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PREPARED FOR: LINCOLN COUNTY AND TOWNS OF ODESSA AND REARDAN



Lincoln County Coalition Shoreline Master Program Update Draft Shoreline Inventory, Analysis, and Characterization Report

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LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
°C	degrees Celsius
AMSL	above mean sea level
BLM	U.S. Bureau of Land Management
BP	before present
cfs	cubic feet per second
CMZ	Channel Migration Zone
Coalition	Lincoln County and the Towns of Odessa and Reardan
County	Lincoln County
CRB	Columbia River Basalt
DAHP	Washington State Department of Archaeology and Historic Preservation
DMA	Disconnected migration areas
DTW	depth to water
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
GIS	Geographic Information System
HPA	Hydraulic Project Approval
LiDAR	Light Image Detection and Ranging
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
OHWM	ordinary high water mark
PCB	Polychlorinated biphenyl
PDO	Pacific Decadal Oscillation
ppm	parts per million
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act

SMA	Shoreline Management Act
SMP	Shoreline Master Program
SR	State Route
TCP	Traditional Cultural Properties
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WRIA	Water Resource Inventory Areas

1 INTRODUCTION

1.1 Background and Purpose

Lincoln County (County), the Town of Odessa, and the Town of Reardan (referred to collectively as the “Coalition¹” are in the process of updating their respective Shoreline Master Programs (SMPs). Lincoln County received grant funding from the Washington State Department of Ecology (Ecology) for the “Coalition”, to develop an updated Shoreline Master Program (SMP). A primary purpose of this effort is to update the SMP to comply with Chapter 90.58 Revised Code of Washington (RCW), the Shoreline Management Act (SMA), and Ecology’s 2003 Shoreline Master Program Guidelines (Chapter 173-26 Washington Administrative Code [WAC]).

The Inventory, Analysis, and Characterization Report (Report) provides a technical foundation for the SMP update. This report includes a discussion of the setting and ecosystem-wide processes that influence ecological functions within Coalition shorelines. The report also addresses alterations based on existing land use patterns and future potential development within the shoreline jurisdiction areas. Inventory, analysis, and characterization tables summarizing conditions by reach are provided in Appendices A through C. A map folio is provided in Appendix D.

The guidelines require the Coalition to demonstrate that the SMP will result in “no net loss” to shoreline ecological functions during implementation. This report will serve to describe the existing baseline conditions of shoreline ecological function. An associated Shoreline Restoration and Protection Plan and Cumulative Impacts Analysis will follow development of the draft program and code elements. The cumulative impacts analysis will demonstrate how future development under the proposed SMP will result in no net loss of shoreline ecological function. The restoration measures described in the Shoreline Restoration and Protection Plan could be implemented to improve shoreline ecological functions beyond existing conditions.

¹ The City of Sprague was initially included in the Coalition and the Town of Reardan was not, but after completing the preliminary shoreline jurisdiction analysis, it is recommended that Negro Creek within the City of Sprague not be included as shoreline jurisdiction and that the Audubon lakes in Reardan are shoreline jurisdiction, which changes the Coalition composition.

1.2 Report Organization

The report is organized in the following sections:

- **Regulatory Overview** describes the SMA; local, state, and federal regulations, and cultural resource considerations.
- **Shoreline Jurisdiction** reviews the data and analysis used to determine the shoreline jurisdiction waterbodies and extents of the SMA shoreline jurisdiction.
- **Lincoln County Overview** provides a description of the project area, including ownership and land cover characteristics, land use and SMP environment designations, geology, climate, surface water resources, water quality, groundwater resources, floodplains and floodways, channel migration zones, geologic hazard, and cultural resources characteristics.
- **Shoreline Inventory, Analysis, and Characterization** describe the ecosystem processes and the level to which they are currently impaired or altered. The processes most critical to ecological functions are described for the Columbia and Spokane rivers, and Crab Creek, and also lakes in the County. Also included are a review of the reach characterization methods and an overview of the inventory, analysis, and characterization tables included in Appendices A through C. This section also provides an overview of the future land use and development potential analysis which identifies developable lands and associated residential unit and commercial area available for specific geographic areas within the County.
- **Public Access** identifies existing public access goals and policies.
- **Information sources and limitations** are also described.

2 REGULATORY OVERVIEW

2.1 Shoreline Management Act

Counties, cities, and towns develop or update local SMPs to be in compliance with Washington state's SMA (RCW 90.58), and consistent with Ecology's guidelines. Washington's SMA addresses concerns about the effects of unregulated development on shorelines. The SMP update process indicates the joint state/local nature of the SMA program as local governments develop SMPs in close coordination with Ecology, informed by local opportunities and constraints, and consistent with state law and guidelines.

2.2 Local, State, and Federal Plans and Regulations

SMPs provide provisions to protect archaeological resources, historic resources, and environmentally critical areas within the shoreline, as well as to maintain flood hazard protection (WAC 173-26-221). Environmentally sensitive areas (critical areas) within Lincoln County include wetlands, critical aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas.

In addition, federal, state, and local regulations also apply to these features. Federal regulations include the Clean Water Act, Sections 404 and 401, Endangered Species Act (ESA), Water Pollution Control Act, National Environmental Policy Act (NEPA), and the National Floodplain Insurance Program.

State regulations are administered through the RCW and include the State Environmental Policy Act (SEPA), the Hydraulic Project Approval (HPA), the Bald Eagle Protection Rules, the Surface Mining Act, the State Water Code and Water Pollution Control Act, and the SMA.

The County has an existing SMP and critical areas regulations for wetlands, critical aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas. The Towns of Odessa and Reardan have critical areas regulations for wetlands, critical aquifer recharge areas, critical wildlife habitat, and frequently flooded areas but do not have an existing SMP. Table 1 includes a summary of

critical area buffer requirements identified in critical areas regulations for the County and Towns.

Critical areas for each shoreline jurisdiction reach are also described within the flooding and geological hazards and habitat characteristics sections of the Reach Characterization Tables provided in Appendices A through C. These areas are also identified, as applicable, in the map folio provided in Appendix D.

Table 1
Critical Areas Buffers Summary (as of 2013)

Jurisdiction	Protection Standards					
Lincoln County CAO Ordinance #94-03, Attachment 3 – Critical Areas (1994) and LCC Chapter 18.16 Critical Areas Draft Update (2008)	Wetlands					
	Wetland Delineation and Rating System	1994 CAO	- 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetland or its latest revision - 1993 Ecology’s Washington State Wetlands Rating System for Eastern Washington (Second Edition) or its latest revision			
		2008 Draft CAO ¹	- 1997 Ecology’s Washington State Wetlands Identification and Delineation Manual - 2007 Ecology’s Washington State Wetlands Rating System for Eastern Washington			
	Buffer (feet)		Category			
			I	II	III	IV
	High Intensity Land Use	1994 CAO	200	100	50	25
		2008 Draft CAO ¹	200	150	100	50
	Low Intensity Land Use	1994 CAO	100	50	25	25
		2008 Draft CAO ¹	100	100	50	25
	Mitigation Ratio		Category			
			I	II	III	IV
	Replacement, Creation, or Enhancement Ratio	1994 CAO	6:1	Forested 3:1 Scrub-shrub 2:1 Emergent 1.5:1		1.25:1
		2008 Draft CAO ¹	No Change			
	Fish and Wildlife Habitat Conservation Areas					
	1994 CAO		No specific stream buffers or mitigation ratios identified			
	2008 Draft CAO ¹	Water Categorization System	Department of Natural Resources Forest Practices Rules and Regulations			
Riparian Buffer (feet) for non-agricultural activities		Water Type				
		Type 1 and 2: Fish Bearing Waters	Type 3: Fish Bearing Waters	Type 4 and 5: Non-Fish Bearing Waters		
		100	75	50		
Town of Odessa CAO Odessa Municipal Code Chapter 11.08 (2010)	Wetlands					
	Wetland Delineation and Rating System		2004 Ecology Washington State Wetlands Rating System for Eastern Washington			
			Category			
			I	II	III	IV
	Buffer (feet)		250	200	150	50
	Mitigation Ratio		6:1	3:1	2:1	1.5:1
	Fish and Wildlife Habitat Conservation Areas					
No specific stream buffers or mitigation ratios identified						
Town of Reardan CAO Ordinance #324 (1994) and Ordinance #481 (2002)	Wetlands					
	Wetland Delineation and Rating System		Methodology accepted by the U.S. Army Corps of Engineers or Ecology			
			Category			
			I	II	III	IV
	Buffer (feet)		200	100	50	25
	Mitigation Ratio		3:1	1.5:1	1:1	1:1
	Fish and Wildlife Habitat Conservation Areas					
	No specific stream buffers or mitigation ratios identified					

Notes:
1 = Italicized text indicates regulations that have been drafted but not formally adopted. CAO = Critical Areas Ordinance LCC = Lincoln County Code

2.3 Cultural Resources and Shoreline Development

Federal, state, and local cultural resources laws apply to shoreline development. Section 106 of the National Historic Preservation Act (NHPA) requires a cultural resource review process for federally funded and permitted projects. State laws include RCW 27.53 (Archaeological Sites and Records), which prohibits the unpermitted removal of archaeological materials and establishes a permitting process, and RCW 27.44 (Indian Graves and Records) which describes how human remains must be treated.

Given the importance of shoreline locations throughout the human history of the area, the potential for cultural resources should be considered high for any shoreline development permit unless demonstrated otherwise. To comply with state and local law, applicants should be prepared to follow the provisions of RCW 27.53 and 27.44 if cultural resources are identified or encountered during the planning or construction process. Federal projects would need to undergo Section 106 review.

3 SHORELINE JURISDICTION ANALYSIS

3.1 SMA Shoreline Criteria

The SMA (RCW 90.58.030) defines the criteria for a waterbody to be a Shoreline of the State as follows:

“[A]ll of the water areas of the state, including reservoirs, and their associated shorelands, together with the lands underlying them; except

- (i) shorelines of statewide significance;*
- (ii) (shorelines on segments of streams upstream of a point where the mean annual flow is twenty cubic feet per second or less and the wetlands associated with such upstream segments; and*
- (iii) (shorelines on lakes less than twenty acres in size and wetlands associated with such small lakes;”*

Shorelines of Statewide Significance are defined in the statute as those streams or rivers,

- (i) “That have either: a mean annual flow of 200 cubic feet per second or more, or;*
- (ii) The portion downstream from the first 300 square miles of drainage areas.”*

Shorelands are defined by the statute as:

“...Those lands extending landward for two hundred feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous flood plain areas landward two hundred feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters which are subject to the provisions of this chapter [includes both shorelines of statewide significance and shorelines of the state]; the same to be designated as to location by the department of ecology. Any county or city may determine that portion of a one hundred-year flood plain to be included in its master program as long as such portion includes, as a minimum, the floodway and the adjacent land extending landward two hundred feet therefrom.”

3.2 Shorelines Currently Designated in Lincoln County

WAC Title 173 – Chapter 18 – Section 260, and Chapter 20 – Sections 460 and 470 List Lakes and Shorelines of Statewide Significance and Shorelines of the State designated by statute in Lincoln County. Where there is a conflict with the criteria set forth in RCW 90.58.030(2) or in WAC 173-18-040, the criteria shall control. The designation of the stream or river shall be governed by the criteria, except that the local government must amend the local master program to reflect the new designation (WAC 173-18-046). The Shorelines of Statewide Significance for rivers, streams, and lakes designated in Lincoln County are summarized below in Tables 2 and 3. Negro Creek and other lakes currently designated as shoreline jurisdiction are also discussed below, with lakes listed in Table 4.

Table 2
Shorelines of Statewide Significance (Rivers and Streams) per WAC 173-18-260

Stream Name	Legal Description
Columbia River	All of Columbia River within Lincoln County (Lake Roosevelt) is under federal jurisdiction. The stream flow is over 200 cfs MAF.
Crab Creek	From the confluence of Rock Creek and Crab Creek (Sec.18, T22N, R38E) downstream through Sylvan Lake to Grant County line (Sec.18, T22N, R31E). This stream has over 300 sq. miles of drainage area down to mouth (right bank only) at unnamed tributary (Sec.34, T22N, R37E).
Spokane River	From the Spokane County line (Sec.24, T27N, R39E) starting on left bank of Long Lake (SE corner of same section) thence downstream along left bank of Long Lake to Spokane River, thence downstream on left bank to (Sec.27, T27N, R38E). This stream has both over 200 cfs MAF flow and over 300 square miles of drainage area at Spokane County line.
Wilson Creek	From mouth of Corbett Draw (Sec.16, T25N, R31E) downstream to Grant County line (Sec.6, T24N, R31E). This stream has over 300 square miles of drainage area ending at mouth of Corbett Draw.

Notes:

cfs = cubic feet per second

MAF = million acre-feet

Table 3 contains a list of Lakes specifically listed in WAC 173-20-470 as meeting the criteria for Lakes of Statewide Significance in Lincoln County.

Table 3
Shorelines of Statewide Significance (Lakes) per WAC 173-20-470

Stream Name	Acreage in Lincoln County (Total Acreage)
Long Lake Reservoir	100.0 (5020.0)
Sprague Lake	637.7 (1840.6)

WAC 173-18-260 also identifies other streams meeting shoreline jurisdiction requirements that are not Shorelines of Statewide Significance in the County. Only Negro Creek from its confluence with an unnamed creek in the town of Sprague (Section 23, Township 21 North, Range 38 East) downstream to the mouth at Sprague Lake (Section 21, same Township and Range) is identified as a stream being a shoreline of the state but not a stream of statewide significance.

WAC 173-20-460 identifies 49 lakes that are shorelines of the state in addition to the lakes of statewide significance noted in Table 3. Table 4 lists the lakes identified specifically in WAC 173-20-460 as being subject to shoreline jurisdiction (and their acreage). A few lakes have only a portion of the lake within the County, as also depicted in Table 4.

Table 4
Lakes under Shoreline Jurisdiction per WAC 173-20-460

Lake Name	Acreage in Lincoln County	Lake Name	Acreage in Lincoln County	Lake Name	Acreage in Lincoln County
Ames Lake	29.1	Little Falls Reservoir	125.0 (250.0)	Unnamed Lake (T21N-R39E-S36)	28.9
Bergeau Lake	31.0	Meadow Lake	44.4	Unnamed Lake (T22N-R39E-S32)	24.8
Browns Lake	42.2	Neves Lake	25.1	Unnamed Lake (T23N-R32E-S07)	42.2
Coffee Pot Lake	316.8	Pacific Lake	129.7	Unnamed Lake (T23N-R34E-S25)	25.3

Lake Name	Acreage in Lincoln County	Lake Name	Acreage in Lincoln County	Lake Name	Acreage in Lincoln County
Cormana Lake	48.3	Peterson Lake	20.5	Unnamed Lake (T24N-R35E-S04)	20.0
Deer Springs Lake	60.3	Phillips Lake	31.2	Unnamed Lake (T24N-R34E-S16)	40.8
Downs Lake	28.8 (423.4)	Reisenauer Reservoir	22.0	Unnamed Lake (T24N-R33E-S31)	48.3
Drapers Lake	34.2	Sullivan Lake	72.4	Unnamed Lake (T25N-R34E-S27)	54.3
Fishtrap Lake (Reservoir)	172.8 (195.6)	Swanson Lake – Lower	63.3	Unnamed Lake (T25N-R35E-S10)	28.8
Florence Lake	33.8	Swanson Lake – Upper	38.6	Unnamed Lake (T25N-R39E-S09)	42.2
Fourth of July Lake	35.9 (110.3)	Sylvan Lake	550.0	Unnamed Lake (T25N-R39E-S10)	67.0
Goetz Lake	36.2	Tavares Lake	-	Unnamed Lake (T26N-R38E-S33)	24.0
Greenwood Lake	20.0	Tule Lake (Bobs)	126.7	Wagner Lake	92.7
“H” Lake	26.0	Twin Lakes – Lower	44.9	Wall Lake	32.2
Intermittent Lake (T21N-R39E-S12)	93.0	Twin Lakes – Upper	39.2	Whittaker Lake	26.1
Intermittent Lake (T21N-R39E-S34)	60.0	Unnamed Lake (T21N-R39E-S26)	99.0	Wills Lake	22.0
				Wooley Lake	23.7

Notes:

1 = Tavares Lake did not have a listed acreage in WAC 173-20-460.

3.3 Preliminary Shoreline Jurisdiction Analysis and Findings for the SMP Update

3.3.1 Shoreline Jurisdiction Analysis

Anchor QEA reviewed the information in the WAC and compared it to a number of data sources to determine as accurately as possible with the available data which waterbodies in Lincoln County fit the definition of Shorelines of the State. Anchor QEA obtained GIS format datasets from Lincoln County Planning, the U.S. Geologic Survey (USGS), U.S. Department of Agriculture (USDA), U.S. Fish and Wildlife Service (USFWS), and Ecology containing information from a variety of sources about the waterbodies and potential shorelands within Lincoln County.

Anchor QEA has reviewed and appended a waterbodies dataset developed by Lincoln County to identify those waterbodies that meet the definition of Shoreline of the State, or Shoreline of Statewide Significance in RCW 90.58.030 (Anchor QEA 2013a). Anchor QEA used several data sources in determining whether a waterbody met these definitions. Those most used include:

- Designated streams named in WAC 173-18-260
- Designated lakes named in WAC 173-20-460 and WAC 173-20-470
- Ecology suggested shoreline arcs (stream) and points (at which streams reach the threshold of significance)
- Ecology suggested shoreline polygons (for lakes)
- USGS National Hydrography Dataset
- USDA National Agriculture Imagery Program 2011 Imagery
- Google Earth Historical Aerial Imagery
- USFWS National Wetland Inventory (NWI)
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs)
- A variety of other derivative GIS and map products

3.3.2 Identification of Shoreline Jurisdiction Rivers and Streams

Anchor QEA used Ecology's suggested locations at which streams reach a mean annual flow of 20 cubic feet per second (cfs) or upstream drainage of 300 square miles to determine an

initial upstream extent of the shoreline jurisdiction of several streams. Available stream data were used to review if adjustments of the upstream extent for Wilson Creek, Crab Creek, and Negro Creek were necessary.

This resulted in the recommended removal of Wilson Creek from consideration in the County SMP Update. Within the SMA, there are criteria to provide for reasonable access to water and water-related uses. Within Wilson Creek, there are few to no water-related uses; data suggests that no water continuously exists within the creek for these uses to occur.

The Crab Creek shoreline jurisdiction would remain at its current extent (from its confluence with Rock Creek to the Grant County/Lincoln County border). This point is the location where upstream drainage area reaches 300 square miles. Although there is potential for the mean annual flow above 20 cfs upstream of the current extent, not enough data are available to ascertain that flow is above the 20 cfs threshold at an upstream location. Flow data at additional site locations would be needed to ascertain the flow threshold location in Crab Creek.

Negro Creek shoreline jurisdiction was modified by moving the upper extent of the stream jurisdiction downstream to be located approximately 1 mile upstream of Sprague Lake, at the fork. However, since information regarding mean annual flows is lacking and the drainage area is within 15% of the threshold, gage installation is recommended. The extent of Negro Creek described above is recommended to remain shoreline jurisdiction waterbody for the identified 1-mile area until data indicate otherwise.

The current Lincoln County SMP includes five rivers and streams; the analysis has resulted in the recommendation to remove Wilson Creek from consideration. Three rivers are recommended to remain in the updated SMP as Shorelines of Statewide Significance, with Negro Creek remaining as a shoreline stream but with a reduced upstream extent.

Table 5
Shorelines of Statewide Significance (Rivers) to be included in the SMP Update

River Name	Included in current Lincoln County SMP	Total Length/Area Proposed Shoreline
Columbia River	Yes	40.40 miles ¹
Crab Creek	Yes	58.77 miles
Spokane River	Yes	34.88 miles ¹

Note:

1 = The measurement and division between Columbia River and Spokane River is based on the Ecology 'arc' data

The current Lincoln County SMP includes Negro Creek, and the analysis has resulted in the recommendation that a reduced length of Negro Creek remain within the shoreline jurisdiction (see Table 6).

Table 6
Other Shoreline Jurisdiction Streams to be included in the SMP Update

Stream Name	Included in current Lincoln County SMP	Total Length Proposed Shoreline (mi)
Negro Creek	Yes	1.0 ¹

Note:

1 = A reduced extent of Negro Creek is recommended for inclusion in the SMP Update. The extent included within the shoreline jurisdiction would be moved downstream to approximately 1 mile upstream of Sprague Lake.

3.3.3 Identification of Shoreline Jurisdiction Lakes

The Lincoln County data set identified all lakes that originated from the “waterbody” polygon in USGS National Hydrography Dataset. In order to determine which of these features are likely to be “lakes whose area is greater than 20 acres,” all contiguous polygons with a total area of 15 acres or more were compared with the Google Earth aerial imagery between 2005 and 2013 (Google Earth 2013). The aerial imagery analysis verified the continued existence of lakes represented in the data as being greater than 20 acres, and to identify lakes that decreased in size to less than 20 acres. This was an important task given the de-watering trends in some areas of the County.

The analysis recommended that Sprague Lake and Long Lake Reservoir remains as Shorelines of Statewide Significance (Table 7), that 17 of the 51 identified lakes in the current program

be removed (see Table 8), and three lakes be added: Browns Lake and two unnamed lakes located in T24, R35E, S16 and T24, R34E, S27. See Table 9 for a summary of recommended lakes to be included in the SMP Update.

Table 7
Shorelines of Statewide Significance (Lakes) to be included in the SMP Update

Lake Name	Included in current Lincoln County SMP	Total Length/Area Proposed Shoreline
Sprague Lake	Yes	1,760 acres ¹
Long Lake Reservoir	Yes	4,748 acres ²

Notes:

1 = About 750 acres in Lincoln County

2 = About 330 Acres in Lincoln County

Table 8
Lakes Currently under Shoreline Jurisdiction Proposed for Removal

Lake Name	Acreage in Lincoln County (Total Acreage)	Lake Name	Acreage in Lincoln County (Total Acreage)	Lake Name	Acreage in Lincoln County (Total Acreage)
Browns Lake	42.2	Reisenauer Reservoir	22.0	Unnamed Lake (T24N-R33E-S31)	48.3
Drapers Lake	34.2	Tule Lake (Bobs)	126.7	Unnamed Lake (T25N-R35E-S10)	28.8
Intermittent Lake (T21N-R39E-S12)	93.0	Unnamed Lake (T22N-R39E-S32)	24.8	Unnamed Lake (T26N-R38E-S33)	24.0
Intermittent Lake (T21N-R39E-S34)	60.0	Unnamed Lake (T23N-R32E-S07)	42.2	Wagner Lake	92.7
Neves Lake	25.1	Unnamed Lake (T23N-R34E-S25)	25.3	Wooley Lake	23.7
Pacific Lake	129.7	Unnamed Lake (T24N-R34E-S16)	40.8		

Table 9
Shoreline Jurisdiction Lakes To Be Included in the SMP Update

Lake Name	Included in current Lincoln County SMP	Total Area Proposed Shoreline (acres)	Lake Name	Included in current Lincoln County SMP	Total Area Proposed Shoreline (acres)
Ames Lake	Yes	25	Sprague Lake	Yes	1,760 ¹
Bergeau Lake	Yes	35	Sullivan Lake	Yes	57
Browns Lake	No	38	Swanson – Lower	Yes	22
Coffee Pot Lake	Yes	311	Swanson Lake – Upper	Yes	34
Cormana Lake	Yes	45	Sylvan Lake	Yes	592
Deer Springs Lake	Yes	62	Tavares Lake	Yes	43
Downs Lake	Yes	357 ²	Twin Lakes – Lower	Yes	49
Fishtrap Lake	Yes	191	Twin Lakes – Upper	Yes	41
Florence Lake	Yes	29	Unnamed_T25N_R39 E_9 ³	Yes	39
Fourth of July Lake	Yes	101	Unnamed_T25N_R39 E_10 ⁴	Yes	67
Goetz Lake ⁵	Yes	33	Unnamed_T21N_R39 E_10	Yes	24
Greenwood Lake	Yes	38	Unnamed_T21N_R39 E_26	Yes	89
H Lake	Yes	25	Unnamed_T24N_R35 E_4	Yes	35
Little Falls Reservoir	Yes	204	Unnamed_T24N_R35 E_16	No	64
Long Lake	Yes	20 ⁶	Unnamed_T24N_R34 E_27 ⁷	No	
Long Lake Reservoir	Yes	4,748 ⁸	Unnamed_T25N_R34 E_27	Yes	25
Meadow Lake	Yes	20	Wall Lake	Yes	33
Peterson Lake	Yes	24	Wills Lake	Yes	55
Phillips Lake	Yes	21			

Notes:

- 1 = About 750 acres in Lincoln County
 2 = About 20 acres in Lincoln County
 3 = Field verification may be necessary
 4 = Field verification may be necessary

- 5 = Field verification may be necessary
 6 = About 18 acres in Lincoln County
 7 = Field verification may be necessary
 8 = About 330 acres in Lincoln County

3.3.4 Preliminary Shoreline Jurisdiction Areas

The extent of the preliminary shoreline jurisdiction was determined (mapped) for the Coalition using the following steps:

- All shorelines meeting the definitions above and identified above were buffered by 200 feet.
- All wetlands from the USFWS NWI dataset that intersected any part of the 200-foot buffer were provisionally included.
- Those wetlands identified were reviewed for spatial accuracy to determine if any part of them intersected the 200-foot buffer. If so, they were included.
- Any additional wetlands in the floodway of streams meeting the shoreline definition above were provisionally included.
- Those wetlands identified were reviewed for spatial accuracy to determine if any part of them intersected with the 200-foot buffer. If so, they were included.

The preliminary shoreline jurisdictions are shown in the Map Folio included as Appendix D.

3.4 Study Area

Lincoln County is located in the eastern portion of Washington state and encompasses a total area of 2,339 square miles (6,059 square kilometers), of which 2,275 square miles (5,894 square kilometers) are land and 64 square miles (165 square kilometers; 2.7%) are water. The County is bordered by Okanogan, Ferry, and Stevens Counties to the north, Spokane County to the east, Adams and Whitman Counties to the south, and Grant County to the west.

3.5 Reach Breaks

The analysis and characterization information in this report is organized using a system of analysis reaches and subreaches to represent variations in land use and geomorphic characteristics along the shoreline. Physical changes often translate into differences in the function of the shoreline with regards to ecological and physical processes, which in turn may influence the shoreline designation.

The reach delineation was performed by evaluating aerial photography, topographic data, geologic maps, and land cover data, which were compiled in a GIS database. Specific factors

that influenced the delineation of stream reaches include channel and floodplain geomorphology, geologic controls, channel confinement and modification, hydrology, and irrigation practices. Subreaches were used in the analysis and characterization primarily to distinguish different patterns in land use, ownership, zoning, and level of development. Subreaches were delineated primarily where changes in land use, parcel density, or zoning affected the current or potential future ecosystem function.

A list of the reaches and subreaches for the shoreline jurisdiction areas within the County and Towns are provided in Table 10.

Table 10
Reach and Subreaches

Shoreline	Jurisdiction	Reach (Subreaches)
Columbia River	Lincoln County	1, 2 (a-c), 3(a-b), 4(a-l), 5, 6, 7, 8
Spokane River	Lincoln County	1, 2(a-c), 3, 4, 5
Crab Creek	Lincoln County	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Sprague Lake	Lincoln County	1 (a-c)
Negro Creek	Lincoln County	NA
Southeast Corner Lake Group (Browns Lake, Ames Lake, Fishtrap Lake, Downs Lake, Fourth of July Lake, and two unnamed lakes)	Lincoln County	NA
Lake Creek Lake Group (Wall Lake, Twin Lakes – Upper and Lower, Coffee Pot Lakes, Deer Springs Lake, Tavares Lake, Cormana Lake, and three unnamed lakes)	Lincoln County	NA
West-Central Lake Group (H Lake, Greenwood Lake, Bergeau Lake, Swanson Lake – Upper and – Lower, Philips Lake, Wills Lake, Meadow Lake, Goetz Lake, Sullivan Lake and one Unnamed Lake)	Lincoln County	NA
East-Central Lake Group (Reardan Audubon Lake)	Lincoln County	NA
Long Lake	Lincoln County	NA
Crab Creek	Town of Odessa	1, 2, 3
Reardan Audubon Lake	Town of Reardan	NA

Characterization tables and reach maps are provided in Appendices A through C and figures depicting these reaches and subreaches, where applicable, are provided in the map folio in Appendix D.

4 LINCOLN COUNTY INVENTORY

4.1 Ownership and Land Cover

Table 11 shows land ownership coverage for Lincoln County. Private holdings make up the majority of the County. The U.S. Bureau of Land Management (BLM) owns the largest share of public lands at approximately 63,677 acres (4.25%). Another federal agency, Bureau of Reclamation, owns about 20,458 acres (1.36%), most of which are aquatic lands managed by National Park Service in the Lake Roosevelt National Recreation Area. The rest of public lands are owned by state agencies. The Nature Conservancy, a non-governmental organization, owns about 343 acres (0.02%).

Table 11
Ownership Types within Lincoln County

Ownership Type		Owner	Acreage	Percentage
Public	Federal	Bureau of Land Management	63,677	4.25%
		Bureau of Reclamation	20,458	1.36%
		Others	5,687	0.38%
	State	Department of Natural Resources	44,339	2.95%
		Department of Fish and Wildlife	18,156	1.21%
		Department of Transportation	430	0.03%
Private	Nature Conservancy		343	0.02%
	All Other Privates Ownerships		1,346,794	89.73%
Total			1,500,711	100%

The Bureau of Reclamation is the largest owner of the shoreline land in Lincoln County. This may seem disproportionally high due to the significant amount of Bureau of Reclamation land located below the ordinary high water mark (OHWM) mark within Lake Roosevelt National Recreation Area. Above OHWM mark, the Bureau of Reclamation accounts for approximately 25% of the County's shoreline land ownership. Another federal agency (BLM) owns around 12% of shoreline lands near lakes such as Coffee Pot Lake in the central part of the County and Fishtrap Lake in the southeastern part of the County. State agencies (Washington State Department of Natural Resources [WDNR], and Washington State Department of Fish and Wildlife [WDFW]) own about 7% of shoreline land, mostly adjacent to smaller lakes in the central and southeastern areas of the County. The rest of shoreline land (about 55%) is privately owned.

Table 12
Ownership Types within Lincoln County Shoreline Jurisdiction

Ownership Type		Owner	Acreage (above OHWM)	Percentage	Acreage (below OHWM)	Percentage
Public	Federal	Bureau of Reclamation	2,063	24.99%	14,260	79.88%
		Bureau of Land Management	1,018	12.34%	297	1.67%
		Other	26	0.32%	4	0.02%
	State	Department of Fish and Wildlife	324	2.82%	205	1.14%
		Department of Natural Resources	233	3.93%	2,094	11.73
	Local	All Local Ownership	11	0.13%	4	0.02%
Private	All Other Privates Ownership		4,581	55.47%	989	5.54%
Total			8,257	100%	17,852	100%

Note:

OHWM = ordinary high water mark

Table 13 describes the land cover types within the study area derived from USDA-NASS cropland data layer. Land cover describes the surficial composition analyzed from satellite and aerial imagery. Land cover type analysis indicates that approximately 43.5% or 667,781 acres of Lincoln County can be visually identified as agricultural or fallow lands. About 29.9% or 459,047 acres can be identified as shrub/scrubland. The rest of the County is comprised of a variety of other land covers. See Table 13 for summary of land cover types in the County.

Table 13
Land Cover Types within Lincoln County

Land Cover Type	Acreage	Percentage
Agriculture	915,082	59.6%
Shrub/Scrubland	459,047	30%
Forest	60,750	6.4%
Developed	37,852	2.5%
Open Water	17,290	1.1%
Wetlands	7,193	0.5%
Barren	132	0.01%
Total	1,535,201	100%

Source: USDA-NASS Cropland Data 2012

Land cover types in Lincoln County's shoreline lands are provided in Table 14.

Table 14
Land Cover Types within Lincoln County Shoreline Jurisdiction

Land Cover Type	Acreage	Percentage
Agriculture	2,744	10.5%
Shrub /Scrubland	4,040	15.5%
Forest	1,743	6.7%
Developed	289	1.1%
Open Water	16,683	63.8%
Wetlands	504	1.9%
Barren	126	0.5%
Total	26,129	100%

Source: USDA-NASS Cropland Data 2012

4.2 Land Use

4.2.1 County Existing Land Use

Although agriculture is a predominant land use in Lincoln County, much of the agricultural land is used for dryland crops due to the arid nature of the County. About 84% of the

County's land use is assessed as agricultural land. See Table 15 for summary of land use types in the County.

Table 15
Existing Land Use of Lincoln County

Land Use Type	Acreage	Percentage of Total
Agricultural ¹	1,245,353.1	83.9%
Commercial	4,513.4	0.3%
Manufacturing	0.07	0.0%
Open Space	1,637.3	0.1%
Other (non-taxable)	88,346.2	6.0%
Parks/Recreation	571	0.1%
Residential	467.3	0.0%
Transportation	165.3	0.0%
Unknown	143,143.1	9.6%
Utilities	80.3	0.0%
Total	14,84,277.1	100%

Notes:

Source: Lincoln County Assessor's Office, Kathleen Martello and Jason Guthrie, 9/30/2013

1 Lincoln County Assessor's data includes shrub/scrublands in the Agricultural land use, which explains the differences in Agricultural acreages shown in this table and Table 13.

The zoning regulates different uses and development within the County. The County contains two major zones, Agricultural and Recreational. Agricultural constitutes about 95%, and Recreational constitutes 4% of the County's land. For the most part, recreational zoning coincides with the Lake Roosevelt National Recreational Area along the Columbia River shoreline. See Table 16 for a summary of zoning with Lincoln County.

Table 16
Existing Zoning of Lincoln County

Zoning	Acreage	Percentage of Total
Agricultural	1,420,714.17	94.9%
Commercial	66.99	0.004%
Incorporated	3,683.54	0.3%
Industrial	7,444.46	0.5%
Public Facilities	221.60	0.02%
Recreational	64,702.94	4.3%
Total	1,496,833.68	100%

Source: Lincoln County Assessor's Office, Kathleen Martello and Jason Guthrie, 9/30/2013

Lincoln County's existing shoreline land use is dominated by Agricultural and non-taxable public land. Other shoreline land uses include Residential, Open Space, Parks/Recreation, Commercial, and Rangeland. Non-taxable lands are owned by multiple state and federal agencies such as BLM, WDNR, and WDFW. Most of the shoreline along the Columbia River and westerly portion of the Spokane River are managed by the National Park Service as part of the Lake Roosevelt National Recreation Area. Zoning of this entire shoreline along the Columbia River is Recreational. Crab Creek and Lake Creek shoreline has public ownership of land by WDNR and WDFW. See Table 17 for a summary of land use within the County's shorelines.

Table 17
Existing Land Use within Lincoln County Shoreline Jurisdiction

Land Use Type	Acreage	Percentage of Total
Agricultural ¹	4,764.22	34.56
Commercial	7.38	0.05
Non-Taxable	8,736.41	63.38
Open Space	10.18	0.07
Parks/Recreation	10.94	0.08
Residential	5.23	0.04
Unknown	249.95	1.81
Total	13,784.31	100

Note:

1 = Lincoln County Assessor's data includes shrub/scrublands in the Agricultural land use, which explains the differences in Agricultural acreages shown in this table and Table 14.

Lincoln County is currently in the process of updating its Comprehensive Plan. The zoning code guides the land uses and permit processes. Existing zoning within Lincoln County shoreline consists of Recreational and Agricultural.

The Agricultural zoning district provides minimum standards for areas of general agricultural land use, including requirements for residential dwellings. Agriculture is the primary use in this zone. While other uses are allowed within this zone, non-agricultural uses are meant to minimize their impact on the surrounding agricultural use. Mixed land uses (e.g., residential plats, light commercial activities) may be appropriate on non-tilled lands within the agricultural district and/or the airport overlay district, subject to code review and compliance.

The Recreational zoning is intended to provide and protect land for compatible outdoor recreational and residential uses and those services that usually support these types of uses. Mixed uses may be allowed pursuant to the zoning and subdivision code requirements.

4.2.2 Town of Odessa Existing Land Use

Existing land use along the shoreline is primarily residential with limited commercial land use. The east side of the shoreline is currently unimproved and the zoning is residential on the south and industrial on the north shorelines. Odessa City Park is located along the shoreline. Odessa's existing land use within the shoreline jurisdiction is approximately 5% residential, 5% open space, 0.3% commercial, 0.1% agricultural, 89% unknown, and 2% other use. The Town of Odessa does not have an existing SMP.

Existing zoning includes Residential Zone I, Residential Zone II, Commercial, Industrial, and Public Use. The principal objective of Residential Zone I is to improve and maintain low density residential development of single family dwellings on individual lots. The principal objective of Residential Zone II is to improve and maintain a medium density residential development of single family dwellings, manufactured homes, duplexes, and townhouses. The principal objective of Commercial is to group business uses necessary for the livelihood of the community but are generally incompatible with residential uses. Industrial uses are considered to be high impact uses and particular care is intended to be provided on possible

impacts these uses can create on surrounding uses and areas. The Public Use zoning designation is not defined in the Town's zoning code.

4.2.3 *Town of Reardan Existing Land Use*

Most of the Town of Reardan shoreline is currently unimproved. The entire shoreline is within the mapped 100-year FEMA floodplain for Audubon Lake, with potential flooding risks from storms, such as rain on snow events, or other sudden snow melts. Zoning of the northwest end of the shoreline has recently been changed from Industrial to Agricultural. Few residential structures are located west of State Route (SR) 231. The Town of Reardan does not have an existing Shoreline Master Program.

4.2.4 *Water-dependent Uses*

Water-dependent use means a use or portion of a use which cannot exist in a location that is not adjacent to the water and which is dependent on the water by reason of the intrinsic nature of its operations (WAC 173-26-020(36)). Lincoln County's water dependent uses are mostly located along the Columbia River and Spokane River. They include boat launches, boat moorages, marinas, docks, and ferry terminal.

Boat launches on the Columbia River and Spokane River are located at Spring Canyon, Keller Ferry, Goldsmith, Jones Bay, Hanson Harbor, Lincoln, Hawk Creek, Fort Spokane, and Porcupine Bay. Among the lakes, Coffeepot, Fishtrap, and Sprague Lakes have boat launches.

Marinas in Lincoln County include Rantz Marina located east of Jones Bay, Seven Bays Marina and Fishtrap Lake Resort Marina. Keller ferry terminal is the only ferry terminal in Lincoln County connecting Ferry County and the Colville Indian Reservation in Ferry County on the north bank of the Columbia River.

No water dependent uses have been identified for the towns of Odessa or Reardan.

4.2.5 *Water-related and Water-enjoyment Uses*

Water-related use means a use or portion of a use which is not intrinsically dependent on a waterfront location but whose economic viability is dependent upon a waterfront location because 1) the use has a functional requirement for a waterfront location such as the arrival or shipment of materials by water or the need for large quantities of water; or 2) The use provides a necessary service supportive of the water-dependent uses and the proximity of the use to its customers makes its services less expensive and/or more convenient (WAC 173-26-020 (40)).

Water-enjoyment use means a recreational use or other use that facilitates public access to the shoreline as a primary characteristic of the use; or a use that provides for recreational use or aesthetic enjoyment of the shoreline for a substantial number of people as a general characteristic of the use and which through location, design, and operation ensures the public's ability to enjoy the physical and aesthetic qualities of the shoreline. In order to qualify as a water-enjoyment use, the use must be open to the general public and the shoreline-oriented space within the project must be devoted to the specific aspects of the use that fosters shoreline enjoyment (WAC 173-26-020 (37)).

Lincoln County doesn't include any significant water-related uses within the shoreline area. It consists of many water enjoyment uses such as parks, campgrounds, beach areas, open spaces and trails along the shoreline. The County also contains fishing and hunting opportunities in multiple shoreline locations. Water-enjoyment uses are located mostly in conjunction with water-dependent uses.

Spring Canyon, Keller Ferry, Goldsmith, Jones Bay, Hawk Creek, Fort Spokane, and Porcupine Bay have campgrounds. Boat-in campsites are also located in Crystal Cove, Ponderosa, Detillion, Goldsmith, Jones Bay, Halvestor Canyon, and Sterling Point. Seven Bays Marina has concession areas, fuel dock, and boat waste disposal facilities. Fort Spokane has a visitor center and trail access. Sprague Lake shoreline contains interpretive trail, viewing platform and fishing opportunities. Fishtrap Lake also contains trail and fishing opportunities. Odessa Lake Creek trail abuts the Crab Creek shoreline near Odessa.

In Odessa, street crossings and ends provide aesthetic enjoyment opportunities for Crab Creek. In Reardan, streets also provide aesthetic enjoyment opportunities for the Audubon lakes.

4.2.6 *Non-water-related uses*

Non-water-related uses directly adjacent to the water include agricultural land, rangeland and large lot rural use as well as residential lots. A portion of the water frontage is also bounded by roads or railroads, e.g. north bank of Sprague Lake abutting railroad and Interstate 90.

In Odessa, residential and commercial uses are directly adjacent to Crab Creek. The railroad and several roads also cross the creek.

In Reardan, residential and agricultural uses are in close proximity to the Audubon lakes, along with significant open space.

4.3 *Current SMP Environment Designation*

Lincoln County's existing SMP includes five shoreline environment designations:

1. Natural
2. Pastoral
3. Conservancy
4. Rural Area
5. Urban Area

Odessa and Reardan do not have existing SMPs.

4.3.1 *Natural*

The natural environment is intended to preserve, maintain, or restore those natural resource systems existing relatively free from human activities, and those shoreline areas possessing natural characteristics intolerant of human use or of historical and cultural significance. Uses which will contribute to the preservation of such areas or enjoyment of such areas by the public are to be encouraged, while those use-activities which degrade the natural or cultural aspects of the area or are inappropriate would be discouraged, severely restricted, or prohibited.

4.3.2 Pastoral

The pastoral environment is intended to protect and maintain those shorelines which have historically been subject to limited human interference and have preserved their natural quality as wildlife habitat and places of scenic beauty. These areas are appropriate for passive agricultural and recreational uses.

4.3.3 Conservancy

The conservancy environment is designated in Lincoln County for the purpose of maintaining the existing character of shoreline resources while providing for non-intensive uses. Those uses that are preferred in the Conservancy Area are those, which may utilize the natural resources on a sustained yield basis. These uses include passive agricultural activities, timber harvesting on a sustained yield basis, and diffuse outdoor recreation. The Conservancy Area is designated to protect agricultural land from encroachment by urban uses while providing for recreation wherever recreation will not interfere with agricultural practices.

4.3.4 Rural

The rural area is presently used for agricultural, recreational and low density suburban types of development, and/or has the potential of becoming prime farm land. The purpose of designating the rural area in Lincoln County is to protect agricultural land from urban expansion, and to provide for extensive and intensive recreational uses where these recreational uses do not conflict with agricultural practices. This environment is designated to preserve shorelines most suitable for agricultural uses and recreational pursuits.

4.3.5 Urban

The urban area designation is intended to accommodate compatible water-dependent and water-oriented uses in shoreline areas. The urban area is to be managed so that shoreline developments will enhance and maintain the shoreline for a multiplicity of uses. The urban area is designated in Lincoln County to encourage the redevelopment of existing urban areas and to control the expansion of urban uses in characteristically rural areas of the County. Those urban uses which are water-dependent and can provide visual and/or safe access to the waterfront are to be given priority for shoreline locations.

4.4 Geology

The geology, soils, and topography of Lincoln County are primarily dictated by glacial outburst flooding that occurred near the end of the last major glacial period, approximately 18,000 to 20,000 years before present. This event is referred to as the Missoula Floods. The geologic makeup of the County is the result of erosion of pre-Floods geologic units, deposition of sediments carried by the floodwaters, and the formation of the unique topographic features that influence present-day hydrology. Prior to the Floods, the geology of the County consisted primarily of Miocene-aged Columbia River Basalt (CRB) flows that were in some places (e.g., plateaus) capped with varying thicknesses of wind-blown fine sands and silt known as loess. The CRB bedrock units were formed by numerous separate flows of molten volcanic rock, resulting in stratified layers of rock with distinct contacts that are visible between each volcanic event. The cooling process of each these types of lava flows results in a relatively dense but highly jointed rock that is subject to fracturing and erosion. Metamorphism of the CRB also contributed to its weakness and to the development of fold axes that later became preferential pathways for floodwaters. Granodiorite (an Eocene-aged intrusive crystalline rock) and acidic (felsic) intrusive igneous (Cretaceous age) rocks are present locally in the northern portion of the County and along the Spokane River (and Lake Roosevelt).

During the Missoula Floods, the rapid drainage of glacial Lake Missoula sent floodwaters through northern Idaho and eastern Washington, where the extremely high-erosive energy flows were primarily focused on folds and joints in the bedrock. Today these areas are characterized by steep-walled canyons and coulees. The Grand Coulee and the Crab Creek Valley were two of the major flow paths for the floodwaters and remain as major hydrologic features. The wide, flat, Quincy Basin, which is currently heavily developed for agriculture, is located at the outlet of these two constricted flowpaths, where the floodwaters spread out significantly and temporarily ponded, depositing large quantities of flood-carried sands and gravels; (Easterbrook and Rahm 1970). Wind-driven fine material from these outburst flood deposits have more recently formed active sand dunes that are in some locations used for off-road vehicle recreation but are not well suited to agriculture or other uses. Several smaller-scale erosional features are present throughout the County, such as complexes of lakes that were once scour pools of flooding channels; many of these have eroded to bedrock at the

surface. This unique topography lends itself well to the development of modern drainage channels and reservoirs.

Additional prominent geologic features present in the County include Palouse Formation loess (wind-blown silt) deposits atop high-relief areas that were not eroded in the floods. Loess-dominated areas are typically the source of excellent soils and are dominated by agriculture, particularly wheat farming. Recent fluvial deposits (alluvium) deposited by post-glacial and modern-day streams are present in most of the major stream valleys; these deposits are typically comprised of sands and gravels.

4.5 Climate

Lincoln County falls within the Okanogan Big Bend region of Washington (NOAA 2013a and 2013b). This region includes fruit producing valleys along the Columbia River. The annual precipitation increases from 11 inches in the valley to 16 inches over some of the Plateau. Snowfall varies from 30 to 70 inches and occurs from November through March or April. Monthly average high temperatures in January range from 28 to 32 degrees with low temperatures between 15 to 20 degrees. Monthly average high temperatures in the summer average between 85 to 90 degrees with low temperatures occurring in the lower 50s (WRCC 2013). Additional potential effects on climate conditions are discussed further under Water Resources.

4.6 Water Resources

This section includes an inventory of water resources within the County, including resources that do not fall under the shoreline jurisdiction. Water resources discussed in this section include surface water resources and quality, floodplains and floodways, channel migration zones, and groundwater. Surface water resources are discussed generally and then with regard to specific issues including water quality and flooding.

Surface waters within Lincoln County occur within six Water Resource Inventory Areas (WRIAs), two of which include major streams while the other four include small tributaries to larger streams bordering or outside of the County. These WRIA's are summarized below:

- WRIA 43, Upper Crab Creek covers most of Lincoln County and includes Crab Creek and its major tributaries Rock Creek, Bluestem Creek, Duck Creek, Lake Creek, Marlin Hollow, Canniwai Creek, and Wilson Creek. This is the largest drainage in the County.
- WRIA 34, Palouse River includes the southeastern corner of Lincoln County and includes Negro Creek, which flows into Sprague Lake.
- The other four WRIs, Lower Lake Roosevelt (WRIA 53), Lower Spokane (WRIA 54), Lower Crab Creek (WRIA 41), and Grand Coulee (WRIA 42) host small streams that flow into larger streams outside of the County.

4.6.1 *Surface Water Resources*

Surface water resources include streams and lakes described in Section 3 as well as other streams and lakes that contain surface water but do not fall under shoreline jurisdiction. Lincoln County encompasses approximately 1.49 million acres, or approximately 2,339 square miles in north-central Washington. Approximately 64 square miles (2.7%) of Lincoln County is water. A significant portion of this area is within Lake Roosevelt, the reservoir created by Grand Coulee Dam.

Crab Creek drains over half of Lincoln County, with it and its tributaries generally flowing to the south and southwest off the drainage divide adjacent to the Lake Roosevelt valley. Crab Creek and from east to west its major tributaries Rock Creek, Bluestem Creek, Lords Valley Creek, Coal Creek, Duck Lake Creek, Lake Creek, Marlin Hollow, Canniwai Creek, and Wilson Creek lie in scabland valleys originally scoured into the Lincoln County landscape by the Pleistocene Missoula flood waters that spilled over the drainage divide in northern Lincoln County and flowed south into the Columbia Basin. Lake Creek, and to a lesser extent the other Crab Creek tributaries, host a number of lakes, several of which are now dry. This drying, which has occurred over the last several decades, is a central aspect of surface water resources in Lincoln County.

A drastic decline in stream flows and lake volume has occurred in much of Lincoln County and adjacent portions of Grant and Adams Counties. One prominent example is Pacific Lake in the Lake Creek drainage, located a few miles north of the City of Odessa. This lake, and several others in the area that have gone dry, are located in coulees cut deep into the

Wanapum Basalt and almost to the top of the Grande Ronde Basalt. Pacific Lake has historically seen recreational uses such as fishing, boating and water skiing. It is approximately 130 acres in area, ranges in depths up to 30 feet, and has an approximate static storage volume of 2,400 acre-feet of water. In the mid-1980s, Pacific Lake went dry and has only periodically held water since then. In conversations with area residents and farmers, wildlife professionals, and basic observations of GSI Water Solutions staff, it seems plausible that surface water declines seen in the region since the early 1980s are coupled with groundwater withdrawals and accompanying basalt aquifer system water level declines seen in the CRB aquifer system in the surrounding area. The impacts of declining aquifer system water levels and groundwater storage, and the drying of streams and lakes has already been felt by farmers, stock raisers, recreationalists, and the community as a whole in Lincoln County and adjacent portions of Grant and Adams Counties.

Stream flow information and data is only sporadically available for the County. Given this, some basic observations were made. Based on the gauged flow data, stream flows in the County are highly variable and can generally be characterized as ephemeral. Annual flow cycles consist of seasonal high flows during the winter, followed by sharply decreasing flows starting in March or April, reaching minimum levels in early summer. The precipitation data indicate that in many years, the summer stream flows are supported by groundwater discharge.

Extended periods of no flow commonly are observed during summer months. Most no-flow periods occur from early summer to early fall months. The double peaks observed early on these hydrographs may be associated with the rain on snow events that frequently occur in the region. Average periods of no measurable flow ranged between 6 and 207 days among the stations over the entire period of record. The lowest average period of 6 days of no measurable flow was measured at Crab Creek at Irby. At Wilson Creek, periods of no flow ranged between 2 consecutive days to one period in 1964 to 1966 of over 647 consecutive days. The highest maximum daily flow (7,470 cfs) was measured at Crab Creek at Irby.

Visual observations recorded by Lincoln County Conservation District (LCCD) staff during field reconnaissance and sampling performed in August 2002 indicate that several ungauged stretches of Crab Creek and its tributaries were dry at the time and possibly dry for extended

periods (a few months to a few years). These observations are further supported by aerial video films of the Lake Creek drainage basin during February 1995 and July 1997. These films show flow in many stretches of the mid-section of the creek during 1995, but no flow in the lower sections. Historical aerial photos from 1957 and 1996 for Crab Creek also support these observations (Ecology 2013; UW 2007). Similar observations have been made for other streams, including Coal Creek, Duck Creek, Canniwai Creek, and Wilson Creek.

Stream flows in the County are influenced by both natural and human-induced factors. The natural causes primarily include variations in precipitation and evapotranspiration (ET) from year to year. These factors affect the amount of water runoff and groundwater recharge and the demand for irrigation water to supply irrigated agriculture. Variations in effective precipitation in each year result in variable stream flows that are generally characterized as ephemeral. On a seasonal basis, winter stream flows respond quickly to precipitation events and snow melt. The winter flows are followed by sharply decreasing flows in spring, reaching minimum levels in early summer. Extended periods of no flow are observed during summer months at many locations in the County.

In the Northwest, observed regional warming has been linked to changes in the timing and amount of water availability in basins with significant snowmelt contributions to stream flow (Melillo et al. 2014). Hydrologic response to climate change will depend upon the dominant form of precipitation in a particular watershed, as well as other local characteristics including elevation, aspect, geology, vegetation, and changing land use. The largest responses are expected to occur in basins with significant snow accumulation, where warming increases winter flows and advances the timing of spring melt (Melillo et al. 2014).

This may be further affected by Pacific Decadal Oscillation (PDO) that also influences climate conditions. The PDO, sometimes referred to as El Niño and La Niña, is a pattern of Pacific climate variability that results in decades long (15- to 30-year) warm and cooler weather patterns associated with North Pacific Ocean surface water temperature conditions (source: UW <http://jisao.washington.edu/pdo/>). These climate influences may have an effect on hydrology including stream flow changes and lake expansion and contraction over time, and associated riparian vegetation conditions and shifts in the OHWM.

One or a combination of the following human factors may be contributing to the flow decrease:

- Changes in land surface runoff patterns due to dryland and irrigated farming.
- Increased groundwater pumping may have reduced stream baseflow that derives from groundwater discharge.
- Stream flow diversions have a direct influence on stream flow rates.
- Modifications of stream channel geometry, including removing stream meanders, riparian zones along streams, streambank vegetation, and wetlands, cause faster outflow of stream water.

The relative significance of these factors to stream flow has yet to be determined for the purpose of developing and implementing water management strategies.

4.6.2 *Surface Water Quality*

Surface water quality in Lincoln County is generally affected by climate, dam and hydropower operations, past industrial use, and agricultural runoff. These impacts have caused certain water bodies to be impaired by temperature, dissolved oxygen, total dissolved gas, polychlorinated biphenyls (PCBs), pH, and/or other pollutants.

Within the Crab Creek watershed and the Sprague Lake watershed, there is sufficient information to show that many streams in the County exhibit elevated nitrogen and phosphorous levels. The presence of nutrients in the streams and lakes appears to be associated with non-point sources such as historical agricultural activities. This conclusion was based on a lack of significant non-agricultural-related industry and commercial activities in the watershed over time. Due to significant improvements in agricultural practices, fewer nutrients should be contributed to the surface water bodies in the future than has been in the past.

Monitoring data from the County has also exhibited exceedances of several other water quality parameters including fecal coliform, temperature, pH, and dissolved oxygen at various locations. Elevated temperatures in the streams were attributed to low stream flows, lack of shade from non-existent riparian vegetation, and groundwater contributions.

Elevated pH values are related to excessive aquatic vegetation. These two parameters are indirectly related to elevated nutrient levels, since aquatic vegetation growth is supported by the presence of nitrogen and phosphorous in stream water. The sources of elevated fecal coliform counts at various locations in Crab Creek were not determined.

It should be noted that in some areas of Crab Creek, excessive submerged aquatic vegetation has a direct influence on the water quality. Specifically, the diurnal fluctuations directly affect dissolved oxygen, pH, and temperature. The contribution of excessive nutrients into the surface waters has been identified as the primary cause inducing aquatic vegetative growth.

4.6.3 Floodplain and Floodway

Detailed studies that delineate the floodway have been conducted for Crab Creek near the Town of Odessa. The presence of a delineated floodway on Crab Creek causes the shoreline jurisdiction area to be increased to include the entire floodway. In cases where there is a 100-year floodplain adjacent to the floodway, the 100-year floodplain was also included in the shoreline jurisdiction, up to 200 feet landward from the floodway edge.

In addition to this floodway area, the FEMA 100-year floodplain (Zone A) mapping is available in digital format for the entire county. Floodplains are delineated for most County streams and lakes. Outside of Odessa, there are no mapped floodways within the County's shoreline jurisdiction, and the County has not elected at this time to include the 100-year floodplain as a determining boundary for shoreline jurisdiction.

4.6.4 Channel Migration Zone

The Channel Migration Zone (CMZ) is the area along a river within which the channels can be reasonably predicted to migrate over time as a result of natural and normally occurring hydrological and related processes when considered with the characteristics of the river and its surroundings (WAC 173-26-020). These areas adjacent to a stream or river are susceptible to future erosion (Rapp and Abbe 2003). CMZs were delineated by a geomorphologist for the shoreline extents in Lincoln County for Crab Creek and the Spokane River. As part of SMP development process, the location of the general CMZ was identified for these shoreline

areas. CMZs may require implementation of regulations that are unique to these areas due to the migration potential of a given stream throughout its extents.

The CMZs were delineated in a geographic information (GIS) database and are presented graphically in the map folio included in Appendix D for the Crab Creek and Spokane River figures. Associated text is also provided in the characterization tables included in Appendices A through C. The CMZs represent the existing and potential locations the stream channels may occupy within their valleys.

The CMZ delineations are based on analysis and professional judgment of a geomorphologist using visual observation of various physical characteristics that indicate evidence of past channel migration. Analysis included review of existing geology, geomorphology, infrastructure, channel confinement, valley width, topography, estimated hydraulic energy, vegetation, soils, and floodplain and wetland extents. Each stream was evaluated along its entire shoreline jurisdiction length and a CMZ line was delineated along each bank depending on the conditions present.

Physical characteristics for the CMZ- delineated streams were reviewed in GIS and aerial photos, including historical aerial photos from 1957 and 1996 for Crab Creek. Black and white photos from 1957 were assessed for a limited extent of Crab Creek, with coverage including most portions of reaches 8 through 12 (Ecology 2013). In addition, 1996 aerial photo coverage was available for all reaches of Crab Creek (UW 2007). Aerial photography for most of the other shoreline areas in the County was limited to more recent aerial photos.

At the time of this analysis, Light Image Detection and Ranging (LiDAR) coverage was not available for the stream extents included in the Shorelines jurisdiction.

4.6.4.1 *Disconnected Migration Areas*

In addition, disconnected migration areas (DMAs) were identified throughout the CMZ. WAC 173-26-221 allows exclusions of areas where a legally existing artificial structure is likely to restrain channel migration, and is built above or constructed to remain intact, with appropriate functionality maintenance activities, through the one hundred-year flood. Identified DMAs include bridge crossings (applicable County, state, and federal

crossings) and railroad alignments that meet these criteria. The CMZ is also delineated at each DMA bridge crossing. Therefore, if the status of a DMA bridge changes to a non-DMA structure, the corresponding CMZ delineation is provided for that location. Levee and revetment features were not identified as DMA features within the County's shoreline jurisdiction.

4.6.5 Groundwater Resources

Groundwater resources in Lincoln County occur within alluvial sediments overlying the CRB and within the CRB. Conditions within these groundwater systems are summarized here.

