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# **Conservation Analysis and Updated Ecosystem Mapping for the Central Okanagan Valley: Central Okanagan, South Slopes, Kelowna, Ellison and Joe Rich project areas**

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# 1 Introduction

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Various ecosystem mapping projects have been conducted in the central Okanagan Valley in the past decade, including: Central Okanagan and South Slopes<sup>3</sup>, Kelowna and Ellison<sup>4</sup>, and Joe Rich<sup>5</sup>. Changes to provincial standards for ecosystem mapping have occurred since some of these projects were completed, as well as changes to ecosystems from recent development in some areas. In order to conform to the provincial standards, and to perform a conservation analysis, the project areas were compiled and updated or revised where necessary.

Terrestrial Ecosystem Mapping (TEM) is a stratification of the landscape into map units based on climate, terrain, soils, vegetation and the resulting ecological communities. TEM polygons are delineated on aerial photographs using vegetation, topographic and terrain features. Up to three ecosystem units are mapped within each TEM polygon, with each ecosystem unit representing a proportion of the polygon (decile). The location of each ecosystem within the TEM polygon is not specified. Ecosystem units are field-verified and site and vegetation features of each polygon are recorded in an electronic database. Polygons are digitized and compiled in a geographic information system (GIS). Most TEMs used in this project were done at a scale of 1:15,000; Kelowna was mapped 1:10,000.

Sensitive Ecosystems Inventories (SEI) identify generalized groupings of ecosystems based on at-risk status, ecological sensitivities, ecological processes, and wildlife habitat values. A sensitive ecosystem is one that is considered at-risk or ecologically fragile in the provincial landscape. Other important ecosystems have significant ecological and biological values associated with them. These projects modelled sensitive and other important ecosystems from the TEM. Additional attributes including the condition<sup>6</sup> of all sensitive and other important ecosystems are recorded in the database.

Wildlife Habitat Ratings (WHR) can be applied to an ecosystem map to predict the suitability or habitat value for selected species. Some of the ecosystem mapping projects in the central Okanagan did not originally model wildlife habitat suitability, but this update included applying ratings consistently throughout the compiled project areas.

TEM<sup>7</sup>, SEI<sup>8</sup>, and WHR<sup>9</sup> all have provincial standards, which were followed in all of these mapping projects in the central portion of the Okanagan Valley, except that the polygons for the Ellison project were digitally captured from an orthophoto base rather than using monorestitution.

The first stage in developing a systematic plan for prioritization and protection, and stewardship of local sensitive and other important ecosystems (a Local Ecosystems Plan) is the systematic prioritization of ecosystems for protection. This can provide a basis for a strategy for parks designation and acquisition, other forms of protection, and sensitive development.

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<sup>3</sup> Iverson and Cadrin 2003

<sup>4</sup> Iverson 2008

<sup>5</sup> Iverson and Uunila 2006

<sup>6</sup> Condition is an estimation of how similar the ecosystem is to what it would be without any human influences. It considers the presence and influence of invasive plants, ingrowth and encroachment of trees, grazing, logging and other disturbances. This was originally referred to as quality/condition in the Central Okanagan SEI.

<sup>7</sup> Resources Inventory Committee 1998

<sup>8</sup> Ministry of Environment 2006

<sup>9</sup> Resources Inventory Committee 1999

Details from ecosystem mapping were used to perform a Conservation Analysis, as a way of prioritizing ecosystems. In the Conservation Analysis various factors are weighed, including local and provincial rarity of sensitive ecosystems, ecological sensitivity, ecological condition, wildlife habitat values, size and landscape connectivity. This conservation analysis follows methods used for conservation analyses in the North Okanagan and Lake Country<sup>10</sup>.

## 2 Methods

ArcView 3.2a GIS was used to merge the project areas, update polygon boundaries in the ecosystem mapping, and assist in performing the conservation analysis. Universal Transverse Mercator (UTM) projection was used to portray the spatial information, as this is the projection of the GIS files supplied by the Regional District of the Central Okanagan.

### 2.1 Development Updating

The ecosystem mapping was updated for recent development only for the Central Okanagan project area, as the remainder were completed or updated fairly recently (Table 1).

