenance program that is currently in place is administered by the Southwest Washington Health District. This study concludes that Town should work with the Health District to establish a local program with a local funding program through monthly fees to pay the cost of administering the program. Although the details of the program would require further refinement, this study recommends that the Health District be in the lead role for technical and regulatory issues, and that the Town be in the lead role with public education. To pay the cost of the Community Maintenance Program, a local fee structure would be implemented. We estimate the monthly fee at approximately \$3.00 to \$6.00 per household.

9. A primary function of the Community Maintenance Program would be to provide additional regulatory oversight of septic tank installation to ensure maximum performance of on-site systems. This would include the development and enforcement of standards for materials and construction to assure quality septic system installations. It is anticipated that the Health District would provide the technical direction regarding any septic tank standards. See Appendix D for examples of standards from the Dexter Sanitary District in Lane County, Oregon.

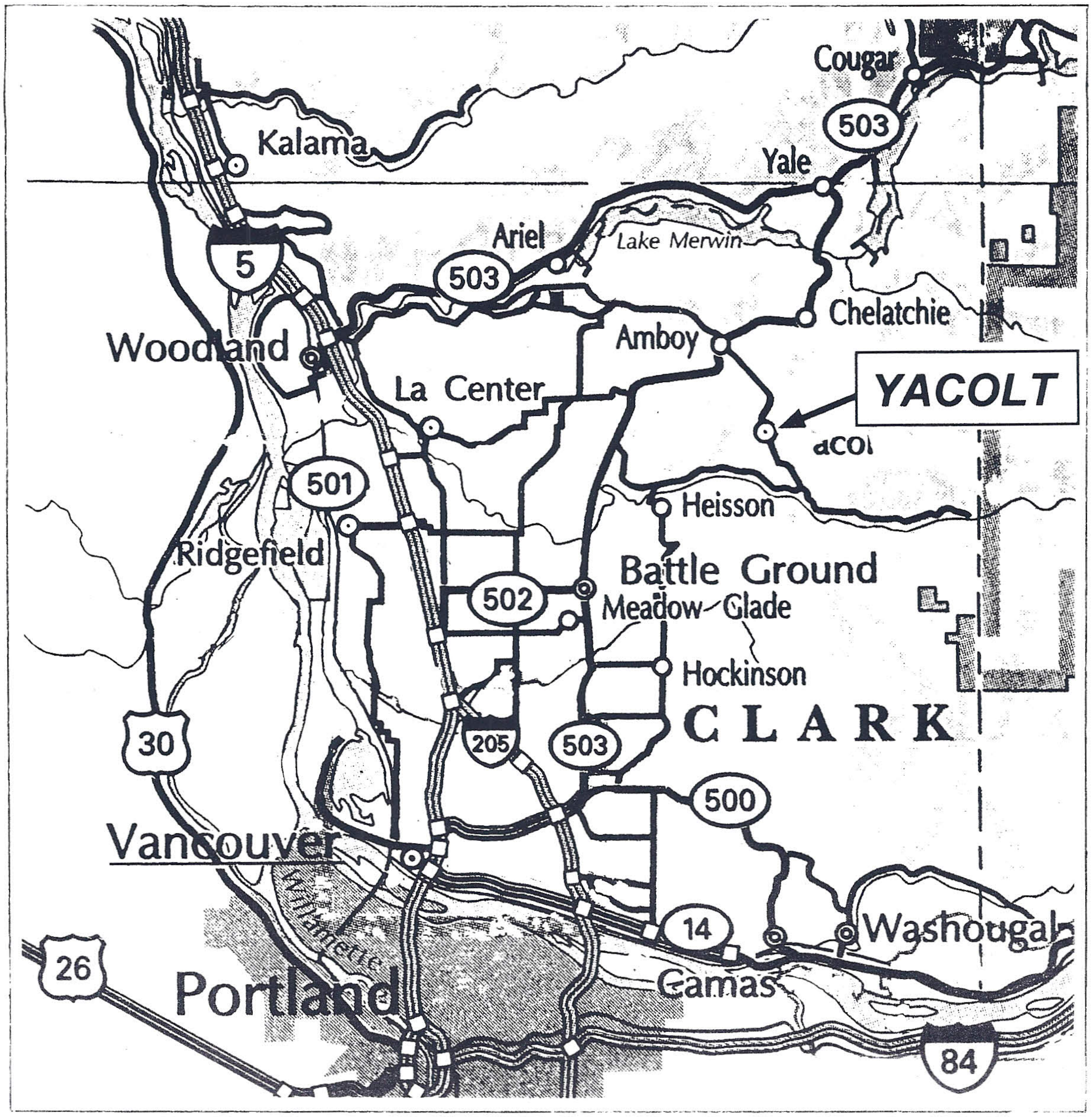
10. A long-term water quality monitoring plan is recommended for implementation to determine the impacts of on-site wastewater disposal systems upon ground water. This could possibly include using the monitoring wells that were installed for the hydrogeologic study.

Planning Area

The Community of Yacolt, Washington, is located in Clark County about 21 miles northeast of the City of Vancouver. The planning area encompasses the 50 year urban reserve area. Figure 1 at the end of this section shows the location of the study area.

Terminology and Small Wastewater System Alternatives

See Appendix E for report terminology definitions and small wastewater system alternative schematics and descriptions.