The alluvial aquifer system is most commonly found in the coarse Quaternary sediments found within scabland tracts. The base of this aquifer system is defined as the top of the upper-most basalt flow. The lateral extent of the alluvial aquifer in Lincoln County is controlled by surface basalt outcrops and areas of quaternary sediment deposition within coulees and canyons. These physical features result in an alluvial aquifer system that is very discontinuous, with hydrologic continuity between different areas of saturated sediment being extremely limited. Features of this system include:

- Alluvial aquifer thicknesses range from less than 10 feet up to as much as 100 feet, generally depending on the thickness of valley fill in any given reach of a coulee.
- Where an alluvial aquifer is present, depth to water (DTW) is relatively shallow and ranges from less than 10 feet up to 60 feet.
- Estimated water table elevations in the system range from approximately 1200 to 1300 feet above mean sea level (AMSL) in the southwestern part of the County and from 2200 to 2300 feet AMSL in the northern part of the County.
- Because the alluvial aquifer system is localized by basalt bedrock topography, a single, county-wide alluvial sediment aquifer is not present.
- Where it occurs in Lincoln County, the alluvial sediment aquifer system typically is unconfined.
- Measured hydraulic conductivity for coarse strata typical of the alluvial aquifer system range from 2,000 to 25,000 feet/day with effective porosity greater than 10%.

Because average annual precipitation is low, less than 16 inches, and the summer season is hot and dry, natural surface recharge for the alluvial aquifer from precipitation (rain and snowmelt) most likely is small. In addition, because the majority of precipitation that falls in the area occurs in the winter and spring the small amount of natural recharge that exists happens predominantly in the winter and spring. Given the local climatic conditions found across the County, natural recharge decreases to the southwest across the County as elevations and precipitation decrease. Bauer and Vaccaro (1987, 1990) describe methodologies for estimating aquifer recharge from natural precipitation. Generally natural recharge will be 10% or less of natural precipitation. However, where irrigation occurs on these sediments some artificial recharge is likely as the amount of water available on the surface and in shallow soils can periodically exceed evapotranspiration.

The basalt aquifer system generally is confined, occurring in water-bearing intervals hosted by interflow zones. Groundwater occurring within interflow zones is found in joints, vesicles, fractures, intergranular pores in sediment interbeds, and other features that create permeable strata at the tops and bottoms of individual Columbia River Basalt Group (CRBG) layers. Horizontal hydraulic conductivity of basalt flow tops and bottoms range from 1×10^{-6} to 1,000 feet per day (feet/day) and averages 0.1 feet/day. Flow tops and bottoms serve as the primary conduit for lateral groundwater flow as vertical and horizontal hydraulic conductivity in dense flow interiors is 3 to 6 orders of magnitude less than the horizontal. Pre-basalt rock highlands beneath the northern portion of Lincoln County likely form a hydrologic barrier separating the basalt aquifer system from Lake Roosevelt. This hydrologic barrier prevents recharge of the basalt system by Lake Roosevelt.

In the absence of recharge from Lake Roosevelt, direct recharge to shallow basalt aquifers results from infiltration of precipitation, runoff, and irrigation within (and along the margins of) the Columbia Basin. Infiltration has been variously interpreted to be vertically downward along faults, past the ends of flow pinchouts, where CRBG flows are breached by erosional windows, on highlands within and bordering the Columbia Basin, and through dense flow interiors. Recharge of the deeper Wanapum and Grande Ronde aquifers is inferred to occur largely from interbasin groundwater movement originating around the edge of the Columbia River Basin in areas where exposures of these deeper units occur and downward through overlying CRBG flows. Regardless of the source of recharge to the CRBG aquifer system,

groundwater age dating by GWMA (GWMA 2009) suggests that the rate of recharge is slow as groundwater more than a few hundred feet deep in the CRBG aquifer system usually is thousands to several tens of thousands of years old. Based on GWMA's groundwater geochemical data, much of the water in the CRBG aquifer system was introduced into the system in the Pleistocene. Areas where younger groundwater has been found in Lincoln County commonly are associated with coulees, suggesting these erosional features facilitate recharge to at least portions of the CRBG system (GWMA 2009, 2011).

Beneath Lincoln County groundwater flow directions in the basalt aquifers generally are toward the south-southwest. Potential discharge areas for deeper portions of the aquifer system, especially within the Grande Ronde Basalt, are uncertain, but groundwater flow is inferred to be generally southwestward with discharge speculated to occur south of the Pasco Basin where folds and faults bring the Grande Ronde closer to the surface. Hansen et al. (1994) and Bauer and Hansen (2000) have also speculated that discharge from deep CRBG aquifers may be directly upward through multiple dense basalt flow interiors into major rivers like the Columbia and Snake. In and around the Lincoln County project area discharge from much of the shallow aquifer system, especially portions hosted by the Wanapum Basalt, may be fairly local as much of the system is completely dissected by Pleistocene Missoula flood cut coulees. In such settings these shallower water bearing zones, where they contain water, will discharge to coulees in spring lines. This would be to the lakes, streams, and surface springs that occur within coulees in the study area. Historically, recharge to these surface water bodies was considerable, but it has likely diminished in recent decades due to factors such as increased groundwater pumping from basalt aquifers. Water-bearing interflow zones within the area which lie below the depth of incision of the deepest coulees likely do not discharge to the surface in Lincoln County. Instead, this groundwater exits the county, moving down gradient into adjacent Grant and Adams County.

4.7 Geologic Hazards

Geologically hazardous areas are defined as those lands susceptible to erosion, landslides, seismic or mine hazard events. Surficial geologic conditions are shown on Map 4 in the map folio (Appendix D). Primary geologic hazards are soils susceptible to erosion and landslides or rock fall areas. Seismic hazards and mine sites are secondary geologic hazards that generally present less of a concern in most areas. Table 18 summarizes each of the hazards

that may be associated with County shorelines, as well as the sources of information that were evaluated.

Table 18
Geologic Hazards of Lincoln County

Hazard	Description	Summary	Source
Erosion	Soil units susceptible to erosion by wind, water, and unstable slopes.	Approximately 39.26% of the County area contains soils classified as having moderate to severe susceptibility to erosion. Many of these soil units are associated with loess deposits, outburst floods, mass-wasting deposits and thin soils overlying bedrock.	Natural Resources Conservation Service (NRCS) Soil Survey (Stockman, 1981)
Landslides	Steep Slopes underlain by weak, fine, and unstable geology	Approximately 13.41% (18,648 acres) of Lincoln County have slopes greater than 15%. About 9.32% of the steep slope area is underlain by unstable geology (dunes, alluvial, loess, outburst flood deposit, mass-wasting deposits) which makes them designated landslide hazards.	USGS 7.5 minute (10 Meter) Digital Elevation Models (DEMs) 1998 , Surface Geology Polygon, 100K Scale (WDNR)
Seismic Hazards	Active faults	No Known faults in Lincoln County	Open File Report 80-2 (DNR)
	Earthquake locations	Any earthquake in Lincoln County registered $1.8 < M_c < 3.0$.	Information Circular 84 and 85 (DNR)
Mine Sites	Active (permitted) mine sites	27 mine sites were identified; 13 were for rock or stone and 14 were sand or gravel. Underground mining practices are currently not taking place in the County; however there are at least 26 known inactive mine sites that can present slope hazards.	Mining and Energy Resources GIS data (DNR) 2004, 2010, 2011, 2012

4.8 Cultural Resources

4.8.1 Historical Background

4.8.1.1 Lincoln County

Lincoln County is the Southern Plateau culture area, which is bounded by the Okanogan Highlands to the north, the Bitterroot Mountains to the east, the Cascade Mountains to the west, and the Deschutes and John Day River drainages to the south (Ames et al. 1998). It forms part of the larger Columbia Plateau culture area.

The oldest archaeological sites in the Southern Plateau date to the end of the Pleistocene, when hunters of large mammals fanned out across North America. The earliest Paleoindian sites in the area are attributed to the Clovis culture, including the Ritchey-Roberts Clovis cache in East Wenatchee, which dates to 12,250 before present (BP) (Mehring and Foit 1990). Clovis sites are rare across the region.

After the brief but widespread Clovis occupation, a “broad-spectrum” hunter-gatherer culture developed in the region and persisted until the middle Holocene, around 5,300 years ago. Sites dating to this time period are generally limited to lithic assemblages (basalt projectile points and flake tools) and lack evidence of long-term habitation (Ames et al. 1998).

A shift towards more permanent settlement began around 6,000 years ago and initiated a period that lasted until the beginning of the early Holocene around 3,000 years ago (Chatters and Pokotylo 1998; Ames et al. 1998). In general, tool assemblages are characterized by the addition of groundstone and bone/antler tools to the existing flaked stone technology. The appearance of woodworking tools correlates with the first semi-subterranean structures.

Late Holocene cultures in the Plateau region exhibit “a “shift in adaptations...to storage-dependent collector strategies” (Chatters and Pokotylo 1998:76), which are characterized by intensive salmon fishing and associated storage features, social inequality, large permanent winter villages, and diverse tool assemblages. This shift began around 4,000 years ago and persisted until historic contact (Chatters and Pokotylo 1998). In the southern Plateau, this period also included evidence of intensive camas processing and fiber and wood artifacts preserved in the relatively dry climate (Ames et al. 1998). The late Holocene archaeological cultures correlate with historic ethnographic descriptions.

Lincoln County is in the traditional territory of Middle Columbia River Salishan peoples who speak the Columbian language (Miller 1998). Many are now members of the Spokane Tribe and the Confederated Tribes of the Colville Reservation (Ruby and Brown 1986:204).

The communities of the southern Columbia Plateau began to see the effects of Euro-American contact decades before the first explorers and traders arrived in the area. These effects, beginning around A.D. 1600, included introduced diseases, trade goods, and the

introduction of the horse (Walker and Sprague 1998). Fur traders and missionaries traversed the area in the early 1800s, earliest Euroamerican settlers arrived in the 1860s (Becker 2006). They were primarily cattle ranchers and wheat farmers who settled near water sources; some of the earliest communities were along the Columbia River and are now beneath Franklin D. Lake Roosevelt (Becker 2006). The Northern Pacific Railroad through the area (passing through Odessa) was completed in 1883, and the company actively recruited settlers to the Lincoln County area (Schwantes 1996:291). Irrigation increased in the area after the 1920s, expanding available farmland. Also in the early twentieth century, dam projects brought both reliable and flood-controlled water supply, and electricity. Ranching and farming still predominate in Lincoln County (Becker 2006).

4.8.1.2 *Town of Odessa*

The Town of Odessa was settled by Euroamericans in the late 1800s and incorporated in 1903 (City of Odessa 2013). A significant proportion of settlers were of German origin, though recently living in the Volga region of Russia (Becker 2006). The Town of Odessa has been a small farming and ranching community to the present day.

4.8.1.3 *Town of Reardan*

The Town of Reardan was founded and platted by the Northern Pacific Railroad in 1888-89, at a location already crossed by precontact and historic roads and trails. A Native American trail from the Spokane area to points west traversed the area, and a local resident in 1930 described a road (also formerly a Native American trail, and possibly the same one) that became the “Colville Trail” – first a military road, then the route travelled by Governor Isaac Stevens to Walla Walla in the 1850s (Reardan Gazette, April 15, 1930). Reardan was incorporated in 1903. It was primarily an agricultural community, and has remained so to the present day.

4.8.2 *Recorded Cultural and Historical Resources*

4.8.2.1 *Lincoln County*

The Department of Archaeology and Historic Preservation (DAHP) maintains an electronic database of archaeological sites, historic structures, and cemeteries. The database lists 613 recorded archaeological sites, 191 recorded structures older than 50 years, 27 structures that

are listed on the National Register of Historic Places, and 66 recorded cemeteries in Lincoln County. No Traditional Cultural Properties (TCPs) - places that are historically significant because of their association with historical and on-going cultural practices or beliefs of a living community – are recorded in Lincoln County.

Of the recorded archaeological sites, primary site types include the following:

- Precontact features such as talus pits, cairns, hearths and rock alignments (146 sites)
- Precontact rockshelters and cave sites (26 sites)
- Precontact lithic sites and lithic isolates (72 sites)
- Precontact camps, habitation sites, and multi-component sites (29 sites)
- Precontact pictographs (2 sites)
- Precontact burial sites (4 sites)
- Precontact and/or historic trails (2 sites)
- Historic structures, compounds, and features (261 sites)
- Historic isolates (39 sites)
- Historic burials (3 sites)
- Sites that have both precontact and historic components (29 sites)

In addition to recorded resources, there are undoubtedly hundreds or thousands more cultural resources that have not been recorded. Many recorded and unrecorded resources are likely within 200 feet of shorelines.

4.8.2.2 Town of Odessa

There are currently no recorded archaeological sites, cemeteries, or TCPs within 200 feet of the shoreline in Odessa, or anywhere within Odessa town limits. However, no cultural resources surveys have been conducted, so the archaeology of the town and its shoreline is unknown.

The Birge Barn, at 506 S. Alder Street, is the only Washington Heritage Register-listed property in or near the town. No other historic structures have been inventoried.

Two cultural resources have been recorded nearby. Archaeological site 45LI168, a precontact lithic scatter is located southwest of the city limits. Odessa Cemetery is located about a quarter-mile west of town.

4.8.2.3 *Town of Reardan*

There are no recorded cultural resources within 200 feet of the shoreline in the Town of Reardan. Within town limits, there are three structures that have been inventoried but not evaluated for listing on state or national registers (Dean's Drive-In, Long's Service Station, and Colville's Garage), as well as the Reardan Cemetery. There are no recorded archaeological sites or TCPs within Reardan town limits. Historic and precontact trails are said to exist in the area, and some are shown on General Land Office maps, but locations have not been verified in the field.

Two cultural resources surveys have been performed, both including archaeological field survey, and both within 200 feet of Reardan's Audubon Lake (Engseth 2007; Parks 1996). Neither located archaeological resources. In general, the archaeology of Reardan and its shoreline are little understood.

4.8.3 *Potential for Archaeological and Historic Resources*

Given the history of Lincoln County from the late Pleistocene to the present, a number of archaeological and historical site types could be expected within 200 feet of the shoreline, including:

- Lithic scatters, and caches
- Precontact habitation sites (camps, villages, cave sites)
- Resource procurement sites (fish traps, camas ovens)
- Pictographs and petroglyphs
- Historic habitation sites (homesteads, farms, cabins)
- Historic agricultural infrastructure
- Historic and precontact transportation corridors (trails , routes, railroad grades, road grades)

Some sites may be on or near the surface, and others may be deeply buried, depending on the localized geomorphology.

4.8.4 Cultural Resources and Shoreline Development

State and local cultural resources laws apply to shoreline development. State laws include RCW 27.53 (Archaeological Sites and Records), which prohibits the unpermitted removal of archaeological materials and establishes a permitting process, and RCW 27.44 (Indian Graves and Records), which describes how human remains must be treated.

Given the importance of shoreline locations throughout the human history of the area, the potential for cultural resources and discovery of human remains should be considered high for any shoreline development permit unless demonstrated otherwise. To comply with state and local law, applicants should be prepared to follow the provisions of RCW 27.53 and 27.44 if cultural resources or human remains are identified or encountered during the planning or construction process.

5 SHORELINE ANALYSIS AND CHARACTERIZATION

5.1 Ecosystem-wide Processes and Conditions in Lincoln County

An ecosystem is a natural system consisting of biological (plants, animals, and microorganisms), physical, and chemical factors that together make up the environment. Ecosystem-wide processes are defined by statute as, “the suite of naturally occurring physical and geologic processes of erosion, transport, and deposition; and specific chemical processes that shape landforms within a specific shoreline ecosystem and determine both the types of habitat and the associated ecological functions” (WAC 173-26-020 (14)). Processes occur at multiple scales and are influenced by hydrology, geology, topography, soils, land cover, and land use characteristics. These processes determine the types and quality of shoreline functions or services that contribute to the maintenance of aquatic and terrestrial environments that make up an ecosystem (WAC 173-26-020 (13)).

The following sections discuss ecosystem processes and habitat structures that these processes form and maintain. This section describes these processes on a broader ecosystem-wide scale as well on a more localized scale to conditions in Lincoln County, including descriptions of current conditions and alterations to the ecosystem processes. Alterations to ecosystem processes can affect habitat structure and the availability of habitat services, especially over long periods of time. Ecosystem-wide processes and local conditions in the County are presented through the categories of hydrology, sediment, water quality, and habitat.

5.1.1 Hydrology

5.1.1.1 Ecosystem Process

The process of water delivery, movement, and storage within an ecosystem is largely affected by landform, geology, soil characteristics, and climate including precipitation. Rain and snowmelt provide the hydrologic inputs into a watershed. This cycle affects other physical, chemical, and biological functions of the river system. The speed with which water flows through the watershed also affects whether nutrients, sediments, or other materials are deposited or retained in the water and transported through the watershed.

Water is delivered to streams primarily from surface water runoff from above ground and, in some cases, from groundwater. The horizontal structure of river and stream channels

includes the wetted channel zone where water is present during low-flow events, an active channel that is seasonally inundated, and the riparian zone located above seasonal high water elevations. The vertical structure of these systems includes a benthic zone along the surface of the bottom substrate and the hyporheic zone, which provides a transition between the surface and the groundwater, or phreatic zone. Hyporheic and benthic zones cycle out excessive nutrients and contaminants, store and transport both water and sediment, maintain base flows, and can support vegetation and microorganism communities. The interaction of hydrologic and geomorphic processes contributes to habitat structures useful to aquatic species including shallow water and off-channel refugia, gravel bars, pools, riffles, and the transport of organic material, including large woody debris.

5.1.1.2 *Conditions in Lincoln County*

Hydrology conditions in Lincoln County generally follow climate conditions with low streamflows occurring during the drier summer and fall and high streamflows occurring during the wetter spring. A hydraulically connected system between groundwater and surface water impacts surface hydrology, causing streamflow in some reaches to go subsurface during the year.

A major portion of the flow volume in Lincoln County occurs in the Columbia and Spokane Rivers. Most flow volume stems from runoff outside of Lincoln County. These rivers are regulated by dams upstream and downstream, and hydrology in these areas is impacted by dam and reservoir operations.

Most lakes in Lincoln County have no visible inlet or outlet, so groundwater and runoff from precipitation are usually the main hydrologic factors on lake levels and quantities.

5.1.2 *Sediment*

5.1.2.1 *Ecosystem Process*

Sediment delivery through a watershed is based on interactions between, gravity, wind, and water across the various geologic features, soils, and land covers. Landslides and mass wasting are a function of slope, soil, and water interacting to create instability. Soil erosion is a function of slope, soil cohesiveness, and ground cover interacting with water or wind

forces. Sediments transported by water or wind are deposited wherever and whenever the water or wind transporting them slows. As the size of sediment increases, the water or wind force required to transport the sediment increases, so smaller sediment is able to travel further than larger sediment when the transporting forces decrease. This is often within topographic depressions where sediment is deposited into lakes and stream pools, wetlands, and floodplains. The sediment erosion, transport, and deposition cycle is a major aspect of river and stream channel formation and channel migration.

5.1.2.2 *Conditions in Lincoln County*

On the major waterbodies (Columbia and Spokane Rivers), upstream dams, and regulated operations restrict the movement of sediment and would cause buildup of sediment at the dam base. Landslide potential in some areas along these rivers may contribute to increased sediment input during storm events.

Most lakes in Lincoln County have no visible inlet or outlet, so sediment may enter into lakes from storm events but will not likely exit, causing silt buildup in lake bottoms.

Streams generally can transport sediment along reaches, and sediment input would likely occur during storm events. Some streams have lakes within a stream reach; sediment may not be mobile in these reaches due to lower velocities occurring in the lake portions of the stream reach.

5.1.3 ***Water Quality***

5.1.3.1 *Ecosystem Process*

The combined processes that deliver, transport, and store water and sediment in the ecosystem have a substantial impact on water quality. Impacts to water quality occur through land cover changes and development; chemical use in manufacturing, agriculture and recreation; pathogens from waste; temperature; and natural processes such as plant respiration.

Human-induced changes to water quality (e.g., industrial effluents, sewer overflows, and runoff from upland areas) can alter river and lake water temperatures, turbidity, and oxygen

content, as well as nutrient, toxin, and pathogen concentrations (Karr 1995; Welch and Lindell 2000). In general, these changes can affect the presence, abundance, and vitality of all aquatic organisms. Water delivery and water quality is affected by soil loss, soil compaction, and road and building construction typically associated with development and urbanization. These activities increase the amount of impervious surface (e.g., parking lots and roads), reduce the percolation of precipitation into the ground, and concentrate pollutants into stormwater discharge areas. Reduced water infiltration increases the amount and rate of surface water runoff, causing high stream discharge or high direct delivery of water to the stream and lake shorelines (Dunne and Leopold 1978; Arnold and Gibbons 1996; Poff et al. 1997).

Fertilizers, pesticides, and automobile- and boat-generated pollutants are linked to runoff-borne pollution that enters streams and lakes. Toxins from these and other human-induced changes previously described can settle in river pools, contaminating the sediments of the benthic zone. This leads to toxins either directly affecting benthic species through illness and mortality, or indirectly affecting aquatic and terrestrial species through bioaccumulation from animals lower on the food chain.

Many pathogenic protozoa, bacteria, and viruses can be found naturally in the environment, some of which occur as a result of fecal wastes deposited by animals. These come from fecal material of wildlife and domesticated animals deposited within upland areas that drain into aquatic ecosystems or deposited directly into them (Sherer et al. 1992; Stanley et al. 2005). A higher concentration of domesticated livestock (such as in livestock farms or concentrated animal feeding operations) can increase the potential of fecal material draining to shoreline areas.

Solar energy input can be another important factor that impacts water quality, especially in the summer when high temperatures coincide with high nutrient loads from agricultural runoff and lower river flows. This can result in high water temperatures and very low levels of dissolved oxygen, both of which can alter the ecology of rivers and streams. Water temperature, a physical characteristic, affects the chemical process of breaking down organic material into nutrients, as well as the biological processes of phytoplankton and zooplankton reproduction and the metabolism of fish species.

Water temperatures, plant respiration, and biological decomposition are also inversely related to dissolved oxygen levels, which play a critical role in supporting aquatic organisms such as salmonids. Similarly, alkalinity/pH and nutrient concentrations influence biological processes, particularly phytoplankton production.

5.1.3.2 *Conditions in Lincoln County*

Water quality in Lincoln County is generally impacted by climate, agricultural runoff, industrial runoff, and hydropower operations. Other potential impacts to water quality in the county include direct pollution recreational uses such as boats, and runoff from impervious material in roads and buildings. Several reaches in the Columbia River, Spokane River, and Crab Creek are on the 303(d) list for a various issues, including temperature, dissolved oxygen, total dissolved gas, and PCBs. Streams and lakes are also impaired by other pollutants.

5.1.4 *Habitat*

The shoreline jurisdiction within Lincoln County provides both aquatic and terrestrial habitat, with a wide variety of habitat types and features within those types. This section describes general aquatic and terrestrial habitat conditions and the stressors that may affect the functions provided by these habitats, focusing on habitat types such as aquatic, riparian, shrub-steppe, and functions such as foraging, breeding/nesting and migration elements for terrestrial species; and spawning, rearing, and migration requirements for aquatic species.

Habitat is the natural environment in which particular species or populations have adapted to live. Habitat provides the physical conditions and biological functions needed to support the species as part of a larger ecosystem. The lifecycles of aquatic, avian, and terrestrial species are often interdependent, meaning that the habitat requirements of a single species include other species on which they depend. The habitat requirements vary for different species and can vary for different life stages of a species.

Habitat is often described in terms of the functions of reproduction, forage, and shelter (Morrison 1992):

- The reproduction needs of species vary greatly. All species have specific needs for areas to find a mate, reproduce, and successfully rear offspring (often referred to as breeding sites, birthing areas, and nest sites). Some species have very specific needs; for example, amphibians (frogs, toads, and salamanders) require water or moist areas for laying eggs and for larval development.
- Forage includes water and food sources. Water is a universal need of all species, while forage needs vary greatly by species. An important consideration is whether a species is prey or a predator. Predators obviously require that the habitat needs for prey species are met.
- Shelter includes areas for safe resting, refuge or cover from predators, and shelter from environmental hazards (e.g., daytime or nighttime temperatures, extreme weather events, seasonal climate fluctuations, and unpredictable disturbances such as drought, fire, or flooding).

Aquatic and terrestrial habitats are discussed below on an ecosystem-wide scale as well on a localized scale to conditions in Lincoln County.

5.1.4.1 Aquatic Habitat and Ecosystem Processes

Characteristics of healthy aquatic habitat vary based on water body type (i.e., ocean, lake, or stream), stream channel type, stream size, water source and type, and location. In smaller stream systems, healthy aquatic habitat may be characterized by presence of larger rocky substrates on the channel bed and minimal amounts of aquatic vegetation due to the high water velocity. Larger riverine systems and lakes with lower water velocity may be characterized by finer substrates, higher turbidity levels, and significant aquatic vegetation along the shoreline.

Some of the important ecosystem features applicable to determining the health of freshwater aquatic habitat include water quality (including presence of contaminants as well as water temperature), water depth, instream cover (such as large rocks and woody debris), substrate size, aquatic and riparian vegetation, floodplain health, and migration access.

Water quality constraints such as low dissolved oxygen conditions, very low alkalinity, elevated temperature or high turbidity conditions (also see Section 5.1.3) may affect the

ability of aquatic habitat to support native fish species such as salmonids. Water depth in aquatic freshwater habitat is a key factor in determining the suitability of habitat to various species and life stages. Waterways that have artificially hardened shorelines may have less shallow water habitat and, therefore, may not provide suitable function for migrating and rearing juvenile fish species. Floodplain habitat availability is required for many fish species during multiple life stages. Extensive and unaltered floodplains that are accessible to fish species are ideal.

Instream cover increases the structural complexity of aquatic habitat through the presence of overhanging vegetation, large woody debris, or larger natural rock outcrops that improve the habitat quality for most fish. Instream vegetation, similar to instream cover, can improve habitat as long as the amount of aquatic vegetation does not create a low dissolved oxygen issue; in general, native aquatic vegetation provides important habitat conditions while introduced species such as Eurasian watermilfoil (*Myriophyllum spicatum*) does not. Riparian vegetation stabilizes banks, provides shade that may reduce summer water temperatures, provides nutrients through leaf debris and insect fall, and provides instream cover through tree-fall.

Instream cover, presence of riparian vegetation, and human alteration of shorelines affect the quality and intensity of available light energy in freshwater systems. Light energy affects water temperature, animal behavior (such as the relationship between predators and prey), and plant photosynthesis and growth (Tilzer et al. 1975). Natural light is altered when riparian vegetation is removed or when structures such as docks are built that create large expanses of artificial shade and prevent natural light from reaching the water. Reductions in this natural light can preclude plant colonization and growth beneath these structures and can cause changes in animal behavior. Natural light can also be reduced by the presence of algal blooms caused by excess nutrient additions that can collect in slack water areas.

5.1.4.1.1 Aquatic Habitat Conditions and Functions in Lincoln County

This section describes the various factors affecting the condition and function of aquatic habitat in Lincoln County, noting that the stressors affecting the Columbia River may be significantly different from those affecting a subreach of Crab Creek, and those may, in turn, differ from the stressors identified for inland lakes.

For the Columbia River/Lake Roosevelt Pool, the ability of the aquatic habitat to provide the full suite of ecological functions is primarily affected by upstream and downstream water management regimes. The hydropower management at the Grand Coulee dam and upstream dams results in significant fluctuations in water levels of the Lake Roosevelt pool, which can impact the quality of the riparian vegetation along the shoreline, among other ecological attributes. These changes may alter the ability of the Lake Roosevelt pool to provide aquatic species rearing, migration, and spawning habitat.

Recreational use in and along all waterways in Lincoln County may also affect the amount of quality aquatic habitat through development of hardened banks and overwater structures. In addition, development of both formal and informal access areas along shorelines can disturb riparian vegetation and lead to degradation of aquatic habitat through impacts to water quality.

At the smaller scale, streams and lakes may be more susceptible to impaired water quality as a result of runoff containing pollutants identified above, and recreational use may be more disruptive to the riparian community. Further, in Lincoln County, Crab Creek and several of the lakes within the County are used for watering cattle. The impact of livestock access along the shoreline may preclude the establishment of native riparian vegetation communities along the shoreline, increase erosion of riparian soils and water turbidity, and provide an excess source of nutrients to the aquatic system in the form of animal wastes deposited in the riparian zone or directly into the water. Section 5.1.4.2.1 raises some considerations for restoration actions in riparian habitat that could improve conditions of aquatic habitat, and additional restoration planning will be developed as part of the SMP update process.

5.1.4.2 *Terrestrial Habitat and Ecosystem Processes*

Terrestrial habitat may consist of many patches of interconnected habitat types. Within Lincoln County, the terrestrial habitat within and adjacent to the shoreline zone primarily includes riparian, shrub-steppe habitat, and agricultural lands, with some forested areas also present in the northern part of Lincoln County, and this section will discuss general characteristics of those terrestrial habitat types relative to their status in eastern Washington.

These terrestrial habitats provide functions to support wildlife habitat and movement corridors, fire suppression, and human food supplies.

Terrestrial wildlife utilizes the variety of habitats through movement corridors. Terrestrial movement corridors are crucial to wildlife and may be seasonal, depending on the species. The primary function of a corridor is to connect different habitat areas to facilitate migration and dispersal between the areas. Movement corridors provide the following functions essential to healthy wildlife populations:

- Provides connectivity and, thereby, genetic variation and biodiversity between differing populations and habitats, connects isolated habitats, and may allow recolonization of extirpated species
- Provides varying habitats for migration patterns (e.g., foraging, mating and nesting, rearing, shelter, and wintering) and allows populations to move in response to habitat changes such as fires
- Can provide habitat for “corridor dwellers”—species that live within corridors for extended periods (Beier and Loe 1992)

The riparian habitat zone along a river, stream, or lake shore is an essential movement corridor for terrestrial species, and a healthy riparian zone can also support the health of the adjacent aquatic habitat. Habitat characteristics of healthy riparian areas include a connected corridor for wildlife travel, vegetation types adapted to wetter soils, occasional flooding, and natural disturbance regimes. Vegetation in the riparian zone within arid and semi-arid regions tends to be unique in comparison to riparian zones other regions of the United States and these areas have stronger changes in character between riparian and upland zones (Malanson 1993 as cited in Buffler 2005). Riparian areas offer important functions for species that inhabit the shrub-steppe, species more limited in range to the riparian zone, and species that inhabit the adjacent aquatic habitat (Anchor QEA 2013b). For shrub-steppe species, riparian habitat provides access to a critical water source and often provides a more productive environment for forage, escape, thermal cover, nesting sites, and critical winter habitat (Anchor QEA 2013b). Riparian areas typically support larger flocks and a greater density of upland birds than shrub-steppe habitat because of the greater production of biomass and the more complex mosaic of vegetation (Stinson and Schroeder 2012). Finally,

riparian habitat supports a healthy freshwater ecosystem through the presence of complex vegetation communities that overhang the shoreline from the uplands. This overhanging vegetation provides cover and refugia to fish and other aquatic species from extreme conditions (e.g., high flows and high temperatures), supports insects that serve as prey for freshwater species, and provides leaf litter and large woody debris, which are integral components to freshwater ecosystems in terms of nutrient cycling and habitat complexity. Management of stream and river hydrology for irrigation and other activities can significantly influence riparian habitats and the terrestrial plant and wildlife species that occupy them. Overall, the availability of water in the semi-arid ecosystem is typically a major limiting factor for the diversity and abundance of terrestrial plant and wildlife species within riparian habitats (Anchor QEA 2013b).

Land use changes and land use activities can have a wide-spread impact on the functions provided by riparian terrestrial habitat. The removal of native riparian vegetation, the introduction and proliferation of invasive plant species, and the filling or degradation of wetlands along shorelines impacts the organic inputs that fuel production of the lower levels of the food chain and, therefore, can have impacts throughout the entire food web. Organic matter produced by these habitats supports terrestrial and aquatic insects and other organisms that are then eaten by birds, juvenile salmonids, and other fish species. An example of invasive plants is the aquatic plant Eurasian water milfoil, which can cover lake bottoms and out-compete the native aquatic species (altering the plant community), deplete dissolved oxygen, and lead to fish mortality (Frodge et al. 1995).

Shrub-steppe habitat in eastern Washington is characterized by associations of sagebrush species and bunchgrasses, the combinations of which vary based on predominant precipitation rates, slope and soil types (Daubenmire 1970). While much of the shrub-steppe habitat in Washington is characterized by the Wyoming big sagebrush/bluebunch wheatgrass (*Artemisia tridentata wyomingensis*/*Pseudoroegneria spicata*) shrub-steppe habitat type, the threetip sagebrush/Idaho fescue (*A. tripartita*/*F. idahoensis*) association occurs in some areas of west-central Lincoln County (Daubenmire 1970; Dunwiddie and Camp 2013). Large tracts of shrub-steppe habitat are diminishing in Washington due to ongoing habitat fragmentation and conversion, and have been identified by WDFW as priority habitats (WDFW 2013a). Some estimates show that available shrub-steppe habitat

in the Columbia basin has reduced by as much as 50% from historical conditions. Several species of birds and mammals are known to only use large, undisturbed tracts of habitat, including the sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), sage trasher (*Oreoscoptes mantanus*), sage grouse (*Centrocercus urophasianus*), black-tailed jackrabbit (*Lepus californicus*), and other species.

Irrigated agricultural lands throughout eastern Washington rely upon water from the Columbia River Basin project and other local streams. These agricultural lands were developed through conversion of large amounts of shrub-steppe habitats, but also included conversion of wetlands and riparian habitat (WDFW 2013a). The irrigated lands are primarily used for pasture and growing commercial grain crops. Irrigated agricultural lands may provide greater productivity of certain types of biomass compared to habitat with native shrub-steppe vegetation. Irrigated pasture, for example, produces much higher biomass than native shrub-steppe in arid areas and, therefore, may provide greater potential forage for certain species. Such agricultural areas may also displace native species because their specific lifecycle needs are not met. Agriculture also may change the predator and prey community that affects native species. Agricultural landscapes typically support much higher rodent populations. This larger population, in turn, supports higher populations of predators, such as raptors, that also support native species. This artificially higher population of predators may substantially change the balance between native species and introduced species more adapted to human alternation (Dunne and Leopold 1978; Moulton et al. 2006).

Finally, artificial night-time lighting associated with human development, such as lights used for roads, parking lots, industrial complexes (including dams), houses, docks, piers, and sports fields can interfere with aquatic and terrestrial animals' routines, change predator-prey relationships, and interfere with plant production and animal behavior. Artificial lighting can be an issue for riparian and shrub-steppe habitats.

5.1.4.2.1 Terrestrial Habitat Conditions and Functions in Lincoln County

Agricultural and urban or residential development has resulted in loss of shrub-steppe habitat, habitat degradation, and fragmentation within Lincoln County. The Lincoln County Planning Department has estimated that perhaps 80% of the County's growth through 2020 is expected to be in housing developments for retired people that include views of Lake

Roosevelt (Lake Roosevelt Forum 2013b). Habitat fragmentation, through the building of roads, utility corridors, agricultural and urban development, and irrigation channels can affect, in varying degrees, aquatic ecosystems and terrestrial riparian and shrub-steppe habitat types. Dam development along the Columbia and Spokane Rivers has altered the floodplain and riparian habitats along these waterbodies within Lincoln County as a result of the water regime management, and disrupted sediment and wood recruitment along the shorelines within the County, as well as transport within the Columbia River basin.

An abundant and diverse community of priority wildlife species inhabits and utilizes shrub-steppe and riparian areas in Lincoln County and, to a lesser extent, the developed lands and agricultural areas. These include a variety of reptiles, raptors, other birds, small mammals, and large mammals (see Table 19). Historically, gray wolves (*Canis lupus*) were a top-level predator in the area, preying primarily on deer and elk, and have been identified by WDFW to be present along certain reaches of the Columbia River in Lincoln County (WDFW 2013a). The breeding population of wolves was decimated by the 1930s as a result of the expansion of ranching and farming in the state. In the absence of natural predators, large mammals such as deer and elk have increased substantially, often in excess of the land's carrying capacity (WDFW 2011).

Table 19
Washington Priority Wildlife Species in Lincoln County Shrub-Steppe and Riparian Area

Common Name	Scientific Name
American White Pelican	<i>Pelecanus erythrorhynchos</i>
Badger	<i>Taxidea taxus</i>
Black-tailed Jackrabbit	<i>Lepus californicus</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Bighorn Sheep	<i>Ovis canadensis</i>
Brewer's Sparrow	<i>Spizella breweri</i>
Coyote	<i>Canis latrans</i>
Elk	<i>Cervus canadensis</i>
Ferruginous Hawk	<i>Buteo regalis</i>
Greater Sage-grouse	<i>Centrocercus urophasianus</i>
Great Basin Spadefoot	<i>Spea intermontana</i>
Golden Eagle	<i>Aquila chrysaetos</i>
Little Brown Myotis	<i>Myotis lucifugus</i>
Loggerhead Shrike	<i>Lanius ludovicianus</i>
Long-billed Curlew	<i>Numenius americanus</i>
Merriam's Shrew	<i>Sorex merriami</i>
Mourning Dove	<i>Zenaida macroura</i>
Mule Deer	<i>Odocoileus hemionus</i>
Sagebrush Lizard	<i>Sceloporus graciosus</i>
Sage Sparrow	<i>Amphispiza belli</i>
Sage Thrasher	<i>Oreoscoptes montanus</i>
Short-eared Owl	<i>Asio flammeus</i>
Townsend Ground Squirrel	<i>Urocitellus townsendii</i>
Western Kingbird	<i>Tyrannus verticalis</i>
Western Long-eared Bat	<i>M. evotis</i>
Western Meadowlark	<i>Sturnella neglecta</i>
Western Rattlesnake	<i>Crotalus viridis</i>
Western Spotted Frog	<i>Heleioporus albopunctatus</i>
White-tailed Jackrabbit	<i>Lepus townsendii</i>
Yuma Myotis	<i>M. yumanensis</i>

The shrub-steppe habitat within Lincoln County provides many ecosystem services including soil stabilization, wildfire moderation, overall biodiversity, and provides overall social or cultural functions for numerous people in terms of religious, spiritual, social, cultural, and recreational uses of these ecosystems. Shrub-steppe habitat exists throughout Lincoln County in large and small tracts. Crab Creek and many of the lakes within the County are adjacent to shrub-steppe habitat, which often abuts the edges of the very narrow riparian zones found along Crab Creek and lake shorelines. The southern end of Lake Roosevelt within Lincoln County is largely shrub-steppe and irrigated agricultural lands. In the mid-lake area (near and above the confluence with the Spokane River), there is a transition from shrub-steppe to second-growth ponderosa pine. Bluebunch, wheatgrass, hard fescue, and forbs such as balsamroot, northern buckwheat, brittle prickly pear, alum root, and lupine are common here. Shrubs such as sagebrush, bitterbrush, rabbitbrush, snowberry, greasewood, and service berry characterize this region. Trees in this portion of the watershed include black cottonwood, ponderosa pine, and Douglas fir (Lake Roosevelt Forum 2013a).

The displacement of shrub-steppe plant species by the invasive cheat-grass (*Bromus tectorum*), Russian thistle (*Salsola tragus*), and other invasive species is a significant stressor to the ability of the shrub-steppe system to provide fire suppression functions, and the loss of native vegetation in this ecosystem increases fire intensity and frequency, which in addition to the hazards this creates for humans and wildlife also further impacts the dominant shrub-steppe plant species big sagebrush (*Artemisia tridentata*), which directly impacts rare birds such as the sage grouse and other sagebrush-obligate species (Link et al. 2006).

Moderately disturbed shrub-steppe communities are fairly common within Lincoln County. Such areas have been affected to various degrees by grazing, invasive species presence and other disturbances. About 26% of the relatively undisturbed shrub-steppe habitat is dominated by native grasses and sagebrush, with an intact cryptogam crust (a thin layer of algae, moss and lichen that indicates an undisturbed community), and contains mostly native shrubs (e.g., big sagebrush and bitterbrush) with a predominantly native grass understory. This habitat type, while negatively impacted by grazing, off-road vehicle use, and other disturbances, still provides significant function in terms of cover, food, and nesting habitat for many species of wildlife.

Recommendations based on best professional judgment for preserving shrub-steppe habitat within Lincoln County include: limiting development footprints including agricultural land cover changes, particularly along Crab Creek; siting additional residential development to minimize the construction of road and utility corridors that may fragment shrub-steppe habitat; restricting vegetation clearing; keeping domestic animals out of sensitive species habitat; and limiting fencing to avoid barriers to native wildlife (Azerrad et al. 2011). As part of the SMP update process, a restoration plan will be developed for Lincoln County that more specifically identifies potential shrub-steppe restoration opportunities.

Riparian habitats are found in relatively narrow bands along the waterways in Lincoln County. Tree and shrub vegetation adjacent to the shoreline and overhanging stream banks is necessary for optimally functioning aquatic habitat, and the functions quality provided by herbaceous riparian habitat with no tree or shrub canopy are generally reduced in terms of food web support, thermal regulation, and soil stabilization. Riparian habitat adjacent to aquatic systems within Lincoln County can have limited or no tree or shrub vegetation due to both land use activities, natural environmental conditions, or both. This is particularly evident in certain reaches of Lake Roosevelt, primarily due to the existing environmental conditions and geology, as well as ephemeral reaches of Crab Creek, which occasionally run dry and leave little water available to support persistent riparian vegetation communities.

Recommendations based on best professional judgment for preserving riparian habitat in Lincoln County include limiting development footprints including agricultural land cover changes, particularly along Crab Creek; limiting siting of additional residential development to minimize shoreline impacts along the Columbia River/Lake Roosevelt, Spokane River, and other lakes; restricting vegetation clearing, particularly along Crab Creek and lakes; controlling and concentrating recreational access at Lake Roosevelt, Spokane River, and lake sites; and managing livestock access, particularly along Crab Creek. As part of the SMP update process, a restoration plan will be developed for Lincoln County that more specifically identifies potential riparian restoration opportunities.

Table 20 summarizes the key stressors affecting ecological functions provided by the specific aquatic and terrestrial systems within Lincoln County.

Table 20
Key Stressors Affecting Ecological Functions

Key Stressors	Lake Roosevelt/ Columbia River		Spokane River		Crab Creek		Lakes of Lincoln County	
	Aquatic	Terrestrial	Aquatic	Terrestrial	Aquatic	Terrestrial	Aquatic	Terrestrial
Recreational access – existing	X							
Recreational area – potential development	X	X	X	X			X	X
Agricultural use – irrigation					X	X	X	X
Agricultural use – livestock					X	X	X	X
Residential Development – existing shoreline development	X	X	X	X			X	X
Residential development – land use change (e.g., development of new roads, utilities)		X		X		X		X
Residential Development – Future	X	X	X	X	X	X	X	X
Hydrologic Management Regimes	X	X	X	X				

5.2 Reach Characterizations

Characterization of shoreline reaches and subreaches are provided in Appendix A. These reach and subreach characterization tables summarize existing physical conditions; characterizations and analyses for water quantity and sediment, water quality, and habitat and species; ecological functions analysis, including identifying functional conditions, stressors, and restoration and protection opportunities; preliminary shoreline environment designation considerations; existing public access and potential additional public access opportunities; and cumulative impact considerations.

Each reach was categorized overall in terms of ecosystem function. The categories include functioning, partially functioning, or impaired. The framework, definitions, and categories for this analysis were adapted from a system originally developed for Riparian Area Management guidelines proposed by BLM (Prichard 1998). This assessment is a relative assessment with some degree of calibration to reflect the overall conditions found in the County and Cities.

The potential ecological function is defined as the highest ecological status a shoreline reach can attain given no development or management constraints, but does take into account the extent to which management (particularly water management) supports ecological function.

Ecological function is defined here as the degree of similarity between existing physical and biological conditions, and the potential ecological function of a site; the higher the ecological function, the closer the site is to potential. Potential, for this assessment, encompasses all the resources defined by the interaction of hydrology, vegetation, water quality, and erosion/deposition (soils), and aquatic and riparian habitat. For example, the potential of the hydrologic component includes the concept of a stream channel's physical characteristics (dimension, pattern, and profile) being within a "normal or usual" range (e.g., entrenchment, sinuosity, width, depth, and slope of the bankfull channel) as defined by landform and geomorphic stream type given current flows.

- **Functioning** is a state of resiliency that will allow a shoreline to hold together during high-flow events with a high degree of reliability. This resiliency allows an area to then produce desired values, such as fish habitat, bird habitat, or forage, over time.

Riparian-wetland areas that are not functioning properly cannot sustain these values over time and are susceptible to stochastic disturbances such as fire.

- **Partially functioning** is a state in which the ecological function of the shoreline is somewhat compromised by development or management trends, or is particularly susceptible to future degradation due to development, management or ecological conditions. A partially functioning shoreline has some ability to recover through changes in management or the removal of identified stressors on ecological function.
- **Impaired** is a state in which the ecological functions of the shoreline are heavily compromised by development or management of the reach. An impaired reach has a low probability of recovery, through restoration, due to the degree of structural change to the shoreline, waterbody, and surrounding shorelands. Impaired shorelines can be functionally improved, but are unlikely to be self-sustainable.

5.3 Future Land Use and Development Potential

Lincoln County shoreline has limited future development potential outside the Odessa and Reardan town limits. Existing land use being predominantly agricultural and rangeland limits the future development potential within the County. There is state and federal land ownership which could add recreational development but would limit residential development along the shoreline.

Future residential development along the Columbia River and portion of the Spokane River shoreline is largely limited due to the Lake Roosevelt Recreation Area managed by the National Park Services. Additionally, there are agricultural and Rangeland on the shoreline that would limit future development. Future residential development would mainly occur on privately owned lands in the form of subdivision and development on existing land, and development of existing vacant lots. Some residential development could occur in areas such as Lincoln, and Jones Bay. However, most intense residential development is expected in Spokane River shoreline east of Porcupine Bay.

Shoreline along Crab Creek is mostly used for agricultural purposes. A significant portion of the Crab Creek shoreline is owned by BLM and some portion is owned by WDNR. Future residential development in Crab Creek shoreline is also limited due to the exiting agricultural use and public ownership.

Shoreline along Sprague Lake has development potential on the south bank. Coffee Pot Lake has some privately owned land on the south bank that could also be developed. However, development would be limited due to lack of access and infrastructure. Most of the other Lake Creek lakes are owned by WDFW and BLM, limiting the future development potential.

Within the Town of Odessa, there is developable land in the shoreline area in a few locations, with other areas constrained by floodway restrictions. The entire shoreline in the Town of Reardan is within the 100-year floodplain. This shoreline has limited development potential. Zoning of the northwest end of the shoreline has recently been changed from Industrial to Agricultural which would prohibit construction of any permanent structure (Johnson 2013).

Public lands may be improved to include enhancement of existing recreational amenities as well as adding new recreational amenities. Most of the recreational developments are expected along the Columbia River and Spokane River as part of the 2009 Lake Roosevelt National Recreation Area Shoreline Management Plan.

The Lake Roosevelt SMP Environmental Assessment (NPS 2009) preferred alternative identifies the following recreational improvements along the Columbia River:

- Development of a trail from Crescent Bay to Spring Canyon
- Add new boat-in campground in Neal Canyon
- Add low-impact (gravel) overflow parking lot at the Keller Ferry terminal
- Designate group boat-in campsites in Penix Canyon
- Add low-impact (gravel) overflow parking lot in Lincoln

Rantz Marina Access Improvement Project (FHWA 2013) under the Federal Lands Access Program indicates upgrade of existing facilities in Martin Canyon, such as widening and enhancement of the existing subgrade to improve safety, improvement of drainage facilities, and resurfacing of the area.

The Lake Roosevelt Plan proposes the following recreational improvements along the Spokane River:

- Add low-impact (gravel) overflow parking lot at Fort Spokane and Porcupine Bay
- Widen the boat launch at Fort Spokane
- Add new boat-in campground in Cougar Cove
- Designate group boat-in campsites in Detillion
- Add vault toilet on site upstream of Cayuse Cove
- Replace private, noncompliant docks and launches with a single public, primitive boat launch

Minimal recreational improvements are expected to occur in the remainder of the Lincoln County shoreline. An off-highway vehicle route on the Lakeview recreation area from Odessa to Lake Creek trail is proposed by BLM. Some improvements could take place as part of the future public access improvement (see Section 6.3).

5.3.1 Methodology

The future residential development potential is analyzed using existing County GIS data and the Town's zoning maps. For the County, GIS data used includes parcel, land ownership, existing land use. These datasets were overlaid on the reach map with shoreline jurisdiction boundary. The overlaid map indicates parcels within the shoreline jurisdiction. Among these parcels, privately owned parcels were reviewed and analyzed. In most cases, portions of the parcels fell within the shoreline. Such areas within shoreline were then measured using the County's online GIS mapping (mapsifter). In some other instances, already subdivided and vacant lots were identified within the shoreline.

The undivided land within the shoreline was then calculated in order to get the number of developable lots. The County doesn't have specific minimum lot size for residential subdivisions. The lots sizes are guided by the requirements of health, safety storm water and infrastructure elements. In order to determine the number of developable lots within the County, the analysis uses 1.5 acres lot size as in the current practice. These lots were then added to the number of current vacant lots to identify the total number of developable lots. This analysis was done for each reach along the Columbia River and Spokane River shoreline.

Preliminary analysis was also done for Crab Creek, Lake Creek, and other shorelines where it indicated some development potential. However, based on the past trend of minimal or no residential development along these shoreline areas, the analysis didn't entail a detailed method to develop the number of lots for future development. Moreover, development on resource agricultural land especially on tilled land, as evident in these areas, has restrictions in the County code.

For Reardan and Odessa, analysis was done using the existing zoning map with parcel overlay. The development in Reardan shoreline is already restricted by the floodplain and zoning. Odessa's future development potential was analyzed by calculating the existing vacant parcels intersecting the shoreline boundary.

5.3.2 Data Gaps

The analysis didn't include the critical areas or steep slopes. Setbacks and other buffers were not factored in the calculation, as these are applied at the time of development. Analysis in Table 21 did not include recreational improvements on public land due to lack of specific development information. Instead, recreational improvements are discussed in Section 5.3.

5.3.3 Land Development Potential Summary

Table 21 shows the future land development potential within Lincoln County shoreline. The purpose of the analysis is to estimate potential residential development that may take place in the planning timeframe along shorelines, according to the existing land use and zoning designations. The analysis uses the existing GIS datasets provided by the County, and existing development trends. These results are intended to provide a general overview of the future development potential, but not to dictate how the development should occur. Future development potential may vary from this analysis based on the overall market condition, intent of the property owner or other local or regional factors.

Non-water-related uses directly adjacent to the water include agricultural land, rangeland and large lot rural use as well as residential lots. A portion of the water frontage is also bounded by roads or railroads (e.g. the north bank of Sprague Lake abuts a railroad line and Interstate 90).

Table 21
Future Development Potential by Shoreline Reach

Reach	Area (acres)	Zoning	Development Constraints	Developable	Future Development ¹
Columbia River - Reach 1	1,708.96	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service; Rocky and high banks	1 acre and 2 acres area, portion of parcels within shoreline	3 lots east of Spring Canyon; development completely within shoreline is unlikely
Columbia River - Reach 2	2,634.27	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service; high banks in some locations.	1 vacant lot; portion of parcels within shoreline - 1.5 acres each	3 SF lots; 1 near Morgan Lane, 2 east of Cayuse Bay
Columbia River - Reach 3	624.50	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service; Keller Ferry managed by WSDOT; existing single family development.	No change	No development potential
Columbia River - Reach 4	5,033.04	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service; high banks at some locations.	3 acres on Jones Bay, 4.5 acres north of Kennedy Road, 3 acres east of Halvestor Canyon, 10 vacant plats in Lincoln, 5 acres near Welch Creek Cove	10 SF lots. 1 on Jones Bay, 3 near Kennedy Road, 2 near Halvestor Canyon, 3 near Welch Creek Cove. Pad sites of 10 vacant plats near Lincoln are outside shoreline. Jones Bay is less likely to be developed in full capacity due to steep slope.
Columbia River - Reach 5	726.32	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service; high and rocky north bank.	2 acres on Hawk Creek	1 lot

Table 21
Future Development Potential by Shoreline Reach

Reach	Area (acres)	Zoning	Development Constraints	Developable	Future Development ¹
Columbia River - Reach 6	237.01	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service.	No change	No development potential
Columbia River - Reach 7	476.57	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service.	No change	No development potential
Columbia River - Reach 8	784.82	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service.	No change	No development potential
Spokane River - Reach 1	259.53	Recreational, Agricultural	Lake Roosevelt Recreational Area, managed by the National Park Service.	No change	No development potential
Spokane River - Reach 2	3497.98	Recreational	Lake Roosevelt Recreational Area, managed by the National Park Service.	8 vacant lots near Porcupine Bay (Reach 2a), 24.5 acres in Reach 2c, 12 vacant lots in Reach 2c	36 SF lots. 20 vacant lots to be developed, 16 new lots if subdivided
Spokane River - Reach 3	276.24	Recreational	Steep slope, agricultural use	4 vacant lots and 5 acres near Spring Creek	7 SF lots
Spokane River - Reach 4	225.83	Recreational	Little Falls Dam	10 vacant lots (portion in shoreline), 3 acres west of Long Lake	12 SF lots
Spokane River - Reach 5	227.12	Recreational	Long Lake Dam	No change	No development potential

Table 21
Future Development Potential by Shoreline Reach

Reach	Area (acres)	Zoning	Development Constraints	Developable	Future Development ¹
Crab Creek - Reach 1 & Peterson Lake	519.80	Agricultural	Resource Agricultural use; railroad; BLM ownership	No change	No development potential
Crab Creek - Reach 2	78.57	Agricultural	Agricultural use	No change	No development potential
Crab Creek - Reach 3	127.59	Agricultural	Constrained by BLM ownership	No change	No development potential
Crab Creek - Reach 4	126.63	Agricultural	Agricultural use; railroad	No change	No development potential
Crab Creek - Reach 5	472.10	Agricultural	Constrained by BLM ownership	No change	No development potential
Crab Creek - Reach 6	212.75	Agricultural	Agricultural use	No change	No development potential
Crab Creek (Sylvan Lake) - Reach 7	812.77	Agricultural	High bank	No change	No development potential
Crab Creek - Reach 8	510.51	Agricultural	Agricultural use	No change	No development potential
Crab Creek - Reach 9	559.64	Agricultural	Constrained by BLM ownership	No change	No development potential
Crab Creek - Reach 10	418.65	Agricultural	Constrained by BLM ownership, agricultural use	No change	No development potential
Crab Creek - Reach 11	87.47	Agricultural	Lack of access road	No change	No development potential
Crab Creek - Reach 12	253.02	Agricultural	Agricultural use	No change	No development potential
Crab Creek - Reach 13	67.75	Agricultural	Agricultural use	No change	No development potential
Sprague Lake - Reach 1	912.75	Agricultural	Railroad; constrained by WDFW easement	Available land on the south bank	Development potential exists
Negro Creek	72.83	Agricultural	Floodplain	No change	No development potential
Southeast Corner Lake Group (Browns Lake, Ames Lake, Fishtrap Lake, Downs Lake, Fourth of July Lake, and two unnamed lakes)	1,377.98	Agricultural	Rangeland and BLM ownership	No change	No development potential
Lake Creek Lake Group (Wall Lake, Twin Lakes – Upper and Lower, Coffee Pot Lakes, Deer Springs Lake, Tavares	1,403.91	Agricultural	Public ownership Less development potential	No change	No development potential

Table 21
Future Development Potential by Shoreline Reach

Reach	Area (acres)	Zoning	Development Constraints	Developable	Future Development ¹
Lake, Cormana Lake, and three unnamed lakes)					
West-Central Lake Group (H Lake, Greenwood Lake, Bergeau Lake, Swanson Lake – Upper and –Lower, Philips Lake, Wills Lake, Meadow Lake, Goetz Lake, Sullivan Lake and one Unnamed Lake)	955.74	Agricultural	WDFW ownership	No change	No development potential
East-Central Lake Group (Reardan Audubon Lakes)	229.19	Agricultural	100-year floodplain; constrained by WDFW Swanson Lakes Wildlife area	No change	No development potential
Long Lake	10.70	Agricultural	Lack of access roads	No change	No development potential
Towns					
Town of Odessa, Crab Creek - Reach 1	14.68	Residential Zone II, Commercial, Industrial, and Public Use	Buildout and constrained by floodway	Vacant lots south of Crab Creek	2 SF lots, paved but vacant
Town of Odessa, Crab Creek - Reach 2	50.11	Residential Zone II, Commercial and Public Use	Build out and floodway	Vacant lots south of the creek, at the east end of SR-2	4 SF lots

Table 21
Future Development Potential by Shoreline Reach

Reach	Area (acres)	Zoning	Development Constraints	Developable	Future Development ¹
Town of Odessa, Crab Creek - Reach 3 ²	39.50	Residential Zone I and II, and Industrial	Constrained by floodway	Development on the north and south sides of the creek; development on existing 11 industrial lots and 14 residential lots	North of the creek: 7.6 acres of industrial land and 16 lots for single family dwelling units or two-family dwelling units South of the creek: 24 lots for single family dwelling units or two-family dwelling units on the south side of the creek
Town of Reardan, Reardan Audubon Lake		Agricultural	Constrained by WDFW Swanson Lakes Wildlife area; local zoning prohibits development	No change	No development potential

Notes:

1 = Future residential development potential is based upon the undeveloped parcels and the maximum allowed density according to the zoning designation.

2 = Two alternatives are provided for future development potential, based on single-family or two-family dwelling units in Residential Zone II.

SF = Single-Family

WSDOT = Washington State Department of Transportation

5.3.4 Preliminary Shoreline Environment Designation Considerations

The information in this report provides the foundation for developing the county and town SMPs. Information is organized by water bodies and reaches to allow for SMP provisions tailored to local conditions found along shorelands. Goals, policies, and regulations will be established based on these conditions. Described in this section are background information on environment designations and a preliminary discussion on how elements of the state classification system may apply to conditions in Lincoln County, Odessa, and Reardan.

Environment designations are applied based on specific criteria, and include a purpose statement, a description of the classification criteria, management policies, and environment-specific regulations.

5.3.4.1 State Recommended Classification System

The state has identified a recommended classification system that can be used as a starting point in considering environment designations most applicable to the County and towns. These consist of: "High-intensity," "shoreline residential," "urban conservancy," "rural conservancy," "natural," and "aquatic" as described in WAC 173-26-211.

The purpose for each of these environment designations is described in WAC 173-26-211:

- **High-intensity** - "...Provide for high-intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring ecological functions in areas that have been previously degraded."
- **Shoreline residential** - "...Accommodate residential development and appurtenant structures that are consistent with this chapter. An additional purpose is to provide appropriate public access and recreational uses."
- **Urban conservancy** - "...Protect and restore ecological functions of open space, flood plain and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses."
- **Rural conservancy** - "...Protect ecological functions, conserve existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use, achieve natural flood plain processes, and provide recreational opportunities. Examples of uses...include low-impact outdoor recreation uses, timber

harvesting on a sustained-yield basis, agricultural uses, aquaculture, low-intensity residential development and other natural resource-based low-intensity uses.”

- **Natural** – “...Protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes. Consistent with the policies of the designation, local government should include planning for restoration of degraded shorelines within this environment.”
- **Aquatic** - "...Protect, restore, and manage the unique characteristics and resources of the areas waterward of the ordinary high-water mark.”

