DRAFT WATERSHED ASSESSMENT

Crooked–Rattlesnake, Jordan and Middle Owyhee Subbasins

July 29, 2005

Submitted to:

Owyhee Watershed Council
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COMPONENT 1—STARTUP

This component is the compilation of initial materials applicable to all other assessment components and preparation of the base map. The base map was compiled from USGS Digital Raster Graphics.

The maps included in this component are:

- Base Map (in envelope)
- Fig01-A-Roads
- Fig01-C-Hydrology
- Fig01-E-Land Use/Land Cover
- Fig01-F-Land Ownership

The road map (Figure 01–A) was compiled from 1:100,000 scale TIGER line files from the US Census Bureau.

Stream data were acquired from Streamnet.org (Figure 01–C). They were compiled from 1:100,000 scale EPA river reach files. Each of the "5th field" watersheds were divided into six to twelve "6th field" subwatersheds for purpose of analysis (Tables 1–1 through 1–3).

The key land uses (forestry, agriculture, rangeland and urban) were identified (Figure 01–E). These were obtained from the US Geological Survey's Land Use/Land Cover dataset, which they derived by manual interpretation or aerial photographs taken during the 1970s and 1980s. Normally, the Oregon Level III and IV ecoregions would also be identified, but the entire project area is in the Snake River Basin /High Desert ecoregion.

Land ownership (agency versus private) is displayed on Figure 01–F. These data were compiled from 1:100,000 BLM Surface Management Status Maps.

Table 1–1. Sixth–field Subwatersheds in Middle Owyhee Watershed (HUC 17050107)

Number	Name
170501070101	Upper Toppin Creek
170501070102	Mustang Lake
170501070103	Lower Toppin Creek
170501070104	Jack Creek
170501070105	Headwaters West Little Owyhee River
170501070106	Upper West Little Owyhee River
170501070107	Middle West Little Owyhee River
170501070108	Lower West Little Owyhee River
170501070201	Upper Pole Creek
170501070202	Field Creek
170501070203	Lower Pole Creek
170501070204	Upper Antelope Creek
170501070205	Middle Antelope Creek
170501070206	Upper Little Antelope Creek
170501070207	Lower Little Antelope Creek
170501070208	Lower Antelope Creek
170501070301	Upper Middle Fork Owyhee River
170501070302	Pole Creek
170501070303	Lower Middle Fork Owyhee River
170501070401	Pleasant Valley Creek
170501070402	Juniper Creek
170501070403	Upper North Fork Owyhee River
170501070404	Squaw Creek
170501070405	Cherry Creek
170501070406	Lower North Fork Owyhee River
170501070501	Owyhee River - Dukes Creek
170501070502	Oregon Lake Creek
170501070503	Owyhee River - Bull Creek
170501070504	Owyhee River - Warm Spring Canyon
170501070601	Upper Soldier Creek
170501070602	Mud Flat Creek
170501070603	Willow Creek
170501070604	Spring Creek
170501070605	Lower Soldier Creek
170501070701	Whitehorse Creek
170501070702	Skull Creek
170501070703	Sand Hollow
170501070704	China Gulch
170501070705	Lower Middle Owyhee River

Table 1–2. Sixth–field Subwatersheds in Jordan Watershed (HUC 17050108)

Number	Name
170501080101	Sheep Creek
170501080102	Upper Rock Creek
170501080103	Meadow Creek
170501080104	Josephine Creek
170501080105	Lower Rock Creek
170501080201	Upper North Boulder Creek
170501080202	Lower North Boulder Creek
170501080203	Upper South Boulder Creek
170501080204	Lower South Boulder Creek
170501080205	Big Boulder Creek
170501080301	Jordan Creek Headwaters
170501080302	Louse Creek
170501080303	Jordan Creek-Flint Creek
170501080401	Williams Creek
170501080402	Lone Tree Creek
170501080403	Trout Creek
170501080404	Rail Creek
170501080501	Baxter Creek
170501080502	Hooker Creek
170501080503	Sheep Spring Creek
170501080504	Jack Creek
170501080505	Downey Creek
170501080601	Jackson Creek
170501080602	Posey Creek
170501080603	Spring Branch
170501080604	Mahogany Creek
170501080605	Lower Upper Cow Creek
170501080701	Cove Creek
170501080702	Jordan Craters
170501080703	Mouth Of Cow Creek
170501080801	Jordan Creek/Rock Creek Reservoir
170501080802	Rock Creek
170501080803	Jordan Creek/Merrill Springs
170501080804	Dry Creek
170501080805	Boney Canyon

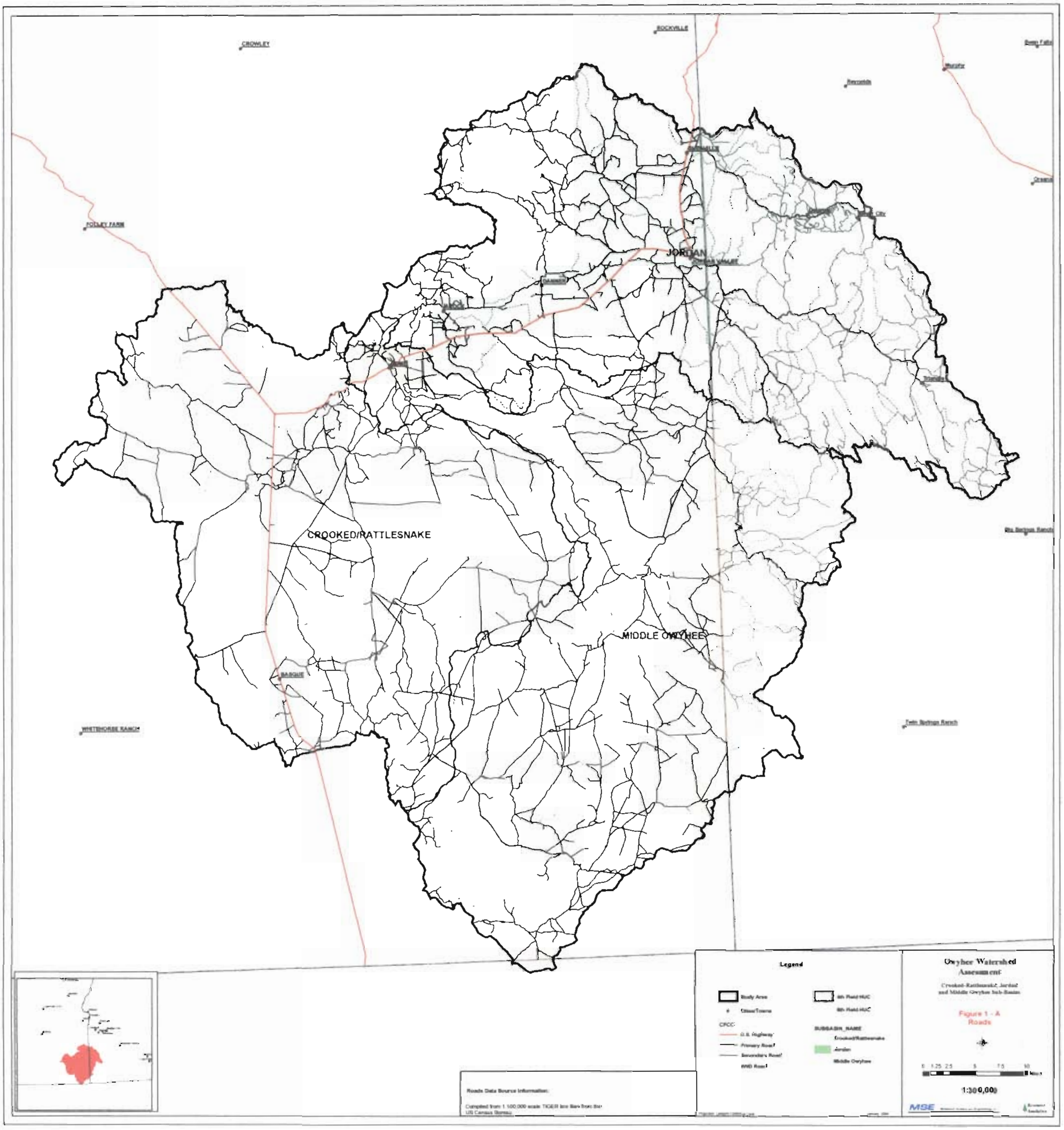
Table 1–3. Sixth–field Subwatersheds in Crooked–Rattlesnake Watershed (HUC 17050109)

Number	Name
170501090101	Bowden Hills
170501090102	Black Hills
170501090103	Headwaters Crooked Creek
170501090104	Three Man Butte Well
170501090105	Middle Upper Crooked Creek
170501090106	Lower Upper Crooked Creek
170501090201	Upper Rattlesnake Creek
170501090202	Middle Rattlesnake Creek
170501090203	Bull Creek
170501090204	Tree Springs
170501090205	Battle Creek
170501090206	Red Hills
170501090207	Lower Rattlesnake Creek
170501090301	Grassy Ridge
170501090302	Upper Wildcat Creek
170501090303	Bone Creek
170501090304	Lower Wildcat Creek
170501090401	Peacock Creek
170501090402	Upper Dry Creek
170501090403	Middle Dry Creek
170501090404	Indian Fort Creek
170501090405	Corbin Creek
170501090406	The Basin
170501090407	Lower Dry Creek
170501090501	The Basin South
170501090502	Drought Creek
170501090503	Palomino Lake
170501090504	Upper Palomino Creek
170501090505	Scott Butte Creek
170501090506	Lower Palomino Creek
170501090507	Moth [*sic*] of Crooked Creek

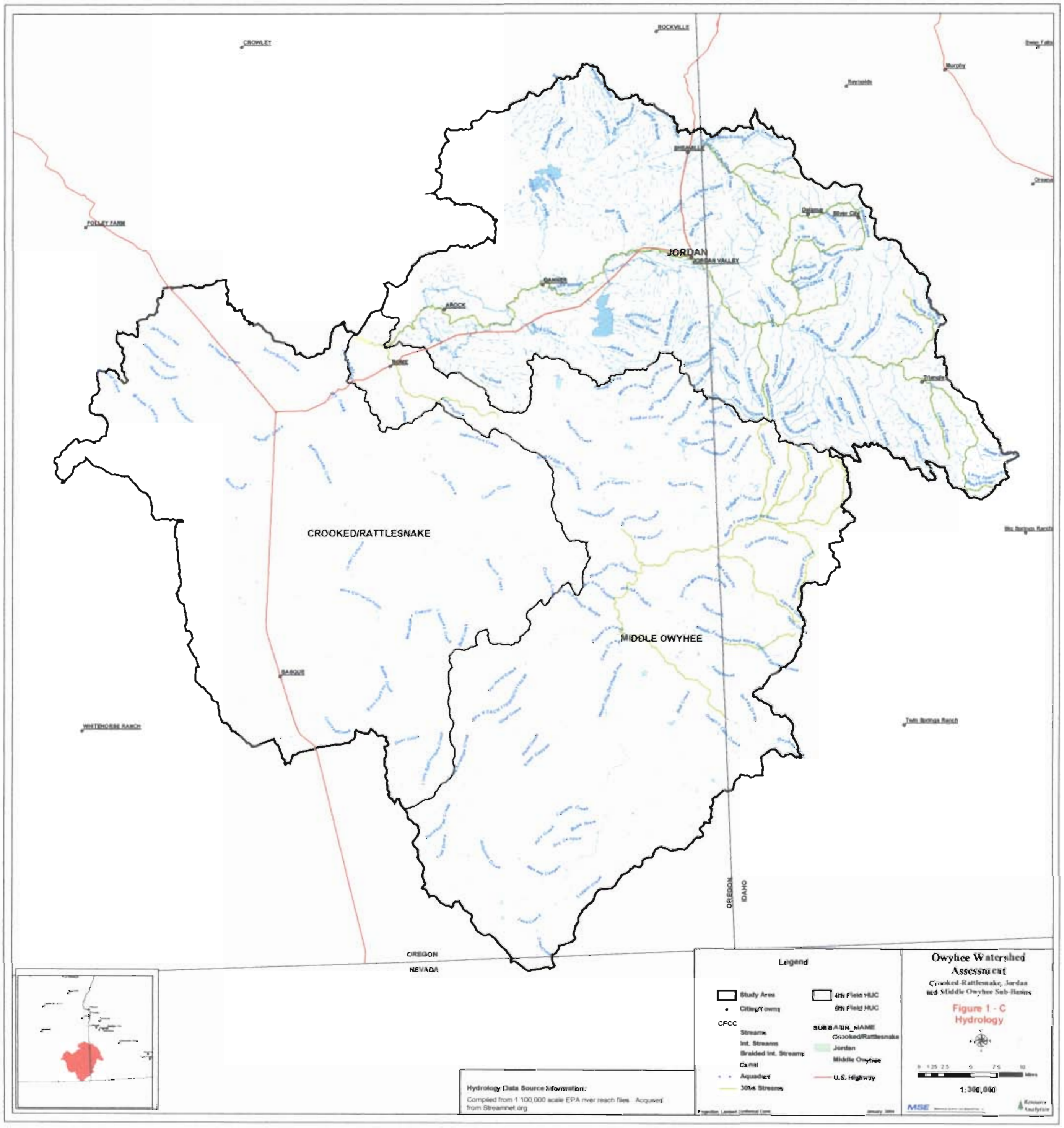
References

WPN 1999. *Oregon Watershed Assessment Manual*. Watershed Professionals Network, prepared for the Governor's Watershed Enhancement Board, Salem, Oregon.

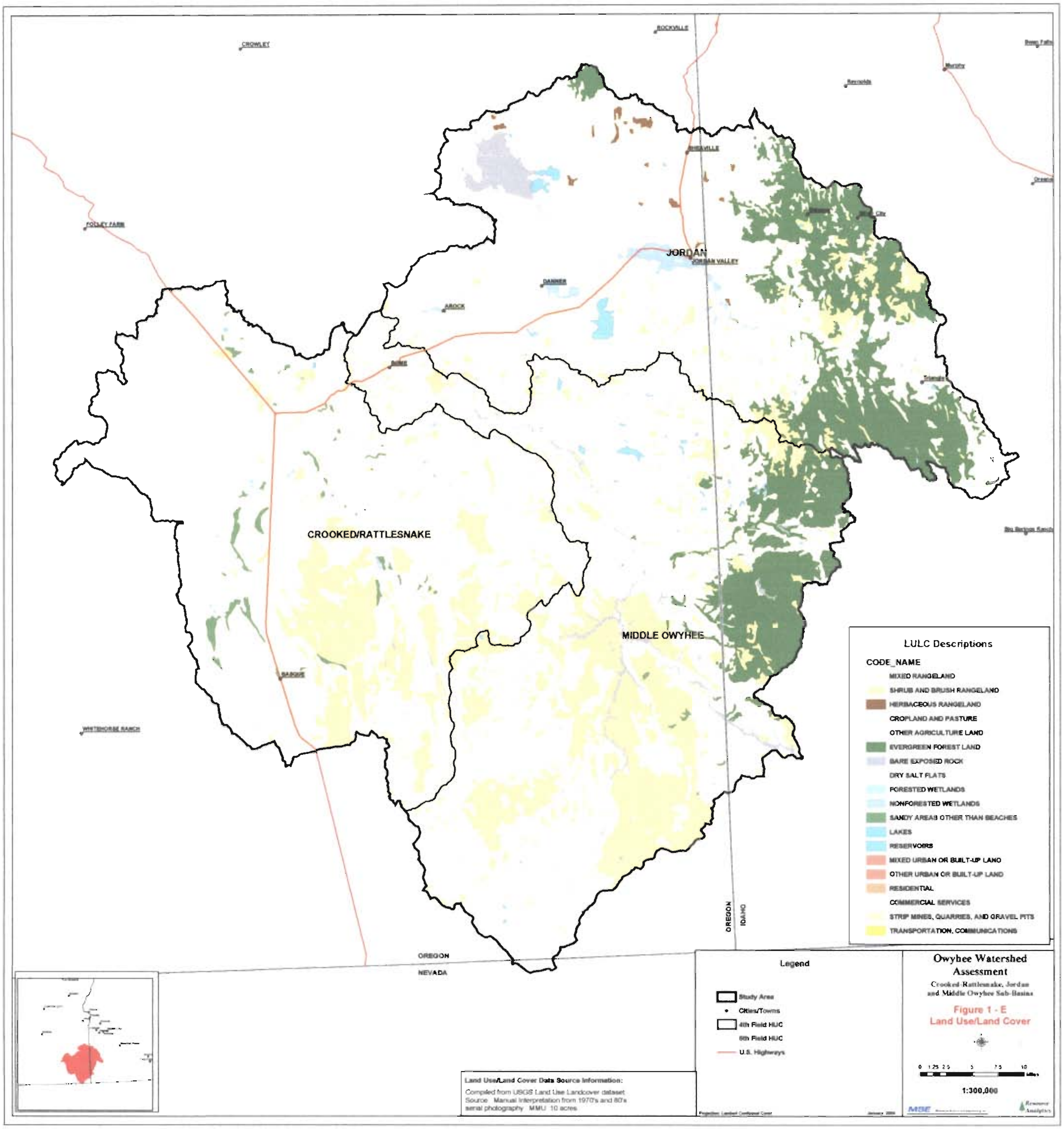
01-startup-internaldraft.doc



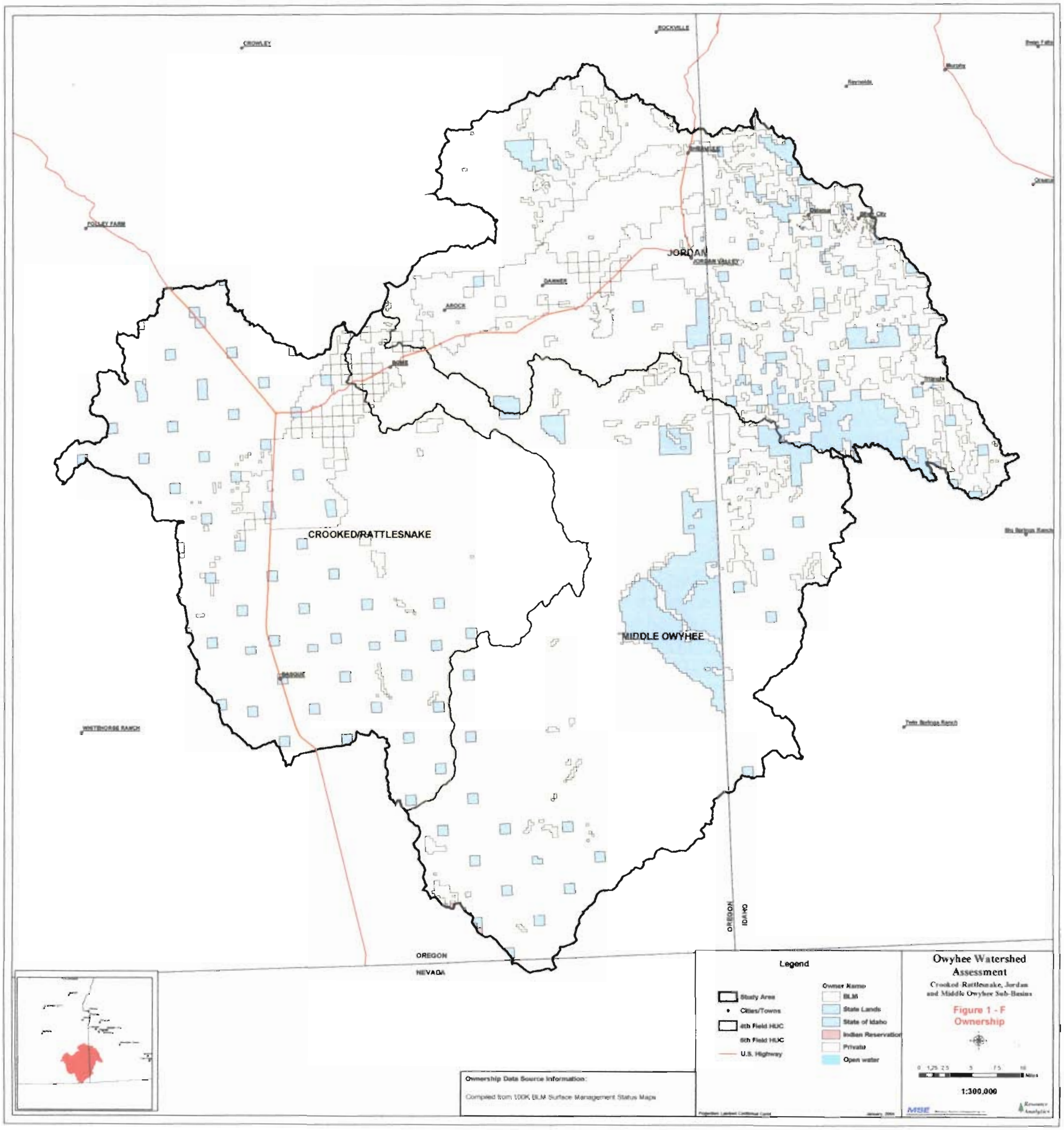
CROWLEY
ROCKVILLE
JORDAN
CROOKED/RATTLESNAKE
MIDDLE OWYHEE
BASQUE
WHITEHORSE RANCH
Twin Springs Ranch
Big Springs Ranch
Legend
Study Area
Cities/Towns
CFCC
U.S. Highway
Primary Road
Secondary Road
4th Field HUC
5th Field HUC
SUBBASIN_NAME
Crooked/Rattlesnake
Jordan
Middle Owyhee
Owyhee Watershed Assessment
Figure 1 - A
Roads
0 1.25 2.5 5 7.5 10
1:300,000
MSE
Roads Data Source Information:
Compiled from 1:100,000 scale TIGER line files from the US Census Bureau



CROWLEY
ROCKVILLE
JORDAN
JORDAN VALLEY
CROOKED/RATTLESNAKE
MIDDLE OWYHEE
OREGON
NEVADA
OREGON
IDAHO
Legend
Study Area
Cities/Towns
CFCC
Streams
Int. Streams
Braided Int. Streams
Canal
Aqueduct
4th Field HUC
6th Field HUC
SUBBASIN_NAME
Crooked/Rattlesnake
Jordan
Middle Owyhee
U.S. Highway
Owyhee Watershed Assessment
Crooked-Rattlesnake, Jordan and Middle Owyhee Sub-Basins
Figure 1 - C
Hydrology
1:300,000
MSE
Hydrology Data Source Information:
Compiled from 1:100,000 scale EPA river reach files. Acquired from Streamnet.org



CROWLEY
ROCKVILLE
Reynolds
Murphy
FOLLEY FARM
JORDAN
JORDAN VALLEY
DANNER
AROCK
ROME
CROOKED/RATTLESNAKE
MIDDLE OWYHEE
BASQUE
WHITEHORSE RANCH
OREGON
IDAHO
OREGON
NEVADA
LULC Descriptions
CODE_NAME
MIXED RANGELAND
SHRUB AND BRUSH RANGELAND
HERBACEOUS RANGELAND
CROPLAND AND PASTURE
OTHER AGRICULTURE LAND
EVERGREEN FOREST LAND
BARE EXPOSED ROCK
DRY SALT FLATS
FORESTED WETLANDS
NONFORESTED WETLANDS
SANDY AREAS OTHER THAN BEACHES
LAKES
RESERVOIRS
MIXED URBAN OR BUILT-UP LAND
OTHER URBAN OR BUILT-UP LAND
RESIDENTIAL
COMMERCIAL SERVICES
STRIP MINES, QUARRIES, AND GRAVEL PITS
TRANSPORTATION, COMMUNICATIONS
Legend
Study Area
Cities/Towns
4th Field HUC
6th Field HUC
U.S. Highways
Land Use/Land Cover Data Source Information:
Compiled from USGS Land Use Landcover dataset
Source Manual Interpretation from 1970's and 80's aerial photography MMU 10 acres
Owyhee Watershed Assessment
Crooked-Rattlesnake, Jordan and Middle Owyhee Sub-Basins
Figure 1 - E
Land Use/Land Cover
0 1.25 2.5 5 7.5 10
Miles
1:300,000
MSE



CROWLEY
ROCKVILLE
POLLEY FARM
JORDAN
JORDAN VALLEY
DANNER
AROCK
ROME
CROOKED/RATTLESNAKE
MIDDLE OWYHEE
WHITEHORSE RANCH
OREGON
NEVADA
OREGON
IDAHO
Legend
Study Area
Cities/Towns
4th Field HUC
5th Field HUC
U.S. Highway
Owner Name
BLM
State Lands
State of Idaho
Indian Reservation
Private
Open water
Owyhee Watershed Assessment
Crooked-Rattlesnake, Jordan and Middle Owyhee Sub-Basins
Figure 1 - F
Ownership
0 1.25 2.5 5 7.5 10 Miles
1:300,000
Ownership Data Source Information:
Compiled from 100K BLM Surface Management Status Maps

·final draft from Chris Moore (8-15-05 received)

NARRATIVE FOR Owyhee Subbasins

(Introduction)

There has been a considerable history of the Crooked Creek-Rattlesnake, Jordan and Middle Owyhee subbasins gathered from interviews with local residents of these areas, some whose history in the particular region dates back into the 1800s.

Some material was taken from interviews with early-day residents of the area in 1980, pertaining to their recollections of the flora and fauna of this vast region which encompasses high dessert, broad plains, river and creek drainages and some mountains.

Included are their recollections of natural water supplies – floods and droughts – opening lands to cultivation, fencing, weed invasion, livestock, wildlife, and development of ranching and farming operations and changes which have evolved with the advent of modern mankind.

Interviews cover many years of time with family members whose ancestors came in the 1870s to some purchasing properties in recent times. More recent interviews give an additional perspective.

References: A

Historical references from 'History of Malheur County Oregon.' Compiled from many sources by Malheur Country Historical Society. This book is in many libraries but few copies are for sale

a. Information on Native American (Indian) tribes, their life styles, travels, etc.

b.First white inhabitants settling along the Owyhee River.

c.Fur trappers and traders—Donald Mackenzie and Wilson Price Hunt, their travels and their men.

d. Description of Owyhee river—"70 yards across."

e. Origin of name Owyhee. (For Hawaiians lost in the mountains along the river and apparently killed by Indians).

f. In 1843 first wagon train (120 wagons, 5,000 livestock) first of migration to Oregon.

g. Discovery of gold brought miners which created need for food asd consequent settling along waterways by farmers. Desert Land Act of 1877 was opportunity to get free land. Grass was abundant.

h. 1883 settlers arrived and began farms along Owyhee River.

References B

In 1980 a number of interviews were taped recorded from old timers to gain a perspective of experiences of persons familiar with life in the 'Owyhee Country 'after the arrival of white men and since the Owyhee Dam became a reality

This summer, interviews with a number of the current residents were transcribed and their perceptions of conditions, wildlife, plants, ranching and farming, living conditions before the Owyhee Dam was built and changes since its completion. These views vary.

From Chris Moore
Roundup

Sketch of the Owyhee River and those who sought to tame her.

Before the white man came to what is now the southeastern corner of Oregon, Native Americans roamed the land, fished the many streams, hunted wildlife, dug roots and roamed the region for centuries.

Some written history indicates the first white men to explore the "Owyhees " were a party of men seeking the highly desireable furs to fill fashion demands of the times. This was around 1818. Under the leadership of Donald Mackenzie of the Northwest Fur Company, the party was seeking places to trap for fur-bearing creatures. In the party were several Hawaiians who never returned, perhaps victims of native warriors. Thus, the area was dubbed, "The Owyhees" at a time when few would, or even have known the correct spelling of "Hawaii."

In the ensuing years a depression forced many persons to leave the eastern part of the United States in search of new opportunities. Later in the 1800's some of the emigrants dropped out of the stream of wagons headed west, settling along the banks of the Owyhee This was near where the Owyhee flowed into the larger Snake River .

First homes were dugouts along the canyon cut by the Owyhee and past flooding had left a deposit of deep fertile soil. It was there families carved a living, raising gardens and fruit trees, sheep and cattle and the forage these animals required; and learned to 'make-do'.. Life was not easy as these people were far from 'civilization' where essentials such as flour, sugar, clothing, and medical services could be obtained. This brought on the independence which helped them survive.

