

Regional Culvert Inventory

Project #02-1658N

Final Report

December, 2007

Prepared for the
Lower Columbia Fish Recovery Board
Longview, WA

Introduction:

Historic, predevelopment conditions for the Lower Columbia region supported multiple runs of salmonid species. These species have evolved varied life history traits that often rely on all areas of the watershed to successfully complete fresh water life stages. Development of the region for settlement and resource extraction has caused many disruptions and destruction of habitat. The loss of access to critical tributary habitats has contributed to the depressed and threatened condition of these species. The Lower Columbia region contains five species listed as threatened under the Federal Endangered Species Act. These species include chum salmon, coho salmon, spring and fall Chinook salmon, summer and winter steelhead, and bull trout. In addition, many streams in the region provide habitat for coastal cutthroat trout and other native fish species.

Road crossings, including culverts, have especially contributed to the decline of salmonid species. Culverts and other barriers may reduce productivity within a watershed by limiting the availability of critical habitat for these different life stages. Tributary habitat often provides a majority of the spawning and rearing habitat for steelhead, coho, and cutthroat, and often experiences the most substantial disruption due to culverts and other road crossings restricting passage. In addition to acting as potential barriers to fish migration, culverts and other barriers alter stream dynamics by restricting debris and sediment flow through the system, and modifying stream velocity and flow patterns.

Because of the potential problems caused by culverts and other barriers, the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan identifies access to blocked habitats as a key limiting factor for the Lower Columbia Region; restoring access to blocked habitat is identified as a key regional habitat strategy (LCFRB 2004). The Lower Columbia Salmon Recovery Six-Year Habitat Work Schedule & Lead Entity Habitat Strategy (LCFRB 2007) further identifies the need to prioritize barriers between basins in order to maximize benefits to fish. Although numerous agencies have collected data on barriers throughout the region, no comprehensive database exists to allow for prioritization across watersheds. In addition, numerous private road and driveway crossings exist that may not be included in previous barrier assessments.

The specific goals of this project were to identify existing culvert and barrier data sources from agencies across the region; compile those data sources into a comprehensive database, ensuring that data is comparable across sources; identify data gaps; conduct surveys to fill gaps and incorporate the new data into the comprehensive database; and prioritize and complete preliminary designs for ten barrier removal projects. The comprehensive database can then be used to prioritize barriers for removal across watersheds.

Methods:

Existing barrier data were obtained from Washington Department of Fish and Wildlife (WDFW). The WDFW database contained numerous sources of data, including data from federal, state, and local agencies. These agencies included WDFW, Wahkiakum County, Cowlitz Conservation District, Lewis County, and Clark Conservation District (CCD). All obtained data were combined into a GIS database to allow for map-based analysis. In order to be consistent with current WDFW barrier

assessment protocols, the WDFW Fish Passage Barrier Assessment and Prioritization methods were used as standard protocols for this study (WDFW 2000).

After data were compiled, the existing barriers were plotted along with stream locations, fish distribution, and road locations. This map was then used to determine where data gaps existed. In cases where barrier information existed but was not consistent with the WDFW protocol (WDFW 2000), the barrier was designated as a data gap.

Areas for field survey were determined by a subcommittee including members from Clark CD, DNR, WDFW, and LCFRB. Field surveys to cover existing data gaps were initially prioritized based on requests from LCFRB to complete surveys in the East Fork Lewis River subbasin because of the large number of data gaps in that area. Field surveys were later reprioritized to focus on high priority areas based on the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (LCFRB 2004).

A multi-step process for landowner contact and permission was formulated. This process included a series of mailings, phone calls, and on-site contacts (Figure 1). Cowlitz County and Clark County mailing addresses were obtained from the county websites (Cowlitz County 2002, Cowlitz County 2006, Clark County 2006). Wahkiakum and Skamania County mailing addresses were obtained from field observations of mailbox addresses. A Fish Barrier Pamphlet explaining the program objectives, description of the CCD, the non-regulatory status of the CCD, and CCD contact information was mailed to the landowners (Appendix A). The mailing was followed with a phone call and visit to the landowner's home, if necessary.

Field surveys were focused in nine subbasins, including Coweeman River, Lower Cowlitz River, Toutle River, East Fork Lewis River, Lower North Fork Lewis River, Elochoman - Skamokawa Subbasin, Kalama River, Mill-Abernathy-Germany Creeks, and the Washougal River. Field surveys consisted of road-based surveys at known road-stream crossings. Road-based inventories consist of locating crossings on the map, driving to the location, and surveying the culvert, dam, bridge, or fishway. Additional crossings, such as driveways, were often identified in the field, and subsequently surveyed.

Each crossing was surveyed using WDFW's protocol (WDFW 2000). General information, including type of crossing (dam, fishway, bridge, or culvert), location, ownership, and fish utilization, was collected for each crossing. Differing Field Forms were used, following WDFW's protocol (WDFW 2000), depending on the crossing type. The "Dam" Field Form was used when there was a water surface difference upstream and downstream of the crossing. Most dams are full-spanned with a culvert outlet or spillway allowing water to pass through; others have a partial span. We recorded the dam and reservoir name, type of dam (earthfill, concrete, boulders, etc.), length and height of dam, water surface difference, plunge pool depth, primary purpose, passability, and other descriptions we deemed important. We marked most of the full-spanned dams as 0% passable.

We surveyed fishways that modified either dams or culverts. Modifications include baffles (devices regulating flow), grade controls (typically boulders placed upstream or downstream of the culvert to slow water flow), and weir (miniature dams that raise water level) pools. We recorded the material type and number of each modification per crossing in the "Fishway" Field Form. The location of a grade control

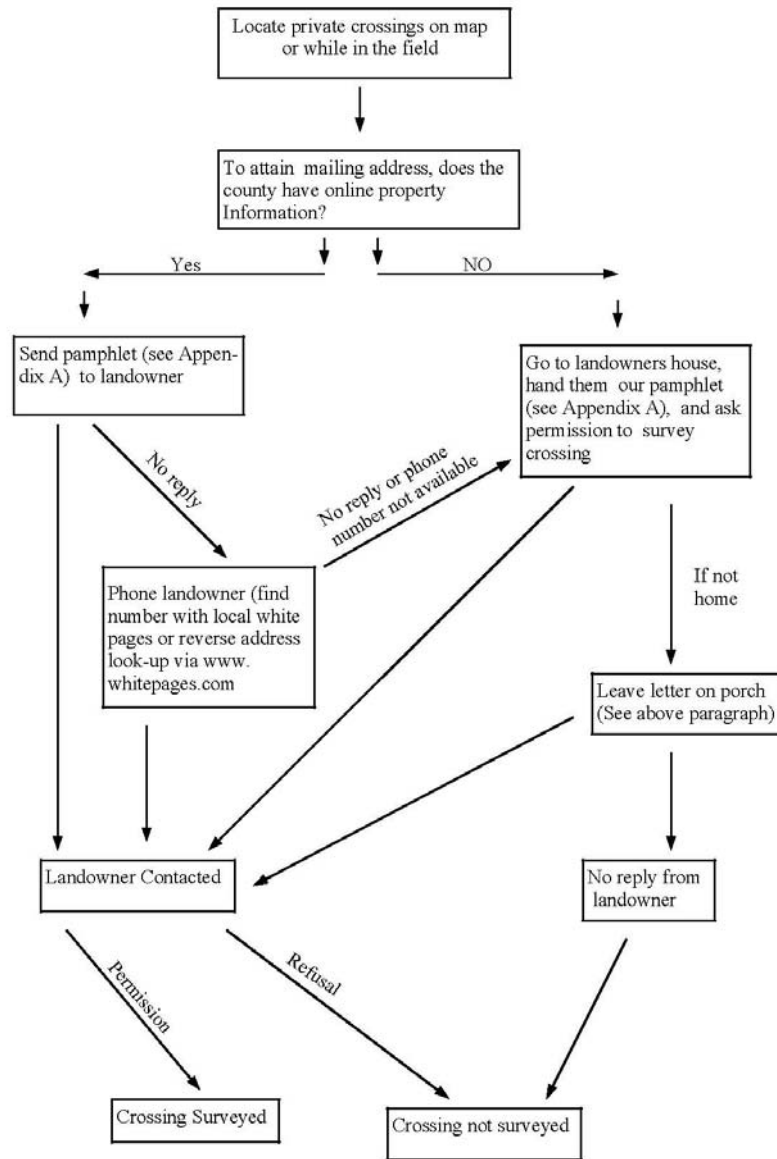


Figure 1. Flowchart depicting process for contacting landowners regarding surveying crossings on private property.

was noted if present. In addition, we counted the number of weir pools and measured the entrance pool depth and pool head difference.

