3.0 Water Resources

This chapter addresses the following types of water resources within Clark County and the cities:

- Surface water bodies (streams, lakes, and rivers);
- Floodplains;
- Shorelines;
- Critical aquifer recharge areas; and
- Wellhead protection areas.

Chapter 4 Fish and Wildlife describes stream and riparian habitats in the county.

3.1 Surface Water

3.1.1 What has changed since 2007?

The location of streams, rivers, and lakes within Clark County has remained relatively unchanged since 2007. Figure 3-1 shows the location of major streams, lakes, and watershed boundaries within Clark County. Changes to water quality and surface water regulations are described below.

3.1.2 Water Quality

There have been some minor changes to surface water conditions of the County since 2007, particularly with respect to water quality. Appendix A identifies streams, rivers, and lakes in Clark County that are currently listed on the 2012 Washington State 303(d) list of impaired water bodies for not meeting current surface water quality standards (Washington Administrative Code (WAC) 173-201A). The appendix also identifies the parameters that are not being met for that water body. In general, most 303(d) listed surface waters identified in the 2006 DEIS and 2007 FEIS are still on the list; however, 11 new surface waters have been added, including Big Tree, Cedar, and Yacolt Creeks and Merwin Lake. Some surface waters that were previously identified are no longer on the 303(d) list and have been removed. Additional parameters have been added or removed from particular water bodies.

Photo courtesy T. Noland

The most common causes of surface water quality impairment are high temperatures, low dissolved oxygen levels, and presence of fecal coliform bacteria. All of these impacts are typically due to human activities or development, such as removing vegetation during development that otherwise shades streams or adding new impervious areas from roads, roofs, and parking lots that increases the potential for stormwater runoff to carry sediment and pollutants into streams. Runoff from agriculture has also negatively impacted many waterways in the county.

Clark County has regulations in place to protect water quality (Clark County Code (CCC) 40.385, Stormwater and Erosion Control; CCC 13.26, Water Quality). The County adopted a modified version of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington. The County is currently updating its Stormwater Manual and development codes. The cities also have stormwater, drainage, and erosion control requirements. For non-exempt activities, the codes

