TECHNICAL MEMORANDUM

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From:	Michael Klisch, LHG. and David Banton, LHG		
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RE: BEST AVAILABLE SCIENCE UPDATE FOR CRITICAL AQUIFER RECHARGE AREAS (SHALLOW GRAVEL AQUIFER), WALLA WALLA COUNTY

This technical memorandum includes a review of the geologic, hydrogeologic, land use, contaminated and regulated sites, and water quality information for the Shallow Gravel Aquifer (SGA) in Walla Walla County (County). The information review served as the framework for the development of a susceptibility matrix for the SGA and an assessment of aquifer vulnerability to determine the Critical Aquifer Recharge Area (CARA) for the SGA.

The extent of the SGA as designated by Walla Walla County (County) is shown on Figure 1. The SGA as delineated by the County encompasses a large area of Walla Walla County from the Washington-Oregon state line on the south to approximately Dry Creek on the north, and from the eastern part of the City of Walla Walla westward to the west of Touchet. It includes the area of the Cities of Walla Walla and College Place (Cities) and the area of Walla Walla County surrounding the Cities where permeable sand and gravel deposits are exposed at the ground surface or are present beneath other geologic materials. The SGA delineated by the County does not include alluvial sands and gravels within the Touchet River and Dry Creek valleys and in other surface water bodies that are continuous with the SGA area delineated by the County.

The SGA delineated by the County is a sub-area within the boundaries of the Walla Walla River Water Resources Inventory Area (WRIA) 32 delineated by the Washington State Department of Ecology (Ecology) which encompasses much of Walla Walla County (Figure 1). The WRIA 32 boundary delineated by Ecology includes the topographic catchment of the Walla Walla River and its tributaries and also includes areas of Walla Walla County where surface water discharges to the Snake and Columbia Rivers. The topographic catchment of Walla Walla River shown on Figure 1 includes that area of the SGA delineated by the County, and also includes the alluvial valleys of rivers and streams tributary to the Walla Walla River that are continuous with the SGA. The catchment of the Walla Walla River including the area of the SGA delineated by the County is referred to as the “SGA Study Area” in this technical memorandum.

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1.0 SHALLOW GRAVEL AQUIFER

Information on the geology, extent, and hydrogeologic properties of the SGA Study Area was obtained from existing reports, maps, and databases. These are listed in Section 6 (References).

1.1 Setting

The extent of the SGA as delineated by the County is shown on Figure 1. The SGA occurs in the upper 100 to 300 feet of the unconsolidated alluvial and Miocene coarse-grained materials (conglomerate) overlying Miocene fine-grained sediments and Columbia River Basalt Group (CRBG) bedrock. The greatest thickness of the SGA occurs in the Walla Walla Valley from the City of Walla Walla west to the area west of Touchet (Figure 1). Numerous domestic and irrigation wells are completed in the SGA, along with a number of Group A and B public water system wells. Well yields range from about 10 gpm for small-diameter domestic wells to over 500 gpm for properly-constructed irrigation wells.

Groundwater in the SGA occurs under unconfined to semi-confined conditions. The depth to water in the SGA generally ranges between about 5 feet below ground surface to 50 to 75 feet below ground surface.

1.1.1 Recharge

The SGA is recharged by infiltration of precipitation and snowmelt over the entire area where the SGA is exposed at the ground surface or is present below other geologic units such as loess or Touchet Beds. Groundwater recharge also occurs from surface water from losing stream reaches, infiltration of irrigation water from return flows or canal seepage, and groundwater discharge from the underlying basalt aquifers.

United States Geological Survey (USGS) groundwater modeling studies conducted using the Deep Percolation Model as part of the Columbia Plateau Regional Aquifer System Analysis estimated the pre-development recharge (prior to the development of irrigation) to the shallow aquifer in the Walla Walla valley was about 56,000 acre-feet per year, or about 1.5 inches per year (Bauer and Vaccaro 1988). The USGS estimated that recharge to the SGA increased to about 129,000 acre-feet per year, or about 3.3 inches per year, following development of irrigation because of seepage from canals and infiltration of return flows.

The SGA also receives an estimated 10,000 acre-feet per year of recharge from upwelling (discharge) from the underlying basalt aquifer (Barker and Mac Nish 1976), based on groundwater modeling of an area of about 120,000 acres. The areas where recharge to the SGA occurs from upwelling were not described by Barker and Mac Nish, but would likely occur where an upward component of hydraulic gradient occurs between the basalt aquifer and the SGA, such as in areas of flowing artesian wells, for example near College Place or in the vicinity of City of Walla Walla Well No. 4. Recharge to the SGA could also occur in areas where groundwater in the underlying basalt aquifer system backs up against low-permeability faults (Newcomb 1965). The recharge from upwelling from the basalt aquifer was estimated by Barker and Mac Nish to be equivalent to about 1 inch per year.

Groundwater recharge can also be estimated using stream baseflow. Baseflow was estimated for several gaging stations on Mill Creek, Yellowhawk Creek, and the Walla Walla River (Golder 2007). Based on baseflow evaluations, annual groundwater recharge was estimated to range from about 1 to 2 inches in the middle and lower reaches of Mill Creek and the Walla Walla River between the Washington-Oregon state line and the Mill Creek confluence.

1.1.2 Discharge

Groundwater in the SGA discharges to seeps and springs, to gaining reaches of streams such as the lower reaches of Mill Creek and the Walla Walla River, to wells, springs, and to evapotranspiration in areas where the water table is close to the surface. The SGA also discharges to the underlying basalt aquifer where a downward component of hydraulic gradient occurs.

1.2 Groundwater and Surface Water Interaction

1.2.1 Ecology Hydraulic Continuity Studies

The Department of Ecology evaluated hydraulic continuity between surface water and the SGA in Mill Creek, Yellowhawk Creek, the Touchet River, and the Walla Walla River as part of ongoing water quality (Total Maximum Daily Load) work in the Walla Walla watershed (Marti 2005). Ecology installed mini-piezometers in the streambeds to evaluate head differences between the stream stage and shallow groundwater below the streambed, and to collect water temperature and specific conductance data. Ecology also conducted seepage runs over selected reaches of Mill Creek, Yellowhawk Creek, and the Touchet River. A seepage run is a set of near-simultaneous measurements of all inflows and outflows, including tributaries, diversions, and return flows, over a stream reach. A water budget is developed based on the measured inflows and outflows, and the discrepancy in the water budget is attributable to inflow or outflow through the stream bed. The seepage run assumes any unaccounted for water is seepage out of the stream to groundwater, or seepage to the stream from groundwater.

The results of Ecology's evaluations are summarized below:

Mill Creek - Ecology installed mini-piezometers in several locations between the Washington-Oregon state line and the Mill Creek flood diversion structure. Over this reach, the river flows out of the Blue Mountains, where the channel is primarily within bedrock with a thin veneer of alluvial sediments, to alluvial fan deposits near Walla Walla, where the alluvial materials in the channel are significantly thicker. The mini-piezometers indicated a downward component of hydraulic gradient between the creek and shallow groundwater in this reach between mid-July and mid-October 2002, indicating seepage from the creek to the SGA was occurring. No mini-piezometers were installed in the channelized portion of Mill Creek below the Yellowhawk diversion structure. Below the channelized portion of Mill Creek, in the lower reaches of the stream where the alluvial fan deposits are finer, an upward component of hydraulic

gradient between the SGA and creek was observed in July, indicating seepage of shallow groundwater to the creek. The hydraulic gradient was reversed in September and October 2002.

Evaluation of streamflow data collected between the USGS gages at Kooskooskie, 5-Mile Road Bridge, and Walla Walla (Golder 2007) indicates that baseflow in Mill Creek increases moving downstream. However, based on mini-piezometers, seepage from Mill Creek to the SGA is also occurring over this reach. Further downstream, below the channelized section to Swegle Road, baseflow in Mill Creek decreases because of diversions and seepage from the creek to the SGA.

Seepage runs conducted in the headwaters area where the channel is on basalt indicated Mill Creek gains groundwater in this area.

Yellowhawk Creek - Several mini-piezometers were installed on Yellowhawk Creek between the diversion structure and the confluence with the Walla Walla River, where the creek flows over a broad alluvial fan. A seepage run was also conducted over this reach in July 2002. The results of the seepage run indicated streamflow in Yellowhawk Creek decreased by about 4.5 cfs over the central portion of the reach. The mini-piezometers indicated a strong downward component of hydraulic gradient between the creek bed and the SGA in this reach. Further downstream, immediately above the confluence with the Walla Walla River, the vertical component of hydraulic gradient between the creek and SGA was directed downward in July 2002, and upward in August 2002.

Touchet River – Ecology installed mini-piezometers on the Touchet River between the confluence with the Walla Walla River upstream to the Walla Walla – Columbia County line. Ecology also installed mini-piezometers on Touchet River tributaries in Columbia County, and conducted seepage runs in August 2002. The Ecology data suggested that downstream of Waitsburg, the river loses a considerable amount of flow until just above the confluence with the Walla Walla River. Seepage runs over several reaches in the area between Waitsburg and the Walla Walla River confluence suggested that the river lost between about 1 and 15 cfs depending on the reach. The riverbed consists of poorly-sorted coarse gravel and sand over this reach. Near the confluence with the Walla Walla River, the SGA becomes thinner and the water table is near the river stage and groundwater in the SGA discharges to the Touchet River.

Walla Walla River - Ecology installed mini-piezometers between the Washington-Oregon state line and the Whitman Mission in the Walla Walla River. These mini-piezometers indicated a downward component of hydraulic gradient between the river and the SGA between July and October 2002. Stream gaging conducted by Ecology at the Washington-Oregon state line (Pepper Bridge gage) and Beet Road gage indicates streamflow in the river increases over this reach, however, ungaged tributary inflows from several creeks and the East Little Walla Walla River, and irrigation outflows are not included. Further west, the alluvial fan deposits become finer and mini-piezometers indicate an upward component of

hydraulic gradient between the river and shallow groundwater. No seepage runs were performed by Ecology on the Walla Walla River.

1.2.1.1 Summary of Ecology Studies

The Ecology studies indicate that groundwater in the SGA is recharged by streams flowing across the SGA. Recharge to the SGA occurs in the upper reaches of Mill Creek and along Yellowhawk Creek. In other areas such as lower Mill Creek and parts of the Walla Walla River, the SGA discharges to surface water at least part of the year. However, the interaction between the SGA and surface water is complex and streams can gain and lose water over relatively short distances, or vary seasonally, based on the Ecology studies.

1.3 Groundwater Recharge Areas

Surface recharge to the SGA Study Area occurs by direct infiltration of precipitation or snowmelt to the aquifer, infiltration of irrigation water, and from streams and rivers in losing reaches. Direct infiltration of precipitation to the aquifer occurs over the entire extent of the SGA (unless covered with impermeable surfaces such as buildings or paved areas), but the rate of recharge is variable depending on the geologic units and soil properties of the materials exposed at the ground surface. Groundwater recharge areas are shown on Figure 1. There are two principal zones of groundwater recharge in the SGA Study Area:

- **Zone 1** - The area where the SGA is exposed at the ground surface in the Walla Walla valley. This occurs primarily in the low-lying areas of the Walla Walla valley along the major rivers and streams such as the Walla Walla River, Mill Creek, Yellowhawk Creek, and Dry Creek. The SGA receives groundwater recharge from direct infiltration of precipitation, snowmelt, irrigation returns, and groundwater discharge from streams. The alluvial and Miocene conglomerate materials are moderately to highly permeable. Groundwater recharge in these areas is higher than in areas where the SGA is not exposed at the ground surface. The amount of recharge through these materials has not been determined but is likely in the range of 2 to more than 10 inches per year based on USGS modeling (Bauer and Vaccaro 1988).
- **Zone 2** – Zone 2 is the area where the SGA is not exposed at the ground surface but underlies loess and Touchet Beds in the upland areas north and east of the Walla Walla valley. The SGA receives groundwater recharge from infiltration of precipitation, snowmelt, and irrigation returns. Because the loess and Touchet Bed materials at the ground surface are fine-grained, the permeability of these materials is low and groundwater recharge is also low. The amount of recharge through these materials has not been determined but is likely in the range of 0.1 to about 1 to 2 inches per year based on USGS modeling (Bauer and Vaccaro 1988). Runoff and small surface water drainages are a source of groundwater recharge to the SGA in Zone 2. USGS topographic maps (i.e. Walla Walla and College Place 7.5-minute quadrangles) show small drainages originating in upland areas mantled with loess or Touchet Beds disappearing as they flow off of the upland areas onto the alluvial valleys of streams such as Dry Creek, Russell Creek, and the Touchet River, indicating these small streams are a source of recharge to the SGA.

The Miocene Conglomerate is generally not exposed at the ground surface except for a small area on the south side of the Cottonwood Creek valley south of Walla Walla (Derkey et all 2006). Direct groundwater

recharge to the Miocene Conglomerate is likely slightly lower than to the alluvial materials because of the varying degree of cementing of the conglomerate, reducing the hydraulic conductivity in comparison to the unconsolidated (uncemented) alluvial materials.

Groundwater recharge for the Columbia Plateau (including Walla Walla) was estimated by the USGS (Bauer and Vaccaro 1988). The USGS estimated recharge for pre- and post-irrigation development conditions. For the Walla Walla model zone, which includes the SGA and some of the surrounding areas to the north and south where loess and Touchet beds are exposed at the ground surface overlying the SGA, they estimated pre-development recharge to be 1.45 inches per year. Within the Walla Walla model zone, recharge was estimated to range from about 0.1 inches per year to about 1 to 2 inches per year in the area of the SGA.

The USGS work estimated that recharge increased to about 3.33 inches per year over the Walla Walla model zone with the development of irrigation, with estimated recharge ranging from 2 to more than 10 inches per year in the SGA Study Area. This suggests that infiltration of irrigation water is an important component of groundwater recharge to the SGA. This includes infiltration of irrigation, return flows, and seepage of water from creeks that are supplied with water from the Mill Creek diversion, including Yellowhawk and Garrison Creeks, to the SGA.