When we surveyed bridges, we filled out an “Other” Field Form. The bridge material and year built (if known) was recorded. We marked all bridges as 100% passable.

Culverts were initially surveyed using WDFW’s Level A protocol to determine if the crossing was passable or a barrier (Figure 2) (WDFW 2000). Level A analysis includes collecting information on physical characteristics of the culvert (or other crossing type) and the stream. If the barrier status could not be determined using the Level A analysis, a Level B analysis was conducted to determine if the culvert was a barrier based on velocity. In some cases, the Level B analysis could not determine a culvert’s barrier status; these culverts were categorized as ‘Unknown’. Culverts of ‘Unknown’ status include tributary influence on plunge pool, beaver dam making creek inaccessible, inability to receive permission to access culvert, and road ditch influence. Details on why a culvert is of ‘Unknown’ status are included in the database.

After the field data were collected and compiled, the data were entered into a Microsoft Access database. This database includes information collected on the Field Forms, as well as links to photos of the crossings. In addition, the data were incorporated into a GIS database to allow for map-based analysis and comparison with data from other agencies.

Twelve barriers were prioritized for design. These barriers were selected based on landowner interest and potential for funding. The Conservation District’s Southwest Washington District Engineer completed designs following WDFW’s fish passage standards (WDFW 2003a).

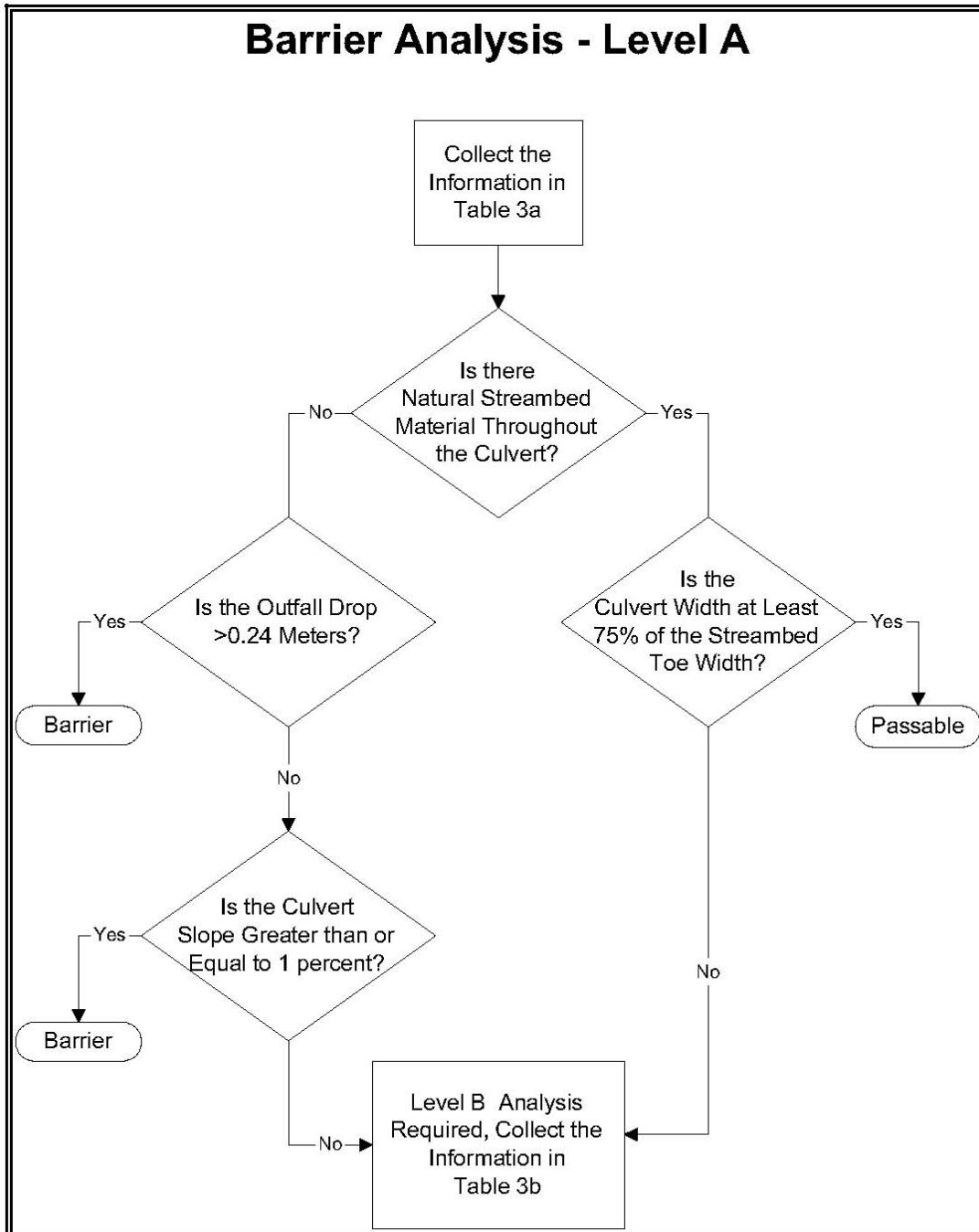


Figure 2. Flowchart depicting WDFW's criteria for determining barrier status of culverts (WDFW 2000). If the barrier status cannot be determined using a Level A analysis, a Level B analysis is conducted. Table numbers in the flowchart refer to tables in WDFW's Fish Passage Barrier and Assessment manual.

Results and Discussion:

Field surveys were completed for 520 crossings in four Water Resource Inventory Areas (WRIA’s) (Table 1). These field surveys filled all identified data gaps, except those where the landowner denied access or that were not identified by mapping stream-road crossings (i.e., private driveways).

Table 1. Overall summary of crossings compiled in the Regional Culvert Inventory database for Water Resource Inventory Areas (WRIA) 25-28, including those surveyed by Clark Conservation District (CCD).

WRIA	Surveyed Subbasins	CCD surveyed crossings	Previously surveyed crossings
25	Elochoman R, MAG, Skamokawa Cr	60	112
26	Cowlitz R, Coweeman R, Toutle R	114	2131
27	E. Fork Lewis R, N. Fork Lewis R, Kalama R	297	390
28	Washougal R	49	130

Field surveys in WRIA 25 (Grays-Elochoman) focused on the Mill Creek, Abernathy Creek, and Germany Creek (MAG) complex, the Elochoman River subbasin, and the Skamokawa Creek subbasin (Table 2; Appendix B - Map 1). Coal Creek was not included because of a barrier located near the mouth; the Grays River subbasin was not included due to prioritization decisions made by the subcommittee. Most culverts in the MAG complex were located at tributary crossings on county roads that run parallel to the MAG creeks.

Table 2. Summary of crossings surveyed in WRIA 25. Bridges were considered 100% passable. Culvert passability was determined as a percent based on measurements taken following WDFW’s SSHEAR protocol (WDFW 2000).

Subbasin	Bridges	Culverts				
		0%	33%	67%	100%	Unknown
Elochoman R	2	0	0	0	1	0
MAG	18	3	8	1	1	1
Skamakowa Cr	11	1	10	0	1	2
Total	31	4	18	1	3	3

Field surveys in WRIA 26 (Cowlitz) focused on the Coweeman River, lower Cowlitz River, and Toutle River subbasins (Table 3; Appendix B – Maps 2 and 3). The middle and upper Cowlitz River were not included as part of this project due to prioritization decisions made by the subcommittee.

Table 3. Summary of crossings surveyed in WRIA 26. Bridges were considered 100% passable. Crossing passibility was determined as a percent based on measurements taken following WDFW's SSHEAR protocol (WDFW 2000).

