Upper Klamath Basin
Watershed Assessment Strategy

Prepared for the

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1 INTRODUCTION

The Upper Klamath Basin Watershed Assessment process is a collaborative effort between the Klamath Basin Ecosystem Foundation (KBEF), the Upper Klamath Basin Working Group, and the Klamath Watershed Council. These organizations recently received funding from the Oregon Watershed Enhancement Board (OWEB) to conduct Watershed Assessments within the Upper Klamath Basin. Because of its size, the Upper Klamath Basin should be divided into Individual Assessment Units for the purpose of conducting Watershed Assessments. Watershed Assessments will then be conducted on these Individual Assessment Units over the next several years. This document proposes a strategy for dividing the Upper Klamath Basin into Individual Assessment Units (as illustrated in Figure 1) and a schedule for conducting the Watershed Assessments.

For the purposes of this evaluation, the Upper Klamath Basin (Basin) includes the headwaters located in the upper Williamson and Sprague Rivers, Upper Klamath Lake, and all of the waters that flow into the Klamath River above the Iron Gate Dam in California. The Basin consists of 7,447 square miles and includes a diverse range of vegetation communities. The Basin includes five hydrologic subbasins (4th field hydrologic units): the Williamson, the Sprague, the Lost River, the Upper Klamath Lake, and the Upper Klamath River. There are approximately 41 5th field hydrologic units within the Basin. The boundaries of the Upper Klamath Basin, including the 4th and 5th field hydrologic units that are being considered within this Assessment Strategy, are illustrated in Figure 1and Figure 2.

The intent of the Upper Klamath Basin Watershed Assessment Project is to conduct Watershed Assessments throughout the Upper Klamath Basin, in accordance with the OWEB Watershed Assessment Manual (Manual). The Assessment techniques described in the Manual are generally intended for 5th field watersheds, which contain an average of 40,000 to 120,000 acres in Oregon, but average approximately 128,000 acres in the Upper Klamath Basin. Because of time and resource constraints, it is not reasonable to conduct Assessments on each individual 5th field. It is much more pragmatic to cover the entire Basin by delineating five or six areas as Individual Assessment Units (IAUs or Assessment Units).

While the specific methods outlined in the Manual are not practical on the sub-basin or 4th field scale, the Manual still provides valuable guidance for conducting Watershed Assessments on larger areas. Each Watershed Assessment will address all of the critical questions identified within the Manual, identify data gaps, and provide a list of restoration opportunities within the assessment area. It is anticipated that landowners, members of the Watershed Councils, and other interested citizens will conduct the field verification of site-specific data to the greatest extent practicable.

A Hydrologic Analysis has been prepared that describes the macro-scale processes that affect hydrologic response within the Basin (Salminen 2004, in Appendix). It provides a

framework for understanding the hydrologic processes within each subbasin and throughout the Basin. This Hydrologic Analysis has been used, in combination with other data, to delineate the IAUs.

This Assessment Strategy describes the proposed boundaries of the Assessment Units and the methods that were used to delineate them. This Strategy also suggests a chronology and schedule for conducting the Watershed Assessments on the IAUs.

2 METHODS

David Evans and Associates (DEA), the primary consultant working for KBEF on the initial phase of the Assessment, has collected a significant amount of data (written studies and GIS data layers) relevant to the Watershed Assessment effort in the Upper Klamath Basin. All of the relevant material collected to date is listed in the Reference section at the end of this document. DEA collected and compiled GIS data for the Upper Klamath Basin from over 20 agencies and organizations. Primary sources of information include the U.S. Forest Service (USFS), the U.S. Bureau of Reclamation (USBR), the Ecosystem Restoration Office (ERO) of the U.S. Fish and Wildlife Service (USFWS) and the Oregon Institute of Technology (OIT).

The data acquired were of various scales and spatial reference systems, and contained information pertaining to a wide range of subjects. DEA assessed each dataset to determine spatial and content accuracy, appropriate scale of use, and spatial registration. In many cases, data was re-projected from its native coordinate system to a more standard coordinate system to make it easier to use in conjunction with other datasets. Small-scale datasets, representing large areas, were used for the basin-wide Assessment Strategy effort, while more detailed datasets (large-scale) can be utilized in the Watershed Assessments within the Individual Assessment Units. For example, a 1:100,000 scale stream network was used to develop this Assessment Strategy for the Upper Klamath Basin, which covers an area of approximately 4.8 million acres, while a 1:24,00 scale stream network is being used in the Upper Williamson River Watershed Assessment, where the average 5th-field watershed is approximately 185,000 acres.

2.1 CRITERIA TO DELINEATE INDIVIDUAL ASSESSMENT UNITS

While all of the information sources listed in the reference section have helped us to better understand the Upper Klamath Basin, not all of this information is critical in determining the boundaries of the IAUs for purposes of conducting Watershed Assessments. This section provides a description of the criteria and factors that were used to delineate the IAUs. In general, these criteria are not weighted; however, there are some that are more important in determining boundaries in some part of the Basin. How each of these criteria is used to delineate the boundaries of the IAUs is discussed further in the sections describing the proposed IAUs.

Upper Klamath Basin Watershed Assessment Strategy

Figure 1: Upper Klamath Basin Proposed Individual Assessment Units

Legend

- State Boundary
- Streams
- 4th-Field Subbasin
- 5th-Field Watershed
- Klamath Project

Proposed Individual Assessment Units:

- Upper Lost River
- Lower Lost River / Klamath Project
- Lower Sprague / Lower Williamson
- Upper Klamath Lake
- Upper Klamath River
- Upper Sprague
- Upper Williamson

Sources:

Oregon Streams -OGDC (EPA 100k)
California Streams -CaSIL (EPA)
Klamath Project -BORC
Assessment Units -DEA (based on 5th field HUCs)