Ecology surface water-groundwater interaction studies (Marti 2005) demonstrated that the SGA is recharged by infiltration of water from streams that cross the SGA. This occurs in the upper reaches of Mill Creek and other creeks where the streams flow out of the Blue Mountains foothills and start to flow across the alluvial materials at the surface of the SGA. There is also seepage from streams where as they flow across the broad alluvial materials at the surface of the SGA in the Walla Walla valley. However groundwater-surface water interactions in the lower reaches of the streams are complex and the streams may gain or lose water over short reaches, or the gaining and losing reaches may vary seasonally depending on streamflows and groundwater levels.

1.4 Geology

The geologic units in the SGA Study Area were described in detail by Newcomb (1965), Derkey et al (2006), and Washington State Department of Natural Resources (2011). The soils and geologic units exposed at the ground surface are shown on Figure 2. The geologic units that are exposed at the ground surface within the SGA Study Area include:

- **Alluvium** consisting of unconsolidated deposits of sand, gravel, silt, and clay found in and adjacent to streams and rivers on the valley floor. The alluvial materials do not contain basalt clasts and are not cemented. The alluvium is up to 50 feet thick.
- **Touchet Beds** consisting of glacial slackwater deposits of fine sand and silt. The Touchet Beds are up to 200 feet thick.

- **Loess** consisting of windblown fine sand, slit, and clay ranging from about 5 to 50 feet thick underlying Touchet Beds.
- **Miocene Conglomerate** consisting of variably cemented sandy gravel with a muddy to sandy matrix. In comparison with the alluvial materials, the clasts are primarily basaltic. The Miocene Conglomerate underlies much of the Walla Walla valley and is up to 300 feet thick.

These units are unconsolidated or semi-consolidated. The SGA Study Area is underlain by Miocene fine-grained sediments and bedrock of the CRBG. The CRBG has been folded, resulting in the formation of a syncline. The axis of the syncline is parallel to the axis of the Walla Walla Valley. The thickest portion of unconsolidated sediment is present along the axis of the syncline. The thickness of the sediments decreases to the north as the basalt surface rises. The thickness of the sediments also decreases west of Touchet as the basalt surface rises.

Geologic cross-sections presented in Derkey et all (2006) show the Miocene Conglomerate extending from the Oregon border to north of Dry Creek. North of Dry Creek, the thickness of the Miocene Conglomerate decreases as the surface of the CRBG rises. The CRBG is exposed in the valleys of unnamed tributaries to Dry Creek on the north side of Dry Creek, and in the valley of the Touchet River, suggesting the SGA is not present in the subsurface north of Dry Creek and the Touchet River with the exception of the alluvial valleys of Dry Creek and the Touchet River and their major tributaries.

1.4.1 Hydraulic Properties

Based on previous groundwater modeling studies (Barker and Mac Nish 1976), the transmissivity of the SGA (alluvium and Miocene Conglomerate) in the Walla Walla Basin ranges from about 10,000 ft^2/d to 60,000 ft^2/d, and the hydraulic conductivity ranges from about 13 ft/d to 650 ft/d. The hydraulic conductivity of the loess and Touchet Beds is likely lower because of the finer-grained nature of these materials.

The transmissivity of the SGA in the vicinity of the City of Walla Walla was estimated based on specific capacity data from wells completed in the SGA in the Walla Walla – College Place area. The specific capacity, or a well's pumping rate divided by the observed drawdown, can be used to estimate the aquifer transmissivity using the following relationship:

$$T = 2000\ Q/s/7.481$$

where

T is the transmissivity (ft^2/d);
Q is the pumping rate (gpm); and
s is the drawdown (feet).

The drawdown data were corrected to account for well efficiency before calculating the specific capacity. A well efficiency of 70 percent was assumed for the wells completed in the SGA. Using this relationship, the transmissivity of the SGA was estimated to range from 30 ft^2/d to 100,000 ft^2/d, with a mean and median transmissivity of 2,100 ft^2/d and 780 ft^2/d, respectively (Golder 2007). The highest transmissivity values are likely associated with the uncemented alluvial materials. The transmissivity of the Miocene Conglomerate material is likely lower because of the cementation of the geologic materials. The lowest transmissivity may be associated with wells completed in localized gravel lenses within underlying fine grained sediments, or in highly cemented gravel materials. The storativity (specific yield) of the SGA is estimated to be about 0.1 to 0.25, based on previous groundwater modeling work (Barker and Mac Nish 1976).

1.4.2 Aquifer Boundaries

The upper boundary of the SGA is the water table. The water table is a variable boundary because the position of the water table fluctuates over time with changes in recharge and discharge.

The lower boundary of the SGA is the low-permeability unconsolidated Miocene silt and clay that underlies the sand and gravel. At the margins of the SGA, the SGA pinches out against the basalt. This occurs north of Dry Creek and the Touchet River where the surface of the basalt rises. The basalt may represent a low-permeability boundary if the SGA is in contact with dense basalt flow interiors. If the SGA is in direct contact with a permeable interflow zone, groundwater exchange between the SGA and basalt aquifers occurs.

1.4.3 Groundwater Flow

Groundwater in the SGA in the Walla Walla valley generally flows to the west from the upland areas east of Walla Walla. The groundwater elevation in the SGA generally reflects the topography being highest beneath areas of higher elevation and lowest beneath areas of lower elevation. The hydraulic gradient in the SGA ranges from about 0.017 ft/mile in the upper part of the Mill Creek valley to about 0.008 ft/mile west of College Place.

2.0 SUSCEPTIBILITY ANALYSIS

Aquifer susceptibility is defined as the ease with which groundwater can be recharged, how it travels in the subsurface, and the characteristics of the aquifer that determine how contaminants travel and attenuate (Ecology 2005). Aquifer susceptibility is dependent on a number of factors including (Ecology 2005):

- **Vadose Zone** - The thickness of the unsaturated materials above the aquifer determines how fast the aquifer is recharged. The greater the thickness, the longer time it takes for water from the surface to reach the aquifer.
- **Hydraulic Conductivity** – The hydraulic conductivity determines the rate at which water can infiltrate and travel in the subsurface. Water infiltrates and travels faster in materials

with higher hydraulic conductivity such as sand and gravel. Water infiltrates and travels slower in materials with a lower hydraulic conductivity such as silt and clay or cemented materials.

- **Chemical Retardation** – Materials such as clays and organic matter may react with some chemicals in the recharge water to slow their travel in the subsurface or chemically react with them.
- **Adsorption** – Some materials have a greater tendency to adsorb ions than others. This may be affected by particle size or the presence of things such as cements or iron or manganese oxides. A clean sand may have little adsorptive capacity, while a clay or organic-rich material may have high adsorptive capacity.
- **Low Permeability Layers** – Low permeability layers such as silt or clay layers, cemented zones, or caliche horizons, may restrict the downward movement of recharge water.
- **Hydraulic Continuity with Surface Water** – A high degree of hydraulic continuity with surface water in losing reaches of surface water results in high rates of groundwater recharge.

An unconfined aquifer composed of clean sand and gravel with a shallow depth to water with a high degree of continuity with surface water would be defined as high susceptibility because of the high permeability, little potential for attenuation or retardation of contaminants in the vadose zone, and high degree of continuity. A confined aquifer overlain by a significant thickness of low-permeability materials and limited continuity with surface water would be defined as low susceptibility.

A susceptibility analysis was developed for the SGA Study Area integrating the geologic, hydrogeologic, and soil properties and hydraulic continuity with surface water. Table 1 summarizes the susceptibility analysis. The SGA Study Area was subdivided into three zones for the purpose of the susceptibility analysis:

- **Zone 1** is where alluvial materials are exposed at the ground surface. These materials are generally moderately permeable with some areas of high permeability. The depth to groundwater is relatively shallow (from less than five to 50 feet below ground surface), and there is a high degree of continuity with surface water. Because these materials are generally sand and gravel, areas with fine materials and significant organic content are likely restricted to overbank deposits. Retardation and adsorption in the cleaner sand and gravels are likely low. Zone 1 is ranked as high susceptibility.
- **Zone 2** is where the Miocene Conglomerate is exposed at the ground surface. The permeability of these materials is variable depending on the degree of cementation and the matrix material, but is likely lower than the permeability of Zone 1. These materials are in continuity with surface water. The degree of continuity with surface water is likely less than Zone 1 because of the cemented nature of the materials, but may be similar in the stream beds where the conglomerate has been reworked. The depth to groundwater is relatively shallow from less than 5 to 50 feet below ground surface. The degree of retardation and adsorption in these materials is higher than in Zone 1 because of the cementation of the materials, possible presence of iron oxides on basalt clasts, and areas with a muddy (silt or clay matrix). Zone 2 is ranked as moderate to high susceptibility.
- **Zone 3** is where the Touchet Beds and loess are exposed at the ground surface. The permeability of these materials is lower than the alluvial and Miocene conglomerate materials because they consist of fine sand and silt. These materials are generally found

in upland areas and are generally not in continuity with surface water except for headwater areas of some streams. The degree of continuity with surface water is likely low because of the fine grained nature of the materials, however runoff from these areas can recharge Zones 1 and 2 where the surface water flows off Zone 3 and onto Zones 1 and 2. The depth to groundwater is greater than in Zones 1 and 2 because these materials are generally at higher elevations than Zones 1 or 2. The degree of retardation and adsorption in these materials is higher than in Zones 1 or 2 because of the fine-grained nature of the materials. Zone 3 is ranked as low to moderate susceptibility.

Figure 3 shows the results of the susceptibility analysis. The boundaries shown on Figure 3 for the susceptibility zones are approximate and based on published, large scale mapping. Zones 1 and 2 correspond with recharge Zone 1, and Zone 3 corresponds with recharge Zone 2 (Figure 1). Because Zone 2 occurs at the ground surface over a small area and the susceptibility of Zone 2 is similar to Zone 1, they are combined as one zone on Figure 3.

3.0 EXISTING GROUNDWATER USE, LAND USES, AND GROUNDWATER CONTAMINATION POTENTIAL

This section describes land use within the SGA Study Area and a summary of the potential sources of contamination that could impact the groundwater quality within the SGA.

3.1 Groundwater Use

3.1.1 Water Systems

Information on active groundwater-supplied water systems within the extent of the SGA Study Area was obtained from the Washington Department of Health (DOH 2011). Group A and B water systems within the SGA Study Area obtaining groundwater from the SGA in Walla Walla County are summarized in Table 2 and shown on Figure 4, along with the 10-year time-of-travel zone, if delineated, for Group A systems. Four of the eight Group A systems in the SGA have a 10-year time-of-travel delineated. The time-of-travel was delineated using simple fixed-radius methods and may not reflect the true capture zones of the wells because the fixed-radius method does not account for groundwater flow directions and the presence of aquifer boundaries such as streams.

DOH has rated the susceptibility of two of the Group A water systems (Table 2). None of the Group B systems were rated. The Group A systems that were rated by DOH are ranked as high and low to moderate susceptibility, respectively.

3.1.2 Permit Exempt Wells

There are numerous permit-exempt wells completed in the SGA Study Area. Most of these wells are used for domestic water supply at single residences outside of water system service areas. The locations of permit-exempt wells in Walla Walla County were obtained from Ecology on-line databases (2011a) and are shown on Figure 5. The wells in the Ecology database are generally located to the ¼-¼ section (+/- 660 feet) based on the location reported on the well log, however, some wells may be located to the ¼

section (+/-1,320 feet) or section (+/- 2,640 feet). The database does not include information on geology for each well. The location of wells potentially completed in the SGA was estimated assuming that wells less than 300 feet deep are completed in the SGA because the SGA extends to about 300 feet below ground in the area delineated by the County. North of the area delineated by the County, the base of the SGA may be shallower.

Most of the permit-exempt wells are located in developed areas south or west of the Cities of Walla Walla and College Place and around Touchet and Lowden. There are relatively few wells north of the Walla Walla River, where land use is primarily agricultural, with the exception of the areas around Prescott and Waitsburg and along the Touchet River.

3.1.3 Contaminated and Regulated Sites

Databases of regulated and contaminated sites maintained by Ecology (2011a and 2011b) and the United States Environmental Protection Agency (EPA 2011) were searched to locate known contaminated sites and sites where hazardous materials that could affect groundwater if released are stored or handled in the SGA Study Area.

There are no sites under EPA jurisdiction (Brownfields, Oil, RCRA Corrective Action, or Superfund sites) in SGA Study Area.

Ecology's Facility Index/Sites Database (Ecology 2011b) includes all sites ("Ecology sites") that are regulated or registered with Ecology. Some of these sites have the potential to impact groundwater quality, including:

- Hazardous waste generators or sites where hazardous materials are stored
- Sites with underground storage tanks
- Sites where hazardous materials have been released

Ecology sites with the potential to impact groundwater quality within the SGA Study Area in Walla Walla County are shown on Figure 6 and summarized on Table 3. There are 153 sites within the SGA Study Area that have the potential to impact groundwater. Most of the sites are located in four areas:

- There is a cluster of sites located at the Walla Walla Airport east of the City of Walla Walla. This area is underlain by Touchet Beds.
- There are a number of sites located south and west of the City limits of Walla Walla and College Place. Most of these sites are underlain by alluvium.
- There are several sites located near Touchet that are underlain by alluvium.
- There are several sites located outside of Waitsburg and Prescott that are underlain by alluvium.

The remaining sites are located between Walla Walla and Touchet and are generally located in areas underlain by alluvium, or are scattered around the County and located in areas underlain by loess or Touchet Beds.

The Ecology sites are summarized as follows:

- There are 25 sites listed as having releases to the environment. This includes sites in the Voluntary Cleanup Program, leaking underground storage tank (LUST) sites, or independent cleanup sites. Most of the sites are LUST sites. Of the 25 sites, 11 had reported or suspected some impact to the groundwater system above cleanup levels, but these sites have been cleaned up or are undergoing cleanup.
- The remaining sites include sites with registered underground storage tanks or where some quantity above regulatory thresholds (not defined for each site) of hazardous materials are generated or stored. Most of the registered underground storage tanks have been removed or closed in place. There are several sites that have operational underground storage tanks.