Subbasin	Dam (0%)	Fishway/ Culvert (33%)	Bridges	Culverts				
				0%	33%	67%	100%	Unknown
Coweeman R	0	0	5	2	8	4	0	3
Cowlitz R	0	0	38	8	9	4	3	6
Toutle R	1	1	0	3	7	6	0	6
Total	1	1	43	13	24	14	3	15

Field surveys in WRIA 27 focused on the East Fork Lewis River, North Fork Lewis River, and the Kalama River (Table 4; Appendix B - Maps 4 - 7). In the East Fork Lewis subbasin, surveys did not include Rock Creek, Brickie Creek, Yacolt Creek, Big Tree Creek, and Weaver Creek because of they had been previously surveyed or had barrier falls near their mouths. Surveys did not include tributaries to Lake River and Allen Canyon Creek because they were not high priority areas. Clark County contained a high number of crossings because of the rapid rate of development and associated road construction.

Table 4. Summary of crossings surveyed in WRIA 27. Bridges were considered 100% passable. Crossing passibility was determined as a percent based on measurements taken following WDFW's SSHEAR protocol (WDFW 2000).

Subbasin	Dams		Fishways/Culverts			Bridges	Culverts				
	0%	33%	67%	100%	Unknown		0%	33%	67%	100%	Unknown
EF Lewis R	12	4	1	2	1	16	29	62	55	8	16
NF Lewis R	3	1	1	0	0	2	5	30	4	2	9
Kalama R	1	0	0	0	0	1	12	11	3	3	1
Gee Cr	0	0	0	0	0	0	0	1	0	0	1
Total	16	5	2	2	1	19	46	104	62	13	27

Field surveys in WRIA 28 focused on the Washougal River subbasin (Table 5; Appendix B - Map 8).

Table 5. Summary of crossings surveyed in WRIA 28. Bridges were considered 100% passable. Crossing passibility was determined as a percent based on measurements taken following WDFW's SSHEAR protocol (WDFW 2000).

Subbasin	Dams		Fishways/Culverts		Bridges	Culverts				
	33%	0%	67%	0%		0%	33%	67%	100%	Unknown
Washougal R	1	1	2	1	8	6	9	4	2	14
Salmon Cr	0	0	0	0	0	0	1	0	0	0
Total	1	1	2	1	8	6	10	4	2	14

Preliminary designs were prepared for twelve existing barriers. These barriers were prioritized based on landowner interest and potential for funding through Washington Department of Natural Resources Family Forest Fish Passage Program (FFFPP). Eleven of these have been funded and the barriers corrected. One is currently unfunded. The designs were prepared and the construction overseen by the SW Conservation District Engineer, Samuel E. Giese PE. All work was designed and constructed to meet WDFW fish passage standards (WDFW 2003a). A summary of these projects is shown in Table 6.

Table 6. Barriers identified and designed for replacement. Projects were chosen based on landowner interest and potential for funding.

Project Name	County	Stream	Basin	WRIA	EDT Reach	Barrier	Correction	Status	Year Corrected
Faubion	Wahk	Trib to Birnie	Columbia	25	N/A	Log Puncheon	64 " Span Steel Pipe Arch	Complete	2004
Baxter	Cowlitz	Trib to Coweeman	Cowlitz	26	Coweeman 5	60 " Dia Concrete Culvert	30 ft long Steel Bridge	Complete	2004
Nesbitt	Cowlitz	Trib to Coweeman	Cowlitz	26	RB trib 2	48 " Dia Steel Culvert	103 " Span Steel Pipe Arch	Complete	2004
Andrews	Cowlitz	Turner Creek	Cowlitz	26	Turner	(2) 48 " Dia Steel Culverts	30 ft long Steel Bridge	Complete	2005
Rauth 1	Cowlitz	Trib to Coweeman	Cowlitz	26	RB trib 2	72 " Dia Steel Culvert	137" Span Steel Pipe Arch	Complete	2005
Rauth 2	Cowlitz	Trib to Coweeman	Cowlitz	26	RB trib 2	36 " Dia Concrete Culvert	30 ft long Steel Bridge	Complete	2006
Mallet	Cowlitz	Baxter Cr	Arkansas	26	Baxter Cr	(4) misc diam culverts	60 ft long Steel Bridge	Complete	2006
Allen	Lewis	Salmon Creek	Cowlitz	26	Salmon Cr 3	60 " Dia Steel Culvert	29 ft long Steel Bridge	Complete	2006
Rashford 1	Clark	Mason Creek	East Fork	27	Mason Cr	60 " Span Steel Pipe Arch	45 ft long Steel Bridge	Complete	2007
Rashford 2	Clark	Mason Creek	East Fork	27	Mason Cr	60 " Span Steel Pipe Arch	45 ft long Steel Bridge	Complete	2007
Peterson	Clark	Dean Creek	East Fork	27	Dean Cr	96 " Dia Steel Culvert	20 ft Span Steel Arch	Complete	2007
Woolderidge	Clark	Mill Creek	East Fork	27	Mill Cr	check field book	TBD	Unfunded	TBD

The information from the culvert surveys has been provided to WDFW to include in their Fish Passage and Diversion Screening Inventory (FPDSI) Database. General information about culvert location can be obtained from WDFW's SalmonScape online database (WDFW 2003b). Specific information about the culverts can be obtained by contacting WDFW. The original database is currently housed with the LCFRB, and information regarding the database can be accessed by contacting LCFRB staff or WDFW.

The results of this project have provided useful information on the location and barrier status of culverts, bridges, and dams around the region. In order for prioritization of culvert replacements across multiple watersheds, a second phase of this project has

been planned and funded by the Salmon Recovery Funding Board (SRFB). This second phase will use a GIS/map-based evaluation to further identify and prioritize barriers for conducting a Physical Habitat Survey to generate a Fish Passage Priority Index (PI). PI values are based on amount of habitat above the barrier, expected passage improvement, production potential of the blocked stream, fish stock health, cost of barrier repair, and other factors. The GIS/map-based evaluation will be based on species using the reach, distance of habitat up and downstream, and the watershed group and tier from the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (LCFRB 2004) and Lower Columbia Salmon Recovery Six-Year Habitat Work Schedule & Lead Entity Habitat Strategy (LCFRB 2007). For example, the data collected in Phase I of this project indicate that numerous barriers are located in high priority reaches (Table 7). Depending on ownership, urgency, and PI values, these barriers may be prioritized for replacement.

Table 7. Locations of barriers surveyed as part of the Regional Barrier Assessment in 2007 EDT reach tiers in the Lower Columbia Region. Barriers noted are at least a partial barrier.

Barrier Type	Tier			
	1	2	3	4
Culvert	8 (+1 unk)	5 (+1 unk)	0 (+1 unk)	49 (+12 unk)
Fishway	0	0	0	3
Dam	1	0	0	5 (+1 unk)

Using this GIS-based priority list, Physical Habitat Surveys will be conducted and PI's will be generated on at least the top 100 culverts within the region. A ranking will then be established, incorporating the PI value, as well as project feasibility, landowner interest, and urgency. Preliminary engineering designs and cost estimates will be established for the five top-priority culverts.

In addition to the region-wide prioritization of culverts, the second phase of this project aims to establish a protocol for assessing tidegates in the region. This portion of the project will include investigation of barrier status of the tidegate structures, amount and quality of habitat above the tidegate (including both stream habitat and estuary habitat), water quality at the project site, fish utilization, and flood hazard information. Ultimately, this information will be compiled with the Regional Culvert Inventory to provide a comprehensive database of barriers across the Lower Columbia region.

Acknowledgements:

Funding for this project was provided by the state of Washington's Salmon Recovery Funding Board (Project # 02-1658). The Clark Conservation District would like to express thanks and gratitude to all of those people and entities that made our work possible: Steve Vanderploeg of WDFW was extremely helpful by providing many ArcView shapefiles and technical assistance to CCD personnel. Dave Caudill and Dave Collins gave the crew the skills needed to perform barrier evaluations and provided helpful guidance to the project. Contributions from Tony Meyer of the Lower Columbia Fish Enhancement Group, provided equipment necessary to complete barrier evaluations. Donna Hale of WDFW helped District personnel access property for evaluations on less than cooperative landowners' property. Gil Lensegrav of WDFW provided excellent input for database management for merger with WDFW's dataset.