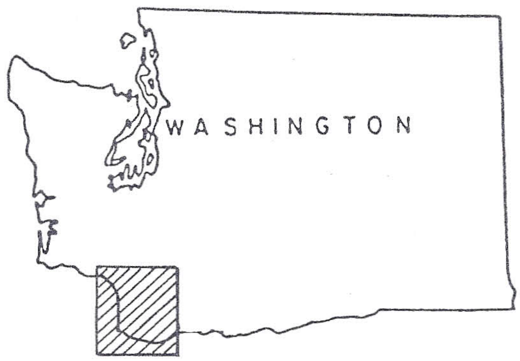


FIGURE 1
General Location Map
Town of Yacolt

SECTION 2

PRESENT CONDITIONS

Growth and Development

Land Use

The land use in the study area is typical of a rural community located remote from an urban area. Most of the land is devoted to low density residential use. There is very limited commercial and no industrial development.

Clark County has prepared a comprehensive growth management plan for the Yacolt Community. In 1993, the County implemented an interim urban growth boundary that coincides with the town corporate limits. The County recommends slightly increasing this boundary, provided that a public sewer system is constructed.

Zoning for the Community of Yacolt is as shown in Figure A1, with vicinity topography as shown in Figure A2 in Appendix A.

Population

The population within the Town of Yacolt is estimated at 860 people. The population estimate for the entire community within the urban growth reserve is 990 people. Population changes within the town have been relatively stable since it was established in 1908.

Existing Regulations and Institutions

Local Government

The Town of Yacolt is responsible for planning publicly owned wastewater treatment works in the planning area. The Town of Yacolt has the necessary legal, institutional, and managerial resources to construct, operate, and maintain a wastewater treatment system.

Institutions

Currently the only governmental institution located in the planning area is the Yacolt Town Hall, with the exception of a primary school and a post office.

Natural and Physical Features

Surface Water

The study area is located in a valley, and is surrounded by creeks. North of Town is the meandering Cedar Creek. Directly to the west is Yacolt Creek which runs in a north-south direction. The Weaver and Big Tree Creeks are located at the southern end of the valley.

Groundwater

The groundwater elevation varies seasonally by approximately 25 feet. The depth of the water table beneath the Town is on the order of 20 to 40 feet. In the southern part of the valley the water table depth is much more shallow.

The groundwater flow direction is variable depending on the time of year. During most of the year, generally from December to August, groundwater flows from both the east and the west towards Town. It then diverges and is directed either to the north towards Cedar Creek, or to the south and down the valley. South of Town, the groundwater flow direction is southerly. When the water table is lowest, normally between September and November, the groundwater divide beneath the Town does not exist. Groundwater flowing from the east, north, and west converges in the Town and flows to the south.

Climate

Clark County typically has wet, mild winters and cool, dry summers. Yacolt, like most of the County, is fairly mild throughout the year. Average annual rainfall is approximately 75 inches.

Geology and Soils

Unconsolidated soils in the valley are the result of stream and glacial deposits. These soils are a mixture of gravel and sand with variable percentages of silt, also referred to as the Yacolt Basin Aquifer. The thickness of this soil layer is from 60 to 120 feet, although it is believed to be much thinner in the southern part of the valley. Near the Town, in the lower part of the aquifer, is more coarse gravel and sand. This is referred to as the Gravel Aquifer.

Soil Suitability for Septic Systems

The soils in the Yacolt area provide adequate potential for disposal of on-site sewage. The predominate soil type is Yacolt loam (75.0% of total). More limited soil types present are Yacolt stony loam (14.1%), Cinebar silt loam (1.7%), Gumboot silt loam (8.5%), and Cinebar stony silt loam (0.7%). The following table summarizes the important characteristics of these soil types for OSS (on-site systems, including septic tank) based on the Soil Conservation Service Guide for Clark County. The soil types are ordered by decreasing frequency by type within the Yacolt planning area as noted for each soil type. Multiple series symbols such as YaA and YaC indicate the same general soil type with different predominate slope.

Table 2.1
Service Area Soils

Soil Type (% of total)	Symbol (Slope)	Septic Considerations	Other
Yacolt loam (75.0%)	YaA (0-3%)	moderate permeability	
	YaC (3-15%)	moderate permeability, limitations where slope is greater than 10%	
Yacolt stony loam (14.1%)	YcB (0-5%)	moderate permeability	
Gumboot silt loam (8.5%)	GuB (0-8%)	limitations due to very slow permeability	not suited for residential development
Cinebar silt loam (1.7%)	CnB (3-8%)	well-suited where slope is less than 5%, fine where slope is greater than 5%	
	CnG (30-70%)	severe slope limitations	
Cinebar stony silt loam (0.7%)	CrE (3-30%)	well-suited where slope is less than 5%, slope limitations where slope is greater than 10%	
	CrG (30-70%)	severe slope limitations	

Most of the soil in the Yacolt planning area has moderate permeability and is well suited for septic systems. The Town of Yacolt is very flat and slopes do not present a significant limitation to septic systems. One soil type that is not suited for septic systems is Gumboot silt loam; however, this soil is mainly found along stream beds which cannot support residential development.

The fact that almost 90% of the Town is composed of Yacolt loam and stony loam does not necessarily indicate that the soils are uniform, as this soil type is inherently non-uniform. The percentages of larger stones and fines are variable depending on location. Therefore, no particular areas require additional evaluation; rather, attention will be required on a site specific basis in choosing a location for a new system. Soil types are shown in Figure A3 of Appendix A.

Existing OSS Problem Areas and Failures

The existing areas with OSS problems are located throughout the Town and are not concentrated within any certain area. The failure locations are mostly found in areas that have a high population density. These systems most likely have failed due to poor design, which did not provide for even flow distribution within the drainfield, or had inadequate land area for conventional systems.