1:850,000

0 10 20 Miles

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June 4, 2004
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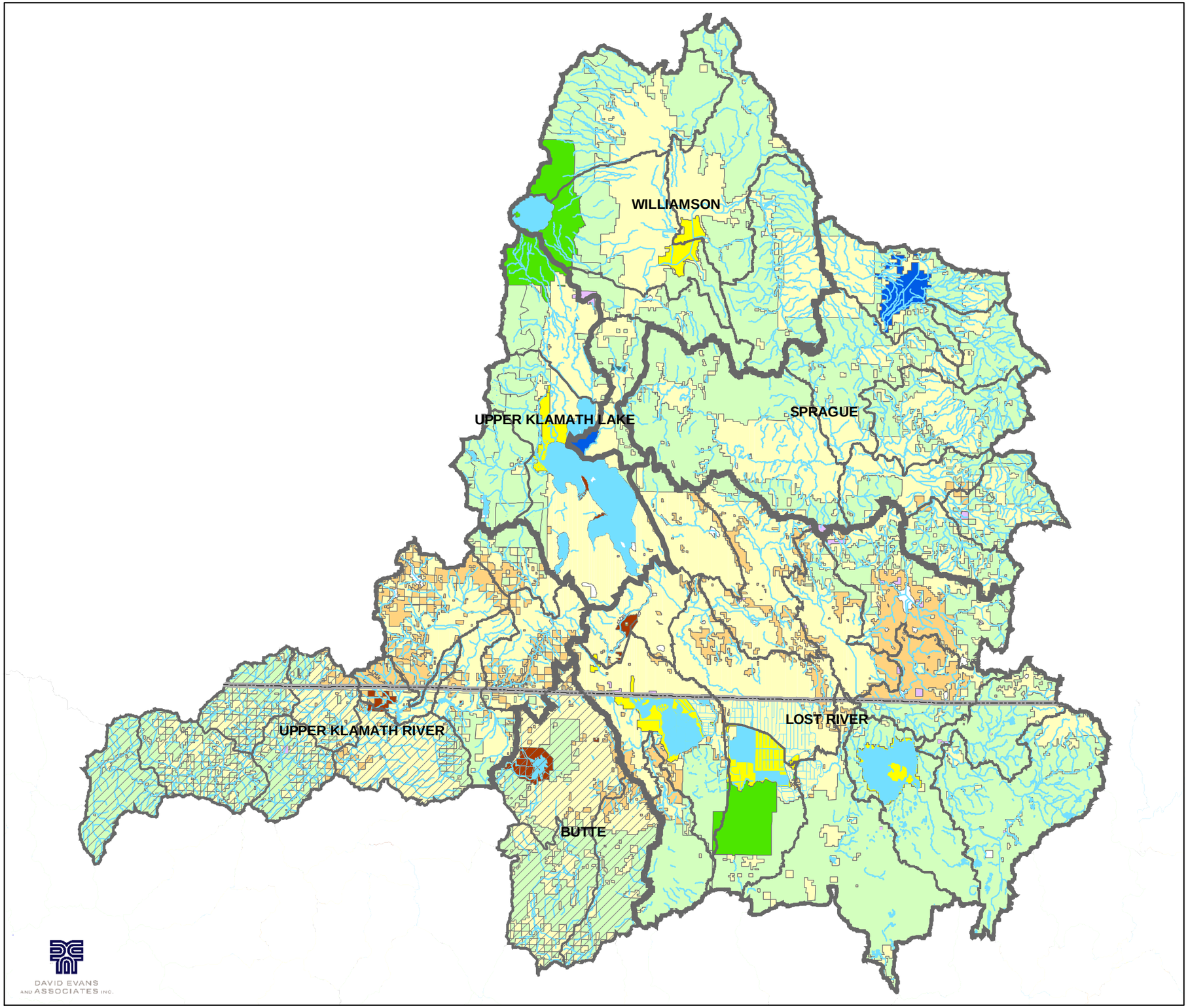
Upper Klamath Basin Watershed Assessment Strategy

Figure 2: 4th-Field Subbasins, 5th-Field Watersheds, and Ownership



Legend

- State Boundary
- Streams
- 4th-Field Subbasins
- 5th-Field Watersheds
- Excluded Watersheds

Ownership:

- BLM
- BORC
- USFS
- NPS
- Private
- State
- OR/CA F&W
- State Park
- TNC
- USFWS

Sources:

Oregon Streams	*-OGDC (EPA 100k)*
California Streams	*-CaSIL (EPA)*
4th- and 5th-Field HUCs	*-Regional Ecosystem Office*
Oregon Ownership	*-OGDC (Oregon Natural Heritage Program)*
California Ownership	*-CaSIL (CA Dept. of Forestry)*

1:850,000

0 10 20 Miles

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Hydrology: The boundaries of the hydrologic units (as illustrated in Figure 1 and Figure 2) may be the most important criteria used to delineate the Assessment Units, because it is the connectivity of the waterways within these hydrologic units that is so important from a Watershed Assessment perspective. This connectivity involves the physical connections between the surface water, groundwater, and wetlands within the hydrologic unit. Because water moves downstream in a watershed, any activity that affects the water quality, quantity, or rate of movement, at any location within the watershed, can change conditions downstream. There are some cases when it might be practical to join portions of two hydrologic units into one assessment unit – for example, if water from one hydrologic unit makes a significant contribution to the other, or if there are other social or land use factors that would unite the two hydrologic units.

In addition to the hydrologic boundaries, there are other hydrologic considerations that may help to delineate IAUs. These considerations may include hydrologic influences, natural barriers, and runoff patterns. When applicable, these are discussed further in the descriptions of the IAUs.

Social, Cultural, and Community Considerations: There are approximately nine existing watershed working groups located throughout the Upper Klamath Basin. In general, these working groups are organized according to hydrologic boundaries and have been working together for some time to address issues within their particular watershed. Because community involvement is such a large component of the Watershed Assessment process, it is important to use the framework of the existing working groups to the extent practicable. A valuable head start to the Assessment process is provided by having this framework in place and community members already engaged in the issues within their watersheds.