Literature Cited:

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<<http://gis.clark.wa.gov/applications/gishome/property/>>

Cowlitz County. 2002. Cowlitz County Parcel Map.
<http://www.co.cowlitz.wa.us/gis/parcel_map.htm>

Cowlitz County. 2006. Cowlitz County Parcel Search.
<[http://www.co.cowlitz.wa.us/cowlitzapps/cowlitzassessorparcelsearch/\(S\(oj5wv345thvkr45osu4wheq\)\)/default.aspx](http://www.co.cowlitz.wa.us/cowlitzapps/cowlitzassessorparcelsearch/(S(oj5wv345thvkr45osu4wheq))/default.aspx)>

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Appendix A. Program pamphlet that was mailed to landowners by Clark Conservation District to describe the culvert inventory program.

Clark Conservation District

The conservation district is a grant funded agency that administers programs to conserve natural resources. It is self governed by local volunteers who establish priorities and set policies.

Examples of our services:

- Watershed Enhancement





- Habitat Restoration



- Farmland Management

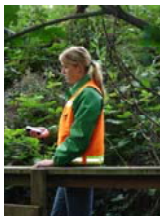



Clark Conservation District
 11104 NE 149th St.
 Building C Suite 400
 Brush Prairie, WA 98606

	Protect, Conserve, Improve
Fish Barrier Survey Program	
	
Clark Conservation District	
Tel: (360) 883 - 1987 x118	

Program Objectives

Clark Conservation District employees will be working in conjunction with Cowlitz, Lewis, Underwood, and Wahkiakum Conservation



Data Collection

Districts, in the southwest Washington Columbia River Sub-basins. Our purpose is to create a list of culverts (pipes that allow streams to flow under land/roads) that impede stream flow and inhibit fish from returning to their natural spawning habitat. The information will be added to an existing database and used to prioritize critical waterways. The list could then be used for future rehabilitation of barriers at little or no cost to the land owner. To accomplish this project, a team of two people will be surveying the physical properties of each culvert such as dimensions, water flow, and gradient. In addition, they will be conducting a habitat assessment, both upstream and downstream, to determine quality of habitat. The majority of the surveys will be conducted during the winter months due to increased stream flow activity.

Landowner Support

- The Conservation District is a non-regulatory agency.
- Many of the streams that will be surveyed are located on privately owned land, and it will be necessary for the crew to access associated stream crossings.
- **Land owners will not experience any negative regulatory repercussions for allowing staff to access private property.**
- One of the goals of this project is to work with landowners that want to replace their culverts by coordinating with engineers, workers, and grant funds with little or no cost to landowner.



Culvert assessment

Importance

Salmon and Steelhead require unimpeded access to spawning grounds, which are often far upstream. It is equally important that young fish have free passage, both up and downstream, to escape predators and to locate rearing habitat. Without proper habitat, fish will not spawn, potentially resulting in destruction of historical salmon runs. Furthermore, the health of streams influences the well-being of other fish and wildlife (otters, deer) species.



Please call or e-mail our staff at Clark Conservation District if you have any questions regarding the Fish Barrier Survey Program.

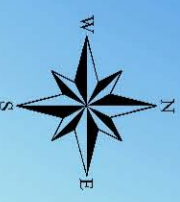
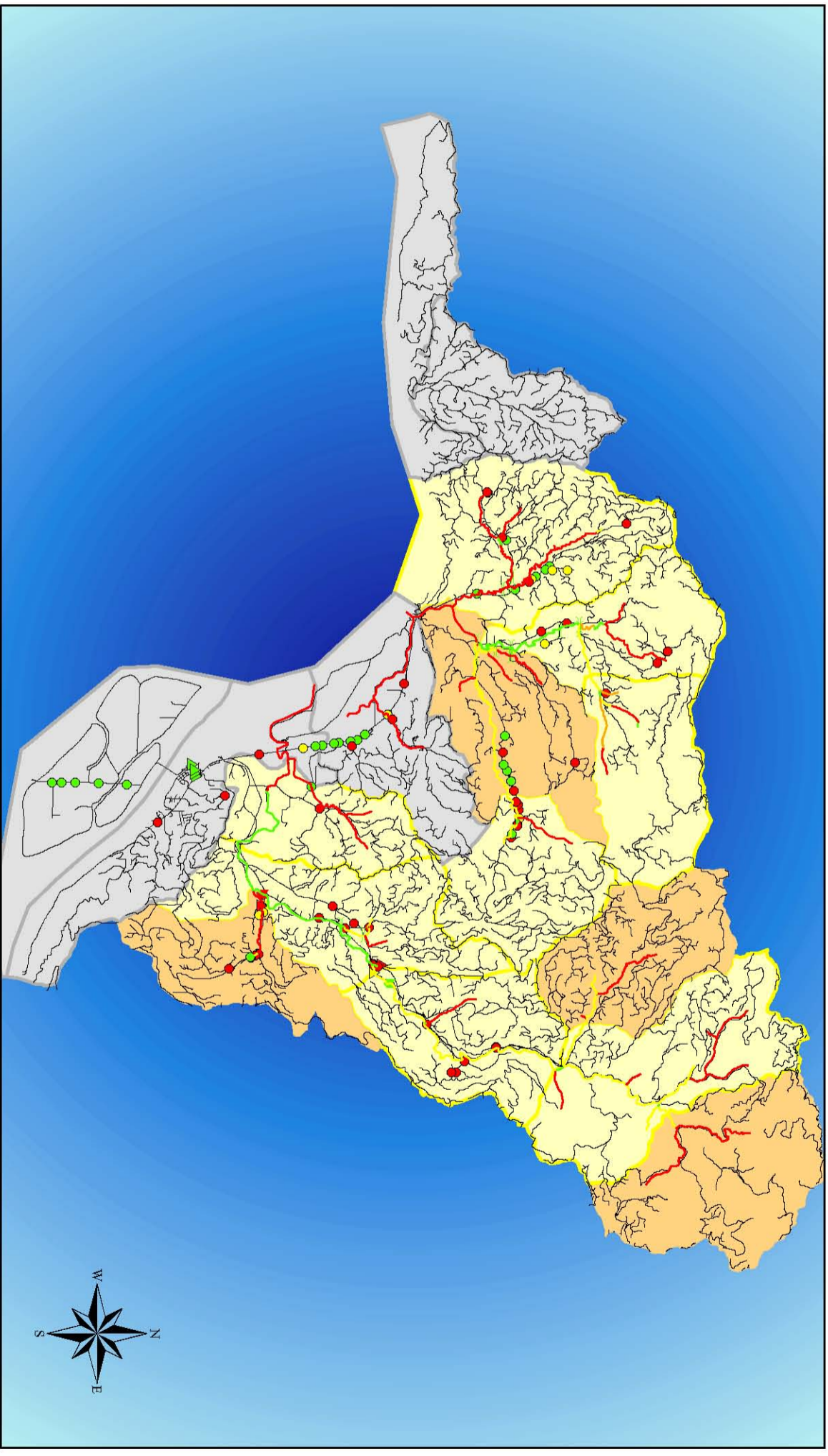
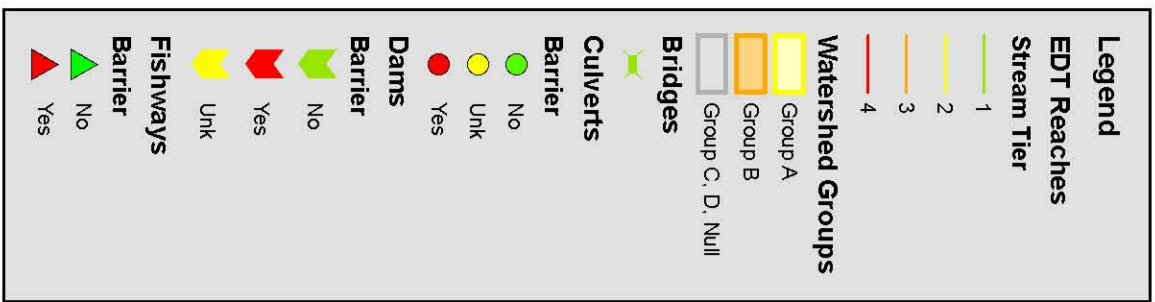


Chum Salmon returning from the sea.