**Table 1: Date of ecosystem mapping, and date and scale of air photos used.**

Project	Date of Ecosystem Mapping	Air Photos Used	
		Year	Scale
<b>Central Okanagan</b>	2000; updated for this project in 2008	1996; 2005/2006	1:15,000
<b>South Slopes</b>	2001; updated in 2007 during Kelowna mapping	1996; 2006	1:15,000
<b>Ellison</b>	2000; updated, refined and expanded in 2005	1996	1:15,000
<b>Joe Rich</b>	2006	1994	1:15,000
<b>Kelowna</b>	2007	2006	1:10,000

Existing ecosystem polygons were themed by type and amount of development, and overlaid onto 2005 (west side) or 2006 (east side) orthophotos created from 1:10,000 aerial photographs, as well as GIS files of roads, contours, and lot lines. Areas of recent development were then identified and digitized.

Subdivided polygons were assigned new map labels based on aerial photograph interpretation (percentiles were reassessed for both portions). Some areas had patchy or larger lot development such that the polygons could not be readily divided. For these polygons, the components and their deciles were re-evaluated.

Condition and viability ratings were updated for polygons in or near recent development, and for any polygon components with sensitive or other important ecosystems that were missing these values.

<sup>10</sup> Iverson 2008 (Coldstream-Vernon); Iverson 2006 (Lake Country); Iverson 2005 (Vernon Commonage); Iverson 2003 (Bella Vista-Goose Lake Range)

## 2.2 Sensitive Ecosystems Inventory

All TEM units were assigned to Sensitive Ecosystem Inventory (SEI) categories. Table 2 below lists the SEI classes and descriptions. A single updated SEI ratings table was developed for the compiled study area.

**Table 2: Sensitive and other important ecosystems mapped in the study area.**

<b>Cod e</b>	<b>Sensitive Ecosyste ms</b>	<b>Ecosystem Description</b>
<b>WN</b>	Wetlands	Non-forested ecosystems where the water table is at or near the surface; includes <b>wet meadows</b> (WN:md), <b>marshes</b> (WN:ms), <b>swamps</b> (WN:sp), and <b>shallow open water</b> (WN:sw) including ponds.
<b>RI</b>	Riparian	Streamside ecosystems occurring on <b>floodplains</b> (RI:fp) or in gullies with intermittent or permanent creeks ( <b>gully</b> , RI:gu), and fringe ecosystems associated with pond and lake shorelines ( <b>fringe</b> , RI:ff); also includes <b>river</b> (RI:ri) and <b>beach</b> (RI:be) ecosystems.
<b>OF</b>	Old Forest	Forest ecosystems dominated by large, old trees; excludes old riparian forests; includes old Coniferous Woodlands and old Broadleaf Woodlands.
<b>GR</b>	Grasslands	Non-forested ecosystems dominated by bunchgrasses ( <b>grassland</b> , GR:gr), or non-native invasive plants with some bunchgrasses ( <b>disturbed grassland</b> , GR:dg); also includes <b>shrubland</b> (GR:sh) ecosystems that occur in a grassland matrix.
<b>BW</b>	Broadleaf Woodlands	Ecosystems dominated by trembling aspen; includes <b>aspen copse</b> ecosystems (BW:ac) occurring in depressions and moist areas in grasslands, and <b>aspen seepage</b> ecosystems (BW:as) occurring on slopes with subsurface moisture in a matrix of coniferous forest; old Broadleaf Woodlands are part of the Old Forest category.
<b>WD</b>	Coniferous Woodlands	Open stands of Douglas-fir or ponderosa pine, often on shallow soils, with typically grassy understories; old Coniferous Woodlands are part of the Old Forest category.
<b>SV</b>	Sparsely Vegetated	Shrubby rock outcrops ( <b>shrub</b> , SV:sh), grassy or unvegetated <b>rock outcrops</b> (SV:ro), <b>talus</b> (SV:ta) slopes, and <b>cliffs</b> (SV:cl)
<b>Cod e</b>	<b>Other Important Ecosyste ms</b>	<b>Ecosystem Description</b>
<b>FS</b>	Seasonally Flooded Agricultural Fields	Cultivated fields that flood annually, providing important migrating habitat for birds and habitat for other wildlife. These sites were formerly riparian or wetland ecosystems and may have some potential for restoration of these ecosystems.
<b>MF</b>	Mature Forest	Forests dominated by mature trees; includes <b>broadleaf</b> (MF:bd) forests, <b>coniferous</b> (MF:co) forests, and <b>mixed</b> (MF:mx) deciduous and coniferous forests; excludes mature riparian forests and mature coniferous and broadleaf woodlands

## 2.3 Wildlife Habitat Ratings

Wildlife habitat suitability was rated for 10 selected life requisites of at-risk species (Table 3). All but one of these species are known from the study area. Yellow-breasted Chats have not

been recorded from the Central Okanagan, but have been observed in the North Okanagan (Vernon area), and breeding has recently been observed in the West Kootenays; an expansion of their previously known breeding range.