3.2 Existing Land Uses

Land use zoning in the SGA study area is shown on Figure 7. Almost the entire SGA study area is outside the urban growth area and is zoned for agricultural uses. Most of the area has 40 acre zoning, but 120 acre and 10 acre zoning also comprise large portions of the study area.

A small portion of the SGA study area lies in the urban growth areas surrounding the cities of Walla Walla, College Place, Waitsburg and Prescott. Some of these areas are zoned for residential uses. Two areas are zoned for heavy industrial uses: on the north and west sides of Walla Walla; and two areas are zoned for light industrial uses: one east of Walla Walla and one west of College Place. There is also an area zoned for general commercial use south of College Place. Some of the sites in the Ecology database are in these commercial and industrial areas, and they represent potential sources of contamination. There are also numerous Ecology sites at the Walla Walla airport, which is zoned as airport development. Airport development zoning allows a variety of commercial and industrial uses.

3.3 Existing Areas of Impacted Groundwater in the SGA

The DOH (2011) database was queried to find public water systems within the SGA Study Area that may have existing groundwater impacts from volatile organic compounds (VOC) or synthetic organic compounds (SOC) and nitrate over the period January 2000 through June 2011. The organic constituents are not naturally found in groundwater, and nitrate concentrations above about 3 mg/L suggest some impact from sources of nitrate at the surface (Ecology 2011c). Thus, detections of SOCs or VOCs and nitrate concentrations above 3 mg/L suggest migration of these constituents in infiltrating recharge from sources near the surface such as irrigation returns, contaminated sites, or poor management and application of pesticides or herbicides (SOC compounds).

No water systems in the SGA Study Area were identified having VOC concentrations that exceeded applicable drinking water criteria under WAC 246-290-310 *Maximum contaminant levels (MCLs) and maximum residual disinfection levels*. Ecology (2011c) identified several water systems in Walla Walla County where VOC were detected at concentrations above the detection limit but below the reporting limit. Two of these systems are within the area contributing groundwater recharge to the SGA:

- Methylene chloride (dichloromethane) was detected at 3.31 μg/L in a sample collected at the Touchet School in 2002. The MCL for methylene chloride is 5 μg/L.
- Ethyl benzene, o-xylene, and total xylene were detected in a sample collected at the Walla Walla Labor Home. Ethyl benzene was detected at 0.6 μg/L, well below the MCL of 700 μg/L. Total xylene was detected at 3.5 μg/L, well below the MCL of 1,000 μg/L. There is no MCL for o-xylene.

One SOC constituent (DCPA Acid Metabolites) was detected in three Group A water systems:

- Walla Walla Labor Home
- Walla Walla River Packing & Storing
- Hill Top Acres

DCPA Acid Metabolites were detected at concentrations ranging from 0.2 to 21.5 μg/L. DCPA Acid Metabolites are degradation products of the herbicide Dacthal (dimethyl tetrachloroterephthalate). There is no MCL for DCPA or DCPA Acid Metabolites.

Nitrate concentrations for Group A and B water systems in the SGA that were above the DOH reporting limit of 5 mg/L nitrate as N are summarized on Table 4. Thirty systems reported nitrate concentrations greater than 5 mg/L-N. Nitrate was detected in four water systems in the SGA at concentrations ranging from 10.2 to 24.5 mg/L-N, above the primary drinking water criterion of 10 mg/L-N.

Ecology (1995) sampled 26 domestic wells (not Group A or B wells) and one irrigation well completed in the SGA Study Area for nitrate and pesticides. The wells ranged in depth from 15 to 100 feet, and were located south and west of the Cities of Walla Walla and College Place. Pesticides were detected in 14 of the 27 sampled wells. DCPA was the most commonly detected pesticide, occurring in 11 of the wells. Other pesticides were also found smaller numbers of wells. All pesticide concentrations were below the drinking water criteria.

Nitrate was detected in all of the sampled wells at concentrations ranging from 0.1 to 23.0 mg/L-N. Nitrate concentrations in 7 of the wells exceeded the primary drinking water criterion (10 mg/L-N), and 11 wells had concentrations greater than 5 mg/L.

4.0 VULNERABILITY ASSESSMENT

The vulnerability of the aquifer combines the risk of contamination with the susceptibility of the aquifer. The risk of contamination can be from current and future point and non-point sources. Review of contaminated sites, sites that process or store hazardous materials, current land use and zoning, and areas with groundwater quality impacts in the form of elevated nitrate (Morgan 2011) suggests that there are areas within the SGA Study Area that are vulnerable to contamination. The SGA is used as a source of drinking water for both public water systems and private wells in most areas outside the Cities of Walla Walla, College Place, Waitsburg, and Prescott.

The most vulnerable areas of the SGA Study Area are where potential or existing sources of contamination occur where the alluvial materials and Miocene Conglomerate are exposed at the ground surface and the SGA is used as a source of drinking water. This includes most of the area south and west of the Cities of Walla Walla and College Place adjacent to surface water with the exception of the upland areas, and the alluvial channels of rivers and streams in the areas north and east of Walla Walla and College Place. The materials in these areas are highly permeable, allowing contaminants to enter and travel rapidly in the groundwater system. The alluvial materials have a low attenuation and adsorption capacity, so there will be little reduction in contaminant concentrations from attenuation or retardation.

In areas where loess or Touchet Beds are exposed at the ground surface, the vulnerability will be lower because of the low permeability of the geologic materials and because of the greater attenuation and adsorption capacity of the fine grained materials. Contaminants infiltrating in these areas will take longer to reach groundwater, and the concentrations are likely to be reduced through attenuation and adsorption before reaching the water table. A summary of aquifer vulnerability is presented on Table 5.

Based on the review of land use and zoning, locations of contaminated and hazardous materials sites, and the presence of elevated nitrate concentrations along with detections of pesticides in wells completed in the SGA Study Area suggests that the SGA is vulnerable to groundwater contamination from a variety of sources, and there is a strong hydraulic connection between sources of recharge including surface water and irrigation infiltration or return flows and the SGA.

Aquifer vulnerability is shown on Figure 8. The boundaries shown on Figure 8 for the aquifer vulnerability are approximate and based on published, large scale mapping. Aquifer vulnerability was classified as follows:

- Zone 1 is high vulnerability and includes the area where the susceptibility was rated as moderate to high (Zones 1 and 2, Figure 3) and there are a high density of potential contaminant sources such as sites in the Ecology database (Figure 6) or where zoning could permit potential sources of contamination to be located such as light or heavy industrial, commercial, or airport development (Figure 7). Zone 1 also includes areas

with a high density of Group A and B public water systems and domestic wells (Figures 4 and 5, respectively). The high vulnerability areas are around the Cities of Walla Walla, College Place, Prescott, and Waitsburg;Touchet; and the Walla Walla Airport (Figure 8).

- Zone 2 is moderate vulnerability. Zone 2 is the area within the area of the SGA delineated by the County (Figure 1) where the SGA is not present at the ground surface but is present below loess or Touchet Beds which are low susceptibility (Figure 3). This includes the upland areas south and west the Cities of Walla Walla and College Place (Figure 8).
- Zone 3 is low vulnerability and includes the area where the susceptibility was rated as low (Zone 3, Figure 3) and there are a low density of potential contaminant sources such as sites in the Ecology database (Figure 6) or where zoning would not permit potential sources of contamination to be located such as light or heavy industrial, commercial, or airport development (Figure 7). The density of Group A and B water systems (Figure 4) and domestic wells (Figure 5) is low in this zone. This includes most of the area north of the Cities of Walla Walla and College Place and west of Touchet with the exception of areas along the Touchet River and Dry Creek and other surface water bodies (Figure 8) where the SGA is not present at the surface or below Touchet Beds.

5.0 REVISED CRITICAL AQUIFER RECHARGE AREAS

Critical Aquifer Recharge Areas are designed to protect sources of potable water supply from contamination. The SGA CARA designated under Walla Walla County Code 18.08.210 were originally delineated as the wellhead protection areas (10-year time for travel) for all public water supply systems within Walla Walla County (SGA and basalt systems) (HDR, Inc. 2008). Glover (2010a and 2010b) proposed to also include areas within 200 feet of the ordinary high water mark of reaches of streams above 750 feet in elevation as part of the SGA CARA. The streams being proposed by Glover for inclusion in the CARA were:

- Birch Creek
- Blue Creek
- Cottonwood Creek
- Garrison Creek
- Little Blue Creek
- Mill Creek
- Russell Creek
- Reser Creek
- Titus Creek
- Stone Creek
- Yellowhawk Creek
- Walla Walla River

The revised CARA for the SGA Study Area in Walla Walla County are shown on Figure 9. The revised CARA map is based on the vulnerability assessment (Figure 8). The CARA delineated on Figure 9 is the portion of the SGA Study Area that was rated as highly vulnerable (Zone 1 on Figure 8). In comparison

with the original delineation based wellhead protection areas (Map1 of Walla Walla County Code 18.08.210) and Glover's (2010a) proposed revision (Exhibit B {Map 7}, Glover 2010a), the revised SGA CARA shown on Figure 9 includes the entire area where the alluvial and Miocene Conglomerate materials are exposed at the ground surface, including the alluvial channels along surface water bodies (vulnerability Zone 1, Figure 8). The revised SGA CARA shown on Figure 9 also includes the delineated wellhead protection areas for public water systems obtaining water from the SGA and all reaches of streams and irrigation canals including the streams listed above. The revised SGA CARA also includes the reaches of the Touchet River, Dry Creek, and other surface water bodies where permeable alluvial materials are present. The alluvium is moderately to highly permeable, has good hydraulic continuity with surface water, has a low attenuation and adsorption capacity, and has a shallow depth to groundwater. These factors make these areas susceptible to contamination.

The revised SGA CARA includes those areas of the SGA Study Area where alluvial and Miocene Conglomerate materials are exposed at the ground surface. The alluvium and Miocene Conglomerate are moderately to highly permeable, have good hydraulic continuity with surface water, have a low attenuation and adsorption capacity, and a shallow depth to groundwater. These factors make the SGA susceptible to contamination. Most of the industrial and commercial development in the SGA Study Area is in the area where these materials are at the ground surface, most of the existing and potential sources of groundwater contamination are in this area, and there are documented impacts to groundwater in the form of elevated nitrate and detections of SOC. Thus, this part of the SGA is vulnerable to contamination and is delineated as highly vulnerable (Zone 1, Figure 8).

The area where the SGA is overlain by loess and Touchet Beds is less susceptible to contamination because of the low permeability of the overlying fine-grained materials, greater depth to groundwater, and because the fine-grained materials have a higher attenuation and adsorption capacity than the coarse-grained sediments (vulnerability zone 2, Figure 8). Most of the development in the area where the SGA is underlain by loess and Touchet Beds is zoned for agricultural use, with few Ecology sites or water supply wells. Because this area is less vulnerable than Zone 1, it is not part of the SGA CARA.

The low vulnerability area (Zone 3, Figure 8) is not part of the SGA CARA because it is not underlain by permeable materials, the loess and Touchet Beds are low permeability, there are few Ecology sites in this area, and limited use of these materials for water supply.

The delineation of the SGA CARA was completed at a coarse, County-wide scale using existing large-scale mapping, rather than a site-specific assessment. The approximate location and extent of SGA CARA is shown on the map, and should be used as a guide for the County, project applicants and/or property owners, and may be updated as more detailed data becomes available.

6.0 CLOSING

Please contact us if you have any questions or comments

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List of Tables

List of Figures

TABLES

Table 1: Susceptibility Matrix

Geologic Unit[a]	Description	Saturated Hydraulic Conductivity[b] (cm/s)	Saturated Hydraulic Conductivity[b] (ft/d)	Depth to Water (feet)	Hydraulic Continuity with Surface Water	Attenuation and Adsorption Potential	Susceptibility Ranking Zone
Alluvium	Sand, gravel, silt, clay found in and adjacent to stream channels, up to 50 feet thick	0.004 to 705	11 to 2,000,000	5 to 50	Moderate to High	Low - little organic matter or fine-grained sediments, discontinous low permeability layers (if present) shallow depth to groundwater, moderate to high permeability	1 (high)
Conglomerate (Miocene)	Variably cemented sandy gravel with muddy to sandy matrix, up to 300 to 400 feet thick	0.004 to 14	11 to 40,000	5 to 50	Moderate	Moderate - some cementing, may have muddy fine-grained matrix, may have iron oxides on basalt clasts, shallow depth to groundwater, moderate permeability	2 (moderate to high)
Touchet Beds	Rhythmically bedded fine sand and silt, glacial slackwater deposits up to 200 feet thick	1E-5 to 14	0.03 to 14	>50	Low, however streams flowing across discharge to alluvium	Moderate to High - fine grained sand, silt, and clay, greater depth to water, low permeability.	3 (low to moderate)
Loess	Silt, clay, and fine sand deposited by wind up to 50 feet thick. Mantles and underlies Touchet Beds	1E-5 to 14	0.03 to 14	>50	Low, however streams flowing across discharge to alluvium	Moderate to High - fine grained sand, silt, and clay, greater depth to water, low permeability.	3 (low to moderate)