Groundwater and Surface Water Impacts

The potential for environmental impacts was assessed in the hydrogeologic study completed by Hart Crowser in 1996. The parameters tested included nitrate, total Kjeldahl nitrogen, chloride, sulfate, dissolved oxygen, pH, and conductivity. The major parameter of concern was nitrate, which is known to be elevated in areas with septic systems. Nitrate test results are presented in Table 2.2.

Table 2.2 - Groundwater Quality Sampling Data

Location	Date	Nitrate as N (mg/L)
MW-1	Jan-95	0.04
	Apr-95	0.03
	Jul-95	ND
	Oct-95	0.04
MW-2	Jan-95	3.1
	Apr-95	3.1
	Jul-95	2.6
	Oct-95	NS
MW-3	Jan-95	0.39
	Apr-95	0.24
	Jul-95	0.20
	Oct-95	0.11
Well B	Jan-95	2.1
	Apr-95	2.0
	Jul-95	2.3
	Oct-95	2.4

Location	Date	Nitrate as N (mg/L)
No. 3	Jul-84	2.0
	Apr-87	2.0
	Jul-90	2.5
	Sep-93	1.5
	Aug-95	1.8
No. 4	May-84	1.4
	Apr-87	1.7
	Jul-90	1.7
	Sep-93	1.6
No. 5	May-84	0.8
	Apr-87	0.9
	Jul-90	0.7
	Sep-93	0.3
No. 6	Apr-87	0.3
	Jul-90	0.2
	Sep-93	0.1

Eight wells have been tested for possible groundwater impacts: four are the public supply wells for Yacolt (No. 3,4,5,6), three are monitoring wells installed by Hart Crowser (MW-1,2,3), and one is a domestic well (Well B). Monitoring wells MW-1 and MW-3 are located up-gradient of the Town and represent natural water quality. The remainder of the wells are influenced by sources of groundwater discharge within the Town. Based on this data, the average natural nitrate concentration is 0.14 mg/L. The nitrate concentration down-gradient of the Town is 1.60 mg/L.

Down-gradient from the Town is Yacolt Creek, which is located in the East Fork Lewis River Watershed. The County has done extensive water quality monitoring in this watershed, and has a sampling station at Yacolt Creek where the creek crosses the railroad right of way. Data from this station indicates that it is heavily influenced by groundwater recharge, as tabulated below.

Table 2.3 - Surface Water Quality Sampling Data

Date	Fecal Chloroform (mpn/100ml)	Nitrate (mg/L)
5/91	100	0.5
6/91	36	0.7
7/91	73	
8/91	150	0.0005
9/91	36	0.73
10/91	15	0.86
11/91	36	0.78
12/91	36	0.8
1/92	230	0.77
2/92	15	0.85
3/92	15	0.77
4/92	91	0.49
5/92	140	0.49
6/92	68	0.58
7/92	45	0.55
8/92	20	0.69
9/92	170	0.77
10/92	9	0.78
11/92	45	0.44
12/92	45	0.7

This data set indicates that the average fecal chloroform count is 69 mpn/100 ml and that the average nitrate concentration is 0.65 mg/L. Although it is influenced by human activities, the water quality of Yacolt Creek is much better than that found in the western part of the East Fork Lewis River Watershed. The Class A surface water quality standard is 100 fecal coliform colonies/100 ml.

It is important to note that the fecal coliform concentration in streams flowing through agricultural or urban areas is often quite high, regardless of whether the area is served by public sewers or private septic tanks. Fecal coliform concentrations in surface water runoff from urban areas commonly range between 10,000 to 10,000,000 counts/100 ml.

Existing Public Water and Wastewater Facilities

Water Supply

The Town of Yacolt owns and operates the water system that serves the community. The Town owns water rights for a well (Well #3) located on the western side of Town and three wells (Wells #4,5,6) located just north of the Town limits.

Existing Wastewater Facilities

The existing homes within the study area are served by individual septic tanks and drainfields. The primary school is served by the only large on-site system (LOSS) in Yacolt, which is designed for a flow of 5,200 gpd. LOSS are those septic systems that treat from 3,500 to 14,500 gpd. There is a commercial area in Town of approximately six acres, with businesses typical of those found in a small community. For example, there are several establishments that serve food. The wastewater from these businesses is similar to domestic wastewater. As there are no industries in the Town, there are no industrial wastewater facilities.

SECTION 3

FUTURE SITUATION

Planning Period

The planning period for this project is 20 years.

Service Area

The study area for this plan is an approximately 1000 acre area in the vicinity of Yacolt where growth would likely occur. A service area within the study area, designated the Phase 1 Service Area, has been selected for closer evaluation with respect to sewer collection and treatment alternatives. This service area lies within the Yacolt Town limits, as shown in Figure A6 of Appendix A. The entire service area is within the Yacolt Urban Growth Area. The total area within the defined service boundaries is presented in the table below, divided by land use. This table represents *current usage* (not zoned land use classification), and is used to determine start-up conditions for a public sewer system.

Table 3.1
Existing Service Area Land Use
(acres)

Area Designation	Residential	Commercial	Other	Total
Total Study Area	658	6	386	1050
Phase 1 Area, Total	181	6	129	316
Phase 1, West Node	89	6	61	156
Phase 1, East Node	92	0	68	160

Future Land Use and Population Projections

Clark County has prepared a comprehensive growth management plan for the Yacolt Community that was used as a guide for future land use and population projections. This includes recommended land use and zoning requirements which are presently in the process of being implemented. Figure A1 in Appendix A provides information on the proposed land use for the Yacolt Community.