Local governments may also establish a different designation system or may retain their current environment designations, provided these are consistent with the purposes and policies of WAC 173-26-211. "Parallel environments" can also be used where appropriate, with shorelands divided into different sections generally running parallel to the shoreline or along a physical feature such as a bluff. In applying environment designations, the state reminds local governments that they should assure that existing shoreline ecological functions are protected with the proposed pattern and intensity of development, and that restoration potential for an area is considered (WAC 173-26-211).

5.3.4.2 Preliminary Considerations

Developing and applying environment designations in the County and towns will come in later steps in the SMP update process. In preparation for this, an initial description of shoreland areas with high intensity, residential, conservancy and natural characteristics is described in Table 22. This initial description will provide a starting point for drafting environment designations, which will be applied at the reach level in the future. The listing of these areas under the high intensity and other categories should not imply that this is what these areas will be designated in the SMP update process. Developing and applying environment designations in the County and towns will occur with more detailed analysis of the information in this report, input from the County and town staff and Planning Commissions, and Ecology, and input from the public during the shoreline visioning process and other public forums.

Table 22
Preliminary Environment Designation Consideration

Shoreland Characteristics	Applicable Geographic Areas
High intensity	• Recreation areas on Sprague Lake Wildlife Area (Reach 1) • Recreation areas on Lake Roosevelt at Eden Harbor and Spring Canyon (Reach 1) • Recreation area on Lake Roosevelt at Keller Ferry (Reach 3b) • Recreation area on Lake Roosevelt at Goldsmith (Reach 4b) • Recreation area on Lake Roosevelt at Jones Bay (Reach 4d) • Recreation area on Lake Roosevelt at Halverson Canyon (Reach 4g) • Recreation area on Lake Roosevelt at Hawk Creek (Reach 5) • Recreation areas on Lake Roosevelt at Seven Bays (Reach 7) • Recreation areas on Spokane River at Fort Spokane Visitor Center and Porcupine Bay (Reach 2a) • Dams along Spokane River (Reach 4 and 5) • Recreation area at Fishtrap Lake (Southeast Corner Lake Group [Browns Lake, Ames Lake, Fishtrap Lake, Downs Lake, Fourth of July Lake, and two unnamed lakes]) • Recreation area at Coffeepot Lake (Lake Creek Lake Group [(Wall Lake, Twin Lakes – Upper and Lower, Coffee Pot Lakes, Deer Springs Lake, Tavares Lake, Cormana Lake, and three unnamed lakes)]) • Recreation area at Deer Springs Lake (Lake Creek Lake Group) • Industrial and commercial area within Town of Odessa along Crab Creek (Reach 1 and 2)
Residential	• Residential areas within the Town of Odessa along Crab Creek
Conservancy	• Undeveloped areas along Lake Roosevelt and the Spokane River (All Reaches) • Agricultural areas along Crab Creek (All Reaches) • Agricultural and Low-Density Residential areas along Negro Creek • Agricultural, Low-Density Residential and Low-Impact Recreation areas around all County lakes, except for portions of Sprague Lake • Low-Impact Recreation area at Swanson Lakes Wildlife area at Audubon lakes(Town of Reardan) • Low-Density Residential area on Lake Roosevelt at Keller Ferry (Reach 3b) • Low-Density Residential area on Lake Roosevelt at Hanson Harbor(Reach 4c) • Low-Density Residential area on Lake Roosevelt at Lincoln (Reach 4k) • Low-Density Residential area on Lake Roosevelt at Seven Bays (Reach 7) • Low-Impact Recreation area on Lake Roosevelt at Plum Point (Reach 2a) • Low-Impact Recreation area on Lake Roosevelt at Goldsmith (Reach 4b) • Low-Impact Recreation area on Lake Roosevelt at Penix Canyon (Reach 4d) • Low-Impact Recreation area on Lake Roosevelt at Sterling Point(Reach 4i) • Low-Impact Recreation area on Spokane River at Crystal Cove (Reach 2a) • Low-Impact Recreation area on Spokane River at Ponderosa (Reach 2a) • Low-Impact Recreation area on Spokane River at Detillion (Reach 2a) • Low-Density Residential area on Crab Creek at Irby (Reach 4) • Low-Impact Recreation area on Crab Creek at Lakeview Recreation Area/Odessa Lake Creek Trail (Reach 5) • Low-Density Residential area on Crab Creek near Odessa (Reach 6)

Table 22
Preliminary Environment Designation Consideration

Shoreland Characteristics	Applicable Geographic Areas
Natural	• National Park Service-owned, open space areas on Lake Roosevelt (All Reaches) • BLM-owned, undisturbed wetland complex between Grant County boundary to Peterson Lake along Crab Creek (Reach 1) • BLM-owned, undisturbed riparian wetlands along Crab Creek (Reach 3, middle section) • BLM-owned, undisturbed portion of riparian area along Crab Creek (Reach 9) • WDNR-owned, undisturbed portion of riparian area along Crab Creek (Reach 10) • WDFW-owned, undisturbed shoreline at Unnamed_T24N_R35E_4 (Lake Creek Lake Group [(Wall Lake, Twin Lakes – Upper and Lower, Coffee Pot Lakes, Deer Springs Lake, Tavares Lake, Cormana Lake, and three unnamed lakes]) • WDNR-owned, undisturbed shoreline at Unnamed_T24N_R35E_16 (Lake Creek Lake Group) • BLM-owned, undisturbed shoreline at Unnamed_T24N_R34E_27 (Lake Creek Lakes Group) • WDFW-owned, undisturbed shoreline at Florence lake and Swanson Lakes (West Central Lakes Group) • WDFW and BLM owned, undisturbed shoreline at Phillips Lake, Wills Lake, and Meadow Lake (West Central Lakes Group)

Notes:

BLM = Bureau of Land Management

WDFW = Washington State Department of Fish and Wildlife

WDNR = Washington Department of Natural Resources

6 PUBLIC ACCESS

6.1 Existing Public Access

Public access in Lincoln County shoreline includes boat launches, docks, marinas, campgrounds, swim beaches, trails, parks, or other water-oriented recreational facilities. Lincoln County has shoreline public access opportunities in multiple locations along the Columbia River. Most of the Columbia River shoreline public access and recreational facilities are managed by the National Park Service as part of the Lake Roosevelt National Recreation Area. Along the Columbia River shoreline, public access is available at Spring Canyon, Keller Ferry, Goldsmith, Jones Bay, Hanson Harbor, Lincoln, Hawk Creek, Fort Spokane, and Porcupine Bay. These areas have boat launches, camping, trails, or similar public access opportunities. Boat-in access is available in Crystal Cove, Ponderosa, Detillion, Goldsmith, Jones Bay, Halvestor Canyon, and Sterling Point. No private docks are allowed on Columbia River shoreline.

The Crab Creek shoreline mostly contains agricultural land or environmentally sensitive land along the shoreline. Public access is limited along Crab Creek and several other lakes within Lincoln County due to agricultural land use, or lack of access roads. Among the lakes, Coffeepot, Fishtrap, Sprague and Florence Lakes have public access opportunities. Low impact recreational opportunities such as fishing, nature appreciation, etc., are available on most of the publicly owned land.

6.2 Public Access Goals

6.2.1 *National Park Services*

Several management policies are identified in the *Lake Roosevelt National Recreation Area Shoreline Management Plan Environmental Assessment* (NPS 2009). These policies aim to provide for enjoyment of the parks. The National Park Service will encourage visitor activities that:

- Are appropriate to the purpose for which the park was established
- Are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and will foster an understanding of and appreciation for park resources

and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources

- Can be sustained without causing unacceptable impacts to park resources or values

6.2.2 U.S. Bureau of Land Management

BLM recognizes that the public lands must be managed to protect the quality of ecological, environmental, and multiple other values. BLM intends to preserve and protect certain public lands for habitat conservation as well as provide for outdoor recreation and use for public (BLM 2013).

6.2.3 Washington State Department of Fish and Wildlife

WDFW's vision for Lands 20/20 (WDFW 2005) intends to offer all Washington citizens "an opportunity to access and appreciate this state's fish and wildlife." Recreational uses of land are consistent with WDFW's land policy for providing outdoor recreation opportunities when they "don't threaten fish and wildlife or degrade the habitats that support them." WDFW intends to continue providing wildlife viewing opportunities.

WDFW's Swanson Lake Wildlife Area Management Plan (Anderson 2006) indicates that the agency's management objective to provide recreation compatible with fish, wildlife, and habitat protection. It indicates that access and recreation must be controlled to protect fish and wildlife resources and to comply with federal and state regulations.

6.2.4 Washington State Department of Natural Resources

DNR allows public access on DNR-owned land. The management of DNR land's recreation and public use is guided as follows:

- (a) The department may limit any recreation activity or public use on department-managed lands to:
 - (i) Protect public safety, natural resources, or other property.
 - (ii) Execute its management and administrative obligations if any recreation activities or public use unreasonably interferes with the department's ability to carry out those obligations.

- (b) All persons shall comply with any department-posted restrictions that limit recreational activities (WAC 332-52-100)

6.3 Future Public Access

Future public access improvements and opportunities are described for each reach in the reach tables. Overall, the Columbia River and Spokane River reaches and have more opportunities for public access due to the public ownership of the shoreline area. The Lake Roosevelt Shoreline Management Plan (NPS 2009) identifies opportunities to improve public access on multiple locations. Public access opportunities are limited in some of the reaches due to the nature of the shoreline, such as steep slope. As described in the reach tables, the proposed improvements seem to be adequate to meet the public access need along the Columbia River and Spokane River shoreline.

Future public access opportunities are limited along Crab Creek, mostly due to the agricultural land use on privately owned land or lack of access roads. Additionally, due to the agricultural land use, demand for public access along Crab Creek shoreline is also low. Some areas contain sensitive shorelines (e.g., BLM-owned land on Reach 1) and are not appropriate for public access. Shorelines along Sylvan Lake could include public access once the area is developed.

Negro Creek contains sensitive shoreline area; therefore, public access may not be feasible on the shoreline. Several lakes have opportunities for future public access or improvement of public accesses. Among southeast corner lake group, Lake Creek lake group, and west central lake group, public access could be enhanced in the areas where shoreline is accessible and where shoreline is publicly owned. Existing fishing and boating facilities could also be enhanced (e.g., Coffee Pot, Deer, Twin, and Swanson lakes).

Crab Creek shoreline in Odessa could add limited public access through road ends in the developed areas and trails in the unimproved areas.

7 INFORMATION SOURCES, ASSUMPTIONS, AND LIMITATIONS

This document is based on the best information available to the Coalition at the time this document was produced. This information was obtained from a variety of sources and was collected and prepared for a variety of different purposes. The information was collected over a long time period; however, a substantial effort was made to use the most accurate and current information available.

Existing data, reports, and information used for the shoreline inventory are shown in the reference section. Generally, the documents used include County and town comprehensive plans and municipal codes, USFWS, and WDFW subbasin and habitat conservation plans, historical references, and scientific literature on ecological functions. GIS data illustrated in the map folio includes information on hydrology, soils, topography, vegetation, land cover, priority habitat and species concentrations, and other features.

This report relied largely on GIS data and remotely sensed imagery. Integrating various GIS layers together into map folio projects often resulted in polygon boundary discrepancies. Rectification of these discrepancies was only conducted for layers and geographic locations most relevant to the SMP update. For example boundaries for zoning or land use designations do not always match identified OHWM. The identified shoreline jurisdiction areas are only an approximation for purposes of updating the SMP for the Coalition. Precise OHWM delineation and associated shoreline jurisdiction boundaries will be determined on a project-by-project basis, based on site-specific analysis during the proposal development application and review process.

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APPENDIX A
LINCOLN COUNTY REACH
CHARACTERIZATION TABLES AND
REACH MAPS

Columbia River – Reach 1	Lincoln County
Reach Description: Columbia River from Grant County boundary to Plum Point	
Shoreline Jurisdiction: 1,709 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 1:	
Not applicable	
CHARACTERISTICS	
Ownership: The majority is public (National Park Service [NPS]) with a small amount (<10%) of private ownership.	
Land Use/Current SMP: Land use designation: • Current land use is Agricultural and Parks and Recreation • Zoning is Recreational Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Primarily open space including one recreational facility with accessory structures, access roads, a parking lot, docks, and a boat launch. Adjacent development includes rural residential development.	

Columbia River – Reach 1	Lincoln County
Geomorphic Character: Description: Lake Roosevelt is an artificial lake formed by the Grand Coulee Dam. The Lake Roosevelt shoreline upstream of the dam is high and steep. The banks consist of glaciolacustrine and outburst flood deposits (undivided), glaciolacustrine deposits, and intrusive igneous rocks. Mass wasting deposits are present along the lake margins. Lake levels fluctuate seasonally. Hardened Banks: No artificial hardened banks appear to exist along the Reach 1 extent.	
Flooding and Geological Hazards: Flood risk is managed by Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. The reach contains slight to moderate erodible soils; landslide hazard (>15%) exists near Plum Point where outburst flood deposits may be susceptible to mass wasting. Soils generally have very low liquefaction potential.	
Existing Public Access: Shoreline and public access is managed by NPS as part of the Lake Roosevelt National Recreation Area. Eden Harbor Drive North parallels the shoreline on the west end and provides access to boat moorage facilities. Spring Canyon Campground has camping facilities, boat launches, docks, parking, and a beach area. Identified Public Access Improvements: The Lake Roosevelt National Recreation Area Shoreline Management Plan Environmental Assessment (2009; Lake Roosevelt Plan) preferred alternative identifies the following improvement for Spring Canyon: • Development of a trail from Crescent Bay to Spring Canyon Public Access Opportunities: Opportunities are limited in some areas due to high banks. Planned and existing public access opportunities may be adequate for this reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity is mainly regulated by upstream dam operations located in Canada and by Grand Coulee Dam downstream. Sediments would generally be trapped by Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.	

Columbia River – Reach 1	Lincoln County
Water Quality: The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.	
Habitat Characteristics and PHS Species Presence: The reach of the Columbia River behind Grand Coulee Dam is also known as Lake Roosevelt. In this reach, the riparian zone is sparse due to climate and geological constraints of the coulee walls. The reach includes a number of small coves where there may be drainage from the uplands down the steep banks and into the Columbia. Some of these coves are characterized by lacustrine wetland conditions and vegetation consists of small trees (e.g., willows) and shrubs. A section of Reach 1 is within 1-mile radius of the area that has been documented to support one rare plant species: Whited's penstemon. As this reach transitions to Reach 2, the riparian zone vegetation becomes more consistent with shrub-steppe habitat. Sand dunes are present along the shoreline in this reach as the habitat transitions to shrub-steppe. Resident and lake associated species are kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. Western toad presence has been noted in the area near the transition to shrub-steppe habitat. The area experiences high concentrations of waterfowl at certain times of the year. Northwest white-tailed deer and mule deer may utilize the shorelines, and there are bald eagle nests near the shoreline.	
ECOLOGICAL FUNCTIONS ANALYSIS	
Level of Existing Function: Partially Functioning Stressors: Upland development: - Residential, predominately outside of shoreline jurisdiction Upland development primarily affects water quality through run-off. It may also impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. Recreational use: - Campground development with irrigated landscaping - Overwater structures (two at Eden Harbor and four at Spring Canyon Campgrounds) - Boat ramp at campground - Formal and informal recreation trails - Motorized boat use - Boat camping Recreational use primarily affects water quality, forage, and rearing functions of aquatic habitat. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control,	

Columbia River – Reach 1	Lincoln County
wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Shrub-steppe restoration consistent with WDFW 2011 recommendations. Potential Protection Opportunities: Protect intact shrub-steppe habitat from fragmentation by future trails or roads. Concentrate recreation water access to limit habitat fragmentation. Stormwater controls for new development consistent with Eastern Washington Stormwater Manual. Protect steep slope areas from runoff and sedimentation.	

Columbia River – Reach 2 Lincoln County
Reach Description: Columbia River from Plum Point to RM 613
Shoreline Jurisdiction: 3,043 acres
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx
Subreaches (SR); see Figures 2 and 3: SR A: Begins at Plum Point extending 8 miles to the east SR B: Extends 2.7 miles to the east SR C: Extends 1.7 miles around the bend to the north
CHARACTERISTICS
Ownership: The majority is public (National Parks Service [NPS]) with a very small number (<5%) of private parcels.
Land Use/Current SMP: Land use designation: • Land use is a mix of Rangeland, Agricultural, and Parks/Recreation • Zoning is Recreational Current SMP Environment Designation: Not available
Existing Land Cover/Development: Open space

Columbia River – Reach 2	Lincoln County
Geomorphic Character: Description: The Lake Roosevelt shoreline upstream of the Grand Coulee Dam in this reach is steep and flanked by glaciolacustrine and outburst flood deposits (undivided), glaciolacustrine deposits, outburst flood deposits, and intrusive igneous rocks. Mass wasting deposits are also present along the lake margins. Lake levels fluctuate seasonally.	
Hardened banks: No artificial hardened banks appear to exist along the Reach 2 extent.	
Flooding and Geological Hazards: Flood risk is managed by Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. The reach contains slight to severely erodible soils in SR A, and mostly severe erodible soils in SRs B and C. The reach is mostly bedrock or has very low to low liquefaction susceptibility. A section upstream of Plum Point contains designated landslide hazards where slopes are steeper than 15% over underlying flood deposits. Some local areas also present landslide hazards with pockets of mass-wasting deposits over steep slopes (>15%).	
Existing Public Access: Plum Point has a boat-in campsite. Neal Canyon Road, a gravel road runs parallel to the shoreline in the middle section of this reach. The high bank prohibits public access at some locations. Identified Public Access Improvements: The Lake Roosevelt Plan preferred alternative identifies the following improvement: • Add new boat-in campground in Neal Canyon Public Access Opportunities: Opportunities are limited in some areas due to high banks and rocky nature of shoreline. Planned public access opportunities may be adequate for this reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity is mainly regulated by upstream dam operations located in Canada and Grand Coulee Dam downstream. Sediments would generally be trapped by Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.	
Water Quality: The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are	

Columbia River – Reach 2 Lincoln County
likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.
Habitat Characteristics and PHS Species Presence: In this reach of the Columbia River/Lake Roosevelt, the riparian zone is sparse due to climate and geological constraints of the coulee walls. In SRs A and C, there are many small drainage coves that convey seasonal runoff from the uplands down the steep banks and into the waterway. Some of these coves have been characterized as lacustrine wetlands, with vegetation consisting of small and medium-sized trees and shrubs. Within the shoreline zone, but moving into the uplands, some of these areas may transition to palustrine wetlands with Gray alder/Speckled alder and black cottonwoods nearer the water's edge or at springs/seeps/wetlands. SR B is characterized by a steeply sloped cliff that slopes directly into the water, providing no obvious riparian zone along the shoreline. The slopes of the cliff contain Ponderosa pine and Douglas fir, with patches of native shrubs such as snowberry closer to the shoreline and transitioning to giant sagebrush and rabbitbrush in open areas and in the shrub layer, shrub-steppe/sub-montane transition. Resident and lake associated species are kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. Night snake and Western toad presence is noted in this reach. The area experiences high concentrations of waterfowl at certain times of the year, and there are bald and golden eagle nests near the shoreline. Mule deer, bighorn sheep, rocky mountain elk, and gray wolf are present in the uplands and may occasionally utilize the shorelines at certain times of the year.
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)
SUBREACH A
Level of Existing Function: Partially Functioning Stressors: Upland development : • Agricultural fields and a few residential developments predominately outside of shoreline jurisdiction, though a few small homes with Morgan Land access road fall within boundary • Neal Canyon Road inside and outside of shoreline jurisdiction Upland development primarily affects water quality through run-off and may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. Recreational use: • Two over-water structures • Motorized boat use • Boat camping • Formal and informal upland and water access trails

Columbia River – Reach 2 Lincoln County
Recreational use primarily affects water quality through potential releases of contaminants, forage and rearing functions of aquatic habitat through shading, and alteration of aquatic shoreline structure. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody plant strips in between agricultural fields and shoreline. Shrub-steppe restoration consistent with WDFW 2011 recommendations. Potential Protection Opportunities: Concentrate recreation water access to limit fragmentation of upland habitat. Stormwater controls for new development consistent with Eastern Washington Stormwater manual.
SUBREACH B
Level of Existing Function: Functioning Stressors: • Narrow segment of Neal Canyon Road near jurisdiction boundary • Motorized boat use • Informal upland and water access trails Potential Restoration Opportunities: Shrub-steppe restoration consistent with WDFW 2011 recommendations Potential Protection Opportunities: Concentrate recreation water access to limit fragmentation of upland habitat. Protect cove areas with riparian vegetation from increased recreation use. Stormwater controls for new development consistent with Eastern Washington Stormwater manual.
SUBREACH C
Level of Existing Function: Partially Functioning Stressors: • Scattered upland development predominately outside of boundary • Clearing suggests future upland residential development • Highway 21 • Motorized boat use • Boat camping • Formal and informal upland and water access trails Potential Restoration Opportunities: Shrub-steppe restoration consistent with WDFW 2011 recommendations Potential Protection Opportunities: Concentrate recreation water access to limit fragmentation of upland habitat. Stormwater controls for new development consistent with Eastern Washington Stormwater manual.

Columbia River – Reach 3	Lincoln County
Reach Description: Columbia River from RM 613 to Keller Ferry Terminal	
Shoreline Jurisdiction: 624 acres	
Source: https://fortress.wa.gov/ecy/coastalatlantools/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 3: SR A: Begins at RM 613, extending 1.4 miles to the northeast SR B: Extends 1 mile to the northeast ending at the edge of Keller Ferry area	
CHARACTERISTICS	
Ownership: Reach 3 is entirely public owned by National Park Service (NPS).	
Land Use/Current SMP: Land use designation: • Land use is Agricultural • Zoning is Recreational Current SMP Environment Designation: Not available	

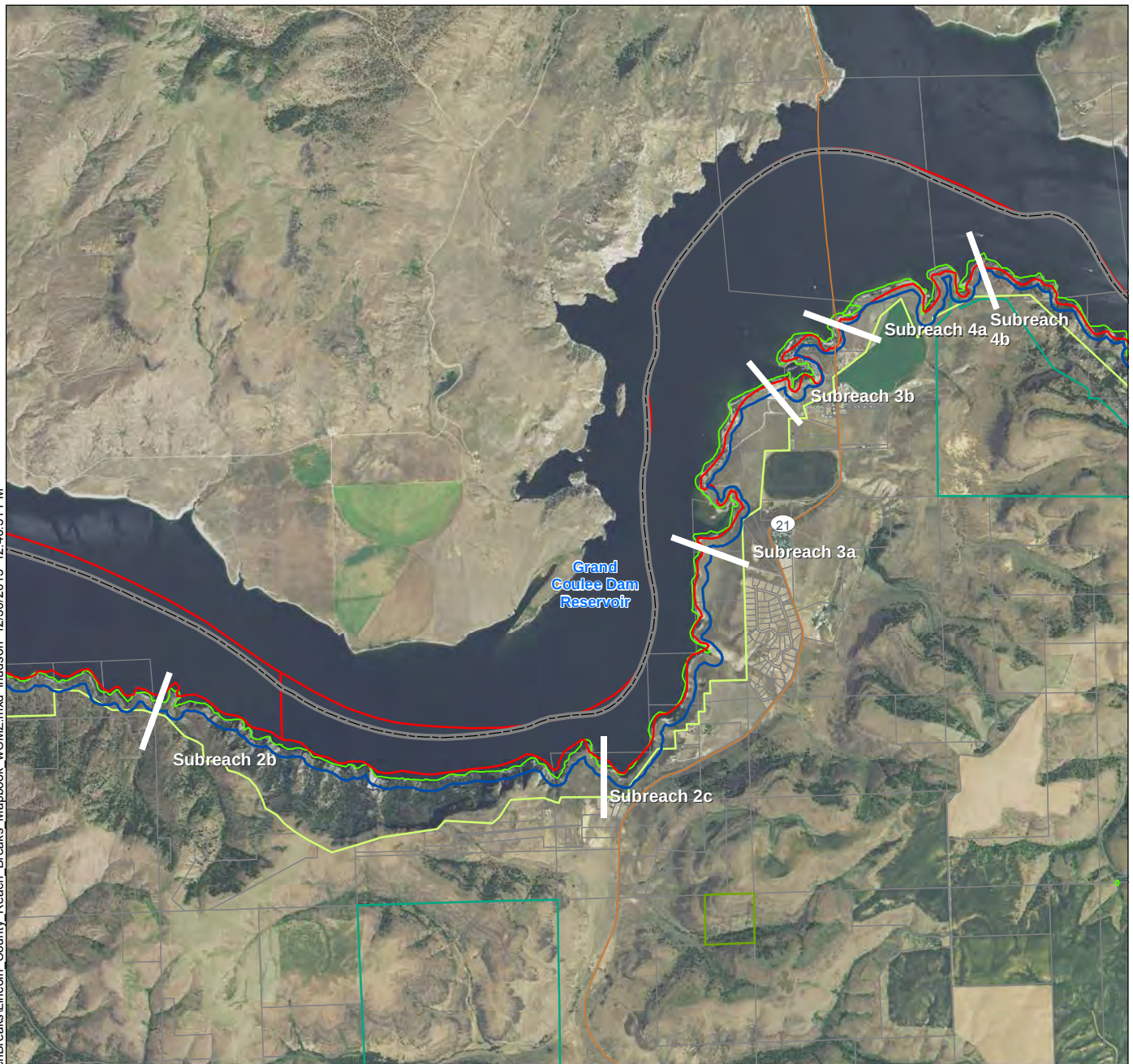


Columbia River – Reach 3 Lincoln County
Existing Land Cover/Development: Open space, State Route 21, campgrounds, and parking facilities accessory to a ferry terminal. Adjacent uses include agricultural development.
Geomorphic Character: Description: The Lake Roosevelt shoreline has generally low banks and is flanked by alluvium. Lake levels fluctuate seasonally. Hardened Banks: Localized hardened banks exist in the vicinity of the boat ramp. The extent of the hardened banks is 2,000 feet.
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. The reach contains soils designated as slight erodible potential. Soils have moderate to high liquefaction potential associated with river alluvium from RM 613 to the Keller Ferry.
Existing Public Access: The Keller Ferry area includes campground, boat launches, a beach area, and parking in addition to the ferry terminal. The shoreline public access is managed by NPS as part of the Lake Roosevelt National Recreation Area. The Keller Ferry, which is operated by the Washington State Department of Transportation (WSDOT), connects with Ferry County and the Colville Indian Reservation on the north bank of the Columbia River. Identified Public Access Improvements: The Lake Roosevelt Plan preferred alternative identifies the following improvement: • Add low-impact (gravel) overflow parking lot at the Keller Ferry terminal. Public Access Opportunities: Planned and existing public access opportunities seem adequate for this reach.
ECOLOGICAL CONDITIONS
Water Quantity and Sediment: Water quantity is mainly regulated by upstream dam operations located in Canada and Grand Coulee Dam downstream. Sediments would generally be trapped by Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.

Columbia River – Reach 3	Lincoln County
Water Quality: The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.	
Habitat Characteristics and PHS Species Presence: In this reach of the Columbia River/Lake Roosevelt, the riparian zone is in some cases much wider than in downstream reaches nearer the Grand Coulee dam. This reach has more gently sloped banks and supports a riparian community comprised of a mix of larger trees (such as black cottonwoods and Siberian elm) in close proximity to the water, with smaller shrubs consistent with a shrub-steppe habitat as distance from the waterway increases. The shoreline area in SR B includes a cove near Highway 21 that has been developed into a marina for recreational boating use and a campground managed by NPS. The reach contains a minimal amount of riparian vegetation near the marina, a landscaped riparian area surrounding the adjacent campground featuring mown grass, and large non-native Siberian elm and Sycamore trees. Resident and lake associated species are kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. Reptile and amphibian presence are not noted in this reach. There are raptor nests near the shoreline in the vicinity of this reach, and northern goshawk are located nearby. Mule deer, bighorn sheep, rocky mountain elk, and gray wolf are present in the uplands, in the area around this reach, but it is less likely they utilize the shorelines of this reach due to the higher occurrence of human activity.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
SUBREACH A	
Level of Existing Function: Partially Functioning Stressors: Recreational use: • Recreation access road mostly inside shoreline jurisdiction • Camp sites • Small parking lots • Formal and informal trails • Overwater structure and access road • Motorized boat use • Boat camping Recreational use primarily affects water quality through potential releases of contaminants, forage and rearing functions of aquatic habitat through shading, and alteration of aquatic shoreline structure. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.	

Columbia River – Reach 3	Lincoln County
Potential Restoration Opportunities: Shrub-steppe restoration consistent with WDFW 2011 recommendations	
Potential Protection Opportunities: Concentrate recreation water access to limit fragmentation of upland habitat. Protect cove areas with riparian area from increased recreation use. Stormwater controls for new development consistent with Eastern Washington Stormwater Manual.	
SUBREACH B	
Level of Existing Function: Impaired	
Stressors:	
Extensive recreation development, including:	
• Large paved parking lots and access roads • Boat ramps • Overwater structures • Formal and informal trails • In-water booms and net pens • Irrigated landscaping/turf • Upland campsites • Motorized boat use • Boat camping	
Potential Restoration Opportunities: Consider options for soft shore armoring techniques to stabilize shoreline below lawn areas near Keller Ferry, increase riparian vegetation while still allowing for shoreline access and views, and best management practices for irrigated turfgrass areas to reduce pesticide runoff.	
Potential Protection Opportunities: Manage shoreline access to allow for further riparian and soft shoreline enhancements	

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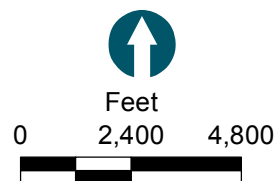


- Populated Place
- County Seat
- Interstates
- Highways
- - - Channel Migration Zone
- ▭ Incorporated City
- ▭ County Boundary

- Land Ownership**
- ▭ Federal
 - ▭ National Park Service
 - ▭ Nature Conservancy
 - ▭ WA State Dept. of Natural Resources
 - ▭ WA State Dept. of Fish and Wildlife
 - ▭ WA State Dept. of Transportation

- ▭ SMA Jurisdiction
- ▭ FEMA 100 Year Floodplain
- ▭ NWI Wetland
- ▭ Parcel

NOTES:
 1. This information is to be used for planning purposes only.
 Data is displayed as is and without any guarantee of accuracy or completeness.
 2. Aerial imagery courtesy of USDA NAIP (2013).



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Columbia River – Reach 4 Lincoln County

Reach Description: Columbia River from Keller Ferry Terminal to the downstream of Hawk Creek Harbor

Shoreline Jurisdiction: 5,032 acres



Source: <https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches (SR); see Figures 3, 4, 5, and 6

SR A: Begins after Keller Ferry Terminal extending 1.4 miles to the northeast

SR B: Extends 2.6 miles to the southeast, ending downstream of Hanson Harbor

SR C: Extends 0.8 miles along the developed area of Hanson Harbor

SR D: Extends 5.3 miles to the east, including the shoreline along Jones Bay

SR E: Extends 0.6 miles along the short section of developed area

SR F: Extends 3.4 miles to the south, ending at Jump Canyon

SR G: Extends 2.8 miles to the east, ending at Halverson Canyon

SR H: Extends 1.3 miles to the east, ending downstream of Sterling Point

SR I: Extends 4.25 miles to the southeast, ending downstream of Welsh Creek Cove

SR J: Extends 0.8 miles around Welsh Creek Cove

SR K: Extends 1.2 miles to the east along the Town of Lincoln waterfront

SR L: Extends 1.1 miles to the east, ending at the mouth of Hawk Creek Harbor

Columbia River – Reach 4 Lincoln County
CHARACTERISTICS
Ownership: Mostly public (National Parks Service [NPS]) with exceptions in SRs E and F, where a substantial amount (>10%) of land is private.
Land Use/Current SMP: Land use designation: • Land use is Agricultural and Parks/Recreation • Zoning is Recreational Current SMP Environment Designation: Not available
Existing Land Cover/Development: Open space, campgrounds, and a recreation dock. Adjacent uses include agricultural development.
Geomorphic Character: Description: The Roosevelt Lake shoreline is generally steep throughout this reach and is flanked by glaciolacustrine and outburst flood deposits (undivided), alluvium, and intrusive and extrusive igneous rocks. Mass wasting deposits are also present along the lake margins. Lake levels fluctuate seasonally. Hardened banks: No artificial hardened banks appear to exist along the Reach 4 extent.
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. The reach contains mostly slight erodible soils in SRs A and C, while SR C is dominantly severe erodible soils. SRs E, F, G, H, and I contains dominantly severe erodible soils, excluding flat areas near Sterling Point and mid-range of SR I. SR J has mostly slight erodible soils, whereas SRs K and L have areas of severe erodible soils. Soils generally have low liquefaction potential, except for SR C (Hanson Harbor). SR C also contains designated landslide hazards (slopes >15%) over underlying river alluvium, as well as in some local areas with pockets of alluvial and mass-wasting deposit. Landslide hazards also exist in steep slopes on both sides of Welsh Creek Cove (SR J).

Columbia River – Reach 4**Lincoln County****Existing Public Access:**

Jones Bay has boat launches and boat-in campsites. Hanson Harbor has a boat launch, parking, and an unimproved trail that parallels the shoreline. Rantz Marina east of Jones Bay consists of boat launch and boat moorage facilities. Halverson Canyon and Sterling Point both have boat-in campsites. Lincoln has a boat launch and parking accessed from Redwine Canyon Road. This area also has an unimproved road that parallels the shoreline.

Identified Public Access Improvements:

Planned improvements identified in the Lake Roosevelt Plan include:

- Designate group boat-in campsites in Penix Canyon
- Add low-impact (gravel) overflow parking lot in Lincoln
- Martin Canyon—Rantz Marina Access Improvement Project (FHWA 2013) under the Federal Lands Access Program indicates upgrade of existing facilities, such as widening and enhancement of safety of the existing subgrade, improvement of drainage facilities, and resurfacing of the area.

Public Access Opportunities:

Planned and existing public access opportunities seem adequate for this reach.

ECOLOGICAL CONDITIONS**Water Quantity and Sediment:**

Water quantity is mainly regulated by upstream dam operations located in Canada and the Grand Coulee Dam downstream. Sediments would generally be trapped by the Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.

Water Quality:

The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.

Habitat Characteristics and PHS Species Presence:

In this reach of the Columbia River/Lake Roosevelt, the riparian zone is sparse due to climate and geological constraints of the steep cliffs and bluffs adjacent to the shoreline. The reach includes a few small coves where there may be drainage from the uplands down the steep banks and into the waterway, and these coves support more typical riparian community that includes small to medium sized trees near the water's edge. The steep cliffs slopes that are adjacent to the waterway throughout much of this reach provide no obvious riparian zone along the shoreline, although trees (such as Ponderosa pine and Douglas fir) and shrubs (rabbitbrush and giant sagebrush) are present along the slopes, sometimes thickly. A section of SR I

Columbia River – Reach 4 Lincoln County
east of Sterling Point has been documented to support one rare plant species: Palouse milk-vetch. Resident and lake associated species are kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. Night snake and Western toad presence is noted in this reach. The area experiences high concentrations of waterfowl at certain times of the year, and there are bald and golden eagle nests near the shoreline. Mule deer, bighorn sheep, rocky mountain elk, and gray wolf are present in the uplands and may occasionally utilize the shorelines at certain times of the year.
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)
SUBREACH A
Level of Existing Function: Partially Functioning Stressors: Recreational use: • Keller Ferry rest area with paved parking lot • Dirt road to shoreline viewing area/trailhead • Informal trails and remnant irrigated fields and infrastructure just outside of jurisdiction boundary • Motorized boat use • Boat camping Recreational use primarily affects water quality through potential releases of contaminants or run-off from paved surfaces, forage and rearing functions of aquatic habitat through shading, and alteration of aquatic shoreline structure. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Convert areas within the shoreline jurisdiction to native vegetation, and re-establish a functional riparian shoreline. Evaluate opportunities to incorporate aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) along with soft bank stabilization techniques, particularly to support habitat substrate and water access opportunities. Potential Protection Opportunities: Protect native riparian and shrub-steppe vegetation to preserve and support re-establishment of this land cover type. Limit recreation access within intact riparian and shrub-steppe areas. Stormwater controls for new development consistent with Eastern Washington Stormwater Manual.
SUBREACH B
Level of Existing Function: Functioning Stressors: • Motorized boat use • Dirt roads and trails outside of shoreline jurisdiction Potential Restoration Opportunities: Shrub-steppe restoration consistent with WDFW 2011

Columbia River – Reach 4 Lincoln County
recommendations Potential Protection Opportunities: Protect cove areas and intact riparian slopes from recreation use; consider encouraging public access moorage outside of vegetated areas, especially those areas providing high-quality habitat.
SUBREACH C
Level of Existing Function: Partially Functioning Stressors: • Residential development with lots mostly outside of shoreline jurisdiction • Paved parking lot • Boat ramp • Motorized boat use • Boat camping • Informal trails and water access points Potential Restoration Opportunities: Improve riparian conditions on undeveloped parcels, formalize and concentrate water access trails. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual. Evaluate opportunities to improve riparian vegetation and landscape maintenance practices and reduce impacts of armoring during redevelopment or through landowner incentive and education programs.
SUBREACH D
Level of Existing Function: Partially Functioning Stressors: • Hell Gate Drive road to solitary cabin within jurisdiction • RV camping areas from Jones Bay Road with nearby over-water structures and boat ramps • Plowed agricultural fields predominately outside jurisdiction • Motorized boat use • Boat camping Potential Restoration Opportunities: Consider incorporating aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) within small off-channel coves where aquatic species may take refuge. Woody or grass vegetation buffers in between agricultural fields and shoreline. Potential Protection Opportunities: Protect cove areas from heavy recreation use; consider encouraging public access moorage outside of vegetated areas, especially those areas providing high-quality habitat including riparian and shrub-steppe habitat.
SUBREACH E

Columbia River – Reach 4 Lincoln County
Level of Existing Function: Impaired Stressors: • Access roads to paved parking lots and cabin properties • Formal and informal roads and trails to water access points • Over-water structure • Motorized boat use • Boat camping Potential Restoration Opportunities: Improve riparian conditions on undeveloped parcels Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual. Evaluate opportunities to improve riparian vegetation and landscape maintenance practices and reduce impacts of armoring during redevelopment or through landowner incentive and education programs.
SUBREACH F
Level of Existing Function: Functioning Stressors: • Two developed lots with access roads at south end of reach • Irrigated agriculture outside of jurisdiction boundary • Motorized boat use Potential Restoration Opportunities: Woody or grass vegetation buffers in between agricultural fields and shoreline. Shrub-steppe restoration consistent with WDFW 2011 recommendations. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual.
SUBREACH G
Level of Existing Function: Partially Functioning Stressors: • Isolated development within shoreline jurisdiction with unpaved access road (Lake Roosevelt Drive E) • Motorized boat use Potential Restoration Opportunities: None Potential Protection Opportunities: Protect steep slopes areas from runoff and sedimentation. Stormwater controls for new development consistent with Eastern Washington Stormwater manual.
SUBREACH H
Level of Existing Function: Partially Functioning

Columbia River – Reach 4	Lincoln County
Stressors: • Isolated upland development outside of shoreline jurisdiction • Informal trails with a few water access points • Motorized boat use Potential Restoration Opportunities: Shrub-steppe restoration consistent with WDFW 2011 recommendations Potential Protection Opportunities: Protect steep slopes areas from runoff and sedimentation. Stormwater controls for new development consistent with Eastern Washington Stormwater manual.	
SUBREACH I	
Level of Existing Function: Partially Functioning Stressors: • Water access trail and over-water structure • Motorized boat use • Boat camping • Low density upland development with access roads in and outside of jurisdiction boundary Potential Restoration Opportunities: Evaluate incentives for private landowners to preserve native vegetation or increase riparian buffers. Incorporate riparian planting with future development. Shrub-steppe restoration consistent with WDFW 2011 recommendations. Potential Protection Opportunities: Protect intact shrub steppe habitat from fragmentation by future trails or roads. Stormwater controls for new development consistent with Eastern Washington Stormwater manual.	
SUBREACH J	
Level of Existing Function: Partially Functioning Stressors: • Upland development within or near edge of jurisdiction boundary • Trailhead/viewpoint near water's edge • Many informal trails • Fish net pen • Motorized boat use Potential Restoration Opportunities: Shrub-steppe restoration consistent with WDFW 2011 recommendations. Woody or grass buffer in between agricultural fields and shoreline. Potential Protection Opportunities: Protect intact shrub steppe habitat from fragmentation by future trails or roads. Stormwater controls for new developmet consistent with Eastern Washington Stormwater manual.	
SUBREACH K	

Columbia River – Reach 4 Lincoln County
Level of Existing Function: Impaired
Stressors: • Water access road alongside water’s edge for half of subreach • Upland development inside and outside of shoreline jurisdiction boundary • Paved parking lot and boat ramp • In-water booms • Motorized boat use • Boat camping
Potential Restoration Opportunities: Riparian plantings in between access road/trail and water’s edge. Evaluate incentives for private landowners to preserve native vegetation or increase riparian buffers. Incorporate riparian planting or shrub-steppe restoration with future development.
Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual.
SUBREACH L
Level of Existing Function: Impaired
Stressors: • Residential development with irrigated landscaping at top of bluff • Parking lot for boat ramp at water’s edge • Motorized boat use • Informal moorage/camping
Potential Restoration Opportunities: Convert areas within the shoreline jurisdiction to native vegetation and re-establish a functional riparian shoreline
Potential Protection Opportunities: Protect native riparian and shrub-steppe vegetation to preserve and support re-establishment of this land cover type. Stormwater controls for new development consistent with Eastern Washington Stormwater manual.

Columbia River – Reach 5	Lincoln County
Reach Description: Columbia River around Hawk Creek Harbor and a section of Hawk Creek	
Shoreline Jurisdiction: 726 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlantools/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 7:	
Not applicable	
CHARACTERISTICS	
Ownership: The majority is public (National Park Service [NPS]) with a small amount (<10%) of private ownership.	
Land Use/Current SMP:	
Land use designation:	
• Land use is Agricultural • Zoning is Recreational	
Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Open space	
Geomorphic Character:	
Description: The Lake Roosevelt shoreline is generally steep throughout this reach and is flanked by glaciolacustrine and outburst flood deposits (undivided), glaciolacustrine deposits, and basalt. Mass wasting deposits are also present along the lake margins. Lake levels fluctuate seasonally.	
Hardened Banks: No artificial hardened banks appear to exist along the Reach 5 extent.	

Columbia River – Reach 5	Lincoln County
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. Reach 5 contains soils that have severe to very severe erosion potential, but generally low liquefaction susceptibility. The reach contains designated landslide hazards in some local areas with pockets of mass-wasting deposits.	
Existing Public Access: Hawk Creek campground and boat launch is located on the east end of the Hawk Creek Harbor, on the north bank of this reach.	
Identified Public Access Improvements: No specific improvement has been identified for this reach.	
Public Access Opportunities: Additional public access opportunities are limited due to high bank and rocky nature of the shoreline.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity is mainly regulated by upstream dam operations located in Canada and the Grand Coulee Dam downstream. Sediments would generally be trapped by the Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.	
Water Quality: The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.	
Habitat Characteristics and PHS Species Presence: Reach 5 of the Columbia River/Lake Roosevelt includes the shorelines of a larger embayment where Hawk Creek flows into the Columbia River waterway. The upper portion of this reach includes Hawk Creek and the Hawk Creek Falls. The riparian zone remains sparse due to climate and geological constraints of the steep cliffs and bluffs adjacent to the shoreline. This reach also includes a few smaller coves where there may be drainage from the uplands down the steep banks and into the waterway, and these coves support more typical riparian community that includes small to medium sized trees near the water's edge. The steep cliffs slopes that are adjacent to the waterway throughout much of this reach provide no obvious riparian zone along the shoreline, although trees (such as Ponderosa pine and Douglas fir) and shrubs	

Columbia River – Reach 5	Lincoln County
(rabbitbrush and giant sagebrush) are present along the slopes, sometimes thickly. In the portion of this reach that includes Hawk Creek Fall, the riparian zone just above the falls contains cottonwoods, elms, and other deciduous trees in intact bands alongside either bank of the creek. Resident and lake associated species include kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. Mule deer, bighorn sheep, and rocky mountain elk are present in the uplands, and may occasionally utilize the shorelines at certain times of the year.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Upland development: • Isolated development and access roads within shoreline jurisdiction • Hawk Creek Road runs near the waterline at the northeast end of Hawk Creek Harbor Upland development primarily affects water quality through run-off, may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. Recreational uses: • One boat ramp and over-water structure • Motorized boat use • Boat camping Recreational use primarily affects water quality through potential releases of contaminants, forage and rearing functions of aquatic habitat through shading, and alteration of aquatic shoreline structure. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Riparian plantings in between access road/trail and water's edge. Shrub-steppe restoration consistent with WDFW 2011 recommendations. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual.	

Columbia River – Reach 6	Lincoln County
Reach Description: Columbia River from the upstream of Hawk Creek Harbor to Seven Bays	
Shoreline Jurisdiction: 237 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 7:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Reach 6 is entirely public owned by a federal agency (National Park Service [NPS]).	
Land Use/Current SMP: Land use designation: • Land use is Agricultural • Zoning is Recreational Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Open space	
Geomorphic Character: Description: The Lake Roosevelt banks are generally steep throughout this reach and consist of glaciolacustrine deposits and basalt. Lake levels fluctuate seasonally. Hardened banks: Based on existing aerial photos, no artificial hardened banks appear to exist along the Reach 6 extent.	

Columbia River – Reach 6	Lincoln County
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. The reach is dominantly severe erodible soils, but generally with low liquefaction susceptibility. A steep (>15%) section just upstream of Hawk Creek Harbor underlain by mass-wasting deposits is a designated landslide hazard.	
Existing Public Access: No public access is available in this reach. Identified Public Access Improvements: No specific improvement has been identified for this reach. Public Access Opportunities: Public access opportunities are limited due to the rocky nature of the shoreline. Furthermore, the existing public accesses on the nearby reaches may be adequate.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity is mainly regulated by upstream dam operations located in Canada and the Grand Coulee Dam downstream. Sediments would generally be trapped by the Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.	
Water Quality: The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.	
Habitat Characteristics and PHS Species Presence: In Reach 6 of the Columbia River/Lake Roosevelt, the riparian zone is very sparse due to climate and geological constraints of the steep cliffs and bluffs adjacent to the shoreline. The reach includes a few small coves related to drainage from the uplands down the steep banks and into the waterway, where some trees and shrubs are concentrated. The steep cliffs slopes that are adjacent to the waterway throughout much of this reach provide no obvious riparian zone along the shoreline, and vegetation is considerably sparser in this reach. Resident and lake associated species are kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. Night snake and	

Columbia River – Reach 6**Lincoln County**

Western toad presence are noted in this reach. The area experiences high concentrations of waterfowl at certain times of the year, and there are bald and golden eagle nests near the shoreline. Mule deer, bighorn sheep, rocky mountain elk, and gray wolf are present in the uplands and may occasionally use the shorelines at certain times of the year.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Functioning

Stressors:

Upland development:

- Isolated residential development far outside shoreline jurisdiction with access road

Upland development has the minor potential to affect water quality through run-off. It may also impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors.

Recreational use:

- Few informal trails mostly outside of boundary
- Motorized boat use
- Boat camping

Recreational use may affect water quality through potential releases of contaminants, forage and rearing functions of aquatic habitat through shading, and alteration of aquatic shoreline structure. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Consider incorporating aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) within small off-channel coves where aquatic species may take refuge.

Potential Protection Opportunities: Protect cove areas from heavy recreation use; consider encouraging public access moorage outside of vegetated areas, especially those areas providing high-quality habitat including shrub-steppe habitat.

Columbia River – Reach 7	Lincoln County
Reach Description: Columbia River from Seven Bays to Swede Flats	
Shoreline Jurisdiction: 477 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlant/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 7:	
Not applicable	
CHARACTERISTICS	
Ownership: Ownership is mostly public (National Park Service [NPS]), but a small amount of private land (<10%) is consisted of multiple small residential parcels along the Seven Bay's waterfront.	
Land Use/Current SMP: Land use designation: • Land use is Agricultural, Commercial, and Parks/Recreation • Zoning is Recreational Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Residential development and a marina	
Geomorphic Character: Description: The Lake Roosevelt banks generally low throughout this reach and consist of glaciolacustrine deposits. Lake levels fluctuate seasonally. Hardened Banks: Localized hardened banks likely exist throughout this reach and are associated with the	

Columbia River – Reach 7	Lincoln County
development of Seven Bays.	
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. The reach is mostly made of severe erodible soils. Liquefaction susceptibility is generally low to very low. There is no designated landslide hazard area.	
Existing Public Access: Seven Bays Marina has boat launch, parking and marina facilities such as concession areas, fuel dock, and boat waste disposal facilities. Identified Public Access Improvements: No specific improvement has been identified for this reach. Public Access Opportunities: Public access opportunities seem to be adequate in this reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity is mainly regulated by upstream dam operations located in Canada and the Grand Coulee Dam downstream. Sediments would generally be trapped by the Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.	
Water Quality: The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.	
Habitat Characteristics and PHS Species Presence: Reach 7 of the Columbia River/Lake Roosevelt has a very sparse riparian zone, characterized by erosional glacially deposited sediments along the shoreline, as well as some minor development impacts related to the Seven Bays community located within this reach. The slopes along the shoreline are steep, but the elevation of the uplands is lower and the nearshore upland topography is flatter. The vegetation is limited to smaller shrubs (rabbitbrush and sagebrush species) due to substrate type, and the prevailing climate and geological constraints of the nearly vertical slopes that are very exposed to erosional forces of wind and wave action. The reach includes a few small coves related to drainage from the uplands and into the waterway and some larger trees (including black cottonwood and potentially Siberian elm) and smaller shrubs are concentrated in these	

Columbia River – Reach 7**Lincoln County**

areas, typically within a narrow area along the shoreline and in the wet areas.

Resident and lake associated species include kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. There is documented presence of western toad in the vicinity of the main Seven Bays Marina, and there are peregrine falcon nests near the shoreline. Mule deer, bighorn sheep, and rocky mountain elk, are present in the uplands and may occasionally use the shorelines at certain times of the year.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Impaired

Stressors:

Upland development:

- Residential development with irrigated landscaping within shoreline jurisdiction

Upland development primarily affects water quality through run-off, as well as water quality and forage function through reduced native vegetation within shoreline jurisdiction. It may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors.

Recreational use:

- Many informal trails to water access points
- Seven Bays Marina with boat ramps and over-water structures
- Parking lot and access road near water's edge
- Fish net pens
- Motorized boat use
- Boat camping/informal moorage

Recreational use primarily affects water quality through potential releases of contaminants and run-off, as well as the forage and rearing functions of aquatic habitat through shading and alteration of aquatic shoreline structure. This may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Convert areas within the shoreline jurisdiction to native vegetation, and re-establish a functional riparian shoreline. Evaluate opportunities to incorporate aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) along with soft bank stabilization techniques, particularly to support habitat substrate and water access opportunities. Improve riparian conditions on undeveloped parcels, formalize and concentrate water access trails.

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual. Evaluate opportunities to improve riparian vegetation and landscape maintenance practices and reduce impacts of armoring during redevelopment or through landowner incentive and education programs.

Columbia River – Reach 8	Lincoln County
Reach Description: Columbia River from Swede Flats to the mouth of Spokane River	
Shoreline Jurisdiction: 785 acres	
Source: https://fortress.wa.gov/ecy/coastalatl/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 7:	
Not applicable	
CHARACTERISTICS	
Ownership: Primarily public (National Park Service [NPS]) with a very small amount of private ownership (<5%).	
Land Use/Current SMP:	
Land use designation:	
• Land use is Agricultural, Commercial, Parks/Recreation, and Rangelands • Zoning is Recreational	
Current SMP Environment Designation: Not available	

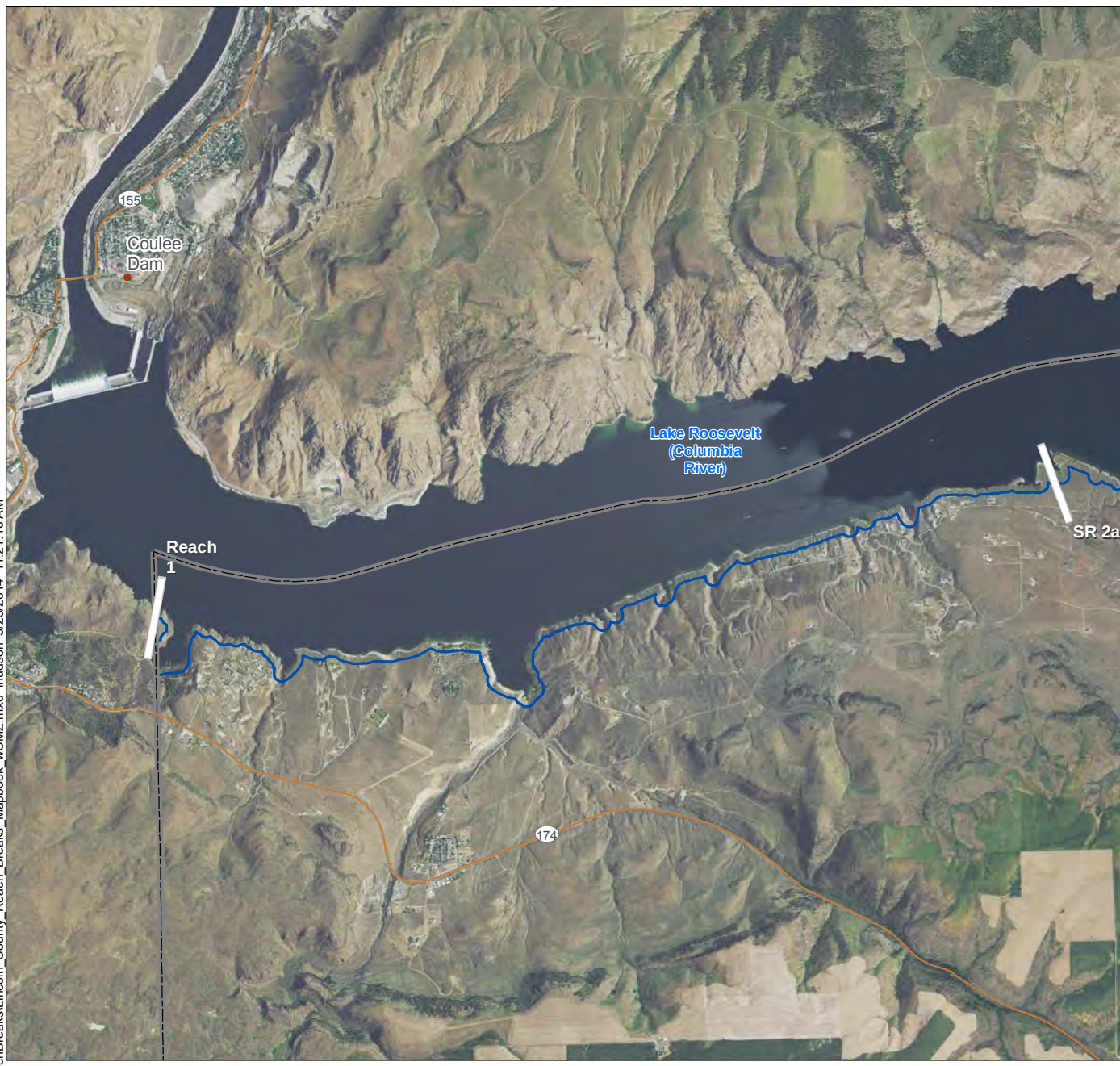


Columbia River – Reach 8 Lincoln County
Existing Land Cover/Development: Open space. Adjacent development includes agricultural and residential development.
Geomorphic Character: Description: The Lake Roosevelt banks generally steep throughout this reach and consist of glaciolacustrine deposits and glaciolacustrine and outburst flood deposits (undivided). Lake levels fluctuate seasonally. Hardened Banks: No artificial hardened banks appear to exist along the Reach 8 extent.
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and by dams located in Canada upstream of the reach, as determined by the Columbia River Treaty. The reach contains mostly severe erodible soils and a minor amount slight erodible soil. Soils have generally low to very low liquefaction susceptibility.
Existing Public Access: No specific public access exists in this reach. Deer Meadows area has one gravel road (Bauer Lane North) that runs close to the shoreline. Identified Public Access Improvements: None has been identified. Public Access Opportunities: Opportunities exist to provide physical or visual access to shoreline.
ECOLOGICAL CONDITIONS
Water Quantity and Sediment: Water quantity is mainly regulated by upstream dam operations located in Canada and the Grand Coulee Dam downstream. Sediments would generally be trapped by the Grand Coulee Dam at the downstream end of this reach. Additionally, the draft of Lake Roosevelt levels may cause movement of some sediment. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.
Water Quality: The Columbia River at Lake Roosevelt is on the 303(d) list (Category 5) for temperature and dissolved oxygen. It also has a total maximum daily load (TMDL) in place (Category 4A) for total dissolved gas (TDG) and is a water of concern (Category 2) for polychlorinated biphenyls (PCBs). Impacts to water quality are likely caused by impounded water causing temperature and dissolved oxygen issues. Past industrial runoff and river use likely caused PCB problems in this reach.

Columbia River – Reach 8	Lincoln County
Habitat Characteristics and PHS Species Presence: The riparian zone in Reach 8 is minimal, and vegetation within the riparian area is virtually nonexistent. This reach is characterized by glacially deposited sediment along the shoreline, as well as some minor development impacts related to the Deer Meadows community located within this reach. The slopes along the shoreline are steep, but the elevation of the uplands is lower and the nearshore upland topography is flatter. The vegetation is limited to smaller shrubs (rabbitbrush and sagebrush species) due to substrate type, and the prevailing climate and geological constraints of the nearly vertical slopes that are very exposed to erosional forces of wind and wave action. The reach includes a few small coves related to drainage from the uplands and into the waterway, where vegetation is more prevalent, but even in these areas larger trees are scarce and therefore almost non-existent within the shoreline boundaries of this reach. Resident and lake associated species include kokanee, rainbow trout, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. There is documented presence of western toad in the vicinity of the main Seven Bays Marina, and there are peregrine falcon nests near the shoreline. Mule deer, bighorn sheep, and rocky mountain elk are present in the uplands and may occasionally use the shorelines at certain times of the year.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning	
Stressors:	
Upland development:	
• Low density upland development mostly outside of shoreline jurisdiction (except at north end of subreach) • Many access roads leading to existing and planned development	
Upland development primarily affects water quality through run-off and may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors.	
Recreational use:	
• Informal trails • Motorized boat use • Boat camping	
Recreational use has minor impacts to water quality through potential releases of contaminants. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.	
Potential Restoration Opportunities: Improve riparian conditions on undeveloped parcels, formalize and concentrate water access trails.	
Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual. Evaluate opportunities to improve riparian vegetation and landscape	

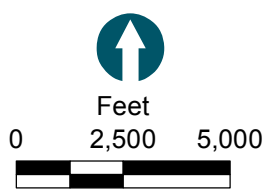
Columbia River – Reach 8	Lincoln County
maintenance practices and reduce impacts of armoring during redevelopment or through landowner incentive and education programs.	