In addition to the watershed working group boundaries, there are other, perceived community or social boundaries. These may follow patterns of demographics, land use, topography as well as other, less defined lines. While these patterns may be difficult, or impossible, to map from a GIS perspective, they are valuable in determining where the IAUs should be delineated. It is anticipated that social and community issues will be taken into consideration by the Upper Klamath Basin Watershed Assessment Administrative Team during their review of this Assessment Strategy.

Irrigation Infrastructure: The main irrigation delivery system within the Upper Klamath Basin is the Klamath Project, operated by the U.S. Bureau of Reclamation. The development and operation of the Klamath Project has significantly altered hydrology within the Lost River and Upper Klamath River subbasins. Prior to Project development, the Lost River was generally a closed basin. Today, because various diversion channels and drains control the flow between the Klamath River and the Lost River, the traditionally applied hydrologic boundaries in the Klamath Project area are not as relevant. The watershed working groups in the Klamath Project area are actually delineated by water source: the Lost River/Cloverleaf Watershed Working Group area is

supplied by the A Canal, Gerber Reservoir, and Clear Lake; the Klamath Project Working Group is supplied by the Lost River diversion channel; the portion of the Klamath River Watershed Working Group that sits within the Klamath Project is supplied by the Ady Intake Channel. There are approximately 19 Irrigation and Drainage Districts within the Klamath Project (Figure 3). The Watershed Working Group boundaries cross the district boundaries.

Ownership and Land Cover: Ownership within the Upper Klamath Basin is characterized by USFS, USBR, USFWS, the National Park Service (NPS), The Nature Conservancy (TNC), and other private lands (Figure 2). In some areas, land (vegetative) cover patterns are often a reflection of ownership patterns. Figure 4 illustrates land cover or land use within the Upper Klamath Basin. The Hydrologic Analysis (Salminen 2004) provides a good summary of land cover within the Upper Klamath Basin (Section 2.3 of the Hydrologic Analysis). In general, evergreen forest characterizes most of the Basin, except in the Lost River subbasin, which is dominated by shrubland. Agricultural uses make up a significant portion throughout the Basin, but predominately in the Lost River subbasin. Developed areas (commercial/industrial/transportation) make up less than 1% of the total area in any subbasin.

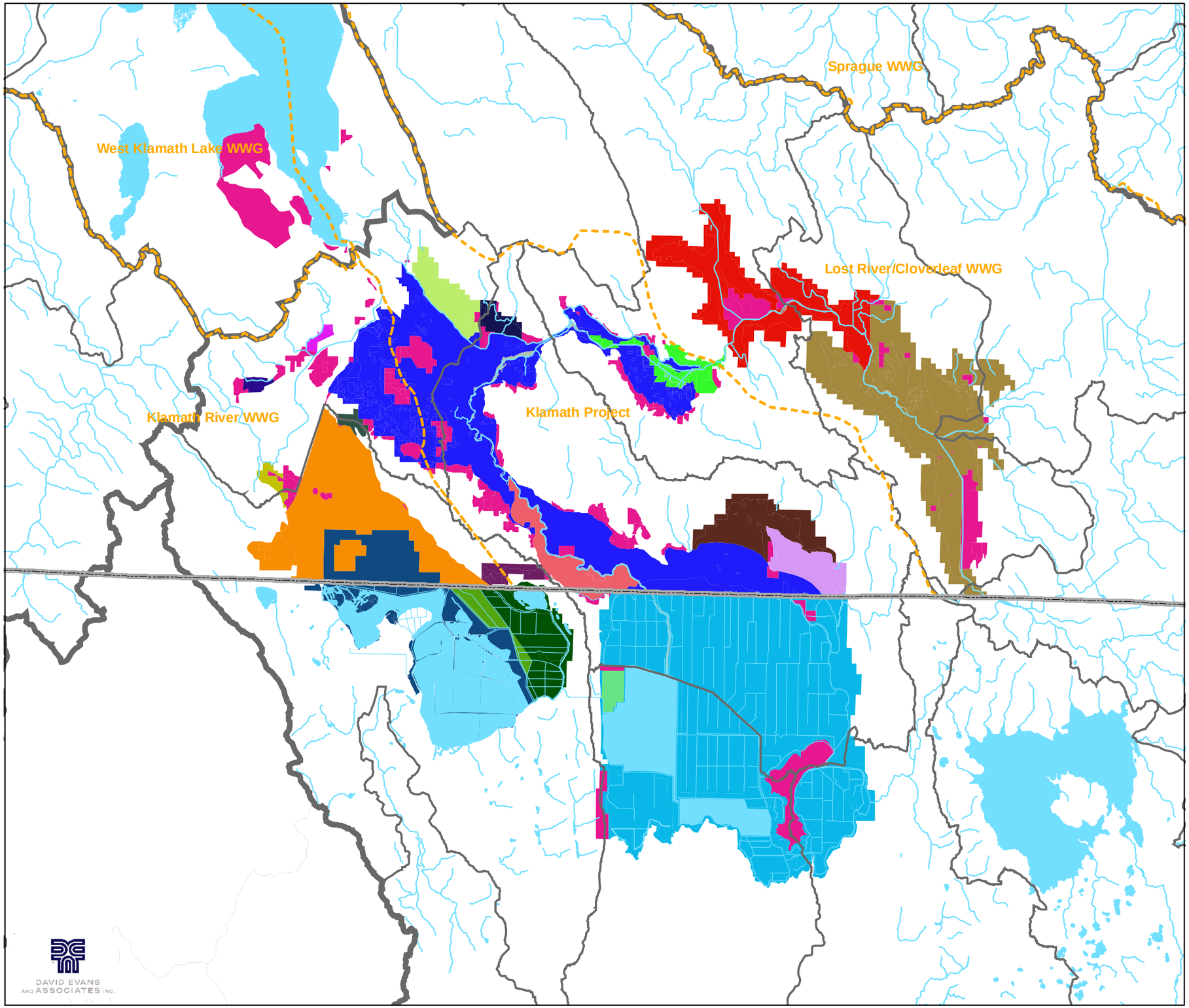
Ecoregions: Ecoregions denote areas of general vegetation, geologic and climatic similarity. Figure 5 illustrates the ecoregions identified for the Upper Klamath Basin within Oregon. Ecoregion boundaries are important for delineating IAUs because watershed assessments should be conducted on areas that are defined by similar ecological parameters. The ecoregions that characterize most of the Upper Klamath Basin are: 1) Pumice Plateau Forest, ranging across the northern portion of the Basin; 2) Cold Wet Pumice Plateau Basins, which are smaller areas scattered within the Pumice Plateau Forest; 3) High Southern Cascades Montane Forest, located along the eastern flanks of the Cascades on the west side of the Basin; 4) Southern Cascade Slope, located in the southwest portions of the Basin; 5) Klamath/Goose Lake Warm Wet Basins, located in some of the lower portions of the Basin; 6) Klamath Juniper/Ponderosa Pine Woodland, located in the lower elevation foothills of the Sprague River and Lost River subbasins; and 7) Fremont Pine/Fir Forest, characterizing mountains and high plateau areas.