Currently, most of the residential area in Yacolt is dedicated to single-family development. As of 1993, there were 121 acres of land in the Town that were zoned for residential housing, with many lots vacant. Due to the lack of a sewer system, minimum lot size is 12,500 square feet within the Town. Outside of the Town, the minimum lot size is five acres.

The goals and policies stated in the community action plan express the desire of the residents to maintain the existing rural character of the community while providing employment and potential recreational opportunities. Without a community sewer system, the maximum density will be limited by the need to provide on-site systems. With a community system, it is possible that the land use zoning could be changed to provide for denser development. For this study, it has been assumed that the minimum lot size would remain unchanged, even with the availability of a community sewer system. In the URA area outside of the Town, it is assumed that the minimum lot size would decrease from 5 acres to 12,500 square feet.

Population estimates are based on information provided by the Town Council. The population estimate of 860 people within the Town limits is similar to estimates used in previous studies. The estimate of 130 people living within the Community of Yacolt, but outside of the Town limits, is also consistent with the number of lots in this area, assuming a population density of 2.4 people per lot.

Population within each of the service areas has been estimated based on an average of 3 people per household. Potential services within each service area are based on the maximum density allowed, based on current land use designations. For future residential areas, it was assumed that 65% of land would be available for residential development. Projections of 20-year service connections have been based on two growth rates. The moderate growth rate projection is 2% per year, which corresponds to the value that was used in the comprehensive growth management plan. It has been assumed that additional services would develop within the sewered areas at the same rate as the unsewered areas. The high growth rate projection is a growth rate of 7% per year. At this rate, the area within the Town will reach a maximum population of 1,890 in ten years.

Based upon the previous assumptions, and the land use and service area projections presented in Table 3.1, population projections are presented in Table 3.2.

Table 3.2
Population Projections

Year	West Node Phase 1 Service Area	East Node Phase 1 Service Area	Total Phase 1 Service Area	Total Study Area
1996	423	437	860	990
2016 Moderate Growth	628	650	1278	1471
2016 High Growth	929	961	1890	2393

Flow and Waste Load Forecast

Future flow and waste loading criteria, using Washington State Department of Ecology guidelines, are as follows:

Wastewater Flow . . . . 100 Gallons/Person/Day
B.O.D. . . . . 0.20 Pounds/Person/Day
Total Suspended Solids . . . . 0.20 Pounds/Person/Day

It should be noted that the 100 Gallons/Person/Day includes an allowance for infiltration into the sewers from groundwater. Flow and waste load estimates (based on the above population projections and waste load criteria for the Phase 1 Service Area) are presented in Table 3.3.

Table 3.3
Phase 1 Service Area
Flow and Waste Load Projections

Year	Avg Daily Flow (gallons/day)	Avg Daily SS and BOD5 Loading (lbs/day)
1996	95,700	191
2016 Moderate Growth	137,500	275
2016 High Growth	224,200	448

Commercial business, industries, and institutions also contribute to wastewater flows and loadings. The elementary school in Yacolt is designed for an equivalent population of 52 and it was assumed that it operates under design conditions. It was assumed that commercial and industrial contributions are 750 gpd/acre.

The Town currently has 6 acres of commercial development and no industrial areas. It was assumed that the Town's commercial and industrial situation would remain unchanged under moderate growth projections and would grow to 40 acres under high growth projections.

SECTION 4

GENERAL PLANNING CONSIDERATIONS

Regulatory Issues Related to On-Site Systems

State Groundwater Quality Standards

Washington State regulations regarding groundwater pollution are addressed by the Ground Water Quality Standards, hereinafter referred to as the GWQS (Chapter 173-200 WAC). These apply to any activity which has the potential to adversely impact groundwater quality. A key element of these regulations is an antidegradation policy, which generally prohibits degradation of groundwater quality beyond a specific limit which is established by the background concentration of the pollutant. Another key element of the regulations is the requirement that All Known Available and Reasonable Treatment (AKART) be used to prevent the degradation of groundwater quality. A third key element of the GWQS is that specific limits, called maximum contaminant levels (MCL's), are listed for key pollutants. The groundwater cannot be used for drinking if the MCL's are exceeded.

Although the GWQS imply that the regulation will prevent any degradation of groundwater quality, the reality is that it does not. A large number of activities associated with agricultural, industrial, and urban development continue to degrade groundwater quality across the State. Although not totally effective, the GWQS do provide a regulatory mechanism by which public health can be protected. Given the fact that the Town of Yacolt relies on water wells for drinking water, local development that relies upon on-site septic systems is impacted by the GWQS. The reality of that impact is uncertain. If a very large residential development was proposed, the resulting change in groundwater quality could trigger the anti-degradation regulatory mechanism of the GWQS. The same number of residences, constructed as part of a number of smaller development over a longer period of time, would likely not violate the anti-degradation policy.

On-Site Sewage System Regulations

In the State of Washington, WAC 246-272 outlines the regulations regarding septic tanks and other on-site wastewater systems. Design requirements, as well as provisions for inspection and regulation of failed systems, are addressed in these regulations. Under these regulations, the local health department is given the responsibility of regulating on-site systems with a capacity of 3,500 gallons per day. For systems with a capacity greater than 3,500 gallons per day, the State Health Department has regulatory responsibility. Systems with capacity greater than 14,500 gallons per day are regulated by the Department of Ecology.

For existing on-site systems located in areas served by sanitary sewers, these regulations give the local health department the ability to require failed on-site systems to connect to public sewers if such sewers are available within 200 feet of the failed system. These regulations do not address connection to public sewers other than a situation of on-site system failure within 200 feet of a public sewer. More stringent requirements for connection can be enacted under local ordinance.