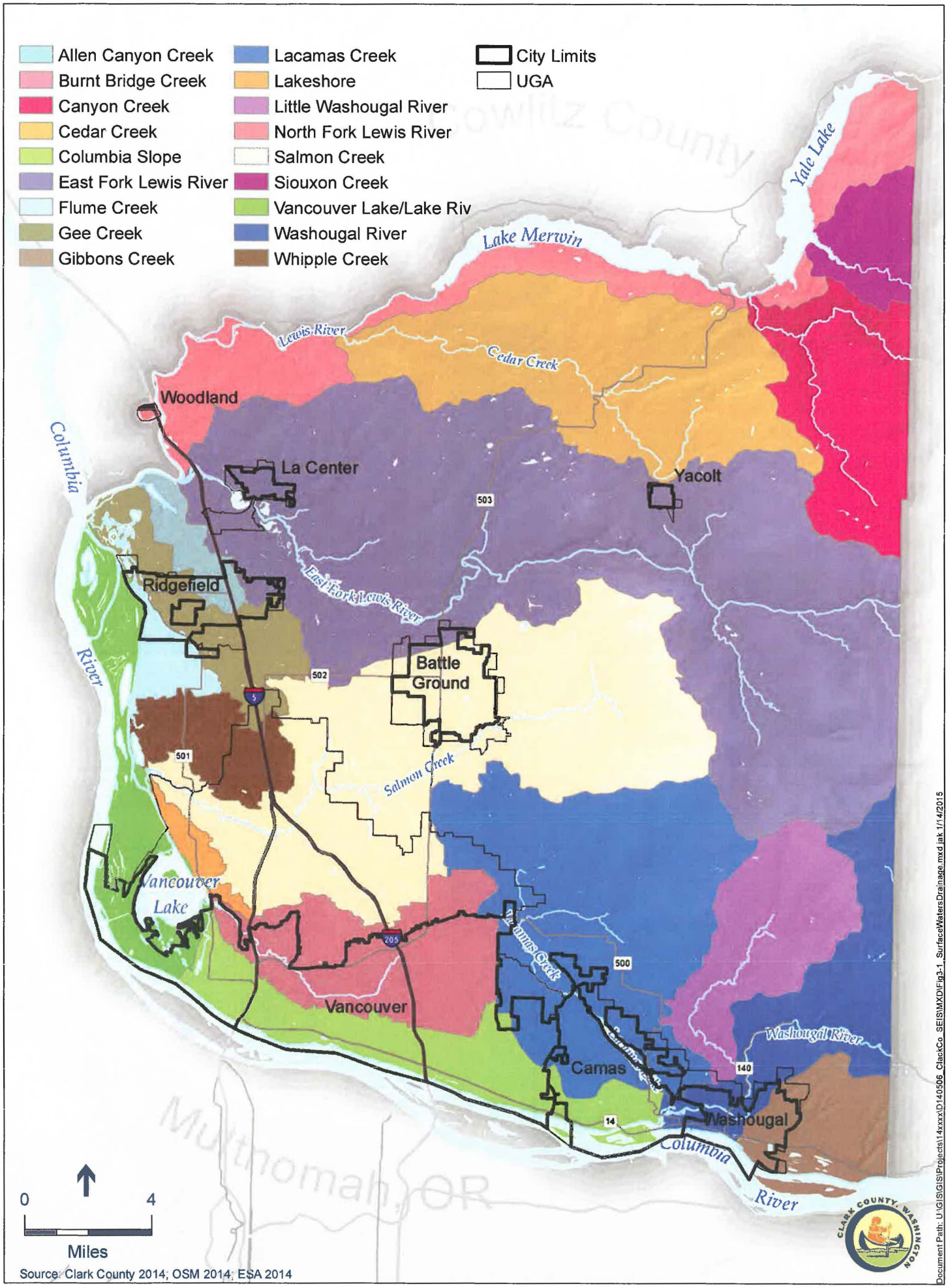


Figure 3-1: Major Surface Waters and Drainage Basins

generally require applicants to prepare a stormwater management plan, implement best management practices (BMPs) to protect water quality during construction, and install detention and water quality treatment for stormwater runoff.

3.1.3 Shoreline Master Plan

Clark County's Shoreline Master Program (SMP) was approved by the Department of Ecology on August 9, 2012. The SMP took effect on September 12, 2012. Clark County, Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal, and Yacolt all partnered in the effort to update their respective SMPs.

In the course of implementing the SMP, a discrepancy in the regulations was discovered through a development proposal on Carty Lake relating to dredging and dredge material disposal. Ecology also noted that Carty Lake was not on the list of lakes subject to shoreline jurisdiction. To address these issues, a limited amendment to the Clark County SMP has been approved. Shoreline designations are shown on Figure 3-2. The SMP provides requirements for development along shorelines to protect ecological functions. Within each shoreline designation, slightly different requirements may apply depending on the proposed activity.

3.1.4 Floodplain Regulations

Since 2007, the areas of special flood hazard identified by the Federal Emergency Management Agency (FEMA) have been updated in a report entitled "Flood Insurance Study, Clark County, Washington and Incorporated Areas," effective September 5, 2012, and accompanying Flood Insurance Rate Maps (FIRMs). Revisions were adopted by reference into the Clark County Code (CCC 40.420.010). Significant flood zones are the Floodway, Floodway Fringe and 500 Year Flood Area. Floodplain areas in Clark County are shown on Figure 3-3. The County's flood hazard regulations restrict uses that increase erosion or flood risks; require flood protection for vulnerable uses; control alteration of floodplains and stream channels; limit filling and dredging in the floodplain; and regulate the construction of flood barriers.

The floodway is the area needed to move the 1-percent flood downstream; the state of Washington does not allow construction in the floodway.

The floodway fringe is the portion of the floodplain lying on either side of the floodway.

The 500 Year Flood Area is an area that has a .2-percent chance of being equaled or exceeded in any given year; it is not the flood that will occur once every 500 years.

3.2 Groundwater Resources

3.2.1 How have conditions changed since 2007?

There has been little change in groundwater resources since 2007. However, GIS mapping of groundwater resources and the land use/zoning potentially affecting the resources has vastly improved, allowing for more accurate long-term planning.