Much to the chagrin of some of the hardy lot, the Reclamation Service came into being and technical and financial help became available to develop the water sources. Although thousands of acres of soil was being cultivated and irrigated, the possibility of a high dam on the Owyhee was pursued as such could bring many thousands of acres under cultivation as well as establishing control over the frequently flooding river .

Homesteaders were not in unison over selling their land and losing their hard earned advances in their farming efforts. Many felt their land was far more valuable than the amount set by appraisers.

However, great pressure was put on Congress by Malheur County citizens and many delegations pushed for development of the Owyhee project for agricultural development. In 1928 work began.

The first water from the Owyhee Project was delivered in 1935, bringing thousands of acres of eastern Oregon and south western Idaho into production. This brought wealth to the region and new tax dollars to the country and opened a vast area for recreation.
In recent times, the search for thunder eggs, (rock {lava bombs?}with mineral deposits inside, petrified wood and other geological wonders as well as the search for precious minerals has put more pressure on the area.

Owyhee
Wildlife and cover, forage

Bob Skinner Sr., Jordan Valley
Eighty-four year old Bob Skinner who was born on the Skinner Ranch and lived there all his life aside from schooling and serving in the Army, recalls few fish in Jordan Creek for suckers, trash fish, perch. He remembers being told there had been salmon in the streams there but "the Owyhee dam probably halted that."
He saw his first deer on the ranch when he was 15 years old. "Now there are hundreds of them in our fields in the summer. As a youngster riding on the range, we saw some antelope but they never came onto the ranch until about 1950. Now we have quite a few."
Canada Geese and ducks were abundant . No pheasants or quail but there were many sage hens.

Tim Lequerica , Arock
He has lived all his 59 years on the family ranch and remembers "Jordan Creek has always been full of carp and suckers. The water for his ranch comes from Antelope Reservoir which is fed by Jordan Creek. Water is released and returns to Jordan Creek yo be taken out at the Diversion Dam, then waters the North and South sides of the project.
"There is 10 times more deer here than when I was a kid. There were more pheasants and bird years ago. We are swarmed with predators now, " and he thinks this may be cause of the fewer birds.

Ruby Staples,, born where, lives now?
Mrs. Staples , 86, who claims to be 85 as "I was born Christmas because that just a week's difference!" She doesn't see much difference in wildlife—" Maybe a little more ,, because I think deer and antelope come into the meadows more..
Probably only trout in the creeks where she grew up.

Richard Eiguren, Arock
Richard Eiguren, 58, (a son of Fred who is now 88)., He said his grandfather came to the U.S. from Spain when he was 17 to work in sheep.
"Dad recalls salmon coming up Jordan Creek when he was a kid." Indicating there are fewer deer and pheasants than in past years, attributable to hard winters and predators. Many pheasants are lost to crows and hawks.

Mike Hanley, Jordan Valley

Hanley has property near JordanValley and on Juniper Mountain in Idaho. Salmon came up until the diversion dam was built on Jordan Creek and with construction of the Owyhee Dam. Trout are increasing in Jordan Creek.. Certain construction activities have improved habitat for fish with cooler water.

Deer populations have increased, probably because of improved agricultural conditions which provide a constant food supply.

Fish and Game manage wildlife better. The animals have less fear of humans.

B:Interviews with area residents gives a snapshot of "the

C

Cut here

KIRT SKINNER, Jordan Valley

Born in Jordan Valley, S,K, Skinner (Kirt) lived there all his 91 years. He was the grandson of Silas Skinner who built the toll road from Silver City to the Owyhee. Kirt ranched west of Jordan Valley.

His grandfather was a sailor, coming to America from Great Britain in the late 1850s or early 1860s. He and another man walked from Nevada to Silver City where he prospected for gold. Seeing the need for passable roads from the mines, he and a partner built toll roads.

"My family did play a major role in the area's development. Silas and several others built a stage station on Trout Creek (a tributary of the Owyhee River) which he and his wife operated. My father was born in Ruby City in 1871.

"My grandfather sold the station or traded for some land where this ranch is now. They went in the livestock business and did some farming. They cut wild hay, had a small grain crop and some alfalfa. There were no buildings here except a small house on Jordan Creek."

Some of the early livestock included 10 registered Standard Bred mares and a stallion in Kentucky. These were trotting horses and many were raced . Silas moved his family to California to be nearer schools for his children and moved most of the registered horses there too. They drove the horses to California.

Kirt's father W.S.Skinner, was only 15 when his father died. He used to come up here to take care of the livestock and things.

"I was born halfway between Jordan and this ranch," Kirt said.

The first hay cut in the Jordan Valley was cut along the creek about a mile below Jordan. It was cut with a scythe and raked with a pitchfork made out of willow sticks. It sold to Silver City where there was a terrific demand for livestock feed of any kind. Cantor cut the first to cut hay around here.

Kirt told of helping his father run horses and he helped break them He explained the use of a gentle horse to help control an unbroken horse. He also explained the art o roping calves. To market, the cattle were driven to Murphy and sometimes to Ontario. He said then trucking came and in the easrly 30's we sold about 2,500 head.

He told of the Indian wars and of hard winters, all a part of early days in southeast Oregon. He said during the winter of 1952 "when we didn't see the ground from early November until April. Other hard winters occurred in 1917, 1949 and '51 and '52.

"The Owyhee played a big part in our lives after the range began to have problems. That was when transient sheep came in and ate the grass needed for local cattle and horses."

The Skinner Ranch was cleared by Indians grubbing sagebrush. Some little overflow meadows didn't have brush and hay was raised there. There was kind of a commissary for the Indians. Sometimes families would go together and buy a beef and butcher it. More often they bought meat from Skinners, They bought small amounts of food at a time –a sack of four at a time; some sugar, salt and meat. Usually just enough to last a few days.They hunted rabbits and ground hogs. There would be over 100 Indians, men, women and children camped on the ranch at a time.

Skinner spoke of the Sheep Ranch and the Inskeep Station, commenting on the history Ben Dire (sp?) mountain to Vale Moved to Owyhee in April .Family ran sheep off the river and summer in Blue Mountain close to Drewsey.

Area covered with sagebrush which had to be grubbed with a hoe. Water Wheels provided water from the river for irrigation.

Basque farmer Simon Acortagoitia's wife had baby on way to JordanValely. It was born in the sheep camp.

Grass was good at foot of Steens Mountain and Palmers bedded sheep 2-3 nights in one place. "Lying in bed one night, I felt something under mebut was too tired to look, I thought it was a clod. When I rolled up my bed the next morning there was a big rattlesnake coiled up there!."

We had a few work horses and saddle horses and milk cows. Machinery was all horse drawn. They had a spring tooth harrow and walking plow. We never had any tractors. Soil was the best in the world. The person working an outfit, fixed it when it broke. Moving sheep to summer range, we had tents and moved camp twice a day. It took 18028 days to move from Owyhee to Drewsey, the Blue Mountain summer range.

It was hard to find dependable help. Late storms were bad, once we lost 400 lambs that froze to death.

The sheep were sheared by hand Two fellows I knew averaged 326 head of sheep a day. Then they got gas-powered clippers.

BIG CHANGES

After San Francisco earthquake, they said it moved us 400miles to the north by climate. Drier and hotter.

The biggest change was feuding between cattle and sheep men. Sheep, cowboys and buckaroos got shot. We were trailing through cattle country from Condon to Austin Junction. They shot into our sheep. Our lay down behind a long and he killed four of the sheep shooters.

The best sheepherder was an old cowboy

World War I saw prices go to nothing. Signed wool contracts were worthless, we still owed the wool warehouse. Banks went broke with only Baker PAC and Vale bank operating.

Palmer objected to BLM and others changing long-time names of certain places in the Owyhee country. Hand dug wells were deep; drilled wells were 4-6 inches diameter. Owyhee wells were 12-14 feet deep. Dirt dams in the creeks made reservoirs.

Making whiskey was taken as routine. It was a way to make a living, Sold for $3-$10 a gallon. Some bootleggers could get ahold of some and sell as high as $25 a quart.

We were tickled to see the boys come home from WW I.

I didn't feel very good about the dam being built. They drowned us out. They appraised our places, you might say took them away. Just condemed them. Appraisers never came from out there. They all came from under the dam! You might say they took a lot of our life away.

Palmer recalled "ashes exiting the Jordan Volcano (Coffee Pot)? And roaring as it shook the country.'

3. JOSEPHINE LYTLE, wife of attorney Bob Lytle who helped get the dam proposal approved. Born in 1884 and came to Vale in 1915

LIVING CONDITIONS

"Vale was terrible. I must have loved my husband very much or I would have gotten on the train and gone right back to Wisconsin."

" I moved into a three room house with a Chick Sales (outdoor toilet) and a coal shed in the back yard. I lived in the same house for 65 years. We kept enlarging it. As my husband would get a fat fee, we'd build on to it!

Mrs. Lytle recalled the big county seat fight, July 4 picnics which evolved into the Vale Rodeo, people called on you formally—with calling cards and wearing white gloves.

She recalled the first car in Vale "but it took 10-12 years before cars took over from horses. "I was among the first to have an electric refrigerator. Before that we used an 'ice box' and bought ice.

4. Opal Ivers McConnell, born at Watson in 1906, moved to in 1917 to Vale after her father drowned in the Owyhee River.

HOUSING ALONG THE RIVER

"They weren't finished houses like nowadays; no bathrooms, we packed water in and out. Some had an upstairs. The rock house of Gramma and Grandpa Page was partly into the side of a hill.

Children's chores included stacking the dishes, feeding the chickens and caring for their own horses.

WOMEN'S WORK

Laundry was done on a washboard; whites were boiled in a big boildr.We ironed with sad irons which were heated on the stove. Cooking was on old wood ranges heated with sagebrush.

Families raised big gardens and their own meat. Fruits were canned, Cellars stored produce. Beef was corned, bacon and hams smoked. We had to be self-sufficient. Ice was cut from the river in sinter and put up in an ice house—a layer of ice, a layer of sawdust. It would last nearly all summer.

Home remedies solved many illnesses, sometimes a doctor was summoned from Jordan Valley. All the women helped when someone was ill.

Her father was bitten by a mad coyote and medicine had to be obtained from SanFranciso.

When women gained the right to vote, her father said he'd help her mother vote. S responded emphatically, telling him she would vote as she saw fit.

Woman's role: Keeping house, raise the family, work in the garden, can fruit, work in the hay—drive derrick, pitch hay, drive teams, anything that needed to be one.

COMPONENT 3—CHANNEL HABITAT TYPE

The purpose of this component is to provide information on the classification of streams by use of Channel Habitat Types (CHTs). The channel habitat typing is based upon the fifteen basic types of channel habitat as described in the Oregon Watershed Assessment Manual (WPN 1999). The classification was based primarily on available data, without extensive field verification. Due to budgetary constraints, a representative sample (20%) of the 105 subwatersheds in the study area was classified. These are referred to as our analysis areas.

The study area consists of 105 (sixth field) subwatersheds located in three fourth–field hydrologic units located in the Snake River Basin/High Desert ecoregion. It straddles the Oregon–Idaho border, incorporating most of Malheur County and a substantial portion of Owyhee County. A few square miles of Humboldt County, Nevada are also included in the study area. Deep stream canyons cut through broad undulating plateaus. Streams flow generally towards the north, eventually joining the Snake River. The study area is in Oregon Climate Division 9, with temperature extremes and limited rainfall, except in the higher elevations to the east.

SELECTION OF WATERSHEDS

Several approaches for selecting subwatersheds based on their characteristics and potential problems were considered and rejected. The Owyhee Watershed Council agreed that we would randomly select twenty of the sixth–field hydrologic units for detailed analysis, divided approximately between the three third–field hydrologic units for geographic diversity. The selection would not be made according to any preconceived notion of the importance of a subwatershed or any of its properties.

In order to suitably distribute the analyzed subwatersheds, they were separated according to their associated third–field unit. Subwatersheds located on Jordan Creek, Crooked Creek or the Owyhee River were classified as "main stem" subwatersheds, and the remainder as "upland" subwatersheds. Each subwatershed was assigned an identification number for purposes of random selection.

Table 1. Subwatersheds Selected for Channel Habitat Typing

Main Stem Subwatershed Number	Main Stem Subwatershed Name	Upland Subwatershed Number	Upland Subwatershed Name
Middle Owyhee—17050107			
170501070301	Upper Middle Fork Owyhee R.	170501070107	Middle West Little Owyhee R.
170501070701	Whitehorse Creek	170501070203	Upper Pole Creek
170501070705	Lower Middle Owyhee River	170501070401	Pleasant Valley Creek
—	—	1705070404	Squaw Creek
—	—	1705070405	Cherry Creek
Jordan—17050108			
170501080301	Jordan Ck Headwaters	170501080102	Upper Rock Creek
170501080501	Baxter Creek	170501080601	Jackson Creek
170501080803	Jordan Ck/Merrill Springs	170501080604	Mahogany Creek
170501080805	Boney Canyon	—	—
Crooked–Rattlesnake—17050109			
170501090103	Headwaters Crooked Creek	170501090303	Bone Creek
170501090502	Drought Creek	170501090402	Upper Dry Creek
—	—	170501090406	The Basin
—	—	170501090504	Upper Palomino Creek

A short computer program (Listing 1) was written to generate sequences of random integers in the desired range, using the built–in random(3) function of the FreeBSD computer operating system, version 4.10. This program was used to generate sequences of 77 pseudorandom integers (corresponding to the main stem subwatersheds) and 28 pseudorandom numbers (corresponding to the upland subwatersheds). Six trials were run for each sequence size, until visual inspection showed the subwatersheds to be distributed among all three third–field hydrologic units. A map identifying the selections is appended.

Listing 1. randomset.cpp

```
/***'****1****'****2****'****3****'****4****'****5****'****6****'****7****'****8
randomset.cpp
This program uses the FreeBSD random(3) function to generate a series
of pseudo-random positive integers in a range specified by the user.
****'****1****'****2****'****3****'****4****'****5****'****6****'****7****'****/

//#define DEBUG

#include <iostream.h>
#include <stdlib.h>

unsigned       uCount;
unsigned       uMin;
unsigned       uMax;
unsigned long  uMask;
unsigned long  uTemp;
unsigned long  uRan;

main ()
{
	//obtain user input
	cout << "How many random positive integers do you want?: ";
	cin >> uCount;
	cout << "Smallest random positive integer (must be 0 or 1): ";
	cin >> uMin;
	cout << "Largest random positive integer (0 for default 2**32-1): ";
	cin >> uMax;
	cout << "You requested " << uCount << " integers ranging from " << uMin;
	cout << " to " << uMax << endl;

	// set uMask to remove bits above uMax (to reduce mo. of discards)
	if (uMax == 0)
	{
		uMask = 0xFFFFFFFF;
	}
	else
	{
		//shift uMax right
		#ifdef DEBUG
			cout << "setting uMask..." << endl;
		#endif
		uTemp = uMax;
		while (uTemp != 0)
		{
			#ifdef DEBUG
				cout << dec << uTemp << "\t" << hex << uMask <<
endl;
			#endif
			uTemp >>= 1;
			uMask = 2*uMask+1;
		}
	}
	#ifdef DEBUG
		cout << "uMask=" << dec << uMask << endl;
	#endif

	// get pseudorandom numbers in specified range
	srandomdev();
	for (int i = 1; i <= uCount; i++)
	{
		do
		{
			uRan = random() & uMask;
		} while ( (uRan > uMax) || (uRan < uMin) );
		cout << uRan << " ";
	}
	cout << endl;
}
```

CHANNEL HABITAT TYPE CLASSIFICATION

MSE utilized the channel habitat type classification steps described in the *Oregon Watershed Assessment Manual*. Channel gradient and confinement are used to determine channel habitat. Geographic Information System software was used to calculate channel gradient and to determine channel segment length. ESRI's Arcmap and Arcview software were the primary tools used for this analysis. The final products for this component include a series of maps showing channel habitat types by watershed for the representative sample and a summary table of the study area listing the number of stream miles of each CHT by subwatershed.

Ten–meter digital elevation models (DEMs) of the area were used in conjunction with 1:24K hydrologic vector data. 1:24K digital raster graphics derived from the USGS topographic map series (National Geographic TOPO!) were also used to provide a visual display of the hypsography.

Each hydrologic arc was split into smaller arc segments. Segment boundaries were determined based upon a visual inspection of slope changes, *i.e.* from flat valley floor to steeper hillsides. A minimum channel segment length of 1000 feet was used to avoid extensive segmentation of streams in pool and drop areas.

Channel gradient was determined for each stream segment by dividing the difference in elevation of the start and end of its arc by the horizontal distance of that arc. GIS software was used to calculate this stream gradient. Digital elevation models were overlaid with the stream segments to obtain elevation estimates at the beginning and end of each arc segment, along with segment length. Once gradient was calculated, they were assigned to one of six gradient classes.

The channel confinement of all stream segments was estimated by visual inspection of the topographic raster data. Three factors were considered. The first was how the contour lines intersected the channel segments. A second factor, channel pattern, was also used. A meandering channel combined with low gradient is indicative of an unconfined nature. Steeper gradients, with contour lines approaching the channel segments at acute angles (V–shaped contour pattern) are suggestive of a confined channel. The area in between these two extremes can be classified as moderate confinement. Each segment was assigned a confinement class of either: **U**nconfined, **M**oderately Confined or **C**onfined.

Once all channel segments have been defined with gradient and confinement values, the CHT designation can be mapped. Channel Habitat Types are defined by the characteristics listed in the following table (*Oregon Watershed Assessment Manual*, p. III-10).

Table 2. Channel Habitat Types.

Code	CHT Name	Gradient	Channel Confinement	Size
ES	Small Estuary	<1%	Unconfined to moderately confined	Small to medium
EL	Large Estuary	<1%	Unconfined to moderately confined	Large
FP1	Low Gradient Large Floodplain	<1%	Unconfined	Large
FP2	Low Gradient Medium Floodplain	<2%	Unconfined	Medium to large
FP3	Low Gradient Small Floodplain	<2%	Unconfined	Small to medium
AF	Alluvial Fan	1-5%	Variable	Small to medium
LM	Low Gradient Moderately Confined	<2%	Moderately confined	Variable
LC	Low Gradient Confined	<2%	Confined	Variable
MM	Moderate Gradient Moderately Confined	2-4%	Moderately confined	Variable
MC	Moderate Gradient Confined	2-4%	Confined	Variable
MH	Moderate Gradient Headwater	1-6%	Confined	Small
MV	Moderately Steep Narrow Valley	3-10%	Confined	Small to medium
BC	Bedrock Canyon	1->20%	Confined	Variable
SV	Steep Narrow Valley	8-16%	Confined	Small
VH	Very Steep Headwater	>16%	Confined	Small

The Channel Habitat Types found in the analysis areas are listed in Table 2 and described below (based on Appendix III-A of the *Oregon Watershed Assessment Manual*).

FP1 - Low Gradient Large Floodplain Channel

FP1 channels are lowland and valley bottom channels of large watersheds. Normally these channels have extensive valley floodplains and river terraces. The channel pattern is sinuous with single to multiple channels present. They are typically positioned at the bottom, lower portion of the drainage.

These channels function as sediment deposition systems, with short-term storage of fine sediment. Fines are typically mobilized during most high-flow events. Small side-channels dissecting the floodplain are common.

Enhancement Potential- Due to the unstable nature of these channels, the success of enhancement efforts is questionable. The best opportunities are where lateral channel movement is low.

FP2 - Low Gradient Medium Floodplain Channel

FP2 channels are main-stem streams in broad valley bottoms with well established floodplains. Channels are often sinuous with extensive gravel bars, multiple channels and terraces. These channels are generally associated with extensive riparian areas that may include such features as sloughs, side channels and wetlands. The channel pattern is sinuous, with single to multiple channels present. They are positioned in the middle to lower end of a drainage basin.

Sediment deposition is prevalent, with fine sediment storage evident in pools, point bars and flood plains. Bank erosion and bank-building processes are continuous.

Enhancement Potential- Due to the unstable nature of these channels, the success of enhancement efforts is questionable. The best opportunities are where lateral channel movement is low.

FP3 - Low Gradient Small Floodplain Channel

FP3 streams are located in valley bottoms and flat lowlands. The frequently lie adjacent to the to of foot slopes or hill slopes within the valley bottom of larger channels, where they are typically fed by high gradient streams. FP3 channels may dissect the larger floodplain. Channel pattern is single to multiple channels. Its position is the drainage is variable.

These channels can be associated with a large floodplain complex and may be influenced by flooding of adjacent main-stem streams. Sediment routed from upstream channels is temporarily stored in these channels and on the adjacent floodplain.

Enhancement Potential- The limited power of these streams offer better opportunities than larger floodplain channels. Enhancement efforts should be concentrated in areas where lateral channel movement is lowest.

AF – Alluvial Fan Channel

Alluvial fans are generally tributary streams that are located on foot slope landforms and in a transitional area between valley floodplains and steep mountain slopes. Alluvial fan deposits are formed by the rapid change in transport capacity as the high energy mountain slope stream spills onto the valley bottom. The channel pattern is single to multiple channels spread across the fan surface. Its position in the drainage is at the lower end of small tributaries.

Enhancement Potential- High sediment loads often limit success of enhancement efforts, they are generally not suited to enhancement activities.

LM – Low Gradient Moderately Confined Channel

LM channels consists of low-gradient reaches that display variable confinement by low terraces or hill slopes. The channels tend to be of medium to large size. These types of channels are often misidentified as LC channels due to the difficulty in determining channel confinement. The channel pattern is single with occasional multiple channels. Its position in the drainage is variable, but often at the lower end of main tributaries.

Enhancement Potential- These channels can be the most responsive of channel types. The presence of confining landform features often improves the accuracy of predicting channel response to activities. These channels are good candidates for enhancement activities.

LC – Low Gradient Confined Channel

LC channels are incised or contained within adjacent, gentle landforms or incised in volcanic flows. Later channel migration is controlled by frequent bedrock outcrops, high terraces, or hill slopes along stream banks. The channels are often stable, with those confined by hill slopes or bedrock less likely to display bank erosion or scour than those confined by alluvial terraces. Channel pattern is a single channel with variable sinuosity. Its position in the drainage is variable but generally mid to lower in the larger drainage basin.

High flow events are well contained by the upper banks. High flows in these well contained channels ten to move all but the most stable debris accumulations downstream.

Enhancement Potential- These channels are not highly responsive and enhancements may not yield the desired results. Livestock may have an adverse affect on bank erosion so access control measures may prove beneficial.

MM – Moderate Gradient Moderately Confined Channel

This group includes channels with variable controls on channel confinement. Alternating valley terraces and/or adjacent mountain slope, foot slope, and hill slope landforms limit channel migration and floodplain development. A narrow floodplain is usually present and may alternate from bank to bank. Channel pattern is usually single channel with low to moderate sinuosity. Its position in the drainage is in the mid to lower portion of the drainage basin.

Enhancement Potential- These channels can be the most responsive of channel types. The presence of confining landform features often improves the accuracy of predicting channel response to activities. These channels are good candidates for enhancement activities.

MC – Moderate Gradient Confined Channel

MC streams flow through narrow valleys with little river terrace development or are deeply incised into valley floors. Hill slopes and mountain slopes composing the valley walls may lie adjacent to the channel. Moderate gradients, well contained flows and large particle substrate indicate high stream energy. Landslides along the channel sides may be a major contributor of sediment in unstable basins. Channel pattern is a single, generally straight channel. Position in the drainage is in the middle to lower portion of the drainage.

Enhancement Potential- These channels are not highly responsive and enhancements may not yield the desired results. Livestock may have an adverse affect on bank erosion so access control measures may prove beneficial.

MH - Moderate Gradient Headwater Channel

Moderate gradient headwater channels are common to Columbia River basalts, young volcanic surfaces or broad drainage divides. These channels are similar to LC channels but occur exclusively in headwater regions. They are potentially above the anadromous fish zone. The channel pattern is low sinuosity or straight.

These channels generally have low streamflow volumes and therefore low stream power. The confined channels provide limited sediment storage in low gradient reaches. Channels have a small upslope drainage area and consequently a limited sediment supply. Sediment sources are limited to upland surface erosion.

Enhancement Potential- These channels are moderately responsive. Livestock may have an adverse affect on bank erosion so access control measures may prove beneficial.

MV – Moderately Steep Narrow Valley Channel

MV channels are moderately steep and confined by adjacent moderate to steep hill slopes. High flows are generally contained within the channel banks. MV channel patterns are single channels that are relatively straight. Its position in the drainage is middle to upper.

Large amounts of bedrock and boulders are typically present. These create stable streambanks, however steep side slopes may be unstable.

Enhancement Potential- These channels are not highly responsive and enhancements may not yield the desired results. Livestock may have an adverse affect on bank erosion so access control measures may prove beneficial.

BC – Bedrock Canyon Channel

BC channels are associated with valley bottom gorge landforms typically cut through bedrock with long, steep side slope walls. Cascades, rapids and major falls are common. The channel pattern is a single straight channel. Its position in the drainage is variable.

Enhancement Potential- These channels are not responsive and are generally poor sites for enhancement efforts.

SV – Steep Narrow Valley Channel/VH – Very Steep Headwater

These two channel types are very similar except that VH channels are steeper. SV channels are situated in a constricted valley bottom bounded by steep mountain or hill slopes. Vertical steps of boulder and wood with scour pools, cancades and falls are common. VH channels are found in the headwaters of most drainages or side slopes to larger streams and commonly extend to ridge tops and summits. Channel pattern is single and straight. Its position in the drainage is in the middle upper to upper area.

Enhancement Potential- These channels are not highly responsive and enhancements may not yield the desired results.

Results

Table 3 shows the results of the habitat typing in the twenty–one analysis areas. A little over 40% of the streams in the analysis areas fall within channel types that are generally responsive to enhancement activities. Another 15% fall within flood plain areas where enhancement activities can work if consideration is given as to location along the channel.

Table 3. Channel Habitat Type Mileages by Subwatershed

Subwatershed	AF	BC	CM	FP1	FP2	FP3	LC	LM	MC	MH	MM	MV	NV	SV	VH	Grand Total
170501070107		34.18					1.13	18.78	12 89	0.78	1 68	2.93			0 21	72.57
170501070201						3.36	22.71	8.32	7.57	1.74	8.32	3.07				55 10
170501070301	6.07	0 37	1.91		13.62		9 72	2.14	15.47	52 22	8.47	15.67		15.62	0.42	141.70
170501070401	1 23			8.53	10 74		8.96	4.59	2.78		3 00	5.57			0.22	45.63
170501070404	2.47						16.66	7.83	9.47	2.53	20.62	13.59		7.92	0.96	82.05
170501070405					13.94	1.86	6.21	40.69	0.37		6.58	12.87		0.27		82.78
170501070701						1.36	15.93	26.28	6.80	2.86	3.13	4.70		4.41	2.72	68 18
170501070705				12.16		1.50	1 47	13.24	3.69	3.14	8.50	2 00		1.59		47.29
170501080102	1.58				10.72	5.08	7.25	4.05	11.40	5.03	6.06	12.22		10.71	0.18	74.28
170501080301						3.34	3.65	9.60	4.02		6.90	16.19		25.85	2.14	71.71
170501080501					28.14	1 37	5 34	3.24	5.63	3.72				0.74	0.07	48.25
170501080601					4.76	9.35	2.12	3.01	9 42	1.02	0.73	28.08		22.01	0.52	81.03
170501080604	1.89				17 01	7.13	7.84	2.65	16.74	0.23	0.92	24.39		9.55	0.24	88.60
170501080803					5.64	3 47	43 32	27.26	5 66	2 02	4.06			2.48		93.90
170501080805							4.33	6.99	1.58		4.16			0.23		17.28
170501090103				6.93	4.57	2.66	6 36	8.13	24.71	8 28	22.96	5.22	1.74	6.50	2.27	100.32
170501090303					9.35		9.97	3.57	14.97	7.33	13.22					59 41
170501090402					12.52		4 91	49.90		5 90	5.74					78.97
170501090406					4.38			20.49		0.42	0.37					25 66
170501090502					23.70		15.45	45.35	1.53	17 25	7.99					111.26
170501090503					4.96											4 96
170501090504					11.35		1.71	12.08	16.22	1.82	19.25	19.51		2.49		84 44

Field Verification

Field inspection was performed at nine sites selected by the Owyhee Watershed Council as representative of overall study area conditions and geographic diversity. Field observations (below) generally resulted in CHT determinations that were similar to those obtained by GIS analysis. Observation summary forms for the nine sites are appended.