Regulatory Factors: There are two federal regulations that are relevant to most activities in the Upper Klamath Basin: the Endangered Species Act (ESA) and the Clean Water Act (CWA).

There are several species that are listed, candidate, or proposed for listing under the federal ESA that have been recently documented within the Upper Klamath Basin. These special status species include the Lost River and shortnose suckers, the bull trout, the bald eagle, the Northern spotted owl, the fisher, the Oregon spotted frog, Applegate's mikvetch (plant) and Gentner's fritallaria (plant). The distribution of these species is important from a regulatory perspective, differentiating between areas that could be subject to the requirements of the federal ESA.

Upper Klamath Basin Watershed Assessment Strategy

Figure 3: Klamath Project Irrigation and Drainage District Boundaries with Watershed Working Group Boundaries



Legend

- State Boundary
- Streams
- 4th-Field Subbasin
- 5th-Field Watershed
- Watershed Councils / Working Groups (Oregon)

Irrigation District / Improv Co:

- Ady Dist Improv Co
- Colonial Realty ID/West S
- Emmitt Dist Improv Co
- Enterprise ID
- Horsefly ID
- Klamath Drainage Dist
- Klamath ID
- Langell ID
- Lower Klamath NWR
- Malin ID
- Midland Dist Improv Co
- Not in District
- P Canal Mutual Water Co
- PVID
- Pine Grove ID
- Plevna Dist Improv Co
- Shasta ID
- Sunnyside ID
- Tule Lake ID
- Van Brimmer Ditch Co
- Water
- White Lake (Area F)

Sources:

Oregon Streams	*-OGDC (EPA 100k)*
California Streams	*-CaSIL (EPA)*
4th- and 5th- Field HUCs	*-Regional Ecosystem Office*
Irrigation Districts	*-BORC*
Watershed Councils/Working Groups	*-OGDC (OWEB)*

1:300,000

0 5 10 Miles

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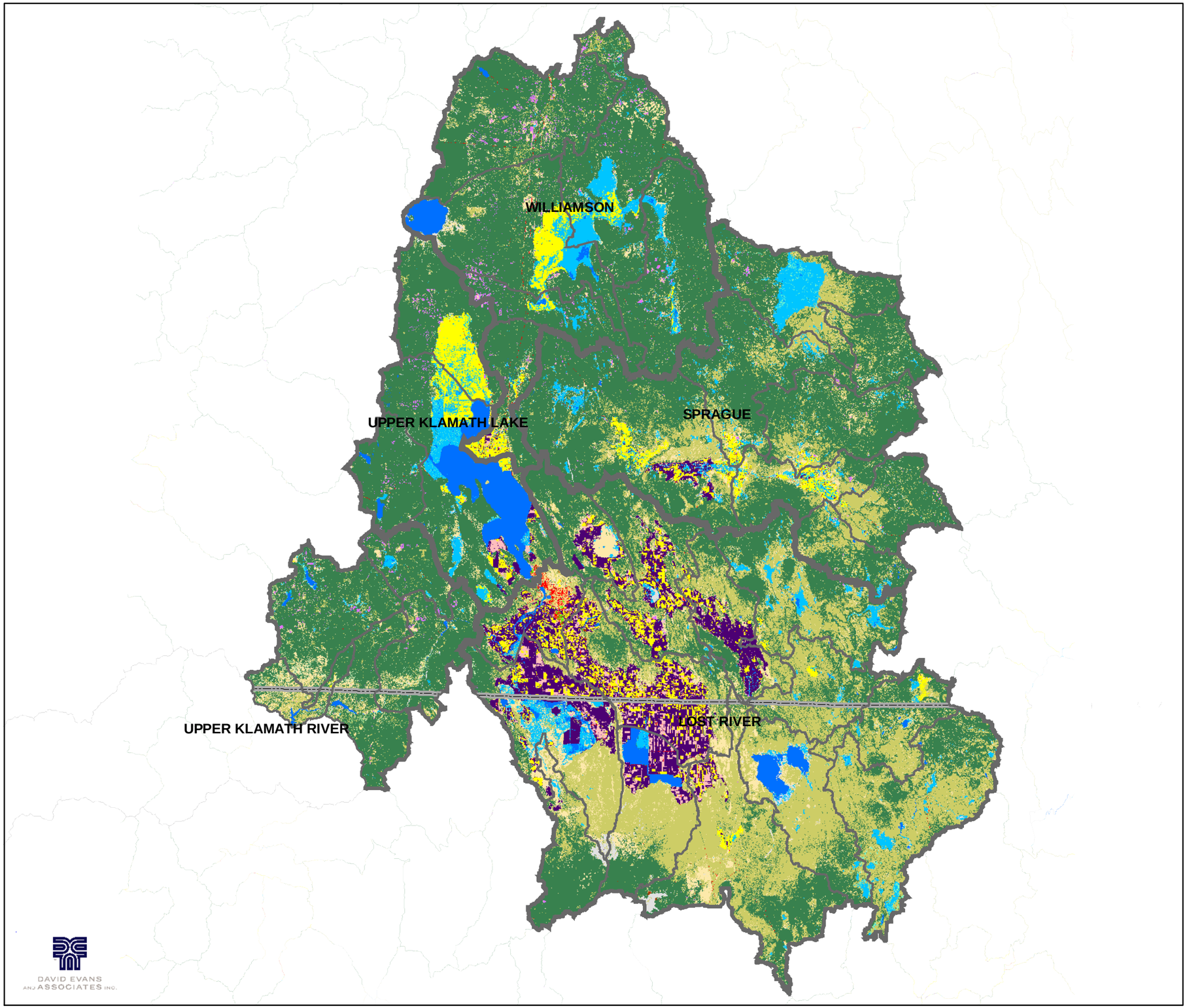
Upper Klamath Basin Watershed Assessment Strategy