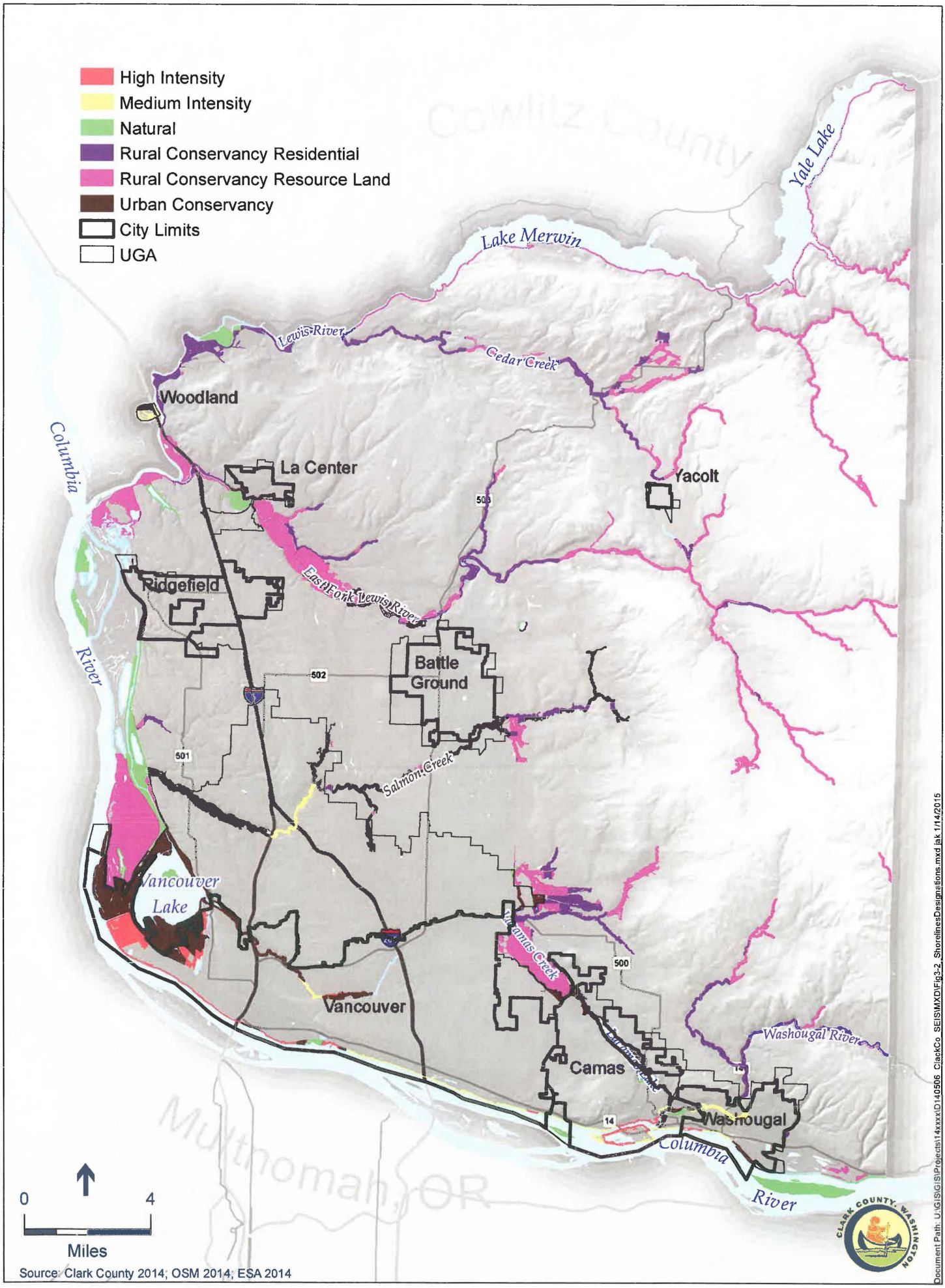


Figure 3-2: Shoreline Designations

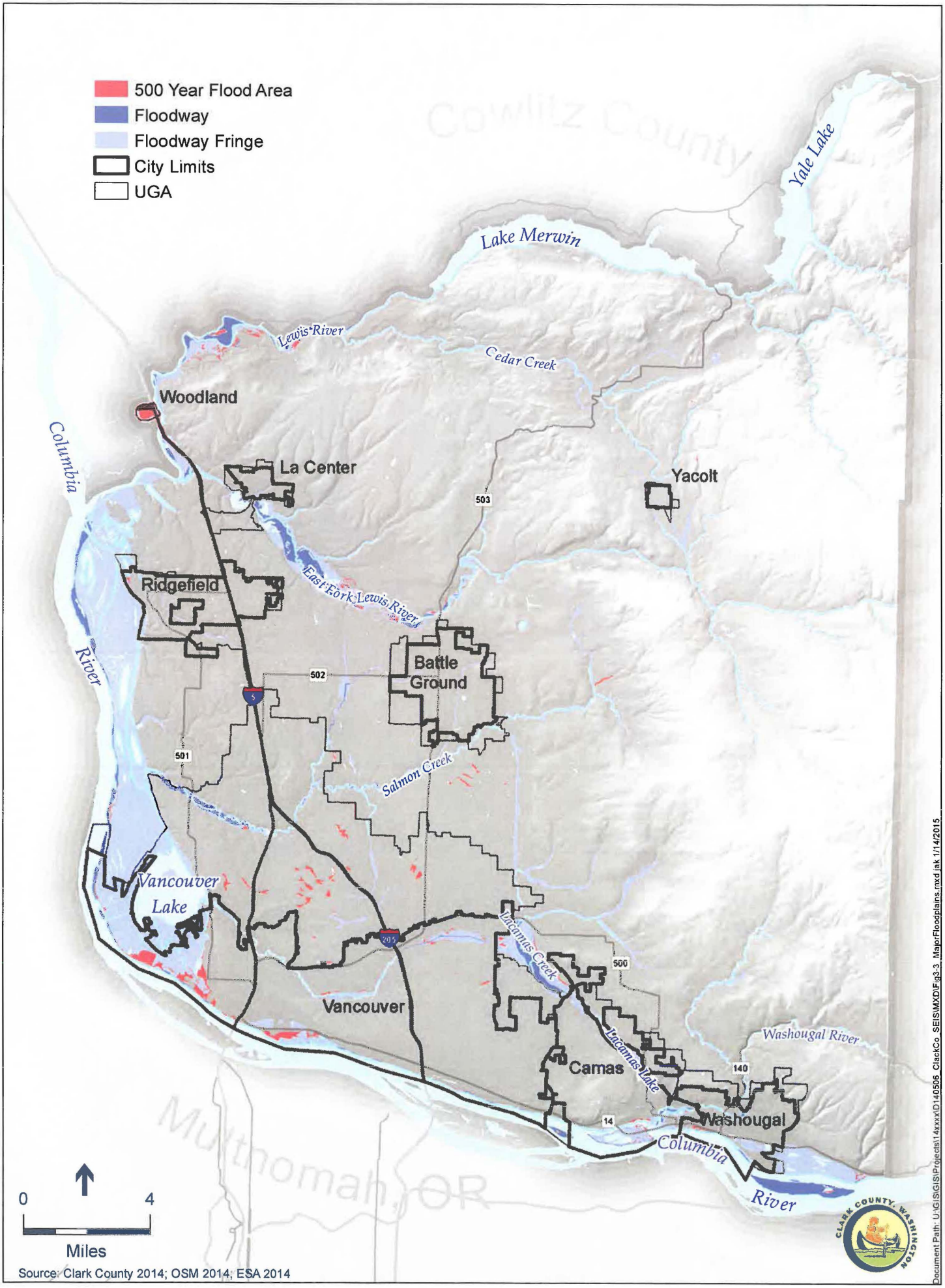
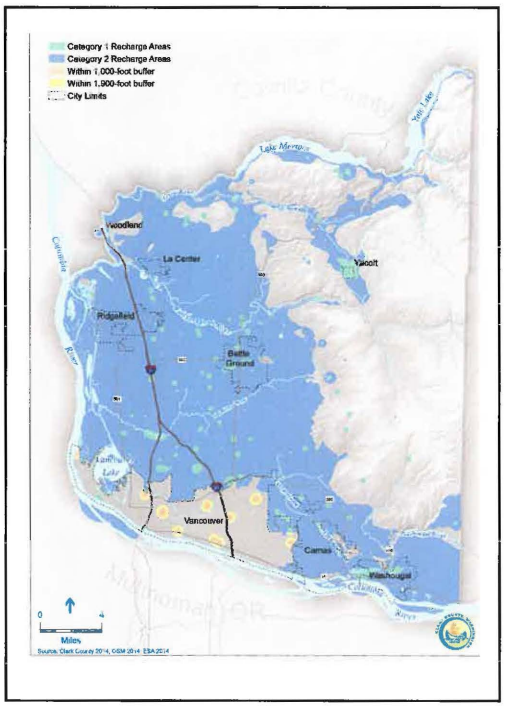