Notes:
a. From Derkey et al 2006
b. From Harrison et al 1964

Table 2: Group A and B Water Systems Competed in Shallow Gravel Aquifer

Water System Name	Water System Identification Number	Water System Group Code	Number of Sources	Location	Treatment	Source Susceptibility Rating
HILL TOP ACRES	07937 0	A	1	T6N/R35E-11 SWSE	CHLORINATION, HYPOCHLORITE	Not Rated
KPS Gas & Grocer (Touchet Travel Center)	88888 0	A	1	T7N/R33E-34 NWSE	No Source Treatments	Not Rated
PROSPECT HEIGHTS COMM WATER ASSN	69700 N	A	1	T7N/R36E-32 SWSE	No Source Treatments	Not Rated
THREE RIVERS WINERY	07430 Q	A	1	T7N/R35E-29 SWSE	ULTRAVIOLET RADIATION	Not Rated
TOUCHET SCHOOL	88890 4	A	1	T7N/R33E-34 SENW	No Source Treatments	High
WALLA WALLA LABOR HOME	92475 A	A	2	T6N/R35E-11 NESE	CHLORINATION, HYPOCHLORITE	Low and Moderate
Walla Walla River Packing & Storage	AA597 D	A	1	T7N/R34E-35 NWSW	CHLORINATION, HYPOCHLORITE	Not Rated
Amavi Cellars	AC473 J	B	1	T6N/R35E-12 SWNW	No Source Treatments	Not Rated
AYER JUNCTION	03440 Q	B	1	T13N/R35E-19 NESW	No Source Treatments	Not Rated
BASEL WATER SYSTEM	AA479 3	B	1	T6N/R35E-3 SWSE	ULTRAVIOLET RADIATION	Not Rated
Berghan Vineyards	AB055 J	B	1	T6N/R36E-17 SESW	No Source Treatments	Not Rated
BIAGI WATER SYSTEM	41392 X	B	1	T7N/R36E-5 NWSW	No Source Treatments	Not Rated
BOGART WATER SYSTEM	03597 R	B	1	T9N/R31E-31 NWNW	No Source Treatments	Not Rated
BOWE WATER SYSTEM	08102 N	B	1	T8N/R36E-31 NWNW	No Source Treatments	Not Rated
BROOKSHIRE TERRACE WATER SYSTEM	08785 2	B	1	T7N/R36E-34 NWSW	CHLORINATION, HYPOCHLORITE	Not Rated
Bunchgrass Winery	AB502 H	B	1	T7N/R35E-27 NENE	ULTRAVIOLET RADIATION	Not Rated
CARRIAGE HOUSE APARTMENTS	11277 R	B	1	T6N/R35E-13 SWNW	No Source Treatments	Not Rated
COLLEGE PLACE WWTP	11821 5	B	1	T6N/R35E-3 NWSW	No Source Treatments	Not Rated
Columbia Basin Rebar	00251 2	B	1	T8N/R30E-2 NESW	No Source Treatments	Not Rated
Cougar Crest Winery	AB399 H	B	1	T7N/R35E-31 NWNW	No Source Treatments	Not Rated
CRAMER TOM WATER SYSTEM	15809 1	B	1	T7N/R35E-27 SESW	No Source Treatments	Not Rated
DUFF, VERL WATER SYSTEM	02716 C	B	1	T7N/R36E-4 NWNW	No Source Treatments	Not Rated
DUNNING IRRIGATION SUPPLY	08402 2	B	1	T7N/R34E-29 SESW	No Source Treatments	Not Rated
Edward Lewis Water System	AB706 F	B	1	T6N/R37E-36 NWSW	No Source Treatments	Not Rated
Florida Power & Light	00595 J	B	1	T6N/R33E-3 NWNE	No Source Treatments	Not Rated
FRENCH TOWN HALL	06253 F	B	1	T7N/R34E-29 SENW	No Source Treatments	Not Rated
Frenchtown Historical Site	AC734 H	B	1	T7N/R34E-36 NWNW	No Source Treatments	Not Rated
Gardena Creek Winery	AB889 C	B	1	T6N/R33E-16 NENE	No Source Treatments	Not Rated
Garrison Creek Cellars	AB442 4	B	1	T6N/R36E-11 SESW	No Source Treatments	Not Rated
GLEN FIONA WINERY	08153 F	B	1	T6N/R36E-18 NENE	ION EXCHANGE	Not Rated
Glenncorrie	AC254 E	B	1	T7N/R34E-36 NWNE	ULTRAVIOLET RADIATION	Not Rated
Greenwalt Water Supply	AB348 J	B	1	T6N/R35E-3 SESE	No Source Treatments	Not Rated
HERBERT WATER SYSTEM	07440 0	B	1	T7N/R36E-33	No Source Treatments	Not Rated
HRB Partners, LLC	AB675 H	B	1	T6N/R36E-8 NWSW	No Source Treatments	Not Rated
ISENHOWER CELLARS	08415 V	B	1	T6N/R36E-6 NWNW	No Source Treatments	Not Rated
JOHNSON, WALTER WATER SUPPLY	36895 D	B	1	T7N/R36E-33 SWNE	CHLORINATION, HYPOCHLORITE	Not Rated
KLICKER WATER SYSTEM 1	15427 0	B	1	T7N/R36E-13 NWSW	SOURCE BLENDING	Not Rated
KLICKER WATER SYSTEM 2	02133 K	B	1	T7N/R36E-14 NESE	No Source Treatments	Not Rated
LA FRONTERA WATER SYSTEM	06190 U	B	1	T6N/R35E-11 NESE	No Source Treatments	Not Rated
Longshadows Vintners LLC	AB537 J	B	1	T7N/R35E-19 NWSW	CHLORINATION, HYPOCHLORITE	Not Rated
LOPEZ, BERNARDO WATER SYSTEM	02414 Y	B	1	T6N/R35E-11 NWSE	CHLORINATION, HYPOCHLORITE	Not Rated
MCGREGOR COMPANY	15151 9	B	1	T7N/R35E-35 SWNE	ULTRAVIOLET RADIATION	Not Rated
MCGREGOR COMPANY	15151 9	B	1	T7N/R35E-35 SWNE	CHLORINATION, HYPOCHLORITE	Not Rated
MCGREGOR COMPANY	15151 9	B	1	T7N/R35E-35 SWNE	No Source Treatments	Not Rated
NEW LIFE ASSEMBLY OF GOD	07511 V	B	1	T7N/R35E-31 NESW	No Source Treatments	Not Rated
NORQUIST-TAYLOR WATER SYSTEM	59975 9	B	1	T7N/R33E-34 NWSW	ULTRAVIOLET RADIATION	Not Rated
PATRICK M. PAUL VINEYARDS	51190 N	B	1	T7N/R36E-27 SWSW	No Source Treatments	Not Rated
PEPPER BRIDGE WINERY	07404 1	B	1	T6N/R35E-12 NESE	CHLORINATION, HYPOCHLORITE	Not Rated
Pheasant Creek Golf Course	AB990 K	B	1	T7N/R33E-27 NENE	CHLORINATION, HYPOCHLORITE	Not Rated
PROSPECT POINT GRANGE	10831 B	B	1	T7N/R36E-32 SWSW	No Source Treatments	Not Rated
RASMUSSENS WATER SYSTEM	71260 3	B	1	T7N/R33E-34 NESW	No Source Treatments	Not Rated
REININGER-TUCKER WATER SYSTEM	AA347 M	B	1	T7N/R35E-29 SWSE	CHLORINATION, HYPOCHLORITE	Not Rated

Table 2: Group A and B Water Systems Competed in Shallow Gravel Aquifer

Water System Name	Water System Identification Number	Water System Group Code	Number of Sources	Location	Treatment	Source Susceptibility Rating
ROBISON RANCH	73226 9	B	1	T7N/R36E-8 SWNW	No Source Treatments	Not Rated
ROSEWOOD WATER ASSOCIATION	00931 E	B	1	T6N/R36E-4 SENW	No Source Treatments	Not Rated
RULO WINERY	08128 9	B	1	T6N/R36E-6 SESW	CHLORINATION, HYPOCHLORITE	Not Rated
SAVIAH CELLARS	07720 V	B	1	T6N/R35E-13 NENW	CHLORINATION, HYPOCHLORITE	Not Rated
SEED HOUSE SALOON	64950 W	B	1	T7N/R33E-34 NESE	CHLORINATION, HYPOCHLORITE	Not Rated
Sleight of Hand	AC664 F	B	1	T6N/R35E-13 NENW	SOURCE BLENDING	Not Rated
Sole Rosso	AB827 C	B	1	T6N/R35E-2 NESE	CHLORINATION, HYPOCHLORITE	Not Rated
St. Basils Academy	AB935 6	B	1	T7N/R36E-34 NWSW	No Source Treatments	Not Rated
Tertulia Winery	AB687 K	B	1	T6N/R36E-7 SENW	No Source Treatments	Not Rated
TOUCHET CHURCH	10840 3	B	1	T7N/R33E-34 SWSW	CHLORINATION, HYPOCHLORITE	Not Rated
TOUCHET GRANGE	06540 2	B	1	T7N/R33E-34 NESW	CHLORINATION, HYPOCHLORITE	Not Rated
TOUCHET POST OFFICE	03276 B	B	1	T7N/R33E-34 NESW	No Source Treatments	Not Rated

Table 3: Sites in Ecology Facilty Index/Sites Database

Facility/Site ID	Facility/Site Name	Program Facility Names	Ecology Tegulatory Program	Type of Site	Contaminants	Groundwater Impact?	Status of Sites
129	FUDS WALLA WALLA AFB	FUDS WALLA WALLA AFB	Toxics	Independent Cleanup	Petroleum Products, Unspecified	No	No Further Action Required
774	WALLA WALLA AIRPORT	WALLA WALLA AIRPORT	Toxics	Independent Cleanup	Petroleum Products, Unspecified	Yes, Remediated	No Further Action Required
782	US ARMY COE MOTOR POOL	US ARMY COE MOTOR POOL	Toxics	Voluntary Cleanup Sites, LUST Facility Underground Storage Tank	Petroleum-Other	Yes, Confirmed above cleanup level	No Further Action Required. One exempt tank, five tanks removed
783	BPA WALLA WALLA SUBSTATION	BPA WALLA WALLA SUBSTATION	Toxics	Independent Cleanup	Halogenated Organics, Metals Priority Pollutants, Petroleum Products, Unspecified	Metals below cleanup level in groundwater, no other impacts	No Further Action Required
2987	WA AGR WALLA WALLA 2	WA AGR WALLA WALLA 2	Hazardous Waste	Hazardous Waste Generator, Haz Waste Management Activity			
4853	PACIFICORP DELL AVE	PACIFICORP DELL AVE	Toxics	Independent Cleanup	Petroleum Products, Unspecified	Yes, Confirmed	Awaiting cleanup
6282	WEIDERT FARMS INC QUARRY	WEIDERT FARMS INC QUARRY	Water Quality	Sand and Gravel GP			
8224	GRANITE NORTHWEST DELL AVE	GRANITE NORTHWEST DELL AVE	Water Quality	Sand and Gravel GP			
8785	Blacks Autobody	Blacks Autobody	Hazardous Waste	Revised Site Visit Program			
9515	WALLA WALLA WWTP	WALLA WALLA WWTP	W2R	Biosolids			
9634	WAITSBURG STP HWY 124	WAITSBURG STP	Water Quality	Biosolids			
17623	WALLA WALLA GRAVEL ROCK WHITEQUARRY	WALLA WALLA GRAVEL ROCK WHITEQUARRY	Water Quality	Sand and Gravel GP			
19078	FPL ENERGY VANSYCLE LLC	FPL ENERGY VANSYCLE LLC	Hazardous Waste	Hazardous Waste Generator			
19561	WA DOT SC REGION QS-O-66 WAITSBURG	WA DOT SC REGION QS-O-66 WAITSBURG	Water Quality	Sand and Gravel GP			
20547	Northwest Concaves	Northwest Concaves	Hazardous Waste	Revised Site Visit Program			
21225	WAITSBURG STP	WAITSBURG STP	Water Quality	Muncipal to ground SWDP IP, Municipal NPDES IP			
23528	COMMUNITY BANK COLLEGE PLACE	COMMUNITY BANK/COLLEGE PLACE	Water Quality	Construction SW GP			
24322	HORIZON AIR INDUSTRIES WALLA WALLA	HORIZON AIR INDUSTRIES WALLA WALLA	Water Quality	Industrial SW GP			

Table 3: Sites in Ecology Facilty Index/Sites Database

Facility/Site ID	Facility/Site Name	Program Facility Names	Ecology Tegulatory Program	Type of Site	Contaminants	Groundwater Impact?	Status of Sites
416132	Pacificorp Walla Walla Substation		Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
782518	Pacific Power & Light Walla Walla Svc	Pacific Power & Light Walla Walla Svc	Hazardous Waste	Hazardous Waste Generator, Haz Waste Management Activity, Haz Waste Transfer Facility			
1367331	Stubblefield Salvage Yard	Stubblefield Salvage Yard	Toxics, Hazardous Waste	State Cleanup Site, Revised Site Visit Program	Numerous Origanic and Inorganic Constituents	Suspected	Awaiting cleanup
1652732	MATTHEWS SECTION TOOL HOUSE		Toxics	Underground Storage Tank			One tank closed in place
1825211	OLD MILTON SERVICE STATION		Toxics	LUST Facility	Petroleum Products, Unspecified, Petroleum-Other	Yes, Confirmed above cleanup level	One tank removed, Cleanup Started
1911754	Walla Walla College Whitman Dr		Hazardous Waste	Hazardous Waste Generator			
2040661	Martin Archery		Hazardous Waste	Revised Site Visit Program			
2179186	COOKS DIXIE SERVICE		Toxics	Underground Storage Tank			Two tanks removed
2257556	Wilbur Ellis Co Walla Walla		Hazardous Waste	Hazardous Waste Generator, Emergency/Haz Chem Rpt TIER2			
2467837	US DA FHA Lavern Mickelson Farm		Hazardous Waste	Hazardous Waste Generator			
3332779	BPA SKYROCKET MICROWAVE STATION		Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
3546793	BKI Inc College Place		Hazardous Waste	Hazardous Waste Generator			
3818317	Three Rivers Winery		Hazardous Waste	Hazardous Waste Generator			
4200165	WALLA WALLA CITY MILLCREEK WTP		Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
4214235	AT&T WAITSBURG		Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
4429671	RICHARD HAIR INC		Toxics	Underground Storage Tank			Two tanks removed
4644841	NORTHSTAR WINERY	NORTHSTAR WINERY	Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
4796995	UPS Walla Walla	UPS Walla Walla	Hazardous Waste	Hazardous Waste Generator			
8112957	DERBY SHARI CORKRUM		Toxics	Underground Storage Tank			One exempt tank, one tank removed
8152173	WESTERN FARM SERVICE INC CLYDE	WESTERN FARM SERVICE INC CLYDE	Toxics	Voluntary Cleanup, State Cleanup site	Conventional Contaminants - Inorganic, Pesticides - Unspecified, Petroleum Products - Unspecified	No	No Further Action