	Clark Conservation District
11104 NE 149th St. Bldg C, Suite 400 Brush Prairie, WA 98606	
Phone: (360) 883 - 1987 x 118 Fax: (360) 885 - 2284 Email: steve-selser@wa.nacdn.net jessica-harm@wa.nacdn.net	

Appendix B. Maps created using data collected as part of the regional barrier assessment.

Elochoman River and Skamokawa Creek Watersheds




Clark Conservation District
Steve Selser




Lower Columbia
Fish Recovery Board

September 2006

Coweeman River Watershed

Legend

EDT Reaches
Stream Tier
 1
 2
 3
 4

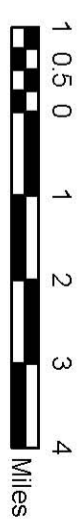
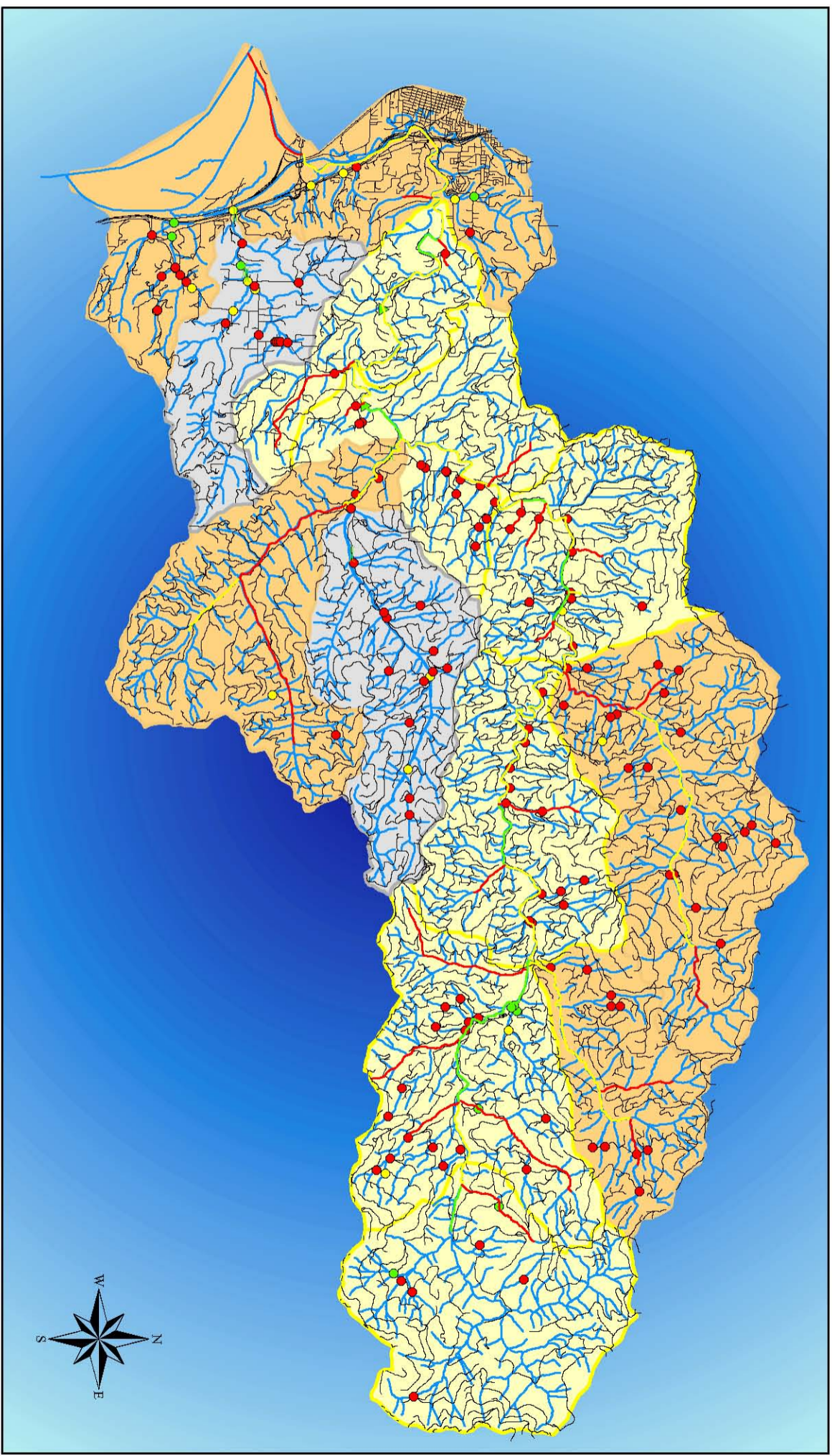
Watershed Groups
 Group A
 Group B
 Group C, D, Null