Figure 3-3: Major Flood Zones

3.2.2 Critical Aquifer Recharge Areas

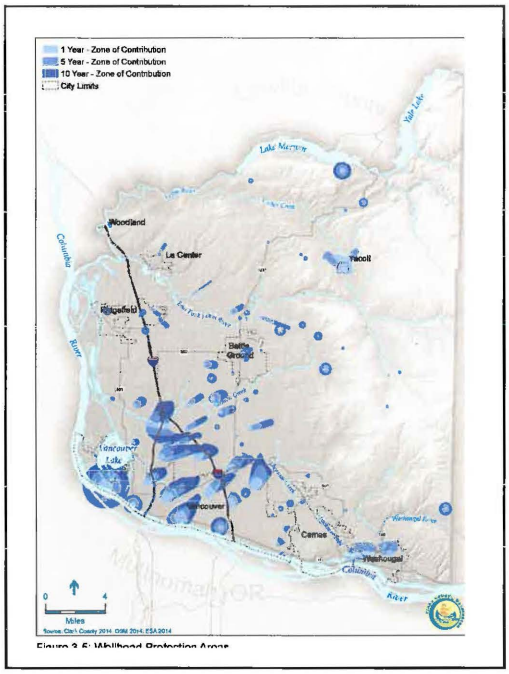


Groundwater provides 95% of the drinking water in Clark County. All of Clark County's lowlands can be considered an aquifer recharge area, as groundwater lies beneath virtually all populated areas and is used as drinking water. Although most of the county's groundwater is of good quality, there are areas where it has been degraded or contaminated due to human activities. Groundwater contamination often occurs where water demand and consumption are greatest.

The County's critical aquifer recharge area (CARA) ordinance (CCC 40.410) was established for preventing degradation, and where possible, enhancing the quality of groundwater for drinking water or business purposes. The CARA review is intended to limit potential contaminants within designated critical aquifer recharge areas. The CARA ordinance took effect August 1, 1997, and was revised in 2005.

The ordinance applies to activities in designated CARAs that include most of Clark County west of the Cascade foothills (Figure 3-4). These areas are divided into two categories based on how close they are to public drinking water. Certain activities are prohibited in Category 1 areas because they are close to public wells. These activities are permitted in Category 2 areas but require a CARA permit. There are no activities prohibited in Category 2 areas, but they may be subject to other limitations specified within the CCC. Specific BMPs are required for certain types of activities to prevent groundwater contamination.

3.2.3 Wellhead Protection Areas



The federal Safe Drinking Water Act requires every state to develop a wellhead protection program. The state Department of Health (DOH) administers the wellhead protection program in Washington. Wellhead protection helps local communities protect their groundwater-based drinking water supplies. A component of the Wellhead Protection Program is delineating wellhead protection areas. A wellhead protection area is defined as the surface and subsurface area surrounding a well or well field that contaminants are likely to pass through and eventually reach the water well(s). In simpler terms, it is the area managed by a community to protect groundwater-based public drinking water supplies (DOH, 2010). The program works with other federal, state, and local groundwater protection programs including Sole Source Aquifer Designation, Groundwater Management Area Program, Aquifer Protection Area Designation, and Critical Aquifer Recharge Area management under the Growth Management Act.

