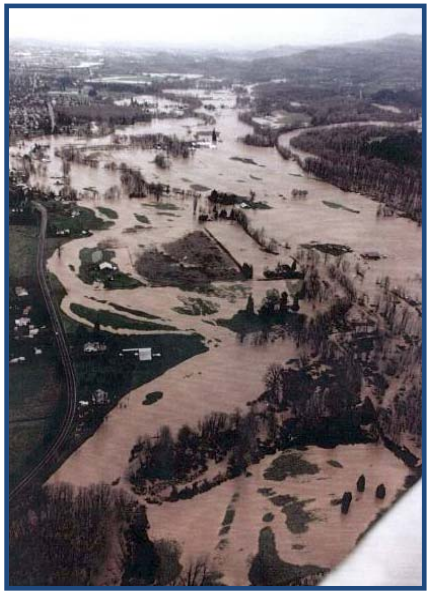
McKenzie River Basin
Development Risk Atlas




EWEB

CPW Community Planning Workshop

Community Planning Workshop

August 2009

McKenzie River Basin Development Risk Atlas

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McKenzie River Basin Risk Atlas

The McKenzie River is the sole source of drinking water for more than 250,000 people. In 2001, the Eugene Water and Electric Board (EWEB) established a source water protection program to evaluate and mitigate water quality risks. The overall concept of source water protection is to have the ability to measure the balance between watershed health and human use over time and implement actions that maintain a healthy balance for production of exceptional water quality.

One of the key risks identified as part of EWEB's planning process is development in the McKenzie River Basin. EWEB wants to better understand the implications of development activity in the McKenzie River Basin on water quality. This project includes an analysis of the Lane County Development Code, how the code is interpreted and applied to development, and the implications for water quality and is part of EWEB's broader source water protection initiative.

The Eugene Water and Electric Board (EWEB) contracted with the University of Oregon's Community Planning Workshop (CPW) to conduct an analysis of the impacts of development on water quality as part of EWEB's Drinking Water Protection Plan. Through the plan, EWEB sought to identify steps to protect the high quality of the McKenzie River for public health benefit as well as maintenance of the continued efficiency of EWEB's water treatment facilities.

As one of four deliverables, CPW prepared the Risk Atlas to show where and to what extent risks to water quality exist in the Basin. CPW analyzed water quality risks across five topic areas: (1) riparian vegetation; (2) development in the floodplain; (3) septic systems in close proximity to the river; (4) development on sensitive soils and slopes; and (5) impervious surfaces. In addition, a basin overview is included in the Risk Atlas to provide background about the context in which development is occurring in the McKenzie River Basin.

Methods

CPW performed spatial analyses of historical and existing conditions in the McKenzie River Basin to identify vulnerabilities to water quality. The Risk Atlas Analysis complements the

Land Use Permit Analysis and Best Management Practices Research. The analysis considers two spatial dimensions: (1) a comparison of cross-sections paralleling the river's course; and (2) an analysis of development features and actions by proximity to the river edge.

The Risk Atlas builds from a range of spatial and tabular data sources. CPW obtained data from Eugene Water & Electric Board, Federal Emergency Management Agency, Lane Council of Governments, Lane County, McKenzie Watershed Council, National Wetlands Inventory, Natural Resources Conservation Service, Oregon Water Resources Department, OFW, and U.S. Geological Service. Table 1 summarizes data sets used in the preliminary analysis.

Table 1. Data sets used to develop the Risk Atlas

Data set	Source	Type	Description
Tax lots	LCOG	Polygon	Tax lots referenced with descriptive attributes from parcel mapping, A & T databases and related GIS layers.
Land Use	LCOG	Polygon	Current land use data at the sub-tax lot level. Includes general land use classifications and detailed land use classifications
Addresses	LCOG	Point	The Site Address file contains all of the site addresses for all addressable structures in Lane County.
Flood Hazard	FEMA	Polygon	This coverage was created by digitizing a set of paper Flood Insurance Rate Maps (FIRM) covering central Lane County. Includes classifications for the floodway, and the 100- and 500-year floodplain
Wetlands	USDI, Fish and Wildlife	Polygon	National Wetlands Inventory data represent a classification of wetlands and deepwater habitats in the United States. These were compiled by US Dept. of Interior, Fish and Wildlife Service.
Roads	LCOG	Line	This data set is a graphic display of Lane County Public Works road maintenance database.
Rural Unincorporated Communities	Lane County	Polygon	This data set includes boundaries for all rural unincorporated communities as identified in the Lane County Rural Comprehensive Plan as required by OAR 660-022.
Zoning	Lane County	Polygon	Lane County Zoning as polygons.
Urban	LCOG	Polygon	This data set represents the outermost limit of the

Data set	Source	Type	Description
Growth Boundary			Eugene-Springfield metropolitan urban growth boundary (UGB).
Rivers	LCOG	Line	1:24,000 scale hydro data collected from a variety of sources, principally SSCGIS/OGDC.
Point of Water Diversion	Or. Water Resources	Point	This data set includes point data for all known water diversions (including wells).
Septic Tanks	EWEB	Point	This data set includes point data for septic tanks inspected by EWEB
Land Use Tracking	EWEB	Access Database	This database is being developed by EWEB to monitor land use permits issued by Lane County
Brownfields	DEQ	Access Database	This database includes point locations and data on all known hazardous waste spills in Oregon.
Soils	NRCS	Polygon	GIS coverage of soils in Lane County
Permits	Lane County Land Mgmt	Database	This database includes an extract of all permits in the County permit data system. CPW created geographic identifiers to allow permits to be matched to tax lots in the study area

Organization of the Risk Atlas

The risk atlas is organized into a basin overview and five topic areas. Each section includes a description of why the topic area is important in analyzing vulnerabilities to water quality. The remainder of the risk atlas is organized as follows:

- Section 1: Study Area Overview
- Section 2: Riparian Areas
- Section 3: Development in the Floodplain
- Section 4: Septic Systems
- Section 5: Sensitive Soils and Slopes
- Section 6: Impervious Surfaces

Section 1:
Study Area Overview

The Study Area Overview provides an orientation to the McKenzie River Basin Study Area as well as a baseline against which development patterns were analyzed throughout the study.

Maps:

Map 1.1. McKenzie River Basin Study Area

Map 1.1 shows the spatial extent of the study area. The study area for this project consists of the following lands in the McKenzie River Watershed: lands upriver from the Hayden Bridge intake that are outside of the Eugene-Springfield Metropolitan Urban Growth Boundary (UGB) and are zoned F-1 (Non-Impacted Forest Lands Zone). Map 1 shows areas within the McKenzie River Basin that are included in the study area. CPW divided the watershed into three focus areas and nine sub-focus areas.

CPW organized the study according to development patterns rather than sub-watersheds since the study specifically focuses on the impacts of development on water quality at the basin level. The study area was further separated into three focus and nine subfocus areas. The nine subfocus areas were established in association with either a rural community or other cluster of development. The three focus areas are the Upper McKenzie, Middle McKenzie, and Lower McKenzie. In order from the Hayden Bridge intake, the subfocus areas are: Camp Creek, Walterville, Leaburg, Vida, Marten Creek, Nimrod, Blue River, Rainbow, and McKenzie Bridge.

Data used for analysis:

- Eugene-Springfield Urban Growth Boundary (LCOG)
- Hayden Bridge EWEB intake facility location (CPW)
- Taxlots (LCOG)
- Urban growth boundary (LCOG)

- Water bodies (LCOG)[1]

In total, the study area covers 62.9 linear miles and 31,816 acres of the McKenzie River. Each subfocus area contains between 4.5 and 10 miles of the total extent with an average of 7 miles per area. Subsequent maps demark subfocus areas by dashed lines.

[1] Layer is a polygon of the McKenzie River depicting the extent of the waterway managed by the Department of State Lands (DSL).