Bridges

Culverts
Barrier
 No
 Unk
 Yes

Dams
Barrier
 No
 Yes
 Unk

Fishways
Barrier
 No
 Yes



Lower Cowlitz River Watershed

Legend

EDT Reaches
Stream Tier

- 1
- 2
- 3
- 4

Watershed Groups

- Group A
- Group B
- Group C, D, Null

Bridges

- Barrier

Barrier

- No
- Unk
- Yes

Dams

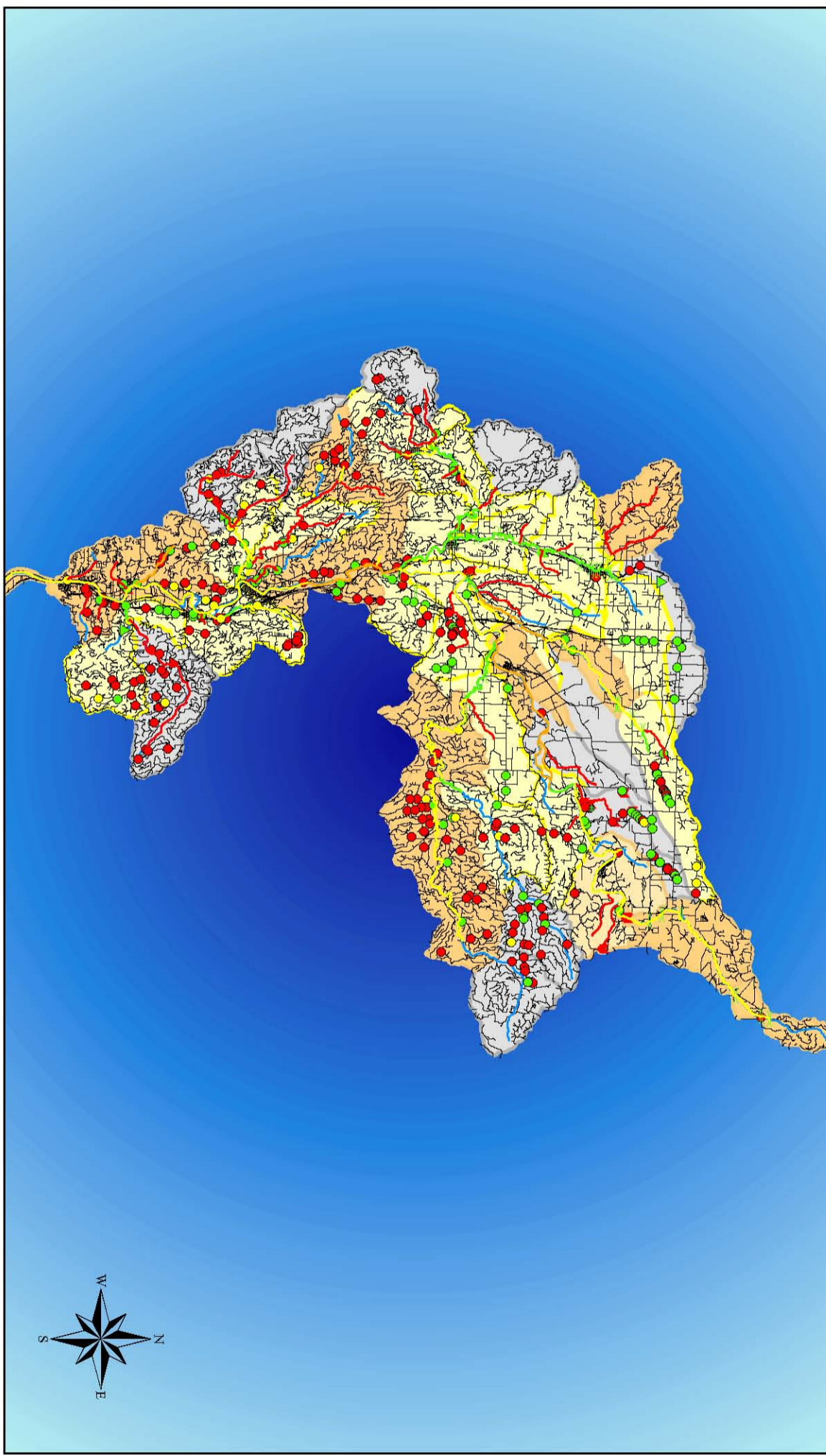
Barrier

- No
- Yes
- Unk

Fishways

Barrier

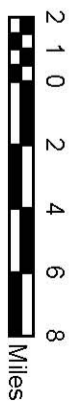
- No
- Yes



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Steve Selser



Lower Columbia
Fish Recovery Board



September 2006

East Fork Lewis River Watershed

Legend

EDT Reaches
Stream Tier

- 1
- 2
- 3
- 4

Watershed Groups

- Group A
- Group B
- Group C, D, Null

Culverts

Barrier

- No
- Unk
- Yes

Bridges

- Yes

Dams

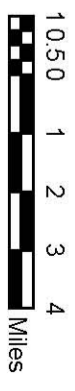
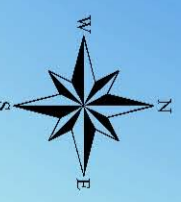
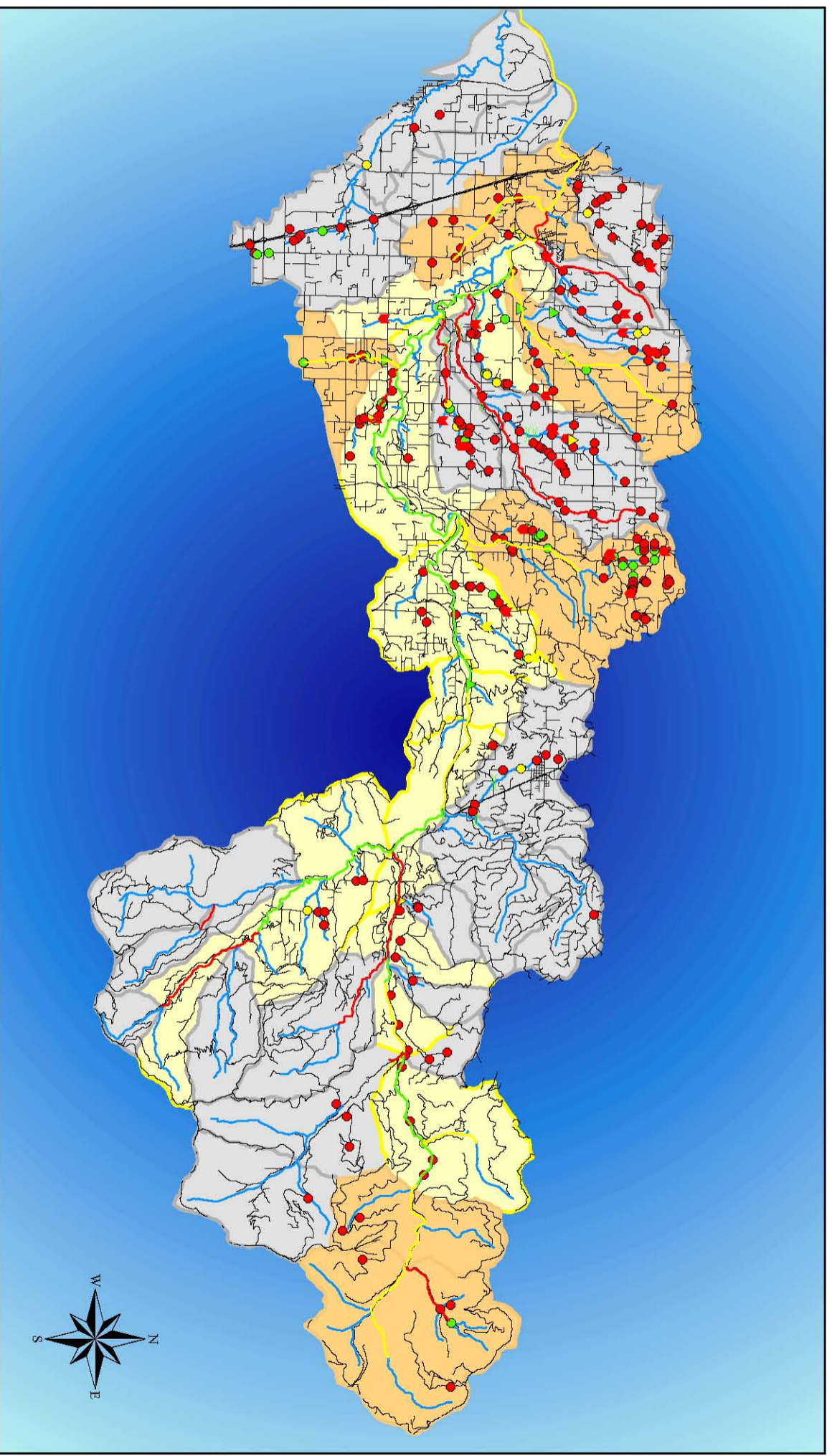
Barrier