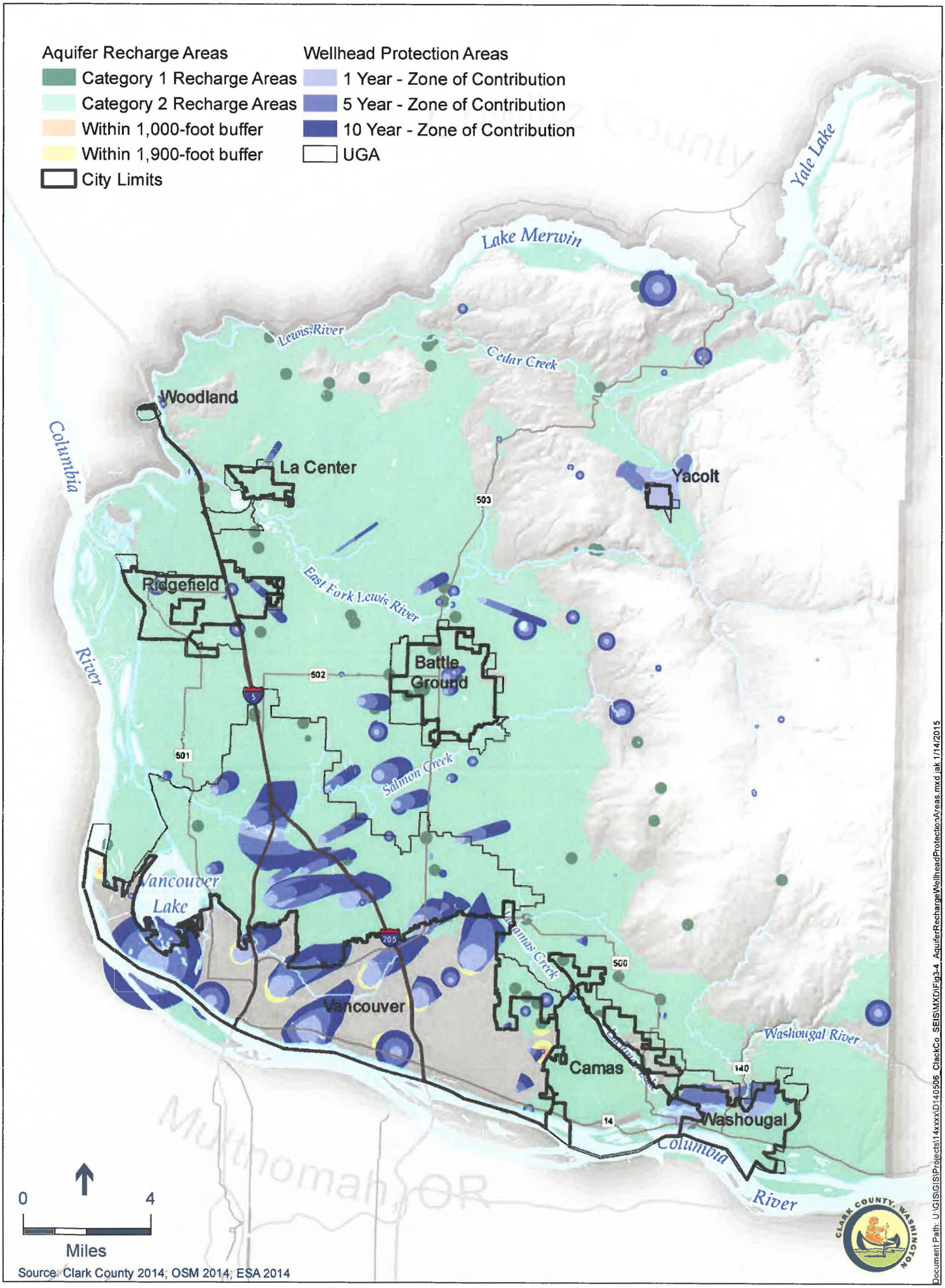


Figure 3-4: Critical Aquifer Recharge Areas & Wellhead Protection Areas

Wellhead protection areas in Clark County are shown on Figure 3-4. Since 2007, no changes to the wellhead protection areas have been documented in Clark County. The "zones of contribution" shown on the figure are based on how long it would take a particle of water to travel from the zone boundary to the well (1 year, 5 years, 10 years).

3.3 Environmental Impacts

3.3.1 What methodology was used to analyze impacts to water resources resulting from each of the alternatives?

Water resources can be affected by increased development due to increased impervious surfaces and intensified activities. More impervious surface can result in additional stormwater runoff carrying pollutants into water bodies and changing the amount and timing of water within streams. Some types of land uses, such as industrial facilities and some commercial operations, have the potential to release contaminants into surface and groundwater. Contaminated water sources could limit the amount and type of development allowed within an area due to reduced water quality, or could be cost prohibitive due to required treatment. The project team calculated the acreage of lands added to the UGAs under each alternative using GIS mapping and assessed the types of land uses that could occur with changes in zoning.

3.3.2 What are the impacts to water resources resulting from each alternative?

Alternative 1 – No Action Alternative

Alternative 1 plans no expansion of UGAs. The impacts to surface water bodies, floodplains, shorelines, CARAs, or wellhead protection areas would be the same as those identified in the 2007 FEIS. Population growth over the next 20 years would primarily occur within existing UGAs. However, the rural areas could accommodate some of the projected growth under the current zoning. As discussed in Section 1.2.1, approximately 7,000 new lots could be created under full build-out conditions.