Map 1.1. McKenzie Basin Study Area

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The study area is divided into three focus areas that are each subdivided into three subfocus areas, creating a total nine subfocus areas. The three focus areas are: Lower McKenzie, Middle McKenzie, Upper McKenzie. The name of each subfocus area is labeled on the map.

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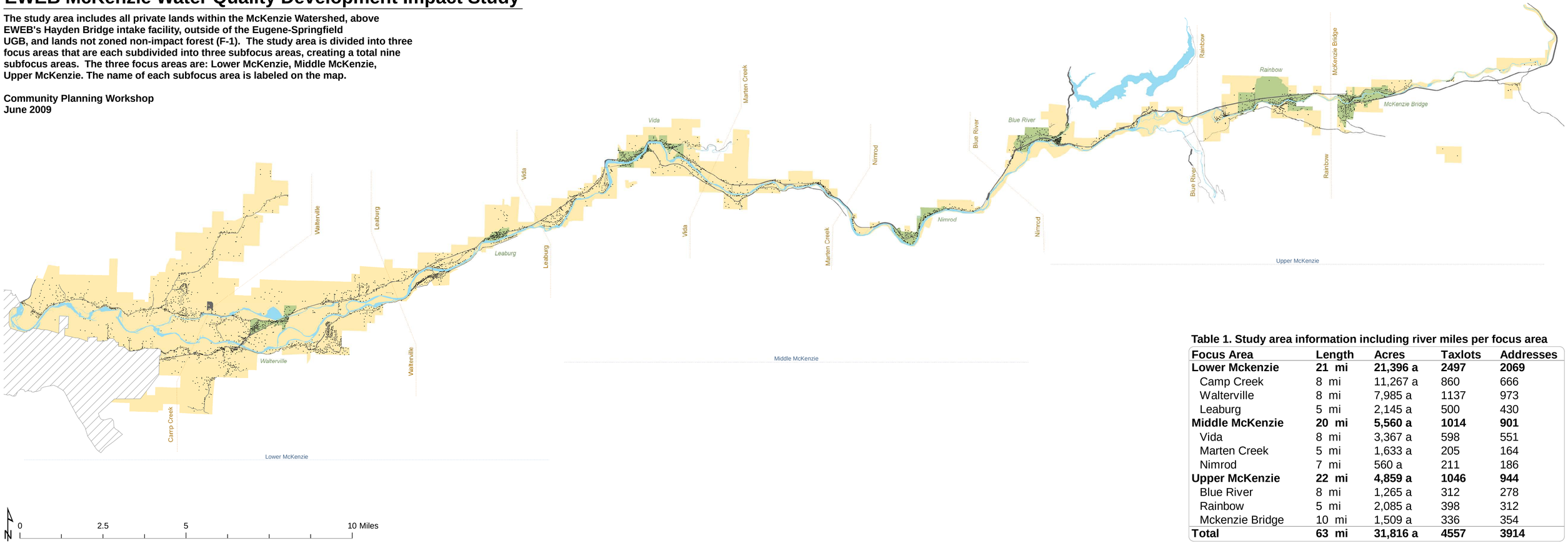

Table 1. Study area information including river miles per focus area

Focus Area	Length	Acres	Taxlots	Addresses
Lower Mckenzie	**21 mi**	**21,396 a**	**2497**	**2069**
Camp Creek	8 mi	11,267 a	860	666
Walterville	8 mi	7,985 a	1137	973
Leaburg	5 mi	2,145 a	500	430
Middle McKenzie	**20 mi**	**5,560 a**	**1014**	**901**
Vida	8 mi	3,367 a	598	551
Marten Creek	5 mi	1,633 a	205	164
Nimrod	7 mi	560 a	211	186
Upper McKenzie	**22 mi**	**4,859 a**	**1046**	**944**
Blue River	8 mi	1,265 a	312	278
Rainbow	5 mi	2,085 a	398	312
Mckenzie Bridge	10 mi	1,509 a	336	354
Total	**63 mi**	**31,816 a**	**4557**	**3914**

Map 1.2. Taxlots within the McKenzie River Basin Study Area

Map 1.2 shows the characteristics of taxlots throughout the study area. CPW analyzed taxlots by zoning, taxlot area of zoning by type, taxlot size in relation to the floodplain, and taxlot size by subfocus area.

Analysis shows the count and average areas of zoning type within each focus and subfocus area.

Data used for analysis:

- Floodzones (FEMA)
- Focus areas (CPW)
- Subfocus areas (CPW)
- Taxlots (LCOG)

In total, the study area covers 31,816 acres. The largest zoning type by acreage is impacted forest lands (12,921 acres) followed by exclusive farm use (8,858 acres), residential (7,209 acres), other (2,531 acres), commercial (219 acres), and industrial (77 acres). The other category includes land zoned for parks, utilities, and quarry and mining activities. The Lower McKenzie focus area contains approximately four times the acreage of both the Middle and Upper McKenzie.

The Lower McKenzie focus area has the highest count of taxlots (2,497), the greatest average taxlot area (24.4 acres), and the greatest total area (21,396.3 acres). The Nimrod subfocus area has the smallest average taxlot size at 2.7 acres followed by Blue River with 4.1 acres.

While lands zoned residential and agriculture are approximately equal in area, the average residential taxlot is 1/10th the size of the average agricultural lot. Consequently, residential taxlots are ten times more numerous than agricultural and forestry taxlots. Forestry and agricultural lots are roughly equal in average size.

Map 1.2. Taxlots within the McKenzie River Basin

EWEB McKenzie Water Quality Development Impact Study

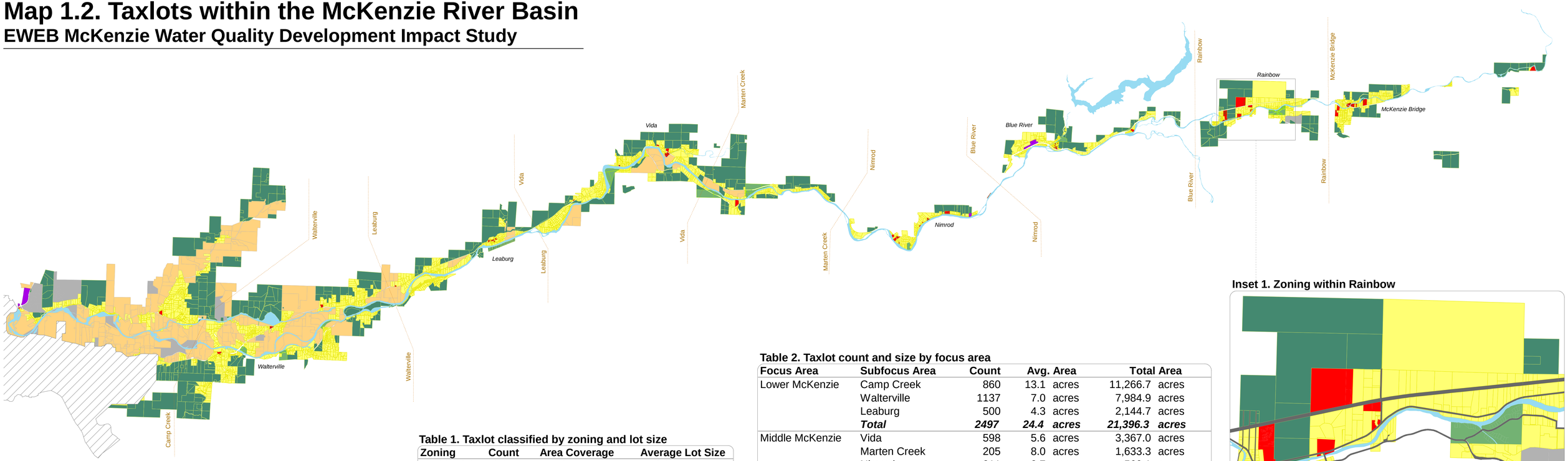

Table 1. Taxlot classified by zoning and lot size

Zoning	Count	Area Coverage	Average Lot Size
Residential	3,347	7,209 acres	2.2 acres
Farm	356	8,858 acres	24.9 acres
Forest	495	12,921 acres	26.1 acres
Commercial	165	219 acres	1.3 acres
Industrial	4	77 acres	19.2 acres
Other	190	2,531 acres	13.3 acres
Total	**4,557**	**31,816 acres**	**7.0 acres**