Historical Perspective Regarding the Regulatory Issues

In the housing boom that followed the Second World War, the U.S. Public Health Service, the federal agency which set national policy regarding wastewater treatment and disposal at that time, focused primarily upon disposal of the water, not on the protection of environmental quality. Septic systems were viewed as a temporary solution until sewers became available.

With septic tanks viewed as short-term, there was limited emphasis upon making them function properly in the long-term. The end result was predictable - high failure rates and operational problems. These problems, including ground and surface water pollution, contributed to the passage in the 1960's of the initial federal legislation directed at addressing water quality issues. These initial regulatory efforts had limited impact, as demonstrated by the continued degradation of surface water quality throughout the nation.

In the 1970's, with a growing public awareness of environmental issues, there was a major shift toward stronger federal action, the most noteworthy result being the establishment of the U.S. EPA, and the enactment of the Clean Water Acts of 1972 and 1977. In the 1970's, significant federal funding became available for wastewater collection and treatment systems. Again, the focus was upon collecting the wastewater and treating it in municipally owned treatment facilities. Although much progress was made as a result of these federal programs, few of the original water quality goals were met. While water quality in many waterways has improved, most of the waterways in urban areas continue to be polluted to a level which prevents many potential recreational uses. In reality, most waterways in urbanizing areas continue to be degraded in conjunction with the rampant urban sprawl being experienced in these areas. In many cases, this degradation of water quality is associated with surface runoff rather than from the discharge of industrial or municipal wastewater.

In the 1980's, there was a growing awareness by the U.S. EPA that on-site treatment should be viewed as a long-term solution. In the 1990's, with the loss of federal funding for wastewater treatment, on-site treatment started to be viewed in a much more favorable light. The technical issues have become much better understood by regulatory agencies. With this, there has become an increased awareness of the need for long-term monitoring and management programs.

Options For Continued Reliance Upon On-Site Disposal

Groundwater Impacts

On-site wastewater disposal systems, if designed, installed, and maintained properly, have limited impact upon groundwater other than nitrate contamination. None of the commonly used on-site systems are capable of removing more than 50% to 60% of the nitrogen in the wastewater. A reduction of 40% of total nitrogen is more typical. For all commonly accepted designs, on-site systems elevate nitrate levels in the groundwater. Where background nitrate levels are low, or densities are low relative to the recharge to the aquifer, nitrates do not become a problem. If either of these are high, nitrate problems are an inevitable consequence of on-site wastewater disposal.

Of particular concern regarding the use of on-site systems is the possibility of contamination from household chemicals. There are strict restrictions on the use of chemicals in on-site systems, since they can damage biological processes within the septic tank and can be highly mobile in the subsurface environment. Depending on the nature of the chemical compound, it can create dangerous vapors in addition to contaminating the soil and groundwater. The threat of contaminating the aquifer is especially critical, since groundwater is used as the public drinking water supply in Yacolt. Despite the severity of this threat, the disposal of household hazardous wastes is very difficult to monitor.

The performance of on-site wastewater disposal systems is dependent upon the groundwater conditions and soil characteristics. Where the groundwater level is very shallow, conventional on-site wastewater disposal systems are largely ineffective. Conventional systems depend upon a drainfield for treatment. As the wastewater percolates through the soil under the drainfield, pollutants are removed by biological and chemical action, and filtration. To function properly, the drainfield must be located in an unsaturated layer of soil. Drainfields must also be located in soils which are sufficiently permeable to allow passage of wastewater at a moderate rate; but not excessively permeable, in which case there is very limited treatment.

Where soils are not sufficiently permeable, the untreated wastewater may discharge to the surface of the ground, or seep out upon nearby embankments or into nearby waterways. In such situations, it is not uncommon for the untreated wastewater to be high in bacterial contamination, and to pose a serious health risk.

Where soils are too permeable, the drainfield cannot provide sufficient filtration to provide adequate treatment, with the end result being groundwater contamination. Where soils are extremely permeable, the groundwater can become contaminated with harmful bacteria.

As discussed in Section 2, the majority of the soils in the Yacolt area are well-suited for septic tanks. There is no specific area where there is a concentration of failed septic systems. The problems that do exist are located throughout the Town.

The question of whether or not there will be future groundwater quality problems if the area continues to develop using on-site sewer systems depends largely upon the regulatory oversight during design and installation, and how well the systems are maintained. If the assumption is made that future on-site systems will be designed, installed, and maintained to high standards, it is unlikely that there will be water quality problems, as long as the area develops under current zoning. This assumption may prove to be optimistic without the active involvement of the Town Council and the public to assist with health department efforts. In particular, the Town should enact higher standards and increased oversight for the installation of new systems. If on-site system standards were to drop, if higher density zoning is permitted, or if significant industrial and/or commercial development occurs, this study concludes that there will be serious water quality problems. This conclusion is based upon the fact that soils in the study area are well-suited for on-site systems.

Without a doubt, groundwater and surface water quality in the proximity of the Town are affected by the use of septic systems. Although there is much evidence that nitrate levels are elevated, there is no evidence to suggest that there is bacterial contamination. The level of bacteria is consistent with urban areas with and without collected sewer systems. It is unlikely that there would be any discharge of coliforms into the groundwater from on-site systems that are designed to current standards, and properly maintained. Of particular concern for groundwater quality is the possibility of contamination by household hazardous wastes. This concern highlights the need for increased awareness in the community about the functions and limitations of septic systems.