References

WPN 1999. *Oregon Watershed Assessment Manual.* Watershed Professionals Network, prepared for the governor's Watershed Enhancement Board. Salem, Oregon.

03-channelhabitattypeswithoutphotos-internaldraft.doc

Site one: Crooked Creek Headwaters

Date: 6/7/05
Observers: Katherine Lanspery, Michael May
Subbasin: Crooked Rattlesnake
Watershed: Headwaters Crooked Creek
HUC: 170501090103
UTM: 0432705 4692368; WP3; EPE 4
Stream name: Crooked Creek
Stream Size: small

Preliminary CHT: LM
Final CHT: LM
Channel slope: 1.3
Bankfull width: 10 ft
Floodplain width: 31 ft
Moderately confined, low gradient
Materials in stream bed: sand

Overall watershed conditions:

The watershed is dominated by sagebrush/steppe plant communities. Along highway 95 there are large areas predominated by *bromus tectorum* (cheatgrass), but as the elevation increased while approaching the headwaters cheatgrass was less evident. The landscape in the headwaters of Crooked Creek is dominated by think stands of *Artemisia spp.* (sagebrush) with few bunchgrass and other shrubs in the interspace. In the headwaters of the drainage bare soil patches are prevalent within the fenced allotment. Multiple watering holes for cattle were present in the uplands. Vegetation around these structures has been altered and converted to grasses.

The first unnamed intermittent stream (UTM 0435398 4688176) we observed was within a grazed area, and appeared to not have flow for several years (Photo 1). Sagebrush and other upland species were growing in the channel. At this site, the soils were compacted. Evidence of sheet erosion was also present due to the pedestalling of shrubs and grasses. Some cheatgrass was also present in the interspace.

Site:

Multiple springs feed the Crooked Creek watershed especially in the headwaters. These intermittent streams are not considered fish bearing habitat. The site on Crooked Creek was located just past a fence line. This fence separated pastures. The sampled site was on a rested portion of the pasture. Photo 2 and 3 show the differences in vegetation between the rested and unrested land. On the rested land, grasses were in the interspaces and biological soil crusts were beginning to reform.

At the site (Photo 4), the channel was dry with few differences in the upland and riparian vegetation. The upland vegetation at this site is predominated by dense sagebrush, bunchgrasses, lupine, and cheatgrass, partially occupying the stream bed. Riparian vegetation was not evident, but included increased grasses. On the left bank of the channel, sheet erosion is beginning to occur leaving the vegetation elevated off of the soil surface. The stream bed materials were mostly sand (Photo 5). Riparian condition units are detailed in Component 6.

Figure 13-1. This photo illustrates the dominance of sagebrush and prevalence of bare soil in the interspaces.

Figure 13-2. Rested pasture

Figure 13-3. Grazed pasture

Figure 13-4. Site

Figure 13-5. Sandy stream bed materials

Site two: Lower Crooked Creek

Date: 6/7/05
Observers: Katherine Lanspery, Michael May
Subbasin: Crooked Rattlesnake
Watershed: Drought Creek
HUC: 170501090502
UTM:429155 4725342; WP4; EPE 5
Stream name: Crooked Creek
Stream Size: small

Preliminary CHT: FP2
Final CHT: LM
Channel slope: 0.3
Bankfull width: 15/11.5 ft
Floodplain width: 26.5/28 ft
Moderately confined, low gradient
Materials in stream bed: silt/clay/organics

Site:

The site was located to the west of highway 95. The sample was taken outside of the influence of the road grade and culvert where the channel begins to meander. The first observation taken was the obvious brown coloring of the water column. It was not suspended sediments; the brown color was caused from something that is dissolved. The channel meanders until it moves toward the road grade with stable banks and floodplain characteristics present. The right and left banks do show some evidence of erosion at high discharge events, including cut banks. Freshwater clams and crawfish were present along with multiple unidentified fish ranging from 1-3 inches in length. Riparian vegetation was diverse including *Carex spp.* (sedges) and *Juncus spp.* (rushes) dominantly. Other species present include currant, thistle, grasses, and equisetum (horsetail). The stream bed materials are mostly silts and organics with macrophytes growing on the stream bed. This creek appears to be properly functioning and is providing habitat for shellfish and smaller fish species. The riparian vegetation is regenerating and appears to be outside the influence of agricultural practices.

Figure 6. Site

Figure 7. Standing on the road grade looking down at the Crooked Creek. This is downstream of the site where the stream channelized as it moves toward the culvert.

Figure 8. This photo illustrates bank erosion from high discharge events and the brown color of the water.

Figure 9. This photo illustrates the health of the floodplain with *Carex* and *Juncus* species.

Site three: North Fork Rye Creek

Date: 6/7/05
Observers: Katherine Lanspery, Michael May
Subbasin: Crooked/Rattlesnake
Watershed: Upper Palomino Creek
HUC: 170501090504
UTM: 408881 4755487; WP6; EPE 5
Stream name: NFK Rye Creek
Stream Size: small-intermittent

Preliminary CHT: MH
Final CHT: MM
Channel slope: 4.2
Bankfull width: 4 ft
Floodplain width: 12 ft
Moderately confined, moderate gradient
Materials in stream bed: silt/clay

Site:

The site is downstream of an impoundment that is creating the flow. The channel was small in size and covered by grasses and forbs. The vegetation on the left bank is bunchgrasses, sparse sagebrush, and lupine (photo 1). The right bank has few lupine, sagebrush and bunchgrasses. The road crosses over this creek multiple times and creates pools of water in the road.

Figure 10. Right bank vegetation is dominantly bunchgrasses and lupine

Figure 11. North Fork Ryegrass Creek

Figure 12. North Fork Ryegrass Creek at road crossing

Site four: Unnamed Creek

Date: 6/7/05
Observers: Katherine Lanspery, Michael May
Subbasin: Jordan
Watershed: Lower Middle Owhyee River
HUC: 170501070705
UTM: 447283 4746932; WP7; EPE 4
Stream name: unnamed
Stream Size: small- intermittent

Preliminary CHT: FP
Final CHT: LC
Channel slope: 1.6
Bankfull width: 7.2 ft
Floodplain width: 12.9 ft
Confined, low gradient
Materials in stream bed: gravel

Sample site:

The channel flows directly into the Owyhee River. This unnamed stream was small in size and intermittent (Photo 1). Grasses are growing in the bottom of the streambed indicating that flow has not occurred here in many years. Due to the lack of flows there was not any riparian species typical of this region. The left bank showed some native grasses, while the right bank and the areas above was dominantly *bromus tectorum* (cheatgrass) and *Brassica spp.* (mustard).

Figure 13. Looking downstream.

Figure 14. Another intermittent stream that would flow into the site.

Site five: Thomas Creek

Date: 6/7/05
Observers: Katherine Lanspery, Michael May
Subbasin: Jordan
Watershed: Mahogany Creek
HUC: 170501080604
UTM:491102 4773732; WP9; EPE 4
Stream name: Thomas Creek
Stream Size: small

Preliminary CHT: FP2
Final CHT: LM
Channel slope: 0.7
Bankfull width: 16.1 ft
Floodplain width: 34 ft
Moderatly confined, low gradient
Materials in stream bed: gravel cobble mix

Site:

The site is downstream of a box culvert in a grazed meadow. The meadow is composed of sagebrush, grasses, and forbs. Sparse vegetation was present on the stream banks, and did not include riparian vegetation typical for this region. Some bank trampling was also evident. Stream bed materials were mostly gravel with some cobble.

Figure 15. The evaluation site.

Figure 16. The culvert outlet is depositing gravel at the bottom of the outlet pool. Water is beginning to dam up behind this depositional feature.

Figure 17. Water damming up behind the inlet of the culvert.

Site six: Rock Creek

Date: 6/8/05
Observers: Katherine Lanspery, Michael May
Subbasin: Jordan
Watershed: Upper Rock Creek
HUC: 170501080102
UTM:525801 4739914; WP10; EPE 4
Stream name: Rock Creek
Stream Size: medium

Preliminary CHT: LC
Final CHT: LM
Channel slope: 1.2
Bankfull width: 22/24 ft
Floodplain width: 73.3/92.11 ft
Moderately confined, low gradient
Materials in stream bed: sand with organics

Watershed conditions:

Overall rangeland conditions in the watersheds below the Rock Creek sample site indicate that juniper encroachment is occurring. Dense stands of juniper cover upland and lowland sites, with sparse grasses growing in the interspace. Idaho Department of Lands has done some prescribed burning in areas of dense juniper, resulting in increased early successional species of bunchgrasses and sagebrush (photo 6).

Sample site:

This sample site is located at the outlet of the 6th code HUC directly above the confluence of Josephine Creek. Feeding the Rock Creek system are multiple thermal and non-thermal springs and two reservoirs used for irrigation return flows. In 1944 the dam at Triangle reservoir broke and flooded the drainage (Personal communication with Kenny Kershner). The site is grazed with 200 head of cattle once every three years in the fall, and is rested for two (Personal communication with Kenny Kershner).

The site is at the mouth of the canyon above Josephine Creek at the end of the road and is used as a parking area for recreationalists. This area does not seem to impact the site, except for the off road vehicle crossing that has widened the stream channel (photo 3). Three beaver dams were present on the site, two of which were blown out in this year's high discharge events (photo 2). Dams were composed of primarily willow branches, as there is no large woody species present. As a result of the dams, the channel widened during the high spring flows (photo 4) and has been scoured down to the bedrock. As the beavers return the channel will most likely continue to change over time. Upstream of the sample site the channel widens, most likely as a result of the beaver dams.

The stream bed was composed mainly of sand and organics with macrophytes growing in dense mats. This may be attributed to increased temperatures from the thermal springs one mile upstream. In addition, the irrigation return flow water stored in reservoirs upstream may add nutrients and increase overall water temperatures. Macrophytes prosper in environments with high nutrients and warm temperatures.

Stable banks were present throughout the sample site. Species along the banks included mostly willow, grasses, sedges and rushes. The riparian vegetation showed much overlap between upland and riparian species. Sagebrush and juniper were both present in the riparian area, as well as willow, brome, grasses, sedges, equisetum, rushes, rose, and snowberry. Species appear to be regenerating on the site. There were no dominant non-native species present on the site.

Streambank stability, diverse riparian vegetation and regeneration indicate that agricultural practices are not hindering the function and structure of riparian and stream habitat. Water temperatures should be monitored due to warm upstream sources and the indicators presented at the site.

Figure 18. Overall view indicates stable banks and riparian vegetation typical for this region

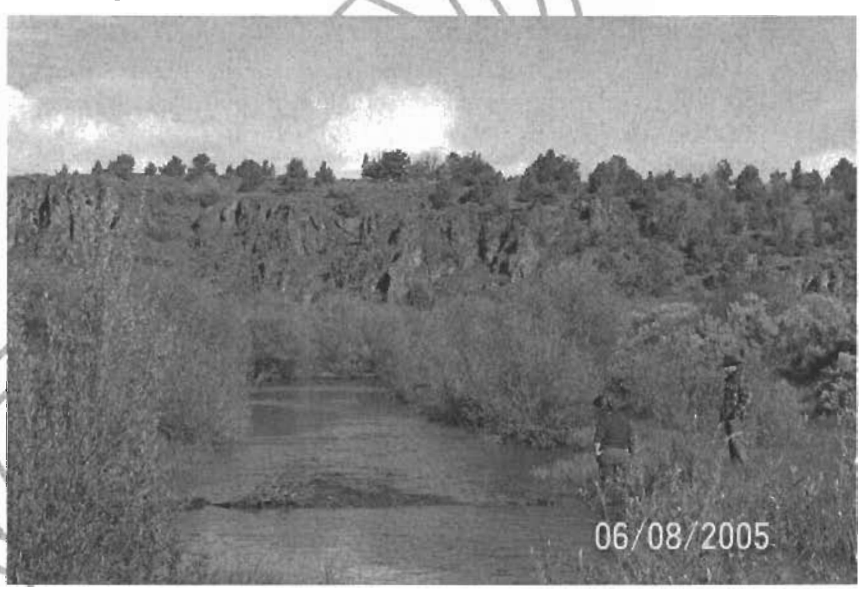


Figure 19. Site included three beaver dam structures. The dams were blown out in this spring's high discharge events.

Figure 20. Off road vehicle crossing at site about 20 ft upstream of confluence with Josephine Creek. The stream has widened in this area.

Figure 21. An area that flooded this spring due to beaver dams.

Figure 22. A beaver dam at the site that was removed at high discharge.

Figure 23. State land that has had a prescribed fire to reduce the amount of juniper, allowing bunchgrasses and sagebrush to reestablish.

Site seven: Soldier Creek

Date: 6/8/05
Observers: Katherine Lanspery, Michael May
Subbasin: Jordan
Watershed:
HUC: 1705010
UTM:496559 4730097; WP14; EPE 5
Stream name: Soldier Creek
Stream Size: small

Preliminary CHT:
Final CHT: LM
Channel slope: 0.4
Bankfull width: 16/22/12 ft
Floodplain width: 33/37/45 ft
Moderalty confined, low gradient
Materials in stream bed: gravel with fine deposits

Site:

Solider Creek is located in a valley location that is moderately confined. The sample site is located upstream of the culvert in a grazed area. On the right bank near the road, an unvegetated channel has formed from excess road runoff. Measurements were taken outside of the influence of the culvert.

The channel meanders in the valley but does not present typical riparian vegetation characteristics for this region. Riparian vegetation present includes sedges and Kentucky bluegrass. Upland species (sage and juniper) are rooted on the stream banks, indicating that this may be an intermittent stream. On the left bank there are more grasses than the right bank, including cheatgrass and native grasses with interspersed sagebrush. The floodplain is wider on the left bank. The right bank is dominated by shrubs with patches of bare soil. Banks are stable in most areas, but some locations on the site included bank slumping and trampling.

Figure 24. Solider Creek site.

Figure 25. Looking downstream at site. Bank slumping is occurring on the left bank and bank trampling on the right bank

Site eight: Jordan Creek Headwaters

Date: 6/8/05
Observers: Katherine Lanspery, Michael May
Subbasin: Jordan
Watershed: Jordan Creek Headwaters
HUC: 170501080301
UTM:516612 4764387; WP15; EPE 4
Stream name: Jordan Creek
Stream Size: med

Preliminary CHT: LM
Final CHT: LM
Channel slope: 1.2
Bankfull width: 22.5 ft
Floodplain width: 55.2 ft
Moderately confined, low gradient
Materials in stream bed: cobble

Site:

The site is located upstream of the Delemar Mine on BLM land. The headwaters of Jordan Creek presented characteristics of a typical mountain stream with stable banks and mixed conifer and hardwood vegetation. The creek was flowing at bankfull discharge. Vegetation present on this site included cottonwoods, Douglas fir, willow, snowberry, juniper, sedges, grasses, and rushes. Evidence of the regeneration of willows was present. Banks at this site were stable in most areas with few areas impacted from bank trampling.

Figure 26. Site at the Jordan Creek headwaters. Some bank trampling is evident on the left bank.

Figure 27. Woody vegetation in the riparian area included Douglas fir, willow, cottonwoods, juniper, and snowberry.

Figure 28. Jordan Creek at bankfull discharge.

Site nine: Baxter Ck

Date: 6/8/05
Observers: Katherine Lanspery, Michael May
Subbasin: Jordan
Watershed: Baxter Creek
HUC: 170501080501
UTM:497889 4763352; WP16; EPE 6
Stream name: Baxter Creek
Stream Size: small

Preliminary CHT: LM
Final CHT: LM
Channel slope: 0.7
Bankfull width: 9.6/10.7 ft
Floodplain width: 37.2/69.5 ft
Moderately confined, low gradient
Materials in stream bed: gravel cobble mix

Site:

The sample site is in a grazed fenced meadow on BLM land. At the fence line there is bank slumping and trampling present. This may be due to increased use at the fence line where cattle tend to gather. The floodplain widens as you move upstream away from the impacted area along the fence. Vegetation within the floodplain includes both upland (sagebrush, bitterbrush, and bunchgrasses) and riparian species (grasses and sedges). Thistle was also present on the site. Stream bed materials are composed of a gravel cobble mix with few fine deposits. Upstream of the fence line there are some areas that also show bank slumping and trampling. This stream is most likely intermittent and is spring fed.

Figure 29. Site is in a grazed meadow.

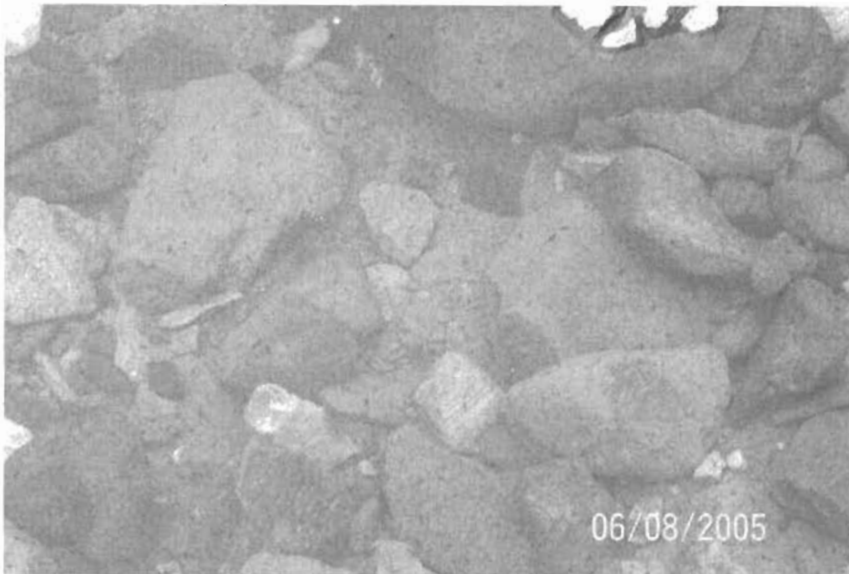
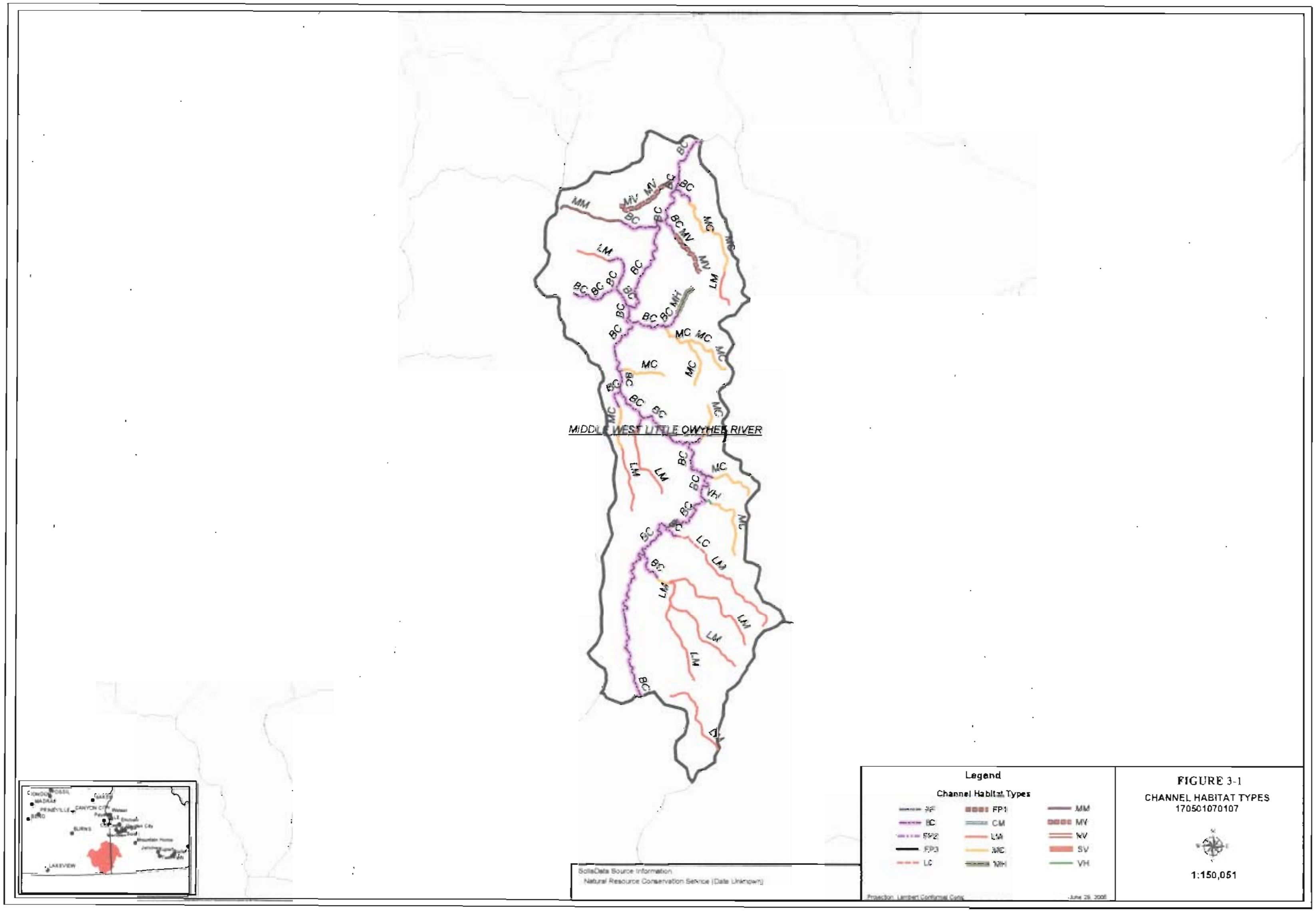


Figure 30. Substrate on the stream bed is a gravel/cobble mix.

Figure 31. The banks here show evidence of bank slumping and trampling.


MIDDLE WEST LITTLE OWYHEE RIVER
Legend
Channel Habitat Types
BC
FP2
FP3
LC
FP1
CM
LM
MC
MH
MM
MV
NV
SV
VH
SoilsData Source Information
Natural Resource Conservation Service (Date Unknown)
FIGURE 3-1
CHANNEL HABITAT TYPES
170501070107
1:150,051