Table 2. Taxlot count and size by focus area

Focus Area	Subfocus Area	Count	Avg. Area	Total Area
Lower McKenzie	Camp Creek	860	13.1 acres	11,266.7 acres
	Walterville	1137	7.0 acres	7,984.9 acres
	Leaburg	500	4.3 acres	2,144.7 acres
	Total	***2497***	***24.4 acres***	***21,396.3 acres***
Middle McKenzie	Vida	598	5.6 acres	3,367.0 acres
	Marten Creek	205	8.0 acres	1,633.3 acres
	Nimrod	211	2.7 acres	560.1 acres
	Total	***1014***	***16.3 acres***	***5,560.4 acres***
Upper McKenzie	Blue River	312	4.1 acres	1,265.1 acres
	Rainbow	398	5.2 acres	2,084.7 acres
	Mckenzie Bridge	336	4.5 acres	1,509.3 acres
	Total	**1046**	**13.8 acres**	**4,859.2 acres**
Grand Total		**4557**		**31815.84 acres**

Inset 1. Zoning within Rainbow

N

0 2.5 5 10 Miles

Zoning Classes: Residential Zones; Exclusive Farm Use Zones; Impacted Forest Lands Zone; Parks and Recreation Zones; Industrial Zones; Commercial Zones

Map 1.3. Land use in the McKenzie River Basin Study Area

Map 1.3 describes land use and land cover by focus and subfocus area.

Analysis includes the count and average area of land use and land cover by the focus and subfocus areas.

Data used for analysis:

- Focus areas (CPW)
- Land use (LCOG)
- Subfocus areas (CPW)

The Lower McKenzie focus area has the greatest acreage of agricultural, residential, timber, and vacant land uses. By subfocus area: agricultural landuse is greatest in the Camp Creek subfocus area (3,560 acres) and least in McKenzie Bridge (1 acre); residential landuse is greatest in the Walterville subfocus area (1,034 acres) and least in Nimrod (148 acres); timber landuse is greatest in the Camp Creek subfocus area (4,159 acres) and least in Nimrod (264 acres); and vacant lands are greatest in the Camp Creek subfocus area (2,166 acres) and least in Nimrod (94 acres).

The majority of vacant land cover is found on residential (1,838 acres), timber (1,369 acres), and agriculture (1,160 acres) zoned taxlots. Most vacant land (3,000 acres) is located in the Lower McKenzie focus area.

Map 1.3. Land use in the McKenzie River Basin Study Area

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The majority of the EWEB McKenzie Water Quality Development Impact Study focuses on the impacts of residential land use, shown in orange.

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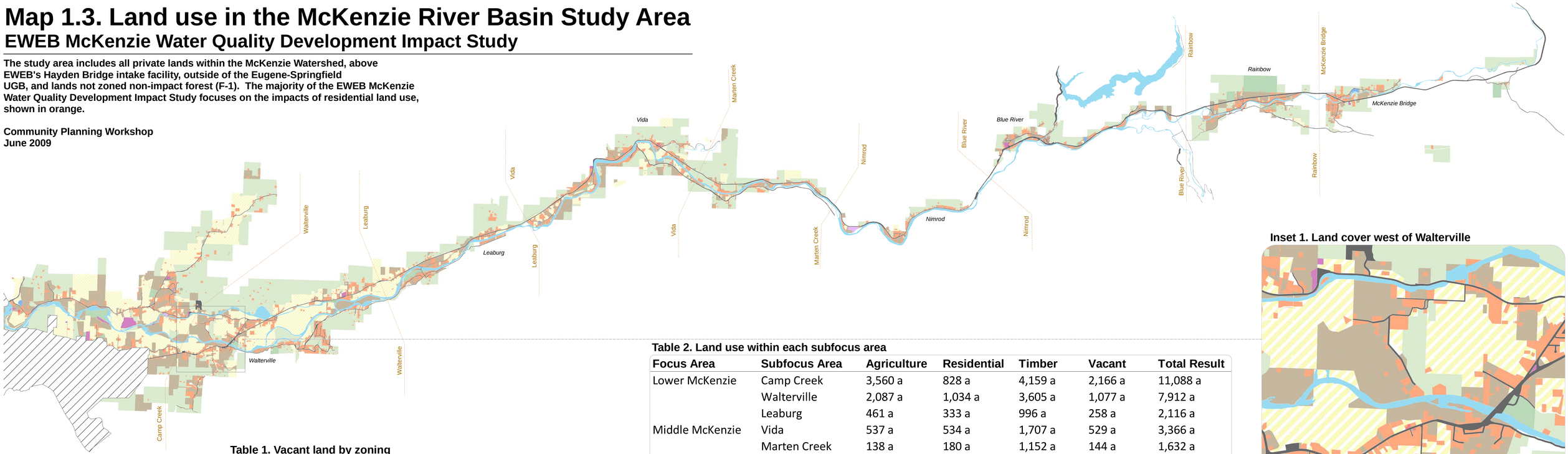

Table 1. Vacant land by zoning

Focus Area	EFU Zones	F2 Zones	RR Zones
Lower McKenzie	1,030 a	1,024 a	1,011 a
Middle McKenzie	131 a	173 a	370 a
Upper McKenzie	na	172 a	457 a
Total	**1,160 a vacant**	**1,369 a vacant**	**1,838 a vacant**

Table 2. Land use within each subfocus area

Focus Area	Subfocus Area	Agriculture	Residential	Timber	Vacant	Total Result
Lower McKenzie	Camp Creek	3,560 a	828 a	4,159 a	2,166 a	11,088 a
	Walterville	2,087 a	1,034 a	3,605 a	1,077 a	7,912 a
	Leaburg	461 a	333 a	996 a	258 a	2,116 a
Middle McKenzie	Vida	537 a	534 a	1,707 a	529 a	3,366 a
	Marten Creek	138 a	180 a	1,152 a	144 a	1,632 a
	Nimrod	26 a	148 a	264 a	94 a	560 a
Upper McKenzie	Blue River	14 a	201 a	809 a	195 a	1,259 a
	Rainbow	27 a	239 a	1,054 a	351 a	2,085 a
	McKenzie Bridge	1 a	264 a	1,043 a	113 a	1,509 a
Total Result		**6,850 a**	**3,761 a**	**14,790 a**	**4,926 a**	**31,527 a**

Inset 1. Land cover west of Walterville

Land use class Timber | Vacant | Residential | Agriculture | Commercial | Government; Education | Parks & Recreation | Water | Paved Surface

Map 1.4. Location of Structures in McKenzie River Basin Study Area

Map 1.4 shows the difference in orientation of structures to the river and roads throughout the study area.

CPW looked at the relationship of structures to the McKenzie River and road infrastructure by finding the nearest distance of a structure to each layer. Comparison of the distances reveals the structures relative orientation to each landscape feature.

Data used for analysis:

- Address points (Lane County)
- Floodzones (FEMA)
- Focus areas (CPW)
- Paved surfaces (LCOG)
- Subfocus areas (CPW)
- Water bodies (LCOG)

In the lower watershed structures tend to be oriented more toward the road than the river; the opposite relationship is seen in the upper watershed where structures are oriented more toward the river than the road.

Map 1.4. Location of Structures in McKenzie Basin Study Area

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The map shows the location and clusters of dwelling locations within the study area. The insets and table explore the relative orientation of dwellings between two principle landscape features: the river and major roads.