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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

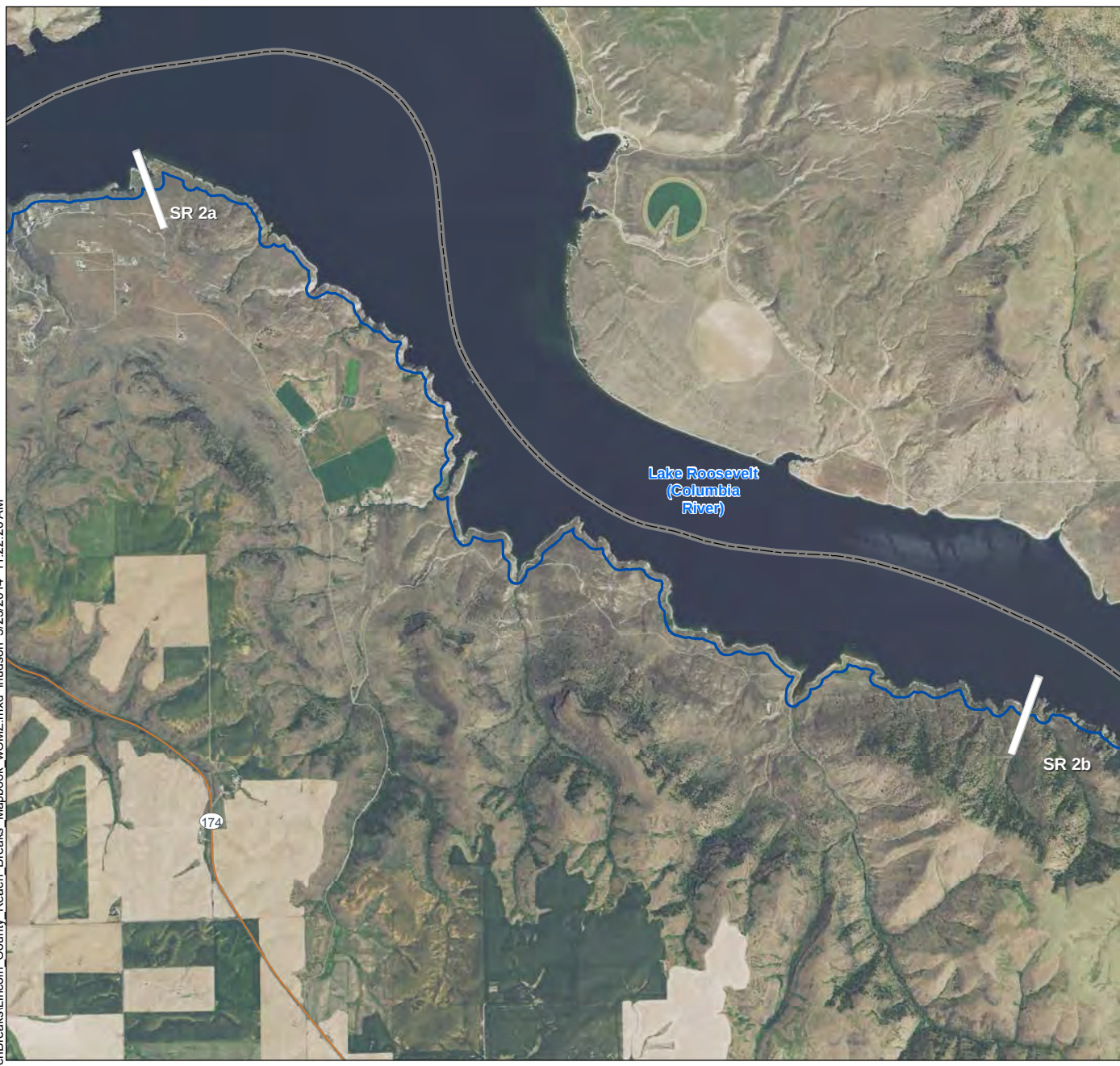
NOTES:
1. This information is to be used for planning purposes only.
Data is displayed as is and without any guarantee of accuracy or completeness.
2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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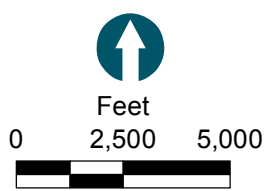


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

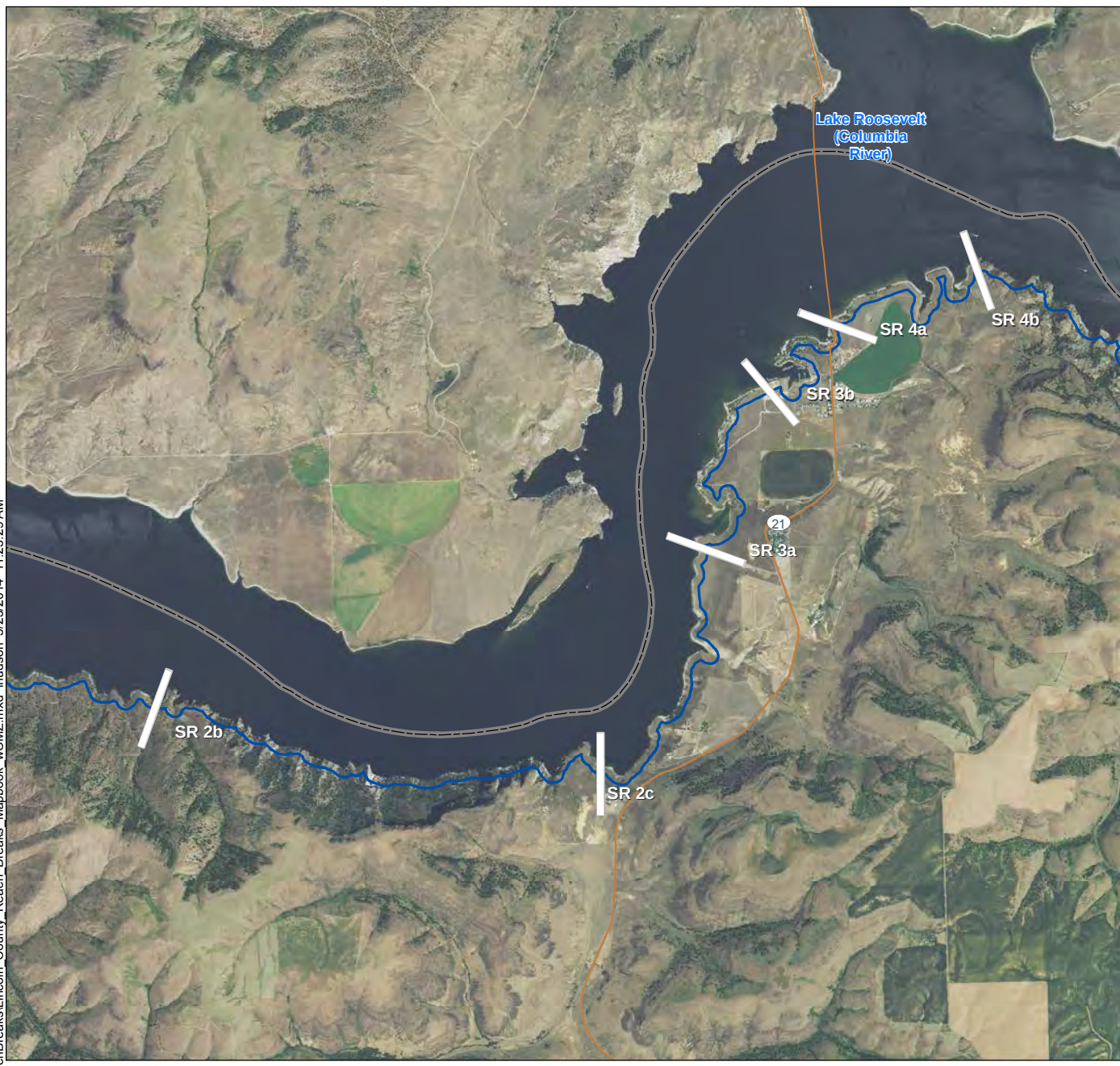
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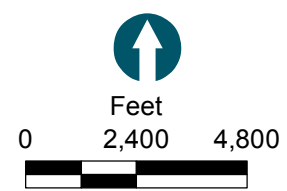


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

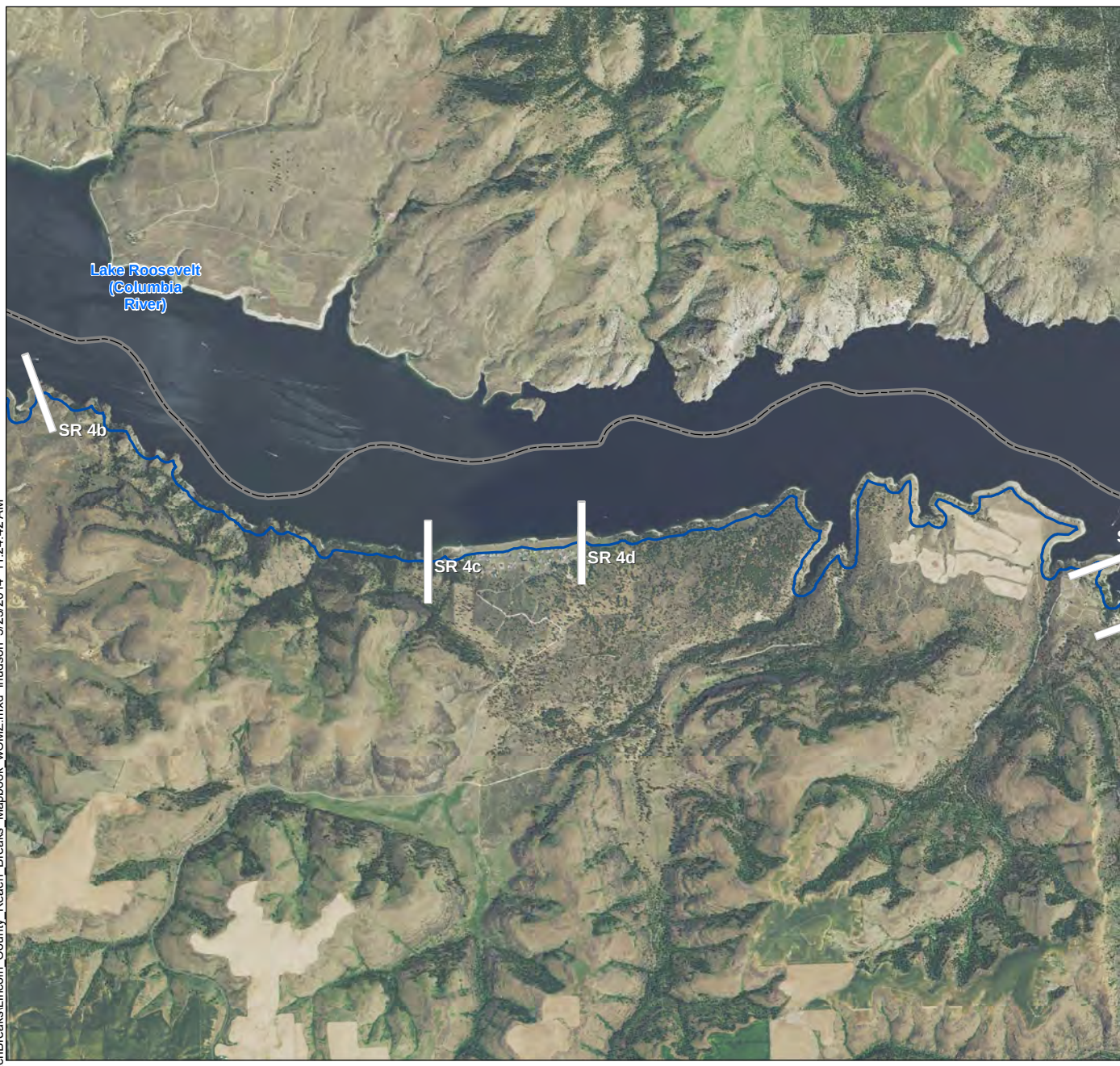
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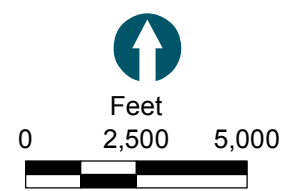


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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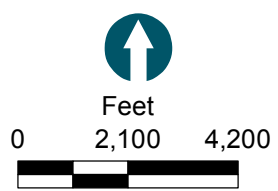


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:
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2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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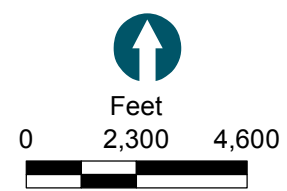


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

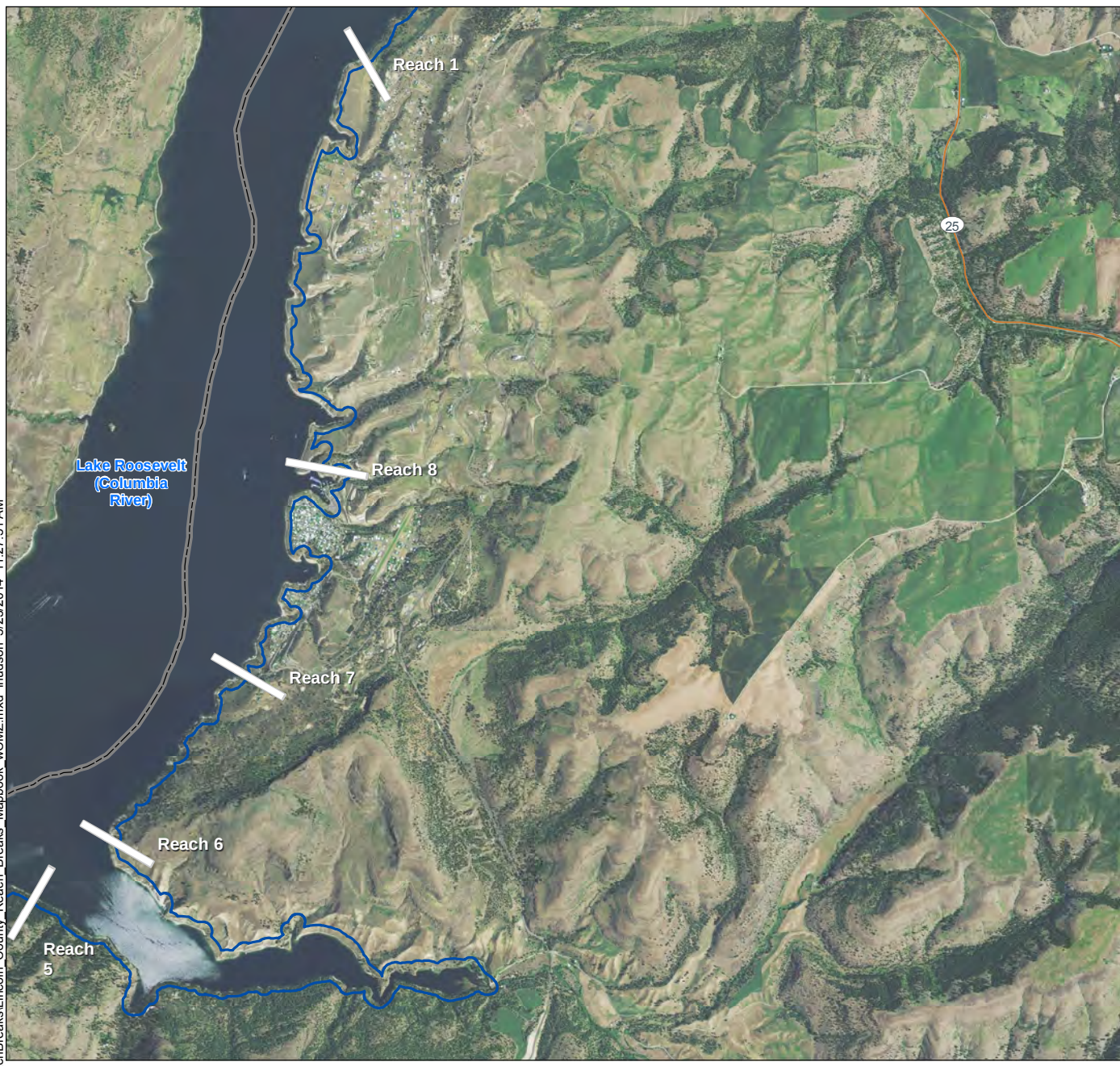
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2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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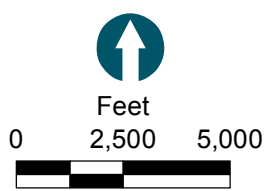


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:
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2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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Spokane River – Reach 1	Lincoln County
Reach Description: Spokane River from Spokane and Columbia River confluence to State Route 25 Bridge	
Shoreline Jurisdiction: 260 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 8:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Reach 1 is entirely publically owned by the National Park Service (NPS)	
Land Use/Current SMP: Land use designation: • Land use is Agricultural, Commercial, Parks/Recreation, and Rangelands • Zoning is Recreational and Agricultural Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Open space	
Geomorphic Character: Description: At its confluence with the Columbia River arm of Lake Roosevelt, Lake Roosevelt (Spokane River) is flanked by glacial lacustrine deposits, granite, quartzite and outburst flood deposits. Hardened banks: No artificial hardened banks appear to exist along the Reach 1 extent (left bank).	

Spokane River – Reach 1 Lincoln County
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and by upstream dams on the Spokane River. The reach contains soils that have severe erosion potential, but low liquefaction susceptibility. No significant of landslide hazards exist except a few small pockets of mass-wasting deposits.
Existing Public Access: No specific public access exists in this reach. Identified Public Access Improvements: None has been identified. Public Access Opportunities: Although there is opportunity for public access in this reach, existing access at Fort Spokane in Reach 2 seems to meet the public access needs. Fort Spokane trail and Fort Spokane Visitor Center are located in Reach 2. Reach 2 also contains Fort Spokane campground and boat launches.
ECOLOGICAL CONDITIONS
Water Quantity and Sediment: Water quantity is mainly regulated by Columbia River dam operations located in Canada, upstream dam operations on the Spokane River, and the Grand Coulee Dam downstream. The draft of Roosevelt Lake levels may cause movement of some sediment, but sediment can generally freely move in this reach. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.
Water Quality: This reach of the Spokane River is a water of concern (Category 2) for mercury and DDT. These issues were likely caused by past irrigation runoff and industrial processes in the upper Spokane River. Water quality may be temporarily impacted by boat recreation and related activities within this reach.
Habitat Characteristics and PHS Species Presence: The riparian zone in this reach is narrow and vegetation within the riparian area is sparse. This reach is characterized by cliffs and glacial lacustrine and outburst flood deposits along the shoreline, as well as some minor development related to residences and Fort Spokane. The slopes along the shoreline are occasionally steep in the beginning of this reach, but flatten out farther inland. The nearshore upland topography is flatter and slopes are not as steep around the mouth of the Spokane River. The vegetation in the riparian zone is generally limited to smaller shrubs (rabbitbrush and sagebrush species) due to substrate type, and the prevailing climate and geological constraints of the slopes. The reach includes a few small coves related to drainage from the uplands and into the waterway, where vegetation is more prevalent, consisting primarily of scrub-shrub and pines. Near the Highway 25 bridge and Fort Spokane, the riparian area is managed for recreational use and access to the shoreline. Resident and lake associated species include westslope cutthroat, kokanee, rainbow trout, eastern brook

Spokane River – Reach 1 Lincoln County

trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. There is documented presence of bald eagle and gray wolf along the shoreline. Mule deer, northwest white-tailed deer, and rocky mountain elk are present in the uplands and likely make use of the riparian zone.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Upland development:

- Isolated development and recreational roads and trails outside of jurisdiction boundary
- Some access roads leading to existing and planned development
- Irrigated landscaping at north end of subreach

Upland development primarily affects aquatic habitat functions of forage and rearing through impacts to water quality via runoff. It may also impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors.

Agricultural use:

- Plowed irrigation field in and near the shoreline
- Informal trails to water access (potentially from grazing cattle)

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may also affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock and large mammal wildlife activity may cause reduced or disturbed shoreline vegetation, compacted soils, or allow establishment of invasive species, impacting riparian functions such as erosion control, aquatic and terrestrial habitat, and terrestrial migratory corridors.

Recreational use:

- Informal trails
- Motorized boat use
- Boat camping
- In-water booms
- Breakwater

Recreational use has minor impacts to water quality through potential releases of contaminants; may result in reduced or disturbed shoreline vegetation and compacting soils impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Woody or grass buffer vegetation in between agricultural fields and shoreline, especially in small segment nearest water's edge, and potentially re-grading and planting areas of soils that may be prone to mass wasting events

Potential Protection Opportunities: Protect native riparian and shrub-steppe vegetation to preserve and support re-establishment of this land cover type by managing recreation activity and perhaps livestock usage in some areas. Implement stormwater controls for new development consistent with Eastern

Spokane River – Reach 1	Lincoln County
Washington Stormwater Manual requirements.	

Spokane River – Reach 2 Lincoln County

Reach Description: Spokane River from State Route 25 Bridge to river mile 65.

Shoreline Jurisdiction: 3,498 acres



Source: <https://fortress.wa.gov/ecy/coastalatlant/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches (SR); see Figures 8, 9, and 10:

SR A: Begins at Route 25 bridge and extends 13 miles along the bend, ending one-half mile upstream of Porcupine Bay

SR B: Extends 3 miles to the southeast

SR C: Extends 9 miles, ending at river mile 65

CHARACTERISTICS

Ownership: Primarily public (National Park Service [NPS] and Washington Department of Natural Resources [DNR]) with a small amount of private ownership near Porcupine Bay in SR A and near Mill Canyon in SR C.

Land Use/Current SMP:

Land use designation:

- Land use is Agricultural, Commercial, and Rangelands
- Zoning is Recreational

Current SMP Environment Designation: Not available

Spokane River – Reach 2	Lincoln County
Existing Land Cover/Development: Open space. Adjacent uses include agricultural development. SR A includes State Route 25, a bridge crossing, and a recreational facility with docks.	
Geomorphic Character: Description: Lake Roosevelt (controlled by the Grand Coulee Dam) is flanked by glacial lacustrine and outburst flood deposits and bedrock that includes hornfels, dacite, volcanic rocks, granite, and quartzite. Mass wasting is evident along steep banks adjacent to the lake. Hardened banks: No artificial hardened banks appear to exist along the Reach 2 extent.	
Flooding and Geological Hazards: Flood risk is managed by the Grand Coulee Dam at the downstream end and upstream dams on the Spokane River. SR A is mostly severe erodible soils and a minor amount of slight erodible soils where slopes are not as steep. SRs B and C are predominantly severe erodible soils. Sections of SR A are soils made of river alluvium, which has high liquefaction potential and also creates designated landslide hazards when combined with steep (>15%) slopes. SR B is almost entirely composed of outburst flood deposits on very steep slopes. SR C has pockets of alluvial deposits and mass-wasting deposits, most of which are on slopes steeper than 15%, which creates designated landslide hazards.	
Existing Public Access: Fort Spokane trail and Fort Spokane Visitor Center are located in this reach. The shoreline also contains the Fort Spokane campground and boat launches. Crystal Cove, Ponderosa, and Detillion have campsites and are boat-in access only. Porcupine Bay (SR A) has a boat launch, campground, and parking. Laughbon Landing Road, south of Porcupine Bay, provides access to a campground. Identified Public Access Improvements: The preferred alternative in the Lake Roosevelt Plan identifies the following improvements: • Add low-impact (gravel) overflow parking lot at Fort Spokane and Porcupine Bay • Widen the boat launch at Fort Spokane • Add new boat-in campground in Cougar Cove • Designate group boat-in campsites in Detillion • Add vault toilet on site upstream of Cayuse Cove • Replace private, noncompliant docks and launches with a single public, primitive boat launch Public Access Opportunities: Planned and existing public access opportunities seem adequate for this reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity is mainly regulated by Columbia River dam operations located in Canada, upstream dam operations on the Spokane River, and the Grand Coulee Dam downstream. The draft of Lake Roosevelt	

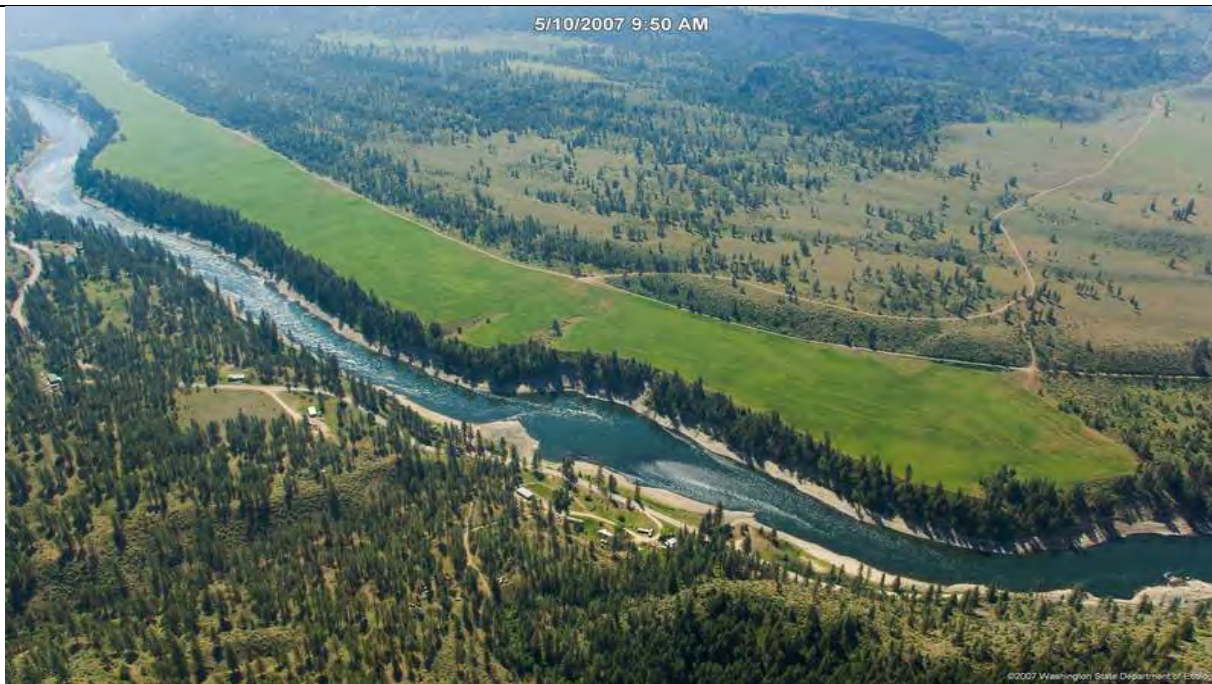
Spokane River – Reach 2 Lincoln County
levels may cause movement of some sediment, but sediment can generally freely move in this reach. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.
Water Quality: This reach of the Spokane River is on the 303(d) list (Category 5) for polychlorinated biphenyls (PCBs), likely caused by past electrical equipment processes. Water quality may be impacted by agricultural runoff in this reach.
Habitat Characteristics and PHS Species Presence: The riparian zone in SRs A, B, and C is narrow due to climate and geological constraints. This reach is characterized by interspersed cliffs and includes bedrock, glacial lacustrine, outburst flood deposits, and mass wasting deposits. Some minor development related to individual residences and smaller residential subdevelopments is located along the shoreline. The slopes along the shoreline are occasionally steep in the beginning of this reach, and the river channel meanders through a relatively wider channel based on the width of the valley floor. Water levels in this reach may fluctuate significantly due to water management regimes. The vegetation in the riparian zone is minimal in the lower elevations, and includes smaller shrubs (rabbitbrush and sagebrush species) with few grasses due to substrate type. Tree species include pines on the steeper slopes, with more complex riparian communities, including deciduous trees, located in creek mouths and small coves related to drainage from the uplands and into the waterway. A section of SR A has been documented to support one rare plant species: Nuttall’s pussy-toes. Fish in this reach include summer steelhead, white sturgeon, with resident and lake associated species include westslope cutthroat, kokanee, rainbow trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, walleye, and burbot. There is documented presence of bald eagle, gray wolf, along the shoreline. Several bat species (Yuma myotis, Townsend’s big-eared bat) are noted along the shoreline. Mule deer, northwest white-tailed deer, and rocky mountain elk are present in the uplands and may make use of the riparian zone.
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)
SUBREACH A
Level of Existing Function: Partially Functioning Stressors: Upland development: • Highway 25 crossing • Boat ramps • Over-water structures and associated parking lots within recreation area near bridge and near Porcupine Bay recreation area • In-water booms, near south end of sub-reach development and access roads • Lawn (potentially fill) and bulkhead area near Pleasant Hill Drive Upland development primarily affects aquatic habitat functions of forage and rearing through impacts to

Spokane River – Reach 2 Lincoln County
water quality via runoff. It may also affect migratory movement function and may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors and erosion protection. Recreational use: • Motorized boat use • Boat camping Recreational use may impact water quality in the aquatic habitat through potential releases of contaminants, which may affect forage and rearing functions. It may also result in reduced or disturbed shoreline vegetation and compacting soils, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Evaluate opportunities to incorporate aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) along with soft bank stabilization techniques, particularly to support habitat substrate and water access opportunities. Potential Protection Opportunities: Protect native riparian and shrub-steppe vegetation to preserve and support re-establishment of this land cover type. Limit recreation access within intact riparian and shrub-steppe areas. Stormwater controls for new development consistent with Eastern Washington Stormwater Manual.
SUBREACH B
Level of Existing Function: Partially Functioning Stressors: • Agricultural fields • Isolated rural development • One access road to water Potential Restoration Opportunities: Woody or grass vegetation buffers in between agricultural fields and shoreline Potential Protection Opportunities: Protect cove areas from heavy recreation use; consider encouraging public access moorage outside of vegetated areas, especially those areas providing high-quality habitat including riparian and shrub-steppe habitat.
SUBREACH C
Level of Existing Function: Partially Functioning Stressors: • Isolated rural and possibly campground development • Multiple access roads within shoreline jurisdiction Potential Restoration Opportunities: Consider incorporating aquatic habitat complexity (substrate, organic

Spokane River – Reach 2**Lincoln County**

material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) within small off-channel coves where aquatic species may take refuge

Potential Protection Opportunities: Protect cove areas from heavy recreation use; consider encouraging public access moorage outside of vegetated areas, especially those areas providing high-quality habitat including riparian and shrub-steppe habitat.

Spokane River – Reach 3	Lincoln County
Reach Description: Spokane River from RM 65 to Little Falls Dam	
Shoreline Jurisdiction: 276 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 11:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Majority of Reach 3 is private with a small amount of federal ownership.	
Land Use/Current SMP: Land use designation: • Land use is Agricultural and Commercial • Zoning is Recreational Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Open space and rural residential development. Adjacent development includes agricultural development.	
Geomorphic Character: Description: Downstream of Little Falls Dam, the Spokane River flows within a steep walled valley flanked mostly by outburst flood deposits along the southern (left) bank and granodiorite along the northern (right) bank. The river flows enter the Lake Roosevelt Reservoir controlled by the Grand Coulee Dam downstream at Coulee City. Hardened banks: No artificial hardened banks appear to exist along the Reach 3 extent (left bank).	

Spokane River – Reach 3	Lincoln County
Channel Migration Zone (CMZ) characterization: The Spokane River flows at the base of steep bluffs that are comprised of mostly outburst flood deposits. The ongoing incision within the valley maintains the river alignment and controls the CMZ through this reach. Evidence of mass wasting is present in the outburst flood deposits along the left bank bluffs. Because the river is entrenched through this reach, the CMZ is limited due to the ongoing incision. The CMZ is delineated downstream until the backwater effects of Roosevelt Lake are present.	
Flooding and Geological Hazards: Flood risk is managed by Grand Coulee Dam at the downstream end and upstream dams on the Spokane River. Reach 3 contains soils that have severe erodible potential, but generally low liquefaction susceptibility except a few local sections of alluvial deposit where liquefaction potential is moderate to high. These sections, as well as a section of outburst flood deposits downstream of Little Falls Dam, present designated landslide hazards combined with slopes steeper than 15%.	
Existing Public Access: No specific shoreline public access exists in this reach. Most of the reach area is privately owned and is not part of the Lake Roosevelt National Recreation area. Identified Public Access Improvements: None identified Public Access Opportunities: Opportunities for public access are limited in this reach due to steep slope in some parts of the shoreline and existing agricultural use. Vacant and undeveloped areas could provide public access as they develop. The public access in adjacent reaches up and downstream may address the lack of public access conditions in this reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity is mainly regulated by Columbia River dam operations located in Canada, upstream dam operations on the Spokane River, and the Grand Coulee Dam downstream. The draft of Roosevelt Lake levels may cause movement of some sediment, but sediment can generally freely move in this reach. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.	
Water Quality: This reach of the Spokane River is on the 303(d) list (Category 5) for total dissolved gas (TDG), likely due to hydropower operations immediately upstream. Additionally, water quality may have limited impacts from rural residential development and potential agricultural runoff in this reach.	

Spokane River – Reach 3**Lincoln County****Habitat Characteristics and PHS Species Presence:**

Reach 3 is the reach immediately downstream of Little Falls Dam. In general, the riparian zone within this reach is intact, but relatively narrow at the downstream end, where it consists primarily of smaller shrubs (rabbitbrush and sagebrush species) with scattered pines and minimal herbaceous cover due to substrate type and the slope of the banks at this end of the reach. The shoreline includes some areas where slopes are more gradual, and the riparian zone is adjacent to upland cultivated fields. Where the slopes are more gradual, more complex riparian cover is present, including deciduous trees. Water levels in this reach may fluctuate significantly due to upstream water management regimes.

Fish in this reach include resident and lake associated species include westslope cutthroat, kokanee, Dolly Varden/bull trout, rainbow trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, and walleye. California floater mussels and western ridgemussels are noted just downstream of the dam. There is documented presence of bald eagle along the shoreline. Mule deer, northwest white-tailed deer, and rocky mountain elk are present in the uplands and may make use of the riparian zone.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Upland development:

- Fairly isolated rural development
- Dirt roads and more formal access roads within jurisdiction

Upland development may affect aquatic habitat functions of forage and rearing through impacts to water quality via runoff. It may also affect migratory movement function and may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors and erosion protection.

Recreational use:

- Motorized boat use
- Boat camping

Recreational use may impact water quality in the aquatic habitat through potential releases of contaminants, which may affect forage and rearing functions. It may also result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Agricultural use:

- Plowed and irrigated fields in and outside of boundary

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may also affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and

Spokane River – Reach 3**Lincoln County**

migratory corridors.

Potential Restoration Opportunities: Establish riparian buffers where absent particularly in areas abutting agriculture fields

Potential Protection Opportunities: Limit recreation access within intact riparian and wetland areas; stormwater controls for new development consistent with Eastern Washington Stormwater Manual.

Spokane River – Reach 4	Lincoln County
Reach Description: Spokane River from Little Falls Dam to Long Lake Dam	
Shoreline Jurisdiction: 226 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 12:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Majority is private with one stretch of public (Washington Department of Natural Resources [DNR]) land 0.67 miles upstream of Little Falls Dam.	
Land Use/Current SMP: Land use designation: • Land use is Agricultural • Zoning is Recreational Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Open space, State Route 231, and bridge crossing. Adjacent uses include agricultural development.	
Geomorphic Character: Description: Downstream of the Long Lake Dam, the Spokane River flows within a steep walled valley flanked by granodiorite and outburst flood deposits. Through this reach, the Spokane River flows at the base of steep bluffs that are comprised of diorite (mostly in the area of the Long Lake Dam) and outburst	

Spokane River – Reach 4 Lincoln County
flood deposits. Sporadic diorite outcrops are present along the bank in the lower extents of the reach. Hardened banks: Artificial hardened banks are not present in this reach. CMZ characterization: The Spokane River is confined within its valley walls throughout this reach. Even though a majority of the bluffs are comprised of outburst flood deposits, the ongoing incision within the valley maintains the river alignment and CMZ through this reach. Upstream of Little Falls Dam, bedrock is present along the channel controlling the extent of the CMZ along the left bank. Backwater effects of the dam extend upstream in the channel defining the downstream extent of the CMZ in this reach.
Flooding and Geological Hazards: Flood risk is managed by Long Lake Dam releases from the upstream end of the reach and Little Falls Dam releases at the downstream end of the reach. The outburst flood deposits along the left bank of Little Falls Reservoir have severe erosion potential except areas with diorite bedrock where erosion potential is slight. Except for the locations with diorites, most of Reach 4 is designated a landslide hazard area.
Existing Public Access: The Little Falls Dam area has public access from Little Falls Road. The reservoir upstream is used for fishing and boating although no formal boating dock or fishing pier exist in this reach. Ownership is mostly private in this reach. The Spring Creek Road (State Route 231) crossing the Spokane River offers visual access to the river. Identified Public Access Improvements: No improvement has been identified. Public Access Opportunities: Opportunities exist for boating and trail facilities in this reach.
ECOLOGICAL CONDITIONS
Water Quantity and Sediment: Water quantity inflow is regulated by Little Falls Dam releases downstream and Long Lake Dam releases upstream. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.
Water Quality: This reach of the Spokane River is on the 303(d) list (Category 5) for total dissolved gas (TDG) and has a total maximum daily load (TMDL) in place (Category 4A) for lead and zinc. These issues are likely due to hydropower operations and industrial processes upstream. Additionally, water quality may be impacted by agricultural runoff in this reach.

Spokane River – Reach 4**Lincoln County****Habitat Characteristics and PHS Species Presence:**

Reach 4 is between Little Falls Dam and Long Lake Dam. In general, the river in this reach is narrow, and the riparian zone within this reach varies in width and vegetation types. At the downstream end, the riparian zone consists primarily of smaller shrubs (rabbitbrush and sagebrush species) with scattered pines and minimal herbaceous cover due to substrate type and the slope of the banks at this end of the reach. A section of Reach 4 has been documented to support one rare plant species and one rare woodland type: gray stickseed and ponderosa pine/bitterbrush woodland. The shoreline includes some areas where upland topography is relatively flat, and the riparian zone is adjacent to or utilized by upland cultivated fields. Along the agricultural reach toward the tailrace of Long Lake Dam, the shoreline slopes appear to be reinforced by riprap. In locations where shoreline slopes are more gradual and no agricultural activity occurs in the uplands, more complex riparian cover is present, including deciduous trees. Water levels in this reach may fluctuate significantly due to upstream water management regimes.

Fish in this reach include white sturgeon, with resident and lake associated species including westslope cutthroat, rainbow trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, burbot, and walleye. There is documented presence of bald eagle and osprey in this reach along the shoreline. Mule deer and northwest white-tailed deer are present in the uplands and may make use of the riparian zone.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Upland development:

- Dam infrastructure and operations
- Irrigated landscaping and isolated rural development
- Highway crossing

Upland development primarily affects aquatic habitat functions of forage and rearing through impacts to water quality via runoff. Dam operations impact water quantity and connectivity to floodplain, which affect both aquatic habitat functions and riparian functions, including migratory corridors, and provision of forage and rearing functions. Upland development may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors.

Agricultural use:

- Plowed irrigation field and irrigated lands in and outside of boundary

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals; it may affect water quality due to nutrient inputs from agricultural runoff.

Recreational use:

Spokane River – Reach 4**Lincoln County**

- Informal trails
- Motorized boat use
- Boat camping

Recreational use has minor impacts to water quality through potential releases of contaminants. It may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Consider incorporating aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) where it will not interfere with dam operations.

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual.

Spokane River (Long Lakes Reservoir) – Reach 5

Lincoln County

Reach Description: Spokane River from Long Lake Dam to Spokane County Boundary

Shoreline Jurisdiction: 227 acres



Source: <https://fortress.wa.gov/ecy/coastalatlant/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches (SR); see Figure 12:

Not Applicable.

CHARACTERISTICS

Ownership: Reach 5 is primarily private with some public land around Long Lake Dam.

Land Use/Current SMP:

Land use designation:

- Land use is Agricultural
- Zoning is Recreational

Current SMP Environment Designation: Not available

Existing Land Cover/Development: Open space and Long Lake Dam

Geomorphic Character:

Description: Long Lake Reservoir is controlled by Long Lake Dam. On the southern shore in Reach 5, the lake is flanked by bedrock shores consisting of granodiorite (Eocene Age, 33 to 55 million years before present) and outburst flood deposits.

Spokane River (Long Lakes Reservoir) – Reach 5	Lincoln County
Hardened banks: No artificial hardened banks exist along the Reach 5 extent. More than half of the lake shoreline in this reach consists of bedrock.	
Flooding and Geological Hazards: Flood risk is managed by Nine Mile Dam releases from the upstream end of the reach and Long Lake Dam releases at the downstream end of the reach. The reach has thin layers of soils that have severe erosion potential, but generally low liquefaction susceptibility due to the bedrock underneath. In the upstream area near Spokane County, designated landslide hazards are present where steep slopes are underlain by outburst flood deposits.	
Existing Public Access: Long Lake Dam is located on the west edge of the reach and has no public access. One access road from Devils Gap road parallels the east edge of the shoreline. No other public access is available in this reach. Identified Public Access Improvements: No improvement has been identified. Public Access Opportunities: Opportunities exist on the east edge of the reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Water quantity inflow is regulated by Long Lake Dam releases downstream and Nine Mile Dam releases upstream. Sediment input is restricted by upstream dams, but tributary inflow and/or landslide potential in this reach may cause sediment input.	
Water Quality: Spokane Lake is on the 303(d) list (Category 5) for PCBs; has a total maximum daily load (TMDL) in place (Category 4A) for total phosphorus and zinc; is impaired (Category 4C) by invasive exotic species; and is a water of concern (Category 2) for DDE, DDD, heptachlor epoxide, endrin, aldrin, chlordane, DDT, PCB, and dieldrin. These issues are likely due to electrical processes, industrial processes, agricultural runoff, and wastewater treatment processes.	
Habitat Characteristics and PHS Species Presence: Reach 5 is the portion of the pool above Long Lake dam that is within Lincoln County. In general, the river in this reach is much wider, and the riparian zone within this reach is sparse, and consists primarily of smaller shrubs (rabbitbrush and sagebrush species) with scattered pines and minimal herbaceous cover due to substrate type and the slope of the banks. The area around Reach 5 has been documented to support two rare plant species: gray stickseed and western ladies' tresses. Water levels in this reach may fluctuate significantly due to upstream water management regimes. Fish in this reach include westslope cutthroat, rainbow trout, eastern brook trout, mountain whitefish, smallmouth bass, largemouth bass, burbot and walleye. The dam presents an upstream fish passage	

Spokane River (Long Lakes Reservoir) – Reach 5**Lincoln County**

barrier. There is documented presence of bald eagle and osprey in this reach along the shoreline, as well as presence of cavity nesting ducks. Mule deer and northwest white-tailed deer are present in the uplands and may make use of the riparian zone.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Upland development:

- Dam infrastructure and operations
- Irrigated landscaping and isolated rural development
- Highway crossing

Upland development primarily affects aquatic habitat functions of forage and rearing through impacts to water quality via runoff. Dam operations impact water quantity and connectivity to floodplain, which affect both aquatic habitat functions, as well as riparian functions including migratory corridors, and provision of forage and rearing functions. Upland development may impact continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors.

Recreational use:

- Informal trails
- Motorized boat use
- Boat camping

Recreational use has minor impacts to water quality through potential releases of contaminants; it may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Consider Incorporating aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) where it will not interfere with dam operations.

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual.

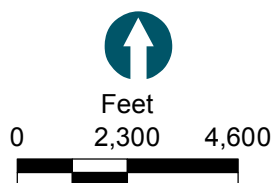
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|--|---|
|  Reach and Subreach (SR) Breaks |  Incorporated City |
|  Populated Place |  County Boundary |
|  County Seat |  SMA Jurisdiction |
|  Interstates | |
|  Highways | |
|  Channel Migration Zone | |

NOTES:

1. This information is to be used for planning purposes only.
Data is displayed as is and without any guarantee of accuracy or completeness.
2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



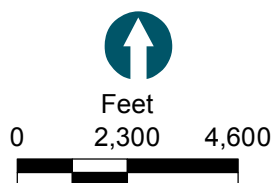
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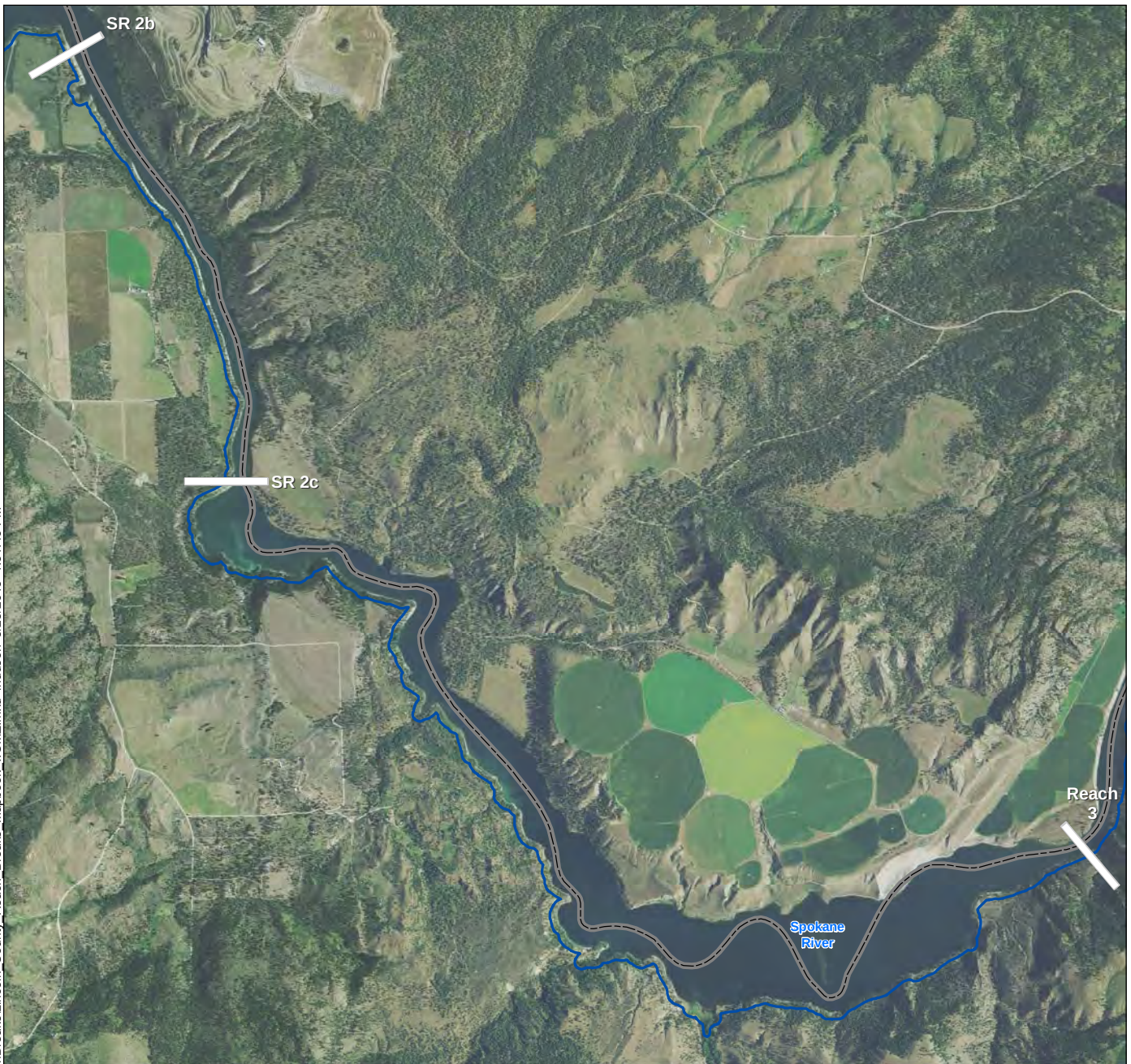
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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:

1. This information is to be used for planning purposes only.
Data is displayed as is and without any guarantee of accuracy or completeness.
2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



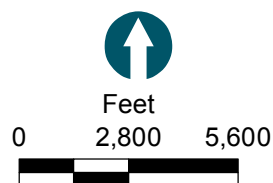
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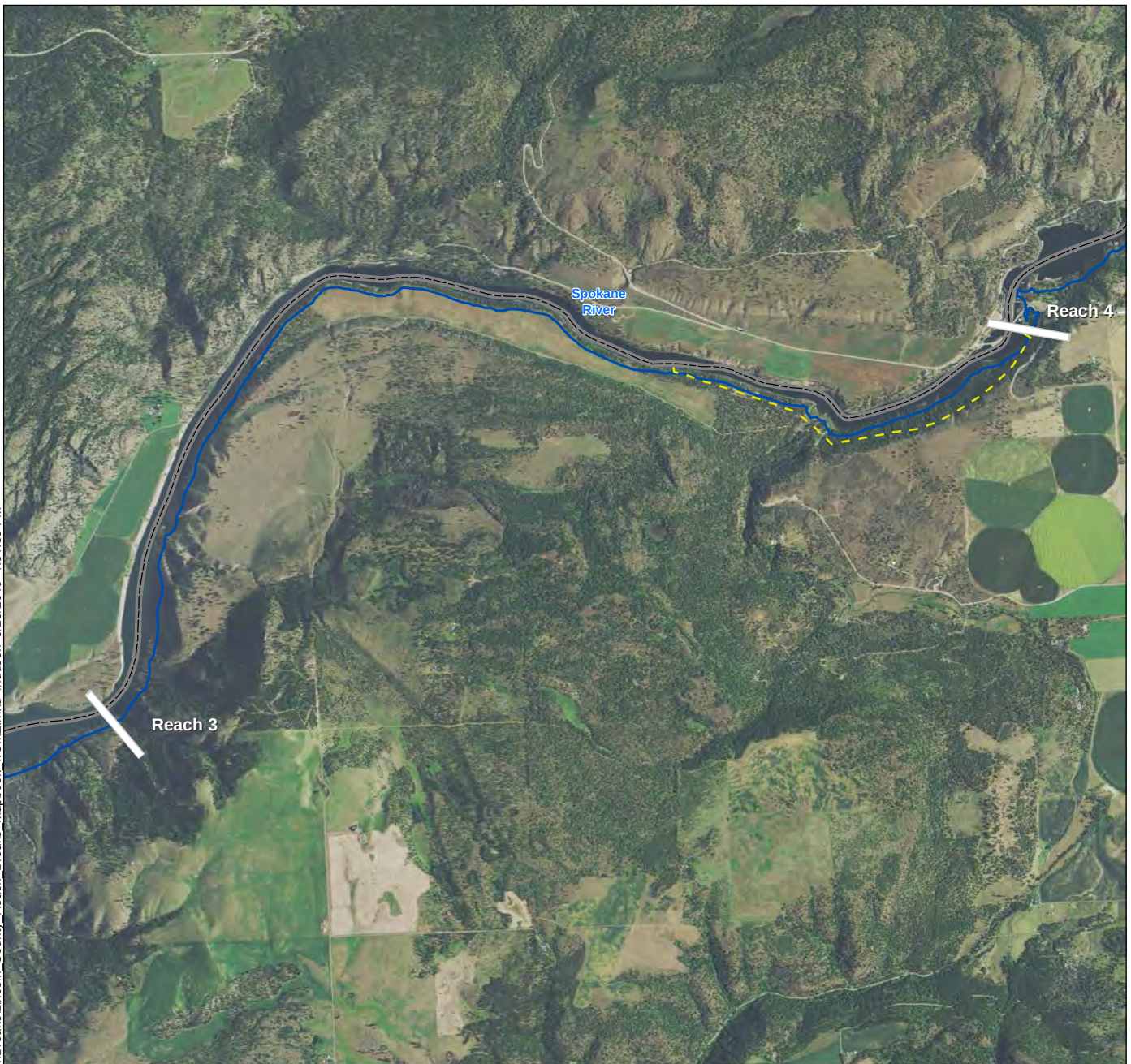
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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:

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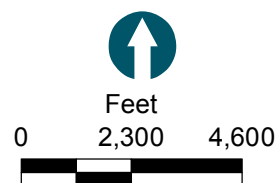
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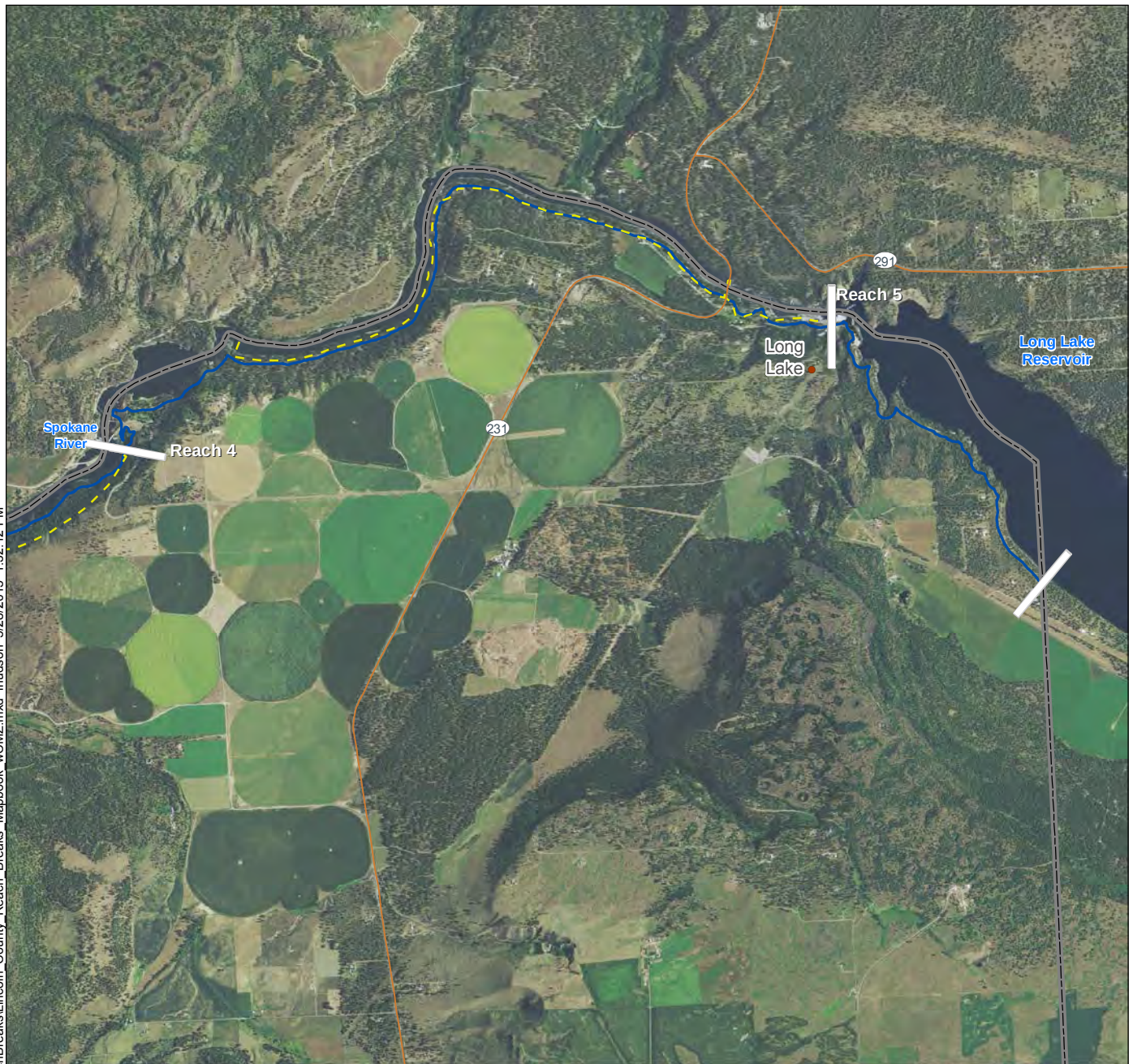
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| Reach and Subreach (SR) Breaks | Incorporated City |
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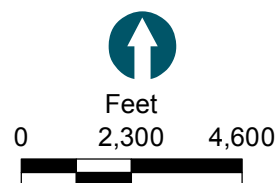
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- | | |
|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:

1. This information is to be used for planning purposes only.
Data is displayed as is and without any guarantee of accuracy or completeness.
2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



**Crab Creek – Reach 1 and
Peterson Lake**

Lincoln County

Reach Description: Crab Creek from Grant County boundary to the upstream channel of Peterson Lake

Shoreline Jurisdiction: 581 acres



Source: <https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches (SR); see Figure 13:

Not applicable

CHARACTERISTICS

Ownership: Most of downstream half of Reach 1 is public (Bureau of Land Management [BLM]). The shoreline around Peterson Lake is primarily private.

Land Use/Current SMP:

Land use designation:

- Land use is Agricultural
- Zoning is Agricultural

Current SMP Environment Designation: Rural

Existing Land Cover/Development: Open space and agriculture (grazing, some irrigated lands)

Geomorphic Character:

Description: Throughout this reach, the stream flows within a wide alluvial valley with large wetland complexes and floodplain. The valley bottom consists of alluvium with bedrock defining the southern extent of the valley. Along the northern valley margins, bedrock outcrops are present. The Burlington Northern Railroad (BNRR) crosses the stream at one location, and is aligned within the floodplain separating

Crab Creek – Reach 1 and Peterson Lake	Lincoln County
stream and floodplain flow paths. This reach also includes Peterson Lake within the floodplain. Hardened Banks: The railroad embankment limits channel migration extents and channel locations within the floodplain along both stream banks totaling approximately 2,700 feet. Channel Migration Zone (CMZ) Characterization: The CMZ encompasses most of the entire 100-year floodplain and valley bottom. Crab Creek flows within a wide alluvial valley with large wetland complexes within a wide floodplain. Multiple flow paths are present through the large wetland complex creating a wide CMZ throughout this reach. For a portion of the reach, the BNRR alignment bisects the CMZ with flow paths along either side of this alignment. In places, the BNRR alignment represents a disconnected migration area (DMA) through this reach. A CMZ is not delineated for the shoreline of Peterson Lake.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through this reach of Crab Creek. The floodplain is generally limited on one side by the railroad. Adjacent soils are designated to have slight erosion potential. Soils have moderate liquefaction susceptibility. Mostly flat wetland complex presents no landslide hazards.	
Existing Public Access: No public access is currently available. Identified Public Access Improvements: No improvement has been identified. Public Access Opportunities: BLM owns a major portion of the shoreline. Public access opportunities are limited due to the sensitive nature of the shoreline. Peterson Lake has opportunity for public access.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area—up to approximately 1,200 square miles at the downstream end of this reach, or over half of the area of Lincoln County. Marlin Hollow is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediment may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: This reach of Crab Creek is on the 303(d) list (Category 5) for pH and dissolved oxygen and is a water of concern (Category 2) for temperature and bacteria. This is likely due to high temperatures combined with low flows in the summer, as well as pasture runoff.	