The continued use of septic tanks will result in the discharge of nitrates to the aquifer. Using current available data of groundwater nitrate levels, projections can be made concerning the impact of continued growth using septic systems on groundwater quality. Data from wells up-gradient from the Town indicate that the natural level of nitrate in the groundwater averages 0.14 mgl. Data representative of groundwater down-gradient of the Town indicate that the average nitrate level is 1.60 mgl. The hydrogeologic study concluded that the annual recharge to the entire Yacolt Aquifer (1,377 acres) was 441 million gallons. However, nitrogen from septic systems infiltrates in only a small area of the total aquifer. To estimate recharge to the area where the septic systems are located, calculations can be made based on the current population. The population of the Town and surrounding area is currently about 990. Based on these assumptions, the annual recharge of the aquifer under the Town is 176 million gallons. Under the GWQS, the enforcement limit for nitrate is 4.27 mgl. This limit will be violated when the population of the Town and surrounding area reaches about 1,400. However, the nitrate concentration is currently significantly below the maximum contaminant level of 10 mg/L and is expected to remain below that level. This will be true provided that the study area does develop to full build-out under predominantly residential land use, and the systems are designed, installed, and maintained properly.

It is likely that most of the nitrates that are discharged to the groundwater will migrate to Yacolt Creek and eventually to the East Fork Lewis River. It should be noted that nitrates will be discharged to the East Fork Lewis River, regardless of whether or not the community utilized on-site treatment systems or a publicly owned mechanical treatment plant. If wastewater is land applied, nitrates will continue to enter the groundwater and will eventually discharge to the East Fork Lewis River. Only the partial removal of nitrate would be required for a conventional treatment plant.

Growth Management and Community Development Issues

The Yacolt community is currently divided in its perception of the need for a community sewer system. Based upon a survey that was completed as part of this study (Appendix B), the Town is almost evenly divided in its perception of the need for a community sewer system. Those that support a sewer system feel that it is necessary to cope with growth and to protect the Town's drinking water source. Those who do not support the development of a sewer system, feel that it is important to preserve the rural nature of Yacolt and that on-site systems are adequate. The Town is also divided in whether or not growth would be good for the community.

On-site wastewater disposal systems are suited for areas with predominantly low density residential land use. Due to the lack of a collection system, the minimum lot size is set by state statute at 12,500 square feet, or 3.48 lots per acre. The SWHD is responsible for regulating the use of on-site systems. In recent years, the SWHD has become more diligent in its regulation of on-site systems. However, it is unlikely that on-site systems will ever be denied in most of the study area if residential lots are 12,500 square feet or larger in size, which matches current zoning.

Economic Development Issues

The lack of public sewers could conceivably prevent some businesses or industries from locating in Yacolt. Whether or not this would actually occur is difficult to predict. The decision by a business or industry to locate in an area is influenced by a large number of factors, one of which is sewer service availability. It would depend upon the type of commercial/industrial establishment that was interested in the area, and the availability of land. While it is certain that the lack of a publicly owned sewerage system would discourage a large industry, or a small one which had significant wastewater discharge, the question is whether such industries would choose to locate in Yacolt even if public sewer service was available. This is a question that cannot be answered within the scope of this study.

The following very general information may provide an indication of how significant the lack of public sewers is upon commercial/industrial development in Yacolt:

- Most of the light manufacturing industries on the fringe of the Portland Metropolitan Area do not discharge significant quantities of industrial wastewater. Generally, wastewater that is discharged from these facilities is domestic in nature, meaning that it is from their restrooms and cafeteria. A typical light manufacturing facility employing 50 people, generates an amount of wastewater equivalent to about four or five single family residences. This means that a light manufacturing facility with 50 employees would require about ½ acre of land for its septic tank and drainfield.

- A typical small restaurant with a seating capacity of about 30, discharges about the same amount of wastewater as do four or five single family residences. Such a restaurant would require about ½ acre of land for a septic tank and drainfield.

Community Maintenance Programs

One consequence of the regulatory shift in emphasis from wastewater disposal to wastewater treatment and environmentally sound disposal, has been an increased emphasis upon on-site sewage systems. This has created a strong need for management programs directed at ensuring the proper use and maintenance of these systems. Throughout the State of Washington, as in other states nationwide, community maintenance programs are being given serious consideration. In many cases, management programs have been established and are functioning quite successfully.

Community maintenance programs keep the ownership of on-site systems in private hands, but place their operation under the jurisdiction of a public agency. These programs have three primary components: 1) they provide relevant information to the public through a program of public education; 2) they provide incentives for proper on-site system management and maintenance; and 3) they establish the basis for regulatory oversight to enforce compliance with regulations.

Although there are many methods by which community maintenance programs can be operated, the local utility model is the most popular. Under this model, a local agency works with the regional or state health department having legal jurisdiction in a partnership role, with the health district having the lead regulatory role. Where the area falls within an incorporated area (city or town), a utility department is normally established for the purpose of administering the program. Where unincorporated, a special utility district is formed or the role of an existing agency is expanded. In either case, personnel can be assigned to the task of operating the system, and fees can be assessed to pay for the costs of salaries, equipment, and supplies.

The real advantage of community maintenance programs is that they help on-site systems to function properly with a significant degree of reliability. While most individuals who own on-site systems operate them properly, in any area there are usually some individuals who do not. A small minority of the total group, by failing to operate their systems properly, can cause significant environmental and public health problems. If all of the on-site systems are under the operational control of an agency, it greatly reduces the probability that there will be problems. At a small cost, significant benefits are often achieved.