Table 3: Sites in Ecology Facilty Index/Sites Database

Facility/Site ID	Facility/Site Name	Program Facility Names	Ecology Tegulatory Program	Type of Site	Contaminants	Groundwater Impact?	Status of Sites
8316271	PRESCOTT SECTION TOOL HOUSE		Toxics	Underground Storage Tank			One tank closed in place
8755185	Waste Management Kennewick Transfer Sta	Kennewick Transfer Station, Waste Management Kennewick Transfer Sta, Waste Management of Kennewick	Hazardous Waste	Hazardous Waste Generator, Haz Waste Management Activity			
9255112	US ARMY COE Walla Walla LMO		Hazardous Waste	Hazardous Waste Generator			
9544476	TOUCHET COUNTY SHOP		Hazardous Waste	Emergency/Haz Chem Rpt TIER2, Underground Storage Tank			2 Tanks removed
11293827	Schwerin Concaves Walla Walla	Schwerin Concaves Walla Walla	Toxics, Hazardous Waste	Hazardous Waste Management Activity, State Cleanup Site	Metals Priority Pollutants	Confirmed	Cleanup scheduled to start in 2012
11317732	Walla Walla College Plant Service	Walla Walla University Plant Service	Hazardous Waste	Hazardous Waste Generator			
11793733	FORT WALLA WALLA PARK		Toxics	Underground Storage Tank			Tank removed
13436431	WALLA WALLA HIGH SCHOOL AUTO MECH BLDG		Toxics	Underground Storage Tank			One tank removed
13487448	PRESCOTT MAINTENANCE SITE		Toxics	Underground Storage Tank			Two tanks removed
15055713	Tumac Machinery Inc		Toxics, Hazardous Waste	Underground Storage Tank, LUST Facility, Hazardous Waste Generator	Petroleum - Other	No	One exempt tank, three tanks removed
15896643	UPS WALLA WALLA AIRPORT		Toxics	LUST Facility, Emergency/Haz Chem Rpt TIER2, Underground Storage Tank	Petroleum-Other	No	Reported Cleaned Up
16646523	CONOVER RANCHES INC		Toxics	Underground Storage Tank			Two tanks removed
17237229	DAVID D DUNHAM		Toxics	Underground Storage Tank			One tank removed
17922783	USWCOM Eureka Co		Hazardous Waste	Emergency/Haz Chem Rpt TIER2, Hazardous Waste Generator			
18892336	FERREL SEED FARMS		Toxics	Underground Storage Tank			One tank removed
18919434	RIPARIA SECTION TOOL HOUSE		Toxics	Underground Storage Tank			One tank closed in place
19436559	COLLEGE PLACE SCHOOL DISTRICT 250		Toxics	Underground Storage Tank			
19452829	DON BUCKLEY		Toxics	Underground Storage Tank			One tank removed
19611753	Ken Christiansen Painting Inc		Hazardous Waste	Hazardous Waste Generator			
19783684	MARSH AVIATION OF WALLA WALLA INC		Toxics	Underground Storage Tank, LUST Facility	Petroleum-Other	No	Reported Cleaned Up

Table 3: Sites in Ecology Facilty Index/Sites Database

Facility/Site ID	Facility/Site Name	Program Facility Names	Ecology Tegulatory Program	Type of Site	Contaminants	Groundwater Impact?	Status of Sites
21379958	WALLA WALLA CITY COUNTY AIRPORT		Toxics	Underground Storage Tank			Tank Removed
22418716	TJ LUND & SON INC		Toxics	Underground Storage Tank			Three tanks removed
25642528	Crop Production Services Inc Clyde	CROP PRODUCTION SERVICES INC CLYDE	Hazardous Waste	Hazardous Waste Management Activity, Hazardous Waste Generator			
25779296	PEGGY MCDOLE		Toxics	Underground Storage Tank			Three tanks removed
26744482	Western States Equipment Co W		Hazardous Waste	Hazardous Waste Generator			
27187718	WALLA WALLA STP	WALLA WALLA STP	Toxics	Underground Storage Tank			One exempt tank, one tank removed
27255225	SCHWERIN FARMS INC		Toxics	Underground Storage Tank			Three tanks removed
27626866	COLLEGE PLACE CITY SHOPS		Toxics	Underground Storage Tank			Closure in place-Three tanks
28163666	REIFF FIBERGLASS		Toxics	Underground Storage Tank			One tank removed
28335269	WESTERN FARM SERVICE INC UST 8861		Toxics	Underground Storage Tank			One tank removed
29177317	CLYDE B53K029 CLYDWAQ0680		Toxics	LUST Facility, Underground Storage Tank	Petroleum - Other	No	No Further Action
29276273	WALLA WALLA FARMERS CO OP INC REESE		Toxics, Hazardous Waste	Emergency/Haz Chem Rpt TIER2, Underground Storage Tank			Six operational tanks
29511945	LEID FORD DISTRIBUTING CO INC PRESCOTT		Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
32234354	PACIFICORP WALLA WALLA SVC CTR	PACIFICORP WALLA WALLA SVC CTR	Hazardous Waste	Hazardous Waste Generator, Emergency/Haz Chem Rpt TIER2, Underground Storage Tank			Two Tanks Removed
32437132	JW THOMAS		Toxics	Underground Storage Tank			One tank removed
33648838	FRED SHERRY FARMS		Toxics	Underground Storage Tank			Two tanks removed
34448667	CAMP FARMS INC UST 11231		Toxics	Underground Storage Tank			One tank abandoned
35116649	TOUCHET SECTION TOOL HOUSE		Toxics	Underground Storage Tank			Closure in place-One tank
35441573	STRUTHERS FARMS INC		Toxics	Underground Storage Tank			Two tanks removed
36521593	WALLA WALLA CITY LANDFILL UST 7261		Toxics	Underground Storage Tank, LUST Facility	Petroleum - Other	No	Tank Removed
37824656	GENES INC		Toxics	Chem Rpt TIER2			Tank Removed
38319496	Gas Transmission NW Station 7	Gas Transmission NW Station 7	Hazardous Waste	Hazardous Waste Management Activity, Emergency/Haz Chem Rpt TIER2, Hazardous Waste Generator			
38444554	Chevron USA Inc Clyde Bulk Plt		Hazardous Waste	Hazardous Waste Generator			
39578724	MOUNTAIN STATES AVIATION INC		Toxics	Underground Storage Tank			Tank Removed
40476225	Arnold Thomas Seed Svc Inc		Hazardous Waste	Hazardous Waste Generator			
41143544	JOE HOLT		Toxics	Underground Storage Tank			Two tanks abandoned
41552767	USWCOM Touchet N Rptr Bldg		Hazardous Waste	Hazardous Waste Generator			

Table 3: Sites in Ecology Facilty Index/Sites Database

Facility/Site ID	Facility/Site Name	Program Facility Names	Ecology Tegulatory Program	Type of Site	Contaminants	Groundwater Impact?	Status of Sites
41936186	Shamrock Cropdusting Inc		Hazardous Waste	Hazardous Waste Generator			
42853164	US GSA Maint Shop		Hazardous Waste	Hazardous Waste Generator			
42862563	TOUCHET CHEVRON	TOUCHET CHEVRON	Toxics	Voluntary Cleanup Sites, LUST Facility Underground Storage Tank, Emergency/Haz Chem Rpt TIER2	Metals Priority Pollutants, Petroleum-Other	Metals remediated, Petroleum-Other confirmed above cleanup level	4 operational tanks, 3 tanks removed, No Further Action Required
43585477	DON SEAVEY		Toxics	Underground Storage Tank			One tank removed
43666257	COMMONWEALTH BUILDING		Toxics	Underground Storage Tank			2 Tanks removed
44628179	US ARMY COE Mill Creek Project		Hazardous Waste	Hazardous Waste Management Activity, Hazardous Waste Generator			
44636591	WALLA WALLA REGIONAL AIRPORT A ST	WALLA WALLA REGIONAL AIRPORT	Toxics	Underground Storage Tank			Ten tanks removed or closed in place, one exempt tank
44868765	WALLA WALLA PORT		Toxics	Underground Storage Tank, LUST Facility	Petroleum-Other	No	Reported Cleaned Up
45337637	DIXIE SCHOOL DISTRICT NO 101		Toxics	Underground Storage Tank			One tank removed
45653362	WALLA WALLA AREA HQ SITE		Toxics	Underground Storage Tank			One tank removed
46912412	WALLA WALLA FARMERS CO OP TOUCHET		Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
48712674	LEE PENNELL		Toxics	Underground Storage Tank			Two tanks removed
51082264	GERALD FILAN		Toxics	Underground Storage Tank			Two exempt tanks, one tank removed
51941951	Valley Diesel Svc Inc	Valley Diesel Svc Inc, Western States Truck Repair	Hazardous Waste, Toxics	Revised Site Visit Program, Voluntary Cleanup Sites, State Cleanup Site, Hazardous Waste Generator	Petroleum Products - Other	Yes, Remediated	No further action
51984119	College Place WWTP	PLACE WWTP	W2R, Hazardous Waste	Hazardous Waste Management Activity			
54882612	FIRE DISTRICT 4 BLDG 2		Toxics	Underground Storage Tank, LUST Facility	Petroleum - Other	No	Unknown
56877991	BARKERS TREE SERVICE		Toxics	Underground Storage Tank			One tank closed in place
57913134	Rees Way Auto Body		Hazardous Waste	Hazardous Waste Generator			
58365269	Robison Dam		Toxics	Underground Storage Tank			
58561656	WALKER SECTION TOOL HOUSE		Toxics	Underground Storage Tank			One tank removed
58961644	BMA INC BLUE MOUNTAIN AVIATION		Toxics	Underground Storage Tank			One exempt tank, eight tanks removed
59117225	WALLA WALLA FIRE DISTRICT 6		Toxics	Underground Storage Tank			One tank removed
59285497	WA AGR M Walla Walla 4		Hazardous Waste	Hazardous Waste Generator			
59789936	CROPLAND AIR SERVICE INC		Toxics	Underground Storage Tank			Two tanks removed
59987737	SAM GRANT JR		Toxics	Underground Storage Tank			One tank removed

Table 3: Sites in Ecology Facilty Index/Sites Database

Facility/Site ID	Facility/Site Name	Program Facility Names	Ecology Tegulatory Program	Type of Site	Contaminants	Groundwater Impact?	Status of Sites
61144383	KLICKER BROTHERS		Toxics	Underground Storage Tank			One tank removed
61812916	WA AGR Walla Walla 1	WA AGR WALLA WALLA 1	Hazardous Waste	Haz Waste Management Activity, Hazardous Waste Generator			
62883819	FRANK HART & SONS INC		Toxics	Underground Storage Tank			Two tanks removed
63439529	AYER JUNCTION		Toxics	Underground Storage Tank			Two tanks removed
63565675	TOLANCO		Toxics	Underground Storage Tank			Two tanks removed
63776686	GROTE FARMS INC		Toxics	Underground Storage Tank			One tank removed
65235566	USWCOM Clyde Td2 Radio		Hazardous Waste	Hazardous Waste Generator			
65434531	LEON FILAN		Toxics	Underground Storage Tank			Two tanks removed
65766583	COWELL RANCH INC		Toxics	Underground Storage Tank			Two tanks removed
66444356	COE WALLA WALLA DIST TANK 40		Toxics	Underground Storage Tank, LUST Facility	Petroleum-Other	No	No Further Action Required
67291653	WESTERN FARM SERVICE INC PRESCOTT		Hazardous Waste	Emergency/Haz Chem Rpt TIER2			
67479249	Nelson Irrigation Corp	Nelson Irrigation Corp	Hazardous Waste	Chem Rpt TIER2, Toxics Release Inventory,			
67686276	Frontier Machinery CL		Toxics	Hazardous Waste Generator	Petroleum-Other	No	Reported Cleaned Up, 2 tanks removed
68759143	TIM M DERUWE		Toxics	Underground Storage Tank			
69426454	ACE MANUFACTURING		Toxics	Underground Storage Tank			One tank removed
70486178	MOUNTAIN EXPRESS INC		Toxics	Underground Storage Tank			Tank status unknown
70918326	Jack In The Box Inc Walla Walla		Hazardous Waste	Hazardous Waste Generator			
71186546	DON MEINERS		Toxics	Underground Storage Tank, LUST Facility	Petroleum - Other	No	Removed
71469953	KURT A BALD		Toxics	Underground Storage Tank			3 tanks closed in place
72617788	Wal Mart Supercenter 2476	Wal Mart Supercenter 2476	Hazardous Waste	Hazardous Waste Generator, Haz Waste Management Activity			
74472321	ELSIE MCCUBBINS		Toxics	Underground Storage Tank			One tank closed in place
77844846	Reiff Manufacturing		Hazardous Waste	Waste Planner, Toxics Release Inventory			
78896331	MCGREGOR CO PRESCOTT		Hazardous Waste	Emergency/Haz Chem Rpt TIER2,			
82673548	GREG FINCH		Toxics	Underground Storage Tank			One tank closure in process
83723155	WA AGR M Walla Walla 2		Hazardous Waste	Hazardous Waste Generator			
85115399	PAGE SECTION TOOL HOUSE		Toxics	Underground Storage Tank, LUST Facility	Petroleum - Other	No	Four tanks removed
85258846	GARDENA FARMS DISTRICT 13		Toxics	Underground Storage Tank			Two tanks removed
85677997	THEODORE B SMALL		Toxics	Underground Storage Tank			One tank removed
88295147	WALLA WALLA TWIN RESERVOIRS		Toxics	Underground Storage Tank			Two tanks closed in place, one exempt tank
88753383	Western Fab Finish		Hazardous Waste	Hazardous Waste Generator			
89268262	WALLA WALLA SUBSTATION		Toxics	Underground Storage Tank, LUST Facility	Petroleum - Other	Yes	One tank removed, No futher action
91332536	WALLA WALLA MP 63 4 PRINTS 398 A 7		Toxics	Underground Storage Tank			Seven tanks removed
92163369	WALLA WALLA 230 KV SUB		Toxics	Underground Storage Tank			One tank removed