Crab Creek – Reach 1 and Peterson Lake**Lincoln County****Habitat Characteristics and PHS Species Presence:**

This reach contains two branches of Crab Creek, along with Peterson Lake. In the first half of the reach, these branches meander between the berm associated with adjacent railroad tracks, and Peterson Mende/Marlin Road. In portions of this reach, the lower branch of Crab Creek is artificially constrained from its normal meander by the presence of the railroad tracks. Both branches of the creek go under railroad tracks and continue on the south side of the tracks before joining together in a meandering channel with natural and artificially formed side channels at the end of this reach. The riparian area of Reach 1 of Crab Creek is relatively free of structures or developments aside from the railroad tracks and several bridge spans that are primarily used by farm machinery and farm vehicles to cross the larger (southern) arm of Crab Creek. The lands adjacent to and between the branches of the creek are in agricultural use, either in crop production or grazing/pasture land for cattle. These agricultural activities affect the riparian zone in this reach through either water withdrawals for irrigation, or through livestock use which affects shoreline stability and water quality. The riparian zone width ranges from the width of the creek (tens of feet) to several hundred feet of riparian palustrine wetland area that spans between the southern and northern branches of Crab Creek, although the largest wetland area is bisected by the railroad tracks. Small trees (alder, willow, chokecherry, and Hawthorn) and shrubs (water birch, red osier dogwood, and mock orange) flank the streambed, and palustrine wetlands dominate. The pasture/grazing generally occurs in the patches of grassland in the middle range of this reach. There are approximately 362 acres of wetlands present (NWI), primarily palustrine emergent with some riparian forested present in small patches. The other portion of this reach includes Peterson Lake. The riparian area around Peterson Lake is also constrained to a very narrow strip around the lake, although there are lacustrine wetland areas near the adjacent Crab Creek that support more vegetation, predominantly grasses and some shrubs. The riparian zone of the lake is impacted by cattle use, and the lake experiences algal blooms at the north end adjacent to Crab Creek, and at the southern end of the lake. Peterson Lake water levels recede, sometimes significantly, in the late summer months.

The reach attracts significant numbers of waterfowl during certain times of the year and is noted for presence of loggerhead shrike, Swainson's hawk, sage sparrow, Washington ground squirrel, badger, and white-tailed jackrabbit in the uplands, and these species may make use of the riparian habitat within this reach. This reach of Crab Creek provides habitat for bass, mountain whitefish walleye, and brown and rainbow trout.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Agricultural use:

- Irrigated agricultural fields adjacent to the riparian zone
- Livestock impacts

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural run-

**Crab Creek – Reach 1 and
Peterson Lake**

Lincoln County

off or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Upland development:

- Railroad crossings and railroad berm constraints

Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat.

Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and streambanks; removal and management of invasive species

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.

Crab Creek – Reach 2	Lincoln County
Reach Description: Crab Creek from the upstream of Peterson Lake to the end of small section of agricultural development	
Shoreline Jurisdiction: 79 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 13:	
Not applicable	
CHARACTERISTICS	
Ownership: Reach 2 is entirely private.	
Land Use/Current SMP: Railroad parallels the shoreline in this reach. Land use designation: • Land use is Agricultural • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space and agriculture (grazing, some irrigated lands)	
Geomorphic Character: Description: Throughout this reach, the stream flows within a narrow, bedrock confined valley and floodplain. The southern valley boundary is mostly defined by bedrock valley wall. The Burlington Northern Railroad (BNRR) alignment is located along the northern edge of the valley. This alignment limits channel	

Crab Creek – Reach 2	Lincoln County
migration to the north. Hardened Banks: The BNRR alignment creates an artificial channel boundary and banks along the northern (right bank) side of the stream throughout most of this reach totaling approximately 3,300 feet. Channel Migration Zone (CMZ) Characterization: The northern boundary of the CMZ is defined by the BNRR alignment and the southern boundary is mostly defined by bedrock valley wall. These two features create a narrow CMZ along the entire reach length.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through this reach of Crab Creek. The floodplain is generally limited on one side by the railroad. Adjacent soils are designated to have slight erosion potential. A portion of the reach contains alluvial soil moderately susceptible to liquefaction. Flat valley floor present no landslide hazard.	
Existing Public Access: No significant public access is currently available. One small culvert crosses the railroad and Crab Creek from Peterson Mende Road East, giving access to the agricultural land south of the shoreline. Identified Public Access Improvements: No improvements have been identified. Public Access Opportunities: Public access opportunities are limited due to the narrow width of the creek and agricultural use of the shoreline.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediment may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: Water quality in this reach is likely impacted by agricultural runoff.	
Habitat Characteristics and PHS Species Presence: This reach contains the portion of Crab Creek that runs primarily adjacent to the railroad tracks. The riparian area is free of structures or developments in this reach, with the exception of a small wooden crossing that is likely used by cattle and farm equipment. The lands adjacent to the creek on the opposite side of the creek from the railroad tracks include a mix of dry scrub-steppe bluffs, irrigated lands that are potentially mown for hay or used for grazing cattle, and some patches of palustrine wetland riparian habitat. The riparian habitat on either side of the Creek in this reach is very narrow, partially constrained by the bluffs along the shoreline. Shrub and small trees (red osier dogwood and willow) and grasses (likely	

Crab Creek – Reach 2	Lincoln County
reed canary grass) flank the creek in the wetter areas, adjacent to the railroad tracks, with vegetation likely disturbed by cattle activity. In the portions of the shoreline in this reach that are adjacent to the shrub-steppe habitat, the vegetated riparian zone is much narrower, consisting of grasses and forbs, adjacent to steppe habitat with shrubs such as rabbitbrush. Channel migration potential is low due to the confinement of the railroad tracks and nature of the surrounding area. The reach, particularly near Peterson Lake, attracts significant numbers of waterfowl during certain times of the year and is noted for the presence of loggerhead shrike, prairie falcon, sage sparrow, mule deer, and white-tailed jackrabbit in the uplands. These species may make use of the riparian habitat within this reach. This reach provides habitat for warm-water fish species such as bass, mountain whitefish walleye, and brown and rainbow trout.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
SUBREACH A	
Level of Existing Function: Partially Functioning Stressors: Agricultural use: • Irrigated agricultural fields adjacent to the riparian zone • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Upland development: • Railroad berm constraints Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat. Recreational use: • Informal trails near Peterson Lake Recreational use may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern	

Crab Creek – Reach 2**Lincoln County**

Washington Stormwater Manual; consolidation of livestock access areas.

Crab Creek – Reach 3	Lincoln County
Reach Description: Crab Creek, the approximate section between small agricultural development to the railroad crossing west of Town of Irby	
Shoreline Jurisdiction: 128 acres	
	
Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 13:	
Not applicable	
CHARACTERISTICS	
Ownership: Approximately half public (Bureau of Land Management [BLM]; Washington Department of Natural Resources [DNR]) and half private ownership.	
Land Use/Current SMP: Land use designation: • Land use is Agricultural • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space	
Geomorphic Character: Description: Throughout this reach, the stream flows within a narrow, bedrock valley along a large meander bend. Valley walls consist of bedrock basalt with alluvium and bedrock comprising the valley floor. The stream channel is incised and confined throughout most of this reach. No major infrastructure is present in this reach. Due to the limited valley width, agriculture lands are not present. In areas, multi-thread flow paths are present.	

Crab Creek – Reach 3	Lincoln County
Hardened Banks: Artificial hardened banks are not present in this reach. Channel Migration Zone (CMZ) Characterization: CMZ within this reach is narrow and is limited by the presence of bedrock along both banks. The channel is confined and incised throughout this reach. No major infrastructure is present to limit channel migration.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through this reach of Crab Creek. The floodplain is generally limited on one side by the railroad. A portion of the reach contains alluvial soil moderately susceptible to liquefaction. A minor amount of steep slopes (>15%) along the valley present landslide hazards.	
Existing Public Access: No public access is currently available. DNR owns land on the west side of the reach. Identified Public Access Improvements: No improvements have been identified. Public Access Opportunities: Public access opportunities are limited due to the narrow width of the creek and lack of access road from the vicinity.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediment may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: Water quality in this reach is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: The riparian area this reach of Crab Creek is absent any structures or developments aside from the railroad tracks. The riparian zone is generally intact along the full length of both sides of the shoreline, and varies in width from just a few feet to approximately the width of the creek. There is a large adjacent palustrine riparian wetland area in the mid-section of this reach as the creek meanders to the south, away from the confinement of the railroad track berm. In this area, the riparian zone vegetation is characterized by the presence of larger deciduous trees, potentially including black cottonwoods and alder, in addition to the grassy shrub vegetation that is present along the full extent of the shoreline. The creek meanders between multiple channels and across wetland area. The creek in this reach sees high use by wildlife and cattle for watering at certain locations along the southern/southwestern banks. This southern meander of the creek, as well as the vegetation conditions, becomes constrained by the presence of steeper upland shrub-steppe	

Crab Creek – Reach 3**Lincoln County**

bluffs to the south. An area of more dense riparian forest cover with multiple layers of vegetation exists at this point where run-off is likely conveyed from the uplands down into the creek; cottonwoods and other large trees, smaller trees and native shrubs (willows and red osier dogwood), and grasses are all present in this area of the shoreline. At this point, the creek turns back to the north and the riparian vegetation zone begins to narrow again. This reach terminates at the point where the creek goes under the railroad tracks, at which point the riparian zone has become increasingly narrow.

There are wetlands present, primarily palustrine emergent with some riparian forested present in small patches. Channel migration potential is moderate due to the constraints of the surrounding upland bluffs and railroad berm, but indications of a northern channel are apparent.

The reach attracts significant numbers of waterfowl during certain times of the year, and is noted for presence of bats (*Yuma myotis*), and prairie falcon, and these species may make use of the riparian habitat within this reach. This reach of Crab Creek provides habitat for bass, mountain whitefish walleye, and brown and rainbow trout.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Agricultural use:

- Irrigated agricultural fields adjacent to the riparian zone
- Livestock impacts

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals; may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Upland development:

- Railroad crossings and railroad berm constraints

Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. Affects connectivity to floodplain which may affect water quality for forage and rearing functions of aquatic habitat.

Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.

Crab Creek – Reach 4	Lincoln County
Reach Description: Crab Creek from the railroad crossing thorough the town of Irby	
Shoreline Jurisdiction: 127 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 14:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Reach 4 is privately owned.	
Land Use/Current SMP: Land use designation: • Land use is Residential and Agricultural • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space, agriculture, and Irby Road bridge crossing	
Geomorphic Character: Description: Throughout this reach the stream flows within a moderately wide bedrock valley. The valley bottom consists of both bedrock and alluvium. The channel is incised and confined throughout much of the reach with low hydraulic energy. Hardened banks: Artificial hardened banks associated with the railroad alignment total 3,600 feet. Channel Migration Zone (CMZ) characterization: Crab Creek flows within a bedrock valley with a valley	

Crab Creek – Reach 4	Lincoln County
bottom consists of both bedrock and alluvium. Even though the valley is widens in places, the CMZ is narrow due to the presence of bedrock, infrastructure and channelized character of the stream. The stream has a narrow CMZ upstream of the Irby Road crossing where stream is channelized through agriculture lands. The BNRR alignment crosses channel at two location limiting channel migration locally.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through this reach of Crab Creek. The floodplain is generally limited on one side by the railroad. Adjacent soils are designated to have slight erosion potential. The reach mostly consists of alluvial soils moderately susceptible to liquefaction. Designated landslide hazard areas exist on slopes greater than 15%.	
Existing Public Access: Irby Road N provides visual access to the shoreline. No other access is available. Identified Public Access Improvements: No improvements have been identified. Public Access Opportunities: Public access opportunities are limited due to the nature of the shoreline and railroad paralleling the shoreline for the most part.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediment may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: This reach of Crab Creek is on the 303(d) list (Category 5) for pH and turbidity and is a water of concern (Category 2) for temperature and dissolved oxygen, likely due to low flows and high temperatures in the summer.	
Habitat Characteristics and PHS Species Presence: This reach contains shoreline habitat of Crab Creek that has been partially modified (channelized/straightened, and potentially cut off from a previous meander) to provide irrigation supply to adjacent agricultural fields. This reach runs parallel to the north side of the railroad tracks before crossing under them and continuing south to the end of the reach. The riparian area is free of structures or developments in this reach, but as a result of the surrounding land uses, the riparian habitat on either side of the creek is very narrow and generally consists of rushes and sedges, grasses, small shrubs, and an occasional larger deciduous tree (e.g., cottonwood, alder) or cluster of mixed trees that are related to a rural residence in this reach. Invasive species within this reach likely include canarygrass, perennial pepperweed, knapweed, rush skeletonweed, and Russian olive. Upland habitat outside of the agricultural	

Crab Creek – Reach 4**Lincoln County**

areas is shrub-steppe habitat, and the riparian zone adjacent to the scrub-steppe uplands is narrow as well, consisting mostly of rushes, sedge, grasses, and occasional small shrubs due to the geological and climate constraints on vegetation.

The riparian zone may also be affected by cattle use. Channel migration potential is low due to the confinement of the railroad tracks and nature of the surrounding area.

The reach is noted for presence ferruginous hawk, greater sage grouse, white-tailed jackrabbit, sage sparrow, and mule deer in the uplands, and these species may make use of the riparian habitat within this reach. This reach of Crab Creek provides habitat for warm-water fish species such as bass, mountain whitefish walleye, and brown and rainbow trout.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Agricultural use:

- Irrigated agricultural fields adjacent to the riparian zone
- Livestock impacts

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Upland development:

- Railroad crossings and berm constraints

Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat.

Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.

Crab Creek – Reach 5	Lincoln County
Reach Description: Crab Creek between the eastern edge of Town of Irby and the western edge of Town of Odessa	
Shoreline Jurisdiction: 472 acres	
	
Source: https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figures 14: Not Applicable.	
CHARACTERISTICS	
Ownership: Approximately half public (Bureau of Land Management [BLM]) and half private ownership. A majority of the downstream reach is private and the upstream reach is mostly public.	
Land Use/Current SMP: Land use designation: • Land use includes Residential and Non-taxable Federally owned land by BLM • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space and agriculture. Adjacent development includes a cemetery.	
Geomorphic Character: Description: Throughout this reach, the stream flows within a confined and unconfined bedrock valley and consists of large bedrock meander bends. Areas of multi-thread channel flow paths are present, creating a wide floodplain. In other areas, stream segments are incised and channelized with low hydraulic energy resulting in a narrow floodplain. Valley widths range from narrow and confined in the downstream extents to wider valley sections outside of Odessa where agriculture lands occupy the wider valley floor. As the	

Crab Creek – Reach 5	Lincoln County
valley widens in the vicinity of Odessa, the valley floor consists of outburst flood deposits; however, bedrock is visible along the channel. Hardened banks: Multiple Burlington Northern Railroad (BNRR) channel crossings occur in this reach. In addition, the BNRR alignment is adjacent to the channel along segments of the reach, totaling 6,000 feet. Channel Migration Zone (CMZ) characterization: Crab Creek flows within a confined to unconfined valley. Areas of multi-thread channel flow paths are present, creating wider CMZ areas, and segments of the stream are incised and channelized with low-hydraulic energy resulting in narrow CMZ areas. The CMZ is wider in the upstream portions of the reach (immediately downstream of Odessa), where the floodplain is wide and agriculture lands occupy the valley floor. In the lower portion of the reach, the CMZ is narrow and confined within the bedrock valley and limited by the BNRR alignment. In addition, the BNRR alignment crosses the stream at four locations within this reach creating hard points limiting channel migration locally.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in the valley of Crab Creek. The upstream portion of this reach (near the Town of Odessa) is part of a detailed FEMA flood study where the floodway is defined. The reach contains a minor amount of moderately erodible soils. Alluvial soils along the most of the reach have moderate liquefaction potential. Designated landslide hazards exist on slopes greater than 15%.	
Existing Public Access: Cemetery/Napier Road parallels the shoreline on the east side. This reach has some federal land (BLM) along the shoreline. Odessa Lake Creek Trail (BLM 2009) on the Lakeview recreation area runs from Odessa to Lake Creek. Identified Public Access Improvements: BLM proposes an off-highway vehicle route on the Lakeview recreation area from Odessa to Lake Creek trail. Public Access Opportunities: Public access opportunities within the shoreline are limited due to the nature of shoreline and agricultural land use around it at some locations.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Lake Creek is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: This reach of Crab Creek is on the 303(d) list (Category 5) for pH. Water quality in this reach is likely	

Crab Creek – Reach 5	Lincoln County
impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: This meandering reach contains shoreline habitat of Crab Creek that is generally constrained by either the bedrock channel, the location of the railroad berm, or both. In addition, this reach provides irrigation supply to adjacent agricultural fields and, under some circumstances, the creek may experience a dry channel in certain portions. The constraints of the channel, as well as the lack of surface waters during the summer, constrain the riparian habitat in certain areas to very narrow strips immediately adjacent to the creek channel. In some locations of this reach, areas of multi-thread channel flow paths are present, containing a wetland system of riparian habitat between and among the channels. Other subsections have very minimal amount of vegetation adjacent to the creek and appear to be more heavily utilized by grazing cattle. While the riparian area is free of developments in this reach, there are a number of locations where the creek runs immediately adjacent to the railroad berm or crosses under the railroad tracks. The riparian habitat on either side of the creek varies in width and generally consists of rushes, grasses, low growing herbaceous cover, small shrubs, and an occasional larger tree or cluster of trees. There are some areas where the canopy on either side of the creek closes over the creek bed. The area around Reach 5 has been documented to support two rare plant species: Snake River cryptantha and Washington polemonium. As the creek nears Odessa, it shows signs of running dry, and the riparian habitat is patchy and consistent with riverine intermittent habitat. This reach is noted for presence numerous bird species, including American white pelican, ferruginous hawk, Swainson’s hawk, loggerhead shrike, sage thrasher, sage sparrow; mammals including white-tailed jackrabbit, mule deer, badger, Washington ground squirrel, Western small-footed myotis, Yuma myotis; and racer in the uplands, and these species may make use of the riparian habitat within this reach. This reach of Crab Creek provides habitat for warm-water fish species such as bass, mountain whitefish walleye, and brown and rainbow trout.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Agricultural use: • Irrigated agricultural fields adjacent to the riparian zone • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Upland development: • Railroad crossings	

Crab Creek – Reach 5**Lincoln County**

- Berm constraints

Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat.

Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.

Crab Creek – Reach 6	Lincoln County
Reach Description: Crab Creek from the eastern edge of Town of Odessa to the downstream outlet of Sylvan Lake	
Shoreline Jurisdiction: 213 acres	
	
Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 15:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Reach 6 is privately owned.	
Land Use/Current SMP: Land use designation: • Land use is Residential and Agricultural • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space, agriculture, minor residential development, and two road crossings at State Route 28 and Coyote Heights Road N	
Geomorphic Character: Description: Throughout this reach, the stream lies within a semi-confined to unconfined valley. The valley floor throughout consists of alluvium and outburst flood deposits. Agriculture lands flank the channel on both	

Crab Creek – Reach 6	Lincoln County
sides in the wider valley segments. Bedrock comprises the valley walls. Bedrock limits channel migration to north in areas of the valley. Hardened banks: Artificial hardened banks are generally not present in this reach. A minor amount of hardened banks may be associated with the Highway 28 and Kings Road North bridge crossings. Channel Zone Migration (CMZ) characterization: Crab Creek lies within a semi-confined to unconfined valley where bedrock limits channel migration to the north along portions of the reach. The CMZ varies in width and is limited in a few places by the presence of bedrock, as well as the Highway 28 and Coyote Heights Road North bridge crossings. The stream is channelized along a segment downstream of Kings Road North crossing, limiting the width of the CMZ.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in the valley of Crab Creek. The downstream portion of this reach (near the Town of Odessa) is part of a detailed FEMA flood study where the floodway is defined. Adjacent soils are designated to have slight erosion potential and very low to moderate liquefaction susceptibility. Alluvial soils present designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: State Route 28 crosses the Crab Creek shoreline providing visual access to the shoreline. Identified Public Access Improvements: No improvements have been identified. Public Access Opportunities: Public access opportunities are limited due to the agricultural land use along the shoreline.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach but upstream input may be reduced due to Sylvan Lake being immediately upstream.	
Water Quality: This reach of Crab Creek is on the 303(d) list (Category 5) for temperature, pH, and bacteria. Water quality in this reach is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: This reach provides irrigation supply to adjacent agricultural fields, and under some circumstances the creek may experience a dry channel in certain portions of this reach. The channel is relatively unconfined by artificial hardening or bedrock channelization, but the channel is constrained by diversions and straightening of the	

Crab Creek – Reach 6**Lincoln County**

channel through agricultural fields. As the reach begins just outside of Odessa just before the creek crosses under Highway 28, areas of multi-thread channel flow paths are present, containing a marshy wetland system of riparian habitat between and among the channels. The riparian habitat on either side of the Creek is generally very narrow east of Highway 28 as the creek channel is managed for agricultural purposes, and it is through this section where the creek may run dry, and the riparian habitat is patchy and consistent with riverine intermittent habitat. The uplands contain shrub-steppe habitat and agricultural use diminishes. As the creek nears Sylvan Lake at the end of the reach, the riparian area expands and becomes much wider, and the vegetation is characterized by shrubs and small trees, with occasional clusters of larger trees such as cottonwoods.

This reach, particularly near Sylvan Lake, is noted for presence numerous bird species, including black tern, great blue heron, long-billed curlew; mammals including white-tailed jackrabbit, Washington ground squirrel; and sagebrush lizard in the uplands, and these species may make use of the riparian habitat within this reach. This reach of Crab Creek provides habitat for warm-water fish species such as brown and rainbow trout.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Agricultural use:

- Irrigated agricultural fields adjacent to the riparian zone
- Livestock impacts

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Upland development:

- Residential and industrial development within Odessa, including structures and roads
- Railroad crossings
- Berm constraints

Development of structures and roadways may affect water quality through runoff, impacting rearing and forage functions of aquatic habitat. Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat.

Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields, residential or commercial developments and stream banks; removal and management of invasive species

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual.

Crab Creek (Sylvan Lake) – Reach 7 Lincoln County
Reach Description: Crab Creek (Sylvan Lake) from downstream outlet to upstream inlet, including associated wetlands surrounding the mouth of Coal Creek
Shoreline Jurisdiction: 813 acres
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx
Subreaches (SR); see Figures 15: Not Applicable.
CHARACTERISTICS
Ownership: Primarily private with a very small amount of public ownership (Washington Department of Natural Resources [DNR]) near the southeast corner of Sylvan Lake.
Land Use/Current SMP: Land use designation: • Land use is Residential and Agricultural • Zoning is Agricultural Current SMP Environment Designation: Rural
Existing Land Cover/Development: Open space
Geomorphic Character: Description: Sylvan Lake is a natural lake feature that exists along the alignment of Crab Creek. Crab Creek is the primary inflow and outflow of the lake. The geologic units that comprise the lake include basalt, alluvium, and outburst flood deposits. Lakes are stagnant water features that do not flow and have the hydraulic energy to migrate throughout the floodplain. Channel migration zones (CMZs) are not established for lakes. Hardened banks: Artificial hardened banks are not present in this reach.

Crab Creek (Sylvan Lake) – Reach 7 Lincoln County
CMZ characterization: There is no delineated CMZ because the reach consists of Sylvan Lake.
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps, but flood risk in this reach tends to be confined to the lake area. The reach contains a minor amount of severely erodible soils on the northwest and southeast corner of Sylvan Lake. Soils generally have moderate to high liquefaction susceptibility. Alluvial soils along the southern shoreline of Sylvan Lake present designated landslide hazard where slopes are greater than 15%.
Existing Public Access: Sylvan Lake has dirt road access. The lake consists of fishing opportunities. Land around the lake is mostly privately owned. DNR owns land bordering the lake on the southeast side. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Opportunities exist to improve public access and recreational facilities along the Sylvan Lake shoreline.
ECOLOGICAL CONDITIONS
Water Quantity and Sediment: Crab Creek drains a significant area. Coal Creek is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments will likely collect in this reach as the lake will likely slow velocities down in this reach such that sediments will drop out.
Water Quality: Water quality in this reach is likely impacted by agricultural and pasture runoff.
Habitat Characteristics and PHS Species Presence: This reach includes the riparian area around Sylvan Lake, which is a natural lake feature that exists along the alignment of Crab Creek. Crab Creek is the primary inflow and outflow of the lake. The lake area is categorized as palustrine habitat surrounded by shrub-steppe upland, with very minimal development or improvements present around the perimeter of the lake. Some areas of the shoreline have steep, near vertical banks with no apparent riparian zone. In general, around much of the lake, the riparian area is intact, but narrow, and vegetation consists primarily of low-growing shrubs and grasses, with a few clusters of taller trees located along the north central shoreline of the lake, as well as the south-eastern shoreline, becoming denser near the end of the reach. The uplands consist of scrub-shrub steppe habitat, with vegetation predominated by rabbitbrush, sagebrush, and grasses. The lake is noted for the presence numerous bird species, including black tern, great blue heron, and long-

Crab Creek (Sylvan Lake) – Reach 7 Lincoln County
billed curlew; with white-tailed jackrabbit, Washington ground squirrel, and sagebrush lizard in the uplands. These upland species may make use of the riparian habitat within this reach. This reach of Crab Creek provides habitat for warm-water fish species such as brown and rainbow trout.
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)
Level of Existing Function: Functioning Stressors: Agricultural use: • Irrigated agricultural fields adjacent to the riparian zone • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks at the entrance and outflow areas; removal and management of invasive species Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas; consolidation of recreational access.

Crab Creek – Reach 8	Lincoln County
Reach Description: Crab Creek between Sylvan Lake and the mouth of South Fork Crab Creek	
Shoreline Jurisdiction: 511 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figures 16:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Reach 8 is primarily private with a small amount of public ownership (Washington Department of Natural Resources [DNR]) intersecting 2 miles downstream of the mouth of South Fork Crab Creek.	
Land Use/Current SMP: Land use designation: • Land use is Residential and Agricultural • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space, agricultural, and two road crossing at Laney Brothers Road North and Rocky Ford Road North	
Geomorphic Character: Description: Throughout this reach, the stream flows within a wide valley that is dominated by agriculture land use. Bedrock bluffs comprise the valley walls with alluvium comprises most of the valley floor. The FEMA 100-year floodplain boundary is generally wide throughout due to the low valley elevations. However, the stream is channelized through much of the agriculture lands, limiting migration. The stream flows along the northern bedrock valley boundary for much of its length limiting the extent of the migration	

Crab Creek – Reach 8	Lincoln County
to the north of the channel. Hardened banks: Hardened banks likely exist along the alignment of Laney Brother Road East, which defines the northern stream boundary for portion of the reach extent for approximately 4,000 feet. In addition, Laney Brothers Road, Downs Road North, and Rock Ford Road cross the stream channel. Channel Migration Zone (CMZ) characterization: Crab Creek flows within a wide bedrock valley through much of this reach. However, the stream is channelized and incised through much of the agriculture lands limiting the CMZ width. The stream is aligned along the northern bedrock valley boundary for much of its length limiting the extent of the CMZ to the north. Laney Brothers Road, Downs Road North, and Rock Ford Road cross the stream channel creating hard points limiting channel migration locally.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through the downstream end and a relatively confined area through the upstream end of this reach. Adjacent soils are designated to have slight erosion potential and generally moderate to high liquefaction susceptibility. Alluvial soils present designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: Laney Brothers Road E parallels a portion of Crab Creek on the north side. Few shoreline crossings exist in this reach. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access opportunities are limited on Crab Creek shoreline due to existing agricultural land use around it.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. South Fork Crab Creek is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: This reach of Crab Creek is a water of concern (Category 2) for pH and dissolved oxygen. Near its confluence with South Fork Crab Creek, Crab Creek is on the 303(d) list (Category 5) for pH. Water quality in this reach is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: This reach provides irrigation supply to adjacent agricultural fields, and the channel is constrained by either	

Crab Creek – Reach 8**Lincoln County**

the steep slopes of upland bluffs, the channelization imposed by the agricultural development, or both. As a result of surrounding geological constraints and land use patterns, the riparian area through this reach is narrow and likely managed to prevent encroachment into cultivated fields. There are pockets of riparian habitat that have also been degraded and de-vegetated through heavy use by cattle. Several roads cross Crab Creek, and there are other smaller informal crossings along this reach. The upland bluffs contain shrub-steppe habitat and agricultural use diminishes. As the creek nears the end of the reach near Rocky Ford Road North, the agricultural use ends and the riparian area expands as the creek channel becomes more natural and unconfined.

This reach has little land area that is not in cultivation, and few PHS are noted in the vicinity. This reach of Crab Creek provides habitat for warm-water fish species such as brown and rainbow trout.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Impaired

Stressors:

Agricultural use:

- Irrigated agricultural fields adjacent to the riparian zone
- Livestock impacts

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Upland development:

- Road crossings

Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat.

Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.

Crab Creek – Reach 9	Lincoln County
Reach Description: Crab Creek, the approximate section between South Fork Crab Creek confluence to Estate Rd N crossing.	
Shoreline Jurisdiction: 560 acres	
 Source: https://fortress.wa.gov/ecy/coastalatl/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 17: Not Applicable.	
CHARACTERISTICS	
Ownership: Approximately half of public (Bureau of Land Management [BLM]) and half private ownership.	
Land Use/Current SMP: Land use designation: • Land use includes Residential and non-taxable, federally owned land by BLM • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space and Harrington Tokio Road crossing	
Geomorphic Character: Description: Throughout this reach, the stream generally flows in a narrow bedrock valley within the basalt formations. The channel alignment is controlled by the bedrock throughout. The narrow valley width and incised channel result in a narrow 100-year floodplain. Due to the narrow valley and floodplain extents, agriculture land use is essentially nonexistent throughout. Wider channel migration zone (CMZ) areas exist in the areas where channel scars are present within the floodplain. In this area, soils are dominated by	

Crab Creek – Reach 9	Lincoln County
Emdent Silt Loam, an all-hydric soil. Areas of outburst flood deposits comprise the valley floor and margins. However, the stream channel is still confined throughout this area as well. Hardened banks: Artificial hardened banks are not present in this reach. Bedrock channel margins limit migration. Limited infrastructure exists within this reach. Harrington Tokio Road crosses the stream at one location. CMZ characterization: Throughout this reach, the stream generally flows in a narrow bedrock valley where the channel alignment is limited by the presence of bedrock throughout. The narrow valley width and incised channel result in a narrow CMZ. Wider CMZ areas exist in the areas where channel scars are present within the valley bottom and floodplain. The Harrington Tokio Road North crosses the stream channel, creating a hard point limiting channel migration locally.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk through this reach of Crab Creek. Adjacent soils are designated to have slight erosion potential and generally very low liquefaction susceptibility. A portion of the reach consists of flood deposits, which can be designated as landslide hazards where slopes are greater than 15%.	
Existing Public Access: Most of the shoreline in this reach is owned by the BLM. No public access is available in this shoreline. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access opportunities are limited in Crab Creek shoreline due to the nature of shoreline and agricultural land use around it.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: This reach of Crab Creek is a water of concern (Category 2) for pH and dissolved oxygen. Near its confluence with South Fork Crab Creek, Crab Creek is on the 303(d) list (Category 5) for pH. Water quality in this reach is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: The riparian habitat on either side of the creek is generally very narrow due to the narrow confinement of	

Crab Creek – Reach 9	Lincoln County
the bedrock creek channel, particularly at the beginning of the reach, just east of Rocky Ford Road. The uplands are characterized by shrub-steppe habitat vegetation, and agricultural use is low. Vegetation in the riparian zone is limited to mostly small shrubs and grasses, with a few clusters of smaller trees. The area around Reach 9 has been documented to support two rare plant species: Spalding’s silene and Washington polemonium. The midsection of this reach is characterized by the presence of multiple channels, some very close together, others separated by several yards. This is particularly apparent near areas where smaller creeks drain into Crab Creek. In some areas, localized water runoff from steeper upland bluffs creates conditions that support wider riparian zones characterized by taller trees and more complex communities. Some areas of the riparian zone in this middle reach are degraded through heavy use by cattle. The riparian zone near the end of this reach grows wider and may be several times wider than the width of the creek channel. Vegetation patterns transition from plants common to shrub-steppe habitat interspersed with palustrine wetland patches consisting of taller trees, shrubs, and more complex riparian communities. This reach, particularly near Rocky Ford Creek Road, is noted for presence of ferruginous hawk and Swainson’s hawk, Columbia spotted frog, tiger salamander, Yuma myotis, little brown myotis, and Western small-footed myotis. This reach of Crab Creek provides habitat for warm-water fish species such as brown and rainbow trout, and has been noted for presence of California floater mussels.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Functioning Stressors: Agricultural use: • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality due to nutrient inputs from livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.	

Crab Creek – Reach 10	Lincoln County
Reach Description: Crab Creek, the approximate section between Estate Rd N crossing and Doerschlag Rd E crossing	
Shoreline Jurisdiction: 419 acres	
	
Source: https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 18: Not Applicable.	
CHARACTERISTICS	
Ownership: There is a mixture of private and public ownership (Bureau of Land Management [BLM]; Washington Department of Natural Resources [DNR]).	
Land Use/Current SMP: Land use designation: • Land use is Residential and Agricultural • Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space, agriculture, and Estate Road North crossing	
Geomorphic Character: Description: Throughout this reach, the stream flows in a moderately-confined valley. Bedrock comprises the valley margins with alluvium (and a lesser extent outburst flood deposits) along the valley bottom. The FEMA 100-year floodplain occupies most of the valley bottom. In the lower extent of the reach, the channel is generally not confined, and the valley topography is flat. In the upper extent of the reach, the channel is	

Crab Creek – Reach 10	Lincoln County
more incised and channelized within the agriculture fields. At the very upstream of the reach extent, the channel generally flows along the bedrock valley margin, limiting the migration potential to the north. Hardened banks: Artificial hardened banks are not present in this reach. Limited infrastructure constraints exist within this reach. Two roads cross the stream in the reach at Estate Road and Doerschlag Road. Channel Migration Zone (CMZ) characterization: In the lower extent of the reach, the CMZ occupies a wide portion of the valley floor where the channel is generally not confined, and the valley topography is flat. In the upper extent of the reach, the CMZ narrows where the channel is more incised and confined within the agriculture fields. At the very upstream of the reach extent, the channel generally flows along the bedrock valley margin, limiting the extent of the CMZ and migration potential to the north. Estate Road and Doerschlag Road cross the stream channel, creating hard points limiting channel migration locally.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through this reach of Crab Creek. Adjacent soils are designated to have slight erosion potential and generally moderate to high liquefaction susceptibility. The valley floor mostly consists of alluvial deposits and a minor amount of outburst flood deposits, which can be designated as landslide hazards where slopes are greater than 15%.	
Existing Public Access: The west part of the shoreline is owned by BLM. A portion of shoreline in the middle of the reach is owned by DNR. No public access is currently available in this shoreline. Few local roads/culverts cross the shoreline in this reach. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access opportunities are limited on the Crab Creek shoreline due to the existing agricultural land use.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: This reach of Crab Creek is on the 303(d) list (Category 5) for dissolved oxygen and is a water of concern (Category 2) for bacteria and pH. Water quality in this reach is likely impacted by agricultural and pasture runoff.	

Crab Creek – Reach 10**Lincoln County****Habitat Characteristics and PHS Species Presence:**

The characteristic habitat of the riparian zone in this reach is divided roughly by Estate Road North. The reach to the west of Estate road is characterized by riparian habitat that is confined by the geologic conditions of the valley, but generally covers a very broad area much wider than the creek channel. The creek to the east of Estate Road provides irrigation supply to adjacent agricultural fields, and the channel is constrained by either the steep slopes of upland bluffs, the channelization imposed by the agricultural development, or both. As a result of surrounding geological constraints and land use patterns, the riparian area through this reach is narrow and likely managed to prevent encroachment into cultivated fields. The vegetation is dominated by grasses and some shrubs, with some stretches where trees have been allowed to grow, although these appear small, and generally occur on just one side of the creek. There are pockets of riparian habitat that have also been degraded and de-vegetated through heavy use by cattle. A section of Reach 10 has been documented to support two rare plant species: Spalding's silene and Washington polemonium.

There are a few informal creek crossings constructed by property owners. The upland bluffs contain shrub-steppe habitat and agricultural use is confined to the valley between the two bluff ridges. The agricultural use ends at approximately the end of the reach, but the riparian zone remains narrow.

This reach has little land area that is not in cultivation, and few PHS are noted in the vicinity. Particularly near the upper end near the brake with Reach 9, this reach is noted for presence of ferruginous hawk and Swainson's hawk, Columbia spotted frog, tiger salamander, Yuma myotis, little brown myotis, and Western small-footed myotis. This reach of Crab Creek provides habitat for warm-water fish species such as brown and rainbow trout, and has been noted for presence of California floater mussels.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Agricultural use:

- Irrigated agricultural fields adjacent to the riparian zone
- Livestock impacts

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species

Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.

Crab Creek – Reach 11	Lincoln County
Reach Description: Crab Creek from north of Doerschlag Rd E to the end of confined section (T22N R37E S34 SESE)	
Shoreline Jurisdiction: 87 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 19:	
Not Applicable.	
CHARACTERISTICS	
Ownership: Reach 11 is privately owned.	
Land Use/Current SMP:	
Land use designation:	
• Land use is Residential and Agricultural • Zoning is Agricultural	
Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space	
Geomorphic Character:	
Description: Throughout this reach, the stream generally flows in a narrow valley within the basalt outburst flood deposits. The reach includes one large stream meander at the foot of a bedrock plateau along the southern channel boundary. The stream is confined to a narrow valley in this reach due to the presence of bedrock along most of the channel margins. In parts of the reach, outburst flood deposits exist along	

Crab Creek – Reach 11	Lincoln County
northern channel margins. The channel is incised with a narrow floodplain. Hardened banks: Artificial hardened banks are not present in this reach. No infrastructure constraints exist within this reach. Channel Migration Zone (CMZ) characterization: The CMZ is narrow due to the presence of bedrock along most of channel and valley margins. In addition, the narrow floodplain and valley bottom width contribute to the narrow CMZ throughout most of this reach. No infrastructure is present limiting channel migration.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through this reach of Crab Creek. Adjacent soils are designated to have slight erosion potential and generally very low to low liquefaction susceptibility. A portion of reach consists of outburst flood deposits, which can be designated as landslide hazards where slopes are greater than 15%.	
Existing Public Access: No public access is currently available in this shoreline. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access opportunities are limited on Crab Creek shoreline due to lack of access roads.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Sheep Creek is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediment may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through this reach of Crab Creek.	
Habitat Characteristics and PHS Species Presence: The riparian habitat on either side of the Creek is generally very narrow due to the narrow confinement of the bedrock creek channel. The uplands throughout this reach are characterized by shrub-steppe habitat vegetation, and the land is not utilized for cultivation, but may be used for grazing cattle. This short reach has a few stretches with multiple channels, and in these locations the riparian habitat spans the channels and is, therefore, occasionally many yards wide. In some areas localized water runoff from steeper upland bluffs creates conditions that support riparian zones characterized by taller trees and more complex	

Crab Creek – Reach 11	Lincoln County
communities. Some areas of the riparian zone in this reach are degraded through heavy use by cattle. Vegetation patterns transition from plants common to shrub-steppe habitat interspersed with palustrine wetland patches consisting of taller trees, shrubs, and more complex riparian communities. This reach does not have significant noted PHS presence. It does provide habitat for warm-water fish species such as brown and rainbow trout.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Agricultural use: • Livestock impacts Agricultural use primarily affects water quality due to nutrient inputs from livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.	

Crab Creek – Reach 12**Lincoln County**

Reach Description: Crab Creek from the end of confined section (T22N R37E S34 SESE) to the end of wide alluvial valley (T22N R37E S13 SWSE)

Shoreline Jurisdiction: 253 acres



Source: <https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches (SR); see Figure 19:

Not Applicable.

CHARACTERISTICS

Ownership: Reach 12 is privately owned.

Land Use/Current SMP:

Land use designation:

- Land use is Residential and Agricultural
- Zoning is Agricultural

Current SMP Environment Designation: Rural

Existing Land Cover/Development: Open space, agriculture, and State Route 23 crossing

Geomorphic Character:

Description: Throughout this reach, the stream flows in a somewhat wide alluvial valley flanked by bedrock valley walls. In the lower portions of this reach, the channel is aligned mostly near the southern boundary of the floodplain at the foot of this bedrock. The valley bottom consists mostly of alluvium. In the lower part of the reach, the channel is incised and flows within a bedrock channel. Upstream, the floodplain

Crab Creek – Reach 12	Lincoln County
widens out in an area where tributaries join the right bank and historical flow paths exist in the right bank floodplain. Upstream of the Highway 23 bridge crossing, the stream is incised and channelized through much of the agriculture lands. The floodplain narrows in this section of the reach. The stream is aligned along the northern bedrock valley boundary in the upstream areas. Hardened banks: Artificial hardened banks are not present in this reach. Limited infrastructure constraints exist with Highway 23 crossing the channel at one location. Channel Migration Zone (CMZ) characterization: Crab Creek flows in a somewhat wide alluvial valley flanked by bedrock valley walls. The stream is incised and channelized in the upstream portions of the reach within the agricultural land use. The CMZ widens in area where tributaries join the right bank and historical flow paths exist in the right bank floodplain. In the lower part of the reach, the stream is incised and flows within a bedrock channel with a narrower CMZ. Along segments of the reach, the channel is aligned mostly near the valley boundaries limiting migration to the north and south. Highway 23 crosses the stream channel creating a hard point limiting channel migration locally.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively wide area through the downstream end of this reach of Crab Creek and a relatively confined area through the upstream end of this reach. Adjacent soils are designated to have slight erosion potential and moderate to high liquefaction susceptibility. Alluvial soils on the valley floor present designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: No public access is currently available in this shoreline. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access opportunities are limited in Crab Creek shoreline due to the nature of shoreline and agricultural land use around it.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Buttermilk Creek is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: This reach of Crab Creek is a water of concern (Category 2) for temperature and pH. Water quality in this	

Crab Creek – Reach 12	Lincoln County
reach is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: The Creek in this reach provides irrigation supply to adjacent agricultural fields, and the channel is constrained by either the steep slopes of upland bluffs, the channelization imposed by the agricultural development, or both. As a result of surrounding geological constraints and land use patterns, the riparian area through this reach is narrow and likely managed to prevent encroachment into cultivated fields. The vegetation is dominated by grasses and some shrubs, with some stretches where trees have been allowed to grow, although generally occur on just one side of the creek. There are pockets of riparian habitat that have also been degraded and de-vegetated through heavy use by cattle. A section of Reach 12 has been documented to support one rare plant species: Washington polemonium. There are a few informal creek crossings constructed by property owners. The upland bluffs contain shrub-steppe habitat and agricultural use is confined to the valley between the two bluff ridges. This reach has little land area that is not in cultivation, and few PHS are noted in the vicinity with the exception of white-tailed jackrabbit. This reach provides habitat for warm-water fish species such as brown and rainbow trout.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Impaired Stressors: Agricultural use: • Irrigated agricultural fields adjacent to the riparian zone • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.	

Crab Creek – Reach 13**Lincoln County**

Reach Description: Crab Creek from the end of wide alluvial valley (T22N R37E S13 SWSE) to the confluence of Rock Creek and Crab Creek

Shoreline Jurisdiction: 68 acres



Source: <https://fortress.wa.gov/ecy/coastalatlantools/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches (SR); see Figure 19:

Not Applicable.

CHARACTERISTICS

Ownership: Reach 13 is privately owned.

Land Use/Current SMP:

Land use designation:

- Land use is Residential and Agricultural
- Zoning is Agricultural

Current SMP Environment Designation: Rural

Existing Land Cover/Development: Open space

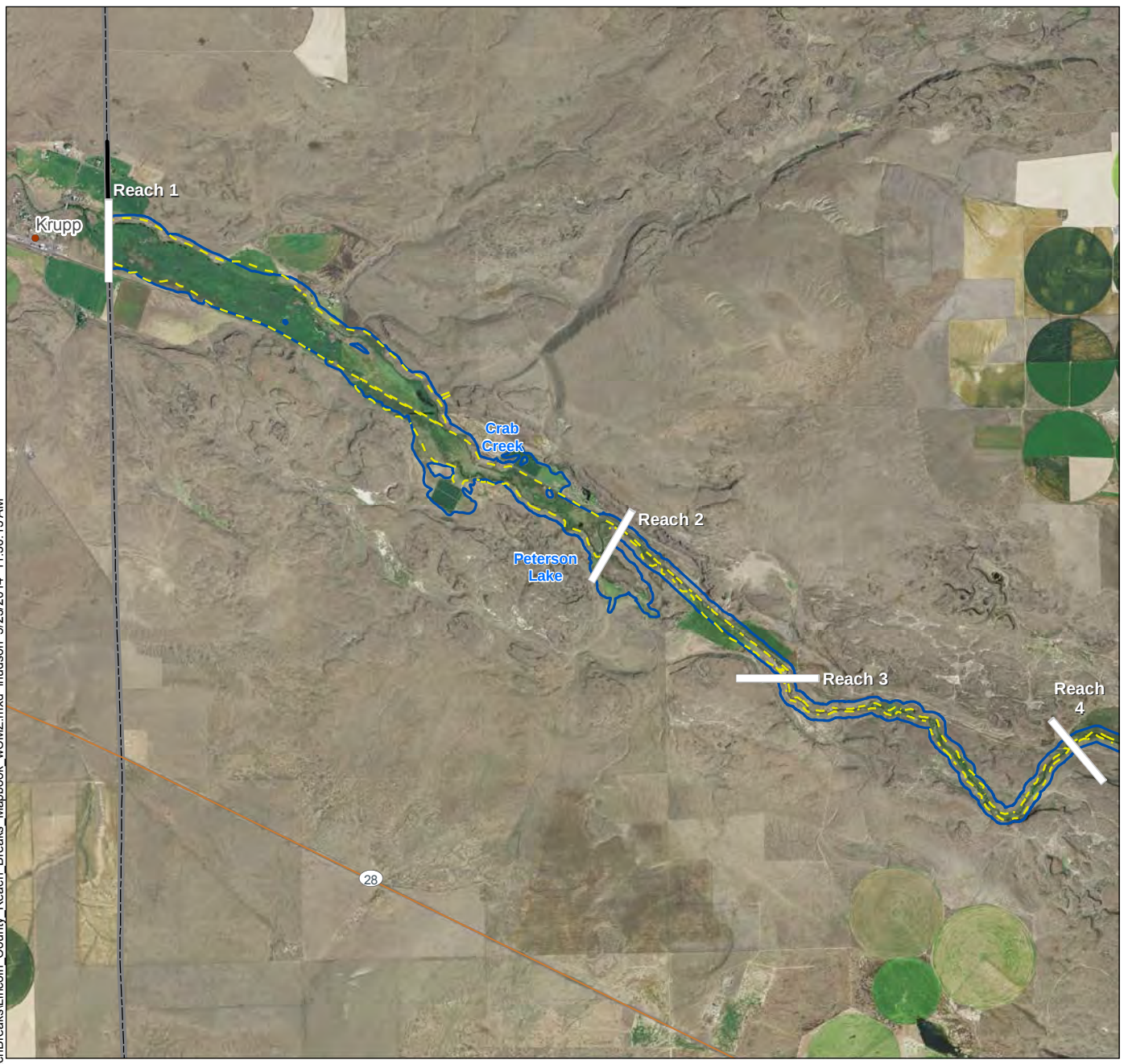
Geomorphic Character:

Description: Throughout this reach, the stream flows mostly within a narrow valley mostly flanked by bedrock. The valley bottom consists of mostly of alluvium. The stream channel is incised throughout. Multiple flow paths exist through the bedrock within the wider floodplain areas that are present. At the very upstream extent of the reach, outburst flood deposits occur along the southern valley margin.

Crab Creek – Reach 13	Lincoln County
Hardened banks: Artificial hardened banks are not present in this reach. Limited infrastructure constraints exist within this reach with an unnamed gravel road crossing at the upstream reach extent. Channel Migration Zone (CMZ) characterization: The CMZ through this reach is generally narrow and is defined by the narrow floodplain and bedrock valley margins. Areas where the CMZ is wider include an area of multiple flow paths within a wider floodplain area. The stream is channelized and incised throughout much of this reach. Limited infrastructure constraints exists within this reach with an unnamed gravel road crossing at the upstream reach extent that likely does not limit potential channel migration.	
Flooding and Geological Hazards: The Crab Creek floodplain is included in FEMA maps showing flood risk in a relatively confined area through the downstream end of this reach of Crab Creek and a relatively wide area through the upstream end of this reach. Adjacent soils are designated to have slight erosion potential. Soils have moderate to high liquefaction susceptibility associated with alluvial deposits on the downstream side, and very low to low liquefaction susceptibility associated with outburst flood deposits near the upstream end. Both soil types present designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: No public access is currently available in this shoreline. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access opportunities may not be feasible in the shoreline due to the sensitive nature of the shoreline.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Rock Creek is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: Water quality in this reach is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: The riparian habitat in this reach is less constrained by land use activities and spans either side of the creek. This reach has multiple channels, and in these locations the riparian habitat bridges these channels and is, therefore, occasionally many yards wide. Toward the end of this reach, the riparian zone narrows, and transitions quickly to the shrub-steppe vegetation typical of the surrounding uplands.	

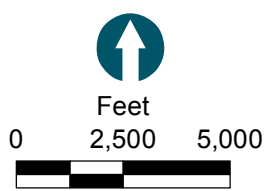
Crab Creek – Reach 13	Lincoln County
This reach has few PHS are noted in the vicinity with the exception of white-tailed jackrabbit. This reach of Crab Creek provides habitat for warm-water fish species such as brown and rainbow trout.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Agricultural use: • Irrigated agricultural fields adjacent to the riparian zone • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody planting strips between agricultural fields and stream banks; removal and management of invasive species Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; consolidation of livestock access areas.	

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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

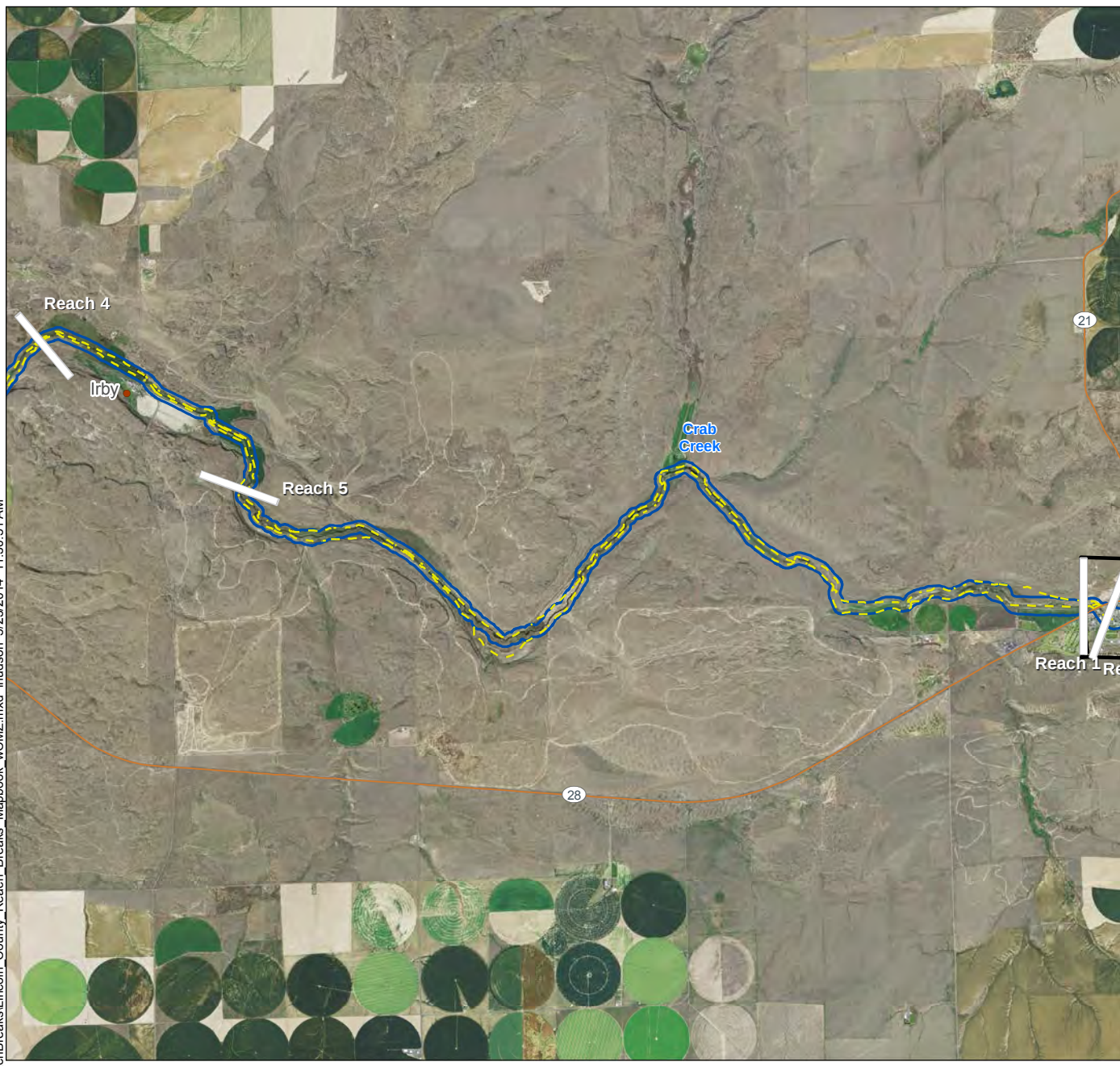
NOTES:
1. This information is to be used for planning purposes only.
Data is displayed as is and without any guarantee of accuracy or completeness.
2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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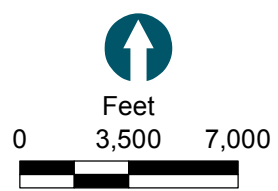


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

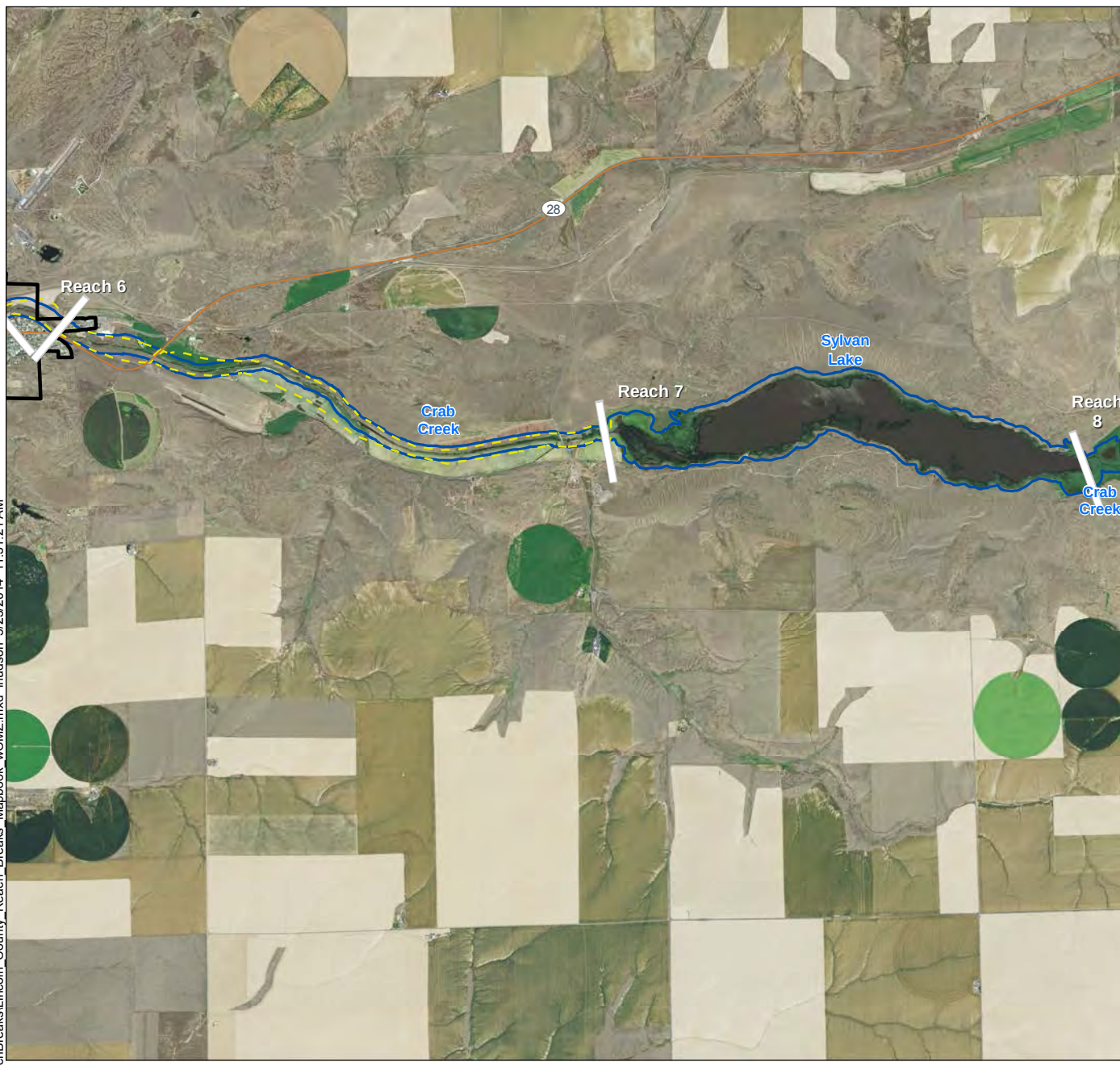
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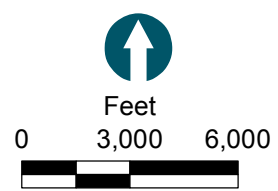