Unfortunately, some individuals oppose becoming part of a community maintenance program. Often this is due to the fact that these individuals feel that, because they do an adequate job of maintenance and operation of their system, they do not believe that they need to become part of a community system. These individuals often fail to understand that many others are less diligent in their responsibilities to maintain their systems. It is often impossible to know who is doing a good job or who is doing a bad job of maintenance. The best way to deal with the isolated problem is for the entire community to join in and have a single agency represent the community.

In many cases, on-site systems are appropriate for an area, and yet community sewer systems are forced upon the community simply because a small minority of the community fail to maintain their systems, or the local health department fails to exercise due diligence in enforcing regulations. In such cases, the establishment of a community maintenance program would likely allow the continued use of on-site systems, with the end result a significant cost savings to the public.

Options for Community-Wide Solutions in Combination with On-Site Systems

The decision to rely primarily upon on-site systems is not an all-or-nothing situation. On-site systems may be suitable over a very large portion of a service area, and yet be unsuitable for a small portion of that service area. In such cases, one option is to install one or more small community systems to serve those isolated areas where on-site systems are not suitable. Where this is done, these small systems are commonly called "cluster" systems. The option to use cluster systems becomes particularly cost-effective when the remaining service area is managed as part of a community maintenance program. See Figure A8 in Appendix A for a typical cluster system schematic.

Sewer Service By Publicly Owned Treatment System

Treatment Objectives For Publicly Owned Systems

NPDES (National Pollution Discharge Elimination System) permits establish the effluent limitations for those communities which are served by public sewers discharging to surface or groundwaters. Because the Yacolt community currently does not have any publicly owned wastewater facilities, it does not have a municipal discharge permit.

The treatment objectives depend upon the method of disposal. There are basically three alternatives for disposal of wastewater: 1) subsurface disposal by infiltration-percolation (drainfield); 2) land application by irrigation; and 3) discharge to surface water.

For subsurface disposal by infiltration-percolation, treatment requirements will depend upon the nature of the soil and groundwater conditions. Reduction of suspended solids is a very important preapplication treatment criterion, so that soil clogging and nuisance conditions from odors are minimized. Depending upon the groundwater conditions and the use of that groundwater, the removal of chemical and biological pollutants may also be required. For the discharge of large amounts of wastewater, the removal of nitrates is normally required. Biological treatment is often provided for the purpose of removing suspended solids as well as other pollutants. Disinfection is generally not necessary, as a number of studies have shown infiltration-percolation to be quite effective in the reduction of pathogenic bacteria.

For land application by irrigation, pre-treatment of wastewater may be necessary for a variety of reasons, including:

- Providing storage of wastewater without nuisance conditions.
- Maintenance considerations associated with the distribution system.
- Maintaining high infiltration rates into the soil.
- Allowing irrigation of crops that will be used for human consumption.

Where the wastewater is used for irrigation, a minimum of primary treatment is recommended. If crops are grown for human consumption, or grazing, or where wastewater may be subject to contact by the public, additional treatment in the form of secondary treatment and disinfection would be required. The Washington State Department of Ecology has specific treatment and testing requirements for wastewater facilities which utilize land disposal.

For any land application option, groundwater quality will need to be protected. Normally, this requires either nitrogen removal, or application rates and management that will ensure that nitrogen is removed by plants which are harvested and disposed of to remove the nitrogen from the site.

For surface water discharge, the level of treatment will depend upon the nature of the receiving water body. Under current water quality regulations, pollutant concentration limits are established by water quality standards, and treatment must be provided following detailed analysis of the impact that wastewater discharge will have upon receiving waters relative to the water quality standards. The degree of treatment depends largely upon the dilution available in the receiving stream.

Treatment System Alternatives

As stated previously, the discharge location will dictate the choice of treatment system. Following is a discussion of treatment options for the three alternative discharge locations: 1) subsurface disposal; 2) land application by irrigation; and 3) discharge to surface water.

For subsurface disposal options (infiltration or percolation by drainfield), several alternative types of treatment systems present themselves as potentially viable options. For relatively small systems, pretreatment by septic tank followed by recirculation sand filters has proven to be cost effective. Recirculating sand filters are basins filled with specially graded gravel, where the wastewater is applied at the top and collected in under-drains. Part of the effluent collected in the under-drains is combined with the influent, and recirculated through the filter. Recirculating sand filters, as with conventional septic tanks and drainfields, do not remove a significant amount of nitrogen. As such, nitrate concentrations in the groundwater are a factor when considering their use.

For larger subsurface disposal systems, a treatment process called Sequencing Batch Reactor (SBR), has proven cost effective. This is a mechanical treatment process which relies upon biological treatment and sedimentation. Although there are a number of biological processes that function similarly, in that they all fall under the category of activated sludge processes, SBR's have been found to be a cost effective biological process for the removal of nitrogen. See Figure A9 in Appendix A for a schematic of the SBR process.

For land application by irrigation, biological treatment and disinfection is normally necessary. Application rates have to be limited to prevent excessive nitrate contamination of the groundwater. Where land application is utilized, either mechanical treatment plants or lagoons are commonly used. For small communities, lagoons are preferred, although in recent years, lagoons have lost favor amongst regulators due to inconsistent performance. For either lagoons or mechanical treatment plants, the general treatment process is similar - biological treatment relying upon biological action and sedimentation to remove pollutants.

For surface water discharge, several varieties of the activated sludge process are applicable. Detailed studies for similar small communities have shown that two processes are approximately equal in construction and operational cost. One of these - SBR - was discussed above. The other is the oxidation ditch process. In the oxidation ditch process, wastewater flows through an aerated basin (called the oxidation ditch) for biological treatment. From there it flows through sedimentation basins, where solids settle out and clean effluent is conveyed to disinfection facilities prior to discharge.