**Table 3: Rated life requisites of at-risk wildlife species.**

<b>Species</b>	<b>Life Requisite</b>	<b>Rating Code</b>	<b>Typical Habitat</b>
Great Basin Spadefoot	Egg-laying (breeding ponds)	A-SPIN_RE	Small or ephemeral wetlands
Painted Turtle	General Living, All year (foraging / overwintering)	R-CHPI_LIA	Permanent waterbodies
Western Rattlesnake	General Living, All year (basking / denning)	R-CROR_LIA	Warm aspect rocky areas
Gopher Snake	Egg-laying	R-PICA_RE	Warm aspect deep-soiled grassland
Lewis' Woodpecker	Egg-laying (nesting)	B-LEWO_RE	Open Ponderosa pine forest or cottonwood stands
Flammulated Owl	Egg-laying (nesting)	B-FLOW_RE	Open, mature or old Douglas-fir or pine/fir forest
Western Screech-owl	Egg-laying (nesting)	B-WSOW_RE	Mature or old riparian stands (cottonwood or birch)
Yellow-breasted chat	General Living, Growing season (nesting and foraging)	Y-YBCH_LIG	Shrubby riparian
Badger	General Living, All year (denning and foraging)	M-TATA_LIA	Deep-soiled grassland or other open areas
California Bighorn Sheep	Birthing (lambing cliffs)	M-OVCA_RB	Warm aspect large cliffs

## 2.4 Conservation Analysis

The conservation analysis involved developing relative conservation values, based on evaluation of at-risk status, ecological fragility/sensitivity, habitat suitability for ten species at risk, and ecological condition. Relative conservation values were derived and used to produce simplified Sensitive Ecosystem Rankings (SER) and conservation zones, using the following method (more details are provided in following sections):

1. A rating scheme was developed to prioritize sensitive ecosystems mapped in each Sensitive Ecosystems Inventory. Each of up to three components (ecosystems) within each TEM polygon was assigned an **SEI Value** from 0 -10, representing the relative provincial and local rarity, the ecological sensitivity of each sensitive ecosystem, and general importance to wildlife.
2. These values were then adjusted based on the estimated ecological **condition** of each ecosystem unit mapped in the polygon. Condition ratings indicate how pristine an ecosystem is, or whether it has been altered by human influences.
3. **Wildlife habitat values** were assigned based on the importance of the habitats within the polygon to the most important life requisites of the ten selected species at risk whose habitats were mapped.
4. Sensitive ecosystem and wildlife habitat values were combined into a single **Conservation Value** giving a two to one weighting of ecosystems to wildlife<sup>11</sup>. The

<sup>11</sup> There is little guidance in scientific literature to determine the appropriate weighting. We found that there was considerable overlap between conservation priorities for ecosystems and wildlife, and maps produced with different weighting would be very similar.

highest Conservation Value for each of the three ecosystem components in the TEM polygon was taken to produce a single Conservation Value for the polygon.

5. Thresholds for the Conservation Values were developed to determine three **Sensitive Ecosystem Ranking** (SER) categories to indicate High (7-10), Medium (3-6.9), and Low (0-2.9) ecosystem sensitivity and value.
6. **Conservation Zones** were identified based on the size, concentration and connectivity of conservation values.

The conservation values are not intended to be “absolute” values, but provide a means of ranking the relative ecological value of each polygon. Our methods emphasize the highest conservation values within each polygon. Although the resulting map is biased towards higher conservation values (e.g. they may appear to occupy a larger area than they actually do), we feel **this method is important to avoid masking important conservation values** that would result if the values within a polygon were averaged. The scale of the aerial photographs used in these projects (1:10,000 - 1:15,000) has inherent limitations in the size of polygons that could be delineated. **Where changes in land use are proposed, we recommend mapping ecosystems, wildlife habitat, and wildlife features at a larger scale (1:5000).** The mapping should be refined, field-verified, and revised as necessary with clear documentation of the rationale for changes.