Figure 4:
Land Use / Land Cover



Legend

- State Boundary
- 4th-Field Subbasins
- 5th-Field Watersheds

Land Cover / Land Use:

- Open Water
- Ice and Snow
- Low Intesity Residential
- Commercial / Industrial / Transportation
- Bare Rock / Sand / Clay
- Quarries
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrubland
- Grassland / Herbaceous
- Pasture / Hay
- Row Crops
- Small Grains
- Urban Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetlands

Sources:
4th- and 5th-Field HUCs -Regional Ecosystem Office
Land Cover / Land Use -USGS (National Land Cover Dataset)

1:850,000

0 10 20 Miles

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Figure 5. Ecoregions

Section 303(d) of the federal CWA lists all impaired or threatened waters within each state. Section 303(d) also authorizes the development of Total Maximum Daily Loads (TMDLs) for any waterbody designated as water quality limited. Many of the waters within the Upper Klamath Basin have been identified by the Oregon Department of Environmental Quality as being water quality limited and a TMDL and Water Quality Management Plan has been developed for the Upper Klamath Lake Drainage (DEQ 2002), which includes the Williamson River, Sprague River and Upper Klamath Lake subbasins (4th fields).

2.2 AREAS NOT INCLUDED IN WATERSHED ASSESSMENT STRATEGY

For the purposes of this Assessment Strategy, all of the waterways/watersheds that contribute flow to the Klamath River above Iron Gate Dam have been taken into consideration. However, the boundaries of the Upper Klamath Basin have been described in several ways, depending upon the source of the GIS coverage. As a result, several areas are not included within the Assessment Strategy (hatched in Figure 2) for the following reasons.

Upper Klamath River Subbasin: Several 5th field watersheds within the Upper Klamath River subbasin are not included within this strategy because the waterways within these areas flow into the Klamath River *below* Iron Gate Dam.

Butte Subbasin: This subbasin includes the Macdoel/Dorris, Upper Butte Creek, and Tennant 5th field watersheds. This subbasin has not been included within the Assessment Strategy because it appears to be hydrologically isolated from the Klamath River and any of the watersheds that contribute flow to the Klamath River.

3 DESCRIPTION OF INDIVIDUAL ASSESSMENT UNITS

Using the criteria described in section 2.1, the Upper Klamath Basin was divided into Individual Assessment Units to facilitate the Watershed Assessment process. The Individual Assessment Units, illustrated in Figure 1, are described in the following section.

3.1 UPPER WILLIAMSON RIVER WATERSHED ASSESSMENT UNIT

The Upper Williamson River Watershed Assessment Unit is approximately 1,325 square miles (848,798 acres) and consists of the Upper Williamson River sub-basin from the headwaters down to Kirk Reef, and includes the following 5th field watersheds:

- Northwest of Klamath Lake
- Klamath Marsh/Jack Creek
- Williamson River above Klamath Marsh
- West of Klamath Marsh
- The north portion of Williamson River below Klamath Marsh

Kirk Reef, a geologic formation just south of where the Williamson River flows out of the Klamath Marsh, was designated as the southern boundary of the Assessment Unit because it demarcates changes in water sources, hydrologic trends, and patterns of land use and ownership. The following describes how each criteria was used in delineating this IAU.

Hydrology: The Williamson River is very different above and below Kirk Reef. The area above Kirk Reef is generally spring-fed, while the area below Kirk Reef is fed primarily by surface flows from Spring Creek, Larkin Springs, Larkin Creek and the Sprague River. The lower river has a more pronounced runoff response than it does upstream of the marsh, probably due to inflow from ephemeral tributaries and direct runoff from the surrounding area. Because the Williamson River flows through the Upper Klamath Marsh and much of the flow becomes sub-surface, it is not well understood how changes in water use and water quality in the upper Williamson River would be observed below the marsh and Kirk Reef.

Social, Cultural and Community Considerations: The Upper and Lower Williamson River Watershed Working Groups use Kirk Reef as their border. This is a significant factor in defining the boundary of this IAU because the members of the Upper Williamson River Catchment Group have been working together, very effectively, for a number of years, and it is important to capture the momentum of this established organization and its inherent relationships.

Irrigation Infrastructure: This criteria is not relevant for this IAU.

Ownership and Land Cover: The area above Kirk Reef is characterized by USFS land (the Fremont and Winema forests), the Klamath Marsh National Wildlife Refuge, Crater Lake National Park, large private timber holdings, and large ranches. The ownership in the lower river, below Kirk Reef, is characterized by USFS-Winema, TNC's Williamson River Delta Preserve, and smaller private land-holdings. Land uses are relatively consistent between the upper and lower parts of the Williamson subbasin and were, therefore, not considered a factor for delineating the IAU.

Ecoregions: The upper Williamson River is located primarily within the Pumice Plateau Forest ecoregion; however, the ecoregion boundaries were not a factor for delineating this IAU.

Regulatory Factors: The Lost River and shortnose suckers are found from the mouth of the Williamson River up to its confluence with the Sprague River; however, there are no listed fish species found upstream of Kirk Reef. Bull trout historically existed in the headwaters of the Upper Williamson, but they have apparently been extirpated from this area. Critical habitat for the bull trout has been identified in Upper Klamath Lake, Agency Lake and western tributaries to these water bodies. Suitable bald eagle, spotted

owl, Oregon spotted frog and fisher habitat exists both above and below Kirk Reef and was, therefore, not considered a delineating factor for this IAU.