Alternative Discharge Locations for Centralized Treatment

As stated previously, there are three alternative methods of wastewater disposal: 1) infiltration-percolation disposal (drainfield); 2) land application by irrigation; and 3) discharge to the Lewis River. The first two of these require a land application site, in addition to a site for the treatment facilities. Disposal to the Lewis River would require a pipeline to convey the wastewater to the River. It would also require an outfall into the River. The cost of this pipeline and outfall eliminates consideration of this alternative as a viable option.

The land area required for an application site would depend upon the amount of flow to be discharged, the treatment process, and the soil characteristics of the site. Assuming that a land application site could be located within those portions of the study area where soils are suitable, land area requirements are estimated for various service areas as follows.

Table 4.1
Land Area Requirements

	Acres Required Per Assumed Population Served ①		
	1,000	2,000	3,000
Centralized Treatment Plant ②	½ acre	¾ acre	1 acre
Community Drainfield ③	6 acres	12 acres	12 acres
Land Application by Irrigation ④	18 acres	36 acres	72 acres

Assumptions:

① Loadings assume a per capita flow contribution of 100 gallons per capita per day.

② Land area varies by process. These are typical values for conventional treatment plants.

③ Land area for community drainfield assumes the drainfield would dispose of effluent from a recirculating sand filter or mechanical treatment plant with drainfield sizing based upon a daily unit loading of 0.8 gallons per square foot of drainfield. It also assumes that a completely redundant drainfield would be available.

④ Land application rates assume a total application rate of 10 feet per acre. It also assumes a buffer around the application site, and the land area for a winter storage lagoon with 10 total feet of operating water depth. The lagoon would be sized to provide six months of storage. This is a very approximate estimate. The actual land area would largely depend upon the nitrogen loading, and the crop management for the site.

Although the above listed values are very approximate, it is apparent that the options of either the community drainfield or land application alternative would require a considerable amount of land.

Options for System Ownership and Operation

In the event that Yacolt does elect to construct a publicly owned wastewater system, there are several options available for ownership and operation:

1. Town ownership and Town operation.

2. Town ownership and private contract operation.

3. Ownership by another agency.

Most small communities served by a public wastewater system own and operate the system. Ownership of public water and sewer systems is a primary reason for most small municipalities to maintain a local government. It is control over these services that makes the community. Without ownership of a community's water and wastewater system, there is commonly no reason for the community to be incorporated. This study concludes that any public owned wastewater system within the Town of Yacolt should be owned by the Town. If the Town is unable to manage the system, serious consideration should be given to contract management by another public agency, or a private entity.

If the Town does elect to implement a sewer system, and chooses to have it owned by another agency, Clark County, the Hazel Dell Sewer District, and the Clark Public Utilities are obvious candidates. The CPU is the most likely candidate, given their past history of being very aggressive toward expansion.

Conclusion Regarding Preferred Type of Publicly Owned Treatment System

If a community sewer system were to be installed, this study concludes that the preferred option would be a sequence batch reactor with effluent discharge to land application or subsurface disposal. A treatment plant would be required for all disposal options. Regardless of the type of treatment system option, this study concludes that the cost of treatment would be similar for the flow ranges anticipated in Yacolt. If the water quality of the Lewis River was not such a high profile issue, discharge to the river would likely be a viable option.

Alternative Collection Systems

Where community-wide sewer systems are used, they can be categorized as either conventional or unconventional. Unconventional systems are commonly used in more rural, less densely populated areas.

Conventional sewer systems are those where raw wastewater is collected by sewer pipes laid at constant grade to provide gravity flow. Manholes are installed at intervals along the sewer and at changes in direction or grade for purposes of venting and clean-out.

There are several types of unconventional sewer systems. Two of these are applicable to this project. Both types have a septic tank installed at each service with the septic tank effluent either flowing by gravity through the collection system to the treatment site or pumped through a pressure system to the treatment site. The gravity type system is called small diameter variable slope (SDVS), or variable grade sewer (VGS). In the VGS system, the septic tank effluent flows by gravity through small diameter (4-inch diameter) sewer at variable grade to a discharge point. In the pumped system, called septic tank effluent pump (STEP), septic tank effluent is pumped out of the septic tank to a pressure sewer. Because of the maintenance requirements associated with pumped systems, VGS sewers are preferred over STEP sewers if the topography is suitable. A third type of system, which is similar to STEP systems, is one that uses a grinder pump instead of a septic tank. This type of system is called a grinder pump system. Schematics of all three types of alternative collection systems are shown in Figures A4 and A5 of Appendix A.

Unconventional sewer systems require more maintenance, and thus more operating costs, than do conventional systems. Conventional systems are thus preferred under most circumstances. Situations where unconventional systems have proved more cost effective are:

- Where the density of development is low (lot sizes greater than 15,000 square feet) lengthy collection mains are required. Due to the lower lineal foot installation cost of VGS and STEP sewers, reduced initial construction cost savings often offset higher maintenance costs.

- Where the terrain is particularly undulating, conventional systems require a large number of major pumping stations. Where many pumping stations are required, it is often more cost effective to have a pressure system.

- Where excavation is particularly difficult, unconventional systems may be more cost effective due to their shallow depth.

In the study area, zoning completed with the Comprehensive Plan specifies lot sizes of 12,500 square feet. This development density, combined with the Town's relatively uniform sloping topography, make conventional gravity sewer collection the most appropriate alternative for the Yacolt area.