- No
- Yes
- Unk

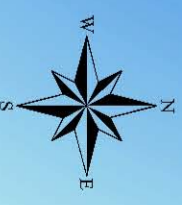
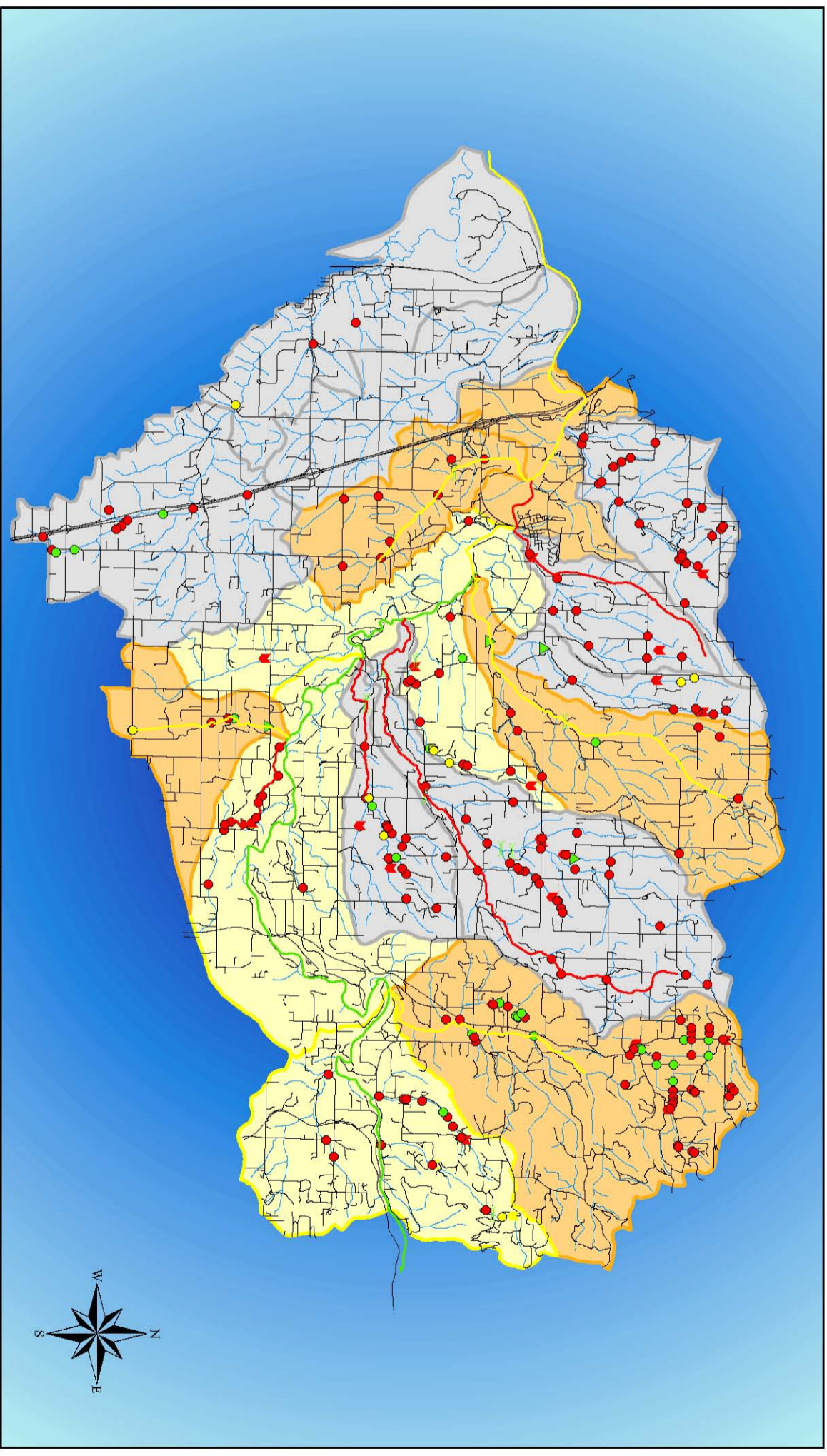
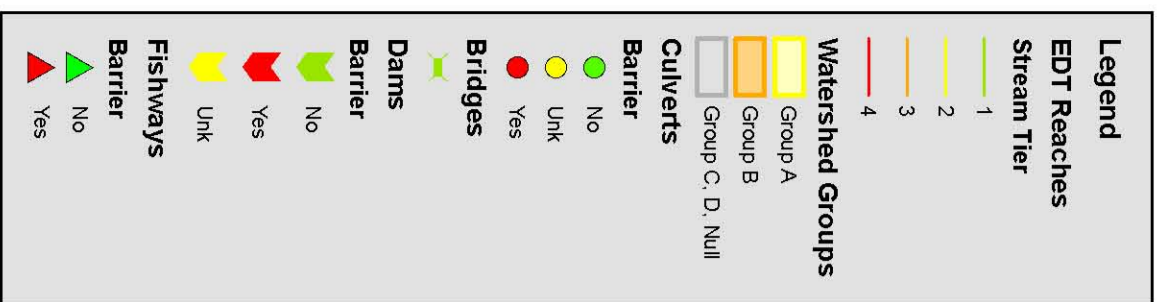
Fishways


Barrier

- No
- Yes



Lower East Fork Lewis River Watershed




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Washington
Department of
FISH and
WILDLIFE


Lower Columbia
Fish Recovery Board

September 2006

Upper East Fork Lewis River Watershed

Legend

EDT Reaches
Stream Tier
 1
 2
 3
 4

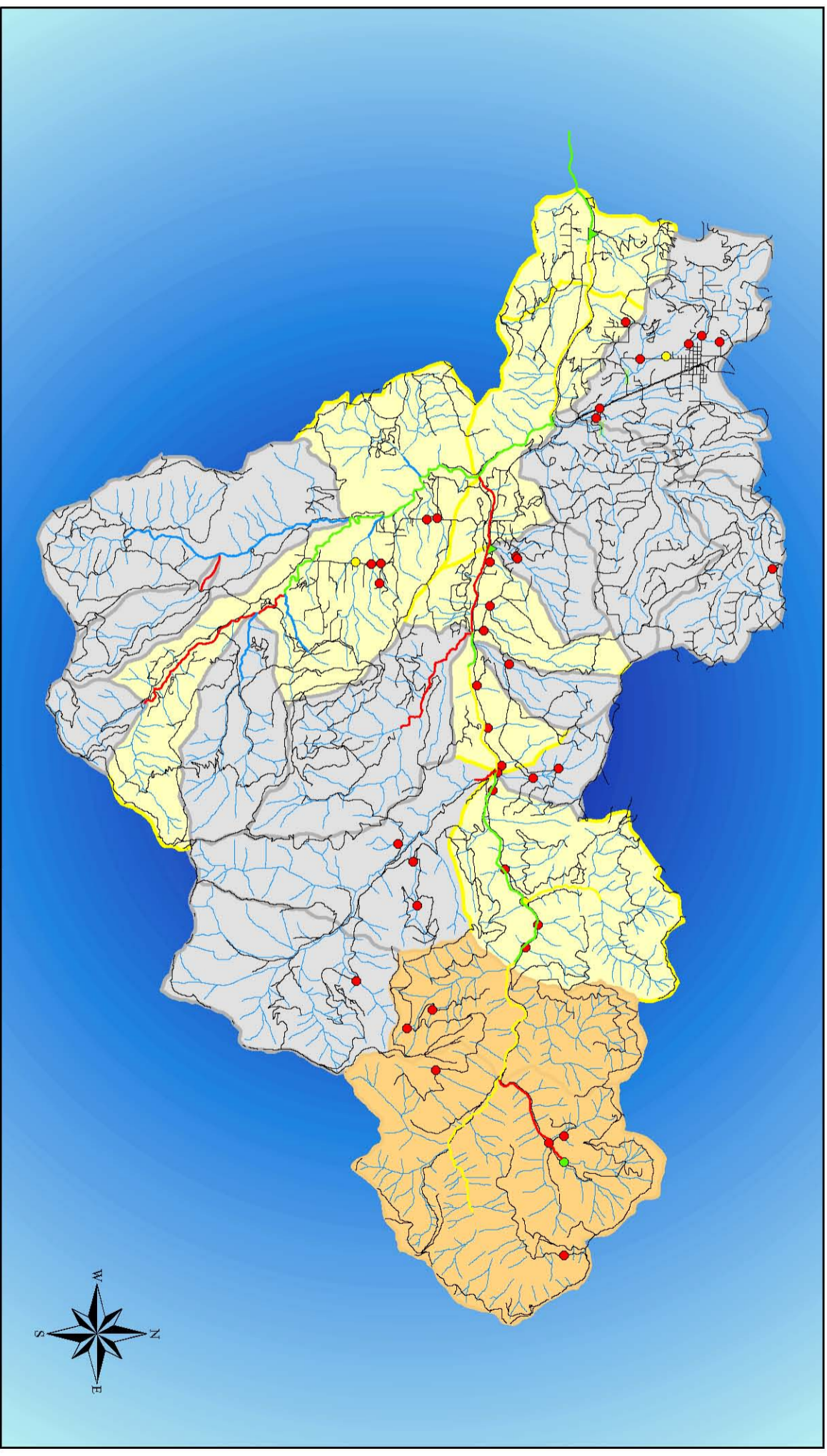
Watershed Groups
 Group A
 Group B
 Group C, D, Null