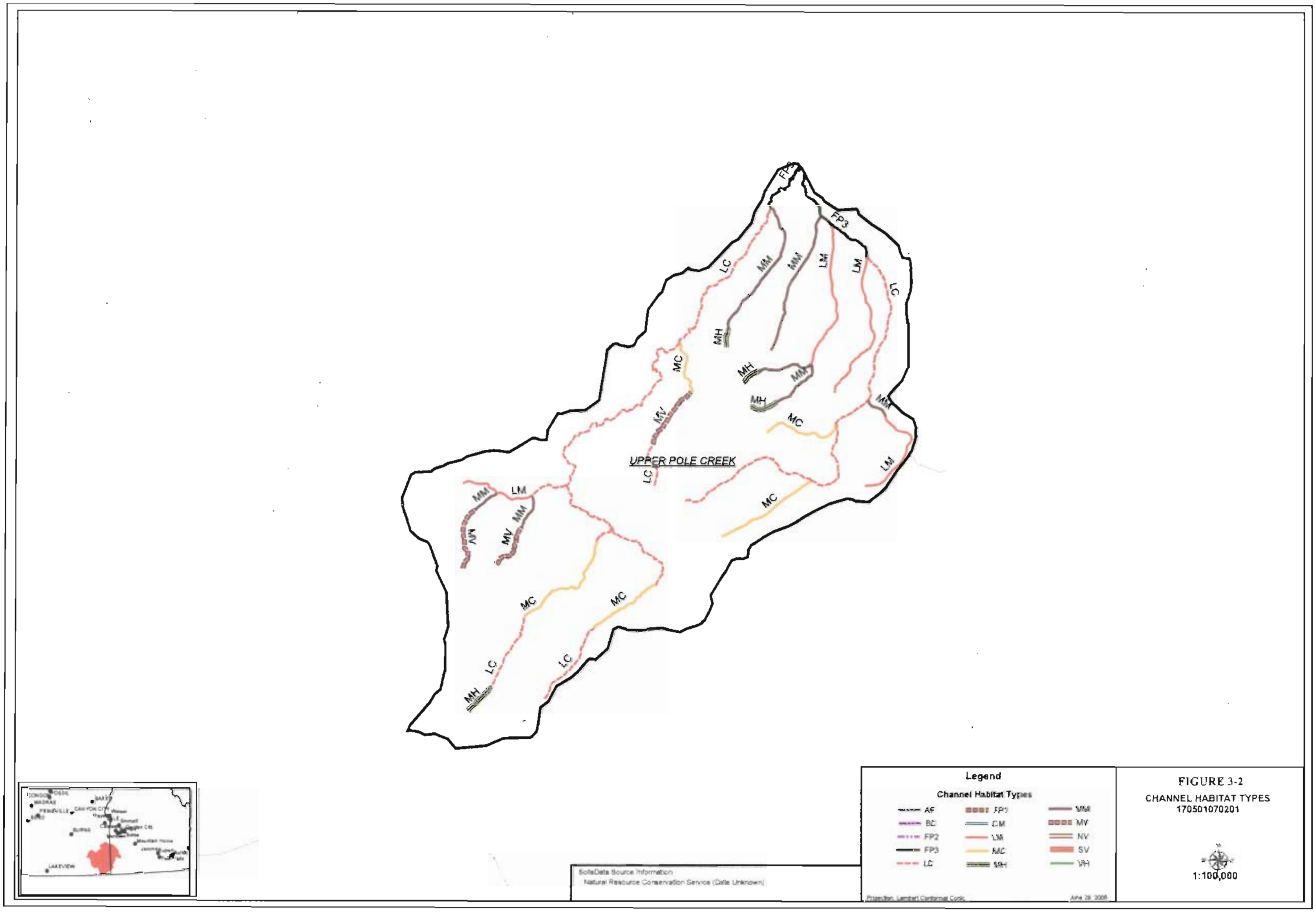


FIGURE 3-2
CHANNEL HABITAT TYPES
170501070201

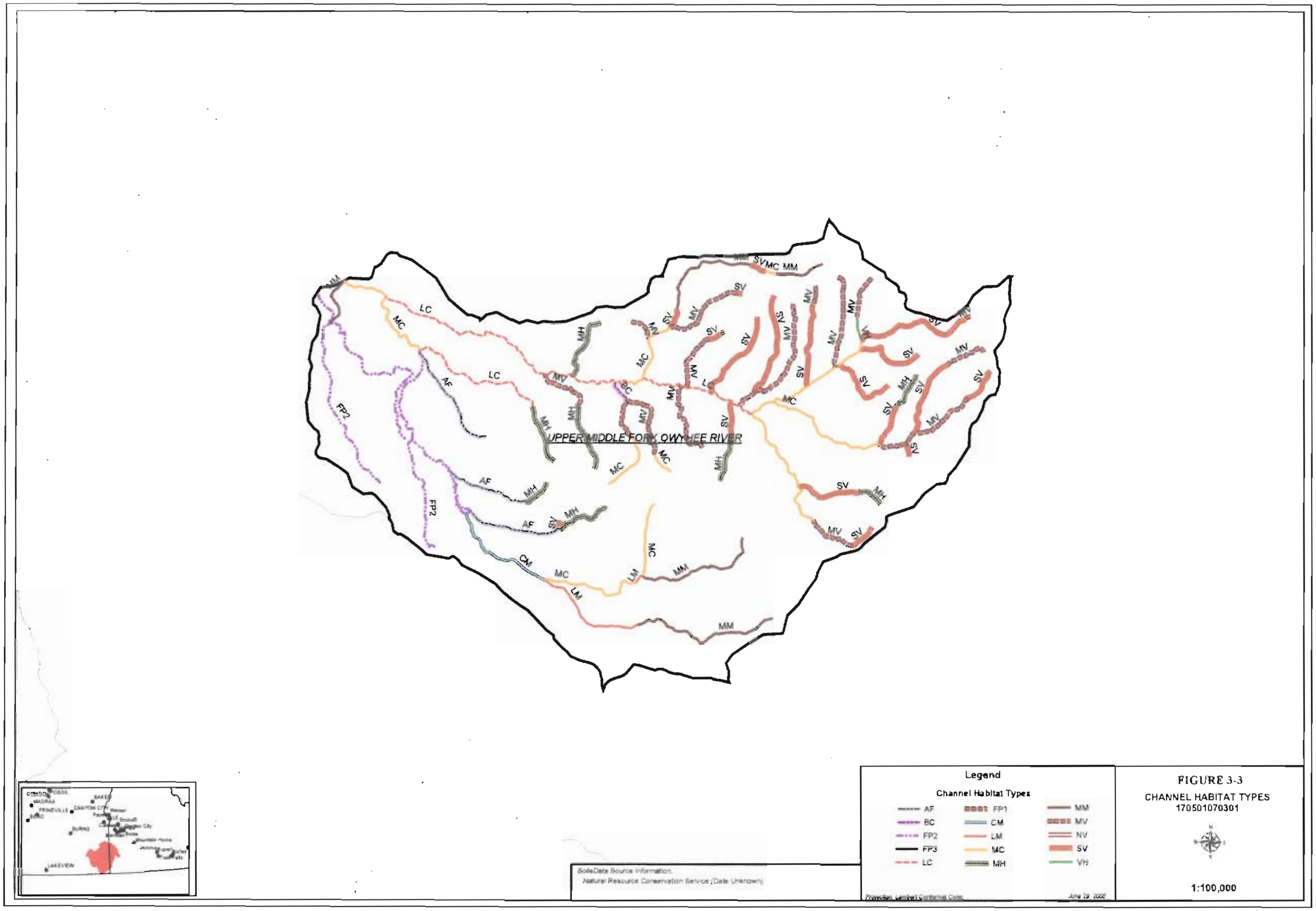


FIGURE 3-3
CHANNEL HABITAT TYPES
170501070301

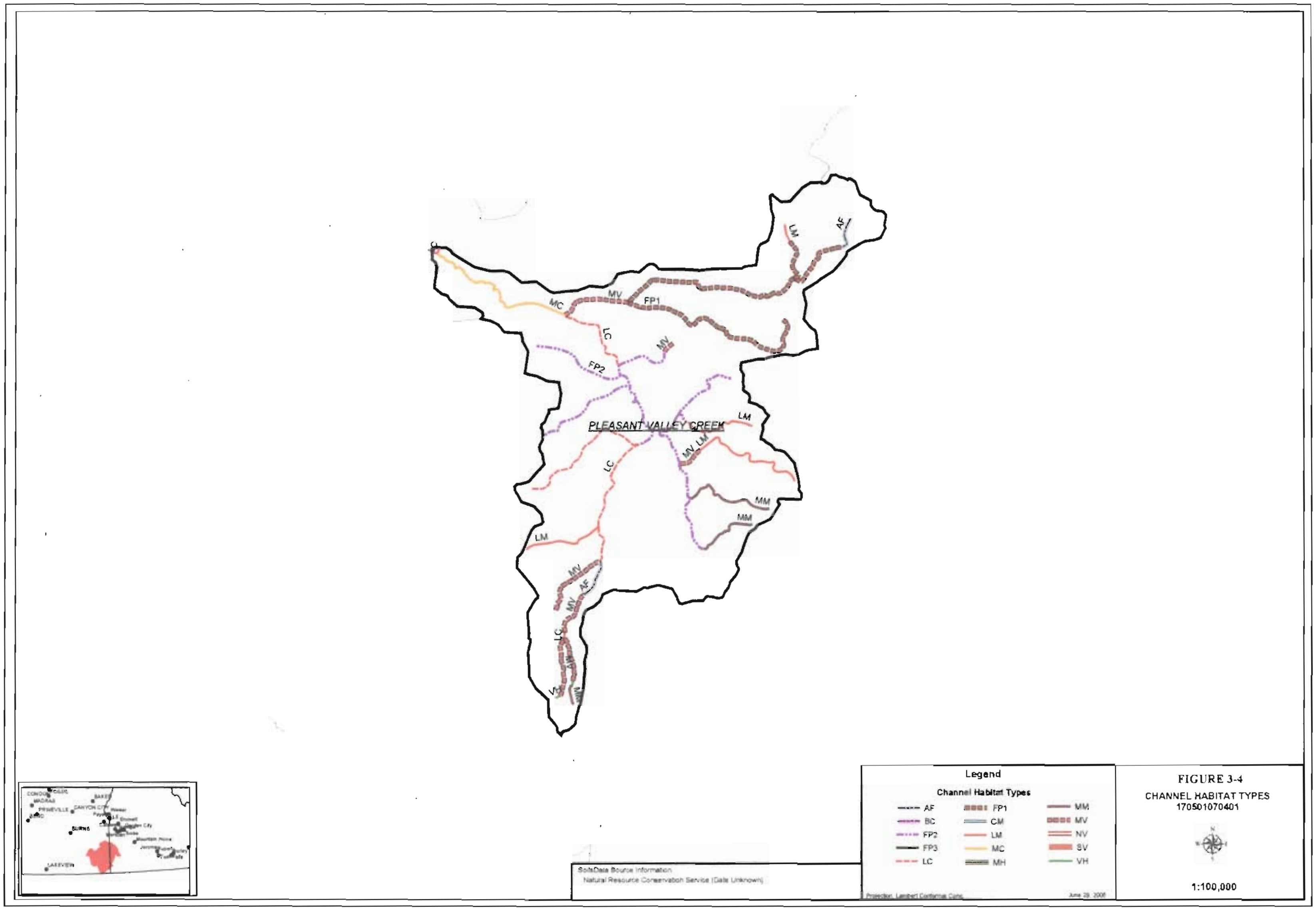
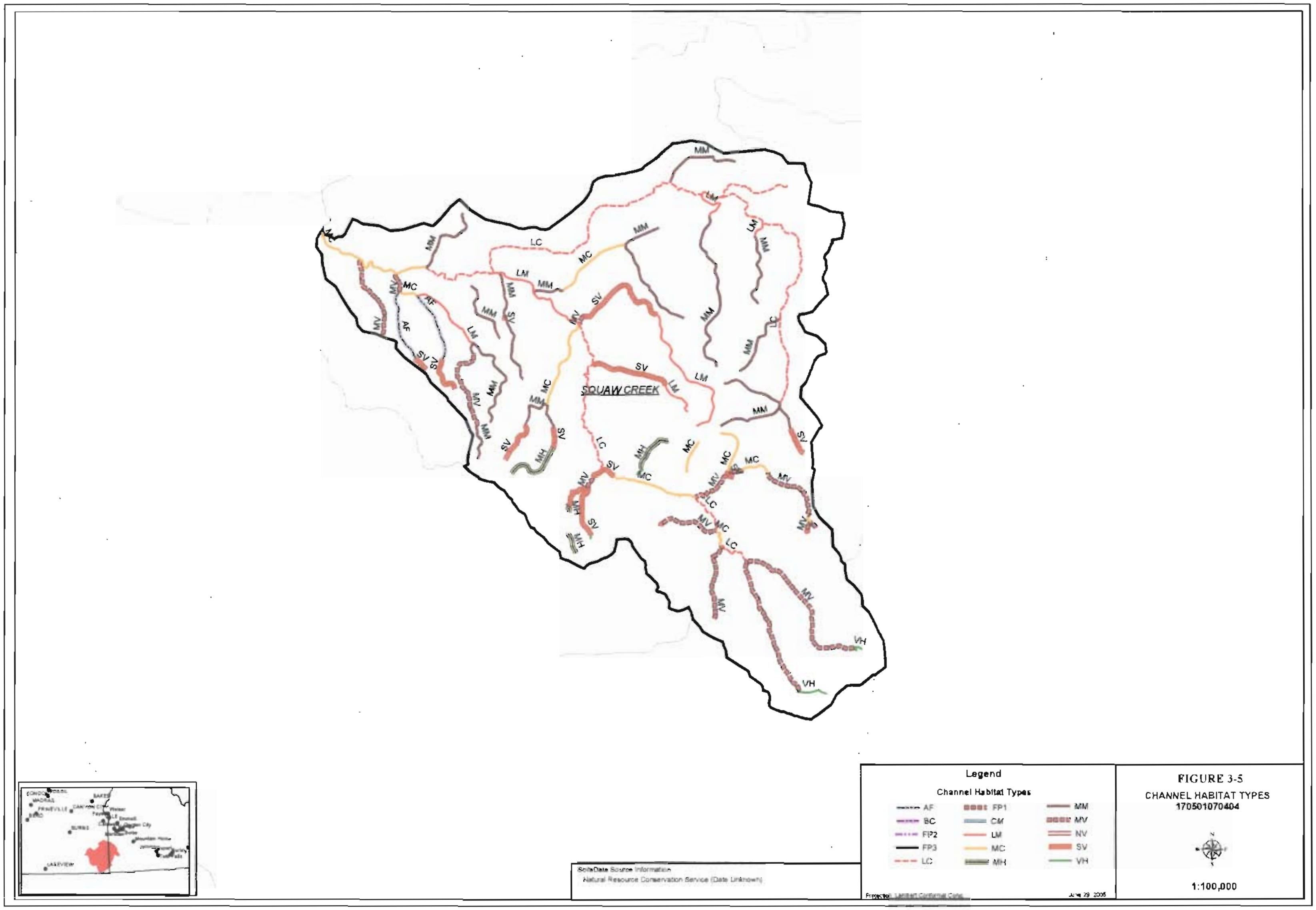
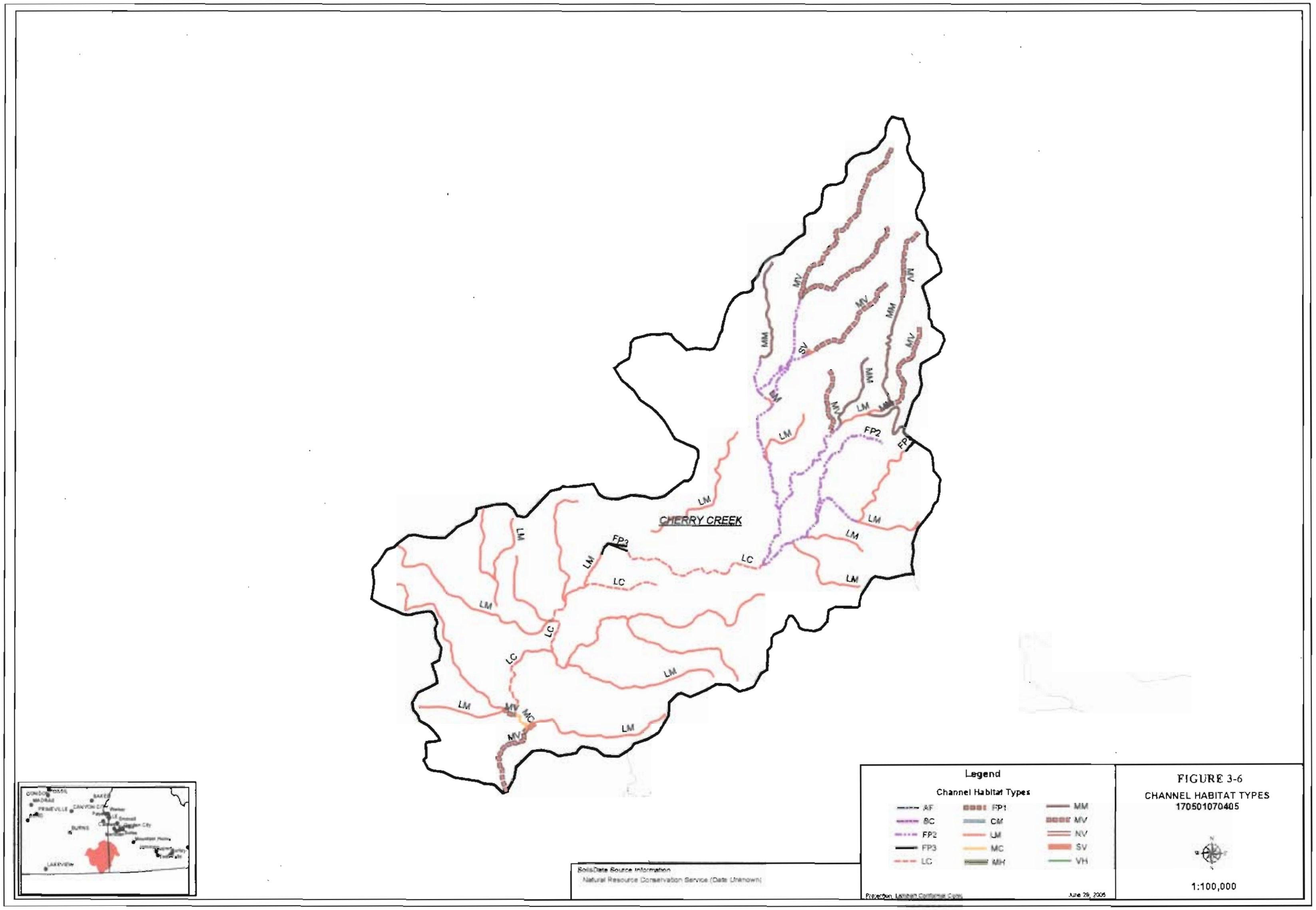


FIGURE 3-4
CHANNEL HABITAT TYPES
170501070401


SQUAW CREEK
Legend
Channel Habitat Types
AF
BC
FP2
FP3
LC
FP1
CM
LM
MC
MH
MM
MV
NV
SV
VH
Soils Data Source Information
Natural Resource Conservation Service (Date Unknown)
FIGURE 3-5
CHANNEL HABITAT TYPES
170501070404
1:100,000


CHERRY CREEK
LM
LC
FP2
FP3
MM
MV
SV
MC
Legend
Channel Habitat Types
AF
BC
FP2
FP3
LC
FP1
CM
LM
MC
MH
MM
MV
NV
SV
VH
Soils Data Source Information
Natural Resource Conservation Service (Date Unknown)
FIGURE 3-6
CHANNEL HABITAT TYPES
170501070405
1:100,000

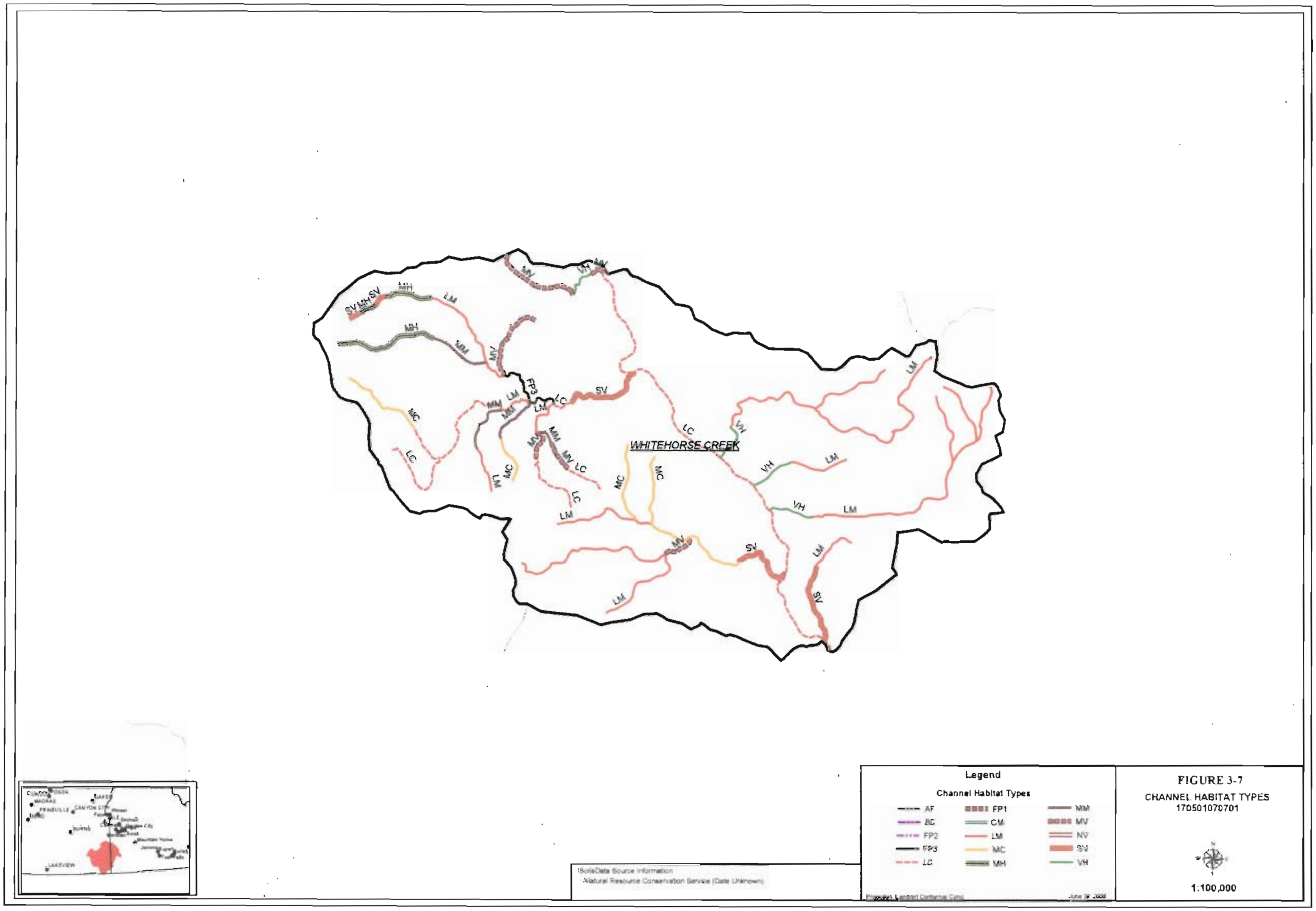
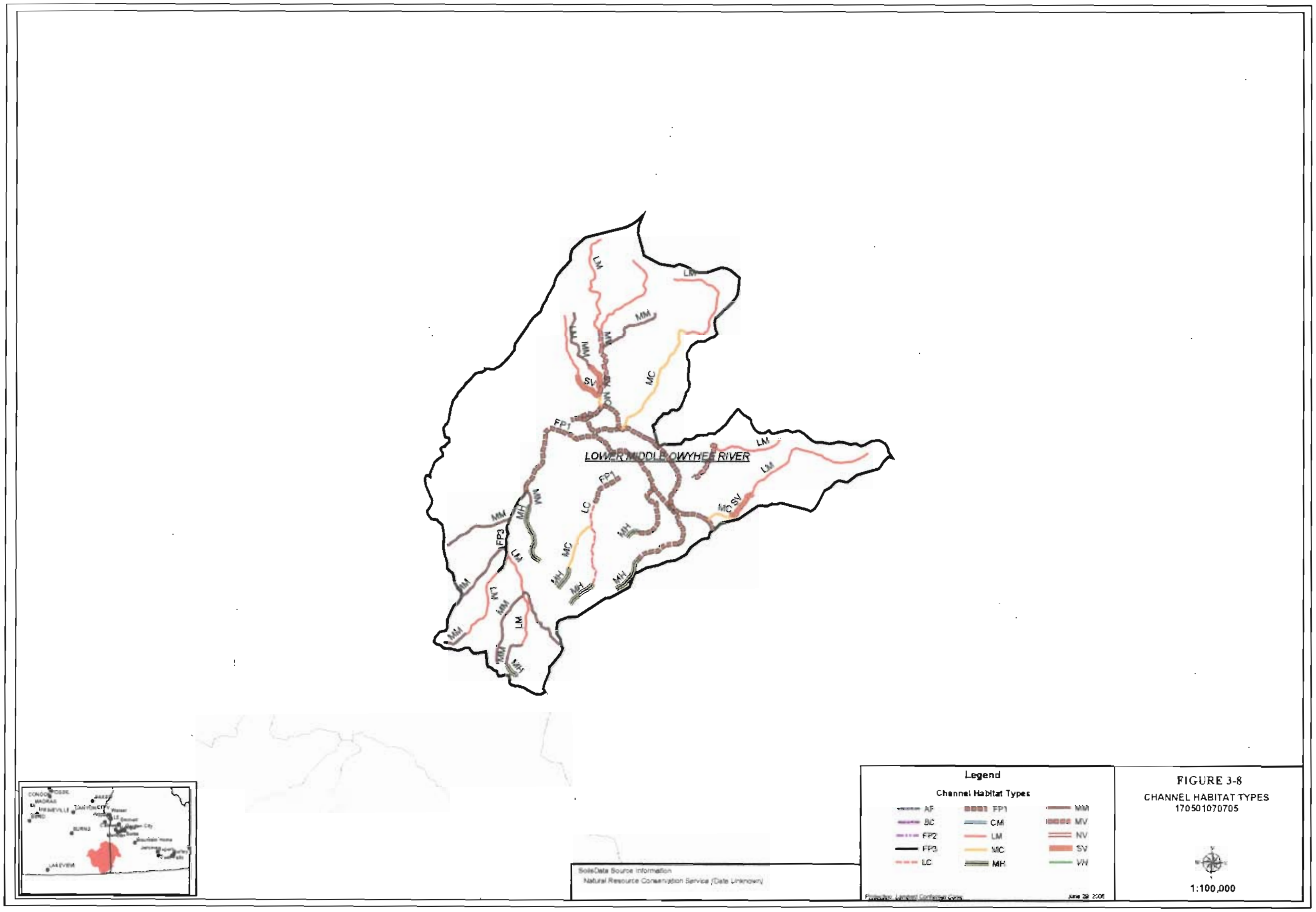


FIGURE 3-7
CHANNEL HABITAT TYPES
170501070701


LOWER MIDDLE OWYHEE RIVER
LM
MM
MC
SV
FP1
FP3
LC
MH
Legend
Channel Habitat Types
AF
BC
FP2
FP3
LC
FP1
CM
LM
MC
MH
MM
MV
NV
SV
VW
SoilsData Source Information
Natural Resource Conservation Service (Date Unknown)
FIGURE 3-8
CHANNEL HABITAT TYPES
170501070705
1:100,000