## SEI Value

SEI Value is the relative ecosystem value based on SEI category, incorporating sensitivity, rarity, and very general condition and wildlife values.

- assign value for each component, or decile (SEIVAL\_1, SEIVAL\_2, SEIVAL\_3), based on the following table:

SEI category	SEI sub-category	Relative SEI Value	Rationale (% of Central Ok study areas)
<b>Sensitive Ecosystems</b>			
Broadleaf Woodland	Aspen Copse	7	Sensitive & very rare within the study area (0.2%)
	Aspen Seepage	7	Sensitive & extremely rare within the study area (0.05%)
Grassland	Grassland	9	Very sensitive & provincially rare; rare in the study area (3%)
	Disturbed Grassland	6	Disturbed but provide values for many grassland species including rare wildlife (3%)
	Shrubland	9	Very Sensitive & provincially rare; very rare in the study area (0.5%)
Old Forest	Coniferous	10	Very sensitive; very important wildlife habitat; very rare (0.5%)
Riparian	Beach	10	Very sensitive; extremely rare (0.02%)
	Fluvial Fringe	10	Very sensitive; very important wildlife habitat; very rare (0.7%)
	Floodplain	10	Very sensitive; very important wildlife habitat; rare (2%)
	Gully	10	Very sensitive; very important wildlife habitat; rare (1%)
	River	10	Very sensitive; important wildlife habitat; very rare (0.2%)
Sparsely	Cliff	10	Sensitive; very important wildlife habitat; very rare (0.1%)



Vegetated	Rock	8	Sensitive; important wildlife habitat; rare (1%)
	Shrub	10	Sensitive; very important wildlife habitat; very rare (0.2%)
	Talus	8	Sensitive; important wildlife habitat; rare (1%)
Woodland	Coniferous	6	Sensitive; very important wildlife habitat; common (21%)
Wetland	Marsh	10	Very sensitive; very important wildlife habitat; very rare (0.2%)
	Meadow	10	Sensitive; important wildlife habitat; very rare (0.1%)
	Swamp	10	Sensitive; important wildlife habitat; extremely rare (0.01%)
	Shallow Water	10	Very sensitive; very important wildlife habitat; very rare (0.3%)
<b>Other Important Ecosystems</b>			
Mature Forest	Coniferous	2	Less sensitive, but rare (4%)
	Mixed	3	Less sensitive, but very rare (0.2%)
Seasonally Flooded Fields		4	Less sensitive, but important wildlife habitat and very rare (0.1%)
<b>Not Sensitive or Other Important Ecosystem</b>			
Not Sensitive		0	Not sensitive (61%)

## Condition Value

Condition values adjust SEI Values downwards for disturbed conditions.

- assign value for each decile (CONDV\_1, CONDV\_2, CONDV\_3), based on the following table:

Condition Rating	Assigned Value
Excellent (1)	1
Good (2)	0.8
Fair (3)	0.5
Poor (4)	0.1

## Wildlife Habitat Value

Wildlife Habitat Values provide detailed habitat ratings for the most important life requisites of selected at-risk species.

- convert wildlife ratings to values (High=10, Moderate=5, Low=1, Nil=0) for each decile, for all life requisites rated
- assign highest value of all wildlife values for each decile (WLhv\_1, WLhv\_2, WLhv\_3)

## Conservation Value

The Conservation Value combines the ecosystem value (SEI Value x Condition Value) and Wildlife Habitat values, with a weighting of two to one for ecosystem values. Condition may lower conservation values, while wildlife ratings may raise conservation values (e.g. little or no ecosystem value due to condition, but may be important for at least one rare species), or lower them (e.g. due to slope, aspect or soil depth). The highest value of all components is then assigned to the polygon.

- multiply SEI value by Condition value for each decile
- add SEI/Condition value and wildlife value, with a weighting of 2 to 1 for SEI/Condition, for each decile ( $Cons_1 = (2 [SEIval_1 * Cond_1] + WLhv_1) / 3$ )
- assign conservation rating value to polygon based on highest value of all components ( $Cons\_val = \text{highest value of } Cons_1, Cons_2 \text{ and } Cons_3$ )

Conservation Values have been used to create both a Conservation Zone map for landscape-level planning, and a Sensitive Ecosystem Ranking map for preliminary identification of sensitive areas that should be ground-assessed within the framework of an environmental assessment prior to disturbance.