Table 3: Sites in Ecology Facilty Index/Sites Database

Facility/Site ID	Facility/Site Name	Program Facility Names	Ecology Tegulatory Program	Type of Site	Contaminants	Groundwater Impact?	Status of Sites
92275899	FSS WALLA WALLA		Toxics	Underground Storage Tank			One tank closure in process
92631862	PERRY ANDERSON		Toxics	Underground Storage Tank			Two tanks removed
94384973	SHORT FARM		Toxics	Underground Storage Tank			Closure in process
94741783	KEY TECHNOLOGY MELROSE		Hazardous Waste	Toxics Release Inventory, Emergency/Haz Chem Rpt TIER2			
96321776	MCGREGOR UST 9812		Toxics, Hazardous Waste	Underground Storage Tank, Emergency/Haz Chem Rpt TIER2			One tank removed
96377222	UNION PACIFIC RAILROAD 820 UST 200642		Toxics	Underground Storage Tank, LUST Facility	Petroleum - Other	No	One tank, unknown
96741569	RA BAUMANN		Toxics	Underground Storage Tank			One tank removed
97111438	FOUNDATION FARM INC		Toxics	Underground Storage Tank			Three tanks removed
97121537	Whitman Mission National Historic Site	Whitman Mission National Historic Site	Hazardous Waste	Hazardous Waste Generator, Emergency/Haz Chem Rpt TIER2, Voluntary Cleanup Sites	Products, Unspecified	Yes, Remediated	No Further Action Required
98741714	TOUCHET SCHOOL DISTRICT 300		Toxics	Underground Storage Tank			One exempt tank, tow tanks removed
99789323	ORCHARD VIEW MARKET		Toxics	Underground Storage Tank			Two operational tanks

Table 4: Water Systems with Nitrate Concentrations above 5 mg/L

Water System ID	Water System Name	Source ID	Sample Date	Nitrate as N (mg/L)	Source
AB055 J	Berghan Vineyards	S01	1/8/2008	6.00	Well #1 - AHE464
08102 N	BOWE WATER SYSTEM	S01	1/26/2004	6.40	WELL 1
08785 2	BROOKSHIRE TERRACE WATER SYSTEM	S01	1/24/2000	8.60	Well #1
AB502 H	Bunchgrass Winery	S01	6/6/2006	8.87	Well #1 - AHE492
AB399 H	Cougar Crest Winery	S01	3/23/2011	6.10	Well #1 - ALB518
00595 J	Florida Power & Light	S01	6/13/2007	5.50	Well #1
08415 V	ISENHOWER CELLARS	S01	1/26/2005	5.50	AHC356 WELL 1
07440 0	HERBERT WATER SYSTEM	S01	8/13/2008	5.00	WELL 1
02133 K	KLICKER WATER SYSTEM 2	S01	12/17/2009	5.10	KLICKER WELL
88888 0	KPS Gas & Grocer	S02	4/6/2008	6.00	Well #2 - AHE420
02414 Y	LOPEZ, BERNARDO WATER SYSTEM	S01	10/22/2003	17.60	WELL 1
15151 9	MCGREGOR COMPANY	S01	5/17/2000	24.50	WELL 1
07511 V	NEW LIFE ASSEMBLY OF GOD	S01	4/17/2000	8.30	WELL 1
59975 9	NORQUIST-TAYLOR WATER SYSTEM	S01	5/19/2010	8.40	WELL 1
08395 T	NORTH STAR WINERY	S01	11/30/2004	5.00	AHC365 WELL 1
51190 N	PATRICK M. PAUL VINEYARDS	S01	4/19/2000	5.70	WELL 1
07404 1	PEPPER BRIDGE WINERY	S01	6/30/2005	7.70	AEL334 / WELL 1
71260 3	RASMUSSENS WATER SYSTEM	S01	12/17/2001	8.30	WELL 1
73226 9	ROBISON RANCH	S01	3/6/2008	8.40	Well #1
00931 E	ROSEWOOD WATER ASSOCIATION	S01	3/29/2000	7.30	WELL #1
AB827 C	Sole Rosso	S01	4/3/2007	5.85	Well #1 - APA461
AB827 C	Sole Rosso	S01	8/5/2010	10.20	Well #1 - APA461
AB935 6	St. Basils Academy	S01	11/9/2010	8.90	Well #1
10840 3	TOUCHET CHURCH	S01	9/25/2002	9.40	WELL 1 (6 INCH)
03276 B	TOUCHET POST OFFICE	S01	3/26/2008	5.80	WELL #1
88890 4	TOUCHET SCHOOL	S01	12/26/2001	5.20	Well #1 - AGG269
38864 8	TOUCHET SDA CHURCH	S01	7/23/2001	7.60	WELL 1
08289 F	Tranche Cellars	S01	8/17/2001	5.38	AGC495 WELL 1
10733 8	WALLA WALLA LANDFILL	S01	12/16/2002	12.90	LANDFILL WELL #2
AA597 D	Walla Walla River Packing & Storage	S01	1/5/2004	7.32	Well #1 - AHC369
AA597 D	Walla Walla River Packing & Storage	S01	6/28/2004	6.80	Well #1 - AHC369
AC287 F	Whispering Winds of Walla Walla	S01	12/11/2008	6.71	Well #1

Notes:
Shaded cells exceed primary MCL of 10 mg/L as N

Table 5: Vulnerability Matrix

Vulnerability Component	Potential Sources of Contamination	Demonstrated Impact to Shallow Gravel Aquifer?
Land Use/Zoning	Accidental spills or releases from industrial or commercially zoned areas	Some contaminated sites with groundwater impacts associated with industrial or commercial land use
Contaminated Sites	Infiltration through contaminated media or direct infiltration of contaminants	25 contaminated sites in Study Area boundary, 12 sites with groundwater impacts, others with soil impacts
Hazardous Waste Handling/Storage	Accidental release or spill of stored or generated material	Soil and groundwater contamination associated with 12 sites where hazardous materials stored or generated at some time
Groundwater Quality	Irrigation returns, infiltration of surface water, infiltration through contaminated media or infiltration of contaminated runoff.	Elevated nitrate concentrations (>5 mg/L-N) and exceedances of nitrate MCL (10 mg/L-N) in some Study Area wells and detections of pesticide breakdown products.

FIGURES

Franklin
Benton
Walla Walla
Columbia
Garfield
Umatilla
Wallowa
Esquatzel Coulee
Lake Sacajawea
Snake River
Fourmile Canyon
Columbia River
Touchet River
Dry Creek
Walla Walla River
Cottonwood Creek
Pine Creek
Mill Creek
Tucannon River
Whetstone Hollow
Wenaha River
WASHINGTON
OREGON
WASHINGTON
OREGON

LEGEND

- Walla Walla River Catchment
- WRIA 32
- City Limits
- Shallow Gravel Aquifer Area Delineated by County
- States
- Counties

Ground Water Recharge Area

- Zone 1
- Zone 2

0 5
Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet
Source:
Walla Walla County,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

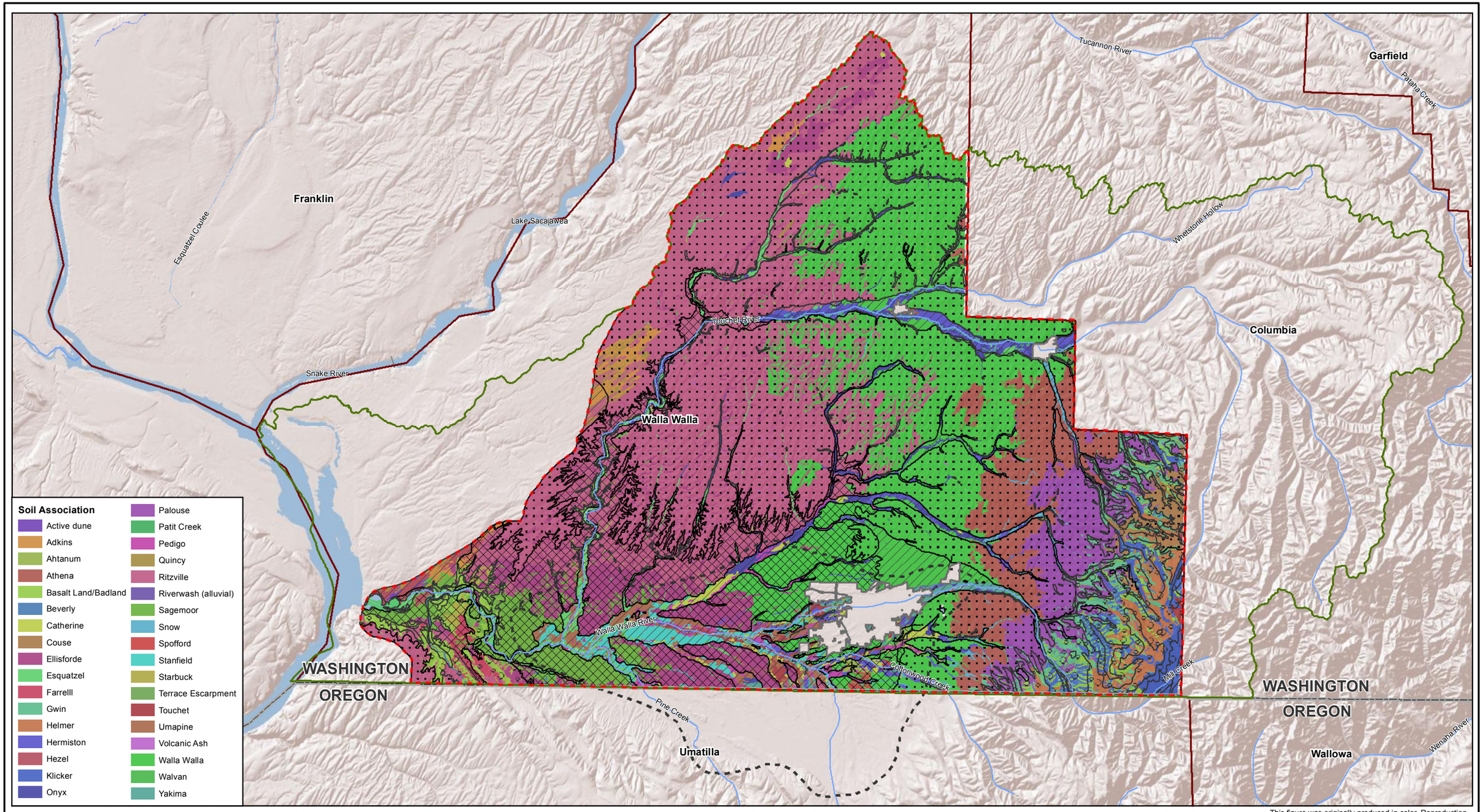
FIGURE **1**

SHALLOW GRAVEL AQUIFER GROUNDWATER RECHARGE AREA MAP

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F08_CriticalAquiferMap.mxd | 9/16/2011 | THAMMOND

Golder Associates



LEGEND

- Walla Walla River Catchment
- WRIA 32
- City Limits
- States
- Counties
- Shallow Gravel Aquifer Area Delineated by County

Geology

- Alluvium
- Columbia River Basalt
- Loess
- Miocene Sediments
- Touchet Beds

0 5

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet

Source:
Walla Walla County,
Golder Associates Inc.

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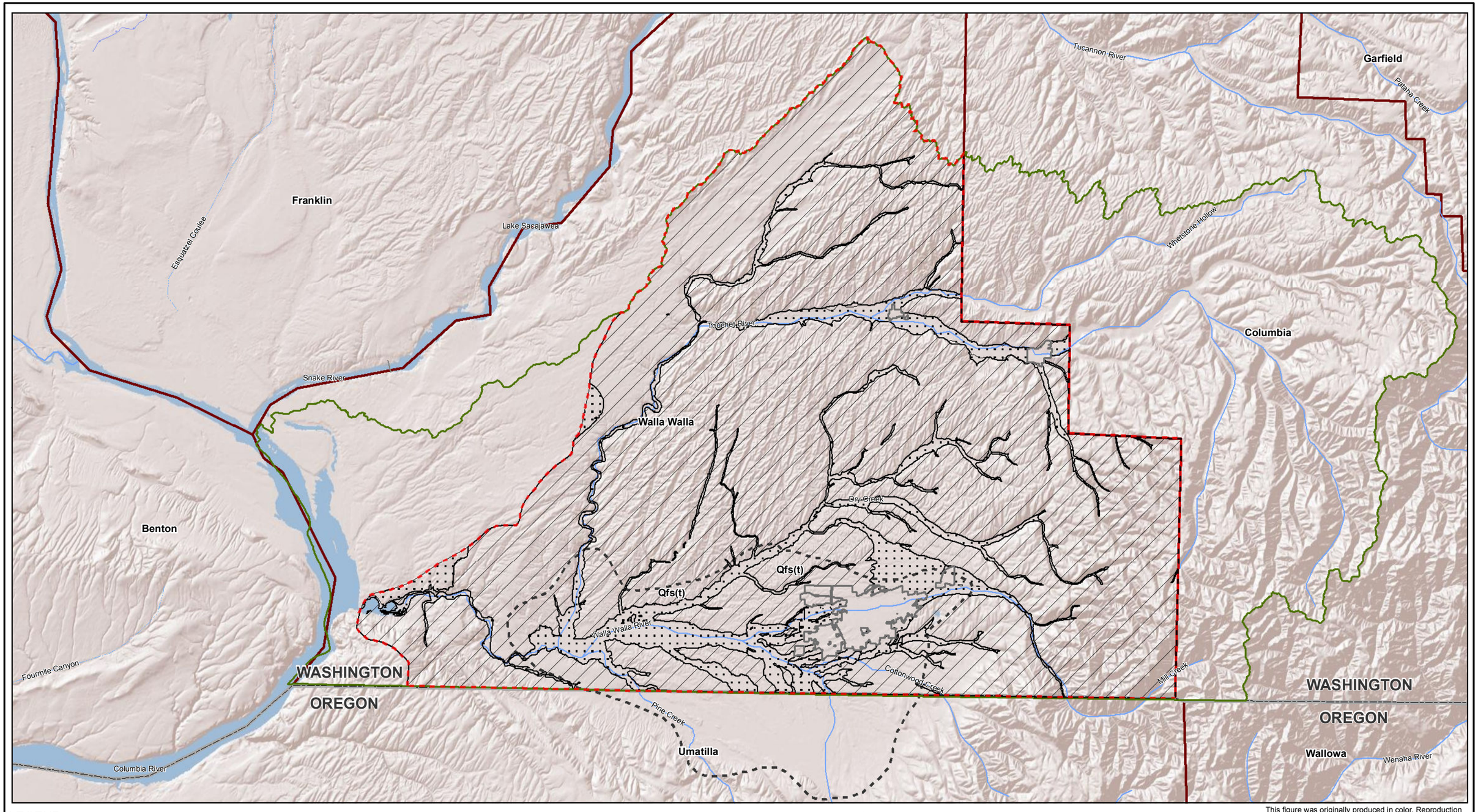
FIGURE **2**

SHALLOW GRAVEL AQUIFER RECHARGE AREA GEOLOGIC UNITS AND SOIL SURVEY SOILS MAP

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F01R01_Soils.mxd |9/16/2011 | THAMMOND

Golder Associates



LEGEND

- Walla Walla River Catchment
- WRIA 32
- City Limits
- Shallow Gravel Aquifer Area Delineated by County
- States
- Counties

Susceptiblity Zone

- High Susceptiblity (Zone 1/2)
- Low Susceptibility (Zone 3)

0 2

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet

Source:
Walla Walla County,
Golder Associates Inc.