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

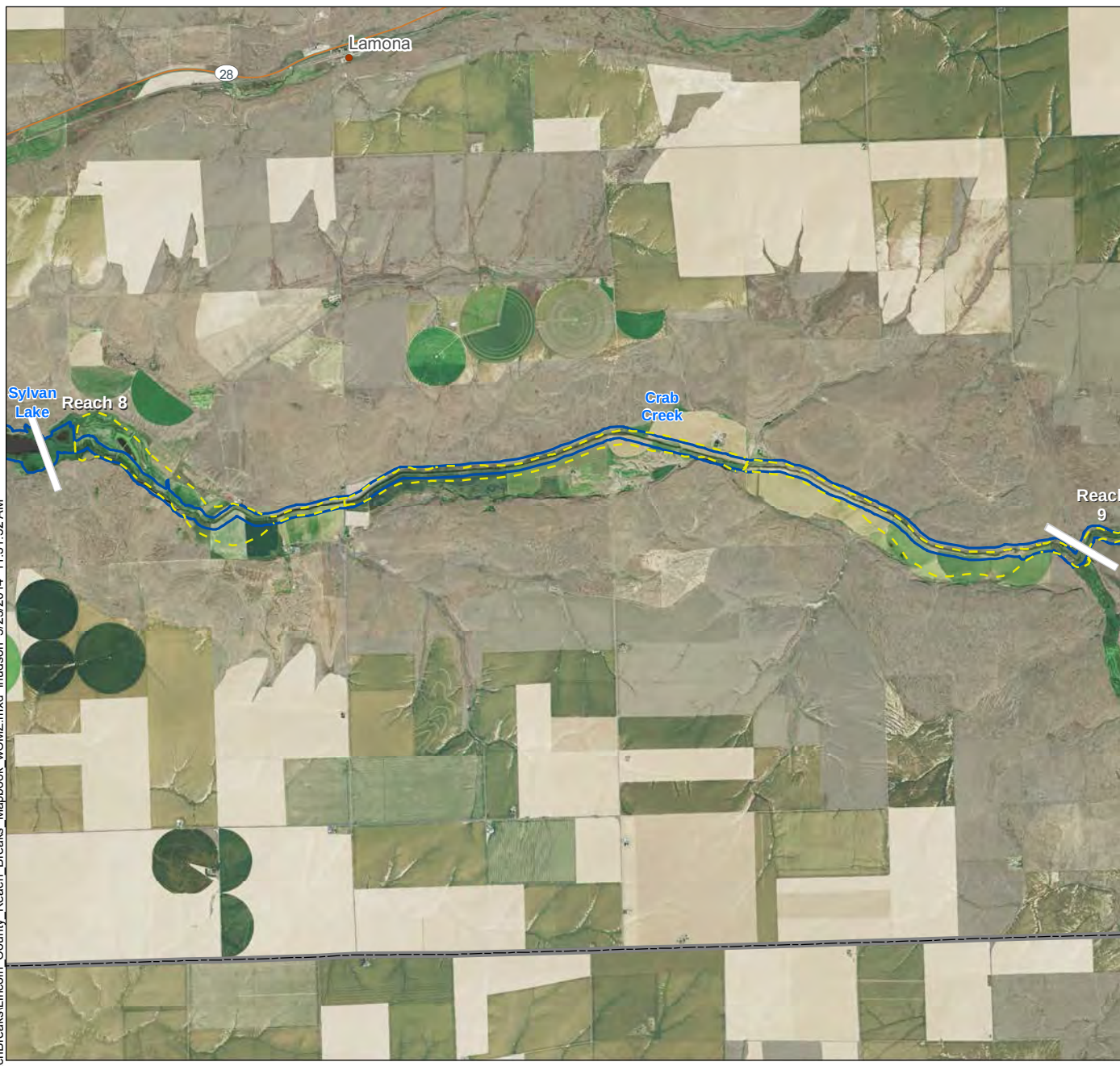
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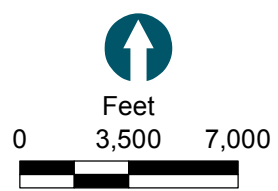


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

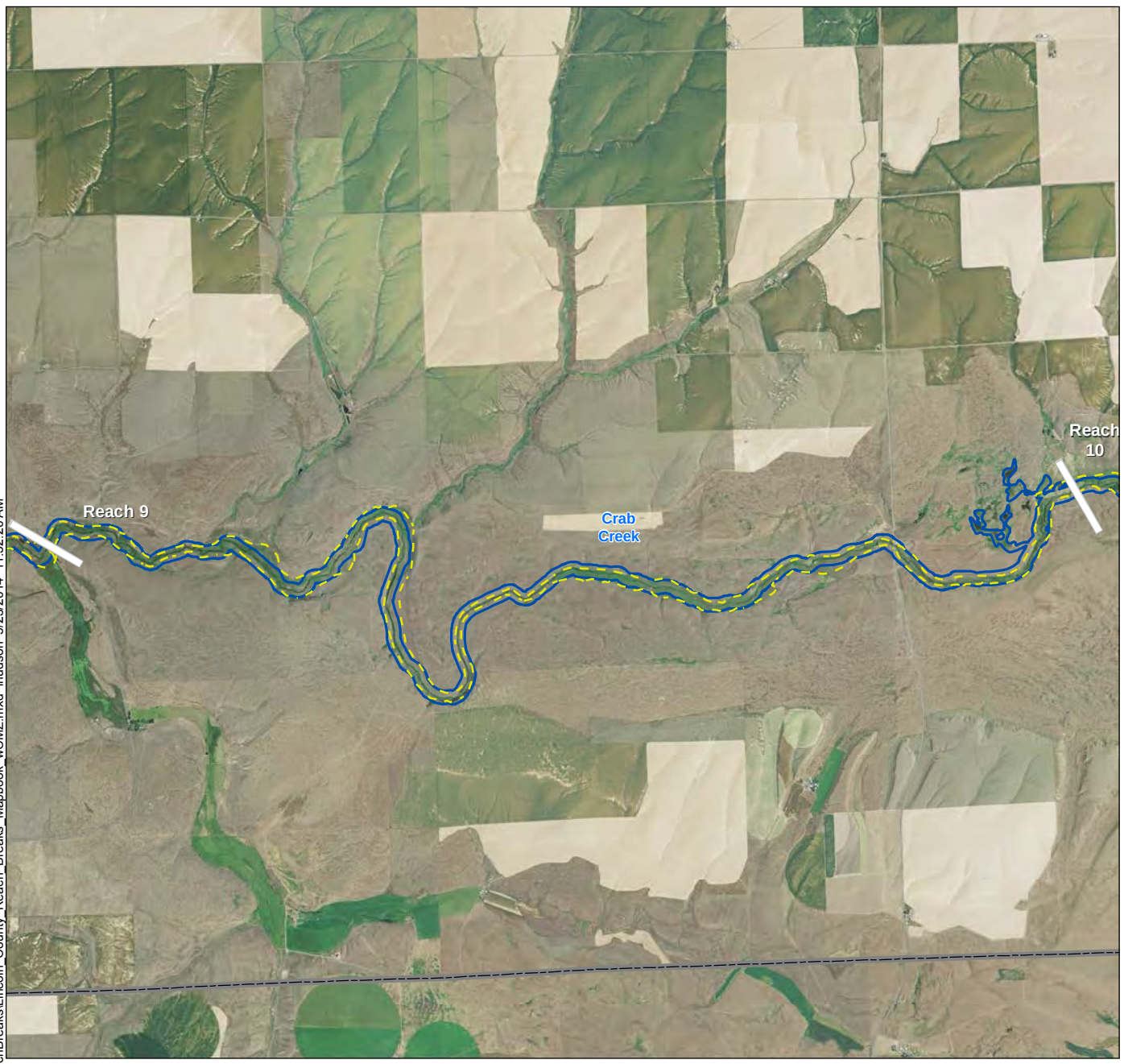
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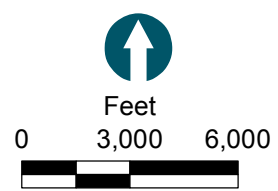


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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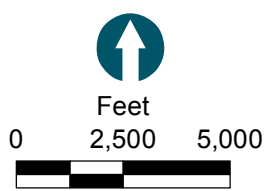


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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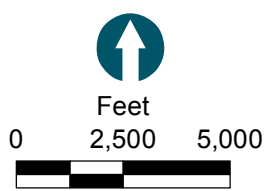


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- | | |
|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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DRAFT



Sprague Lake – Reach 1	Lincoln County
Reach Description: Sprague Lake southwest of Town of Sprague and north of Adams County boundary located along the I-90 corridor	
Shoreline Jurisdiction: 913 acres	
Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figure 20: SR A: Begins at Adams County boundary extending 2.8 miles to the northeast along the eastern shoreline of the lake SR B: Extends 0.4 miles to the west along developed area, ending at the mouth of Negro Creek SR C: Begins at the mouth of Negro Creek, extending along the western shoreline of the lake and ending at the Adams County boundary	
CHARACTERISTICS	
Ownership: Sprague Lake is privately owned.	
Land Use/Current SMP: Land use designation: • Land use is Residential and Agricultural	



Sprague Lake – Reach 1	Lincoln County
• Zoning is Agricultural Current SMP Environment Designation: Conservancy	
Existing Land Cover/Development: Open space and adjacent roadways, including Max Harder Road along SR A and I-90 along SR C. SR B includes recreational and residential development and docks.	
Geomorphic Character: Sprague Lake is a natural lake feature. Negro Creek is the primary lake inflow. The geologic units that comprise the lake within the Lincoln County boundary are bedrock basalt and alluvium. Hardened banks: Artificial hardened banks are present along the lake’s shoreline in association with lake front residences that total 400 feet. In addition, 4,400 feet of lake shoreline is hardened bank associated with the railroad alignment.	
Flooding and Geological Hazards: The Sprague Lake floodplain is included in FEMA maps, but flood risk tends to be confined to the lake area. Sprague Lake is situated in basalt bedrock. Soils adjacent to the lakes are designated to have slight erosion potential. There is no liquefiable soil or landslide hazard around Sprague Lake.	
Existing Public Access: Sprague Lake Wildlife Area Unit as part of Columbia Basin Wildlife Area is located on the south side of the lake, outside the Lincoln County boundary (Fitzgerald 2006). Washington State Department of Fish and Wildlife's maintains a conservation easement for a portion of the lake. The shoreline contains an interpretive trail, boat launch, viewing platform and fishing opportunities. Sprague Lake Resort is located on the north end of the lake that provides camping opportunities. Access from the north bank is limited due to the railroad paralleling the shoreline. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Current public access opportunities seem to be adequate for this reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: This lake has perennial inflow and outflow channels. Water levels are stabilized by a dam at the outlet. Sediments may be input into this reach during high precipitation events but may remain in the lake because of controlled lake levels.	
Water Quality: Sprague Lake is on the 303(d) list (Category 5) for PCB and TCDD and is a water of concern for total phosphorus. Water quality may be impacted by recreational use, non-native species, and agricultural	

Sprague Lake – Reach 1	Lincoln County
runoff.	
Habitat Characteristics and PHS Species Presence: Sprague Lake is partially located within Lincoln County (1,203 acres). The riparian zone in some stretches of the western shoreline is partially constrained by presence of the BNSF railroad tracks. The vegetation consists of lacustrine/palustrine vegetation, predominated shrubs and grasses. Near the inlet of Crab Creek, a small resort community is present, and within this reach, the riparian zone includes residential type landscaping adjacent and overlapping with the riparian zone, and includes grasses and larger trees. Small boat docks are also present, and some areas of the shoreline may be stabilized with riprap. The eastern side of the shoreline has some stretches of gently sloping shoreline with a riparian zone that includes vegetation that may be consistently submerged under certain conditions. This lake is noted for waterfowl concentrations and the presence of prairie and steppe habitat in the uplands. The lake to the south of the county line is noted for presence of bird species, including American white pelican and Caspian Tern. This reach of Crab Creek provides habitat for warm-water fish species such as bass, walleye, and brown and rainbow trout.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
SUBREACH A	
Level of Existing Function: Partially Functioning Stressors: Upland development: • Isolated development and access roads/drives within shoreline jurisdiction • Informal road with boat ramp and parking in jurisdiction • Max Harder Road within jurisdiction for portions of subreach • One small over-water structure Upland development primarily affects aquatic habitat functions of forage and rearing through impacts to water quality via run-off, may impact continuity of riparian and shrub-steppe habitats and therefore riparian functions such as migratory corridors. Agricultural use: • Agricultural fields with limited buffer along shoreline Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals; may affect water quality due to nutrient inputs from agricultural run-off. Riparian functions such as erosion control, wildlife habitat, and migratory corridors may be affected by disruptions to riparian vegetation and establishment of invasives. Recreational use: • Informal trails • Motorized boat use	

Sprague Lake – Reach 1	Lincoln County
Boat camping Recreational use may have minor impacts to water quality through potential releases of contaminants; may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody plant strips in between agricultural fields and shoreline. Consider incorporating aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) along shoreline. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual. Protect intact shrub steppe habitat from fragmentation by future trails or roads.	
SUBREACH B	
Level of Existing Function: Impaired Stressors: - Relatively dense development with irrigated landscaping - Access road - Over-water structures - Irrigated agriculture fields Potential Restoration Opportunities: Consider options for soft shore armoring techniques to stabilize shoreline below lawns, increase riparian vegetation while still allowing for shoreline access and views, and best management practices for irrigated turfgrass areas to reduce pesticide runoff. Grass or woody plant strips in between agricultural fields and shoreline. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual.	
SUBREACH C	
Level of Existing Function: Partially Functioning Stressors: - Railroad embankment near water's edge - Interstate 90 within shoreline jurisdiction in certain areas of subreach - Stormwater infrastructure pools Potential Restoration Opportunities: Establish riparian buffers where absent and where infrastructure allows. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater manual. Protect intact shrub steppe habitat from fragmentation by future trails or roads.	

Negro Creek**Lincoln County****Reach Description:** Negro Creek from the Town of Sprague to Sprague Lake**Shoreline Jurisdiction:** 73 acresSource: <https://fortress.wa.gov/ecy/coastalatl/UICoastalAtlas/Tools/ShorePhotos.aspx>**Subreaches (SR); see Figure 20:**

Not Applicable.

CHARACTERISTICS**Ownership:** Negro Creek is privately owned.**Land Use/Current SMP:**

Land use designation:

- Land use is Residential and Agricultural
- Zoning is Agricultural

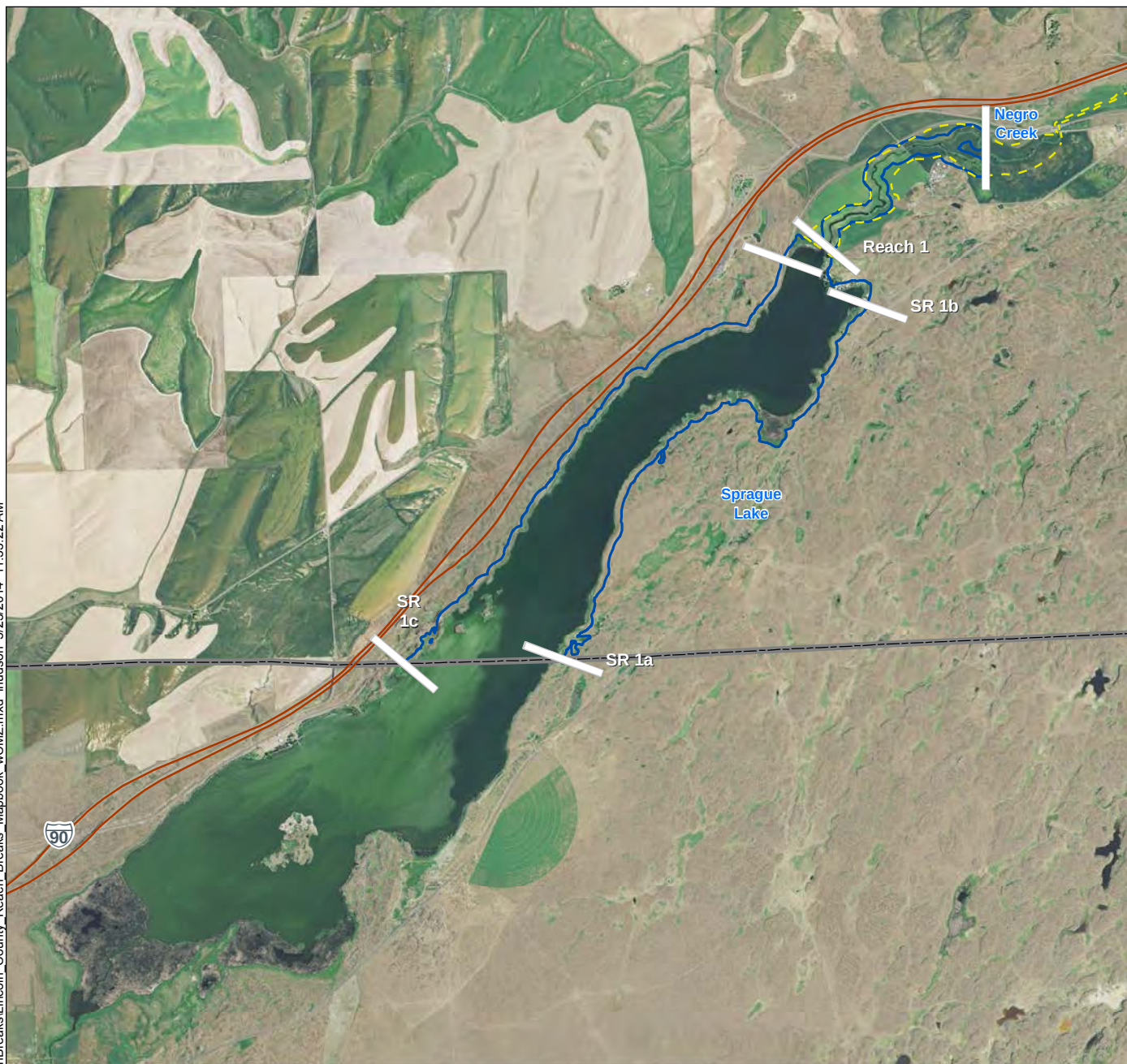
Current SMP Environment Designation: Rural

Existing Land Cover/Development: Agriculture and two minor road crossings**Geomorphic Character:****Description:** Upstream of Sprague Lake, Negro Creek occupies a wide valley with a wide floodplain. The valley bottom consists of alluvium. Wetlands flank both sides of the stream channel. In this reach, the

Negro Creek	Lincoln County
stream is a back water area of Sprague Lake and lacks the hydraulic energy to migrate through the floodplain. Hardened banks: Hardened banks do not exist along the stream reach. Channel Migration Zone (CMZ) characterization: A CMZ was not delineated for this reach. Within this reach, Negro Creek is an open-water, ponded feature upstream of Sprague Lake lacking stream channel characteristics.	
Flooding and Geological Hazards: The Negro Creek floodplain is included in FEMA maps showing flood risk through this reach of Negro Creek. Adjacent soils are designated to have slight erosion potential and moderate to high liquefaction susceptibility. Negro Creek contains alluvial deposits, but presents only a minor amount of designated landslide hazard due to the flat topography.	
Existing Public Access: No public access is currently available in this shoreline. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access opportunities may not be feasible in the shoreline due to the sensitive nature of the shoreline and existing agricultural use along a portion of the shoreline.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Little is known about water quantity information for Negro Creek. It appears to have little flow in this reach, so there is likely interaction with groundwater and/or irrigation diversions upstream that impact water quantity. Some fine sediment may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: Negro Creek is a water of concern (Category 2) for dissolved oxygen. Water quality may be impacted by agricultural runoff.	
Habitat Characteristics and PHS Species Presence: This reach of Negro Creek runs through predominantly agricultural lands. The riparian area in this reach is limited by a channelized streambed as well as presence of cultivated crops. Negro Creek in this reach provides irrigation supply to adjacent agricultural fields. As a result of surrounding geological constraints and land use patterns, the riparian area through this reach is narrow and likely managed to prevent encroachment into cultivated fields. The vegetation is dominated by grasses and some shrubs, with very few trees.	

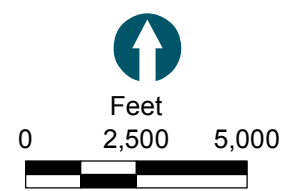
Negro Creek	Lincoln County
The surrounding uplands outside of the agricultural fields are dominated by prairie and scrub-steppe habitat. PHS presence includes burrowing owl, racer, and waterfowl that use adjacent Sprague Lake. Rainbow trout, walleye, largemouth and smallmouth bass are found in this reach of Negro Creek.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Agricultural use: - Irrigated agricultural fields adjacent to the riparian zone Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff. Cultivation may provide opportunity for establishment of invasive species, impacting riparian functions such as wildlife habitat, and migratory corridors. Upland development: - Railroad berm constraints Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. Affects connectivity to floodplain which may affect water quality for forage and rearing functions of aquatic habitat. Potential Restoration Opportunities: Woody or grass buffer in between agricultural fields and shoreline. Evaluate opportunities to incorporate aquatic habitat complexity (substrate, organic material, structural elements [e.g., large woody debris], and aquatic and riparian vegetation) along with soft bank stabilization techniques. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual.	

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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:
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2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



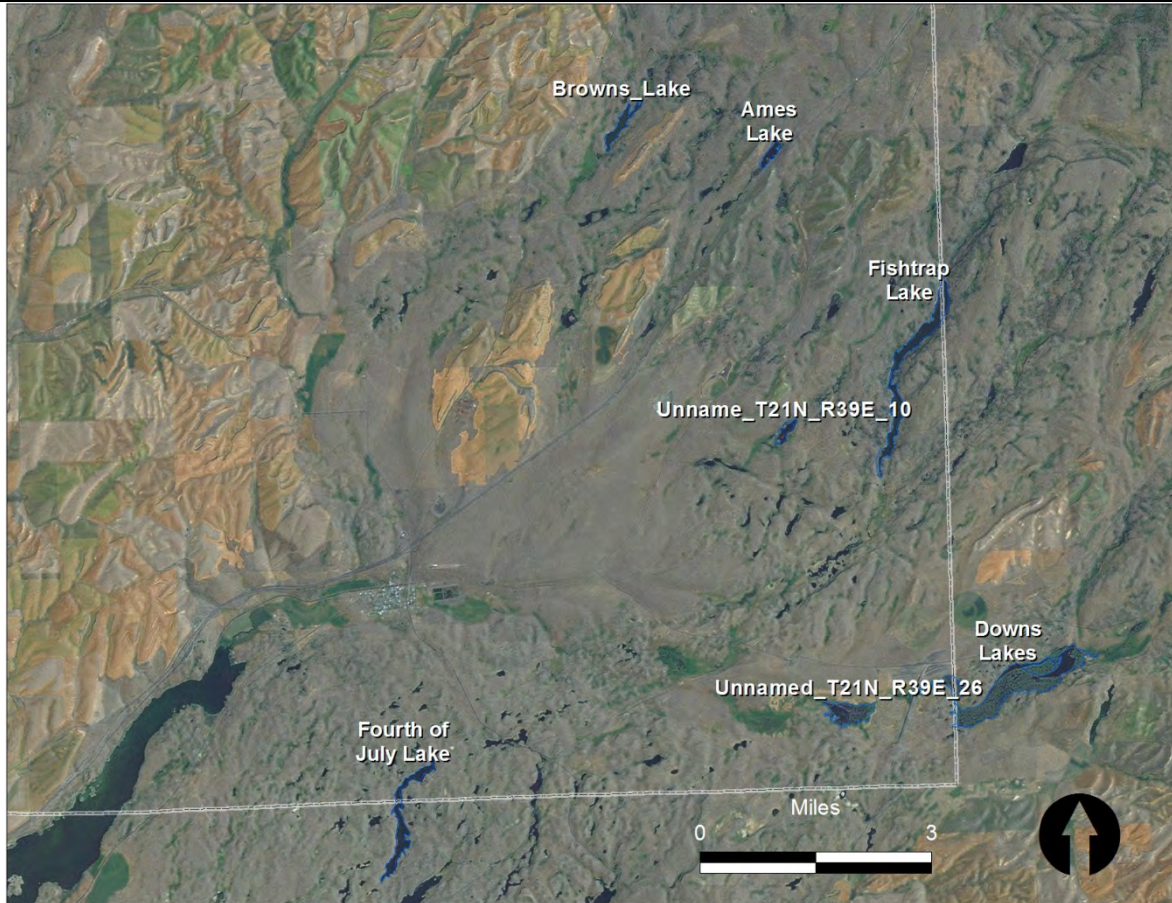
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Southeast Corner Lake Group Lincoln County

Reach Description: The group of lakes located along I-90 corridor, connected by various tributaries draining to Negro Creek and Sprague Lake

Shoreline Jurisdiction: Browns Lakes, 180 acres / Ames Lake, 71 acres / Fish trap Lake, 321 acres within Lincoln County / Unnamed_T25N_R39E_10, 110 acres / Unnamed_T21N_R39E_26, 189 acres / Downs Lake, 84 acres within Lincoln County / Fourth of July Lake, 78 acres within Lincoln County



Source: U.S. Department of Agriculture, *National Agriculture Imagery Program (NAIP)*: 2013 data

Subreaches (SR); see Figures 21, 22, 23, 24:

Not Applicable.

CHARACTERISTICS

Ownership: Western shoreline of Fish trap Lake is publicly owned (Bureau of Land Management [BLM]) as well as northeastern corner of Fourth of July (Washington Department of Natural Resources [DNR]), a portion of Unnamed_T21N_R39E_26 and Downs Lake (DNR), and a portion of Unnamed_T25N_R39E_10 Lake (BLM). The rest of Lake Group is privately owned.

Land Use/Current SMP:

Land use designation:

- Land use is Residential, Agricultural, Rangeland, and non-taxable federally owned land by BLM
- Zoning is Agricultural

Southeast Corner Lake Group Lincoln County
Current SMP Environment Designation: Rural, Lincoln County Rural
Existing Land Cover/Development: Open space
Geomorphic Character: Description: Fishtrap Lake occupies a sinuous coulee in bedrock likely sourced by groundwater and local drainage. No distinct surface inflow channel exists. At the southern end of Fishtrap Lake, an outflow channel is present that likely conveys water when lake elevations are high. Unnamed Lake (T21N, R39E Sec 10) occupies a natural depression in bedrock sourced by groundwater and local surface drainages. Surface inflow and outflow channels are present in the topography, but appear seasonal in nature. Unnamed Lake (T21N, R39E Sec 26) is located in alluvium and bedrock and is part of a larger wetland complex downstream of Downs Lake in Spokane County. The lake appears to have surface inflow and outflow channels that carry water seasonally. Hardened banks: A minor amount of hardened bank is present at marina and boat ramp located at the north end of Fishtrap Lake, approximately 300 feet. The BNRRL crosses the unnamed lake complex in Section 26, approximately 600 feet. The water surface elevation in the lake appears to be controlled by an outlet structure.
Flooding and Geological Hazards: Floodplains are included in FEMA maps; in general flood risk is confined to the lake area with some connectivity between nearby lakes during extreme flood conditions. Soils adjacent to the lakes are designated to have slight erosion potential and generally very low liquefaction potential or situated in the bedrock. Only Unnamed Lake_T21N_R39E_26's shoreline consists of alluvial and outburst flood deposits, which are designated landslide hazards where slopes are greater than 15%.
Existing Public Access: Fishtrap Lake contains boat launch and a marina on the north end. This shoreline consists of trail and fishing opportunities. Shoreline on the west side of the lake is owned by the Bureau of Land Management. Fourth of July Lake has gravel road access from State Route 23. Ames Lake has visual access from Interstate 90, and gravel road access to the north. Browns Lake also has a gravel road access from State Route 231. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Lakes that currently have informal access could be enhanced with a formal public access. However, new public access may not be feasible in most of the lakes due to the sensitive nature of shoreline and limited access.

Southeast Corner Lake Group Lincoln County
ECOLOGICAL CONDITIONS
Water Quantity and Sediment: These lakes generally have no or intermittent inflows and have an outflow channel. Groundwater may also influence lake water quantities. The lake bottoms are generally silt, so sediment is likely to enter during extreme events but may not have an outlet.
Water Quality: Water quality in these lakes are likely impacted by agricultural and pasture runoff.
Habitat Characteristics and PHS Species Presence: This group consists of numerous named and unnamed lakes and palustrine wetlands scattered throughout shrub-steppe lands, which were created as a result of the historic geologic flood outburst. These lakes are situated in a remote area with few roads. The Pine Tree Lake and Dixon's Pond in the extreme southeast corner are connected by canals, are used for irrigation purposes, and are adjacent to cultivated lands. The "Intermittent Lakes" are occasionally interconnected. These lakes may have some hydrological connections among nearby lakes and wetland areas, and some areas experience significantly lower water levels during the summer; in particular, the smaller lakes and wetland areas may occasionally turn dry depending on precipitation patterns. The immediate riparian zone around most of the larger lakes is narrow and vegetated with grasses and shrubs. The largest lake in this group, Fishtrap Lake, has significant riparian habitat surrounding the lake and includes a complex multistoried canopy along some reaches. In most cases, the vegetation adjacent to these lakes is consistent with shrub-steppe habitat, although the larger lakes with less-steeply sloped banks have vegetation that is more characteristic of lacustrine or palustrine wetland habitat and include larger trees found in small clusters near the areas of the lake banks that likely remain wet year-round. The area around Fishtrap Lake has been documented to support three rare plant species; green-keeled cotton-grass, Bristly sedge, and Spalding's silene. The area around Unnamed T21N_R39E_10 has been documented to support one rare plant species: Spalding's silene. The banks of some lakes are in some areas quite steep, and this slope prohibits significant amounts of vegetation from growing in these areas. Several of these lakes are accessible for recreational uses. This region has significant PHS presence. Mule deer, Rocky Mountain elk, Northwest white-tailed deer, and white-tailed jack-rabbit may make use of the lake and surrounding riparian habitat and uplands. A significant number of bat species are also present (Yuma myotis, big brown bat, little brown myotis, western long-eared bat, western small-footed myotis, fringed myotis). The lakes are noted for high concentrations of waterfowl during certain times of the year, which may include black tern, sandhill crane, common loon snowy owl, peregrine falcon, great blue heron, bald eagle, gyrfalcon, swainson's hawk, Forster's tern, loggerhead shrike, greater sage grouse, sharp-tailed grouse, and wild turkey. While most habitat is lacustrine, several acres of freshwater palustrine emergent habitat exists along the lakes' shores, and some of these areas may be inundated and connected to the lakes during certain times of the year. Largemouth and smallmouth bass, rainbow trout, and walleye are present in Fishtrap Lake, Brown's Lake, and Ames Lake.

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Partially Functioning

Stressors:

Agricultural use:

- Livestock impacts

Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Upland development:

- Roadway fill

Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It may affect aquatic habitat functions of forage and migration through alterations to substrate conditions. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat.

Recreational use:

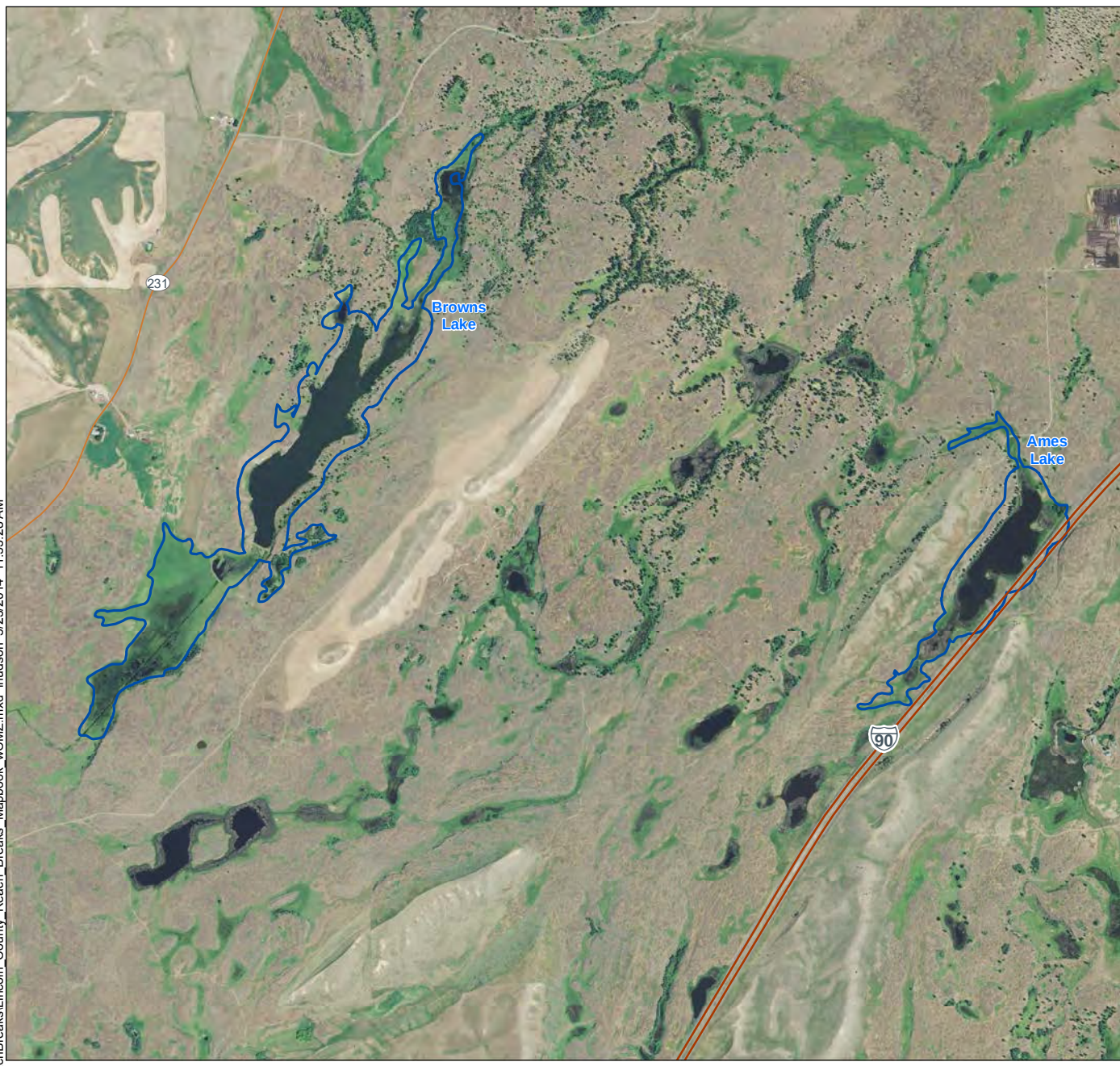
- Informal trails near Peterson Lake

Recreational use may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Removal of fill; management of invasive species; planting of riparian species between lake shores and agricultural lands

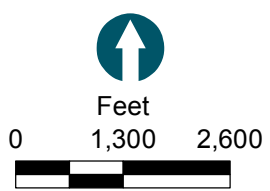
Potential Protection Opportunities: Management of stormwater per most recent Stormwater Management Manual for eastern Washington

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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

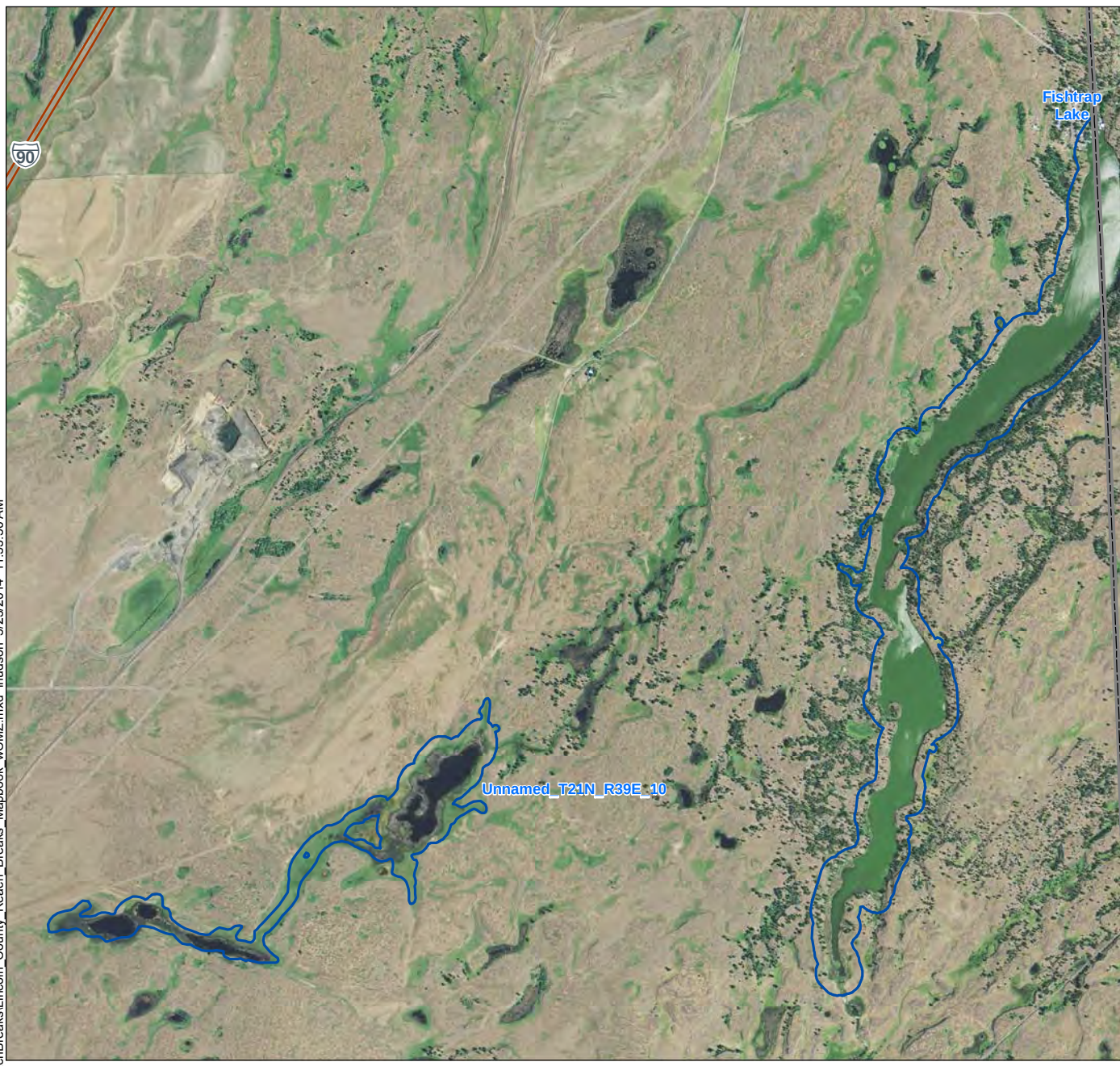
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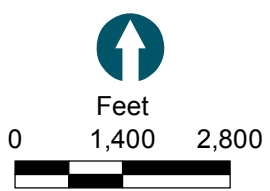


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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
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| Channel Migration Zone | |

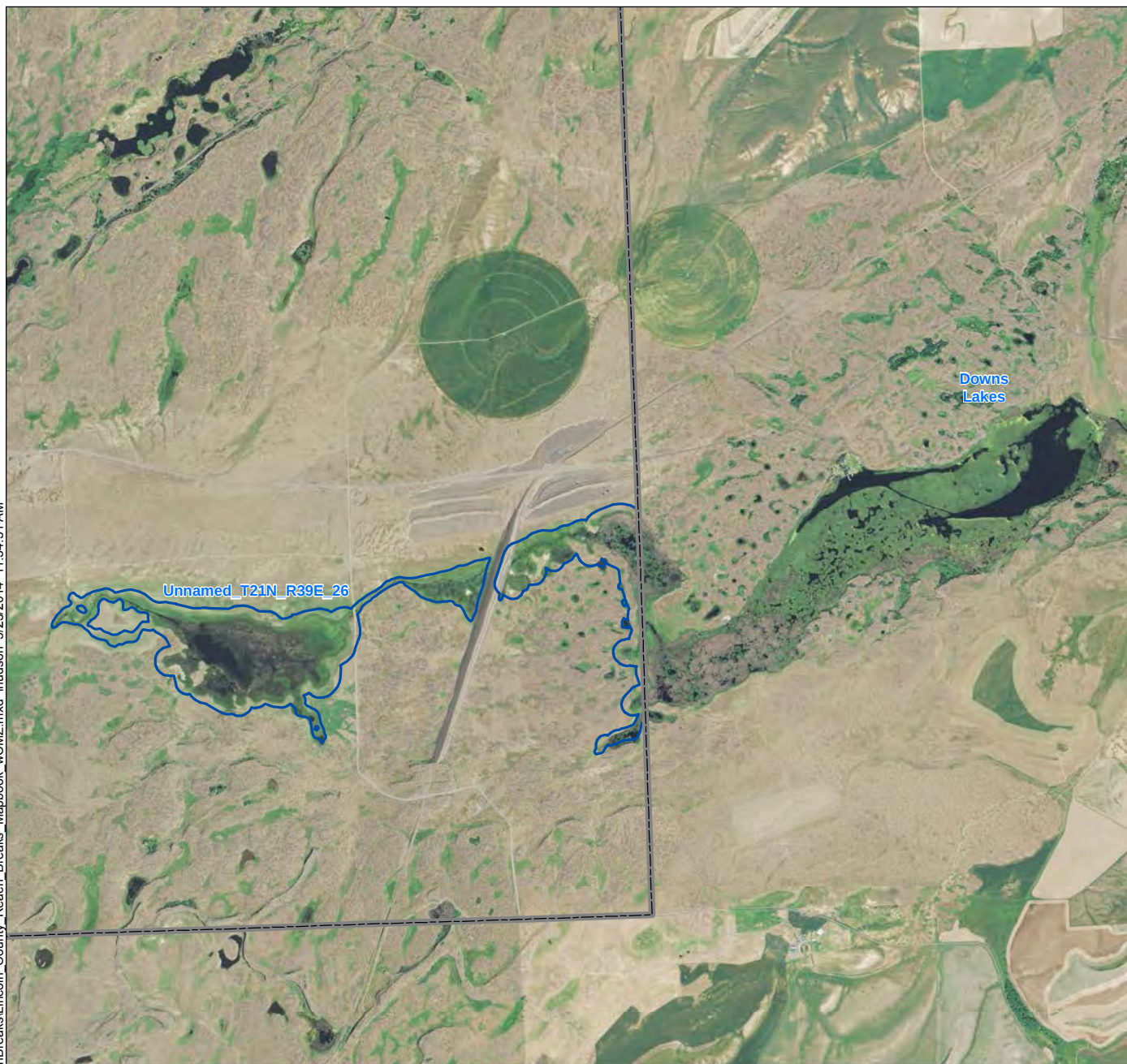
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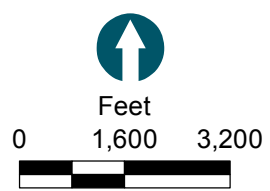


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|--------------------------------|-------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
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| Channel Migration Zone | |

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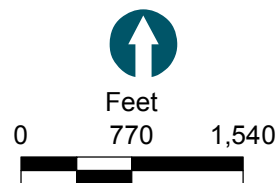


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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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Lake Creek Lake Group**Lincoln County**

Reach Description: The string of lakes connected by Lake Creek from the upstream south of US-2 to Tavares Lake

Shoreline Jurisdiction: Unnamed_T24N_R35E_4, 111 acres / Unnamed_T24N_R35E_16, 99 acres / Wall Lake, 109 acres / Twin Lakes – Upper, 83 acres / Twin Lakes – Lower, 112 acres / Unnamed_T24N_R34E_27, 49 acres / Coffee Pot Lake, 512 acres / Deer Springs Lake, 126 acres / Tavares Lake, 83 acres / Cormana Lake, 119 acres



Source: U.S. Department of Agriculture, *National Agriculture Imagery Program (NAIP)*: 2013 data

Subreaches (SR); see Figures 25, 26, 27, 28, and 29:

Not Applicable.

CHARACTERISTICS

Ownership: Ownership is primarily public around Unnamed T24N R35E 4 (Washington Department of Fish and Wildlife [WDFW]), Unnamed T24N R35E 16 (Washington Department of Natural Resources [DNR]), Twin Lakes – Upper , Unnamed T24N R34E 27 (Bureau of Land Management [BLM]). Ownership is primarily private around Deer Springs Lake, Cormana Lake, Tavares Lake, Wall Lake and Twin Lakes – Lower.

Land Use/Current SMP:

Land use designation:

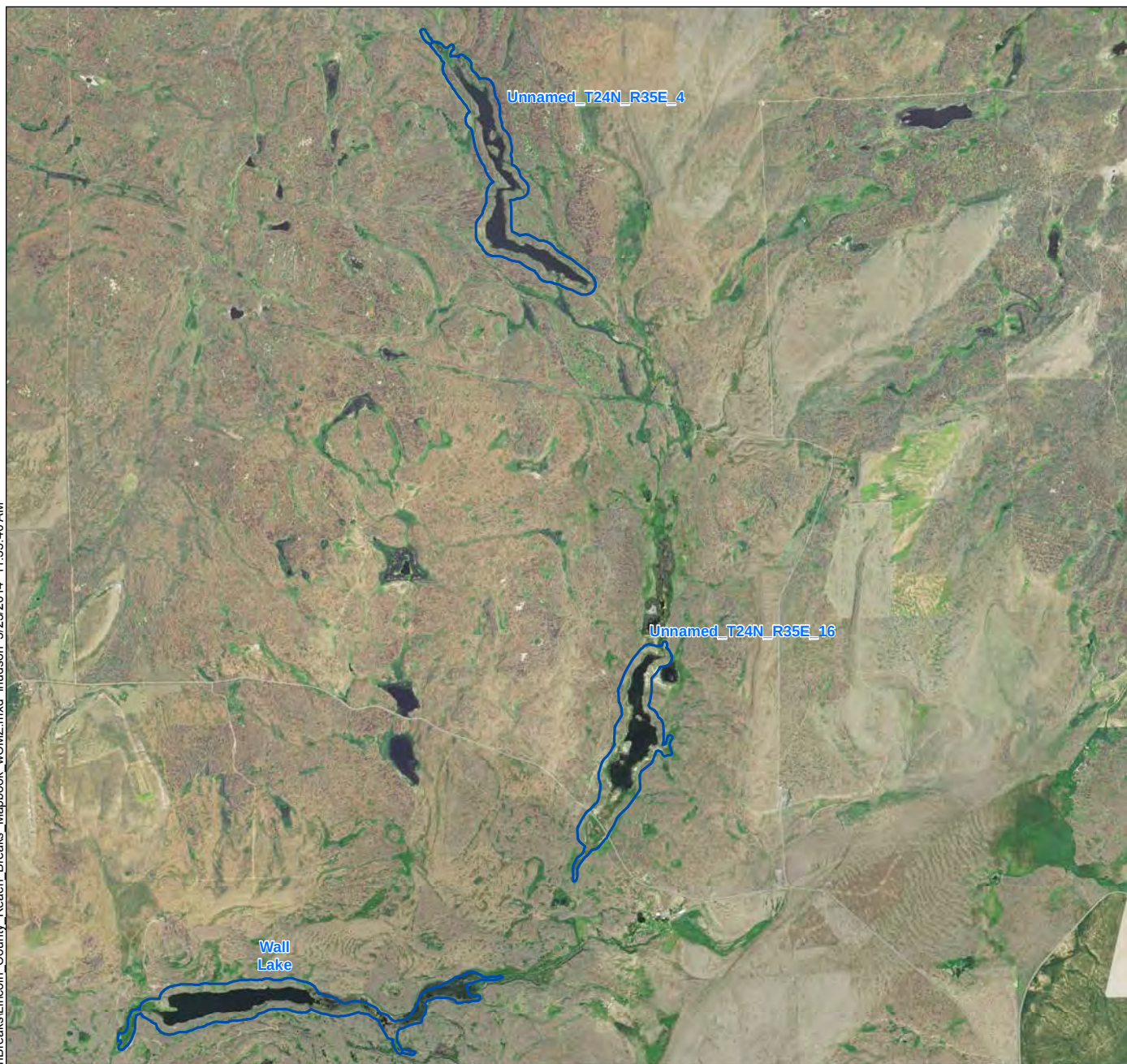
- Land use is Residential, Agricultural, Rangeland, and non-taxable federally owned land by BLM and WDFW

Lake Creek Lake Group	Lincoln County
• Zoning is Agricultural Current SMP Environment Designation: Rural, Conservancy	
Existing Land Cover/Development: Open space	
Geomorphic Character: Description: Wall Lake and two unnamed lakes occupy natural depressions along the Lake Creek alignment. The lakes are fed by Lake Creek, ground water, and small local surface drainages and springs. Hardened banks: A minor amount of hardened bank is associated with the Coffee Pot Lake boat launch (approximately 100 feet).	
Flooding and Geological Hazards: Floodplains are included in FEMA maps; in general flood risk is confined to the lake area with some connectivity between nearby lakes during extreme flood conditions. Soils adjacent to the lakes are designated to have slight erosion potential and generally very low liquefaction potential or situated in the bedrock. Only a portion of Upper Twin Lake, Wall Lake, and Unnamed Lake_T24N_R35E_16 have alluvial soils that can present landslide hazards where slopes are greater than 15%.	
Existing Public Access: Coffee Pot Lake has a boat launch on the north shoreline. Coffee Pot Lake, Deer Lake, and Twin Lakes have fishing opportunities. Twin Lakes have gravel parking near the fishing access. Shoreline along Twin Lakes and west shoreline of the Coffee Pot Lake are owned by BLM. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access could be enhanced in areas where shoreline is accessible. Existing fishing and boating facilities could be enhanced with additional recreational amenities in this reach.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: These lakes generally have intermittent inflows and have an outflow channel. Groundwater may also influence lake water quantities. Sediment may be able to travel between lakes toward the downstream end of Lake Creek, but it is likely low velocities would cause sediments to accumulate in the lakes.	
Water Quality: Lake Creek is a water of concern (Category 2) for temperature, likely due to low flows and high temperatures during the summer. Water quality in these lakes are likely impacted by agricultural and pasture runoff.	

Lake Creek Lake Group	Lincoln County
Habitat Characteristics and PHS Species Presence: This group consists of numerous small lakes scattered throughout shrub-steppe lands, and were created as a result of the historic geologic flood outburst. These lakes are situated in a remote area with few roads and are not directly adjacent to any cultivated agricultural lands, although cattle do roam these areas to graze. These lakes may have some hydrological connection among each other, and some of the lakes experience significantly lower water levels during the summer; in particular, the smaller lakes may occasionally turn dry depending on precipitation patterns. The immediate riparian zone around most of the lakes is narrow and vegetated with grasses and shrubs. In most cases, the vegetation is consistent with shrub-steppe habitat, although the larger lakes with less-steeply sloped banks have vegetation that is more characteristic of lacustrine or palustrine wetland habitat and include larger trees found in small clusters near the areas of the lake banks that likely remain wet year-round. The banks of some lakes are, in some areas, quite steep, and this slope prohibits significant amounts of vegetation from growing in these areas. Several of these lakes are accessible for recreational uses. The northwest corner of Coffee Pot Lake as well as most areas surrounding Upper and Lower Twin Lakes have been documented to support one rare plant species: Spalding's silene. Mule deer, Rocky Mountain elk, Northwest white-tailed deer, white-tailed jack-rabbit may make use of the lake and surrounding riparian habitat and uplands. A significant number of bat species are also present (Yuma myotis, big brown bat, little brown myotis, western long-eared bat, western small-footed myotis, fringed myotis). The lakes are noted for high concentrations of waterfowl during certain times of the year, which may include black tern. Other native birds noted in this area are snowy owl, peregrine falcon, great blue heron, Forster's tern, loggerhead shrike, greater sage grouse, sharp-tailed grouse, and wild turkey. While most habitat is lacustrine, several acres of freshwater palustrine emergent habitat exists along the lakes' shores, and some of these areas may be inundated and connected to the lakes during certain times of the year. Largemouth bass are present in the Deer Springs Lake and may travel between this lake and Tavares Lake when water levels allow, although Tavares Lake does go dry.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Functioning Stressors: Recreational use: • Informal trails and access points along lake shorelines Recreational use may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Agricultural use: • Livestock impacts Agricultural use may affect water quality due to nutrient inputs from livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.	

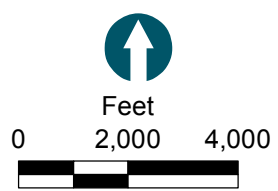
Lake Creek Lake Group	Lincoln County
Potential Restoration Opportunities: Management and removal of invasive species	
Potential Protection Opportunities: Management and development of specific areas of livestock access and recreational access	

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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

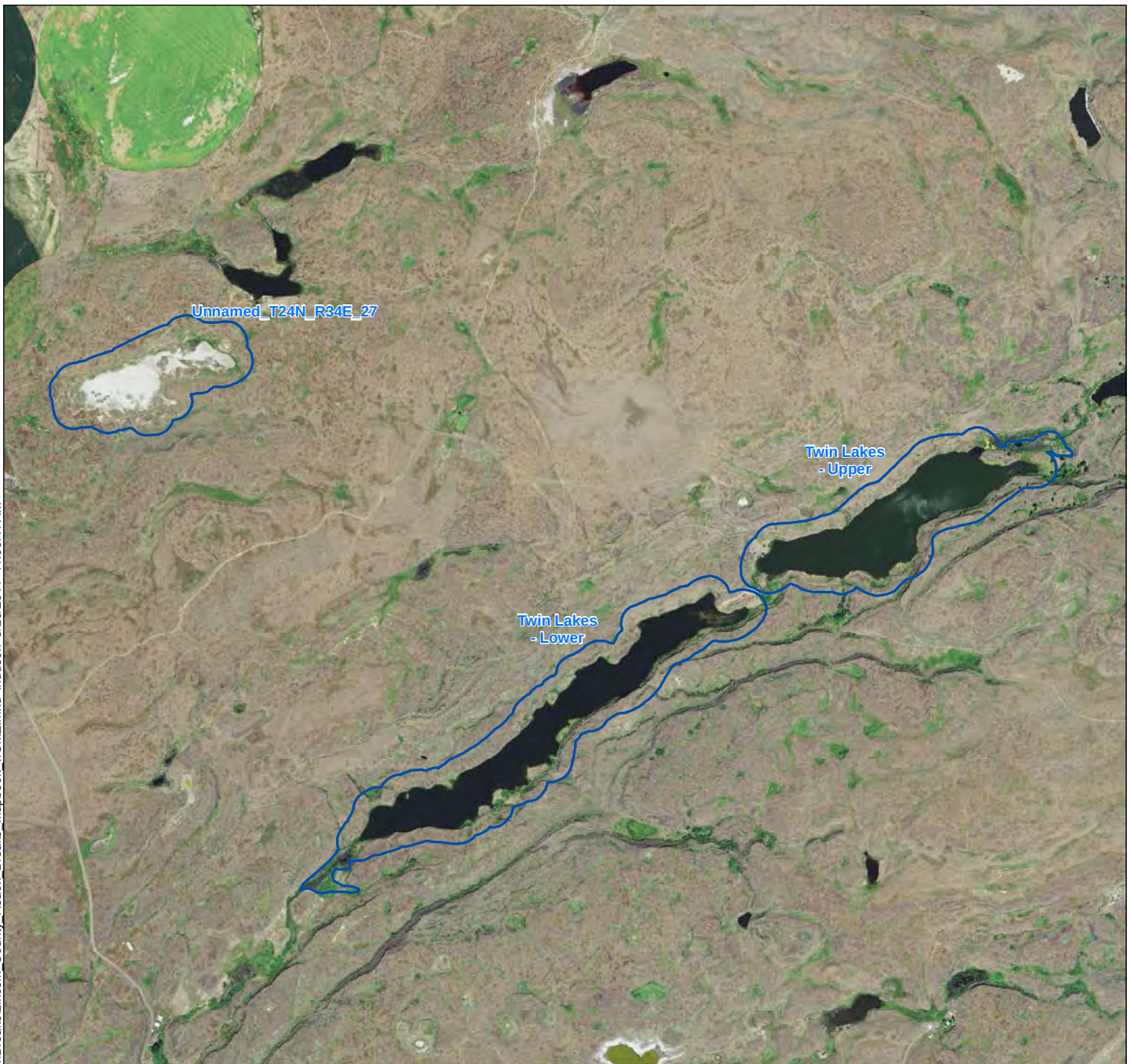
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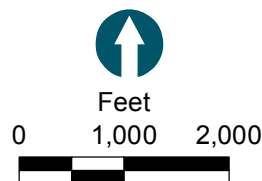
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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
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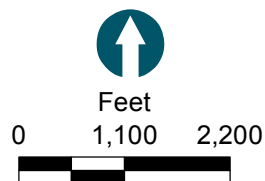
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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
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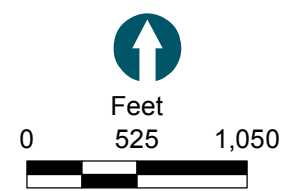


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| Reach and Subreach (SR) Breaks | Incorporated City |
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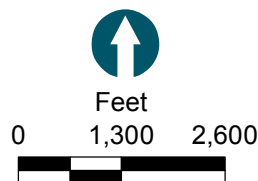


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| Reach and Subreach (SR) Breaks | Incorporated City |
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DRAFT



West-Central Lake Group	Lincoln County
Reach Description: Various sizes of lakes located land west of Lake Creek Lake Group between Route 2 and Crab Creek	
Shoreline Jurisdiction: H Lake, 53 acres / Greenwood Lake, 83 acres / Bergeau Lake, 108 acres / Unnamed_T25N_R34E_27 Lake, 79 acres / Swanson Lake-Upper, 54 acres / Swanson Lake-Lower, 101 acres / Phillips Lake, 57 acres / Wills Lake, 115 acres / Meadow Lake, 57 acres / Goetz Lake, 71 acres / Sullivan Lake, 112 acres	
	
Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches (SR); see Figures 30, 31, 32, 33, 34, and 35	
Not Applicable.	
CHARACTERISTICS	
Ownership: Washington Department of Fish and Wildlife (WDFW) owns Unnamed_T25N_R34E_27 Lake, Swanson Lake-Upper and Swanson Lake-Lower. Phillips Lake, Wills Lake and Meadow Lake are owned by both Bureau of Land Management (BLM) and Washington Department of Natural Resources (DNR). The remaining lakes are privately owned.	
Land Use/Current SMP: Land use designation: - Land use is Residential, Agricultural, Rangeland, and non-taxable federally owned land by BLM and WDFW - Zoning is Agricultural Current SMP Environment Designation: Rural	
Existing Land Cover/Development: Open space	

West-Central Lake Group	Lincoln County
Geomorphic Character: Description: These lakes mostly occupy bedrock depressions within natural drainages, topographic lows, and coulees. The lakes are mostly fed by groundwater and small local surface streams. Greenwood Lake has a distinct seasonal inflow and outflow channel. Hardened banks: None Identified. Swanson Lakes appear to support an irrigation canal with no visible hardened banks.	
Flooding and Geological Hazards: Floodplains are included in FEMA maps; in general flood risk is confined to the lake area with some connectivity between nearby lakes during extreme flood conditions. Soils adjacent to the lakes are designated to have slight erosion potential and generally very low liquefaction potential or situated in the bedrock. Only the Greenwood Lake's shoreline contains extensive alluvial soils which are designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: Florence Lake and Swanson Lake shoreline is owned by WDFW. Wills Lake and Philips Lake shoreline is owned by BLM and WDFW. Florence Lake is open-year round and offers fishing opportunity (WDFW 2013b). Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access could be enhanced in areas where shoreline has vehicular access on publicly owned shorelines.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: These lakes generally have no or intermittent inflows and do not appear to have an outflow channel. Groundwater likely influences lake water quantities. Sediment is likely to enter during extreme events but may not have an outlet.	
Water Quality: Water quality in these lakes are likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: This group consists of numerous small lakes scattered throughout shrub-steppe lands, and were created as a result of the historical geologic flood outburst. These lakes are situated in a remote area with few roads and are not directly adjacent to any cultivated agricultural lands, although cattle do roam these areas to graze. These lakes may have some hydrological connection among each other, and some of the lakes experience significantly lower water levels during the summer, and especially the smaller lakes may	

West-Central Lake Group	Lincoln County
occasionally turn dry depending on precipitation patterns. The immediate riparian zone around most of the lakes is narrow and vegetated with grasses and shrubs. In most cases the vegetation is consistent with shrub-steppe habitat, although the larger lakes with less steeply sloped banks have vegetation that is more characteristic of lacustrine or palustrine wetland habitat, and include larger trees found in small clusters near the areas of the lake banks that likely remain wet year-round. The banks of some lakes are in some areas quite steep, and this slope prohibits significant amounts of vegetation from growing in these areas. Several of these lakes are accessible for recreational uses. Mule deer, Rocky Mountain elk, northwest white-tailed deer, and white-tailed jack-rabbit may make use of the lakes and surrounding riparian habitat and uplands. The lakes are noted for high concentrations of waterfowl during certain times of the year. Other native birds noted in this area are peregrine falcon, great loggerhead shrike, greater sage grouse, sharp-tailed grouse, and wild turkey. While most habitat is lacustrine, several acres of freshwater palustrine emergent habitat exists along the lakes' shores, and some of these areas may be inundated and connected to the lakes during certain times of the year.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Functioning Stressors: Agricultural use: • Irrigated agricultural fields adjacent to the riparian zone • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals; may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasives, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Upland development: • Railroad berm constraints Upland development primarily impacts continuity of riparian and shrub-steppe habitats and therefore riparian functions such as migratory corridors. Affects connectivity to floodplain which may affect water quality for forage and rearing functions of aquatic habitat. Recreational use: • Informal trails near Peterson Lake Recreational use may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, migratory corridors. Potential Restoration Opportunities: Management of invasive species, riparian or woody plantings between	

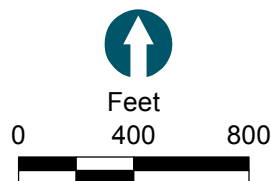
West-Central Lake Group	Lincoln County
shoreline and agricultural fields. Potential Protection Opportunities: Management of livestock access, management of recreational access, management of stormwater for new development consistent with most recent Eastern Washington Stormwater Manual.	