## Sensitive Ecosystem Ranking

Sensitive Ecosystem Ranking (SER) simplifies the Conservation Value mapping into three ranked levels:

- SER1 = High Conservation Value (7 to 10). Locally and provincially significant ecosystems, and are of critical importance to rare wildlife species.
- SER2 = Medium Conservation Value (3 to 6.9). Moderate ecological importance based on ecosystem rarity and sensitivity and/or value to rare wildlife. In some cases, non-sensitive ecosystems may have moderate conservation values because of importance to wildlife, such as agricultural areas that may be significant foraging areas or corridors,

depending on location. The lower limit of 3 is based on the recognized value of habitat such as disturbed grasslands, old fields and other green spaces. While these ecosystems have been altered, they have habitat value to animals such as small mammals and their predators, including snakes, raptors and badger.

- SER3 = Low Conservation Value (0 to 2.9). Assumed to have little or no inherent ecological value or importance as wildlife habitat.

## **Conservation Zones**

Using the conservation values map, conservation zones including core areas, buffers, wildlife corridors, and other important conservation areas were identified based on size, concentration and connectivity of high value areas. Draft conservation zone mapping was compared to the SEI map and each wildlife habitat map to ensure all high priority values were included in the appropriate zone. This ensured that core areas included all old forests and wetlands wherever possible. However, some small and isolated wetlands were identified as other important conservation areas.

### **1. Core Conservation Areas**

Areas with a large concentration of high and some moderate conservation values were identified as core conservation areas. These would be the areas of highest priority for conservation. Ideally, activities would be primarily directed towards maintaining ecological and wildlife habitat values in these areas. There may be small areas within the core areas that could be accessed and developed without compromising core values (e.g., by fragmentation); further larger scale mapping and wildlife inventory would be needed to identify these areas. Core areas are high priorities for acquisition by land trusts, conservation organizations, for Regional Parks, and should be zoned for environmental purposes.

### **2. Buffers**

Core conservation areas need to be buffered from potential adverse effects of adjacent land uses. One hundred meter buffers around core areas were identified to conserve values in core conservation zones, and need to be managed for that purpose. The width and design of buffers also needs to be refined at larger scales to reflect the size of patches, ecosystem types, local landscape features and wildlife habitat values. Wetland and riparian buffers will likely need to be wider, but it is possible that buffers around some upland ecosystems may be narrower.

### **3. Wildlife Corridors**

Wildlife corridors provide animals with an opportunity to move freely between two or more habitat patches or habitat types in an otherwise fragmented landscape. This movement is essential to provide genetic links between populations and prevent inbreeding, and to compensate for temporary population declines in one of the habitat patches. The habitat needs of all priority species should be incorporated into the design of the corridor. Corridors must be suitably wide, with appropriate habitat features to provide security cover during movement. Corridors usually consist of linear habitats such as gully or streamside riparian areas; they are often composed of two or more ecosystem types to provide complexity to the corridor. Development and roads should avoid these zones, and mitigation will be required where roads and other developments transect the corridor. Wildlife corridors were identified to connect core areas to each other and to outside the study area.

In some cases, important corridors have already been fragmented by roads or other disturbances, and connections need to be restored. Although challenging, it is imperative to restore connections through Ellison and the western portion of West Kelowna in particular.

Larger scale mapping and additional wildlife inventory might identify some small areas that could be developed without compromising connectivity and other corridor values. This would depend upon the type and configuration of development, and site-specific issues.

### **4. Other Important Conservation Areas**

Areas with a concentration of moderate conservation values, or small and isolated areas of high values, were identified as other important conservation areas. Activities would be directed towards maintaining ecological and wildlife habitat values. There would be areas within that could be accessed and developed without compromising some ecological values; further larger scale mapping and wildlife inventory would be needed to identify these areas.

### 3 Results

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Sensitive Ecosystem classes are portrayed in Figure 1, by the largest component of the polygon, and Sensitive Ecosystem Rankings are depicted in Figure 2, by the highest value present in the polygon. Conservation Zones are shown in Figure 3. Larger, more detailed maps of the SEI classes and conservation zones are available as separate documents:

- “central ok update\_sei class\_feb09.pdf”
- “central ok update\_ser\_feb09.pdf”
- “central ok update\_cons zones\_feb09.pdf”

Spatial and non-spatial attributes that conform to provincial standard format, as well as report and map documents, will be available on the BC government website ‘EcoCat’<sup>12</sup> (spatial data in BC Albers projection). BAPID for the project is 5433.