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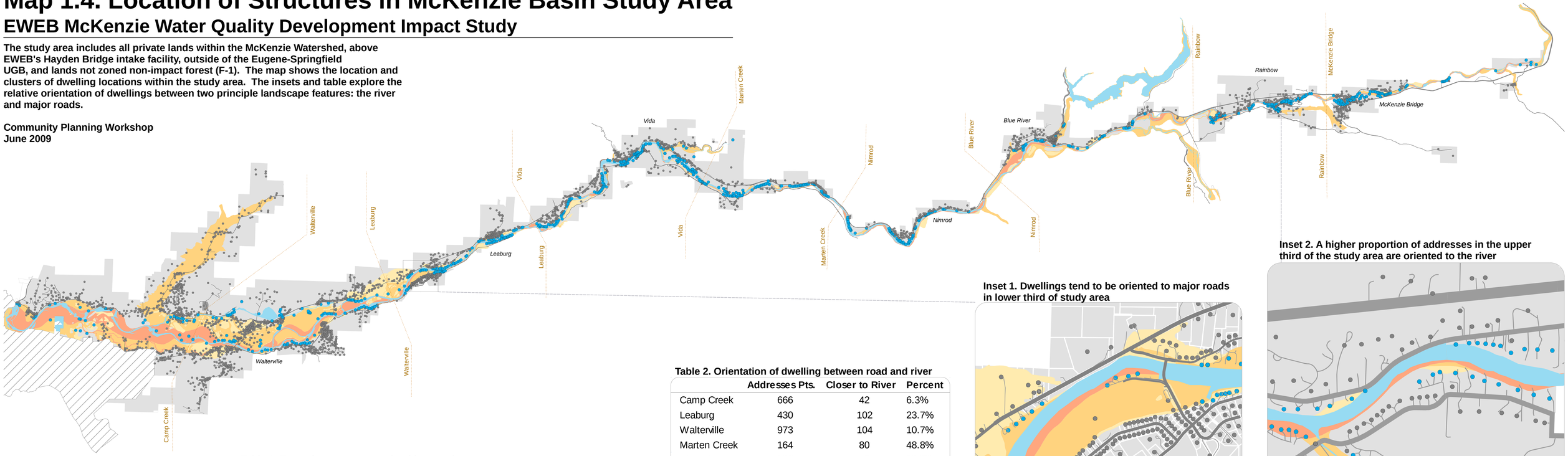

Table 1. Type of structure at each address point

	Single Family	Mobile	Commercial	N/A	Total
Lower Mckenzie	1497	306	51	215	2069
Middle McKenzie	691	114	33	63	901
Upper McKenzie	343	105	35	461	944
Total	**2531**	**525**	**119**	**739**	**3914**

Table 2. Orientation of dwelling between road and river

	Addresses Pts.	Closer to River	Percent
Camp Creek	666	42	6.3%
Leaburg	430	102	23.7%
Walterville	973	104	10.7%
Marten Creek	164	80	48.8%
Nimrod	186	73	39.2%
Vida	551	172	31.2%
Blue River	278	57	20.5%
Mckenzie Bridg	354	113	31.9%
Rainbow	312	132	42.3%
	3914	**875**	**22.4%**

Inset 1. Dwellings tend to be oriented to major roads in lower third of study area

Inset 2. A higher proportion of addresses in the upper third of the study area are oriented to the river

N

0 2.5 5 10 Miles

Legend: Structure closer to river; Structure closer to road; 1996 Flood Extent; Floodway; 100-year Flood Zone; 500-year Flood Zone; Water Bodies

Map 1.5. Floodplains within the McKenzie River Basin Study Area

Map 1.5 represents the extent of FEMA designated floodplains and displays its relationship to the 1996 flood extent.

CPW calculated taxlot size in relation to the floodplain by selecting all taxlot centroids that fell within the any floodplain area (i.e. 500-year, 100-year and floodway).

Data used for analysis:

- McKenzie River 1996 flood extent (ODFW)[2]
- Floodzones (FEMA)
- Focus areas (CPW)
- Land use (LCOG)
- Subfocus areas (CPW)
- Taxlots (LCOG)

The centroid of 1,417 taxlots are located within the floodplain. The average taxlot size found within the floodplain ranges between 7.4 acres in the Lower McKenzie to 1.34 acres in the Upper McKenzie. A total of 8,051 acres and 25% of the study area is located in the floodplain. Lower McKenzie focus area contains the greatest number of taxlots within the floodplain (991 taxlots). One tenth of the taxlots found within the floodplain of the Lower McKenzie are classified as residential land cover. By comparison, one-third of the taxlots found within the floodplain of the Middle and Upper McKenzie focus areas is classified as residential land cover. The greatest class of land cover found within the floodplain is agriculture, the majority of which is found in the lower third of the study area.

The majority of the 1996 flood extent (98%) was located within the FEMA designated floodzones. Additionally, 78% of the 1996 flood occurred within the FEMA floodway.

[2] McKenzie River 1996 flood extent layer is only available between the Hayden Bridge intake and just downstream of Nimrod.

Map 1.5. Floodplains within the McKenzie Basin Study Area

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The map displays the floodplain and historic flood information. The 1996 flood extent is marked against the FEMA designated floodplain extent. Address locations are colored by location in relation to the 1996 flood and the FEMA floodplain.

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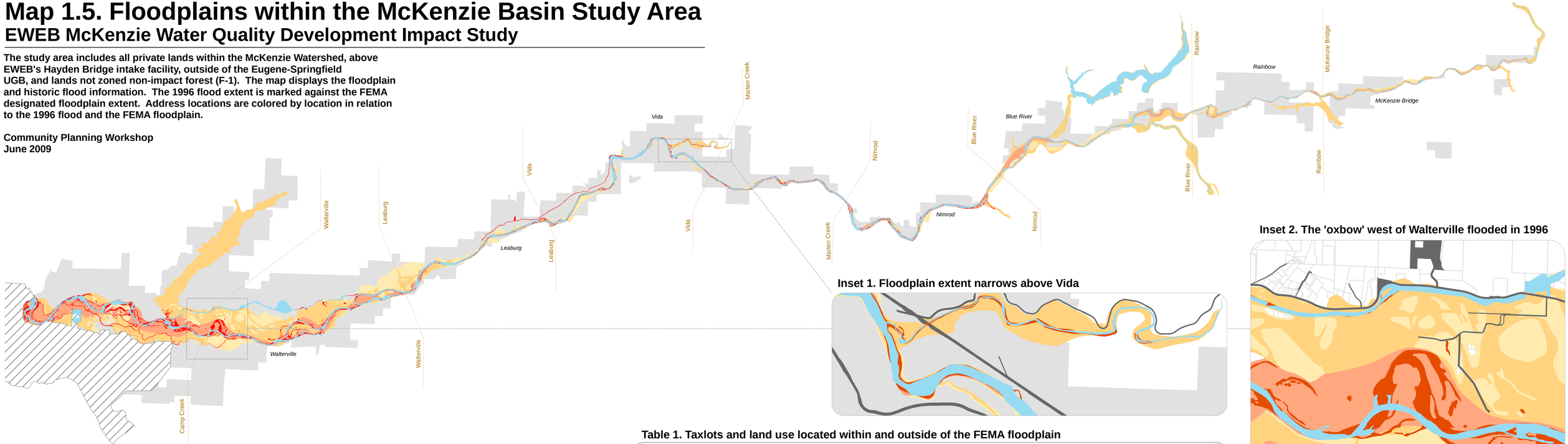

Inset 1. Floodplain extent narrows above Vida

Inset 2. The 'oxbow' west of Walterville flooded in 1996

Table 1. Taxlots and land use located within and outside of the FEMA floodplain

		Taxlots		Land Use Acreage				
Focus Area	Floodplain	Count	Avg. Acreage	Agriculture	Residential	Timber	Vacant	Total Result
Lower McKenzie	Within	991	7.4	3,810	834	977	1,441	7,371
	Outside	1506	9.34	2,298	1,362	7,783	2,060	13,745
Middle McKenzie	Within	127	2.04	31	80	53	70	237
	Outside	887	5.98	669	783	3,070	696	5,321
Upper McKenzie	Within	299	1.37	2	152	174	86	443
	Outside	747	5.96	40	551	2,733	572	4,410

Floodplain classification and 1996 flood extent

1996 Flood Extent | Floodway | 100-year Flood Zone | 500-year Flood Zone | Water Bodies

Section 2: Riparian Areas

Riparian vegetation is important to water quality protection by providing bank stabilization and shading. Developed root structures help prevent and minimize erosion by holding streambanks together. Bare soil is vulnerable to erosion which releases sediment into the river, reducing water quality. Developed vegetation provides a cooling effect to rivers that maintains water quality by limiting algae development as well as creating better fish habitat. In addition, vegetation filters non-point source pollution such as stormwater and erosion as well as dissipating the energy of floodwaters.