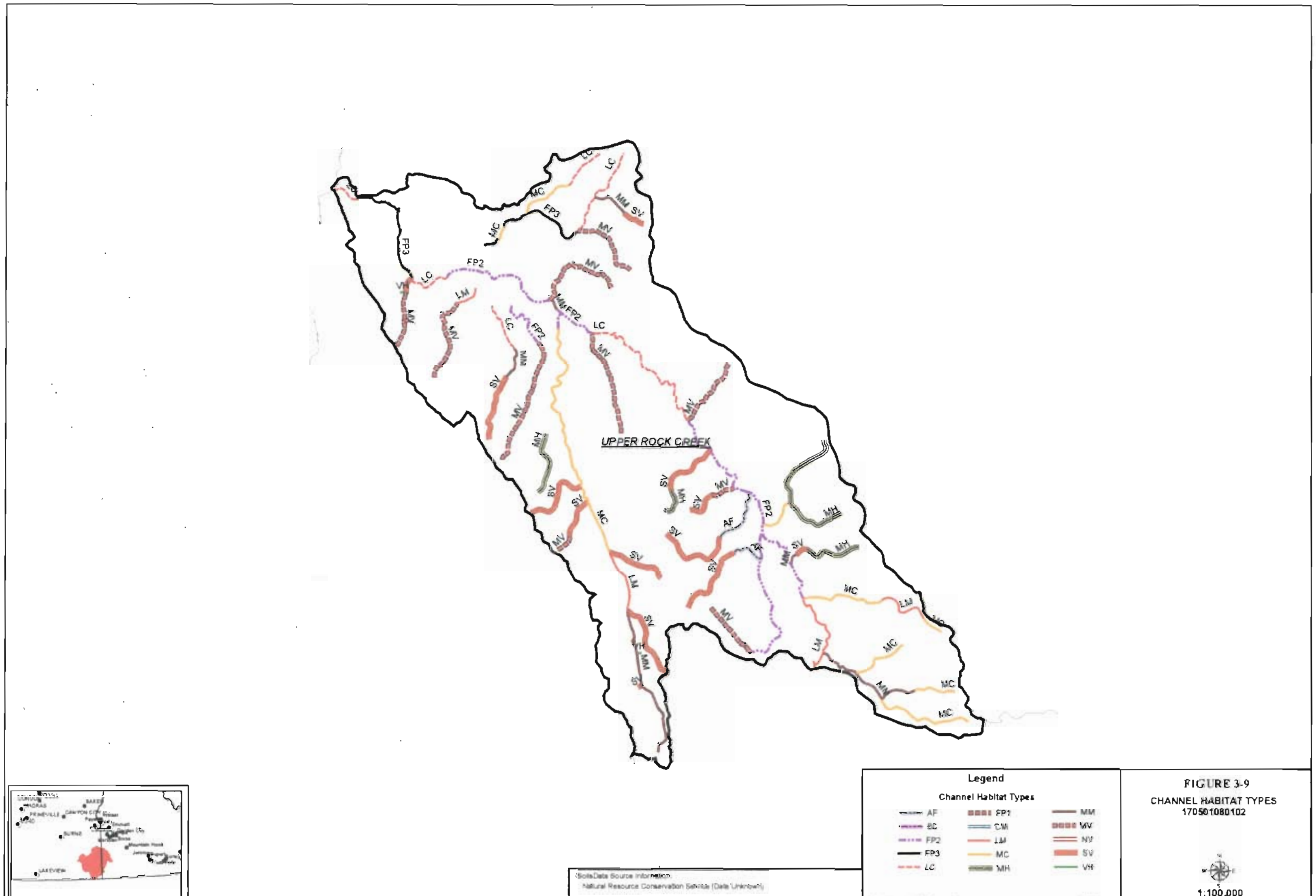


FIGURE 3-9
CHANNEL HABITAT TYPES
170501080102

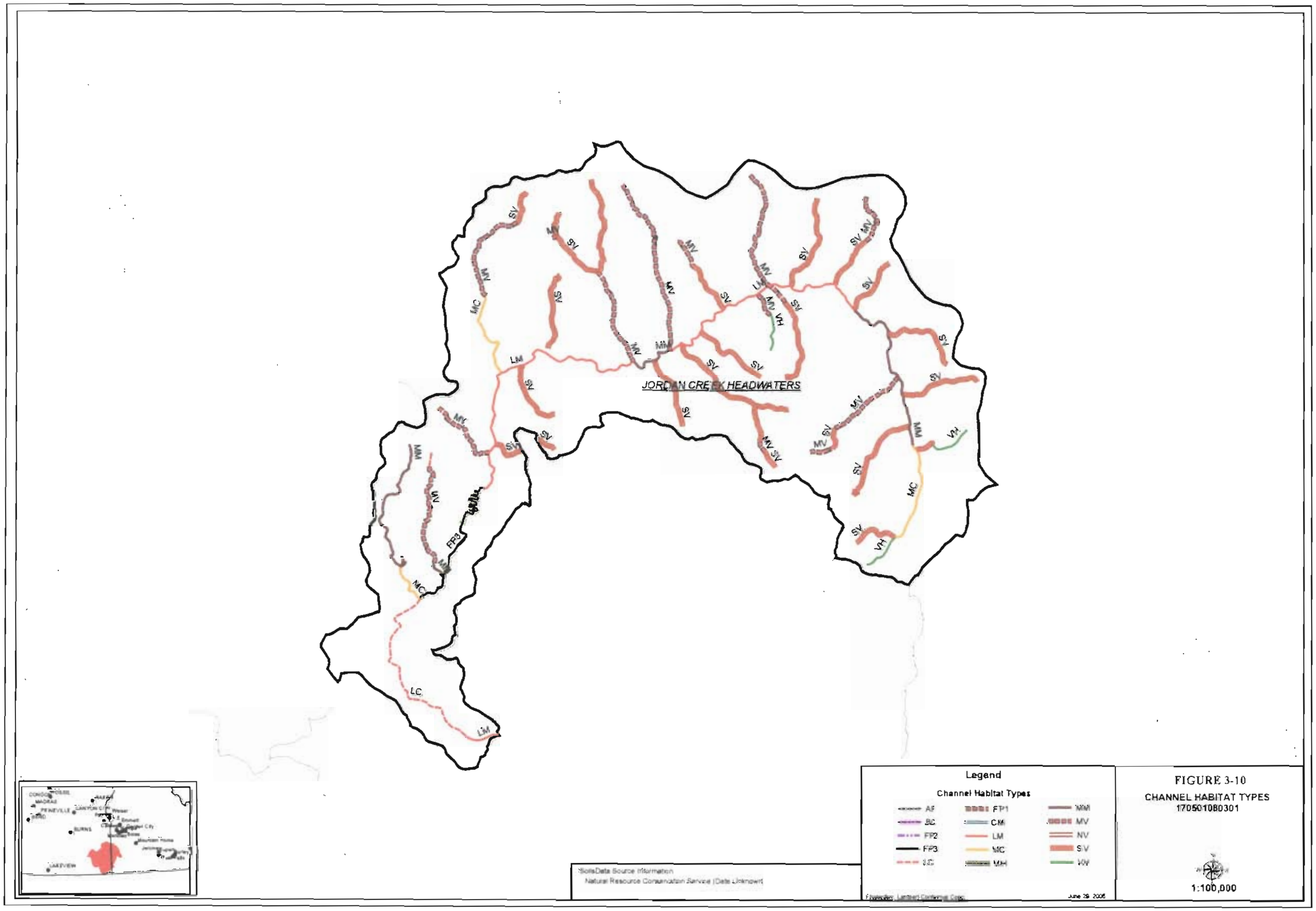


FIGURE 3-10
CHANNEL HABITAT TYPES
170501080301
1:100,000

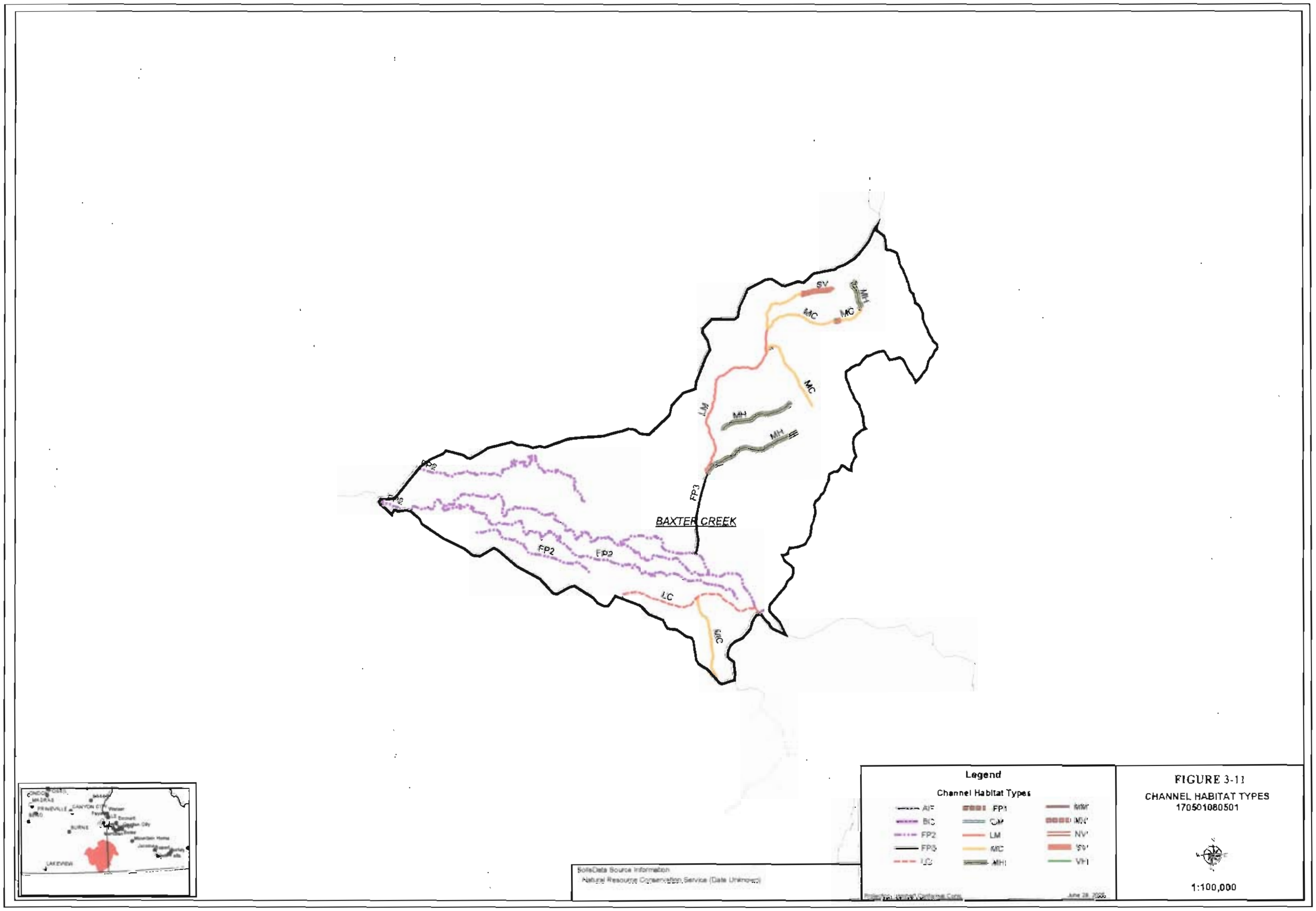


FIGURE 3-11
CHANNEL HABITAT TYPES
170501080501

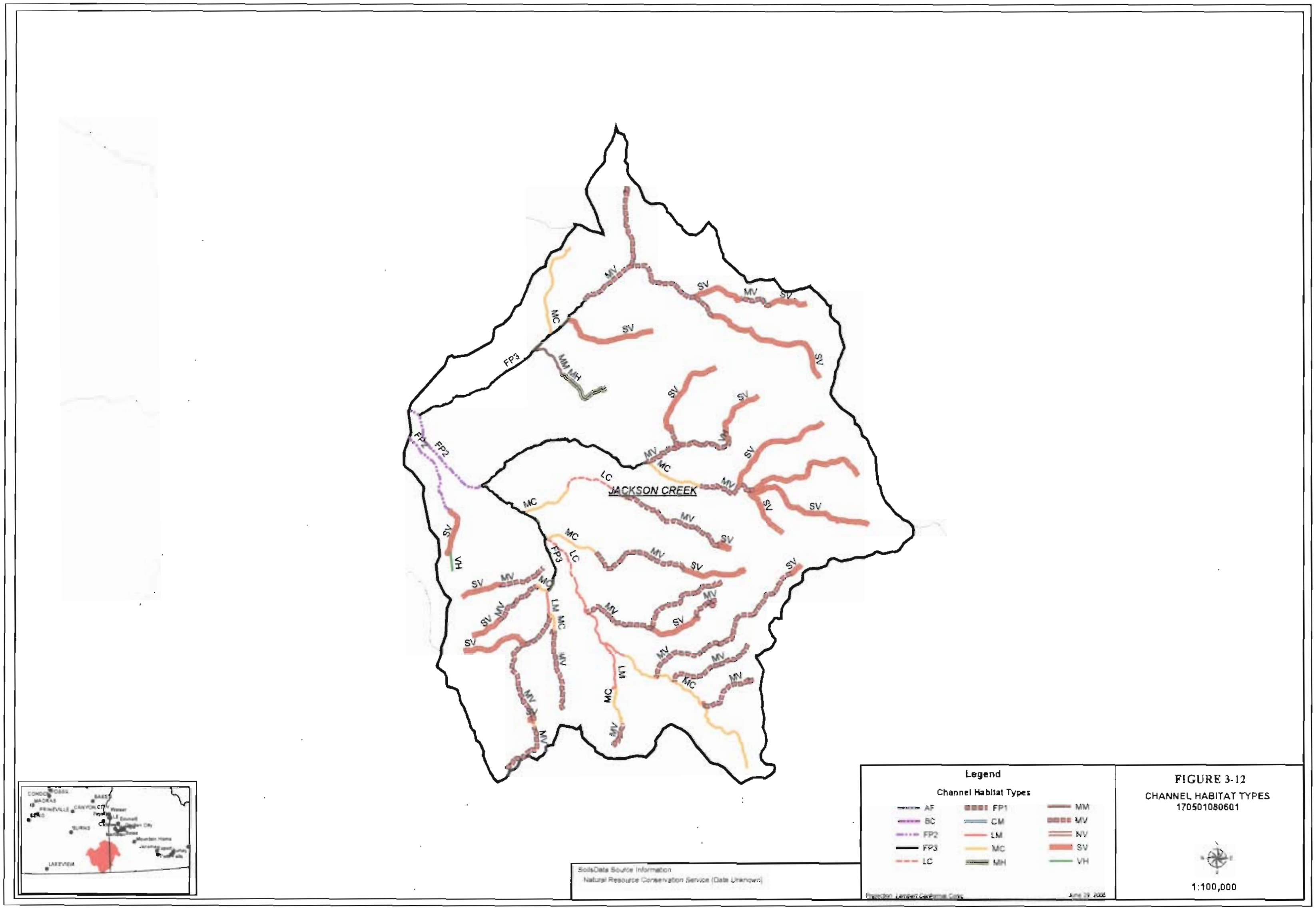


FIGURE 3-12
CHANNEL HABITAT TYPES
170501080601

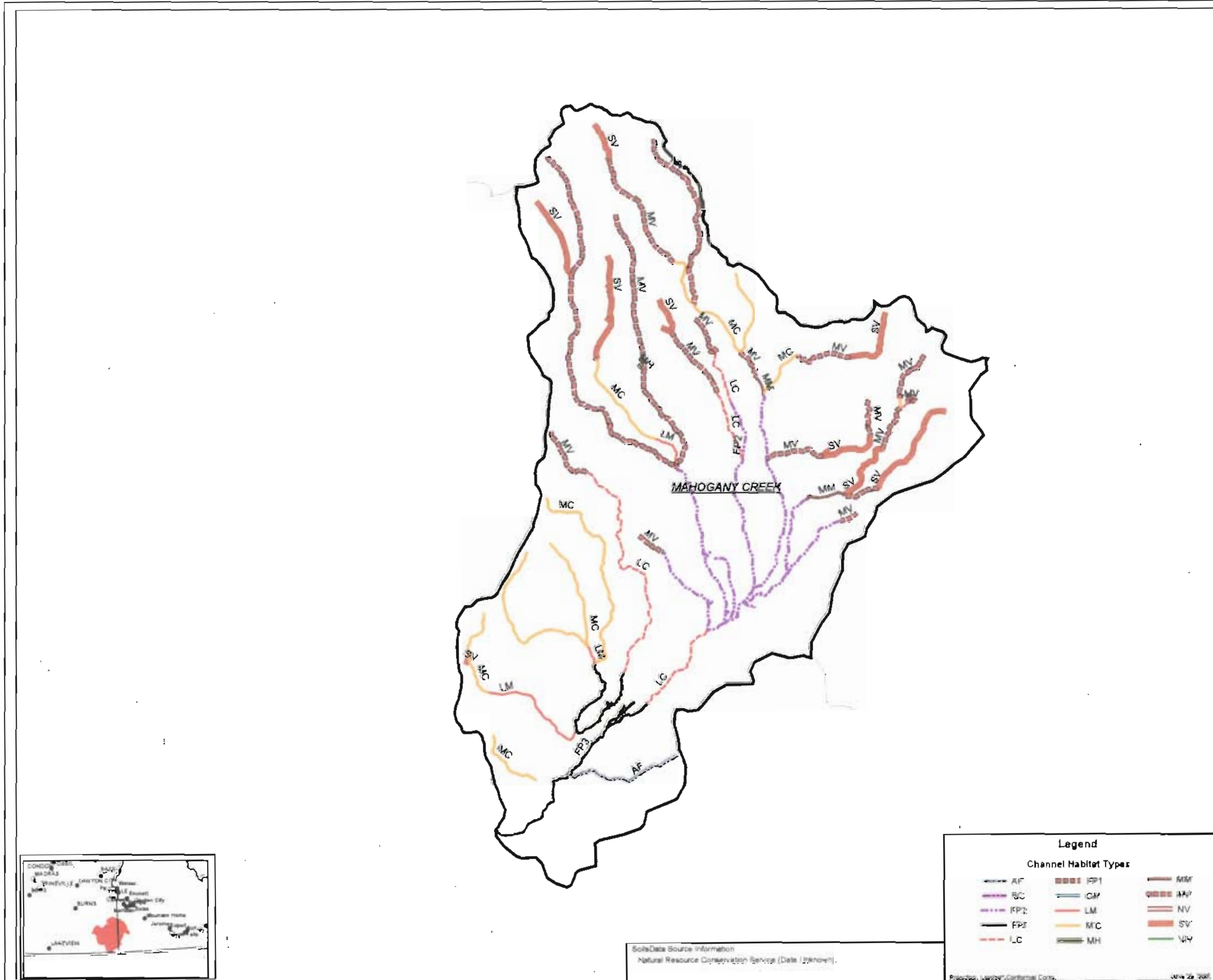
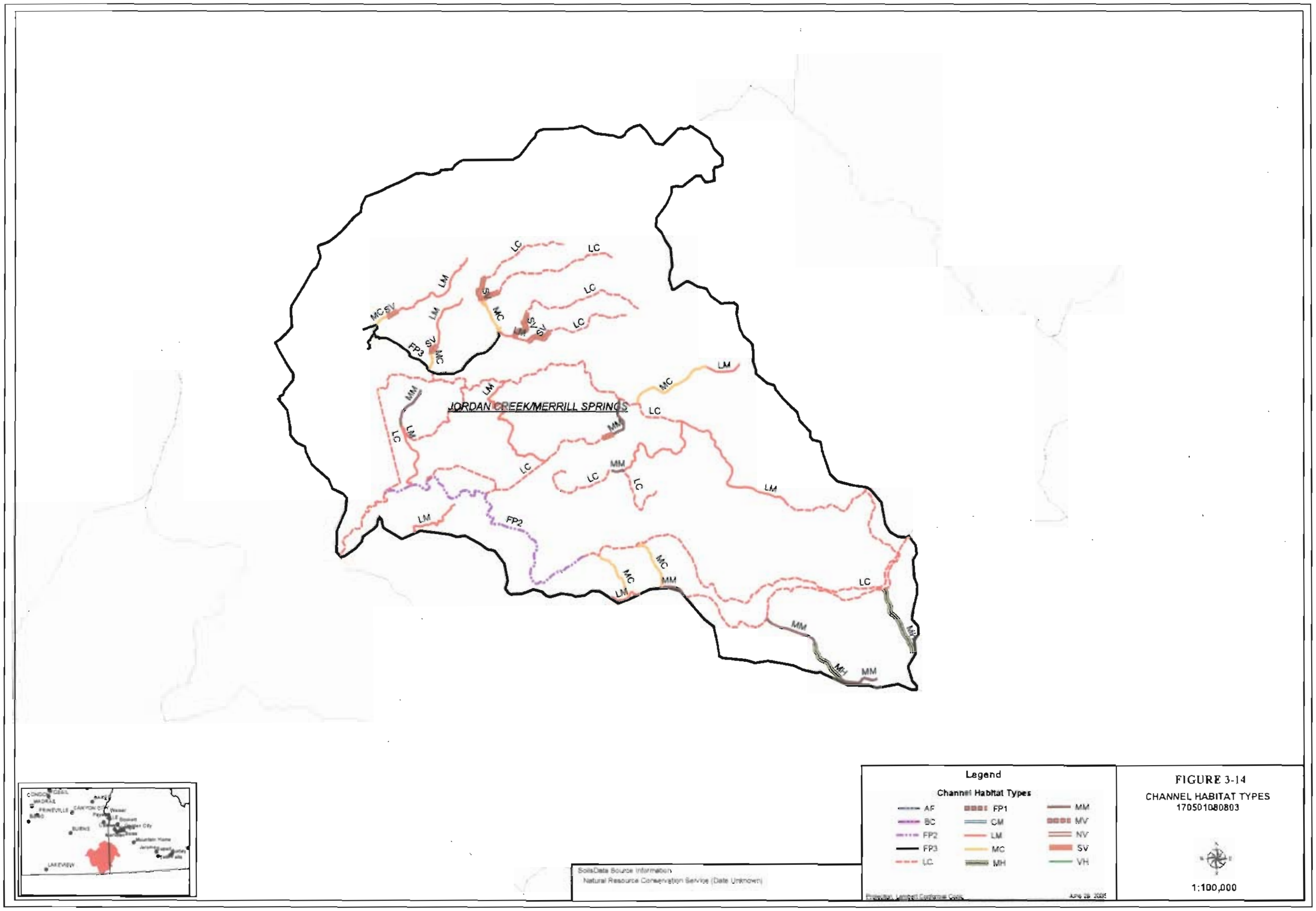


FIGURE 3-13
CHANNEL HABITAT TYPES
170501080604

1:100,000


JORDAN CREEK/MERRILL SPRINGS
Legend
Channel Habitat Types
AF
BC
FP2
FP3
LC
FP1
CM
LM
MC
MH
MM
MV
NV
SV
VH
SoilsData Source Information
Natural Resource Conservation Service (Date Unknown)
FIGURE 3-14
CHANNEL HABITAT TYPES
170501080803
1:100,000

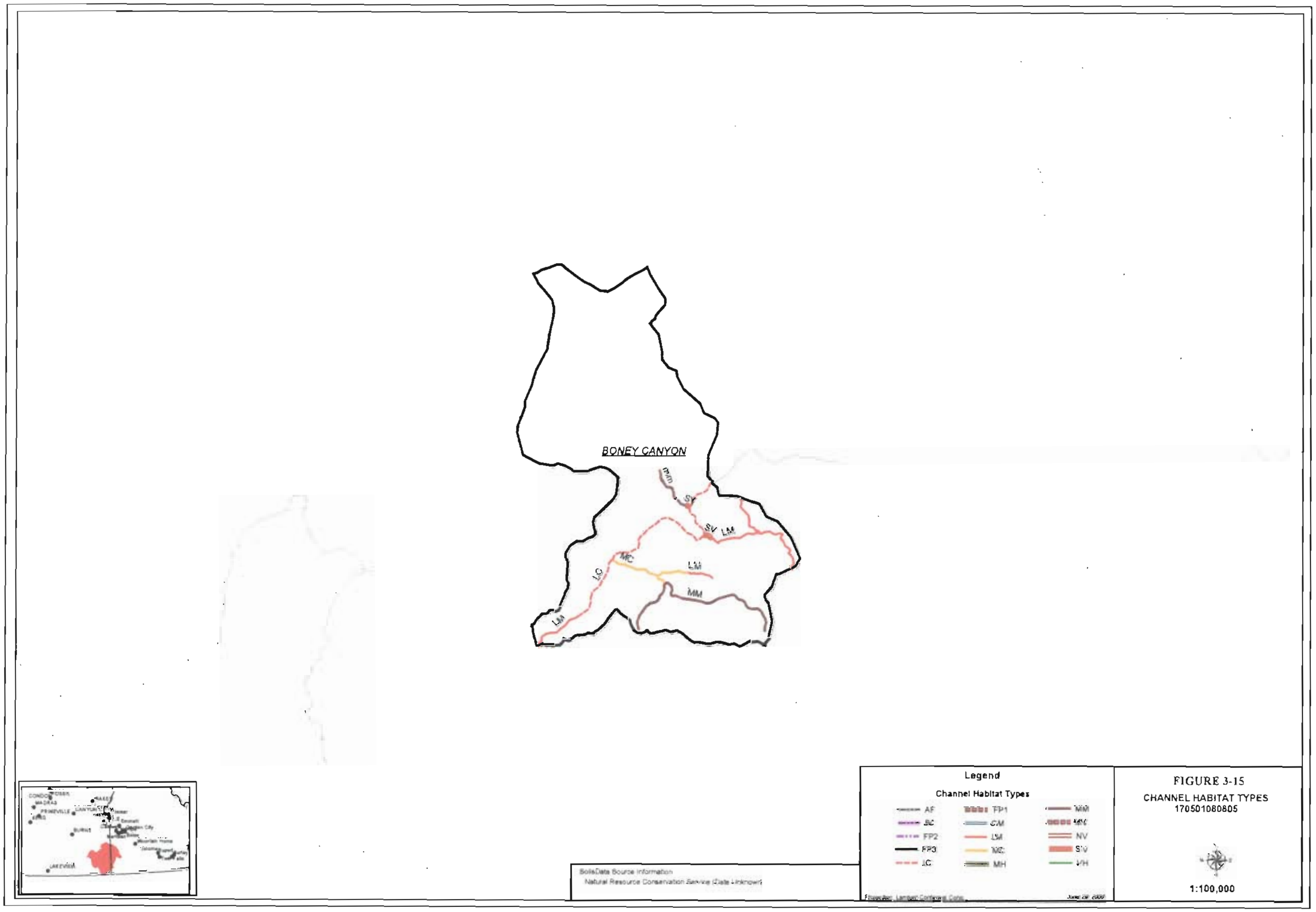
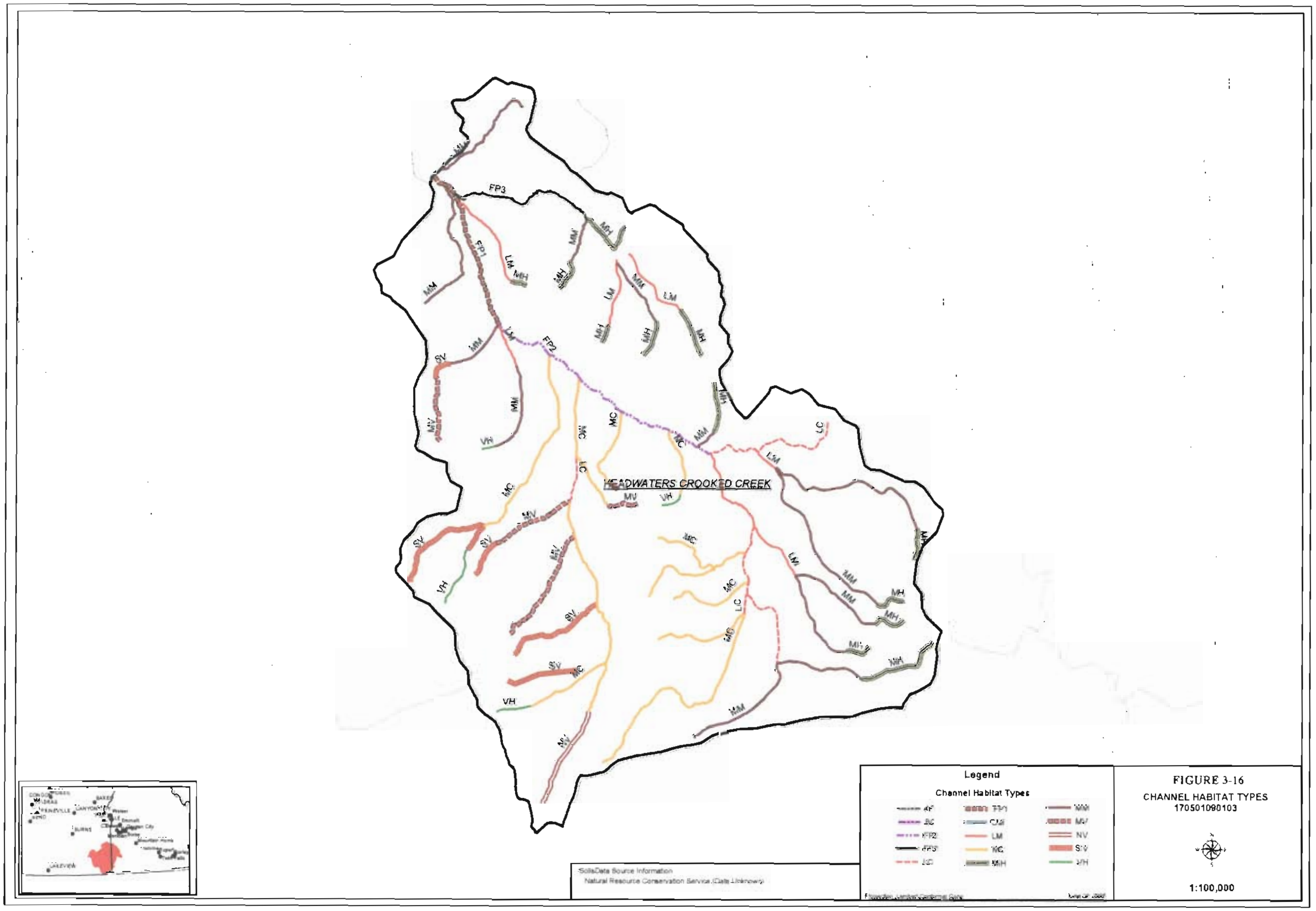


FIGURE 3-15
CHANNEL HABITAT TYPES
170501080805


HEADWATERS CROOKED CREEK
FP1
FP2
FP3
LC
LM
MC
MH
MM
MV
NV
SV
VH
Legend
Channel Habitat Types
SoilsData Source Information
Natural Resource Conservation Service (Date Unknown)
FIGURE 3-16
CHANNEL HABITAT TYPES
170501090103
1:100,000

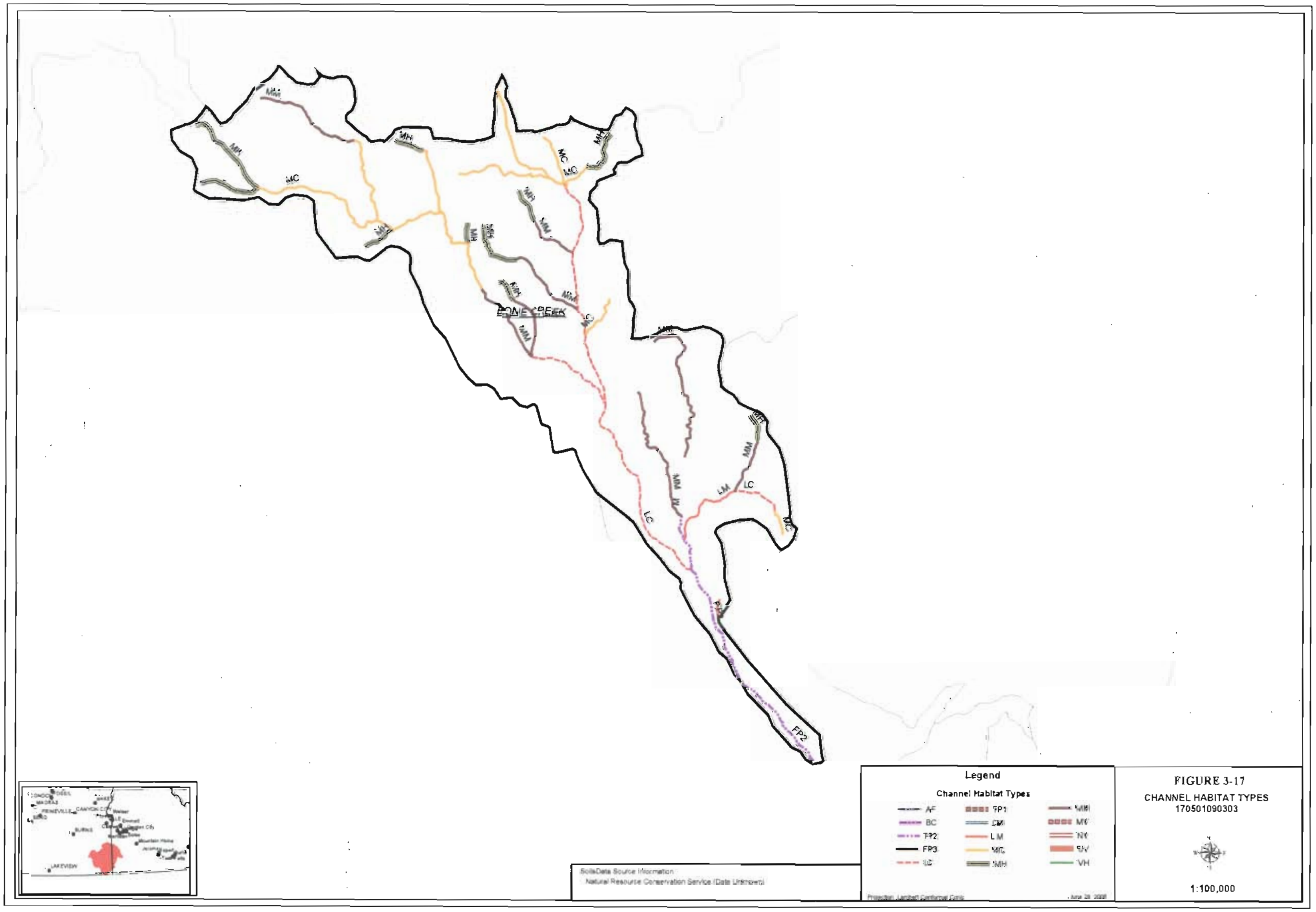


FIGURE 3-17
CHANNEL HABITAT TYPES
170501090303
1:100,000
Legend
Channel Habitat Types
AF
BC
FP2
FP3
FP1
LM
MC
MH
MM
VH
SoilsData Source Information:
Natural Resource Conservation Service (Date Unknown)
BONE CREEK
MC
MH
MM
LC
LM
FP2
LAKEVIEW
BURNS
PRINEVILLE
MADRAS
CANYON CITY