3.2 UPPER SPRAGUE RIVER WATERSHED ASSESSMENT UNIT

The Upper Sprague River Watershed Assessment Unit is approximately 1,125 square miles (721,191 acres) and includes the Sprague River Subbasin from the headwaters to just below the Beatty Gap. Primary rivers in this area include the Sycan River and the North and South Forks of the Sprague River. This area includes the following 5th field hydrologic units:

- Sycan River at Sycan Marsh
- Sycan River above Sycan Marsh
- Sycan River above Sprague River
- North Fork Sprague River
- Sprague River above Williamson River
- South Fork Sprague River
- Sprague River above Sycan River

Hydrology: The Sprague River subbasin drains an area of approximately 1,600 square miles and has the highest drainage density within the Upper Klamath Basin. For these reasons it may be preferable to divide the Sprague River subbasin into two Assessment Units, the Upper Sprague River and the Lower Sprague/Lower Williamson. These two areas are hydrologically unique in that the upper portions of the subbasin are predominately run-off driven, while the lower Sprague is characterized by isolated springs and by spring-driven ephemeral streams.

For the purposes of this report, the 5th field boundaries have been used to delineate the upper and lower portions of the subbasin. However, the Beatty Gap could also be used as the boundary between the two areas, in which case the watershed areas would be re-defined to divide those areas that drain above or below the Beatty Gap.

Social, Cultural, and Community Considerations: There are two watershed councils located in the Sprague River subbasin: the Sprague Watershed Working Group and the Sycan Watershed Council. The boundaries of these entities have not been taken into consideration for the delineation of this IAU. In general, the Sprague River subbasin has a number of social considerations that may divide the subbasin; however, these were not used as criteria for delineating this IAU.

Irrigation Infrastructure: This criteria was not a factor in delineating this IAU.

Ownership and Land Cover: Because both the upper and lower portions of the Sprague River subbasin are characterized by USFS and private ownership, ownership was not used as a factor for delineating this IAU. The upper part of the subbasin appears to have

less agriculture/pasture use than the lower subbasin, which may differentiate the subbasin in terms of land use.

Ecoregions: From an ecoregional perspective, the Sprague River subbasin is divided on a north-south basis, with the upper (east) and lower (west) portions containing a similar ecoregion pattern; therefore, this criteria was not used as a factor for delineating this IAU.

Regulatory Factors: The Lost River and shortnose suckers are found within the mainstem of the Sprague River to just upstream of its confluence with the Sycan River, as well as within the mainstem of the Sycan River. Bull trout historically existed in the headwaters of the Upper Sprague, but they have apparently been extirpated from this area. Critical habitat for the bull trout has been identified in Upper Klamath Lake, Agency Lake, and western tributaries to these water bodies. There is potential suitable bald eagle, spotted owl, Oregon spotted frog and fisher habitat in both the upper and lower portions of the subbasin, so habitat was not considered a delineating factor for this IAU.

3.3 LOWER SPRAGUE RIVER-LOWER WILLIAMSON RIVER WATERSHED ASSESSMENT UNIT

The lower Sprague River-lower Williamson River Watershed Assessment Unit is approximately 600 square miles (380,398 acres) and includes the lowlands portion of the Sprague River subbasin as well as the lower Williamson River subbasin from Kirk Reef to the mouth at the delta. The 5th field hydrologic units include:

- Sprague River Valley
- Williamson River below Klamath Marsh (from Kirk Reef to mouth)

Hydrology: As discussed in Section 3.1, there are significant hydrologic differences between the upper and lower portions of the Williamson and Sprague River subbasins. The primary hydrologic features in this IAU include the perennial Brown, Spring, and Whiskey Creeks, which provide a significant base flow to the Sprague. Downstream of Kirk Reef, the Williamson drops through a steep and narrow canyon, picking up springflow as it descends. As the river exits the canyon it gains inflow from Spring Creek, Larkin Springs, and Larkin Creek, which, combined, contribute the majority of baseflow to the Williamson. The Williamson then flows through TNC's Williamson River Delta Preserve, then out to Upper Klamath Lake. From a hydrologic perspective, it makes sense to combine the lower Sprague River with the lower Williamson River because the lower Williamson River is heavily influenced by the Sprague River.

Social, Cultural, and Community Considerations: See discussion under Section 3.2.

Irrigation Infrastructure: This criteria was not considered a factor in delineating this IAU.

Ownership and Land Cover: Ownership within this Assessment Unit is dominated by USFS and private areas. Land use is primarily forest, pasture and agricultural lands. See discussion under Section 3.2.

Ecoregions: See discussion under Section 3.2.

Regulatory Factors: See discussion under Section 3.2.

3.4 UPPER KLAMATH LAKE WATERSHED ASSESSMENT UNIT

The Upper Klamath Lake Watershed Assessment Unit is contained within the Upper Klamath Lake 4th field subbasin and is approximately 725 square miles (462,599 acres). It is located along the east side of the Cascades, along the west edge of the Upper Klamath Basin. This Assessment Unit includes the following 5th field hydrologic units:

- Wood River
- Fourmile Creek
- Klamath Lake

Hydrology: This IAU is delineated wholly by the boundaries of the Upper Klamath Lake 4th field subbasin. The significant hydrologic features within this area include the Upper Klamath Lake, Agency Lake, Wood River and Sevenmile Creek. As discussed in the Hydrologic Analysis (Salminen 2004), the hydrology of this subbasin is dominated by groundwater discharge along fault scarps along the edges of the Wood River valley and along the western edge of Klamath Lake.

Social, Cultural, and Community Considerations: The boundaries of the West Klamath Lake Watershed Working Group follow the boundaries of this subbasin. This criteria was not considered a factor in delineating this IAU.

Irrigation Infrastructure: This criteria was not considered a factor in delineating this IAU.