Maps:

Map 2.1. Threats to riparian vegetation in the McKenzie River Basin Study Area

Map 2.1 quantifies the amount of vegetation that may be removed under existing Lane County Code. Areas with dense clusters of small taxlots adjacent to the river create a vulnerability to water quality.

CPW's analysis identified vulnerable areas along the McKenzie River based on existing Lane County Code. Currently on Class 1 streams (McKenzie River):

- For legal lots with less than 200 feet of frontage, 50 linear feet may be removed
- For legal lots with 200-400 feet of frontage, 25% of the frontage may be removed
- For legal lots with over 400 feet of frontage, 100 linear feet may be removed (LC 16.253)

CPW approximated the frontage of each taxlots adjacent to the McKenzie River. [3]

[3] A 5 foot buffer along the McKenzie River was isolated; the buffer was bisected by taxlot boundaries; the perimeter of each resultant polygon within the buffer was calculated; the length of frontage was solved using the

Data used for analysis:

- Address points (Lane County)
- Focus areas (CPW)
- Perennial streams (USGS)
- Rivers (USGS)
- Streams (USGS)
- Subfocus areas (CPW)
- Taxlots (LCOG)

Analysis revealed that taxlots with small river frontages (frontages less than 400 feet) tend to be clustered together, and are more prevalent in the middle and upper watershed than the lower third. Within the Middle McKenzie focus area, 43.5% of taxlots fronting the river have frontages of 400ft or less (i.e. that permit 25% or more of riparian vegetation to be removed). Similarly, 36.5% of taxlots in the Upper McKenzie contains frontages with less than 400ft.

Under current Lane County Code about 661 acres, or 89%, of the McKenzie River's riparian vegetation is protected. This means that 11% of the McKenzie River's riparian vegetation may be removed under existing code. Currently, 326 address points are located within the riparian setback of Class-One waterways (greater than 1,000 cfs) and 26 address points are located within 50ft of perennial streams (less than 1,000 cfs) feeding into the greater McKenzie River.

following equation: [frontage] = [perimeter] ÷ 2 – [buffer depth]. Error is minimized using this technique when taxlot boundaries are perpendicular to the river edge and the frontage continues in a straight line. The number of structures within class one and perennial stream riparian set-backs was found by 'selecting by location' all address points within 50-feet of the river.

Map 2.1. Potential for Riparian Modification in the McKenzie Basin Study Area

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The map depicts dwelling locations in relation to Lane County Code riparian setback requirements. Within the study area 326 address points are within the riparian setback. The majority of these address points are located in the upper two thirds of the basin.

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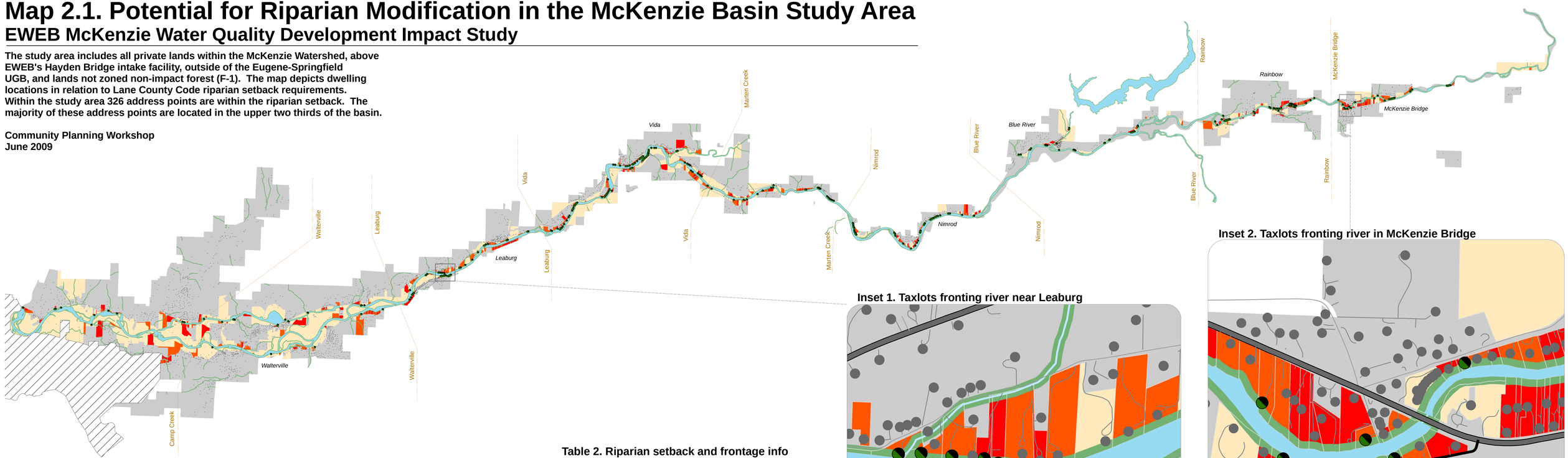

Inset 1. Taxlots fronting river near Leaburg

Inset 2. Taxlots fronting river in McKenzie Bridge

Table 1. Cumulative distance of each frontage class on both sides of river

Focus Area	Frontage < 200 ft Total	Distance	Frontage 200 - 400 Total	Distance	Frontage > 400 ft Total	Distance	Grand Total
Lower McKenzie	4 mi	5.16%	8 mi	9.99%	66 mi	84.85%	78 mi
Middle McKenzie	5 mi	17.49%	8 mi	26.00%	18 mi	56.51%	31 mi
Upper McKenzie	4 mi	17.58%	5 mi	19.14%	16 mi	63.27%	25 mi
Grand Total	**14 mi**	**10.36%**	**21 mi**	**15.43%**	**99 mi**	**74.21%**	**134 mi**

Table 2. Riparian setback and frontage info

Area of Riparian Setbacks	
Class-One Waterway (> 1000 cfs)	745 a
Perennial Stream (< 1000 cfs)	762 a
Structures in Riparian Setback	
Class-One Waterway (> 1000 cfs)	326
Perennial Stream (< 1000 cfs)	26
Amount of Setback Removable	
Class-One Waterway (> 1000 cfs)	84 a / 11 %

N 0 2.5 5 10 Miles

Legend Dwelling within Riparian Setback • Dwelling or Structure | Class-One Riparian Setback | Lot with 0 - 200 ft Frontage | Lot with 200 - 400 ft Frontage | Lot with 400 + ft Frontage

Section 3:
Development in the Floodplain

Several types of development including dwellings, septic tanks, and drainage fields that are located within the floodplain may impact water quality by leaking untreated sewage, household chemicals, or hazardous materials into the waterway. During a flood event, entire structures and septic systems may be washed into the waterway, negatively impacting water quality and leading to further property damage.

Analysis focused on development in Federal Emergency Management Agency designated floodzones as well as by proximity to the McKenzie River, as frequently flooded areas close to the river are most likely to create vulnerabilities to water quality.

Maps:

Map 3.1. Development within the McKenzie River floodplain

Map 3.1 shows address points in relation to the McKenzie River. These structures all have potential for repetitive loss of structures located in FEMA designated floodzones.

CPW looked at the relationship of structures to the McKenzie River by location within FEMA designated floodzones. Location within FEMA designated floodzones was found by tagging address points contained within each floodzone.