Non-standard files will also be supplied to the OCCP and local governments, including the following (shapefiles in UTM projection, NAD83, Zone 11):

- “central ok update\_all-info\_mar09\_utm” - Includes TEM data, SEI, condition, highest wildlife ratings, conservation values and SER
- “WL ratings\_Central Ok\_10Feb09.xls” - wildlife habitat ratings for 10 species, converted to 1-10 scale
- “central ok\_cons zones\_mar09\_utm” - Conservation zones

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<sup>12</sup> <http://a100.gov.bc.ca/pub/acat/public/welcome.do>

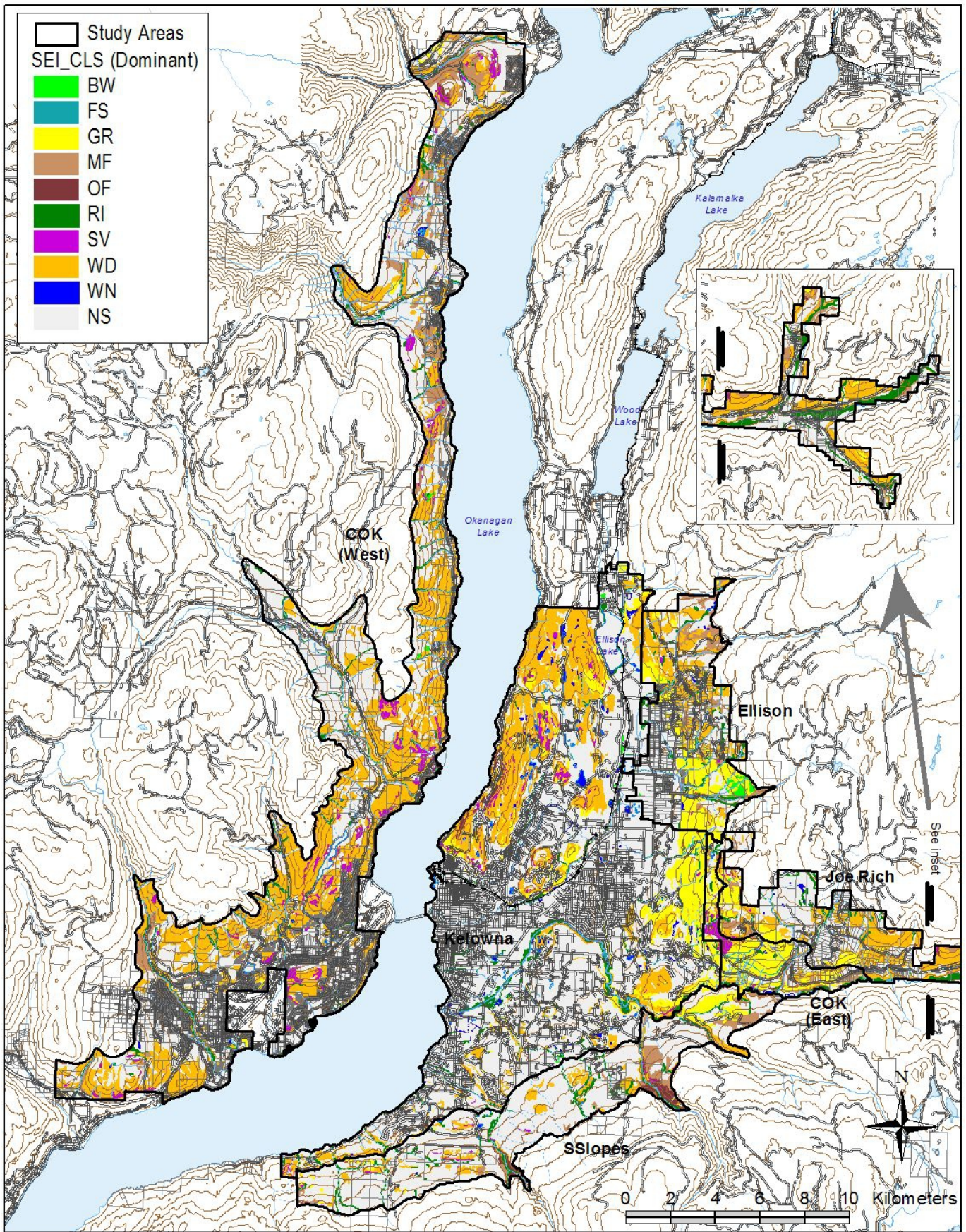


Figure 1: Dominant SEI classes in the Central Okanagan valley.