All of the existing UGAs contain surface water and groundwater resources that could be affected by ongoing development. This includes hundreds of miles of streams, over 600 acres of floodprone areas, over 300 acres in shoreline jurisdiction, and over 30,000 acres in Category 1 CARAs and wellhead protection areas (see Table 3-1 and Chapter 4 for stream lengths). More intensive development within the UGAs could impact these resources; for example by increasing surface runoff and pollutants entering water bodies. However, activities potentially affecting these aquatic resources are regulated at state, federal, and local levels (for example, through local codes that require stream buffers and protection of groundwater; the federal Clean Water Act; local SMPs; and the state Hydraulic Code). Application of current stormwater standards would reduce the impacts of new development and could improve conditions in areas that were developed prior to adoption of current stormwater requirements.

Table 3-1. Alternative 1 – No Action - Existing Water Resources (acres)

Water Resource	Total Acres in Existing UGAs
Floodprone Area	
Floodway Fringe	571
Floodway	36
500 year flood	9
Total Floodprone Area	616
Shorelines	314
Category 1 CARA	4,085
Wellhead Protection Areas (Zones of Contribution)	
1-year	5,235
5-year	9,532
10-year	12,169
Total Wellhead Protection Area	29,936

Alternative 2 –Countywide Modifications

Rural Areas

Reducing minimum lot sizes may allow for increased density of development, potentially leading to impacts on water resources. However, some of the areas affected by this alternative are already at or below the minimum lot sizes that would be allowed under this alternative. These existing smaller lots would not be subject to subdivision and are unlikely to experience additional impacts with the proposed change in zoning. Water resource impacts are more likely to occur when larger parcels are upzoned to allow for more intensive development.

As shown in Table 3-2, Alternative 2 could allow creation of approximately 8,200 new lots with the potential for additional development, potentially affecting over 34,000 acres spread across most of the drainage basins in the county (see Figure 6-2 in Chapter 6).

Table 3-2. Acreage Potentially Affected by Changes in Zoning – Alternative 2

Proposed Zoning Change	Potential New Parcels	Potential Acreage Affected
R20 to R10	5,823	5,823 parcels @ 10 acres each = 58,230 acres
AG20 to AG10	1,937	1,937 parcels @ 10 acres each = 19,370 acres
FR40 to FR20	460	460 parcels @ 20 acres each = 9,200 acres
Total	8,220	34,393 acres

Development of new lots would be subject to project-specific review and regulations intended to avoid and minimize impacts on aquatic resources. Nevertheless, some level of cumulative impact may occur as the basins become more developed. Over time, development tends to increase the proportion of impervious surface, which increases pollutants entering surface and groundwater, and it reduces the amount of vegetation cover in a basin, leading to changes in hydrology and alteration of biological communities. The level of impact for an individual drainage basin would depend on many factors, such as geology and hydrology of the basin, how much of the basin is already developed, the effectiveness of existing and new stormwater management systems, the location and intensity of new development, and the sensitivity of resources such as fish-bearing streams.

As stated in Section 3.2.2 above, there are areas within the county where groundwater has been degraded or contaminated due to increased development, as well as increased water demand and consumption. When demand increases there is a risk of pumping water out faster than it can infiltrate to replenish the aquifer. The additional development that would be allowed under Alternative 2 would in turn increase the number of new water wells in rural areas, and thus increase the risk of both contamination and reducing water supply. Construction of new houses, roads, and other facilities allowed by this zoning change would likely increase impervious surface area, leading to an increase in stormwater runoff that could impact stream habitat.

Overall, this alternative could have a moderate level of impact on water resources if the parcels are built out to their full potential under the proposed zoning changes.

Changing the mixed use comprehensive zoning designation to match existing development would not result in more intensive development or other changes in land uses that would impact water resources.

Urban Growth Areas

City of Battle Ground: Alternative 2 proposes to change the current land use designations to be consistent with how properties are being used and to reduce the potential for an incompatible land use to locate in the midst of residential use in the future. No impacts are expected from this proposed change.

City of Ridgefield: Alternative 2 proposes to increase the UGA by approximately 155 acres. This would bring 0.5 miles of stream into the UGA (see Chapter 4 for stream lengths). The UGA expansion area is

mapped as Category 2 CARA. The area that would be brought into the UGA consists of the Tri-Mountain Golf Course and a narrow strip along I-5. The proposal could have site-specific impacts when urban holding is lifted, which would allow development for industrial or office use. Such development would add increased impervious surface and intensity. Impacts are localized and would be mitigated during project review.

City of Vancouver: Alternative 2 proposes to change approximately 1,100 acres of zoning in the Discovery/Fairgrounds Subarea Plan from Light Industrial to Office Campus or Business Park uses, and to change approximately 465 acres of zoning in the Salmon Creek/University District Subarea Plan from urban low density to accommodate more mixed-uses and higher density residential uses. This could result in moderate impacts to water resources in the area with increased impervious surface and more intense activities. Impacts are localized and could be mitigated during project review.

City of Washougal: Alternative 2 proposes to correct an inconsistency between County and City zoning classifications within the southern portion of the Washougal Urban Growth Area. No impacts are expected.

Alternative 3 – City UGA Expansion

City of Battle Ground

Alternative 3 proposes expansion of the City of Battle Ground UGA by approximately 82 acres. This would bring an additional 0.4 miles of stream, 4.7 acres of floodprone area, 0.04 acres of jurisdictional shoreline, and 29 acres of Category 1 CARA into the UGA (see Table 3-3 and Chapter 4 for stream lengths). The UGA expansion area is also mapped as Category 2 CARA. Portions of the affected area are already developed with rural land uses, but water resources may be affected by more intensive development and activities (e.g., increased stormwater runoff and pollutant loading, decreased water supply, etc.). Impacts are localized and could be mitigated during project review.