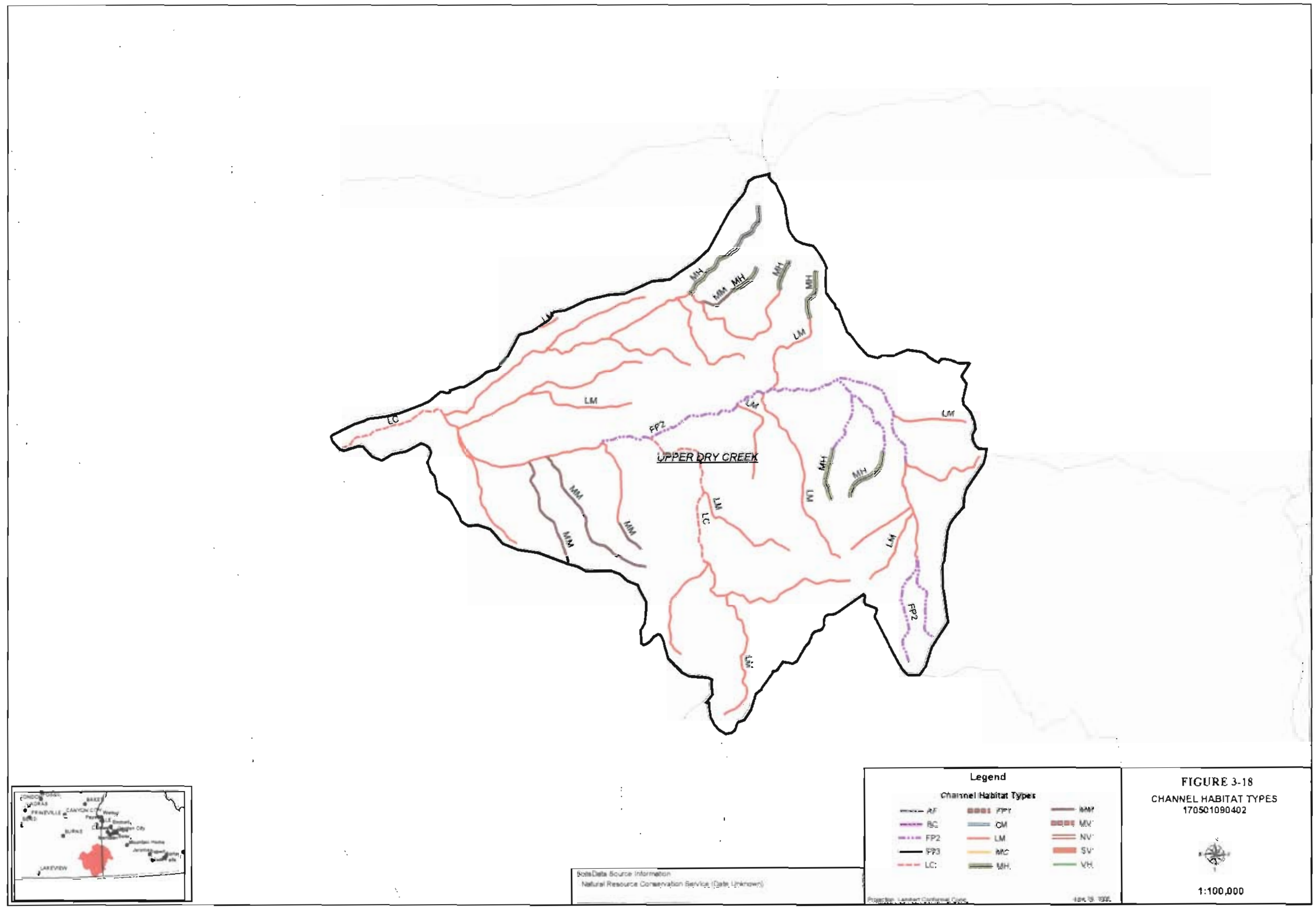


FIGURE 3-18

CHANNEL HABITAT TYPES

170501090402

1:100,000

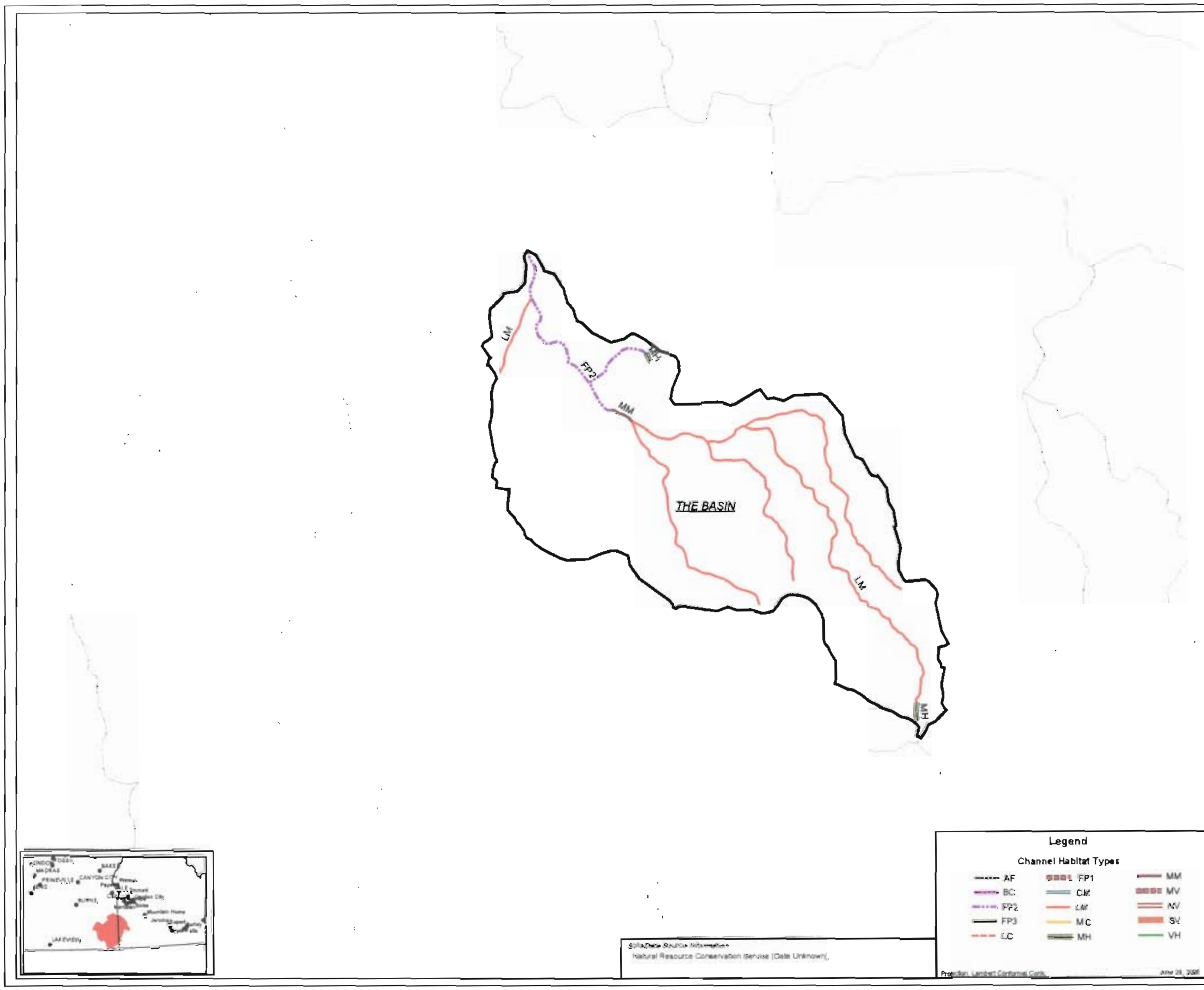


FIGURE 3-19
CHANNEL HABITAT TYPES
170501060406

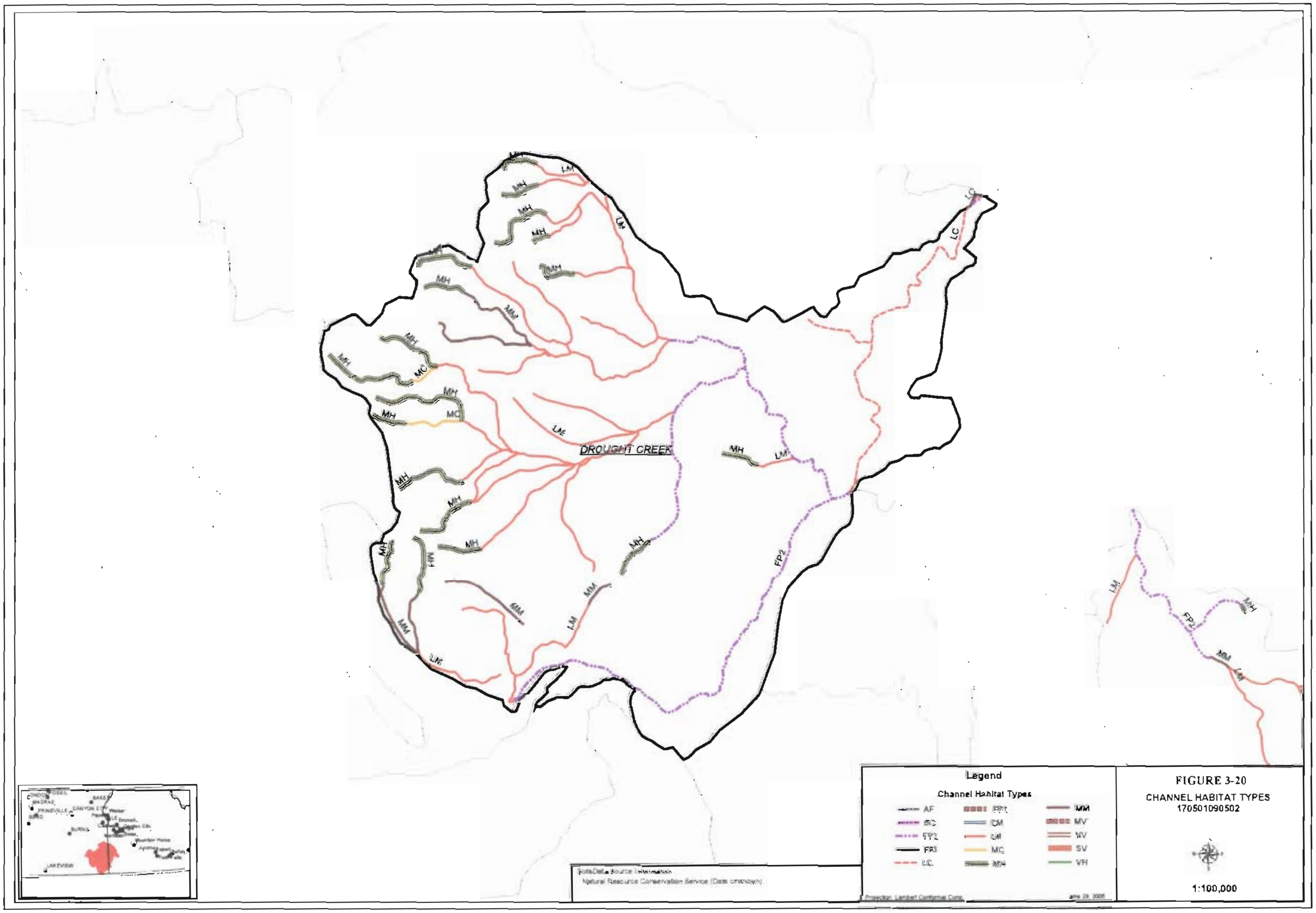


FIGURE 3-20
CHANNEL HABITAT TYPES
170501090502

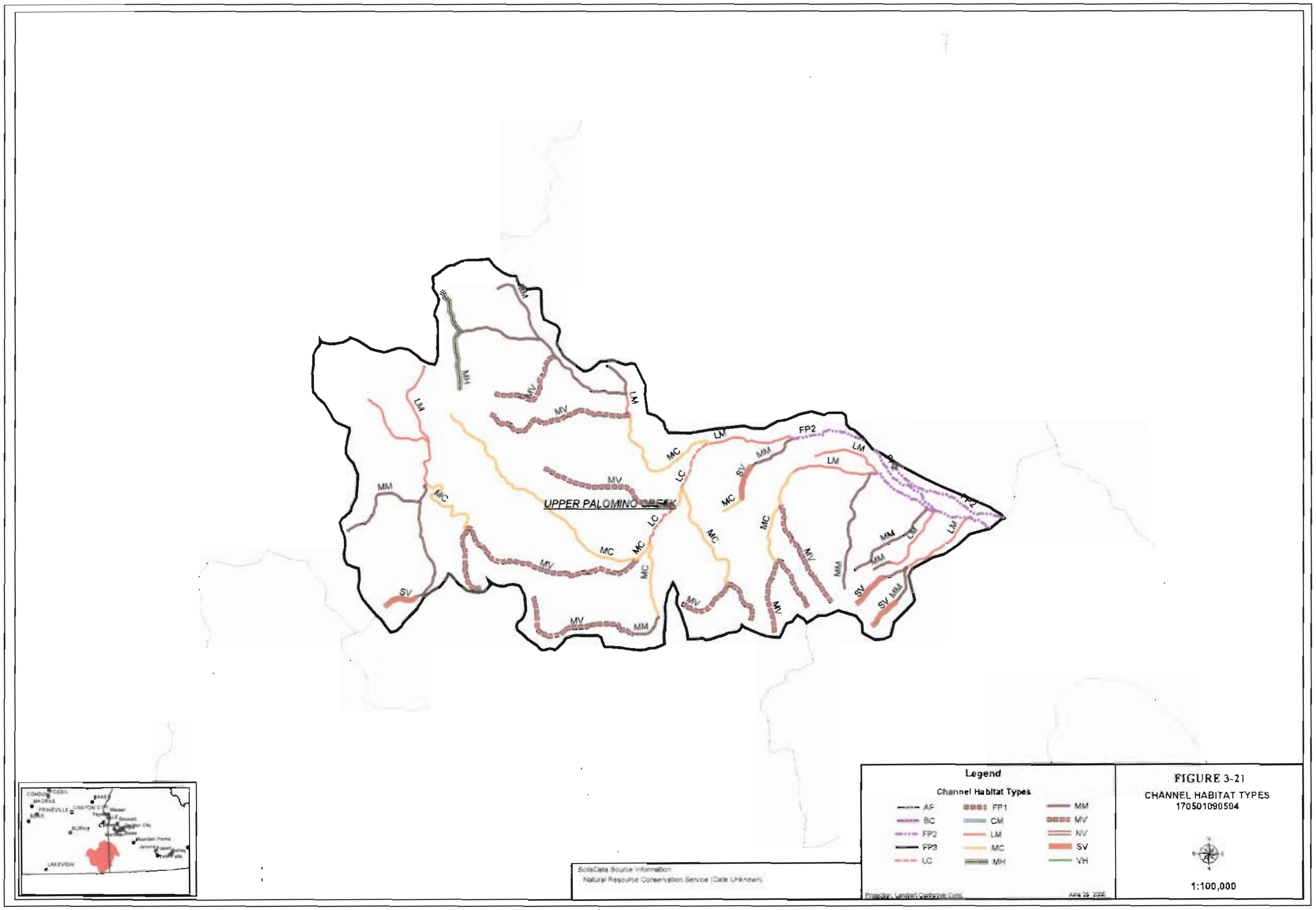


FIGURE 3-21
CHANNEL HABITAT TYPES
170501090504
1:100,000
Legend
Channel Habitat Types
AF
BC
FP2
FP3
LC
FP1
CM
LM
MC
MH
MM
MV
NV
SV
VH
UPPER PALOMINO CREEK
SoilsData Source Information
Natural Resource Conservation Service (Date Unknown)
LAKEVIEW
BURNS
PRINEVILLE

COMPONENT 4—HYDROLOGY

The hydrology component of the watershed assessment is directed at assessing the potential for land use practices to affect peak and low flows of surface water. Such changes to flows could promote flooding under certain conditions, or reduced supply under others. This analysis was conducted largely according to the methodology described in the Oregon Watershed Assessment Manual (OWAM; WPN 2001). It makes some simplifying assumptions and aggregates data that a more sophisticated analysis might keep separated, in order to screen a large watershed area for *potential* problems. Data for this component included: precipitation, topography, land use and land cover, stream reaches, surface water peak flows, and the like.

General Watershed Characteristics

Selected general information about the study area is presented on Form H–1. For each of the 105 subwatersheds, the information includes the area, minimum, maximum and mean elevation and mean annual precipitation. The elevation data were obtained using Digital Elevation Model (DEM) data from the US Geological Survey (USGS). The mean annual precipitation was estimated using the PRISM model, developed at Oregon State University (Daly, *et al.*, 1994), combined with data from the Interior Columbia Basin Ecosystem Management Project (ICBEMP). Figure 4–1 shows annual precipitation superimposed on a shaded relief map.

The study area consists of three fourth–field hydrologic units located in the Snake River Basin/High Desert ecoregion. It straddles the Oregon–Idaho border, incorporating most of Malheur County and asubstantial portion of Owyhee County. A few square miles of Humboldt County, Nevada are also included in the study area. Deep stream canyons cut through broad undulating plateaus. Streams flow generally towards the north, eventually joining the Snake River. The study area is in Oregon Climate Division 9, with temperature extremes and limited rainfall, except in the higher elevations to the east.

Land Use Summary

Form H–2 presents the land use summary. The data were obtained from a USGS land use/land cover dataset derived from aerial photographs taken in the 1970s and 1980s. For purposes of this summary, the 20 land uses found in the USGS data were consolidated into four categories as shown in Table 1 below. Land use is also presented on Figure 1E of component 1.

Table 1. Consolidated Land Use Categories

Forestry	Agriculture	Urban	Other
Evergreen forestland	Cropland and pasture	Commercial services	Bare exposed rock
Forested wetlands	Herbaceous rangeland	industrial	Dry salt flats
—	Mixed rangeland	Mixed urban or built–up land	Lakes
—	Other agricultural land	Other urban or built–up land	Non–forested wetlands
—	Shrub and brush rangeland	Residential	Reservoirs
—	—	Transportation, communications	Sandy areas other than beaches
—	—	—	Strip mines, quarries and gravel pits

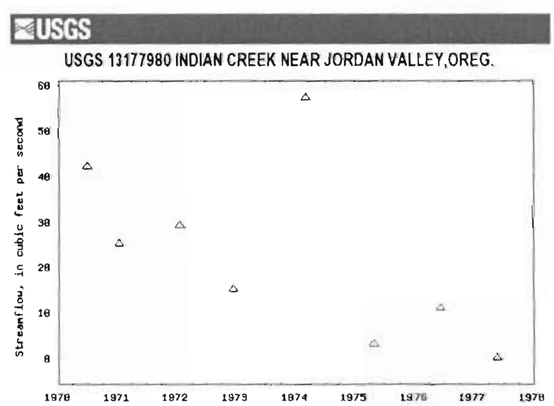
Peak Flow Character

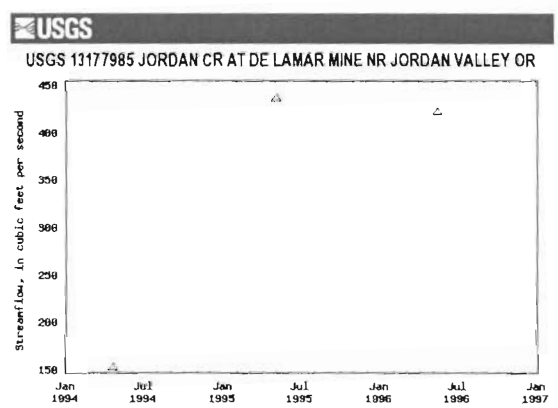
The entire study area lies within the Snake River Basin/High Desert ecoregion, as described in Appendix A of the Oregon Watershed Assessment Manual (WPN 1999). According to that document, peak flows in the Owyhee area of this ecoregion can be generated in any season. Snowmelt and rainfall can generate spring peak flows, and summer thunderstorms produce more peak flows in the Owyhee area than in any other eastern Oregon ecoregion.

The US Geological Survey's National Water Information System (NWIS) was queried to obtain information on stream gauges in the study area. NWIS contained records on 42 gauges, which are displayed on Figure 4–2. Peak flow data were available for only seven of those gauges, as shown in Table 2. These data are displayed on Form H–3A. Annual peak flows for the six gauges having more than one measurement are plotted in Figure 1. Because of natural variation from year to year, data series with fewer than ten years' data are not considered representative. Only gauges 13181000 and 13178000 (on the Owyhee River near Rome and Jordan Creek above Lone Tree Creek) have more than ten years of data.

Table 2. USGS Stream Gauges Having Peak Flow Data

No.	Name	Lat./Long.	Elev.	HUC	Drainage	Period	Yrs
13177915	Cottonwood Cr nr Fairylawn ID	42°33'17"N 116°58'21"W	4900	17050107	12.93	1981/05/30	1
13177980	Indian Cr nr Jordan Valley OR	42°39'25"N 117°12'10"W	—	17050107	3.99	1970/06/30 – 1977/00/00	7
13181000	Owyhee River nr Rome OR	42°51'59"N 117°38'57"W	3344	17050107	8000	1950/04/01 – 2004/03/20	55
13177985	Indian Cr at DeLamar Mine nr Jordan Valley OR	43°01'26"N 116°51'16"W	—	17050108	—	1994/04/19 – 1996/05/14	3
13178000	Jordan Cr above Lone Tree Cr nr Jordan Valley OR	42°54'45"N 116°59'40"	4450	17050108	440	1946/04/19 – 2004/03/24	26
13181300	Crooked Cr nr Burns Jct OR	42°24'09"N 117°51'27"W	—	17050109	46.2	1973/04/12 – 1977/00/00	4
13181400	Crooked Cr Tributary at Burns Jct OR	42°45'48"N 117°51'15"W	—	17050109	4.83	1973/05/10 – 1977/00/00	4





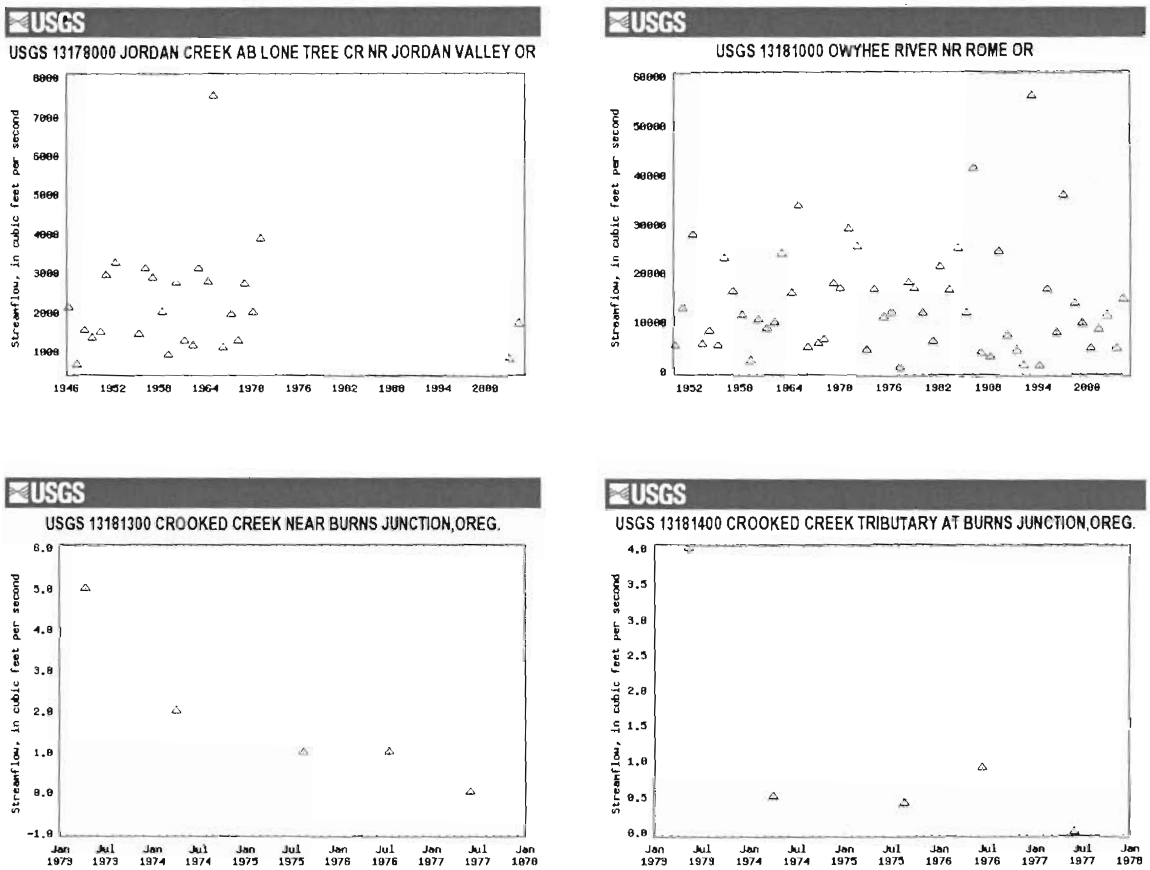


Figure 1. Peak Flows for Six Stream Gauges

Table 3. USGS Stream Gauges Having Peak Flow Data

No.	Name	Lat./Long.	Elev.	HUC	Area (mi^2)	Period	Yrs
13177915	Cottonwood Cr nr Fairylawn ID	42°33'17"N 116°58'21"W	4900	17050107	12.93	1981/05/30 (one date)	1
13177980	Indian Cr nr Jordan Valley OR	42°39'25"N 117°12'10"W	—	17050107	3.99	1970/06/30 – 1977/00/00	7
13181000	Owyhee River nr Rome OR	42°51'59"N 117°38'57"W	3344	17050107	8000	1950/04/01 – 2004/03/20	55
13177985	Indian Cr at DeLamar Mine nr Jordan Valley OR	43°01'26"N 116°51'16"W	—	17050108	—	1994/04/19 – 1996/05/14	3
13178000	Jordan Cr above Lone Tree Cr nr Jordan Valley OR	42°54'45"N 116°59'40"	4450	17050108	440	1946/04/19 – 2004/03/24	26
13181300	Crooked Cr nr Burns Jct OR	42°24'09"N 117°51'27"W	—	17050109	46.2	1973/04/12 – 1977/00/00	4
13181400	Crooked Cr Tributary at Burns Jct OR	42°45'48"N 117°51'15"W	—	17050109	4.83	1973/05/10 – 1977/00/00	4

The number of annual peak flows that occur in different calendar months is displayed in Table 3. It should be noted that flows at the gauge on the Owyhee River near Rome are more reflective of upstream conditions than of runoff within the study area. The observation that nearly equal number of peak flows occurred in March and April at this gauge is probably due to upstream regulation or diversion. If one excludes the Owyhee gauge, over half of the peak flows (58%) occurred in April, May and June, and can be attributed to snowmelt. A smaller proportion (36%) occurred in December through March, corresponding to winter storms and rain on snow events. The three peaks observed in July and August can be presumed to be caused by summer thunderstorms.