Culverts
Barrier
 No
 Unk
 Yes

Bridges
 Yes

Dams
Barrier
 No
 Yes
 Unk

Fishways
Barrier
 No
 Yes



Cedar Creek Watershed

Legend

EDT Reaches
Stream Tier

- 1
- 2
- 3
- 4

Watershed Groups

- Group A
- Group B
- Group C, D, Null

Culverts

Barrier

- No
- Unk
- Yes

Bridges

- No
- Unk
- Yes

Dams

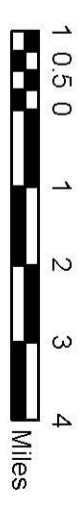
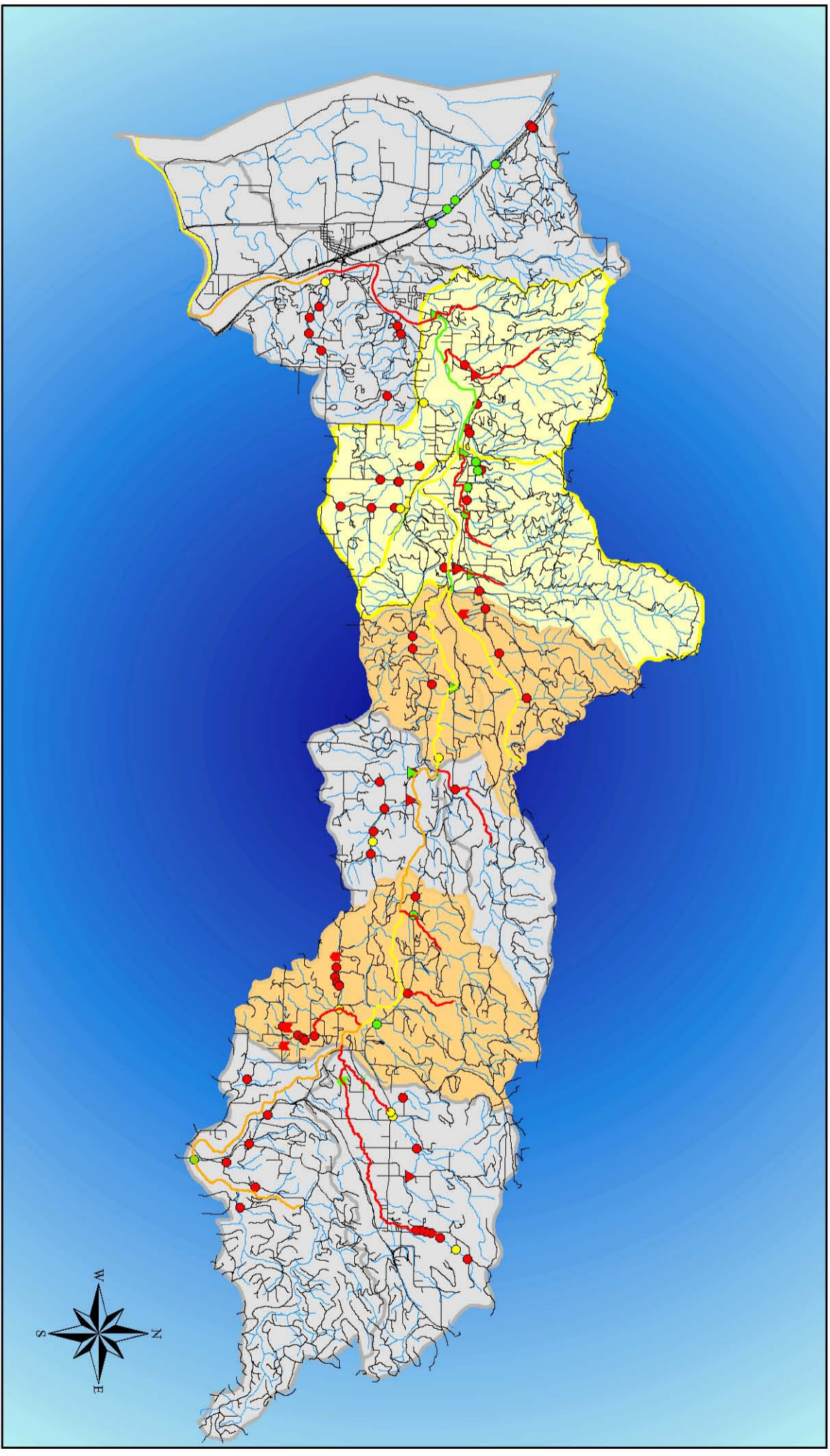
Barrier

- No
- Yes
- Unk

Fishways

Barrier

- No
- Yes



Washougal River Watershed

Legend

EDT Reaches
Stream Tier

- 1
- 2
- 3
- 4

Watershed Groups

- Group A
- Group B
- Group C, D, Null

Barrier

- No
- Unk
- Yes

Bridges

- Yes

Dams

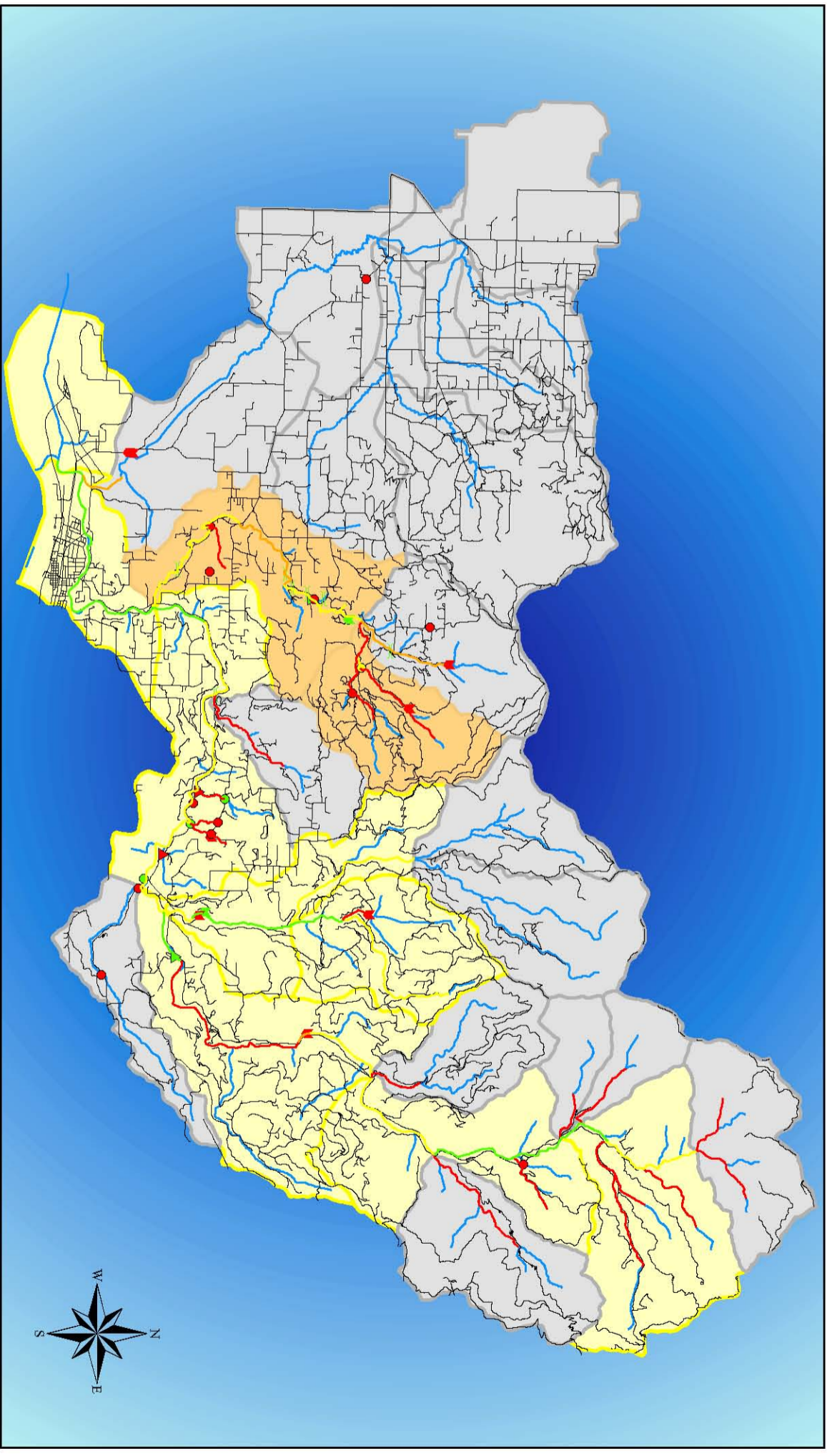
Barrier

- No
- Yes
- Unk

Fishways

Barrier

- No
- Yes




Clark Conservation District
Steve Selser


Washington
Department of
FISH and
WILDLIFE


Lower Columbia
Fish Recovery Board

September 2006