Table 3-3. Alternative 3 – City UGA Expansion- Existing Water Resources (acres)

Water Resource	Battleground	La Center	Ridgefield	Washougal
Floodprone Area				
Floodway Fringe	4.7	0.01	0	0
Floodway	0	0	0	0*
500 year flood	0	0	0	0
Total Floodprone Area	4.7	0.01	0	0
Shorelines	0.04	0	0	0
Category 1 CARA	29	0	0	0
Wellhead Protection Areas (Zones)				
1-year	0	0	0	0
5-year	0	0	0	0
10-year	0	0	0	0
Total Wellhead Protection Area	0	0	0	0

*Approximately 16 acres of floodway area would be included in the Washougal UGA; however this is a result of mapping corrections and does not represent areas that would be added to the UGA under Alternative 3.

City of La Center

Alternative 3 proposes expansion of the City of La Center UGA by approximately 78 acres. This would bring an additional 0.6 miles of stream and less than 1 acre of floodprone area into the UGA (see Table 3-3 and Chapter 4 for stream lengths). The UGA expansion area is also mapped as Category 2 CARA.

While part of the UGA expansion area is currently developed, most of the land consists of pasture and forested areas. Bringing this area into the UGA would allow more intensive development, with the potential for negative effects on water resources. Impacts are localized and could be mitigated during project review.

City of Ridgefield

Alternative 3 proposes expansion of the City of Ridgefield UGA by 111 acres. This would bring 1 mile of additional fish-bearing stream into the UGA (see Chapter 4). No additional floodprone areas, jurisdictional shorelines, or Category 1 CARAs would be brought into the UGA (Table 3-3). The UGA expansion area is mapped as Category 2 CARA.

City of Washougal

Alternative 3 proposes expansion of the City of Washougal UGA by 41 acres. No additional streams, floodprone areas, jurisdictional shorelines, or Category 1 CARAs would be brought into the UGA (Table3-3). The UGA expansion area is mapped as Category 2 CARA.

Alternative 4 – Rural, Agriculture, and Forest Changes

As with Alternative 2, Alternative 4 incorporates changes in policy direction and land use/zoning. This alternative is proposed to essentially retrofit new zoning to the actual predominant lot sizes, while encouraging clustering options to preserve resource lands, open space, and non-residential agriculture uses and provide additional economic opportunities in the rural areas.

Compared to Alternative 2, Alternative 4 would allow a higher density of development outside of the UGAs in the county than would occur with the 2007 Comprehensive Plan.

Reducing minimum lot sizes may allow for increased density of development, potentially leading to impacts on water resources. Water resource impacts are more likely to occur when larger parcels are upzoned to allow for more intensive development. Some of the lots in areas that would be affected by Alternative 4 are already at or below the minimum lot size that would be allowed with Alternative 4. These smaller lots would not be subject to subdivision and are unlikely to experience additional impacts with the proposed change in zoning. However, as shown in Table 3-4, Alternative 4 could allow the creation of approximately 12,400 new lots with the potential for additional development, spread across most of the drainage basins in the county (see Figure 1-4b).

Table 3-4. Acreage Potentially Affected by Changes in Zoning – Alternative 4

Proposed Zoning Change	Number of Potential New Parcels	Potential Acreage Affected
Agriculture		
Ag20 to Ag10	1,780	1,780 parcels @ 10 acres each = 17,800 acres
Ag20 to Ag5	178	178 parcels @ 5 acres each = 890 acres
Subtotal Agriculture	**1,958**	**9,94518,690 acres**
Rural		
R20/R10/R5 to R1	739	739 parcels @ 1 acre each = 739 acres
R20/R10/R5 to R2.5	3,019	3,019 parcels @2.5 acres each = 7,548 acres
R20/R10 to R5	6,122	6,122 parcels @ 5 acres each = 30,610 acres
Subtotal Rural	**9,880**	**13,11238,897**
Forest Resource		
FR80	7	7 parcels @ 80 acres each = 560 acres
FR80 to FT40	30	30 parcels @ 40 acres each = 1,200 acres
FT80/FR40 to FT20	93	93 parcels @ 20 acres each = 1,860 acres
FT80/FR40 to FT10	433	433 parcels @ 10 acres each = 4,330 acres
Subtotal Forest	**563**	**7,950**
TOTAL	**12,401**	**65,537 acres**

As described for Alternative 2, some level of cumulative impact may occur as the basins become more developed. Increased development leads to more impervious surface, which increases pollutants entering surface and groundwater. Reduction in vegetation cover in a basin can lead to changes in hydrology and alteration of biological communities. The level of impact for an individual drainage basin would depend on many factors, such as geology and hydrology of the basin, how much of the basin is already developed, the effectiveness of existing and new stormwater management systems, the location and intensity of new development, and the sensitivity of resources such as fish-bearing streams. Development of new lots under Alternative 4 would be subject to project-specific review and regulations intended to avoid and minimize impacts on aquatic resources.