Ownership and Land Cover: This IAU is divided almost in half, with USFS owning the west side of the subbasin, and the east side of the subbasin in private ownership. The northern tip is owned by the National Park Service and the USFWS owns and operates the National Wildlife Refuge at the north end of Upper Klamath Lake. Land use/land cover is primarily forested in the upland areas along the west slope, while the lower areas are characterized by pasture and wetlands.

Regulatory Factors: Lost River and shortnose suckers occur within a few of the lower tributaries within this subbasin, while bald eagle habitat occurs throughout. There is also known habitat for the Oregon spotted frog, northern spotted owl, and the fisher. This criteria was not a factor for delineating this IAU.

3.5 UPPER KLAMATH RIVER WATERSHED ASSESSMENT UNIT

The Upper Klamath River subbasin drains approximately 650 square miles (417,523 acres) between Keno Dam and Iron Gate Dam. The main hydrologic features, from north to south, are the Klamath River, J.C. Boyle Reservoir, J.C. Boyle Dam, Copco Dams #1 and #2, Copco Reservoir, Iron Gate Reservoir and the Iron Gate Dam. The 5th field hydrologic units in this subbasin that drain into the Klamath River above Iron Gate Dam include:

- Spencer Creek
- Jenny Creek
- Middle Upper Klamath River

Hydrology: The boundaries of the Upper Klamath River 4th field subbasin define this IAU. Flows in the Klamath River above Iron Gate Dam are largely regulated by the PacifiCorp Klamath River Hydroelectric Project, which was built between 1908 and 1962. There are seven dams within the subbasin, including the Link River Dam, which is owned by USBR but operated as part of the PacifiCorp Project. The entire PacifiCorp Project is contained within this subbasin; Iron Gate Dam is the southernmost element of this Project. Because PacifiCorp has recently submitted an application to the Federal Energy Regulatory Commission for a new license for this project (PacifiCorp 2004), a substantial amount of information is available for this area, including information on water quality, hydrology, and fish habitat. The information collected and compiled by PacifiCorp will greatly facilitate the Watershed Assessment for this area.

Social, Cultural, and Community Considerations: The Klamath River Watershed Working Group has been formed to address issues within this part of the Upper Klamath Basin; however, this criteria was not considered a factor in delineating this IAU.

Irrigation Infrastructure: This criteria was not considered a factor in delineating this IAU.

Ownership and Land Cover: Ownership within the subbasin is primarily private, interspersed with USBR lands. A small portion of the USFS-Klamath Ranger District is in the north portion of the subbasin but the area is generally forested throughout. This criteria was not considered a factor in delineating this IAU.

Ecoregions: The bulk of this IAU is located within the Southern Cascade Slope ecoregion. The Klamath River Ridges and Southern Cascades ecoregions characterize the southern portion of the IAU. This criteria was not considered a factor in delineating this IAU.

Regulatory Factors: There are no listed fish species within this subbasin; however, there is potential bald eagle and spotted owl habitat throughout. This criteria was not considered a factor in delineating this IAU.

3.6 UPPER LOST RIVER WATERSHED ASSESSMENT UNIT

The Lost River subbasin drains approximately 3,000 square miles (1,935,671 acres) and is the largest subbasin within the Upper Klamath Basin. Although approximately half of this subbasin is within California, OWEB has agreed that the California portions of the subbasin should be included within this Assessment Strategy. Due to the size of the Lost River subbasin, it is reasonable to divide the area into more than one Individual Assessment Unit. Several scenarios were evaluated for delineating this subbasin and, based upon these discussions, Harpold Dam on the Lost River was chosen as the dividing line between the two IAUS.

The purpose of a Watershed Assessment is to identify features and processes that are important to fish habitat and water quality and to understand how natural processes and human activities affect those features. With this purpose in mind, it is useful to conduct a Watershed Assessment on areas within the Klamath Project. However, because of Klamath Project operations and management requirements, a non-traditional approach will be required for implementing watershed restoration activities. In addition, the Klamath Project has unique water quality/ quantity issues that may warrant a different approach to the Assessment and the prioritization of opportunities for restoration (or best management practices).

The Upper Lost River Watershed Assessment Unit is approximately 1,428 square miles (913,566 acres) and includes the following 5th fields:

- Boles/Fletcher Creek
- Clear Lake
- North Fork Willow Creek
- Upper Lost River
- Gerber Reservoir
- Langell Valley
- Poe Valley/Yonna Valley (east portion)

Hydrology: Historically, the Lost River subbasin was a closed basin, with flows originating in the California headwaters, receiving flows from several Oregon tributaries, and terminating at the Tule Lake sump in California. During high-flow events water would sometimes drain from the Lost River to the Klamath River across a low divide located just south of the present-day Klamath Falls. Today, through the operations of the Klamath Project, flows into and out of the Lost River subbasin are controlled through the regulation of the Clear Lake and Gerber Reservoirs, the A Canal, the Lost River Diversion Channel. Flow and irrigation within the subbasin is controlled by Harpold Dam, Anderson-Rose Dam, the D Pumping Plant and the J Canal.

Upstream of Harpold Dam, flows and irrigation are primarily regulated by Clear Lake and Gerber Reservoirs; while downstream of Harpold Dam, flows and irrigation are

influenced by Klamath River water entering the Lost River system through the A Canal and the Lost River Diversion Channel. Because of this difference, Harpold Dam was chosen to divide the Lost River system into two Assessment Units.

The drainage density in the Upper Lost River IAU is much greater than in the Lower Lost River. Hydrology in the upper part of the subbasin is primarily runoff-driven, while it is spring driven through the Lost River valley.

Social, Cultural, and Community Considerations: Harpold Dam is the dividing line between the Lost River/Cloverleaf Watershed Working Group and the Klamath Project Working Group.

Irrigation Infrastructure: See discussion under Hydrology. This IAU includes the Langell Valley and Horsefly Irrigation Districts, as well as non-Project irrigated lands.