Data used for analysis:

- Address points (Lane County)
- Floodzones (FEMA)
- Focus areas (CPW)
- McKenzie River 1996 flood extent (ODFW)
- Water bodies (LCOG)

Throughout the study area a total of 620 address points are located within the 100-year floodplain, 70 within the floodway, and 18 within the 1996 flood extent.

Map 3.1. Development within the McKenzie River Floodplain

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The map displays FEMA designated floodplain and the 1996 flood extent within the McKenzie River Basin Study Area. The 1996 flood extent is marked against the FEMA floodplain extent. 98% of the 1996 flood was within the FEMA floodplain extent and 80% occurred within the FEMA designated floodway. Address locations are colored by location in relation to the 1996 flood extent and the FEMA floodplain.

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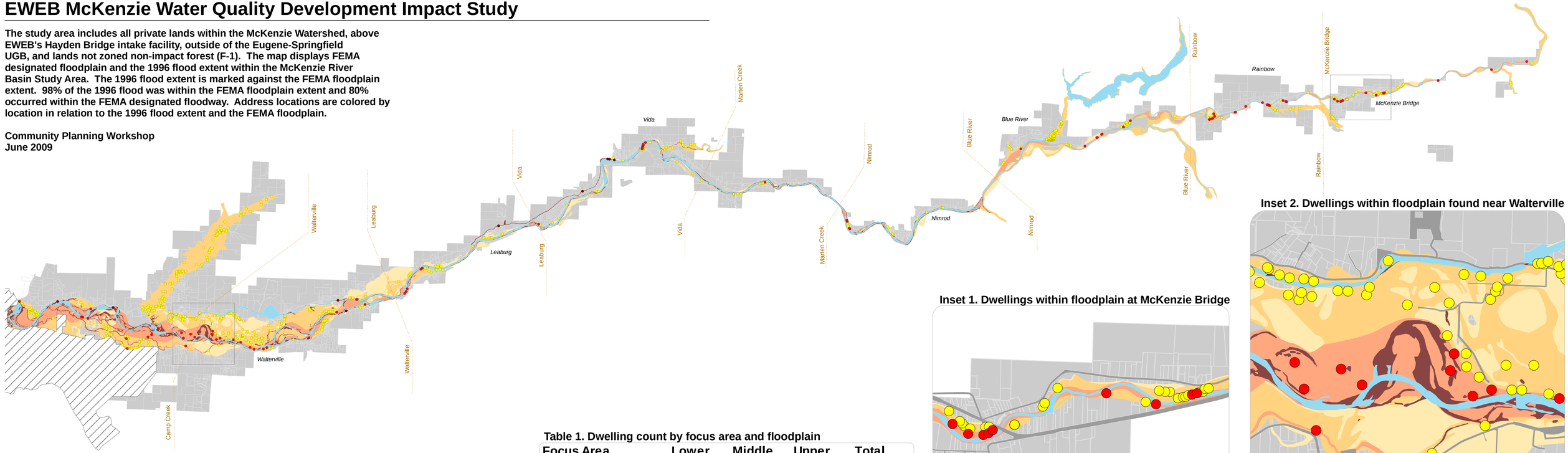

Inset 1. Dwellings within floodplain at McKenzie Bridge

Inset 2. Dwellings within floodplain found near Walterville

Table 1. Dwelling count by focus area and floodplain

Focus Area	Lower	Middle	Upper	Total
Floodplain (100 yr)	371	63	186	620
Floodway	26	18	26	70
1996 Flood	10	8	0	18
Total Study Area	2069	901	944	3914

N

0 1.25 2.5 5 Miles

Dwellings within Floodplain 100yr Floodplain Floodway Flooded in 1996

FEMA Floodplain Classes 1996 Flood Extent Floodway 100-year Flood Zone 500-year Flood Zone Water Bodies

Section 4:
Septic Systems

Septic systems are a common feature of development in rural areas without municipal sewer systems. The McKenzie River basin, upriver from the Hayden Bridge intake facility, has approximately 4,000 septic systems and eight larger community septic systems. According to the Environmental Protection Agency (EPA) up to a quarter of septic systems fail within their lifetime, meaning that the contents of the septic tanks are released into the surrounding soils which may leach into nearby water bodies.

Analysis focused on the relation of septic system locations in relation to the McKenzie River and Federal Emergency Management Agency (FEMA) designated floodzones as well as areas of higher density.

Maps:

Map 4.1. Extrapolation of septic system locations to the entire study area

Map 4.1 shows how EWEB's data set of septic systems and drainfields was extrapolated to cover the study area and the resulting estimation of drainfield density within floodplain, riparian zones, and by subfocus area.

The map depicts the location and concentration of septic systems within the study area. EWEB identified the location of 435 septic systems and approximately 60 septic drainfields in the study area. This layer was extrapolated to the entire study area by simulating a possible location within the taxlot within 250 ft of the dwelling.

Concentrations are based on locations assigned by random probability according to the location of the address point on the taxlot.

Data used for analysis:

- Extrapolation of septic system and drainfield locations (CPW)
- Floodzones (FEMA)
- Rural communities (LCOG)

- Septic system and drainfield locations (EWEB)
- Subfocus areas (CPW)

The highest density of drainfields tends to be located in rural communities and other clusters of development, especially in the lower watershed. Septic system drainfields may cover up to 183 acres of the study area.

Map 4.1. Septic Systems in the McKenzie Basin Study Area

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The map depicts the location and density of septic systems within the study area. Areas with a higher density of septic systems are outlined in red on the full extent map. Densities are simulated based on locations randomly assigned according to the location of the address point on the taxlot. Lower right map depicts area of probable septic locations. Septic points collected by EWEB are indicated by a verticle line. The color is based on the septic location in relation to the floodplain.

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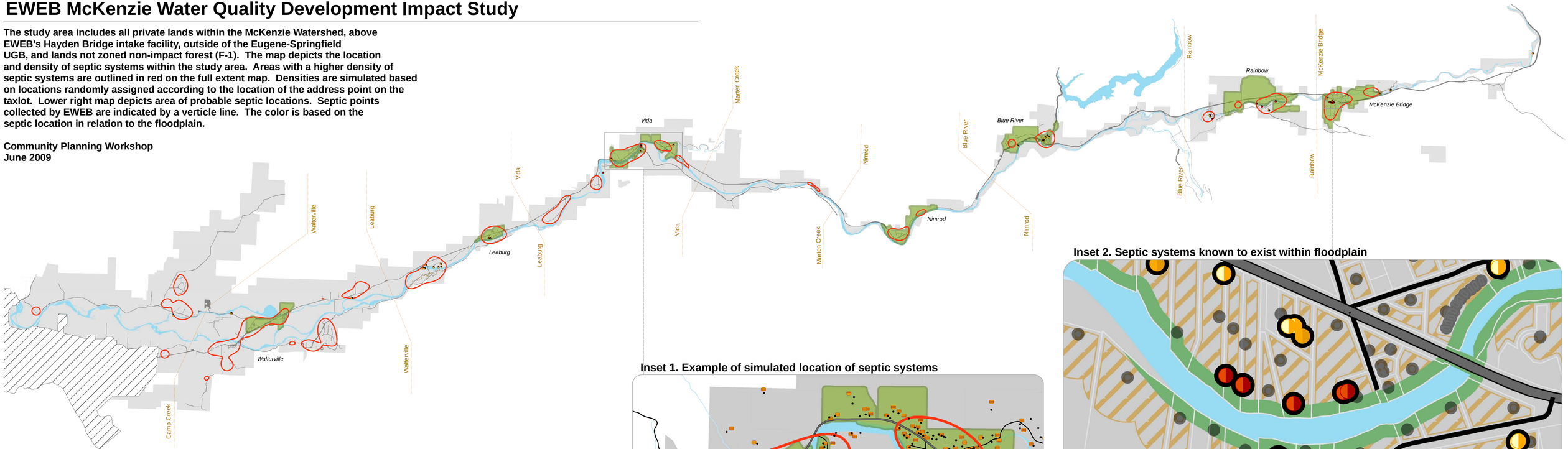
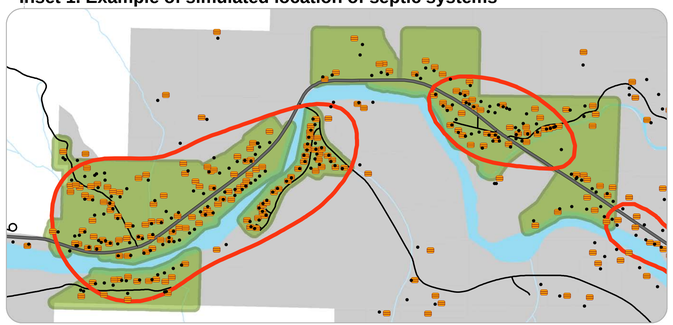