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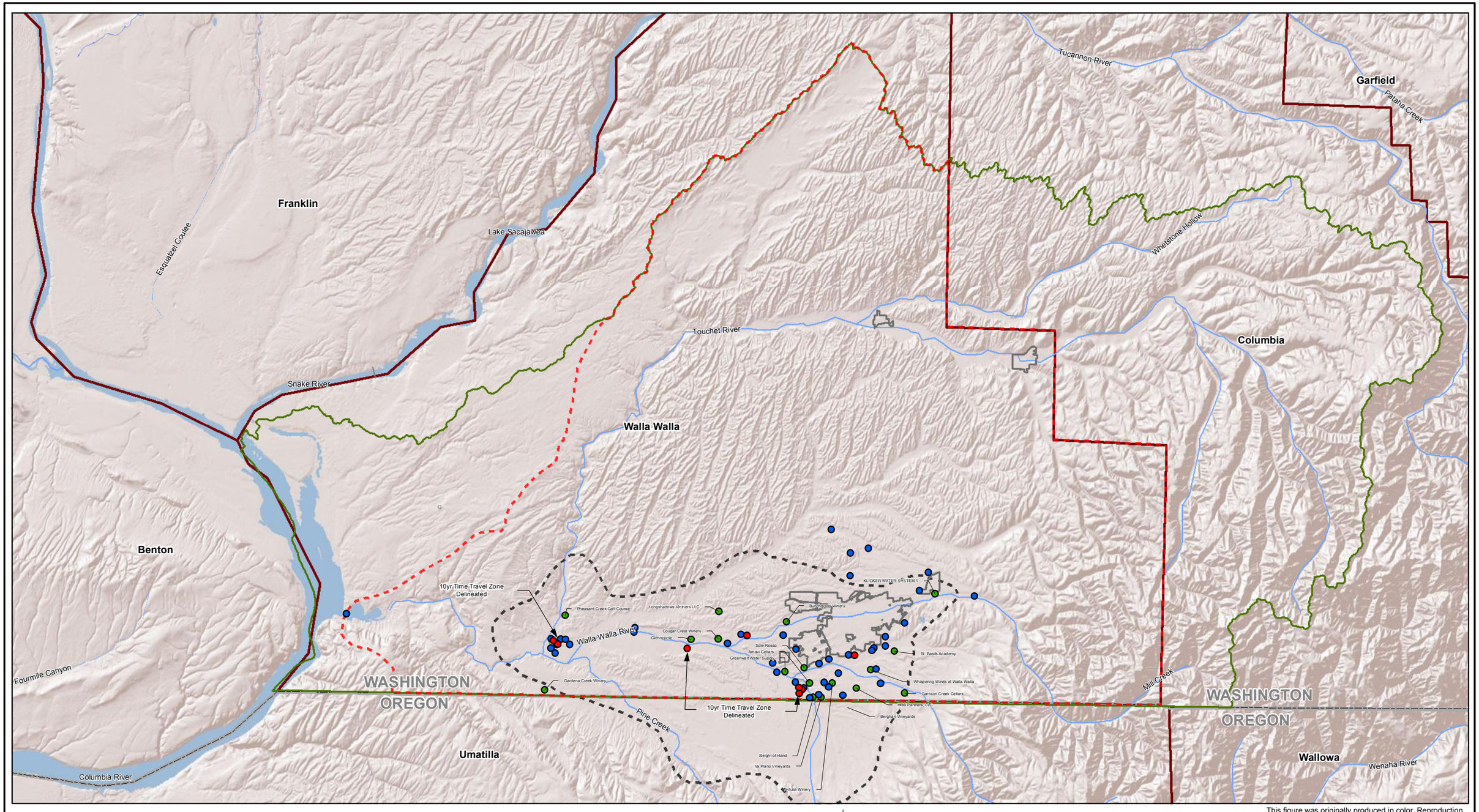
FIGURE **3**

SHALLOW GRAVEL AQUIFER RECHARGE AREA SUSCEPTIBILITY MAP

WALLA WALLA COUNTY CARA REVIEW/WA



LEGEND

- Group A Well
- Group B Well
- Group B Well (Located based on 1/4 1/4 Sections)
- Walla Walla River Catchment
- City Limits
- WRIA 32
- Shallow Gravel Aquifer Area Delineated by County
- 10 yr Time Travel Zones
- States
- Counties

NOTE: Location of wells are approximations.

0 5

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet
Source:
Walla Walla County,
Golder Associates Inc.

N

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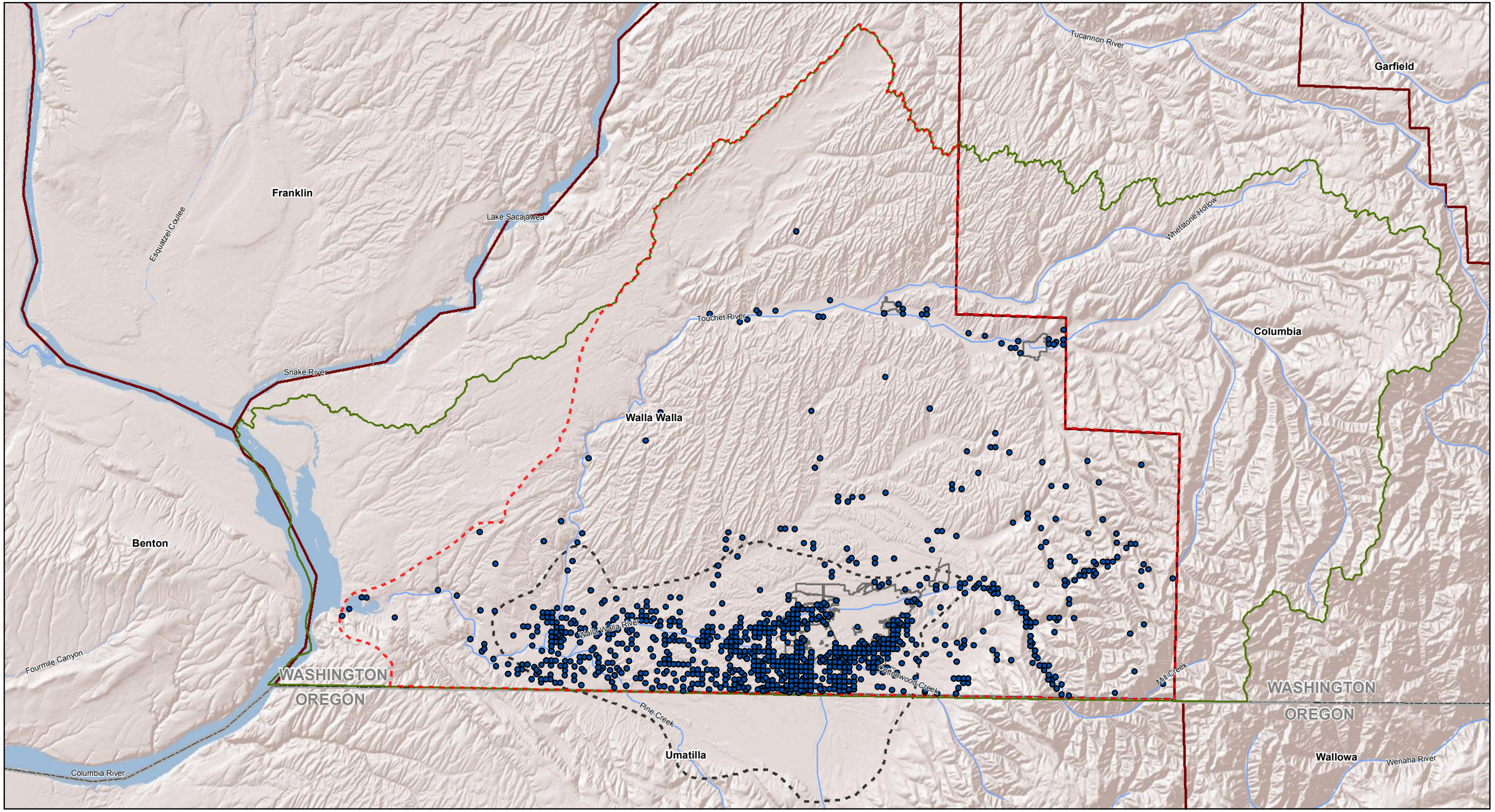
FIGURE **4**

GROUP A AND B PUBLIC WATER SYSTEMS WITHIN SHALLOW GRAVEL AQUIFER RECHARGE AREA

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F03R01_GroupAandB_PublicWater.mxd | 9/16/2011 | THAMMOND

Golder Associates



LEGEND

- Water Well (less than 300 feet deep)
- Walla Walla River Catchment
- WRIA 32
- City Limits
- Shallow Gravel Aquifer Area Delineated by County
- States
- Counties

0 5

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet
Source:
Walla Walla County,
Golder Associates Inc.

N

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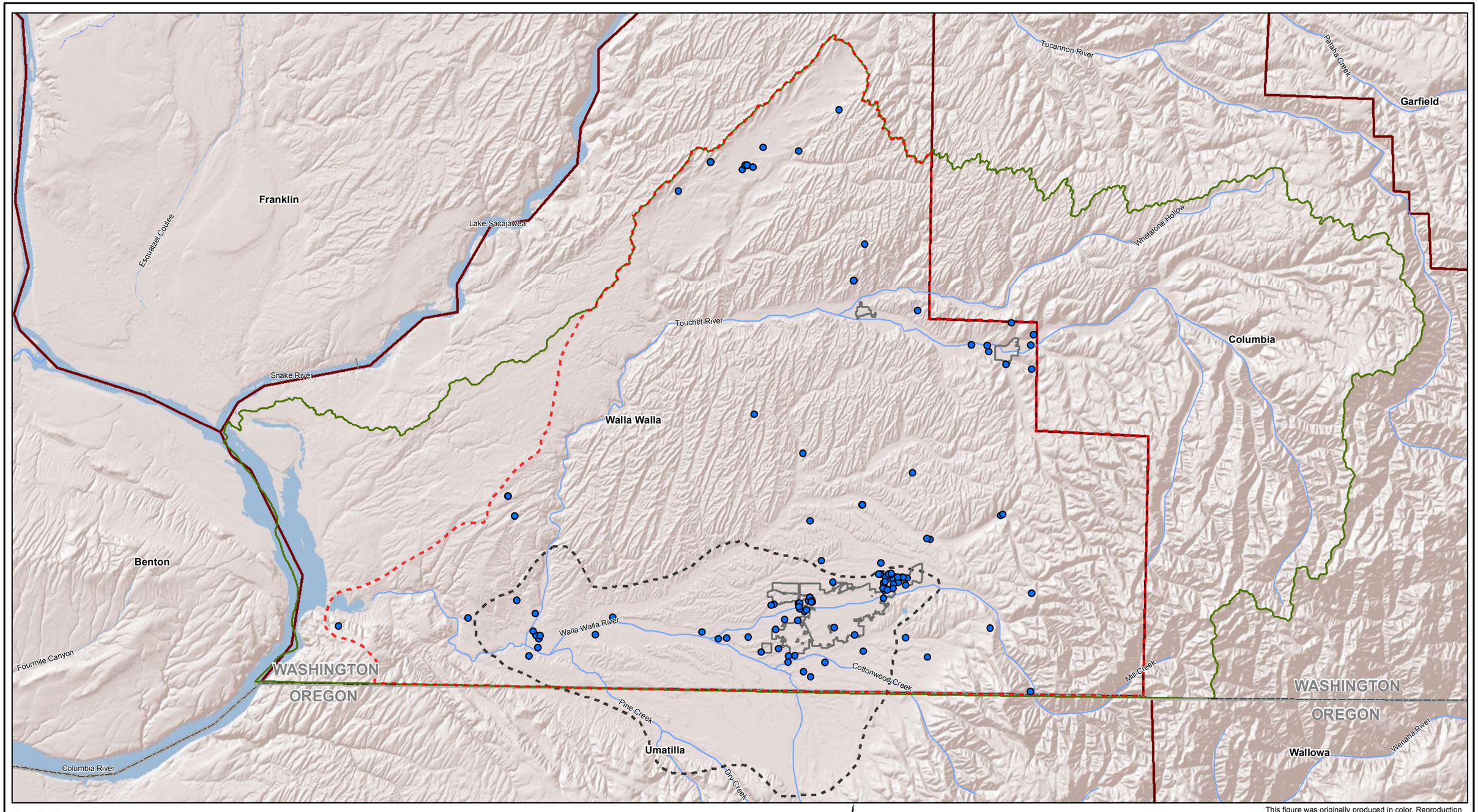
FIGURE **5**