Table 4. Monthly Count of Peak Flows

Gauge	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
13177915	—	—	—	—	1?	—	—	—	—	—	—	—	1?
13177980	2	0	1	1	0	2	0	0	0	0	0	1	7
13177985	0	0	0	1	2	0	0	0	0	0	0	0	3
13178000	4	4	3	12	2	0	0	0	0	0	0	1	26
13181000	6	9	17	16	4	2	0	0	0	0	0	1	55
13181300	0	0	0	2	0	0	1	1	0	0	0	0	4
13181400	0	0	0	1	1	1	0	1	0	0	0	0	4
Total	12	13	21	33	10	5	1	2	0	0	0	2	100

One might expect that snowmelt and rain on snow events would play a larger role at higher elevations, and spring rains to be the dominant precipitation process at lower elevations. However, there is insufficient data available within the ecosystem to instill confidence in any regional conclusions (WPN 2001).

Hydrologic Condition Assessment

The hydrologic condition assessment is a simple screening process used to identify land use activities with the *potential* to impact the watershed. Activities that pass the screen may or may not, in reality, have an adverse watershed impact. Worksheets H–4 through H–7 were developed to examine the following land uses:

- Forestry;
- Agriculture and rangelands;
- Forest and rural roads; and
- Urban and/or rural residential development.

Forestry

The screening process looks first at forest condition. Most of the forested portions of the study area are in the eastern subwatersheds, particularly in Idaho. These are primarily juniper stands, not generally considered prime timber. However, they are subject to fire. The historic crown closure for the Snake River Basin/High Desert ecoregion is less than 30% (WPN 2001). The current crown closure is also less than 30%.

Since there is no significant timber harvesting activity, there are no watershed risks associated with logging activities. Loss of timber stands due to fire could result in similar problems, but the fire analysis is outside the scope of this study.

Agriculture and Rangeland

The agriculture and rangeland assessment was performed on the entire study area, since this land use predominates in most of the subwatersheds. Form H–5 shows the total area for each subwatershed, and the areas (and percentages) assigned by the Natural Resource and Conservation Service (NRCS) to hydrologic groups A, B, C and D. The data set is at a lower spatial resolution than is commonly used for this purpose.

Form H–5A derives estimates of the runoff from the hydrologic soil groups, using the NRCS Curve Number (CN) method (NRCS 1986). The land cover type was derived from the same USGS land use/land cover data set that was used to prepare Form H–2. The annual rainfall depth for each subwatershed was obtained from the PRISM model. Runoff was calculated using the following equation:

$$Q = \frac{\left[P - 0.2 \times \left(\frac{1000}{CN}\right) - 10\right]^2}{P + 0.8 \times \left(\frac{1000}{CN} - 10\right)}$$

where Q = runoff (in)
P = precipitation (in)
CN = Curve Number

Key information needed to assign the correct curve number is the condition of the soil cover. A satisfactory data set describing the soil cover condition across the entire study area was not available. For purposes of this screening analysis, the current condition in each subwatershed was assumed to be "fair" (50–75% ground cover, not heavily grazed). Similarly, the historic condition was taken to be "good" (greater than 75% cover, only lightly or occasionally grazed). These may not be the correct values for all subwatersheds. However, use of these values allowed estimation of runoff with subwatershed–specific values of precipitation and soil cover type. The calculated difference in runoff between the assumed historical and current conditions provides a figure of merit to describe the potential for hydrologic problems from changes in soil and vegetation caused by grazing, planting, fire and other processes. The reader should not infer from the numbers obtained that a hydrologic problem actually exists; the OWAM assessment is intended only to indicate the relative potential for problems.

Roads

Form H–6 displays the lengths of roadways of various classes, in feet. The road areas are calculated assuming that primary roads have a width of 50 feet, rural roads have a width of 35 feet and forest/range roads have a width of 25 feet. The highest proportion of area covered by roads is 1.3%, in the Lower Middle Owyhee and Jordan Headwaters subwatersheds. Since this is well below the 4% cutoff specified in OWAM, the potential risk of flow enhancement due to roads is low.

Urban and Residential Development

The study area has very little urban development. Nearly all development is within the community of Jordan Valley, located in the Baxter Creek subwatershed. The percent urban land use value from Form H–2 was copied to Form H–7. Although there is a commercial strip along US–95, the dominant type of land use in the community is single–family residences. Assuming an average of eight homes per acre within the town of Jordan Valley, the impervious area is 65% (NRCS 1986). For other "urban" areas, four homes per acre were assumed, yielding an impervious area of 38%. The potential risk of peak flow enhancement from urban or residential development is obtained from a table in OWAB. Since far less than 5% of each subwatershed is impervious urban surface, the hydrologic risk is low. The calculations are summarized on Form H–7.

Potential Hydrologic Risk from Land Use

The relative potential hydrologic risks in each subwatershed are summarized on Form H–8 and Map H–1. The risks for all land use options considered are low, except for the rangeland/agriculture use. Most subwatersheds rank as "high risk" for this use, but this result depends strongly on the assumptions made about cover condition. The results should be used to predict which subwatersheds would be more sensitive to land use practices, not to claim that existing practices are causing a problem.

References

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Form H-1: General Watershed Characteristics

Subwatershed Number	Name	Area (ac)	Mean Elevation (ft)	Minimum Elevation (ft)	Maximum Elevation (ft)	Mean Annual Precipitation (ft)
	Middle Owyhee—17050107					
170501070101	Upper Toppin Creek	32414	5583	5263	6076	11.9
170501070102	Mustang Lake	15621	5321	5105	5585	11.6
170501070103	Lower Toppin Creek	27683	5226	4160	5442	10.7
170501070104	Jack Creek	22952	6129	5577	6458	17.9
170501070105	Headwaters West Little Owyhee River	25808	6216	5567	6682	20.2
170501070106	Upper West Little Owyhee River	31490	5820	5076	6489	13.5
170501070107	Middle West Little Owyhee River	34464	5195	4157	5585	10.5
170501070108	Lower West Little Owyhee River	7851	4830	4017	5307	10.7
170501070201	Upper Pole Creek	25783	5696	5106	6387	13.9
170501070202	Field Creek	16965	5625	5034	6460	15.0
170501070203	Lower Pole Creek	34260	5253	4839	5889	12.6
170501070204	Upper Antelope Creek	35414	6093	5605	6650	19.3
170501070205	Middle Antelope Creek	32010	5366	4597	6058	13.3
170501070206	Upper Little Antelope Creek	22572	5349	5011	5816	11.9
170501070207	Lower Little Antelope Creek	33196	5125	4609	5511	12.4
170501070208	Lower Antelope Creek	19607	4912	3996	5167	12.0
170501070301	Upper Middle Fork Owyhee River	36171	5496	4622	6808	12.0
170501070302	Pole Creek	21322	5139	4175	6303	11.6
170501070303	Lower Middle Fork Owyhee River	13252	4774	3962	5102	10.8
170501070401	Pleasant Valley Creek	17281	5612	4935	6538	14.6
170501070402	Juniper Creek	24809	5888	4839	7804	20.9
170501070403	Upper North Fork Owyhee River	26887	5667	4415	6785	16.9
170501070404	Squaw Creek	30663	5531	4413	6804	13.4
170501070405	Cherry Creek	30488	5083	4203	6721	12.6
170501070406	Lower North Fork Owyhee River	11457	4747	3956	5782	12.2
170501070501	Owyhee River - Dukes Creek	23632	5192	4177	6135	10.2
170501070502	Oregon Lake Creek	10552	5275	4177	5427	11.5
170501070503	Owyhee River - Bull Creek	28515	4997	4016	5543	10.4
170501070504	Owyhee River - Warm Spring Canyon	22205	4778	3942	5091	11.9
170501070601	Upper Soldier Creek	39213	5110	4542	7152	15.6
170501070602	Mud Flat Creek	29855	4784	4536	5285	13.4
170501070603	Willow Creek	16016	4933	4423	5983	15.9
170501070604	Spring Creek	19898	4719	4360	6053	14.7
170501070605	Lower Soldier Creek	10515	4589	3612	4970	13.2
170501070701	Whitehorse Creek	31614	4755	3843	5414	13.6
170501070702	Skull Creek	29377	4636	3610	5414	13.2
170501070703	Sand Hollow	24633	4254	3409	4758	11.3
170501070704	China Gulch	24694	3766	3382	4131	8.5
170501070705	Lower Middle Owyhee River	17308	3637	3343	3978	8.6
	Jordan—17050108					
170501080101	Sheep Creek	15433	5912	5535	6536	18.6
170501080102	Upper Rock Creek	29527	5652	5002	6579	14.3
170501080103	Meadow Creek	22838	5611	5024	8067	21.1
170501080104	Josephine Creek	21543	5808	5002	6607	16.6
170501080105	Lower Rock Creek	14396	5705	4845	6859	17.8
170501080201	Upper North Boulder Creek	22346	6201	4843	8402	28.1
170501080202	Lower North Boulder Creek	9742	5657	4571	6861	19.0
170501080203	Upper South Boulder Creek	12227	6306	5082	7770	25.5
170501080204	Lower South Boulder Creek	13194	6094	4726	6843	22.5
170501080205	Big Boulder Creek	28056	5391	4576	7773	18.2
170501080301	Jordan Creek Headwaters	33343	6248	4755	8022	27.0
170501080302	Louse Creek	13741	5937	4760	7923	24.3
170501080303	Jordan Creek-Flint Creek	26411	5470	4564	7919	20.5
170501080401	Williams Creek	11944	5735	4519	7793	21.9
170501080402	Lone Tree Creek	27053	5222	4456	7361	17.9
170501080403	Trout Creek	18059	5135	4403	5937	17.5
170501080404	Rail Creek	28127	4955	4401	7376	15.6

Form H-1: General Watershed Characteristics

Subwatershed Number	Name	Area (ac)	Mean Elevation (ft)	Minimum Elevation (ft)	Maximum Elevation (ft)	Mean Annual Precipitation (ft)
170501080501	Baxter Creek	16923	4646	4323	6127	14.0
170501080502	Hooker Creek	24120	4609	4315	6119	13.5
170501080503	Sheep Spring Creek	22869	4614	4323	6114	13.5
170501080504	Jack Creek	36099	4635	4234	6088	13.6
170501080505	Downey Creek	33620	4413	4215	4924	12.7
170501080601	Jackson Creek	34435	5567	4685	7412	21.0
170501080602	Posey Creek	22296	4723	4421	6099	14.4
170501080603	Spring Branch	14308	4839	4423	5990	15.1
170501080604	Mahogany Creek	30842	4946	4349	6500	15.5
170501080605	Lower Upper Cow Creek	16756	4589	4349	4911	13.4
170501080701	Cove Creek	40493	4721	4342	6434	14.2
170501080702	Jordan Craters	31121	4447	4308	4877	12.9
170501080703	Mouth Of Cow Creek	39045	4386	4216	4871	12.7
170501080801	Jordan Creek/Rock Creek Reservoir	17351	4326	4035	4730	12.3
170501080802	Rock Creek	21717	4450	4049	4817	13.1
170501080803	Jordan Creek/Merrill Springs	37622	4072	3579	4638	11.0
170501080804	Dry Creek	36062	4179	3622	4844	11.4
170501080805	Boney Canyon	10638	3819	3361	4229	9.5
	Crooked–Rattlesnake—17050109					
170501090101	Bowden Hills	24229	4906	4491	5945	9.8
170501090102	Black Hills	33936	4254	3871	5450	8.8
170501090103	Headwaters Crooked Creek	42231	5044	4355	7408	10.3
170501090104	Three Man Butte Well	49461	4737	4137	7414	9.4
170501090105	Middle Upper Crooked Creek	30302	4256	3979	5074	8.3
170501090106	Lower Upper Crooked Creek	27108	4069	3850	4579	9.1
170501090201	Upper Rattlesnake Creek	35584	5657	5036	6513	13.1
170501090202	Middle Rattlesnake Creek	19734	4930	4014	5563	9.3
170501090203	Bull Creek	36918	4564	3958	5335	9.9
170501090204	Tree Springs	11939	4601	4035	5227	8.8
170501090205	Battle Creek	31715	4868	4015	6399	9.5
170501090206	Red Hills	18424	4090	3811	5088	8.5
170501090207	Lower Rattlesnake Creek	35349	4110	3769	5158	8.5
170501090301	Grassy Ridge	13803	4459	4035	5134	14.6
170501090302	Upper Wildcat Creek	28175	4822	4038	6128	18.3
170501090303	Bone Creek	21787	4822	3933	6014	17.8
170501090304	Lower Wildcat Creek	30549	4146	3867	4808	11.3
170501090401	Peacock Creek	25974	4894	4490	5136	12.9
170501090402	Upper Dry Creek	29329	4853	4490	5407	13.9
170501090403	Middle Dry Creek	31080	4430	3979	5413	11.3
170501090404	Indian Fort Creek	30306	4323	3768	5405	11.3
170501090405	Corbin Creek	22618	4357	3981	5307	11.4
170501090406	The Basin	14971	3973	3737	4637	8.5
170501090407	Lower Dry Creek	37011	3894	3574	4505	8.8
170501090501	The Basin South	11245	3936	3770	4383	8.3
170501090502	Drought Creek	40199	3987	3567	4653	9.9
170501090503	Palomino Lake	29800	4421	4036	5346	14.3
170501090504	Upper Palomino Creek	26211	5021	4037	5998	20.1
170501090505	Scott Butte Creek	16456	3996	3725	4257	11.3
170501090506	Lower Palomino Creek	24771	4169	3578	5268	12.0
170501090507	Moth [*sic*] of Crooked Creek	19037	3750	3342	4007	9.9

Form H-2: Land Use Summary

Subwatershed		Area	Forest		Agriculture or Rangeland		Urban		Other	
Number	Name	(ac)	(ac)	(%)		(%)		(%)		(%)
	Middle Owyhee—17050107									
170501070101	Upper Toppin Creek	32414	0	0.0%	32261	99.5%	0	0.0%	152.4	0.5%
170501070102	Mustang Lake	15621	0	0.0%	15525	99.4%	0	0.0%	95.3	0.6%
170501070103	Lower Toppin Creek	27683	0	0.0%	27052	97.7%	0	0.0%	631.4	2.3%
170501070104	Jack Creek	22952	0	0.0%	22841	99.5%	0	0.0%	111.1	0.5%
170501070105	Headwaters West Little Owyhee River	25808	0	0.0%	25449	98.6%	0	0.0%	358.7	1.4%
170501070106	Upper West Little Owyhee River	31490	0	0.0%	29775	94.6%	0	0.0%	1714.9	5.4%
170501070107	Middle West Little Owyhee River	34464	0	0.0%	32360	93.9%	0	0.0%	2103.9	6.1%
170501070108	Lower West Little Owyhee River	7851	0	0.0%	7214	91.9%	0	0.0%	636.4	8.1%
170501070201	Upper Pole Creek	25783	0	0.0%	25318	98.2%	0	0.0%	465.5	1.8%
170501070202	Field Creek	16965	0	0.0%	16812	99.1%	0	0.0%	152.7	0.9%
170501070203	Lower Pole Creek	34260	0	0.0%	34260	100.0%	0	0.0%	0.0	0.0%
170501070204	Upper Antelope Creek	35414	0	0.0%	35134	99.2%	0	0.0%	280.2	0.8%
170501070205	Middle Antelope Creek	32010	0	0.0%	31987	99.9%	0	0.0%	22.3	0.1%
170501070206	Upper Little Antelope Creek	22572	0	0.0%	22495	99.7%	0	0.0%	77.0	0.3%
170501070207	Lower Little Antelope Creek	33196	0	0.0%	33196	100.0%	0	0.0%	0.0	0.0%
170501070208	Lower Antelope Creek	19607	0	0.0%	18136	92.5%	0	0.0%	1471.2	7.5%
170501070301	Upper Middle Fork Owyhee River	36171	17646	48.8%	18326	50.7%	0	0.0%	199.1	0.6%
170501070302	Pole Creek	21322	10374	48.7%	10755	50.4%	0	0.0%	193.6	0.9%
170501070303	Lower Middle Fork Owyhee River	13252	242	1.8%	12211	92.1%	0	0.0%	799.8	6.0%
170501070401	Pleasant Valley Creek	17281	8581	49.7%	8454	48.9%	0	0.0%	245.3	1.4%
170501070402	Juniper Creek	24809	14517	58.5%	9983	40.2%	0	0.0%	309.1	1.2%
170501070403	Upper North Fork Owyhee River	26887	17820	66.3%	8770	32.6%	0	0.0%	296.7	1.1%
170501070404	Squaw Creek	30663	22278	72.7%	7560	24.7%	0	0.0%	824.4	2.7%
170501070405	Cherry Creek	30488	3284	10.8%	26437	86.7%	0	0.0%	766.7	2.5%
170501070406	Lower North Fork Owyhee River	11457	1526	13.3%	9713	84.8%	0	0.0%	216.9	1.9%
170501070501	Owyhee River - Dukes Creek	23632	1379	5.8%	19336	81.8%	0	0.0%	2916.7	12.3%
170501070502	Oregon Lake Creek	10552	0	0.0%	10330	97.9%	0	0.0%	222.5	2.1%
170501070503	Owyhee River - Bull Creek	28515	106	0.4%	25342	88.9%	0	0.0%	3067.2	10.8%
170501070504	Owyhee River - Warm Spring Canyon	22205	0	0.0%	20467	92.2%	0	0.0%	1738.4	7.8%
170501070601	Upper Soldier Creek	39213	118	0.3%	38151	97.3%	0	0.0%	943.8	2.4%
170501070602	Mud Flat Creek	29855	527	1.8%	27964	93.7%	0	0.0%	1363.6	4.6%
170501070603	Willow Creek	16016	0	0.0%	15741	98.3%	0	0.0%	274.5	1.7%
170501070604	Spring Creek	19898	0	0.0%	19616	98.6%	0	0.0%	282.3	1.4%
170501070605	Lower Soldier Creek	10515	0	0.0%	10071	95.8%	0	0.0%	443.9	4.2%
170501070701	Whitehorse Creek	31614	82	0.3%	30358	96.0%	0	0.0%	1174.3	3.7%
170501070702	Skull Creek	29377	0	0.0%	26974	91.8%	0	0.0%	2402.9	8.2%
170501070703	Sand Hollow	24633	0	0.0%	22813	92.6%	0	0.0%	1819.6	7.4%
170501070704	China Gulch	24694	0	0.0%	24636	99.8%	0	0.0%	57.8	0.2%
170501070705	Lower Middle Owyhee River	17308	0	0.0%	17229	99.5%	0	0.0%	78.5	0.5%
	Jordan—17050108									
170501080101	Sheep Creek	15433	4915	31.8%	10518	68.2%	0	0.0%	0.0	0.0%
170501080102	Upper Rock Creek	29527	11632	39.4%	17330	58.7%	0	0.0%	565.9	1.9%
170501080103	Meadow Creek	22838	5559	24.3%	17120	75.0%	0	0.0%	157.9	0.7%
170501080104	Josephine Creek	21543	18315	85.0%	3065	14.2%	0	0.0%	162.8	0.8%
170501080105	Lower Rock Creek	14396	9791	68.0%	4508	31.3%	0	0.0%	97.5	0.7%
170501080201	Upper North Boulder Creek	22346	13049	58.4%	9105	40.7%	0	0.0%	193.0	0.9%
170501080202	Lower North Boulder Creek	9742	5717	58.7%	4022	41.3%	0	0.0%	3.3	0.0%
170501080203	Upper South Boulder Creek	12227	8352	68.3%	3875	31.7%	0	0.0%	0.0	0.0%
170501080204	Lower South Boulder Creek	13194	11114	84.2%	2080	15.8%	0	0.0%	0.0	0.0%
170501080205	Big Boulder Creek	28056	4877	17.4%	22670	80.8%	0	0.0%	509.8	1.8%
170501080301	Jordan Creek Headwaters	33343	23706	71.1%	8522	25.6%	44	0.1%	1071.5	3.2%
170501080302	Louse Creek	13741	7641	55.6%	5853	42.6%	64	0.5%	183.6	1.3%
170501080303	Jordan Creek-Flint Creek	26411	12516	47.4%	13528	51.2%	0	0.0%	366.9	1.4%
170501080401	Williams Creek	11944	878	7.4%	10822	90.6%	0	0.0%	243.3	2.0%
170501080402	Lone Tree Creek	27053	184	0.7%	26605	98.3%	0	0.0%	264.6	1.0%
170501080403	Trout Creek	18059	3308	18.3%	14741	81.6%	0	0.0%	10.1	0.1%
170501080404	Rail Creek	28127	195	0.7%	25679	91.3%	0	0.0%	2253.7	8.0%
170501080501	Baxter Creek	16923	400	2.4%	11550	68.3%	292	1.7%	4680.3	27.7%
170501080502	Hooker Creek	24120	0	0.0%	23905	99.1%	0	0.0%	214.4	0.9%
170501080503	Sheep Spring Creek	22869	21	0.1%	21517	94.1%	0	0.0%	1331.1	5.8%
170501080504	Jack Creek	36099	0	0.0%	32258	89.4%	0	0.0%	3840.9	10.6%
170501080505	Downey Creek	33620	0	0.0%	29940	89.1%	0	0.0%	3679.8	10.9%
170501080601	Jackson Creek	34435	9582	27.8%	24776	72.0%	0	0.0%	76.5	0.2%
170501080602	Posey Creek	22296	0	0.0%	22222	99.7%	0	0.0%	73.8	0.3%
170501080603	Spring Branch	14308	0	0.0%	14308	100.0%	0	0.0%	0.0	0.0%
170501080604	Mahogany Creek	30842	4033	13.1%	26810	86.9%	0	0.0%	0.0	0.0%
170501080605	Lower Upper Cow Creek	16756	0	0.0%	16756	100.0%	0	0.0%	0.0	0.0%
170501080701	Cove Creek	40493	382	0.9%	35161	86.8%	0	0.0%	4950.3	12.2%
170501080702	Jordan Craters	31121	0	0.0%	18447	59.3%	0	0.0%	12674.5	40.7%
170501080703	Mouth Of Cow Creek	39045	0	0.0%	37101	95.0%	0	0.0%	1944.1	5.0%

Form H-2: Land Use Summary

Subwatershed		Area	Forest		Agriculture or Rangeland		Urban		Other	
170501080801	Jordan Creek/Rock Creek Reservoir	17351	0	0.0%	17351	100.0%	0	0.0%	0.0	0.0%
170501080802	Rock Creek	21717	0	0.0%	21398	98.5%	0	0.0%	318.6	1.5%
170501080803	Jordan Creek/Merrill Springs	37622	0	0.0%	36990	98.3%	36	0.1%	595.1	1.6%
170501080804	Dry Creek	36062	0	0.0%	36026	99.9%	0	0.0%	35.5	0.1%
170501080805	Boney Canyon	10638	0	0.0%	10621	99.8%	0	0.0%	17.2	0.2%
	Crooked–Rattlesnake—17050109									
170501090101	Bowden Hills	24229	0	0.0%	23729	97.9%	0	0.0%	499.6	2.1%
170501090102	Black Hills	33936	0	0.0%	32847	96.8%	180	0.5%	909.4	2.7%
170501090103	Headwaters Crooked Creek	42231	0	0.0%	41946	99.3%	0	0.0%	285.4	0.7%
170501090104	Three Man Butte Well	49461	0	0.0%	46583	94.2%	0	0.0%	2877.5	5.8%
170501090105	Middle Upper Crooked Creek	30302	0	0.0%	28762	94.9%	0	0.0%	1539.8	5.1%
170501090106	Lower Upper Crooked Creek	27108	0	0.0%	25677	94.7%	0	0.0%	1431.4	5.3%
170501090201	Upper Rattlesnake Creek	35584	0	0.0%	35584	100.0%	0	0.0%	0.0	0.0%
170501090202	Middle Rattlesnake Creek	19734	0	0.0%	19300	97.8%	0	0.0%	433.5	2.2%
170501090203	Bull Creek	36918	0	0.0%	35794	97.0%	0	0.0%	1123.9	3.0%
170501090204	Tree Springs	11939	0	0.0%	11684	97.9%	0	0.0%	255.6	2.1%
170501090205	Battle Creek	31715	0	0.0%	31281	98.6%	0	0.0%	434.2	1.4%
170501090206	Red Hills	18424	0	0.0%	18358	99.6%	0	0.0%	65.8	0.4%
170501090207	Lower Rattlesnake Creek	35349	0	0.0%	34457	97.5%	0	0.0%	892.4	2.5%
170501090301	Grassy Ridge	13803	0	0.0%	13738	99.5%	0	0.0%	65.6	0.5%
170501090302	Upper Wildcat Creek	28175	0	0.0%	28175	100.0%	0	0.0%	0.0	0.0%
170501090303	Bone Creek	21787	0	0.0%	21787	100.0%	0	0.0%	0.0	0.0%
170501090304	Lower Wildcat Creek	30549	0	0.0%	30328	99.3%	0	0.0%	221.3	0.7%
170501090401	Peacock Creek	25974	0	0.0%	25974	100.0%	0	0.0%	0.0	0.0%
170501090402	Upper Dry Creek	29329	0	0.0%	29318	100.0%	0	0.0%	10.4	0.0%
170501090403	Middle Dry Creek	31080	0	0.0%	31062	99.9%	0	0.0%	18.0	0.1%
170501090404	Indian Fort Creek	30306	0	0.0%	30211	99.7%	0	0.0%	95.4	0.3%
170501090405	Corbin Creek	22618	0	0.0%	22618	100.0%	0	0.0%	0.0	0.0%
170501090406	The Basin	14971	0	0.0%	14939	99.8%	0	0.0%	32.1	0.2%
170501090407	Lower Dry Creek	37011	0	0.0%	36130	97.6%	0	0.0%	880.7	2.4%
170501090501	The Basin South	11245	0	0.0%	11165	99.3%	0	0.0%	80.1	0.7%
170501090502	Drought Creek	40199	0	0.0%	39306	97.8%	0	0.0%	893.7	2.2%
170501090503	Palomino Lake	29800	0	0.0%	29067	97.5%	0	0.0%	733.0	2.5%
170501090504	Upper Palomino Creek	26211	0	0.0%	26211	100.0%	0	0.0%	0.0	0.0%
170501090505	Scott Butte Creek	16456	0	0.0%	16187	98.4%	0	0.0%	268.4	1.6%
170501090506	Lower Palomino Creek	24771	0	0.0%	24520	99.0%	0	0.0%	250.7	1.0%
170501090507	Moth [*sic*] of Crooked Creek	19037	0	0.0%	18917	99.4%	0	0.0%	119.2	0.6%

Form H–3A: Historic Peak Flows at Gauges

13177980 Indian Cr nr Jordan Valley OR

Gauge	Water Year	Peak Flow (cfs)	Date	Rank
13177980	1970	42	6/30/1970	2
13177980	1971	25	1/17/1971	4
13177980	1972	29	1/21/1972	3
13177980	1973	15	12/23/1972	5
13177980	1974	57	3/7/1974	1
13177980	1975	3	4/27/1975	7
13177980	1976	11	6/10/1976	6

13177985 Jordan Cr at DeLamar Mine

Gauge	Water Year	Peak Flow (cfs)	Date	Rank
13177985	1994	151	4/19/1994	3
	1995	435	5/6/1995	1
	1996	421	5/14/1996	2