Table 1. Septic systems in study area

Approx. Number of Septic Systems*	3200
Average Drainfield Size	2500 sq ft
Total Drainfield Coverage	183 acres
Systems Inventoried by EWEB	435
Systems within 100yr Floodplain	62
Systems within Floodway	14

**based on Lane County address points*

Inset 1. Example of simulated location of septic systems



Inset 2. Septic systems known to exist within floodplain

N

0 2.5 5 10 Miles

Legend

Rural Community Boundary

Density of systems > 130 septics / sq.mi

Possible Septic Drainfield Location

System outside floodplain

System within 100 yr floodplain

System within floodway

Section 5:
Sensitive Soils and Slopes

Environmental impacts on water quality from development are exacerbated by both risky soil types and high slopes. As slope increases, erosion caused by construction and movement of earth increases, causing sedimentation of adjacent waterways. Soils affect the ease by which contamination passes from its source to a water resource. Soils with high gravel sand content allow contaminants to pass quickly to sensitive areas, including waterways, water bodies, and well heads. Clay dominated soils also allow for quick transport of contaminants, but through overland flow instead of subsurface flow.

Analysis focused on identifying areas located on steep slopes or risky soils types that are vulnerable due to existing structures and future development.

Maps:

Map 5.1. Development located on steep slopes

Map 5.1 identifies structures and septic systems located on steep slopes which have the potential to cause erosion into the McKenzie River.

Address points were flagged by their location on slopes: less than 5%, 5% to 15%, 15% to 25%, 25% to 35%, and over 35%.

Data used for analysis:

- Address points (Lane County)
- Extrapolation of septic system and drainfield locations (CPW)
- Slope

Concentrations of development on slopes greater than 25% in close proximity to the river primarily occurs in the middle section of the watershed where slopes are the steepest. Approximately 296 address points are located on slopes of greater than 25% and 143 address points on slopes greater than 35%.

Map 5.1. Development on Steep Slopes

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The map depicts various development features (address points and septic drainfields) in relation to underlying slope. Lane County code regulates development beyond 40%. Oregon Department of Environmental Quality restricts septics to slopes less than 30%. Areas of development concentrated on steep slopes are indicated in red.

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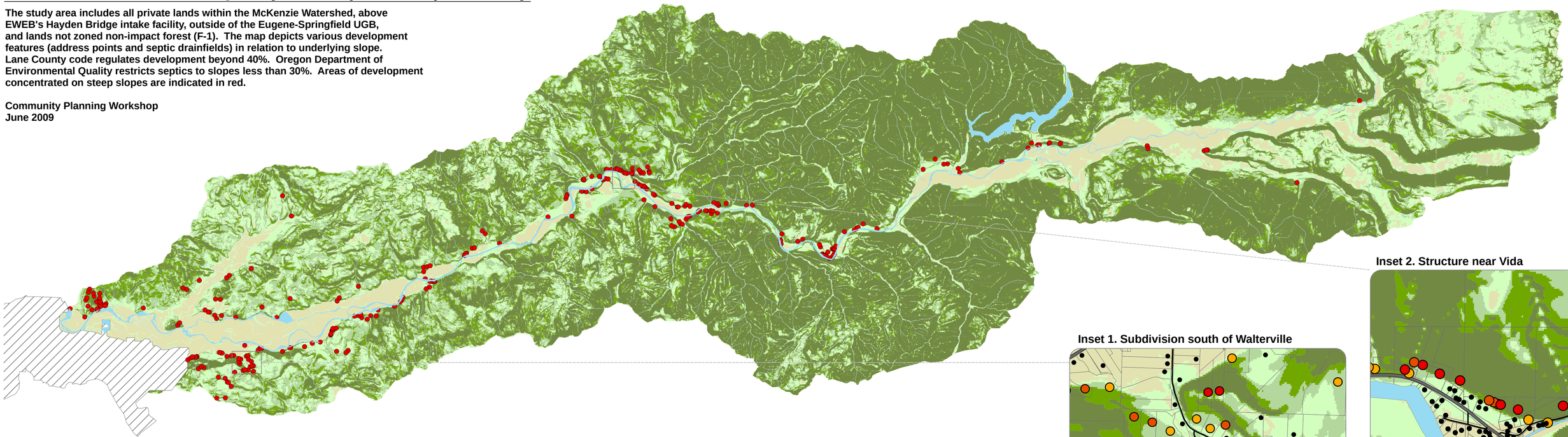
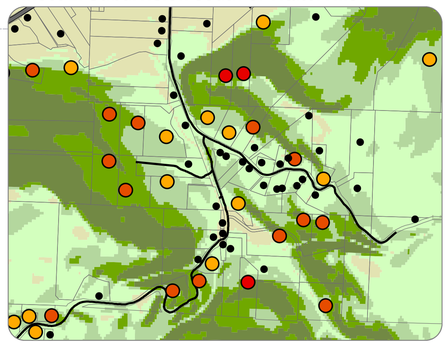
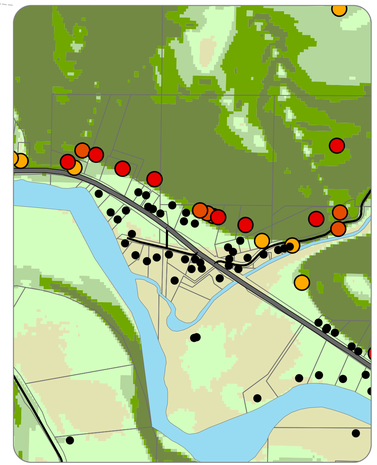


Inset 1. Subdivision south of Walterville



Inset 2. Structure near Vida



Structures Built on Steep Slopes	
Greater than 25% slope	296 address points
Greater than 35% slope	143 address points

N

0 2.5 5 10 Miles

Slope Class < 5% | 5% to 15% | 15% to 25% | 25% to 35% | > 35%

Dwellings on Steep Slopes • < 15 % | 15% to 25% | 25% to 35% | > 35%

Map 5.2. Development located on risky soil types

Map 5.2 identifies septic systems approved on high-permeability soil types; sewage may pass quickly through gravelly or sandy soils or overland on clay-dominated soils.

CPW identified septic systems located on risky soil types by intersecting the septic system layer with the soils layer. Soil types constraining development are hydrological soil groups, shallow depth to first resistant layer, shallow depth to water table, and steep slopes.

Septic systems on risky soils were then identified within the floodzone.

Data used for analysis:

- Address points (Lane County)
- Focus areas (CPW)
- Soils (NRCS)
- Subfocus areas (CPW)

Analysis reveals that the majority of development located on risky soil types is in the lower study area.

Map 5.2. Sensitive Soils of the McKenzie Basin Study Area

EWEB McKenzie Water Quality Development Impact Study

The study area includes all private lands within the McKenzie Watershed, above EWEB's Hayden Bridge intake facility, outside of the Eugene-Springfield UGB, and lands not zoned non-impact forest (F-1). The map displays soil constraints on the placement and functioning of septic systems. The main map displays aggregate constraints for the four criteria depicted in each of the map insets. Soil constraint categories are: hydrological soil group; depth to first resistant layer; depth to water table, and; representative slope.