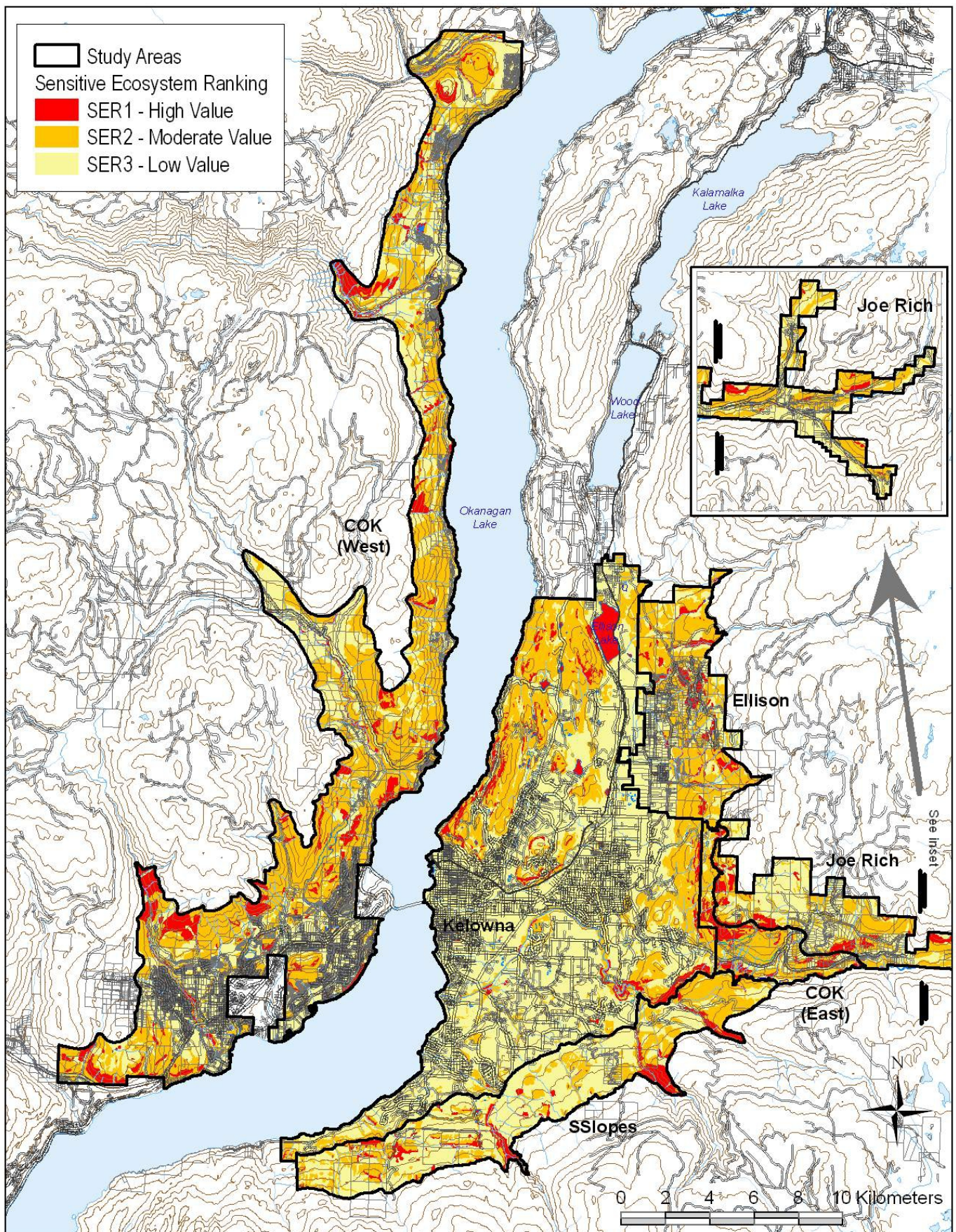
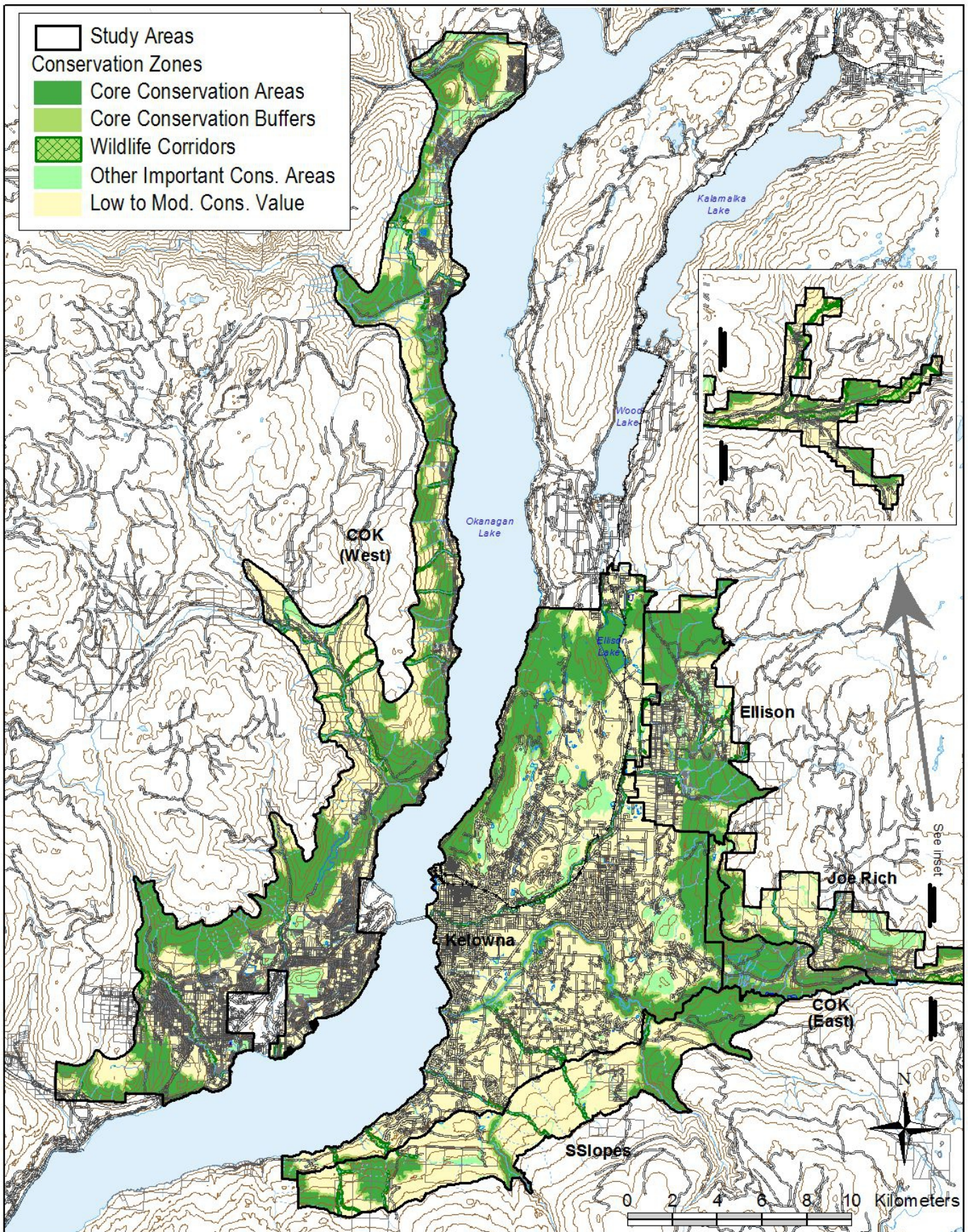


Figure 2: Sensitive Ecosystem Rankings in the Central Okanagan valley, by highest value.





**Figure 3: Conservation Zones in the Central Okanagan valley.**

## 4 Recommendations

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The conservation analysis should be used as a basis for a local ecosystems plan. The conservation zones illustrate priorities for conservation, and could be used to develop a vision for a system of protected areas and resource lands connected across the landscape. The local ecosystems plan should consider known gaps in the system of provincial and regional protected areas, and be integrated across the study area, and with the District of Lake Country and Peachland to ensure landscape level connectivity.

***SEI maps and the conservation analysis are intended to be used for broad-level planning; on-site visits are needed to assess the site and develop site-specific management recommendations.***

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