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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

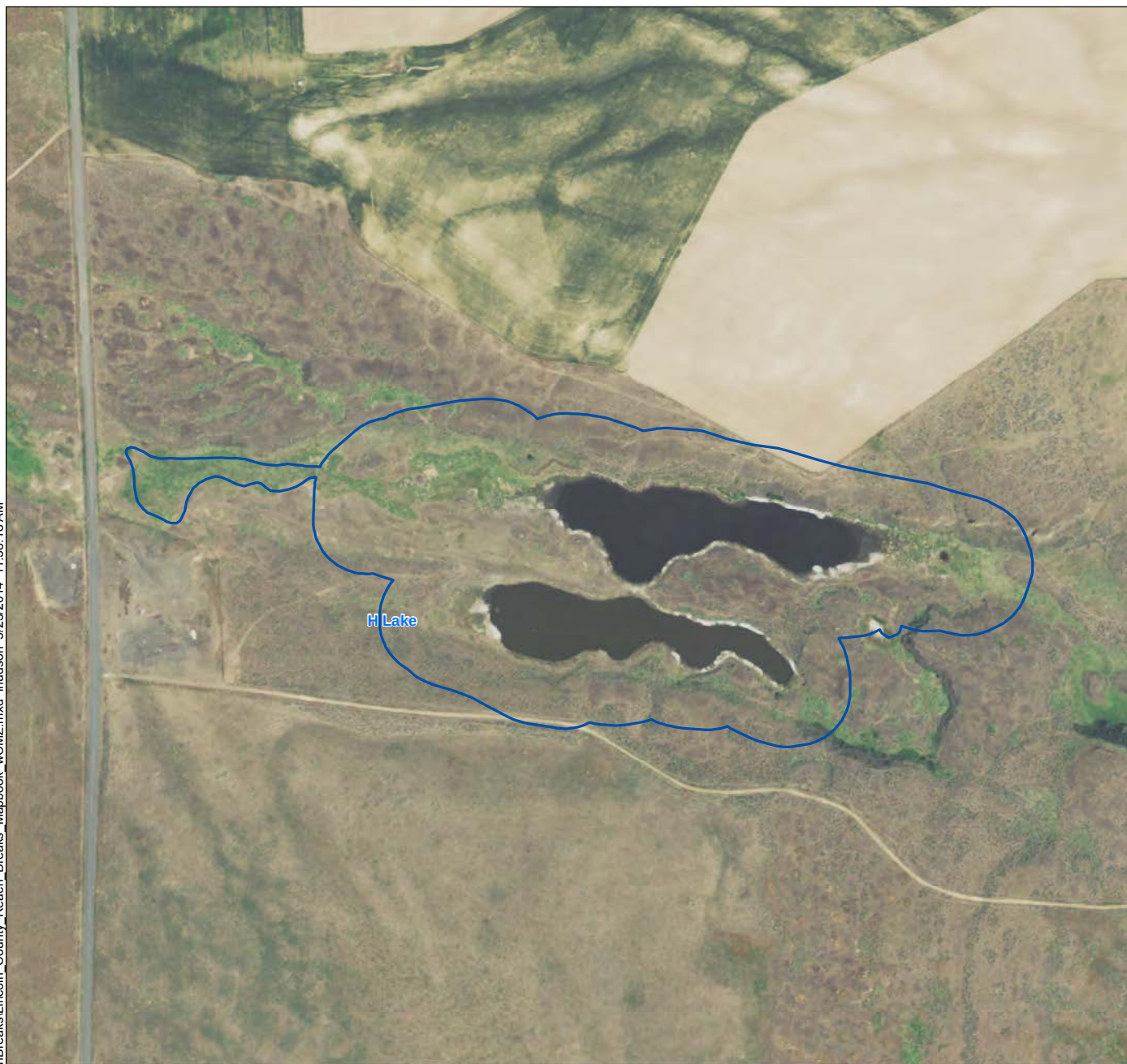
- NOTES:**
1. This information is to be used for planning purposes only.
Data is displayed as is and without any guarantee of accuracy or completeness.
 2. Aerial imagery courtesy of USDA NAIP (2013).
 3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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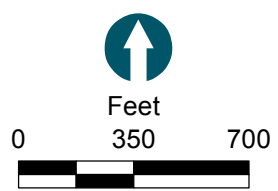


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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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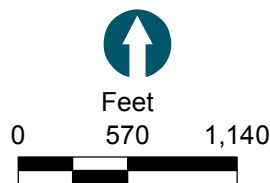


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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
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| Highways | |
| Channel Migration Zone | |

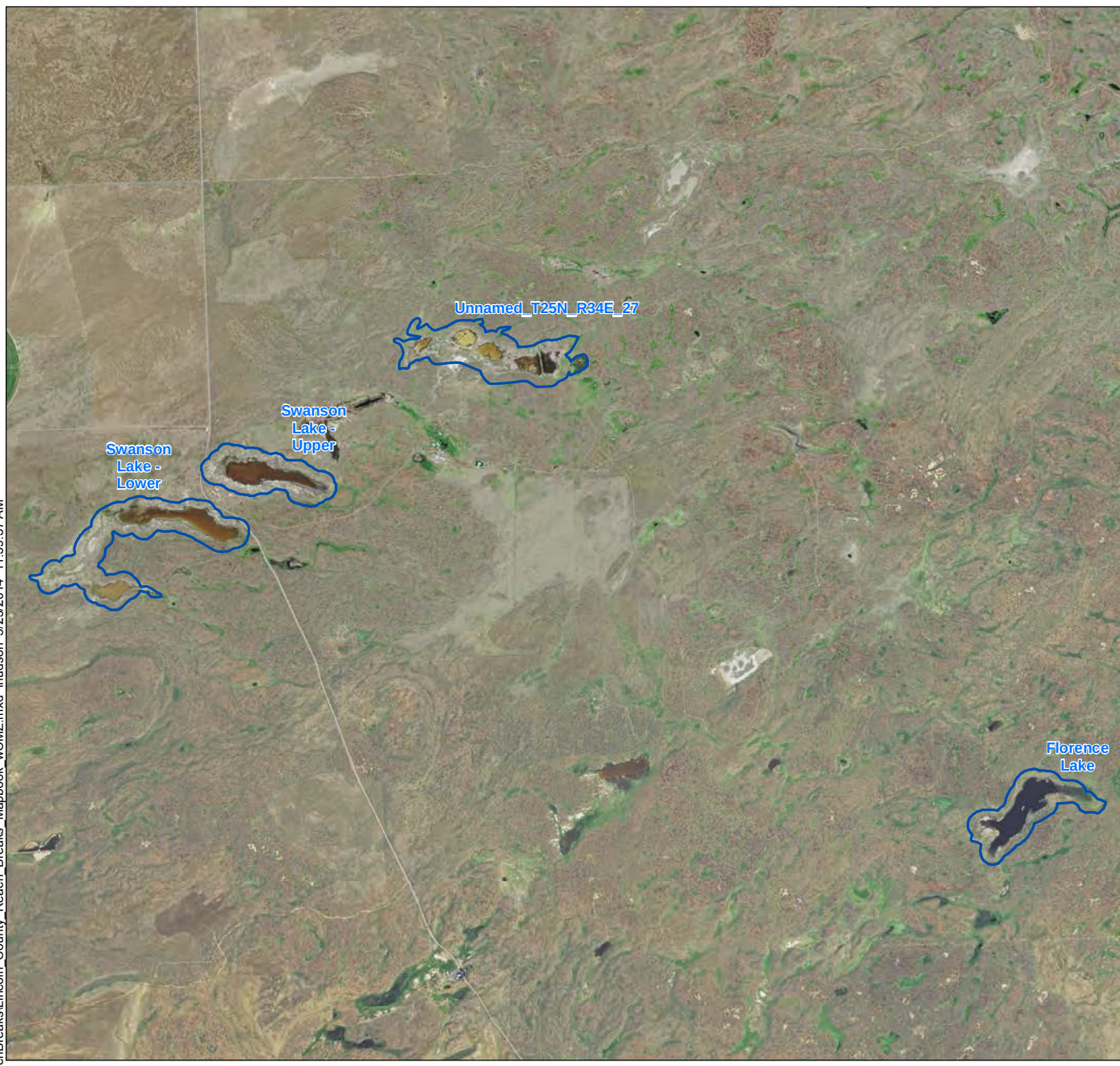
NOTES:
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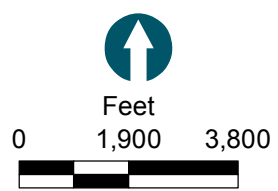


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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

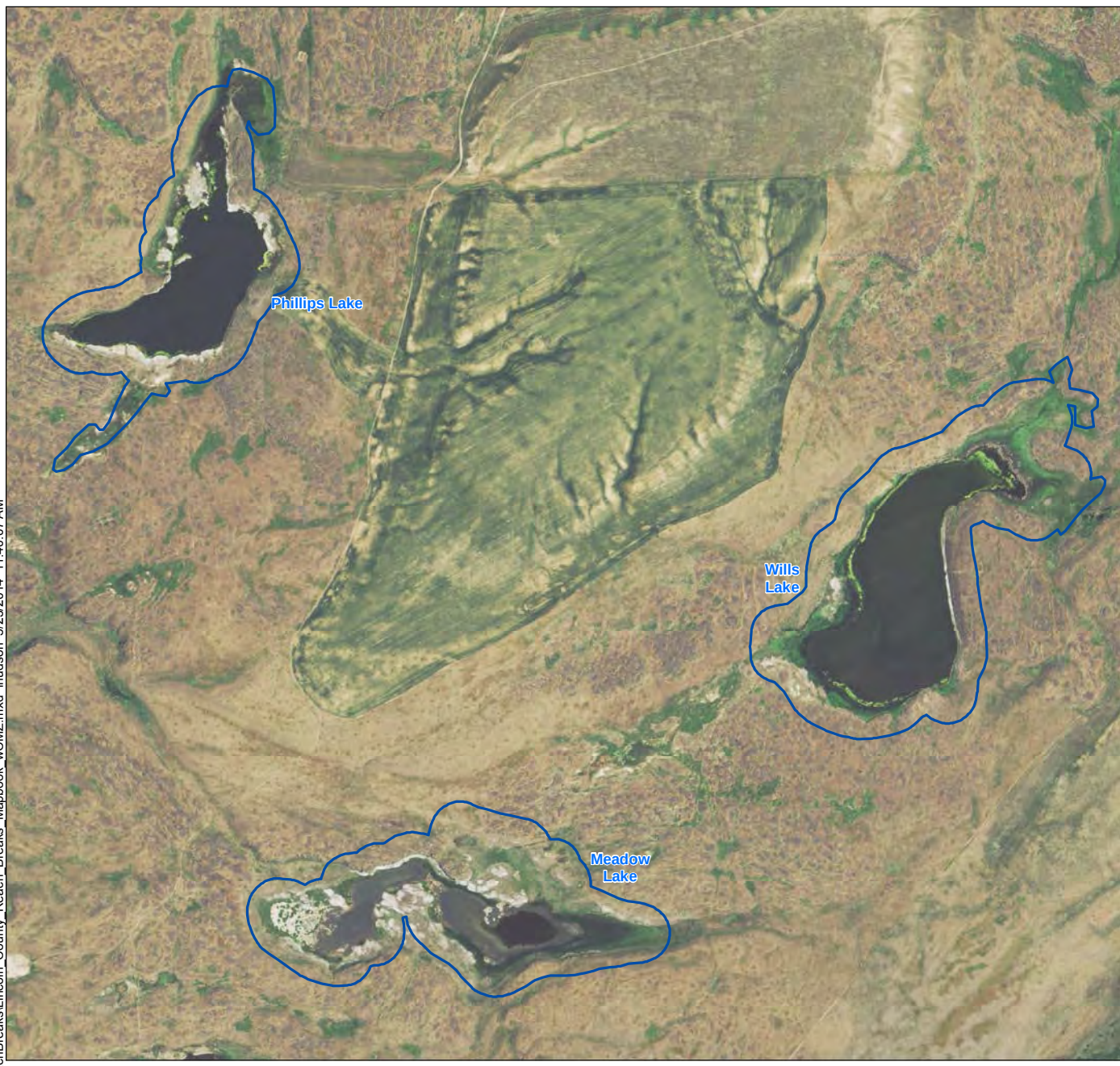
NOTES:
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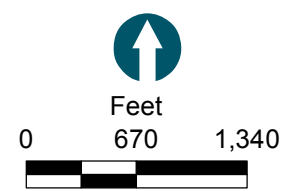


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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:
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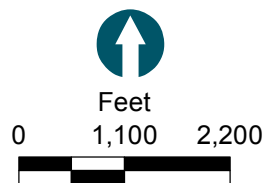


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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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East-Central Lake Group**Lincoln County**

Reach Description: East-Central Lake Group consists of two lakes in and north of the Town of Reardan in the northeast portion of the county. While Ecology lists these lakes as unnamed, they are generally referred to as Reardan Audubon Lakes.

Shoreline Jurisdiction: Unnamed T25N R39E 9 and Unnamed T25N R39E 10, 224 acres



Source: U.S. Department of Agriculture, *National Agriculture Imagery Program (NAIP)*: 2013 data

Subreaches (SR); see Figure 36:

Not Applicable.

CHARACTERISTICS

Ownership: The shoreline around Unnamed T25N R39E 10 is primarily public (Washington Department of Fish and Wildlife [WDFW]). The shoreline around Unnamed T25N R39E 9 is mixture of public (Washington Department of Natural Resources [DNR]) and private.

Land Use/Current SMP:

Land use designation:

- Land use Agricultural
- Zoning is Agricultural

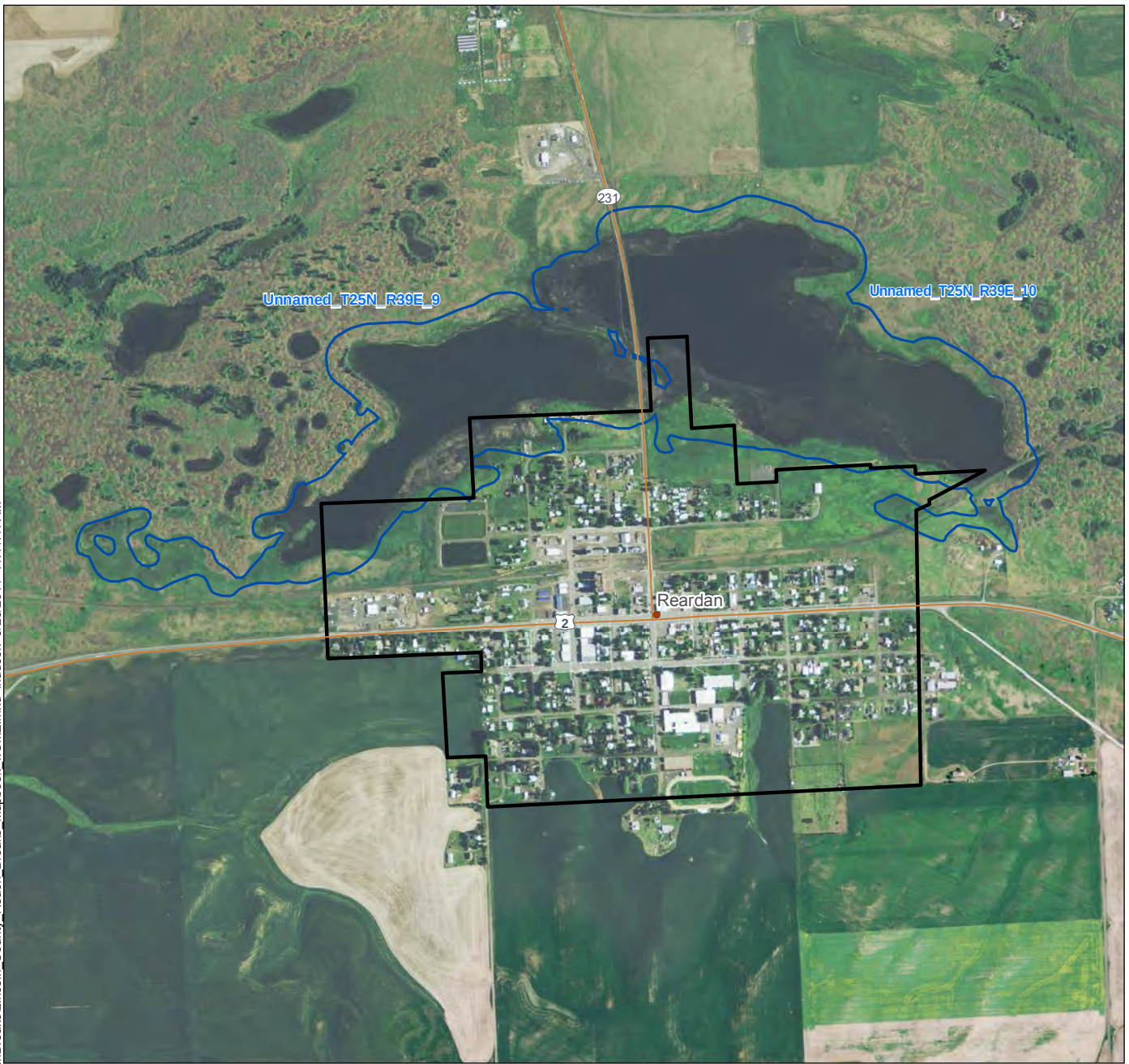
Current SMP Environment Designation: Not available.

Existing Land Cover/Development: Open space, State Route 231 crossing, railroad crossing

East-Central Lake Group	Lincoln County
Geomorphic Character: Description: The lakes are natural depressions located in the outburst flood deposits sourced by ground water and local overland flow. The lakes appear to have no distinct surface inflow or outflow channels. Hardened banks: Highway 231 bisects eastern lake (T25N, R39E, Sec10) along a length of 930 feet.	
Flooding and Geological Hazards: Floodplains are included in FEMA maps; in general flood risk is confined to the lake area with some connectivity between nearby lakes during extreme flood conditions. Soils adjacent to the lakes are designated to have slight erosion potential and very low to low liquefaction susceptibility. Most of shoreline are underlain by outburst flood deposits, but present no landslide hazard due to the flat topography.	
Existing Public Access: The lakes are part of WDFW's Swanson Lakes Wildlife area. WDFW owns land in this shoreline. The shoreline has visual access from State Route 231 and there is no other public access available in these lakes. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access may not be feasible in most of the lakes due to the sensitive nature of shoreline and limited access.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: These lakes generally have no or intermittent inflows and do not appear to have an outflow channel. Groundwater likely influences lake water quantities. Sediment is likely to enter during extreme events but may not have an outlet.	
Water Quality: The lakes are listed as waters of concern (Category 2) for bacteria. Water quality in these lakes is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: These lakes are situated in a remote area, with high levels of agricultural land use. Open-water habitat is isolated from other surface waters. The immediate riparian zone is vegetated with grasses and shrubs. Adjacent uplands are in agricultural production, although one lake occurs adjacent to the community of Reardan and is boarded by residential areas in addition to agricultural land use and open palustrine wetland habitat. Mule deer, Rocky Mountain elk, Northwest white-tailed deer, white-tailed jack-rabbit and snowy owl may make use of the lake and surrounding riparian habitat. The lakes are noted for high concentrations	

East-Central Lake Group	Lincoln County
of waterfowl during certain times of the year. While most habitat is lacustrine, several acres of freshwater palustrine emergent habitat exists along the lakes' shores.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Agricultural use: • Irrigated agricultural fields near the riparian zone Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals or nutrient inputs from agricultural run-off. Recreational use: • Informal trails Recreational use may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Grass or woody plant strips adjacent to the shoreline. Shrub-steppe restoration consistent with WDFW 2011 recommendations. Potential Protection Opportunities: Concentrate water access recreation points.	

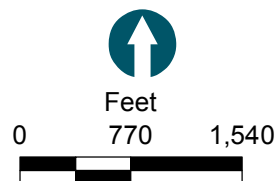
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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

NOTES:

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Long Lake	Lincoln County
Reach Description: Long Lake is in Lincoln and Grant County, in the northwest corner of Lincoln County	
Shoreline Jurisdiction: Long Lake, 60 acres total, 11 acres within Lincoln County	
 Source: U.S. Department of Agriculture, <i>National Agriculture Imagery Program (NAIP): 2013 data</i>	
Subreaches (SR); see Figure 37: Not Applicable.	
CHARACTERISTICS	
Ownership: Long Lake is privately owned.	
Land Use/Current SMP: Land use designation: • Land use is Agricultural • Zoning is Agricultural Current SMP Environment Designation: Not available	
Existing Land Cover/Development: Open space	
Geomorphic Character: Description: Long Lake is located in an elongated bedrock depression that straddles the Grant-Lincoln County line. The lake is likely sourced mostly by groundwater and local surface drainages. Seasonal inflow and outflow channels appear in the topography at the lake's inlet and outlet, respectively. Hardened banks: None identified.	

Long Lake	Lincoln County
Flooding and Geological Hazards: Floodplains are included in FEMA maps; in general, flood risk is confined to the lake area. Long Lake is situated in basalt bedrock. Adjacent soils are designated to have slight erosion potential. There is no liquefiable soil or landslide hazard around Long Lake.	
Existing Public Access: No public access is available.	
Identified Public Access Improvements: No improvements have been identified in this reach.	
Public Access Opportunities: Public access may not be feasible due to lack of access roads.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Long Lake generally has no or intermittent inflows and do not appear to have an outflow channel. Groundwater likely influences lake water quantities. Sediment is likely to enter during extreme events but may not have an outlet.	
Water Quality: Water quality in Long Lake is likely impacted by agricultural and pasture runoff.	
Habitat Characteristics and PHS Species Presence: This table describes the portion of Long Lake within Lincoln County. The level of the lake fluctuates and the portion of the lake within Lincoln County can go dry during low water conditions. The lake is surrounded by shrub-steppe land, created as a result of the historic geologic flood outburst. The lake is situated in a remote area with few roads and isn't directly adjacent to any cultivated agricultural lands, although cattle do roam the areas to graze and utilize the lake for watering, or for foraging once the lake goes dry. The lake has a hydrological connection among several low-lying areas in the immediate vicinity, and some of these may become connected to Long lake during high water levels. The immediate riparian zone around the lake is narrow and vegetated with grasses and shrubs. In most cases, the vegetation is consistent with shrub-steppe habitat, and there are few trees present on the Lincoln County shoreline of Long Lake. The area around Long Lake on the Grant County side has been documented to support two rare plant species; constricted Douglas' onion and arrow thelypody. Mule deer are noted to be present in the area around Long Lake and waterfowl concentrations are notable during wetter seasons. While most habitat is lacustrine, several acres of freshwater palustrine emergent habitat exists along the lake's shores, and some of these areas may be inundated and connected to the lake during certain times of the year.	

Long Lake

Lincoln County

ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)

Level of Existing Function: Functioning

Stressors:

Agricultural use:

- Livestock impacts

Currently there are very low numbers of livestock, but they may affect aquatic functions of forage and rearing through impacts to water quality due to nutrient inputs from livestock wastes or erosion. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors.

Potential Restoration Opportunities: Management of invasive species

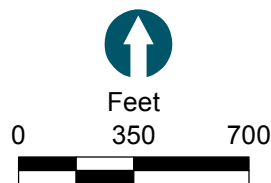
Potential Protection Opportunities: Monitor periodically and evaluate measures needed if grazing impacts appear.

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| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | |
| Highways | |
| Channel Migration Zone | |

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 3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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APPENDIX B
TOWN OF ODESSA REACH
CHARACTERIZATION TABLES AND
REACH MAPS

Crab Creek – Reach 1	Town of Odessa
Reach Description: Crab Creek from Town of Odessa boundary to the upstream of Route 28 bridge near West 2nd Avenue street end	
Shoreline Jurisdiction: 15 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches; see Figure 1:	
Non Applicable.	
CHARACTERISTICS	
Ownership: Reach 1 is privately owned.	
Land Use/Current Shoreline Master Program (SMP):	
Land use designation: - Existing land use is mostly Residential; the railroad parallels the shoreline on the northwest side - Zoning is Residential II, Industrial, Public, and Commercial Current SMP Environment Designation: Not available.	
Existing Land Cover/Development: Residential and agricultural development, and railway and State Route 28 crossing	
Geomorphic Character:	
Description: Crab Creek flows within a confined channel through the Town of Odessa. Throughout this reach, the stream valley and banks consist of outburst flood deposits. Highway 28 and the BNRR cross the stream channel.	
Hardened banks: None identified.	

Crab Creek – Reach 1	Town of Odessa
Flooding and Geological Hazards: The Crab Creek floodplain and floodway is included in FEMA maps showing flood risk through this reach of Crab Creek. In general, the floodplain is bounded in the north by the railroad with the exception of the downstream end of this reach where the railroad crossing occurs. It is bounded on the south by 6th Avenue. Adjacent soils are designated to have slight erosion potential and very low to low liquefaction susceptibility. The valley contains outburst flood deposits, and a small area of designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: Public access is limited due to the developed private properties. Road ends on both sides make the shoreline accessible, but no specific public access opportunities exist. Identified Public Access Improvements: No improvements have been identified. Public Access Opportunities: Public access could be provided at the road ends.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: Crab Creek within the Town of Odessa is a water of concern (Category 2) for pH. Water quality in this reach is likely impacted by stormwater runoff.	
Habitat Characteristics and PHS Species Presence: This short reach of Crab Creek is located within the limits of Odessa, and crosses under the Burlington Northern Santa Fe railroad tracks and under Highway 28. The riparian zone in this reach is constrained by upland land use activities. The vegetation consists of deciduous trees, shrubs and grasses, with a higher concentration of invasive species such as Himalayan blackberry present near the highway crossing. At the end of this reach, the creek occasionally runs dry or continues underground. Just outside of Odessa, Crab Creek is noted for presence numerous bird species, including American white pelican, ferruginous hawk, Swainson’s hawk, loggerhead shrike, sage thrasher, sage sparrow; mammals including white-tailed jackrabbit, mule deer, badger, Washington ground squirrel, Western small-footed myotis, and Yuma myotis; and racer in the uplands. These species may make use of the riparian habitat within this reach as well, although the increased level of development due to industrial and residential uses	

Crab Creek – Reach 1	Town of Odessa
may prevent or deter these species from using this reach of the creek. This reach of Crab Creek provides habitat for warm-water fish species, such as bass and mountain whitefish walleye, and cold-water fish species, such as brown and rainbow trout. Other animals commonly observed in this reach include feral cats, skunks, raccoons, and snakes. Outdoor pets and other non-native animals, including livestock on hobby farms, can impact the presence and expression of life histories of shrub-steppe and riparian wildlife. Dogs and especially cats harass and kill countless numbers of birds, mammals, reptiles, and amphibians each year (Azerrad et al. 2011).	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Upland development: - Roadways and structures adjacent to riparian zone Upland development primarily impacts continuity of riparian and shrub-steppe habitats and allows establishment of invasive species, and, therefore, riparian functions such as migratory corridors, erosion control, and wildlife habitat. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat. Recreational use: - Informal trails near Peterson Lake Recreational use may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Removal of invasive species, planting of native riparian and woody species along shorelines, incorporate soft bank stabilization techniques. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; preserve intact wetland and riparian buffers.	

Crab Creek – Reach 2**Town of Odessa**

Reach Description: Crab Creek from near the West 2nd Avenue street end to East Marjorie Avenue

Shoreline Jurisdiction: 51 acres



Source: <https://fortress.wa.gov/ecy/coastalatl/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches; see Figure 1:

Not Applicable.

CHARACTERISTICS

Ownership: Reach 2 is privately owned.

Land Use/Current Shoreline Master Program (SMP):

Land use designation:

- Existing land use is mostly Residential and Commercial
- Zoning is a mix of Residential II, Commercial, and Public

Current SMP Environment Designation: Not available.

Existing Land Cover/Development: Residential development with several local road crossings

Geomorphic Character:

Description: Crab Creek flows within a confined channel through the Town of Odessa. Throughout this reach, the stream valley and banks consist of outburst flood deposits. Three roadway bridges cross the stream channel.

Hardened banks: Hardened bank along the right bank downstream of East 1st Avenue for approximately 200 feet.

Crab Creek – Reach 2	Town of Odessa
Flooding and Geological Hazards: The Crab Creek floodplain and floodway is included in Federal Emergency Management Agency maps showing flood risk through this reach of Crab Creek. In general, the floodplain is bounded in the north by the railroad with the exception of the upstream end of this reach where Duck Creek crosses under the railroad to meet Crab Creek. The floodplain is generally confined on the south side in this reach. Adjacent soils are designated to have slight erosion potential and very low to low liquefaction susceptibility. The valley contains outburst flood deposits, and a small area of designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: Public access is limited due to the developed private properties. Road ends on both sides make the shoreline accessible, but no specific public access opportunities exist. South Alder Street and South First Street bridges provide visual access to the creek.	
Identified Public Access Improvements: No improvements have been identified.	
Public Access Opportunities: Public access could be provided at the road ends.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Duck Creek is a major drainage input within this reach. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediment may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: Crab Creek within the Town of Odessa is a water of concern (Category 2) for pH. Water quality in this reach is likely impacted by stormwater runoff.	
Habitat Characteristics and PHS Species Presence: This reach of Crab Creek is located within the limits of Odessa, and crosses through more developed land area. The riparian zone in this reach is minimal, as the creek runs dry or continues underground, and vegetation is constrained by upland land use activities. The creek bed is also crossed by a number of local streets. The riparian vegetation, where present, consists of deciduous trees, shrubs, and grasses, with a higher concentration of invasive species such as Himalayan blackberry present near the road crossings and residential areas. This reach of Crab Creek has minimal PHS presence. Burrowing owl has been noted to the north of the creek, on the outskirts of Odessa. This reach may provide transitory habitat for warm-water fish species, such as bass, and mountain whitefish walleye, and cold-water fish species, such as brown and rainbow trout (but only during certain times of the year).	

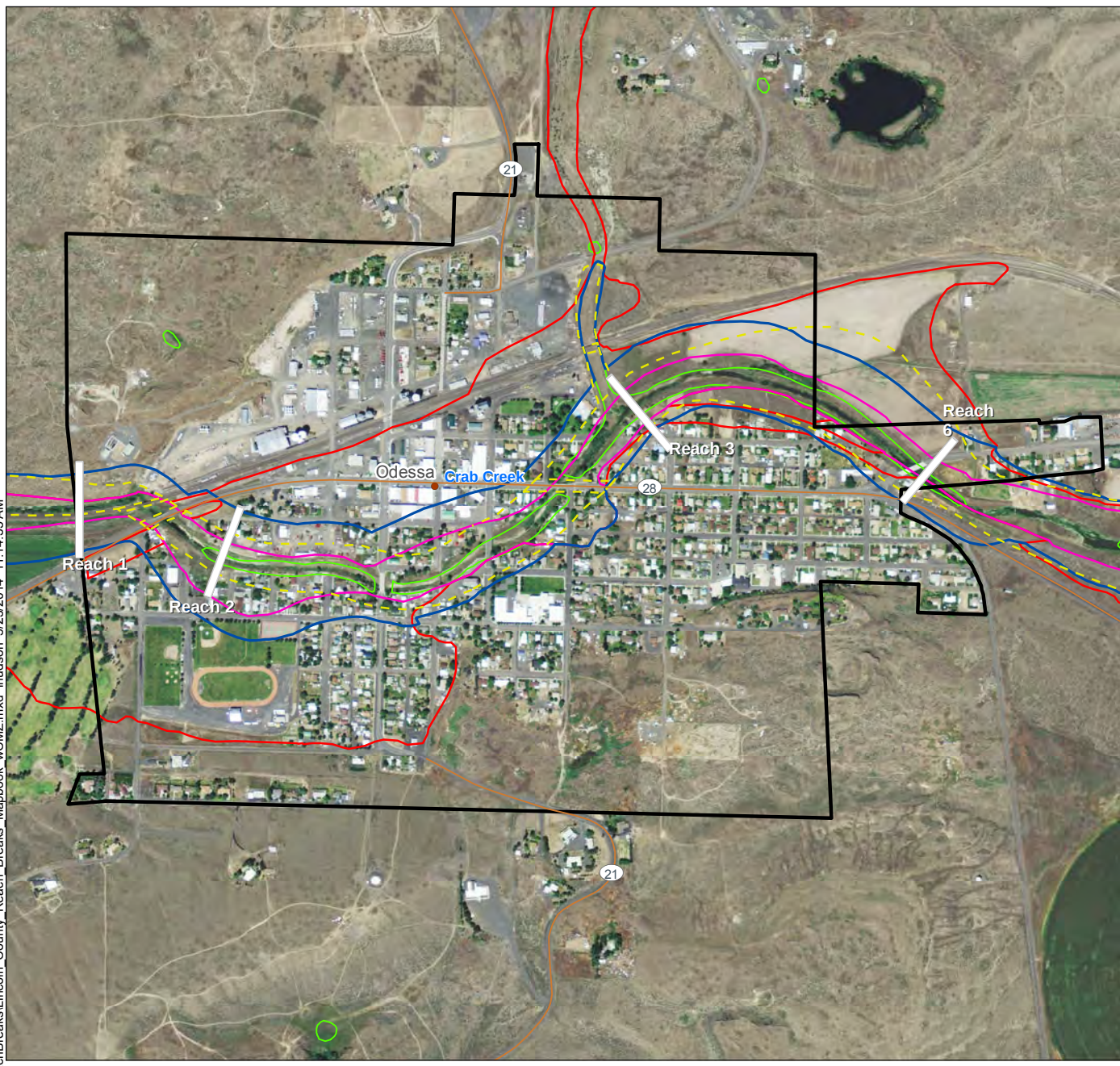
Crab Creek – Reach 2	Town of Odessa
Other animals commonly observed in this reach include feral cats, skunks, raccoons, and snakes. Outdoor pets and other non-native animals, including livestock on hobby farms, can impact the presence and expression of life histories of shrub-steppe and riparian wildlife. Dogs and especially cats harass and kill countless numbers of birds, mammals, reptiles, and amphibians each year (Azerrad et al. 2011).	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Upland development: • Roadways and structures adjacent to riparian zone Upland development primarily impacts continuity of riparian and shrub-steppe habitats and allows establishment of invasive species, and, therefore, riparian functions such as migratory corridors, erosion control, and wildlife habitat. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat. Potential Restoration Opportunities: Removal of invasive species, planting of native riparian and woody species along shorelines, incorporate soft bank stabilization techniques. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; preserve intact wetland and riparian buffers.	

Crab Creek – Reach 3	Town of Odessa
Reach Description: Crab Creek from the upstream of East Marjorie Avenue to Town of Odessa boundary	
Shoreline Jurisdiction: 40 acres	
 Source: https://fortress.wa.gov/ecy/coastalatlas/UICoastalAtlas/Tools/ShorePhotos.aspx	
Subreaches; see Figure 1:	
Not Applicable	
CHARACTERISTICS	
Ownership: Reach 3 is privately owned.	
Land Use/Current Shoreline Master Program (SMP):	
Land use designation: - Existing land use is Residential with vacant land on the north bank - Zoning is a Residential I, Residential II, and Industrial Current SMP Environment Designation: Not available.	
Existing Land Cover/Development: Open space, residential, and agricultural	
Geomorphic Character:	
Description: Crab Creek flows within a confined channel through the Town of Odessa. Throughout this reach, the stream valley and banks consist of outburst flood deposits.	
Hardened banks: None identified.	

Crab Creek – Reach 3	Town of Odessa
Flooding and Geological Hazards: The Crab Creek floodplain and floodway is included in Federal Emergency Management Agency maps showing flood risk through this reach of Crab Creek. In general, the floodplain is bounded in the north by the railroad and is confined on the south side in this reach. Adjacent soils are designated to have slight erosion potential and very low to low liquefaction susceptibility. The valley contains outburst flood deposits, and a small area of designated landslide hazards where slopes are greater than 15%.	
Existing Public Access: The shoreline is undeveloped and currently has no public access. East Dobson Road provides visual access to the creek. Identified Public Access Improvements: No improvements have been identified. Public Access Opportunities: Public access such as trail facilities could be provided along shorelines via easements.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: Crab Creek drains a significant area. Crab Creek is not regulated; however, there are upstream irrigation diversions and groundwater well withdrawals that impact water quantity. Some fine sediments may be input into this reach during high precipitation events; sediments can generally move freely throughout the reach.	
Water Quality: Crab Creek within the Town of Odessa is a water of concern (Category 2) for pH. Water quality in this reach is likely impacted by stormwater runoff.	
Habitat Characteristics and Priority Habitat Species (PHS) Presence: This short reach of Crab Creek is located within the limits of Odessa, and crosses under a local road near the end of the reach at the edge of town. This reach begins where the creek bed has more consistent water presence, and the riparian vegetation is more significant here than in adjacent Reach 2, but remains somewhat constrained by upland land use activities. The vegetation consists of a few smaller scattered deciduous trees, shrubs, and grasses, with a higher concentration of invasive species such as Himalayan blackberry present near the road crossing. There is minimal presence of PHS in this reach. This reach provides habitat for warm-water fish species, such as bass and mountain whitefish walleye and cold-water fish species, such as brown and rainbow trout. Other animals commonly observed in this reach include feral cats, skunks, raccoons, and snakes. Outdoor pets and other non-native animals, including livestock on hobby farms, can impact the presence and	

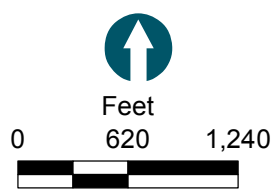
Crab Creek – Reach 3	Town of Odessa
expression of life histories of shrub-steppe and riparian wildlife. Dogs and especially cats harass and kill countless numbers of birds, mammals, reptiles, and amphibians each year (Azerrad et al. 2011).	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Impaired Stressors: Upland development: • Roadways and structures adjacent to riparian zone Upland development primarily impacts continuity of riparian and shrub-steppe habitats and allows establishment of invasive species, and, therefore, riparian functions such as migratory corridors, erosion control, and wildlife habitat. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat. Agricultural use: • Irrigated agricultural fields adjacent to the riparian zone • Livestock impacts Agricultural use primarily affects aquatic functions of forage and rearing through impacts to water quality and quantity through withdrawals. It may affect water quality due to nutrient inputs from agricultural runoff or livestock wastes. Livestock activity may cause reduced or disturbed shoreline vegetation, or allow establishment of invasive species, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Removal of invasive species, planting of native riparian and woody species for buffers along shorelines, incorporate soft bank stabilization techniques. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; preserve intact riparian buffers.	

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- | | |
|--------------------------------|--------------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | FEMA 100 Year Floodplain |
| Highways | FEMA Floodway |
| Channel Migration Zone | NWI Wetland |

NOTES:
1. This information is to be used for planning purposes only.
Data is displayed as is and without any guarantee of accuracy or completeness.
2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.



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APPENDIX C
TOWN OF REARDAN REACH
CHARACTERIZATION TABLES AND
REACH MAPS

Reardan Audubon Lake**Town of Reardan**

Reach Description: This area consists of two lakes north of the Town of Reardan in the northeast portion of the county. While Ecology lists these lakes as unnamed, they are generally referred to as Reardan Audubon Lakes.

Shoreline Jurisdiction: Unnamed_T25N_R39E_9 and Unnamed_T25N_R39E_10, 250 acres



Source: <https://fortress.wa.gov/ecy/coastalatlus/UICoastalAtlas/Tools/ShorePhotos.aspx>

Subreaches (SR); see Figure 1:

Not Applicable.

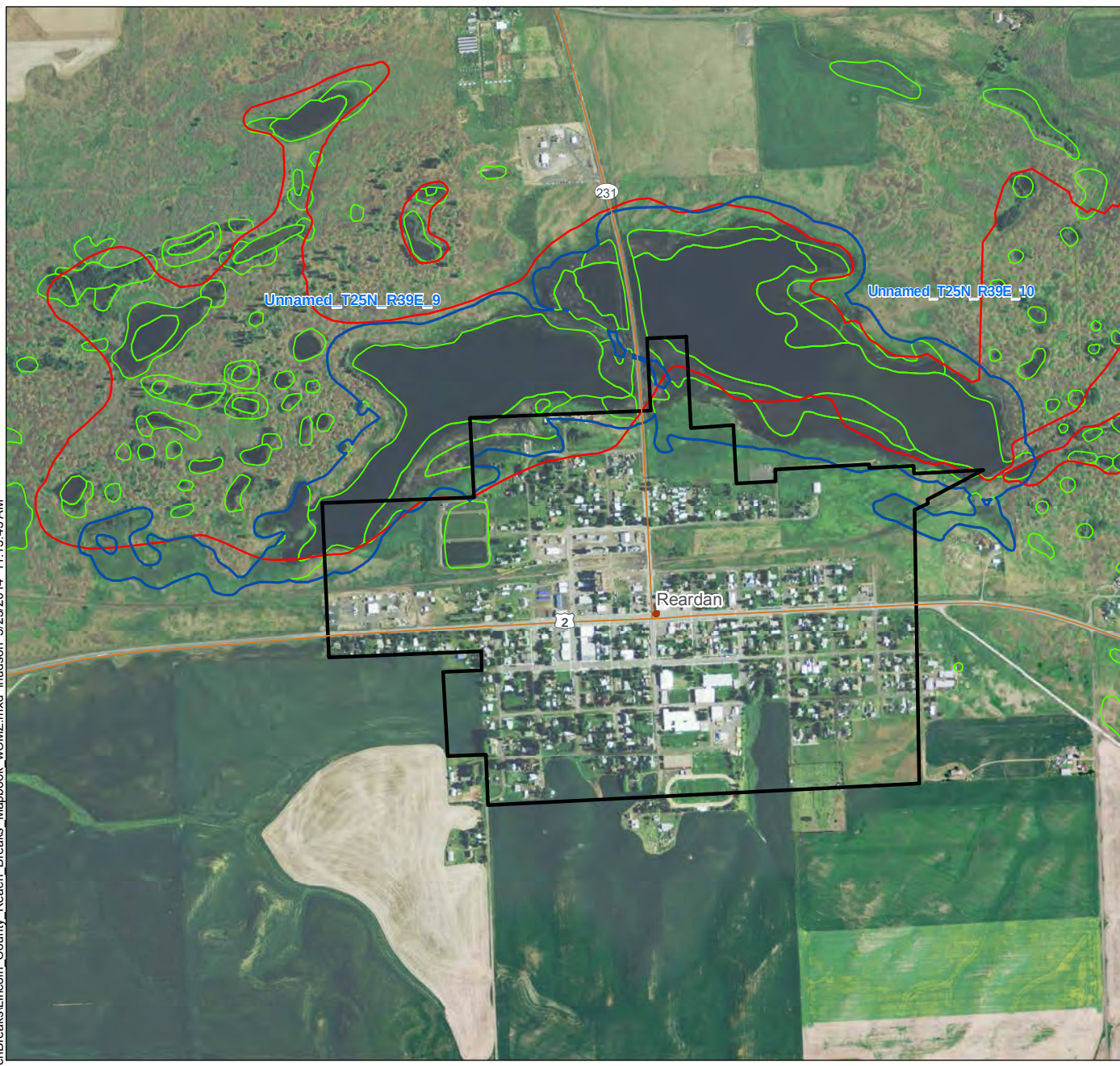
CHARACTERISTICS

Ownership: The shoreline around Unnamed_T25N_R39E_10 is primarily public (Washington Department of Fish and Wildlife [WDFW]). The shoreline around Unnamed_T25N_R39E_9 is mixture of public (Washington Department of Natural Resources) and private.

Reardan Audubon Lake	Town of Reardan
Land Use/Current Shoreline Master Program (SMP): Land use designation: Existing zoning is Residential and Agricultural; much of the shoreline area is vacant and publicly owned and falls within 100-year floodplain. Current SMP Environment Designation: Not available.	
Existing Land Cover/Development: Open space, State Route 231 crossing, residential, and agricultural.	
Geomorphic Character: Description: The lakes are natural depressions located in the outburst flood deposits sourced by groundwater and local overland flow. The lakes appear to have no distinct surface inflow or outflow channels. Hardened banks: None Identified.	
Flooding and Geological Hazards: Floodplains are included in FEMA maps; the Town of Reardan has flood risk in the northwestern portion of town due to the Unnamed_T25N_R39E_9. Soils adjacent to the lakes are designated to have slight erosion potential and very low to low liquefaction susceptibility. Most of shoreline is underlain by outburst flood deposits, but presents no landslide hazard due to the flat topography.	
Existing Public Access: The lakes are part of WDFW's Swanson Lakes Wildlife area. WDFW and the Town of Reardan own land in this shoreline. Shoreline has visual access from State Route 231. The southern shore is accessible from East Railroad Avenue. The northern shore is accessible from Euclid Road, east of State Route 231. The northern shore has a parking area and Americans with Disabilities Act restroom on the north end of Audubon Way. The northern and southern shoreline areas have short, paved pedestrian trails that lead to a bird viewing blind at the end of each trail. Each blind has permanently mounted binocular viewing stations. Identified Public Access Improvements: No improvements have been identified in this reach. Public Access Opportunities: Public access could be provided from road ends.	
ECOLOGICAL CONDITIONS	
Water Quantity and Sediment: This lake does not appear to have inflow or outflow channels, so groundwater and precipitation would likely be the main influences to water quantity. Sediment is likely to enter during extreme events but may not have an outlet.	

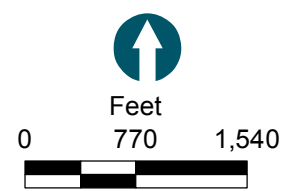
Reardan Audubon Lake	Town of Reardan
Water Quality: The lakes are listed as waters of concern (Category 2) for bacteria. Water quality in the lakes is likely impacted by agricultural and stormwater runoff.	
Habitat Characteristics and PHS Species Presence: The shorelines have wide swaths of undeveloped riparian habitat consistent with palustrine/lacustrine littoral vegetation communities with grasses and marsh plants providing most of the vegetative cover. The lakes are noted for presence waterfowl concentrations at certain times of the year. The lakes are not noted for presence of any fish species.	
ECOLOGICAL FUNCTIONS ANALYSIS (BY SUBREACH)	
Level of Existing Function: Partially Functioning Stressors: Upland development: - Residential structures and roads Upland development primarily impacts continuity of riparian and shrub-steppe habitats and, therefore, riparian functions such as migratory corridors. It affects connectivity to the floodplain, which may affect water quality for forage and rearing functions of aquatic habitat. Recreational use: - Informal trails Residential use may result in reduced or disturbed shoreline vegetation, impacting riparian functions such as erosion control, wildlife habitat, and migratory corridors. Potential Restoration Opportunities: Removal of invasive species, planting of native riparian and woody species along shorelines, incorporate soft bank stabilization techniques, removal of fill materials. Potential Protection Opportunities: Stormwater controls for new development consistent with Eastern Washington Stormwater Manual; preserve intact wetland and riparian buffers.	

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|--------------------------------|--------------------------|
| Reach and Subreach (SR) Breaks | Incorporated City |
| Populated Place | County Boundary |
| County Seat | SMA Jurisdiction |
| Interstates | FEMA 100 Year Floodplain |
| Highways | FEMA Floodway |
| Channel Migration Zone | NWI Wetland |

NOTES:
1. This information is to be used for planning purposes only.
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2. Aerial imagery courtesy of USDA NAIP (2013).
3. Lincoln County's shoreline jurisdiction for Columbia and Spokane rivers ends in the middle of these rivers.

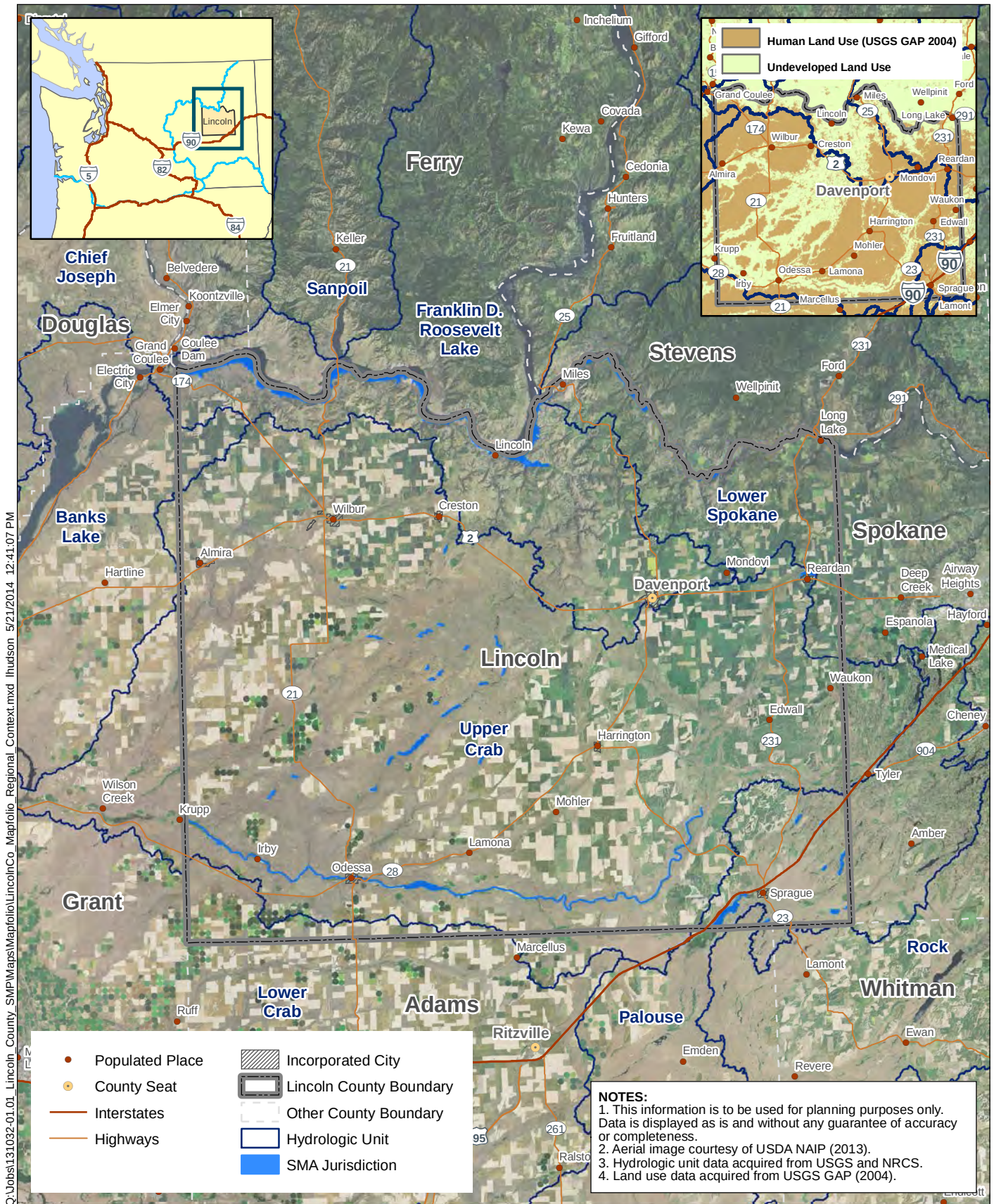


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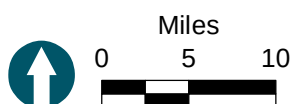


APPENDIX D

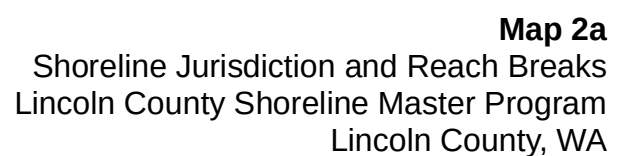
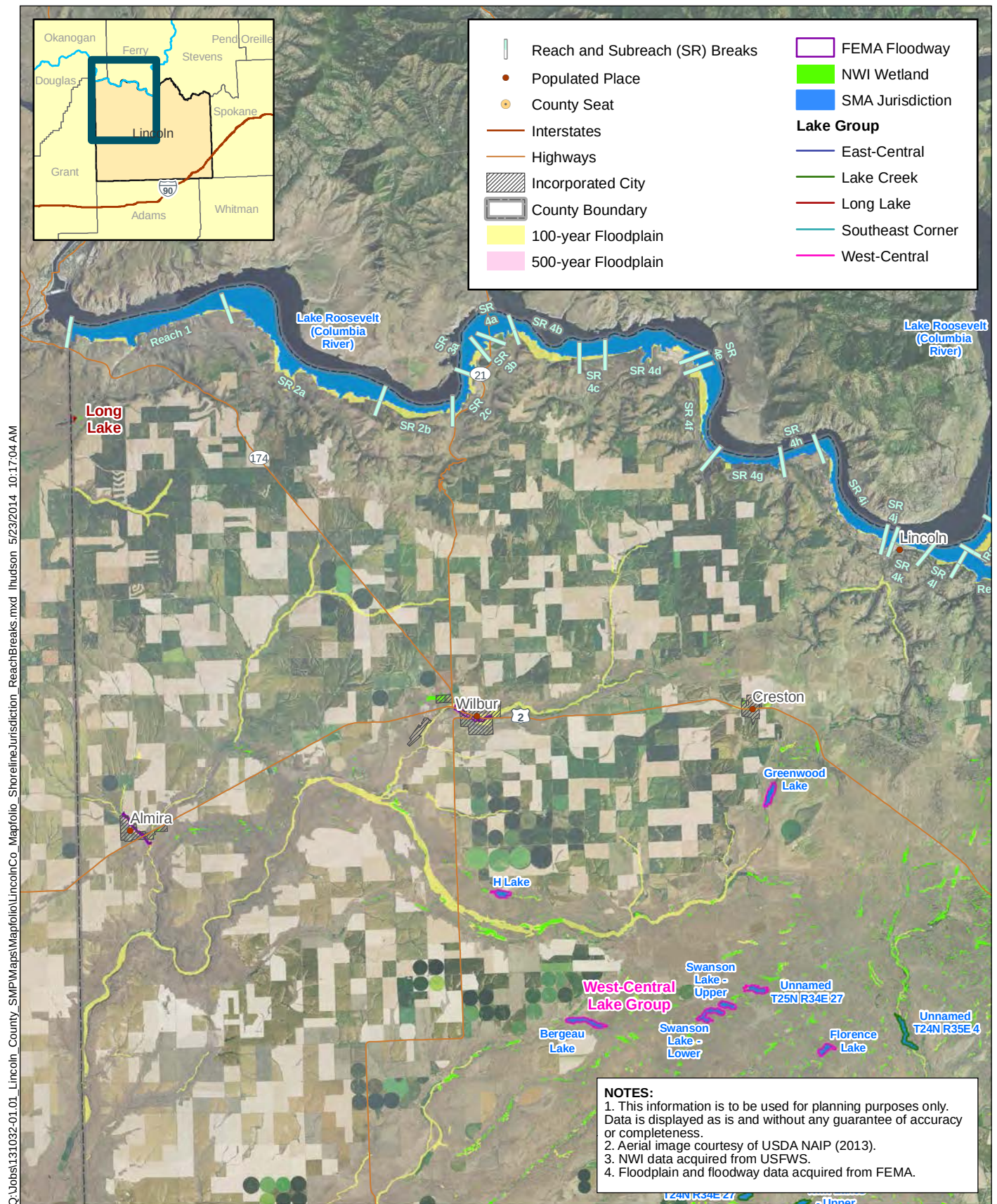
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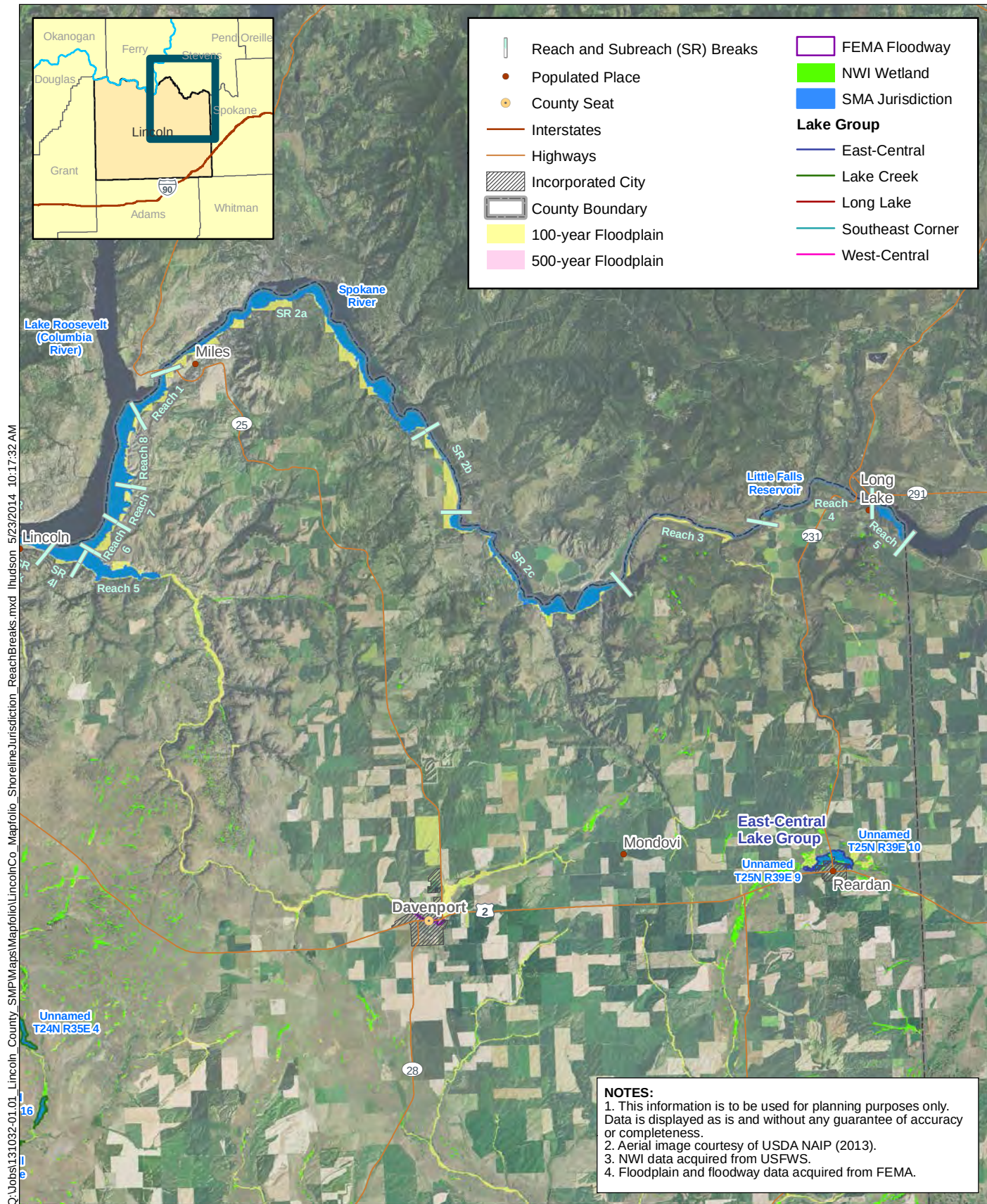