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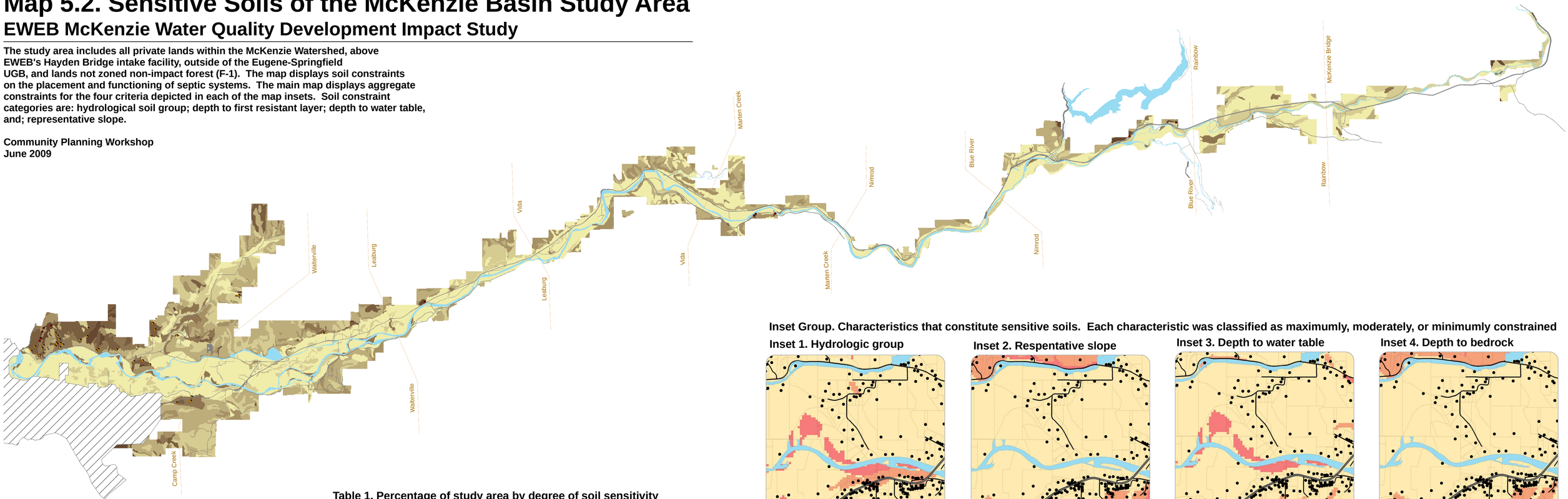

Table 1. Percentage of study area by degree of soil sensitivity

Row Labels	Minimal	Moderate	Maximum	Grand Total
Lower Mckenzie	23.5%	30.1%	8.3%	61.9%
Middle McKenzie	10.5%	8.5%	0.2%	19.2%
Upper McKenzie	10.8%	7.2%	0.9%	18.9%
Grand Total	**44.8%**	**45.8%**	**9.4%**	**100.0%**

Inset Group. Characteristics that constitute sensitive soils. Each characteristic was classified as maximumly, moderately, or minimumly constrained

Inset 1. Hydrologic group

Hydrologic Soil Group D
Hydrologic Soil Group A
Hydrologic Soil Groups B / C

Inset 2. Respentative slope

Slope greater than 30%
Slope betwen 15% and 30%
Slope less than 15%

Inset 3. Depth to water table

Water table< 12" deep
Water table 12" - 24" deep
Water table> 24" deep

Inset 4. Depth to bedrock

Restrictive layer < 12" deep
Restrictive layer 12" - 24" deep
Restrictive layer > 24" deep

0 2.5 5 10 Miles

Main map legend Dwelling on maximumly sensitivite soils | Dwelling on highly sensitive soils | No soil constraints | Medium soil constraints | Maximum soil constraints

Section 6:
Impervious Surfaces

Impervious surfaces impact water quality by contributing to stormwater runoff, which increases erosion and non-point source pollution. Analysis focused on identifying the density of impervious surface cover in close proximity to the McKenzie River.

Maps:

Map 6.1. Impervious surfaces within a quarter mile of the McKenzie River

Map 6.1 estimates impervious surface by proximity and distance along the McKenzie River.

CPW estimated impervious surface area based on an average size of different road classes and assuming an average structure footprint of 1,200 sq ft. However, the numbers presented are a conservative estimate of actual impervious surface cover.

Data used for analysis:

- Address points (Lane County)
- Focus areas (CPW)
- Paved surfaces (LCOG)
- Subfocus areas (CPW)
- Taxlots (LCOG)
- Water bodies (LCOG)

Within a quarter mile of the McKenzie River, an estimated 60 acres of the study area is covered by impervious surfaces. The greatest percentage of impervious surface area within a quarter mile of the river occurs in the Upper McKenzie study area.

Map 6.1. Impervious Surface 1/4 Mile of McKenzie River

EWEB McKenzie Land Water Study

Map depicts the percentage of impervious surface within one quarter mile of the McKenzie River. Impervious surface was based on average size of different road classes and assuming an average structure foot-pring of 1200 sq ft. Numbers presented here are a conservative estimate of true impervious surface cover.

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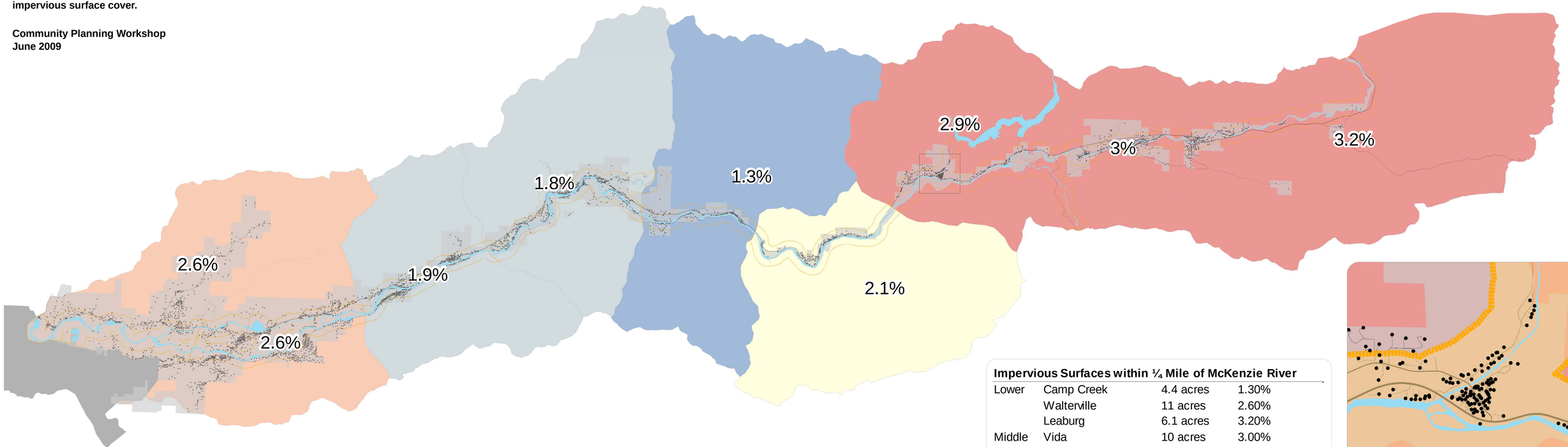

1/4 mi distance from McKenzie River within which percent impervious cover was calculated.

Impervious Surfaces within ¼ Mile of McKenzie River

Lower	Camp Creek	4.4 acres	1.30%
	Walterville	11 acres	2.60%
	Leaburg	6.1 acres	3.20%
Middle	Vida	10 acres	3.00%
	Marten Creek	4.6 acres	2.60%
	Nimrod	4.7 acres	1.90%
Upper	Blue River	7 acres	1.80%
	Rainbow	5.5 acres	2.90%
	McKenzie Bridge	6.8 acres	2.10%
TOTAL		**60 acres**	

N

0 2.5 5 10 Miles