As previously stated, groundwater contamination has already occurred in some areas due to increased development and water consumption. When demand increases, water withdrawal can overwhelm the aquifer's ability to infiltrate. The additional development that would be allowed under Alternative 4 would in turn increase the number of new water wells in rural areas, and thus increase the risk of both contamination and reducing water supply.

Table 3-4. Acreage Potentially Affected by Changes in Zoning – Alternative 4

Proposed Zoning Change	Number of Potential New Parcels	Potential Acreage Affected
Agriculture		
Ag20 to Ag10	1,780	1,780 parcels @ 10 acres each = 17,800 acres
Ag20 to Ag5	178	178 parcels @ 5 acres each = 890 acres
Subtotal Agriculture	**1,958**	**9,94518,690 acres**
Rural		
R20/R10/R5 to R1	739	739 parcels @ 1 acre each = 739 acres
R20/R10/R5 to R2.5	3,019	3,019 parcels @2.5 acres each = 7,548 acres
R20/R10 to R5	6,122	6,122 parcels @ 5 acres each = 30,610 acres
Subtotal Rural	**9,880**	**13,11238,897**
Forest Resource		
FR80	7	7 parcels @ 80 acres each = 560 acres
FR80 to FT40	30	30 parcels @ 40 acres each = 1,200 acres
FT80/FR40 to FT20	93	93 parcels @ 20 acres each = 1,860 acres
FT80/FR40 to FT10	433	433 parcels @ 10 acres each = 4,330 acres
Subtotal Forest	**563**	**7,950**
TOTAL	**12,401**	**65,537 acres**

As described for Alternative 2, some level of cumulative impact may occur as the basins become more developed. Increased development leads to more impervious surface, which increases pollutants entering surface and groundwater. Reduction in vegetation cover in a basin can lead to changes in hydrology and alteration of biological communities. The level of impact for an individual drainage basin would depend on many factors, such as geology and hydrology of the basin, how much of the basin is already developed, the effectiveness of existing and new stormwater management systems, the location and intensity of new development, and the sensitivity of resources such as fish-bearing streams. Development of new lots under Alternative 4 would be subject to project-specific review and regulations intended to avoid and minimize impacts on aquatic resources.

As previously stated, groundwater contamination has already occurred in some areas due to increased development and water consumption. When demand increases, water withdrawal can overwhelm the aquifer's ability to infiltrate. The additional development that would be allowed under Alternative 4 would in turn increase the number of new water wells in rural areas, and thus increase the risk of both contamination and reducing water supply.

Overall, this alternative could have a high level of impact on water resources, such as contamination and decreased water supply, if the parcels are built out to their full potential under the proposed zoning changes.

3.3.3 How do the potential impacts between the alternatives compare?

Table 3-5 summarizes the water resources impacts of the alternatives.

Table 3-5. Summary of Water Resources Impacts by Alternative

Alternative 1 - No Action	Alternative 2 - Countywide Modifications	Alternative 3 - City UGA Expansion	Alternative 4 - Rural, Agriculture, and Forest Changes
Moderate potential for impacts. More intensive development within UGAs could affect aquatic resources.	Second highest potential for impacts of all alternatives due to potential for more intensive development of over 34,000 acres. Individual projects on upzoned parcels could have individually small but cumulatively moderate impacts on aquatic resources. Potential localized impacts with UGA changes; could be mitigated during project-specific review.	Moderate potential for impacts. Potential localized impacts with UGA changes; could be mitigated during project-specific review.	Highest potential for impacts of all alternatives due to potential for more intensive development on 65,500 acres. Individual projects on upzoned parcels could contribute to cumulative impacts on aquatic resources.

3.4 Are there adverse impacts that cannot be avoided?

Development projects that propose to impact water resources are regulated by local critical areas codes and state regulations governing water quality. These regulations require impacts to be avoided and minimized, and unavoidable impacts require compensatory mitigation. These measures help to ensure no net loss of ecological functions on an individual project scale. However, some small level of impact may still occur with each new development. While mitigation is typically required, it is not always successful. Some small-scale activities are exempt from local critical areas review. These small impacts added together can contribute to cumulative effects on local aquatic resources as the drainage basins become more developed. Cumulative impacts would include an increased number of water wells, which in turn increase the potential for groundwater contamination and reduction of water supply, increases in impervious surface that contribute to stormwater runoff, and vegetation clearing that considerably degrade the quality of streams and other surface waters.

3.5 Mitigation

3.5.1 Are there mitigation measures beyond regulations that reduce the potential for impacts?

In addition to the regulations discussed above, the County could encourage low impact development (LID) features for new development where appropriate, to reduce stormwater impacts. LID approaches are being considered as part of the County's update to its stormwater manual. The County could consider incentives for private property owners to add LID features such as rain gardens to existing developed areas.

The measures identified in Chapter 4 for fish and wildlife would also benefit water resources. For example, restoring riparian vegetation along streams would provide more shade and help to lower water temperatures, which would also increase dissolved oxygen levels in the stream.

Provisions for clustering under Alternatives 2 and 4 could help minimize the amount of new wells needed to supply drinking water and the amount of vegetation clearing that would impact streams and wetlands. Zoning code changes to allow lower minimum lot sizes under either Alternatives 2 or 4 could include requirements for cluster development when considering applications for subdivision. This mitigation measure could help reduce the effects of increased development on water resources.