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Map 1
 Regional Context
 Lincoln County Shoreline Master Program
 Lincoln County, WA



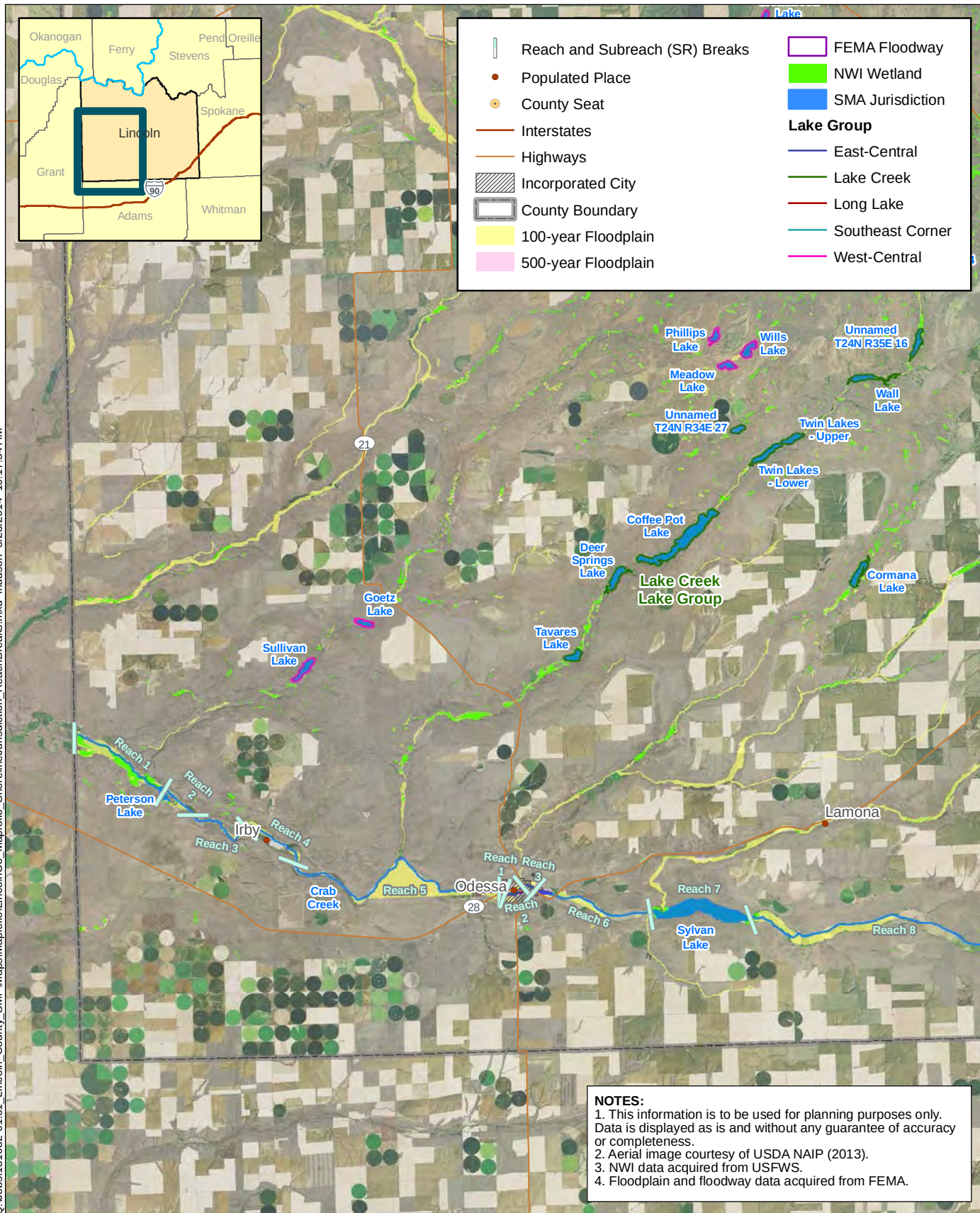


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Map 2b
Shoreline Jurisdiction and Reach Breaks
Lincoln County Shoreline Master Program
Lincoln County, WA

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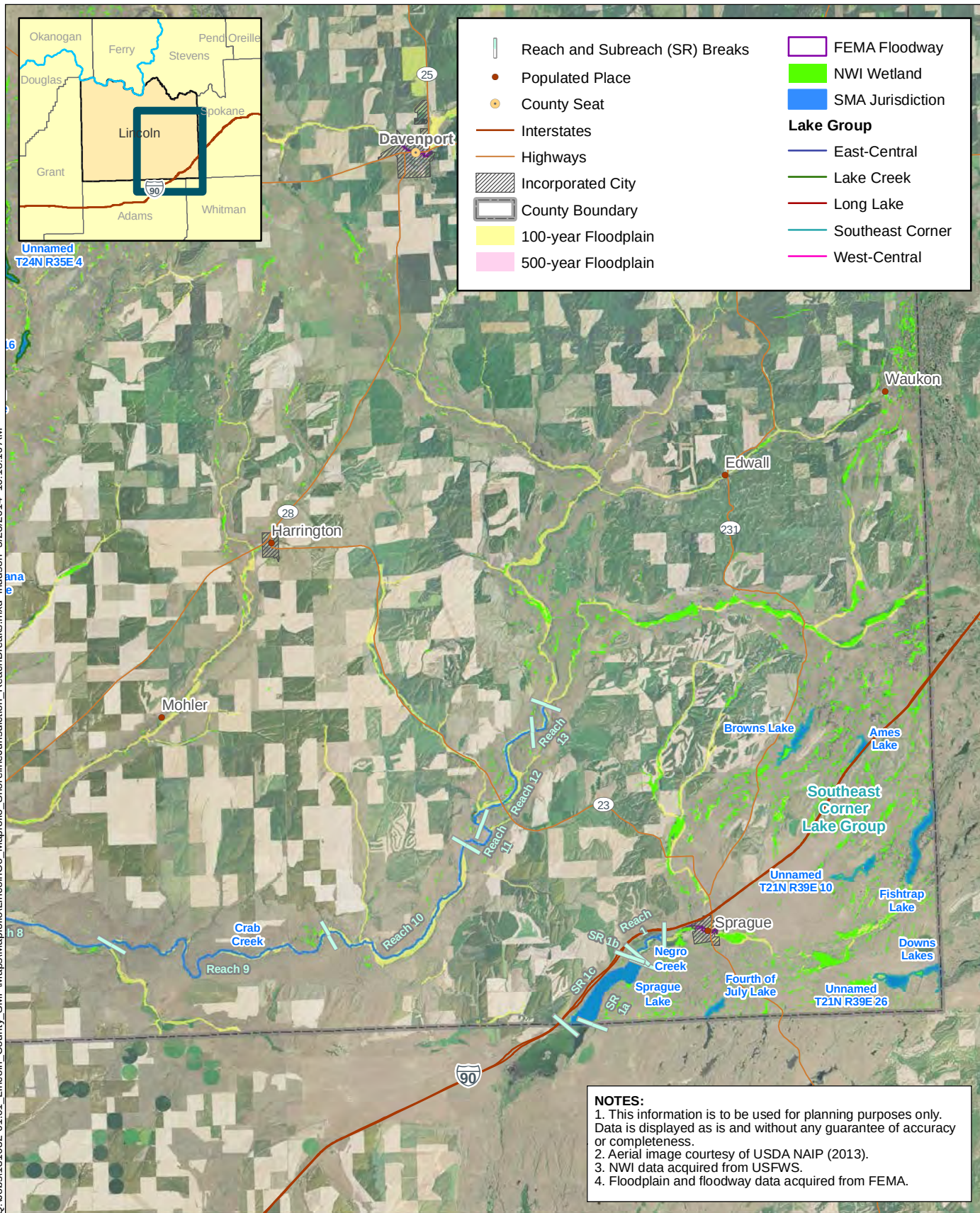


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Map 2c
Shoreline Jurisdiction and Reach Breaks
Lincoln County Shoreline Master Program
Lincoln County, WA

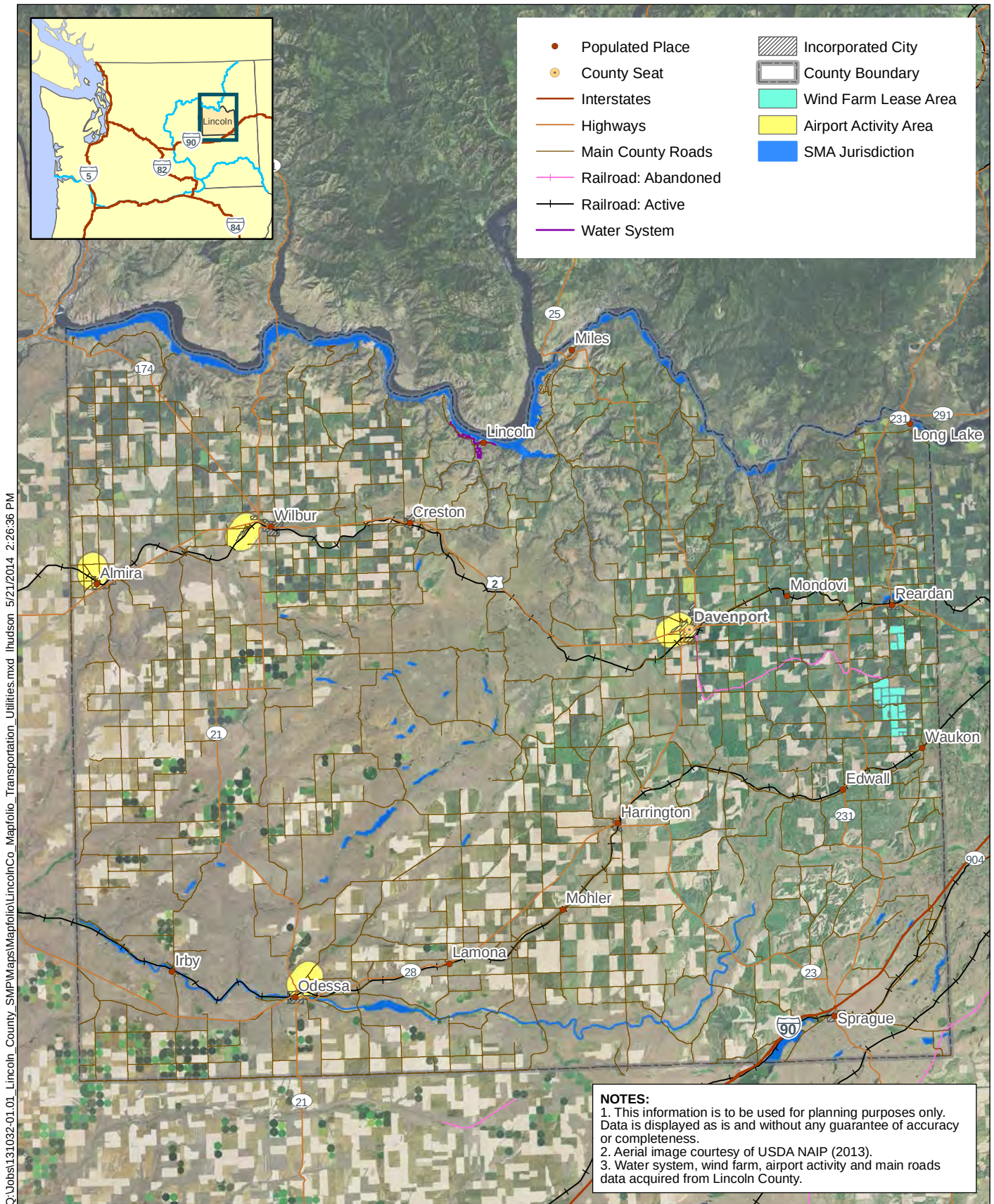
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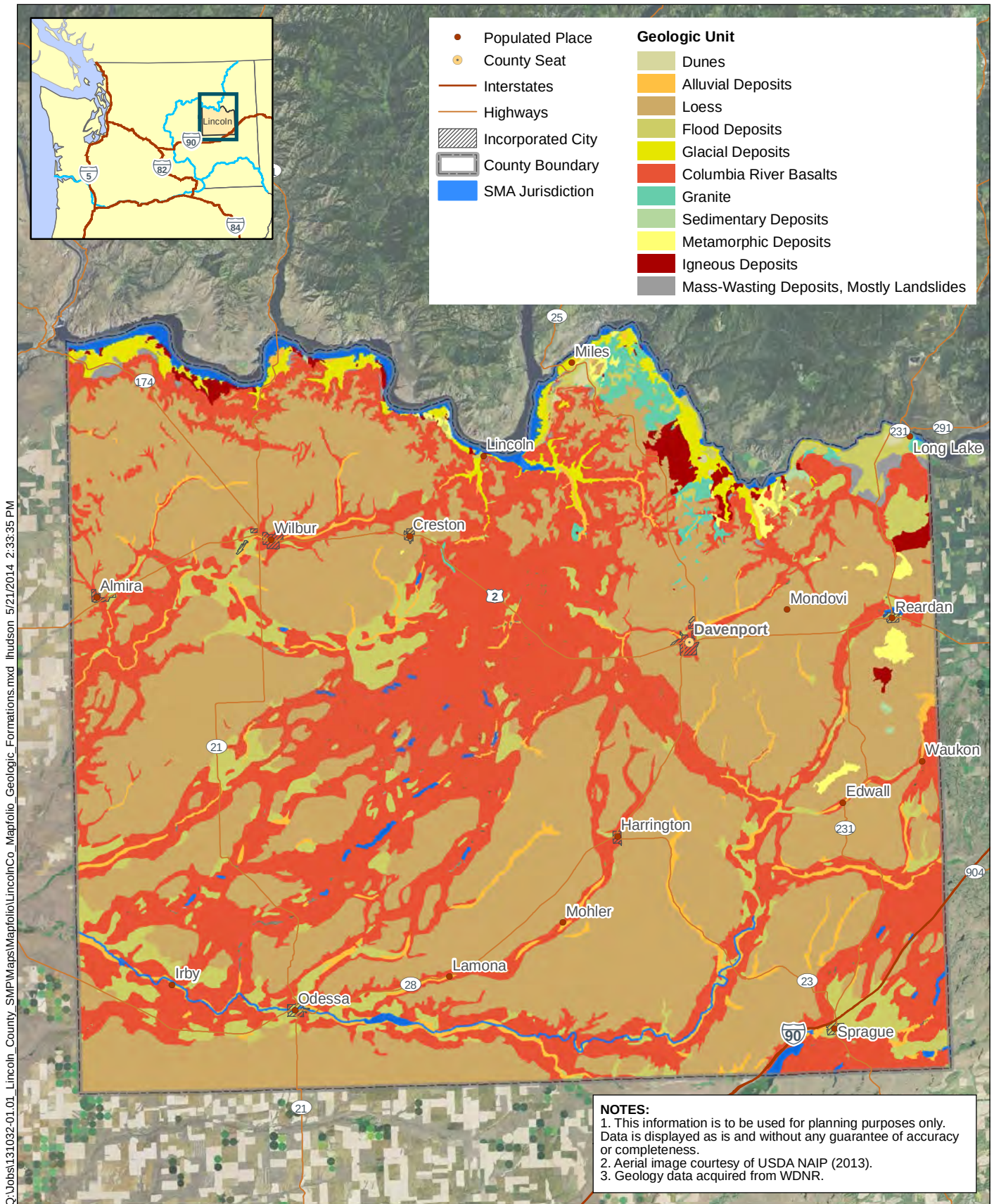
Map 2d
Shoreline Jurisdiction and Reach Breaks
Lincoln County Shoreline Master Program
Lincoln County, WA



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Map 3
 Transportation and Utilities
 Lincoln County Shoreline Master Program
 Lincoln County, WA

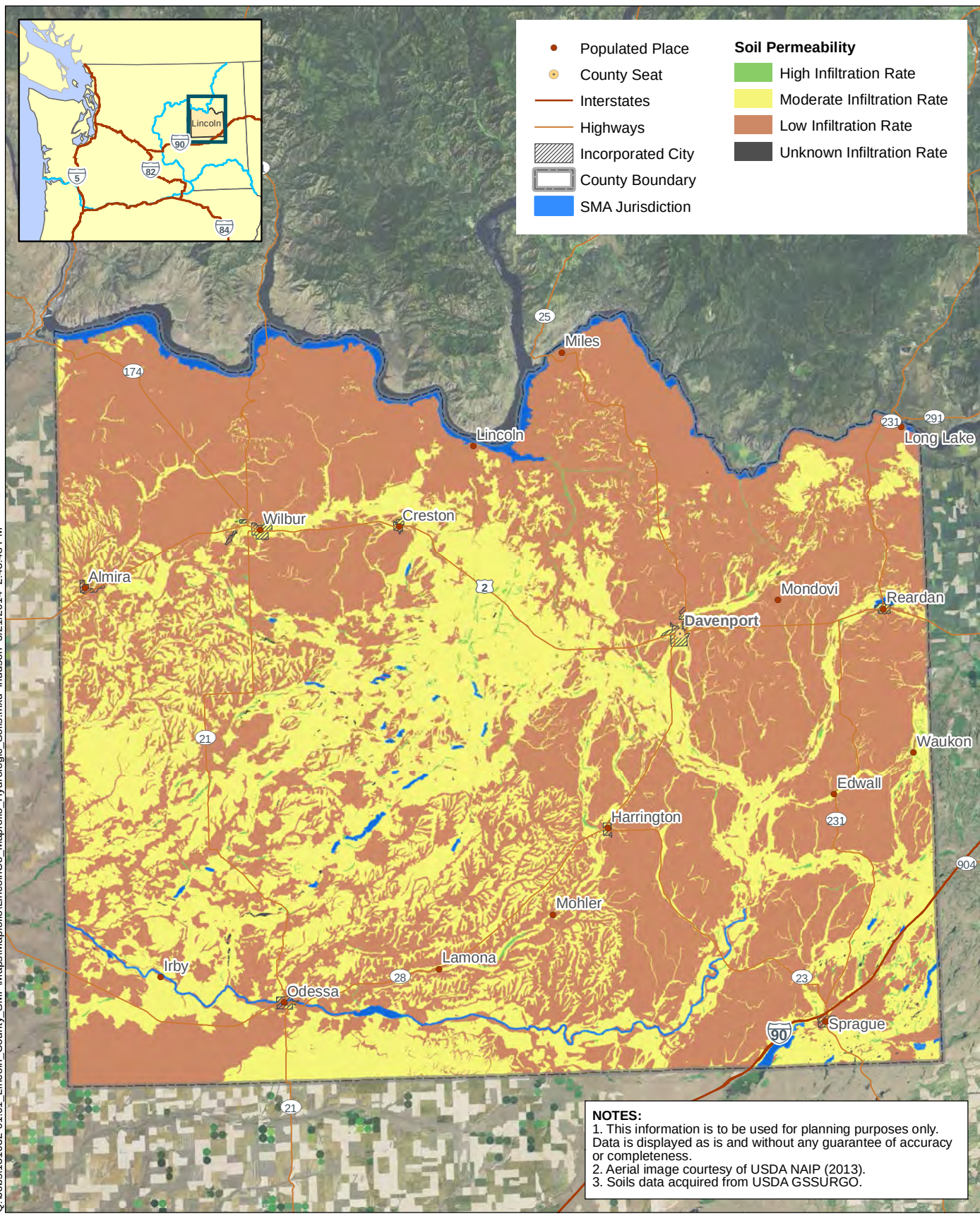


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Map 4
Surficial Geology
 Lincoln County Shoreline Master Program
 Lincoln County, WA

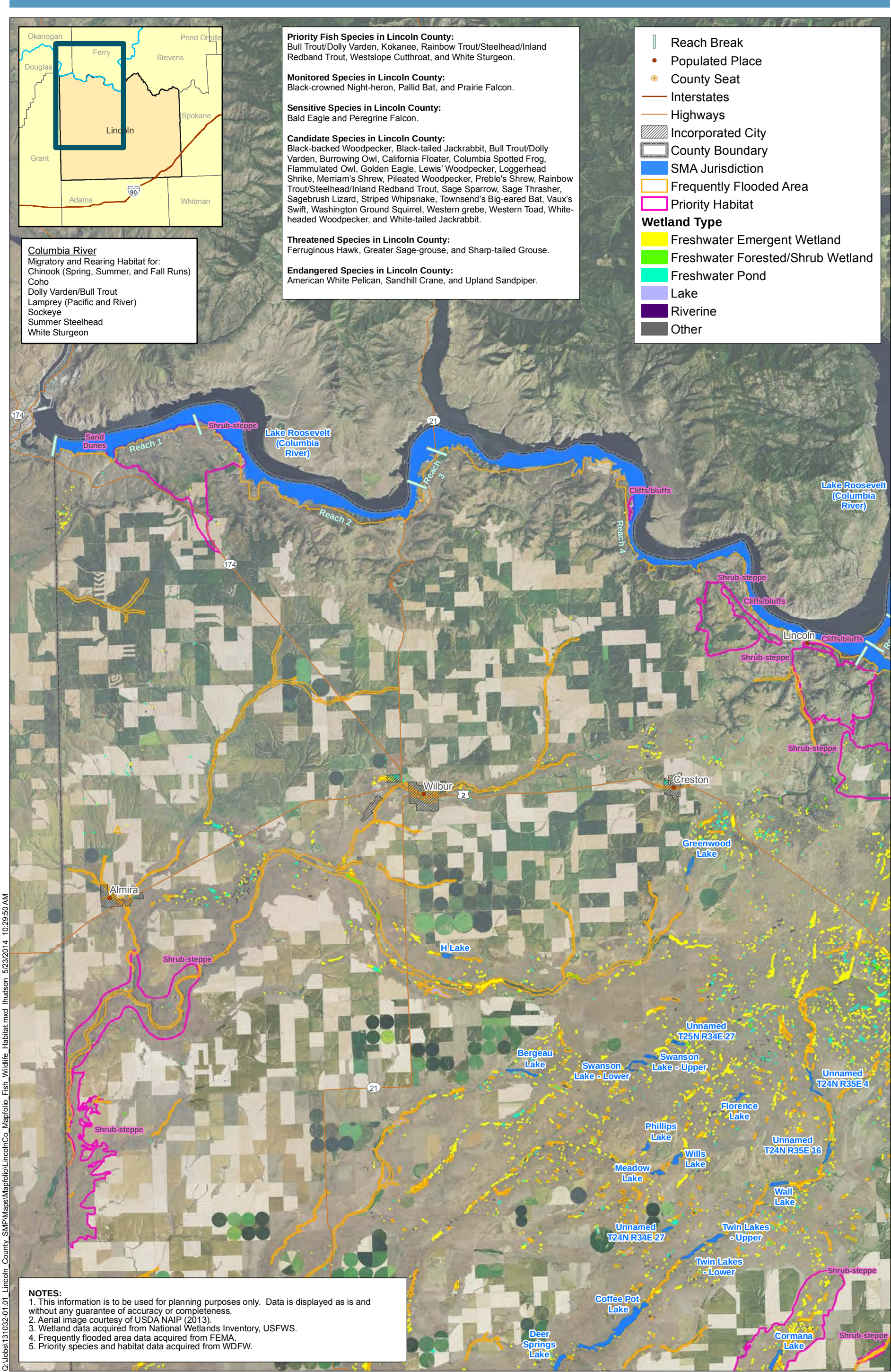
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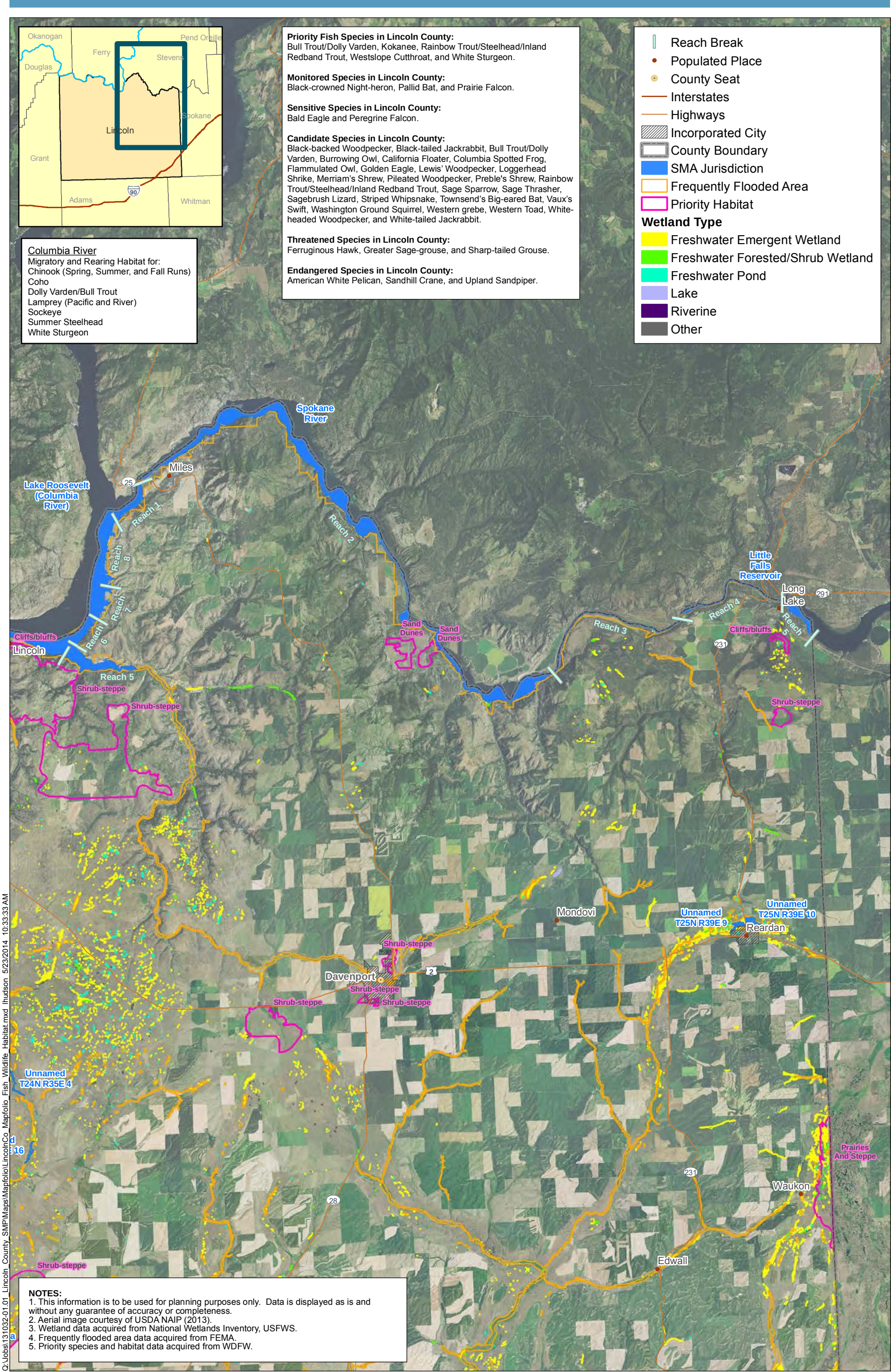


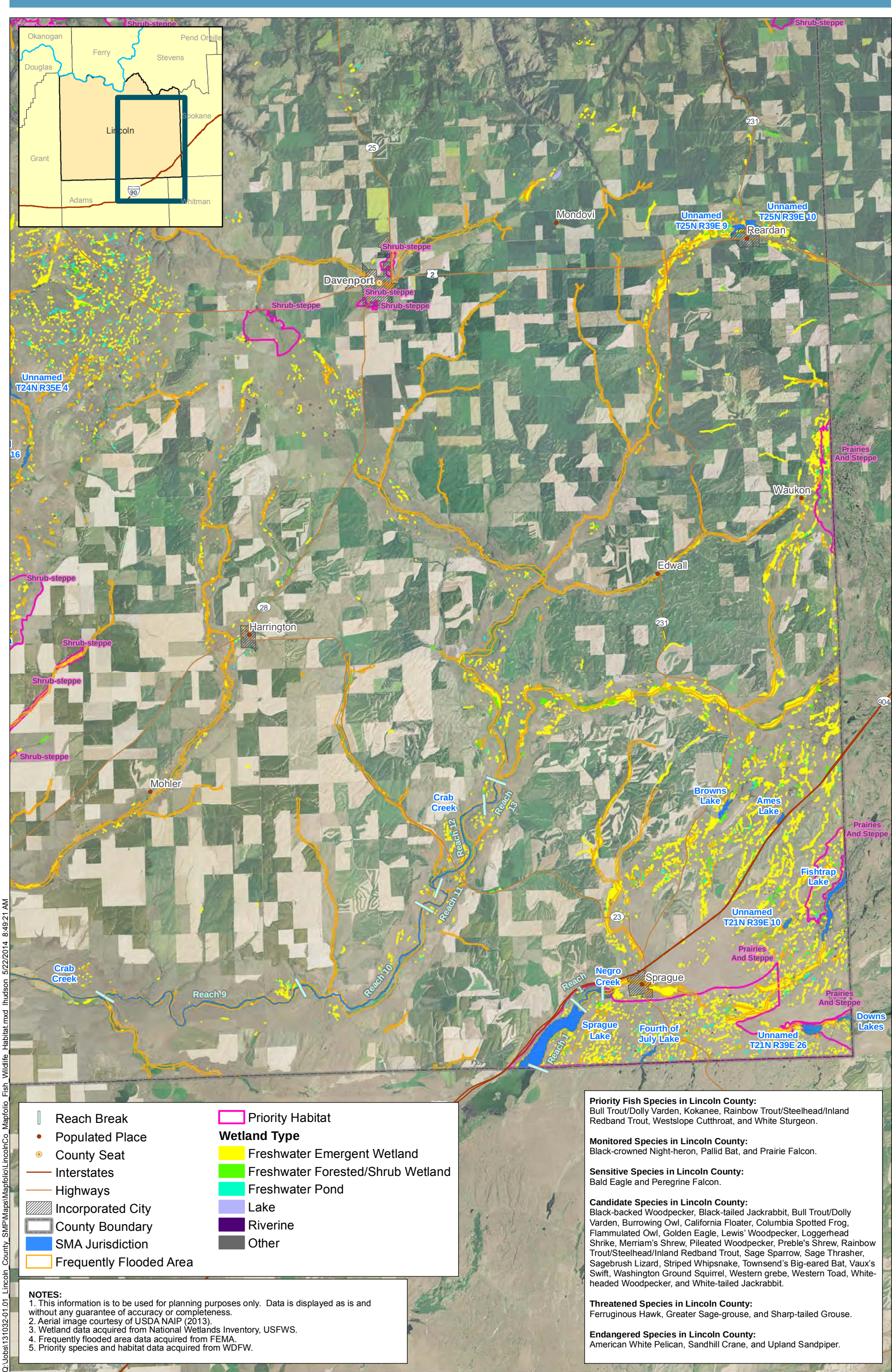
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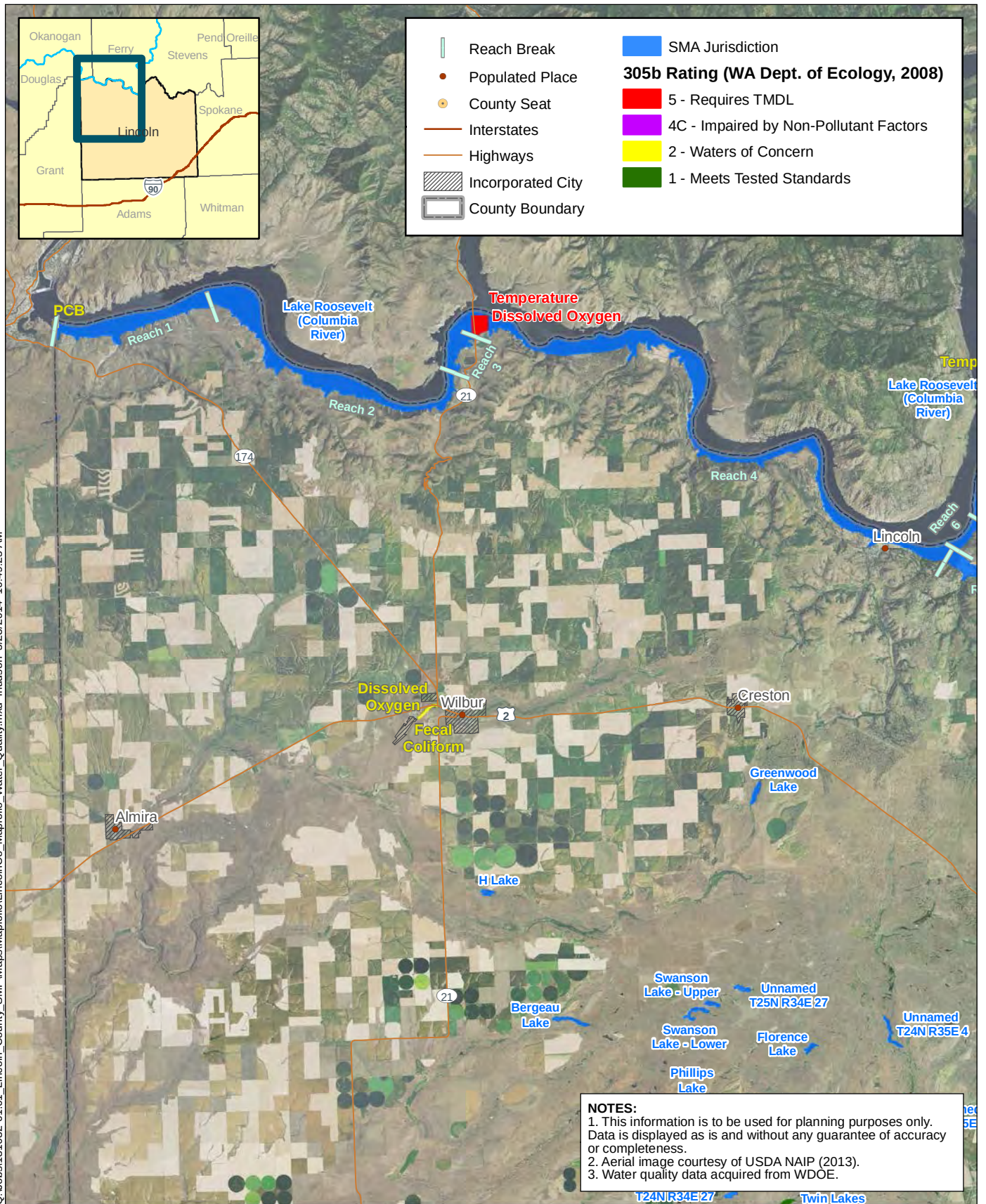
Map 5
Hydrologic Soils
Lincoln County Shoreline Master Program
Lincoln County, WA







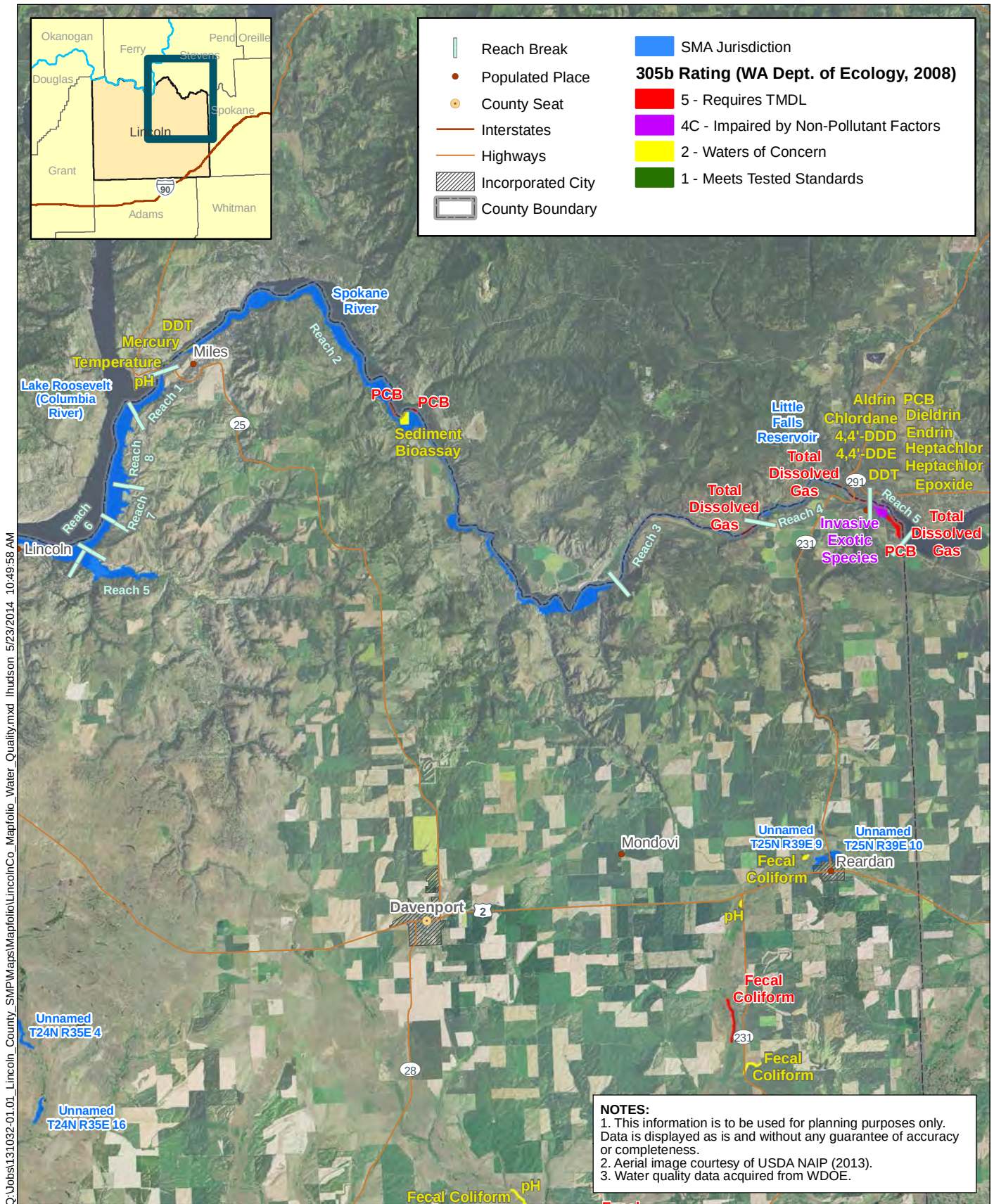
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Map 7a
Water Quality Assessment
Lincoln County Shoreline Master Program
Lincoln County, WA

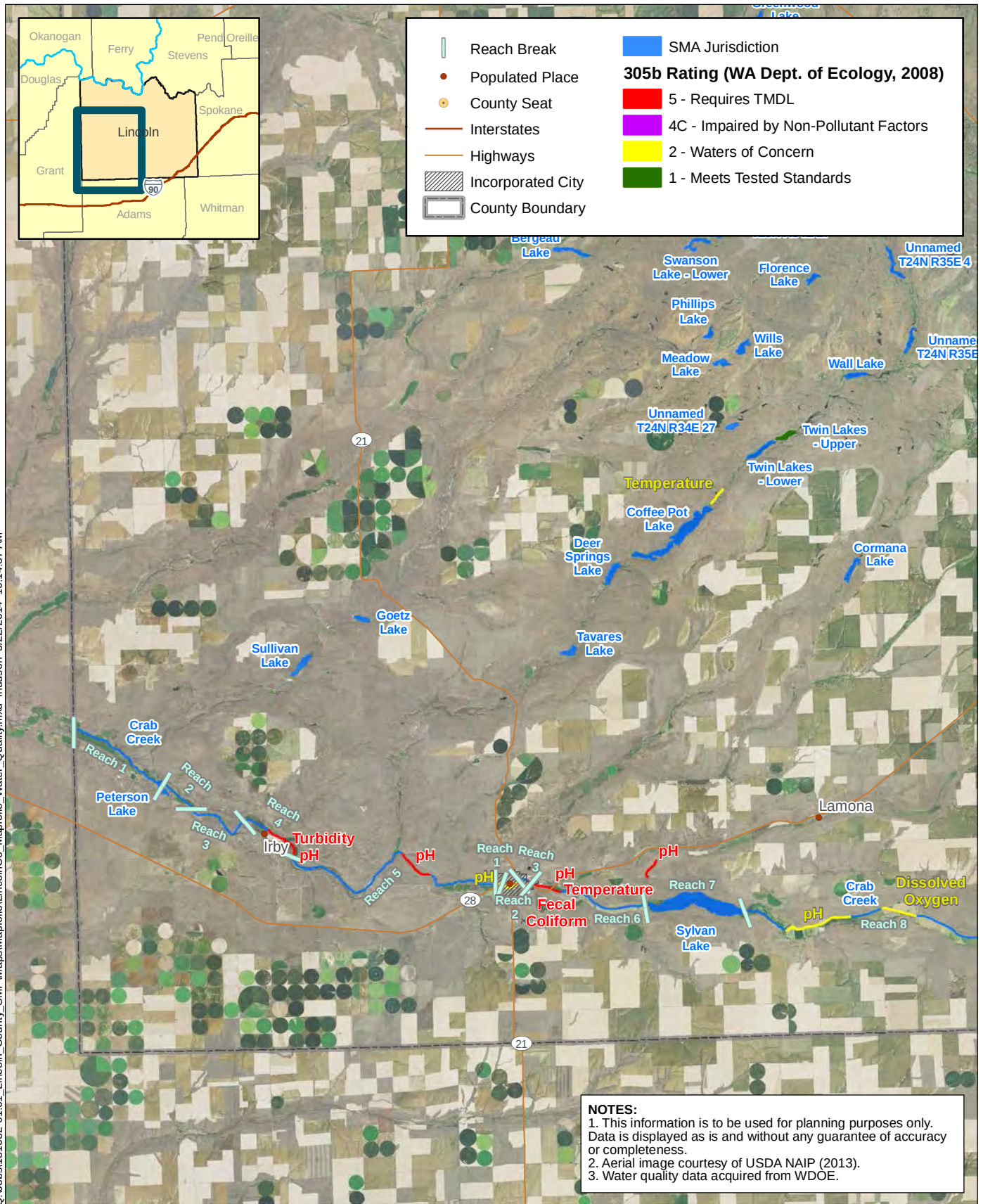


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Map 7b
Water Quality Assessment
Lincoln County Shoreline Master Program
Lincoln County, WA

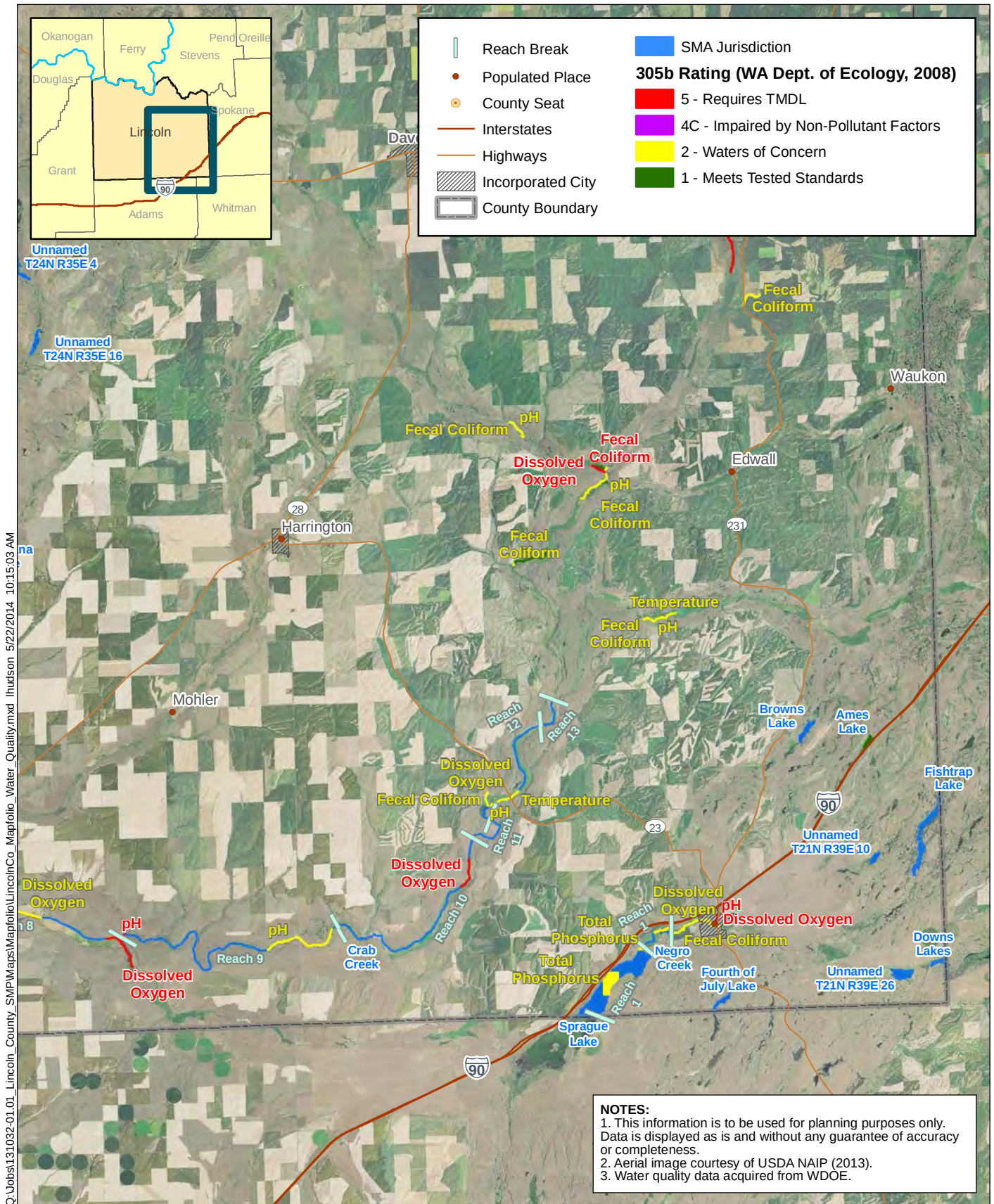
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Map 7c
Water Quality Assessment
Lincoln County Shoreline Master Program
Lincoln County, WA

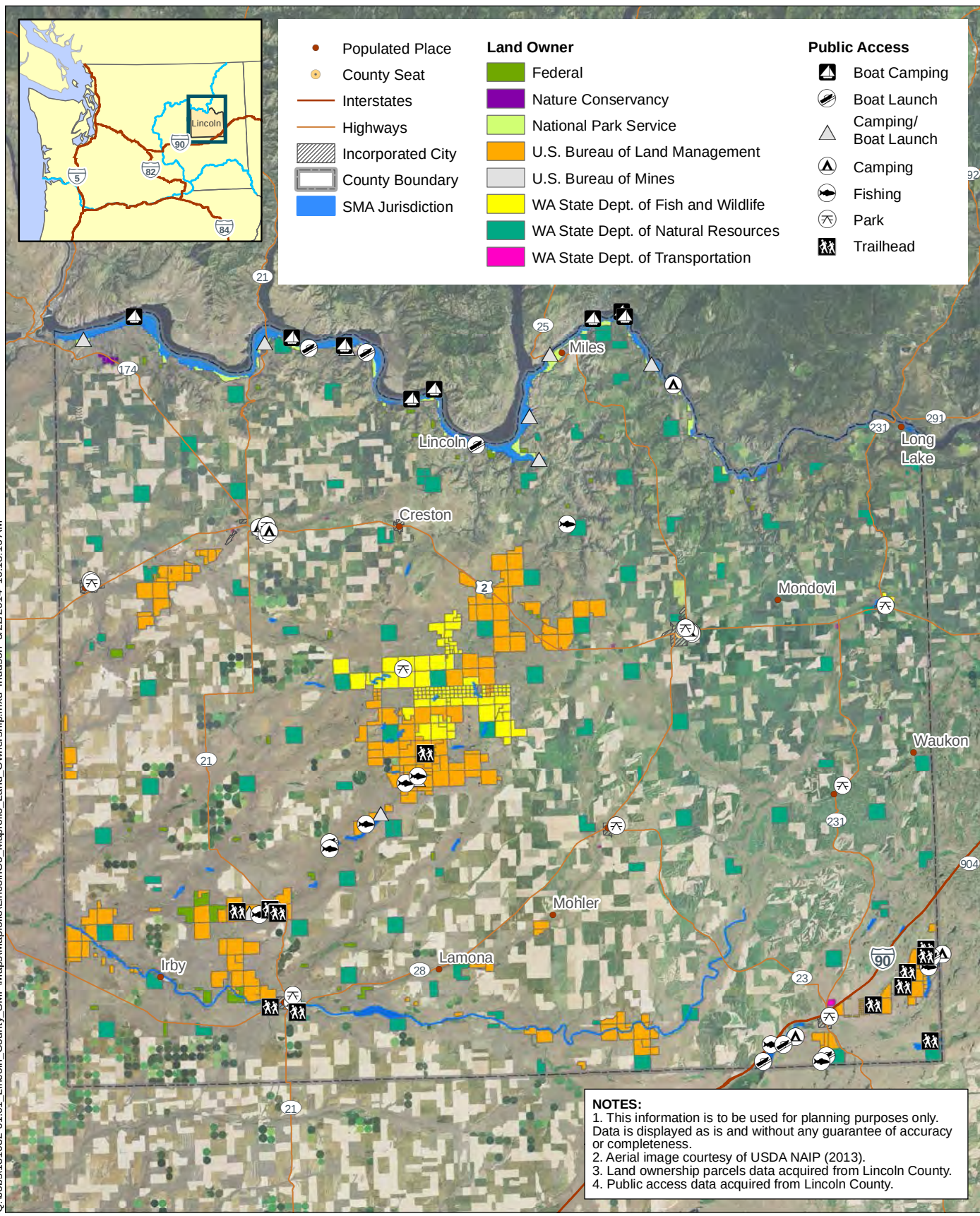


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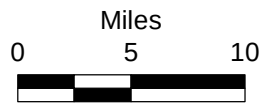


Map 7d
Water Quality Assessment
Lincoln County Shoreline Master Program
Lincoln County, WA

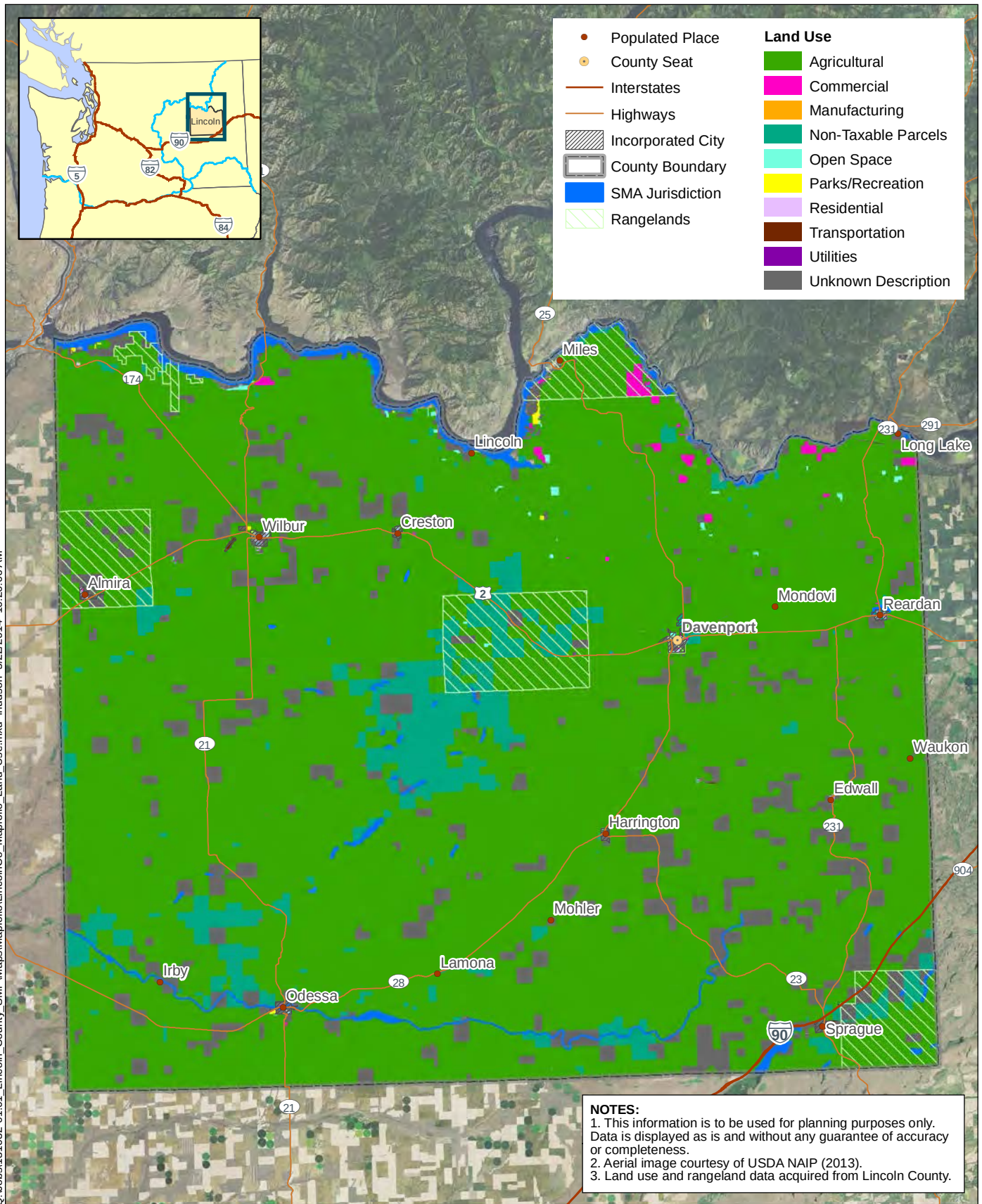
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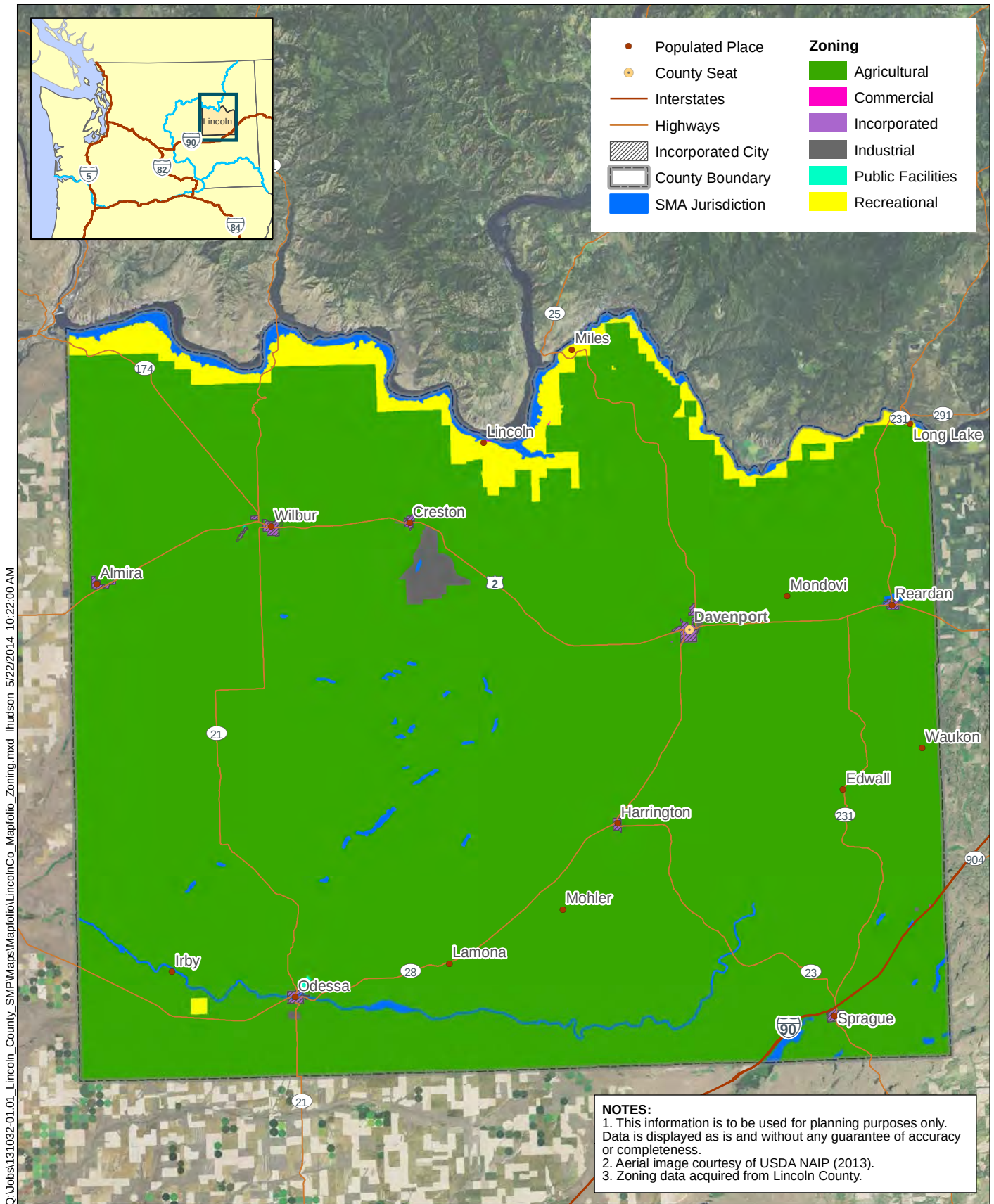


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Map 10
Zoning
 Lincoln County Shoreline Master Program
 Lincoln County, WA