Ownership and Land Cover: This IAU is primarily privately owned along the Lost River and other low-elevation areas, while the higher elevations are the Modoc and Fremont National Forests and BLM. In general, fewer row crops are grown upstream of Harpold Dam than below the dam, and there are more cattle ranches upstream of the dam.

Ecoregions: The higher elevations of the subbasin are within the Fremont Pine/Fir Forest, which slope down to the Klamath Juniper/Ponderosa Pine Woodland. The floodplains and river valleys are within the Klamath/Goose Lake Warm Wet Basin ecoregion.

Regulatory Factors: The Lost River and shortnose sucker are found within the Lost River, on both sides of Harpold Dam. There is bald eagle habitat throughout the Lost River subbasin. This criteria was not used as a factor for dividing the subbasin.

3.7 LOWER LOST RIVER WATERSHED ASSESSMENT UNIT

The Lower Lost River Watershed Assessment Unit is approximately 1,597 square miles (1,022,106 acres) and includes the following 5th fields:

- Poe Valley/Yonna Valley (west portion)
- Lower Lost River
- Tule Lake Sump
- Swan Lake Valley
- Lake Ewauna/Upper Klamath River
- Lower Klamath Lake
- Badger Basin/Willow Creek

Hydrology: The Lower Lost River IAU includes the lower Lost River from Harpold Dam to the Tule Lake Sump, as well as the upper portion of the Klamath River as it flows

out of the Upper Klamath Lake. The major hydrologic features in the Klamath River area, from north to south, are the Link River, the Link River Dam, Lake Ewauna, Keno Reservoir, and Keno Dam. Flows within this reach of the Klamath River are primarily controlled by the Klamath Project and the PacifiCorp Klamath Hydroelectric Project. Flows within the Klamath River are diverted into the Lost River through the A Canal and the Lost River Diversion Channel. Flows from the Lost River and Tule Lake Sump are pumped back into the Klamath River through the D Pump, the P Canal System, and the Klamath Straits Drain.

Social, Cultural, and Community Considerations: The Lower Lost River Assessment Unit includes the Klamath Project Working Group, the Klamath River Watershed Working Group, as well as the Urban Issues Working Group associated with Klamath Falls and the surrounding suburban areas.

Irrigation Infrastructure: See discussion under Hydrology, above, and the Upper Lost River Watershed Assessment Unit, Hydrology section. Irrigation Districts (IDs) within this area include the Van Brimmer Ditch Company, Enterprise ID, Pine Grove ID, Sunnyside ID, Shasta View ID, Malin ID, Tulelake ID, Klamath ID and the Klamath Drainage District.

Ownership and Land Cover: Similar to the Upper Lost River IAU, the Lower Lost River is characterized by private property in the lower elevations, with most of the higher elevation areas under federal ownership. Exceptions to this are the Tule Lake and Lower Klamath Lake National Wildlife Refuges, located in the low elevation marshlands. This IAU also includes the Lava Beds National Monument and the Klamath National Forest south of Tule Lake.

Ecoregions: This IAU is generally lower in elevation than the Upper Lost River IAU and contains larger areas of the Klamath/Goose Lake Warm Wet Basin ecoregion.

Regulatory Factors: See discussion under Upper Lost River Watershed Assessment Unit. This criteria was not used as a factor for delineating this subbasin.

4 ASSESSMENT CHRONOLOGY

A significant amount of restoration funds are currently being directed into the Upper Klamath Basin to address water quantity, water quality, and endangered species issues related to the recent water-use crises. The Watershed Assessment process is a good tool for prioritizing restoration opportunities and will be helpful in focusing restoration funds towards the appropriate projects.

In preparing this Assessment chronology, it was assumed that the funding mechanisms, in association with the capacities of the Administration Team, would allow a maximum of two Watershed Assessments to be conducted at one time.

The Upper Williamson River Assessment Unit was selected for the first Watershed Assessment because of its location in the headwaters of the Basin, the strength of the existing Catchment Group, the amount of existing information in the form of USFS Watershed Analyses, and the relatively good health of the watershed. Rather than a random approach to the Assessments, the Assessment process should move from north to south (downstream) through the Basin, because upstream restoration has the potential to impact downstream watersheds. In addition, it is generally agreed that restoration activities in the headwaters will have the greatest impact on the Basin. Therefore, restoration opportunities should be prioritized and implemented in these areas first.

Using this approach, it is suggested that the next Watershed Assessments be conducted on the Upper Sprague River Assessment Unit and, preferably concurrently, on the lower Sprague and Williamson Assessment Unit. Conducting these two Assessments concurrently will ensure there is no redundancy in data collection. In addition, the Assessment results could be combined and restoration opportunities could be prioritized for both Assessment Units.

Following the Sprague River, the next Assessment should be conducted on the Upper Klamath Lake Assessment Unit. The results of the Williamson and Sprague Assessments can be used to evaluate potential responses in Upper Klamath Lake, which may be used to drive the Assessment in this area.

The next Assessments should be conducted in the Lost River subbasin. The results from the two Assessments in this subbasin will provide valuable information that will facilitate restoration in the Lost River area, as well as improvements to the Klamath River as it flows out of Upper Klamath Lake.

The Upper Klamath River Assessment Unit sits lowest in the Basin and, therefore, has the lowest priority in terms of Assessment and restoration timing; however, it may be combined with the Upper Klamath Lake Watershed Assessment in terms of chronology.

Because of the significant amount of outreach involved in the Watershed Assessments in the Upper Klamath Basin, each Watershed Assessment is anticipated to require approximately one year to complete. Using this as a framework, the following is a proposed schedule for the Watershed Assessments:

- November 2004-November 2005: Upper Williamson River Watershed Assessment
- November 2005-November 2006: Upper Sprague River and Lower Sprague River/Lower Williamson River Watershed Assessments
- November 2006-November 2007: Upper Klamath Lake and Upper Klamath River Watershed Assessments
- November 2007-November 2008: Upper and Lower Lost River Watershed Assessments

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APPENDIX – HYDROLOGIC ANALYSIS OF THE UPPER KLAMATH BASIN