LOCATION OF WELLS LESS THAN 300 FEET DEEP IN SHALLOW GRAVEL AQUIFER RECHARGE AREA

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F04R01_WellLocationMap.mxd | 9/02/2011 | THAMMOND

Golder Associates



LEGEND

- Site in Database
- Walla Walla River Catchment
- WRIA 32
- City Limits
- Shallow Gravel Aquifer Area Delineated by County
- States
- Counties

0 5

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet
Source:
Walla Walla County,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

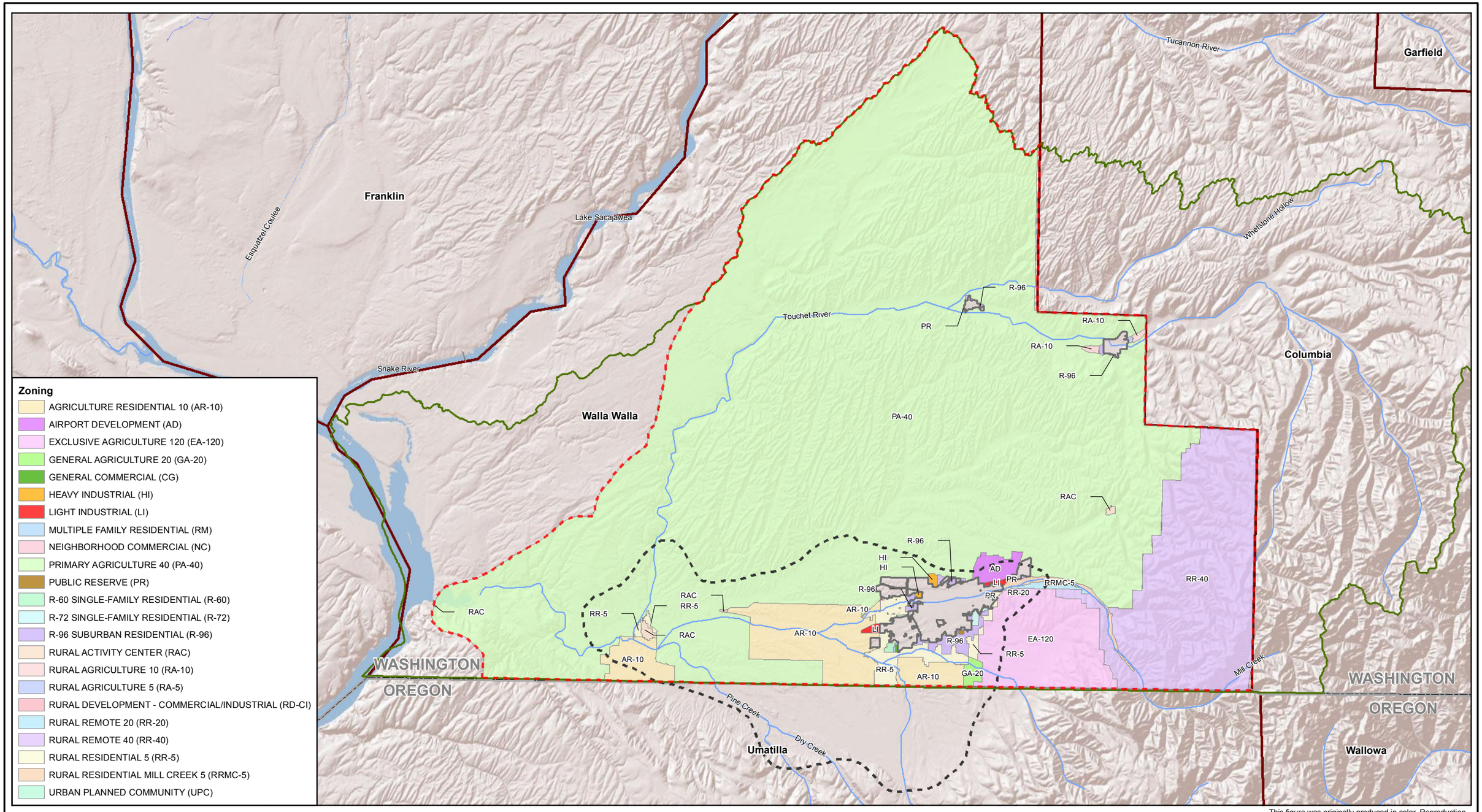
FIGURE **6**

LOCATION OF SITES IN WASHINGTON STATE DEPARTMENT OF ECOLOGY FACILITY INFORMATION DATABASE THAT COULD AFFECT GROUNDWATER QUALITY IN THE SHALLOW GRAVEL AQUIFER RECHARGE AREA

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F02R01_ContaminatedSites.mxd | 9/16/2011 | THAMMOND

Golder Associates



LEGEND

- Walla Walla River Catchment
- WRIA 32
- City Limits
- Shallow Gravel Aquifer Area Delineated by County
- States
- Counties

0 5

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet
Source:
Walla Walla County,
Golder Associates Inc.

N

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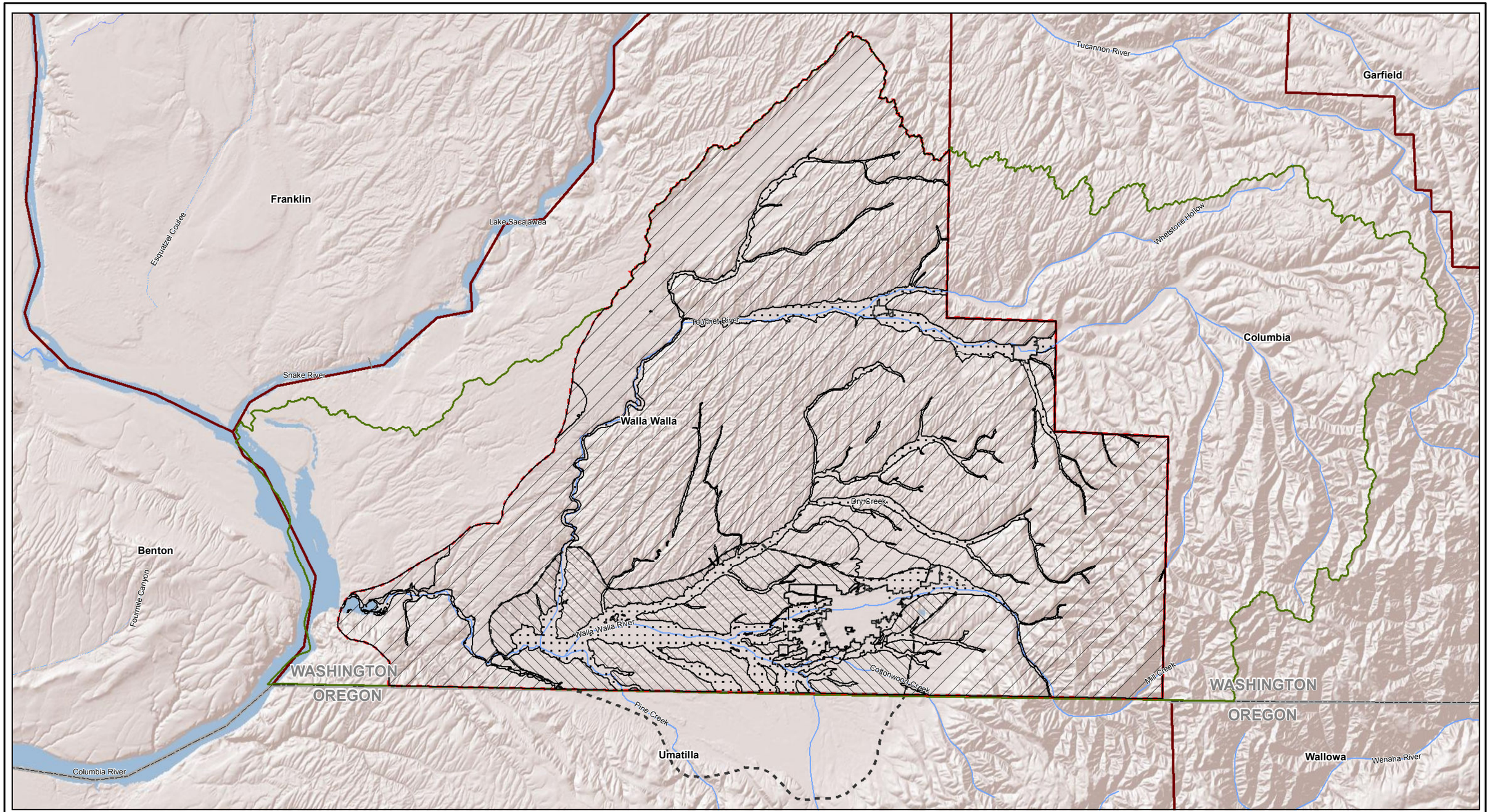
FIGURE **7**

SHALLOW GRAVEL AQUIFER RECHARGE AREA ZONING MAP

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F05R01_ZoningMap.mxd | 9/16/2011 | THAMMOND

Golder Associates



LEGEND

- Walla Walla River Catchment
- WRIA 32
- City Limits
- Shallow Gravel Aquifer Area Delineated by County
- States
- Counties

Aquifer Vulnerability

- Zone 1 (High Vulnerability)
- Zone II (Moderate Vulnerability)
- Zone III (Low Vulnerability)

0 5

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet
Source:
Walla Walla County,
Golder Associates Inc.

N

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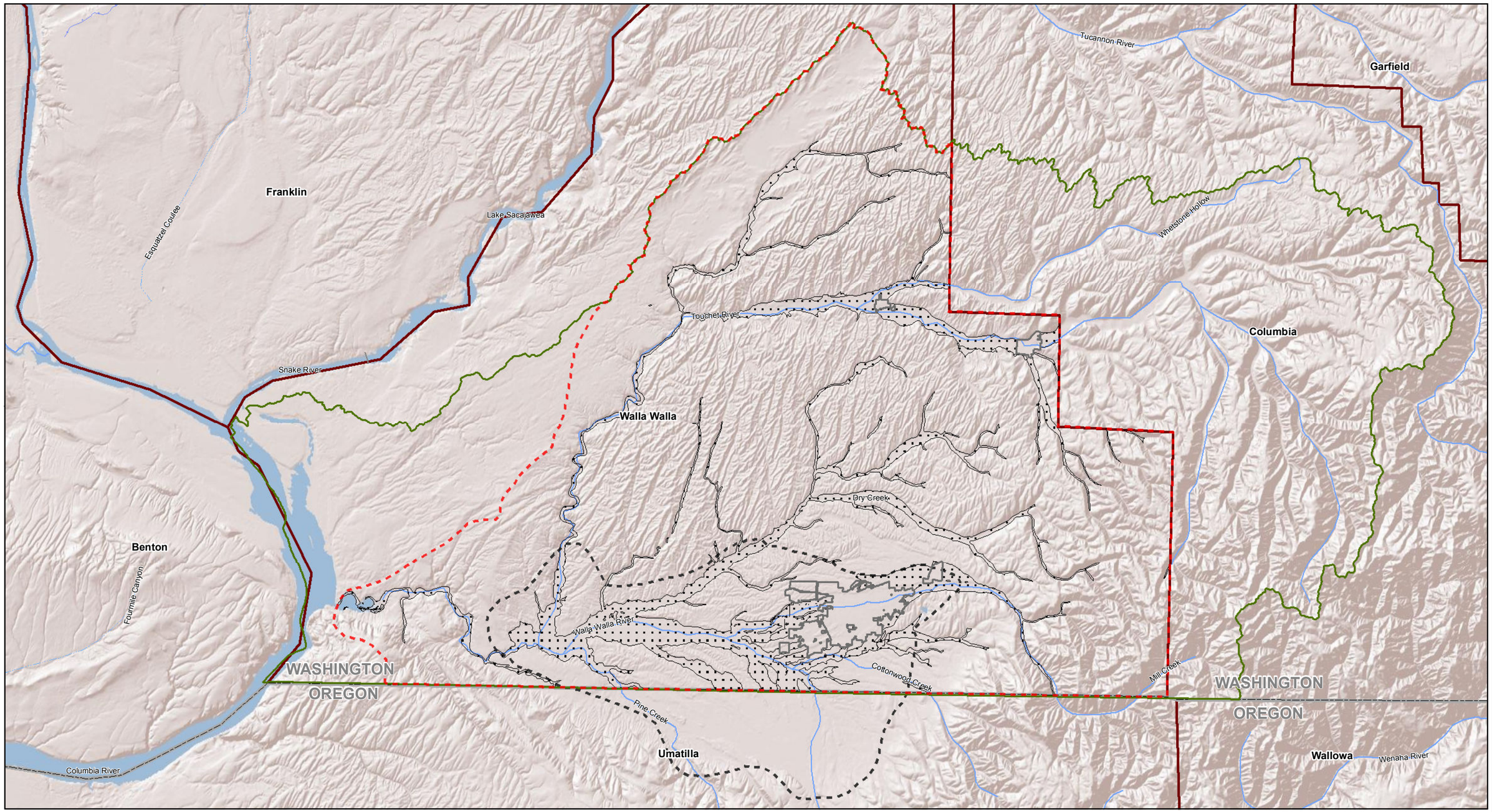
FIGURE **8**

SHALLOW GRAVEL AQUIFER RECHARGE VULNERABILITY MAP

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F09_AquiferVulnerabilityMap.mxd | 9/19/2011 | THAMMOND

Golder Associates



LEGEND

- Critical Aquifer Recharge Area
- Walla Walla River Catchment
- City Limits
- WRIA 32
- Shallow Gravel Aquifer Area Delineated by County
- States
- Counties

0 5

Scale in Miles

Map Projection:
Washington State Plane South
NAD 1983 Feet
Source:
Walla Walla County,
Golder Associates Inc.

N

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FIGURE **9**

SHALLOW GRAVEL AQUIFER
CRITICAL AQUIFER RECHARGE AREA MAP

WALLA WALLA COUNTY CARA REVIEW/WA

11393087F06R01_CriticalAquiferMap.mxd | 9/16/2011 | THAMMOND

Golder Associates