13178000 Jordan Cr above Lone Tree Cr

Gauge	Water Year	Peak Flow (cfs)	Date	Rank
13178000	1946	2110	4/19/1946	11
13178000	1947	676	4/17/1947	26
13178000	1948	1530	4/18/1948	16
13178000	1949	1350	4/19/1949	19
13178000	1950	1490	4/22/1950	17
13178000	1951	2930	2/8/1951	6
13178000	1952	3250	4/14/1952	3
13178000	1955	1430	5/9/1955	18
13178000	1956	3100	3/25/1956	5
13178000	1957	2870	2/23/1957	7
13178000	1958	2000	4/22/1958	13
13178000	1959	901	4/6/1959	24
13178000	1960	2740	3/7/1960	9
13178000	1961	1260	4/4/1961	21
13178000	1962	1160	4/20/1962	22
13178000	1963	3110	2/1/1963	4
13178000	1964	2770	4/1/1964	8
13178000	1965	7530	12/24/1964	1
13178000	1966	1100	4/2/1966	23
13178000	1967	1950	5/18/1967	14
13178000	1968	1280	2/21/1968	20
13178000	1969	2720	1/21/1969	10
13178000	1970	2000	1/22/1970	12
13178000	1971	3870	1/17/1971	2
13178000	2003	845	1/31/2003	25
13178000	2004	1720	3/24/2004	15

13181300 Crooked Cr nr Burns Jct OR

Gauge	Water Year	Peak Flow (cfs)	Date	Rank
	1973	5	4/12/1973	1
	1974	2	4/2/1974	2
	1975	1	8/18/1975	3
	1976	1	7/18/1976	3

13181400 Crooked Cr Trib. at Burns Jct OR

Gauge	Water Year	Peak Flow (cfs)	Date	Rank
	1973	4	5/10/1973	2
	1974	5	4/2/1974	1
	1975	0.4	8/18/1975	4
	1976	0.9	6/11/1976	3

13181000 Owyhee River nr Rome OR*

Gauge	Water Year	Peak Flow (cfs)	Date	Rank
13181000	1950	5370	4/1/1950	43
13181000	1951	13000	2/11/1951	24
13181000	1952	27800	4/14/1952	6
13181000	1953	5400	6/6/1953	42
13181000	1954	8100	3/10/1954	36
13181000	1955	5200	4/11/1955	44
13181000	1956	23000	1/16/1956	11
13181000	1957	16200	2/27/1957	20
13181000	1958	11400	4/18/1958	28
13181000	1959	2110	4/2/1959	52
13181000	1960	10400	3/24/1960	31
13181000	1961	8710	3/24/1961	34
13181000	1962	9890	2/12/1962	32
13181000	1963	24100	2/1/1963	10
13181000	1964	15900	4/1/1964	21
13181000	1965	33500	12/24/1964	4
13181000	1966	4880	3/14/1966	45
13181000	1967	5640	6/10/1967	41
13181000	1968	6360	2/22/1968	39
13181000	1969	17800	4/6/1969	14
13181000	1970	16700	1/23/1970	15
13181000	1971	28900	1/19/1971	5
13181000	1972	25300	3/3/1972	7
13181000	1973	4270	4/7/1973	48
13181000	1974	16600	3/17/1974	17
13181000	1975	11000	5/16/1975	30
13181000	1976	12000	4/5/1976	25
13181000	1977	675	4/6/1977	55
13181000	1978	18000	4/27/1978	13
13181000	1979	16700	1/12/1979	16
13181000	1980	11700	1/14/1980	27
13181000	1981	6060	4/21/1981	40
13181000	1982	21300	2/17/1982	12
13181000	1983	16400	3/14/1983	19
13181000	1984	24900	4/17/1984	8
13181000	1985	11800	4/4/1985	26
13181000	1986	41400	2/19/1986	2
13181000	1987	3900	3/7/1987	50
13181000	1988	3150	3/7/1988	51
13181000	1989	24300	3/10/1989	9
13181000	1990	7340	3/4/1990	38
13181000	1991	4220	5/21/1991	49
13181000	1992	1330	2/22/1992	54
13181000	1993	55700	3/18/1993	1
13181000	1994	1360	3/3/1994	53
13181000	1995	16600	2/2/1995	18
13181000	1996	7670	3/11/1996	37
13181000	1997	35600	1/2/1997	3
13181000	1998	13600	5/14/1998	23
13181000	1999	9570	3/27/1999	33
13181000	2000	4580	4/5/2000	47
13181000	2001	8580	3/22/2001	35
13181000	2002	11300	4/2/2002	29
13181000	2003	4780	5/11/2003	46
13181000	2004	14800	3/20/2004	22

* Discharge is affected by regulation or diversion

13177915 Cottonwood Cr nr Fairylawn ID

Gauge	Water Year	Peak Flow (cfs)	Date	Rank
13177915	1981	122	5/30/1981	1

Form H-5: Agriculture and Range–Land Worksheet

Subwatershed		Area	Hydrologic Soil Group							
Number	Name	(ac)	A (ac)	A (%)	B (ac)	B (%)	C (ac)	C (%)	D (ac)	D (%)
	Middle Owyhee—17050107									
170501070101	Upper Toppin Creek	32414		0%		0%		0%	32415	100%
170501070102	Mustang Lake	15621		0%		0%	1008	6%	14618	94%
170501070103	Lower Toppin Creek	27683		0%		0%		0%	27684	100%
170501070104	Jack Creek	22952		0%		0%		0%	20501	89%
170501070105	Headwaters West Little Owyhee River	25808		0%		0%		0%	25810	100%
170501070106	Upper West Little Owyhee River	31490		0%		0%		0%	31491	100%
170501070107	Middle West Little Owyhee River	34464		0%		0%		0%	34465	100%
170501070108	Lower West Little Owyhee River	7851		0%		0%		0%	7851	100%
170501070201	Upper Pole Creek	25783		0%		0%		0%	25784	100%
170501070202	Field Creek	16965		0%		0%		0%	16966	100%
170501070203	Lower Pole Creek	34260		0%		0%		0%	34261	100%
170501070204	Upper Antelope Creek	35414		0%		0%		0%	35415	100%
170501070205	Middle Antelope Creek	32010		0%		0%		0%	32011	100%
170501070206	Upper Little Antelope Creek	22572		0%		0%		0%	22573	100%
170501070207	Lower Little Antelope Creek	33196		0%		0%		0%	33197	100%
170501070208	Lower Antelope Creek	19607		0%		0%		0%	19607	100%
170501070301	Upper Middle Fork Owyhee River	36171		0%	2884	8%	8336	23%	23419	65%
170501070302	Pole Creek	21322		0%	92	0%	4560	21%	15970	75%
170501070303	Lower Middle Fork Owyhee River	13252		0%		0%		0%	13253	100%
170501070401	Pleasant Valley Creek	17281		0%	2778	16%	7017	41%	6730	39%
170501070402	Juniper Creek	24809		0%	6802	27%	12525	50%	4221	17%
170501070403	Upper North Fork Owyhee River	26887		0%	1404	5%	13283	49%	9297	35%
170501070404	Squaw Creek	30663		0%	4091	13%	16172	53%	7249	24%
170501070405	Cherry Creek	30488		0%	1205	4%	9947	33%	19220	63%
170501070406	Lower North Fork Owyhee River	11457		0%		0%	452	4%	10871	95%
170501070501	Owyhee River - Dukes Creek	23632		0%	99	0%	7730	33%	11336	48%
170501070502	Oregon Lake Creek	10552		0%		0%	2577	24%	7950	75%
170501070503	Owyhee River - Bull Creek	28515		0%		0%	26	0%	28480	100%
170501070504	Owyhee River - Warm Spring Canyon	22205		0%		0%		0%	21546	97%
170501070601	Upper Soldier Creek	39213		0%	4273	11%	6799	17%	28556	73%
170501070602	Mud Flat Creek	29855		0%	1234	4%	2097	7%	26531	89%
170501070603	Willow Creek	16016		0%	520	3%		0%	15496	97%
170501070604	Spring Creek	19898		0%	243	1%		0%	19656	99%
170501070605	Lower Soldier Creek	10515		0%		0%	242	2%	10274	98%
170501070701	Whitehorse Creek	31614		0%		0%		0%	31615	100%
170501070702	Skull Creek	29377		0%		0%		0%	29378	100%
170501070703	Sand Hollow	24633		0%		0%		0%	24634	100%
170501070704	China Gulch	24694	604	2%	813	3%	587	2%	22692	92%
170501070705	Lower Middle Owyhee River	17308		0%	1943	11%	1271	7%	14095	81%
	Jordan—17050108									
170501080101	Sheep Creek	15433		0%	3462	22%	6940	45%	5029	33%
170501080102	Upper Rock Creek	29527		0%	3326	11%	13437	46%	11442	39%
170501080103	Meadow Creek	22838	182	1%	4183	18%	12977	57%	5359	23%
170501080104	Josephine Creek	21543		0%	5140	24%	12980	60%	2376	11%
170501080105	Lower Rock Creek	14396		0%	90	1%	11053	77%	1506	10%
170501080201	Upper North Boulder Creek	22346	574	3%	5700	26%	13980	63%	1840	8%
170501080202	Lower North Boulder Creek	9742		0%	44	0%	8297	85%	442	5%
170501080203	Upper South Boulder Creek	12227		0%	7535	62%	3419	28%	832	7%
170501080204	Lower South Boulder Creek	13194		0%	2563	19%	7344	56%	967	7%
170501080205	Big Boulder Creek	28056	43	0%	2989	11%	17649	63%	5286	19%
170501080301	Jordan Creek Headwaters	33343	640	2%	19335	58%	9011	27%	3140	9%
170501080302	Louse Creek	13741	40	0%	5854	43%	2803	20%	4824	35%
170501080303	Jordan Creek-Flint Creek	26411	391	1%	3968	15%	15302	58%	6008	23%
170501080401	Williams Creek	11944		0%	3765	32%	5385	45%	2519	21%
170501080402	Lone Tree Creek	27053		0%	1729	6%	7507	28%	18019	67%
170501080403	Trout Creek	18059		0%	355	2%	11215	62%	4943	27%
170501080404	Rail Creek	28127	60	0%	1476	5%	17522	62%	6919	25%
170501080501	Baxter Creek	16923		0%	3268	19%	10219	60%	3382	20%
170501080502	Hooker Creek	24120	5314	22%	1364	6%	7316	30%	10182	42%
170501080503	Sheep Spring Creek	22869		0%	1151	5%	1457	6%	20255	89%
170501080504	Jack Creek	36099		0%	994	3%		0%	35107	97%
170501080505	Downey Creek	33620		0%	10993	33%	434	1%	22194	66%
170501080601	Jackson Creek	34435		0%	6282	18%	16937	49%	10783	31%
170501080602	Posey Creek	22296	1573	7%	3281	15%	1254	6%	16325	73%
170501080603	Spring Branch	14308		0%	2067	14%	2305	16%	9936	69%
170501080604	Mahogany Creek	30842		0%	1897	6%	1184	4%	27762	90%
170501080605	Lower Upper Cow Creek	16756	644	4%	1168	7%	5608	33%	9336	56%

Form H-5: Agriculture and Range–Land Worksheet

Subwatershed		Area	Hydrologic Soil Group							
170501080701	Cove Creek	40493		0%		0%		0%	40495	100%
170501080702	Jordan Craters	31121	324	1%		0%		0%	27122	87%
170501080703	Mouth Of Cow Creek	39045		0%	611	2%		0%	38435	98%
170501080801	Jordan Creek/Rock Creek Reservoir	17351		0%	505	3%		0%	16846	97%
170501080802	Rock Creek	21717		0%		0%	1499	7%	20219	93%
170501080803	Jordan Creek/Merrill Springs	37622		0%	13211	35%		0%	24412	65%
170501080804	Dry Creek	36062		0%	4837	13%		0%	31226	87%
170501080805	Boney Canyon	10638		0%	5	0%		0%	10633	100%
	Crooked–Rattlesnake—17050109									
170501090101	Bowden Hills	24229		0%		0%	3397	14%	20832	86%
170501090102	Black Hills	33936	1482	4%		0%	383	1%	32073	95%
170501090103	Headwaters Crooked Creek	42231		0%	1408	3%	1874	4%	38950	92%
170501090104	Three Man Butte Well	49461		0%	1743	4%	3006	6%	44521	90%
170501090105	Middle Upper Crooked Creek	30302		0%	2149	7%	534	2%	27619	91%
170501090106	Lower Upper Crooked Creek	27108		0%	1264	5%	6657	25%	19188	71%
170501090201	Upper Rattlesnake Creek	35584		0%		0%		0%	35586	100%
170501090202	Middle Rattlesnake Creek	19734		0%	745	4%		0%	18990	96%
170501090203	Bull Creek	36918		0%	1870	5%		0%	35050	95%
170501090204	Tree Springs	11939		0%	56	0%	3565	30%	8320	70%
170501090205	Battle Creek	31715		0%	714	2%	7463	24%	23540	74%
170501090206	Red Hills	18424		0%	103	1%		0%	18320	99%
170501090207	Lower Rattlesnake Creek	35349		0%	4806	14%		0%	30543	86%
170501090301	Grassy Ridge	13803	25	0%		0%		0%	13778	100%
170501090302	Upper Wildcat Creek	28175	2251	8%		0%		0%	25925	92%
170501090303	Bone Creek	21787		0%		0%	1	0%	21787	100%
170501090304	Lower Wildcat Creek	30549	87	0%		0%	794	3%	29669	97%
170501090401	Peacock Creek	25974		0%		0%		0%	25975	100%
170501090402	Upper Dry Creek	29329		0%	418	1%		0%	28912	99%
170501090403	Middle Dry Creek	31080		0%		0%		0%	31081	100%
170501090404	Indian Fort Creek	30306		0%		0%		0%	30307	100%
170501090405	Corbin Creek	22618		0%		0%		0%	22619	100%
170501090406	The Basin	14971		0%	27	0%	9	0%	14935	100%
170501090407	Lower Dry Creek	37011		0%	947	3%	1999	5%	34065	92%
170501090501	The Basin South	11245	331	3%	22	0%	2817	25%	8077	72%
170501090502	Drought Creek	40199		0%	252	1%	408	1%	39540	98%
170501090503	Palomino Lake	29800		0%		0%	1334	4%	28467	96%
170501090504	Upper Palomino Creek	26211		0%		0%	548	2%	25664	98%
170501090505	Scott Butte Creek	16456		0%		0%		0%	16456	100%
170501090506	Lower Palomino Creek	24771		0%		0%	732	3%	24040	97%
170501090507	Moth [*sic*] of Crooked Creek	19037		0%	0	0%		0%	19038	100%

Form H–5A: Agriculture and Range–Land Worksheet

Subwatershed Number	Subwatershed Name	Cover	Condition	Dominant Hyd. Grp.	Curve Number	Background CN (good)	Rainfall (in)	Runoff (in)	Background Runoff (in)	Runoff Change
	Middle Owyhee—17050107									
170501070101	Upper Toppin Creek	shrub/brush range	fair	D	86	84	11.9	10.1	9.8	0.3
170501070102	Mustang Lake	mixed range	fair	D	70	55	11.6	7.6	5.4	2.2
170501070103	Lower Toppin Creek	shrub/brush range	fair	D	86	84	10.7	9.0	8.7	0.3
170501070104	Jack Creek	mixed range	fair	D	70	55	17.9	13.6	10.8	2.8
170501070105	Headwaters West Little Owyhee River	mixed range	fair	D	70	55	20.2	15.8	12.9	2.9
170501070106	Upper West Little Owyhee River	mixed range	fair	D	70	55	13.5	9.4	7.0	2.4
170501070107	Middle West Little Owyhee River	shrub/brush range	fair	D	86	84	10.5	8.8	8.5	0.3
170501070108	Lower West Little Owyhee River	shrub/brush range	fair	D	86	84	10.7	9.0	8.7	0.3
170501070201	Upper Pole Creek	mixed range	fair	D	70	55	13.9	9.8	7.4	2.5
170501070202	Field Creek	mixed range	fair	D	70	55	15.0	10.9	8.3	2.6
170501070203	Lower Pole Creek	shrub/brush range	fair	D	86	84	12.6	10.8	10.5	0.3
170501070204	Upper Antelope Creek	mixed range	fair	D	70	55	19.3	15.0	12.1	2.9
170501070205	Middle Antelope Creek	mixed range	fair	D	70	55	13.3	9.3	6.9	2.4
170501070206	Upper Little Antelope Creek	mixed range	fair	D	70	55	11.9	8.0	5.7	2.2
170501070207	Lower Little Antelope Creek	mixed range	fair	D	70	55	12.4	8.5	6.1	2.3
170501070208	Lower Antelope Creek	shrub/brush range	fair	D	86	84	12.0	10.2	9.9	0.3
170501070301	Upper Middle Fork Owyhee River	evergreen forest	fair	D	80	71	12.0	9.4	8.2	1.3
170501070302	Pole Creek	evergreen forest	fair	D	80	71	11.6	9.1	7.9	1.2
170501070303	Lower Middle Fork Owyhee River	mixed range	fair	D	70	55	10.8	6.9	4.8	2.1
170501070401	Pleasant Valley Creek	evergreen forest	fair	C	73	61	14.6	10.9	9.0	1.9
170501070402	Juniper Creek	evergreen forest	fair	C	73	61	20.9	17.0	14.8	2.2
170501070403	Upper North Fork Owyhee River	evergreen forest	fair	C	73	61	16.9	13.1	11.1	2.1
170501070404	Squaw Creek	evergreen forest	fair	C	73	61	13.4	9.8	8.0	1.9
170501070405	Cherry Creek	mixed range	fair	D	70	55	12.6	8.6	6.3	2.3
170501070406	Lower North Fork Owyhee River	mixed range	fair	D	70	55	12.2	8.3	6.0	2.3
170501070501	Owyhee River - Dukes Creek	mixed range	fair	D	70	55	10.2	6.4	4.4	2.0
170501070502	Oregon Lake Creek	mixed range	fair	D	70	55	11.5	7.6	5.4	2.2
170501070503	Owyhee River - Bull Creek	shrub/brush range	fair	D	86	84	10.4	8.7	8.4	0.3
170501070504	Owyhee River - Warm Spring Canyon	mixed range	fair	D	70	55	11.9	7.9	5.7	2.2
170501070601	Upper Soldier Creek	mixed range	fair	D	70	55	15.6	11.5	8.8	2.6
170501070602	Mud Flat Creek	mixed range	fair	D	70	55	13.4	9.3	6.9	2.4
170501070603	Willow Creek	mixed range	fair	D	70	55	15.9	11.7	9.0	2.6
170501070604	Spring Creek	mixed range	fair	D	70	55	14.7	10.6	8.0	2.5
170501070605	Lower Soldier Creek	mixed range	fair	D	70	55	13.2	9.2	6.8	2.4
170501070701	Whitehorse Creek	mixed range	fair	D	70	55	13.6	9.5	7.1	2.4
170501070702	Skull Creek	mixed range	fair	D	70	55	13.2	9.2	6.8	2.4
170501070703	Sand Hollow	mixed range	fair	D	70	55	11.3	7.4	5.3	2.2
170501070704	China Gulch	mixed range	fair	D	70	55	8.5	4.9	3.1	1.8
170501070705	Lower Middle Owyhee River	mixed range	fair	D	70	55	8.6	5.0	3.2	1.8
	Jordan—17050108									
170501080101	Sheep Creek	mixed range	fair	D	70	55	18.6	14.3	11.5	2.8
170501080102	Upper Rock Creek	mixed range	fair	D	70	55	14.3	10.2	7.7	2.5
170501080103	Meadow Creek	mixed range	fair	D	70	55	21.1	16.7	13.7	3.0
170501080104	Josephine Creek	evergreen forest	fair	C	73	61	16.6	12.8	10.8	2.0
170501080105	Lower Rock Creek	evergreen forest	fair	C	73	61	17.8	14.0	11.9	2.1
170501080201	Upper North Boulder Creek	evergreen forest	fair	C	73	61	28.1	24.1	21.6	2.4
170501080202	Lower North Boulder Creek	evergreen forest	fair	C	73	61	19.0	15.2	13.1	2.2
170501080203	Upper South Boulder Creek	evergreen forest	fair	B	58	41	25.5	18.5	13.8	4.7
170501080204	Lower South Boulder Creek	evergreen forest	fair	C	73	61	22.5	18.6	16.3	2.3
170501080205	Big Boulder Creek	mixed range	fair	C	63	47	18.2	12.7	9.4	3.3
170501080301	Jordan Creek Headwaters	evergreen forest	fair	B	58	41	27.0	19.9	15.1	4.8
170501080302	Louse Creek	evergreen forest	fair	B	58	41	24.3	17.4	12.8	4.5
170501080303	Jordan Creek-Flint Creek	evergreen forest	fair	C	73	61	20.5	16.6	14.4	2.2
170501080401	Williams Creek	mixed range	fair	C	63	47	21.9	16.2	12.5	3.7
170501080402	Lone Tree Creek	mixed range	fair	D	70	55	17.9	13.7	10.9	2.8
170501080403	Trout Creek	mixed range	fair	C	63	47	17.5	12.0	8.8	3.2
170501080404	Rail Creek	mixed range	fair	C	63	47	15.6	10.3	7.3	3.0
170501080501	Baxter Creek	mixed range	fair	C	63	47	14.0	8.8	6.0	2.8
170501080502	Hooker Creek	mixed range	fair	D	70	55	13.5	9.5	7.1	2.4
170501080503	Sheep Spring Creek	mixed range	fair	D	70	55	13.5	9.5	7.0	2.4
170501080504	Jack Creek	mixed range	fair	D	70	55	13.6	9.6	7.1	2.4
170501080505	Downey Creek	mixed range	fair	D	70	55	12.7	8.7	6.4	2.3
170501080601	Jackson Creek	mixed range	fair	C	63	47	21.0	15.3	11.7	3.6
170501080602	Posey Creek	mixed range	fair	D	70	55	14.4	10.3	7.8	2.5
170501080603	Spring Branch	mixed range	fair	D	70	55	15.1	11.0	8.4	2.6
170501080604	Mahogany Creek	mixed range	fair	D	70	55	15.5	11.4	8.8	2.6
170501080605	Lower Upper Cow Creek	mixed range	fair	D	70	55	13.4	9.3	6.9	2.4
170501080701	Cove Creek	mixed range	fair	D	70	55	14.2	10.1	7.6	2.5
170501080702	Jordan Craters	mixed range	fair	D	70	55	12.9	8.9	6.5	2.4
170501080703	Mouth Of Cow Creek	mixed range	fair	D	70	55	12.7	8.7	6.3	2.3
170501080801	Jordan Creek/Rock Creek Reservoir	mixed range	fair	D	70	55	12.3	8.4	6.1	2.3
170501080802	Rock Creek	mixed range	fair	D	70	55	13.1	9.1	6.7	2.4
170501080803	Jordan Creek/Merrill Springs	mixed range	fair	D	70	55	11.0	7.1	5.0	2.1
170501080804	Dry Creek	mixed range	fair	D	70	55	11.4	7.5	5.3	2.2
170501080805	Boney Canyon	mixed range	fair	D	70	55	9.5	5.8	3.9	1.9
	Crooked–Rattlesnake—17050109									
170501090101	Bowden Hills	shrub/brush range	fair	D	86	84	9.8	8.1	7.9	0.3

Form H–5A: Agriculture and Range–Land Worksheet

Subwatershed		Cover	Condition	Dominant	Curve	Background	Rainfall	Runoff	Background	Runoff
170501090102	Black Hills	mixed range	fair	D	70	55	8.8	5.1	3.3	1.8
170501090103	Headwaters Crooked Creek	mixed range	fair	D	70	55	10.3	6.5	4.5	2.0
170501090104	Three Man Butte Well	mixed range	fair	D	70	55	9.4	5.7	3.8	1.9
170501090105	Middle Upper Crooked Creek	mixed range	fair	D	70	55	8.3	4.7	3.0	1.7
170501090106	Lower Upper Crooked Creek	mixed range	fair	D	70	55	9.1	5.4	3.5	1.9
170501090201	Upper Rattlesnake Creek	mixed range	fair	D	70	55	13.1	9.0	6.7	2.4
170501090202	Middle Rattlesnake Creek	mixed range	fair	D	70	55	9.3	5.6	3.7	1.9
170501090203	Bull Creek	mixed range	fair	D	70	55	9.9	6.2	4.2	2.0
170501090204	Tree Springs	shrub/brush range	fair	D	86	84	8.8	7.1	6.8	0.2
170501090205	Battle Creek	shrub/brush range	fair	D	86	84	9.5	7.8	7.5	0.2
170501090206	Red Hills	mixed range	fair	D	70	55	8.5	4.9	3.1	1.8
170501090207	Lower Rattlesnake Creek	mixed range	fair	D	70	55	8.5	4.9	3.1	1.8
170501090301	Grassy Ridge	mixed range	fair	D	70	55	14.6	10.5	8.0	2.5
170501090302	Upper Wildcat Creek	mixed range	fair	D	70	55	18.3	14.0	11.2	2.8
170501090303	Bone Creek	mixed range	fair	D	70	55	17.8	13.5	10.7	2.8
170501090304	Lower Wildcat Creek	mixed range	fair	D	70	55	11.3	7.4	5.2	2.2
170501090401	Peacock Creek	mixed range	fair	D	70	55	12.9	8.9	6.5	2.4
170501090402	Upper Dry Creek	mixed range	fair	D	70	55	13.9	9.8	7.3	2.5
170501090403	Middle Dry Creek	mixed range	fair	D	70	55	11.3	7.4	5.3	2.2
170501090404	Indian Fort Creek	mixed range	fair	D	70	55	11.3	7.4	5.3	2.2
170501090405	Corbin Creek	mixed range	fair	D	70	55	11.4	7.5	5.3	2.2
170501090406	The Basin	mixed range	fair	D	70	55	8.5	4.9	3.1	1.8
170501090407	Lower Dry Creek	mixed range	fair	D	70	55	8.8	5.2	3.4	1.8
170501090501	The Basin South	mixed range	fair	D	70	55	8.3	4.8	3.0	1.7
170501090502	Drought Creek	mixed range	fair	D	70	55	9.9	6.2	4.2	2.0
170501090503	Palomino Lake	mixed range	fair	D	70	55	14.3	10.2	7.7	2.5
170501090504	Upper Palomino Creek	mixed range	fair	D	70	55	20.1	15.7	12.8	2.9
170501090505	Scott Butte Creek	mixed range	fair	D	70	55	11.3	7.4	5.3	2.2
170501090506	Lower Palomino Creek	mixed range	fair	D	70	55	12.0	8.1	5.8	2.3
170501090507	Moth [*sic*] of Crooked Creek	mixed range	fair	D	70	55	9.9	6.2	4.2	2.0

Form H-6: Forest and Rural Road Worksheet

Subwatershed		Area	Unknown	Primary	Secondary	Local		Trail		Road Area	
Number	Name	(ac)	A00	A21	A31	A40	A41	A50	A51	(ac)	(%)
	Middle Owyhee—17050107										
170501070101	Upper Toppin Creek	32414			13955		229667		15341	209	0.6%
170501070102	Mustang Lake	15621					100127		15030	89	0.6%
170501070103	Lower Toppin Creek	27683					152411		870	123	0.4%
170501070104	Jack Creek	22952					151360	8633		127	0.6%
170501070105	Headwaters West Little Owyhee River	25808					71062		58661	91	0.4%
170501070106	Upper West Little Owyhee River	31490			38747		193397	5342	5671	206	0.7%
170501070107	Middle West Little Owyhee River	34464					214710		17396	183	0.5%
170501070108	Lower West Little Owyhee River	7851					34653		695	28	0.4%
170501070201	Upper Pole Creek	25783			11515		105432	1838	37344	120	0.5%
170501070202	Field Creek	16965			14614		120256	1121	1565	115	0.7%
170501070203	Lower Pole Creek	34260					267374		4386	217	0.6%
170501070204	Upper Antelope Creek	35414			9794		78330		65397	112	0.3%
170501070205	Middle Antelope Creek	32010			25983		122577	5575	15244	140	0.4%
170501070206	Upper Little Antelope Creek	22572			42839		109869	2535	27030	154	0.7%
170501070207	Lower Little Antelope Creek	33196	193		1502		144015		45530	144	0.4%
170501070208	Lower Antelope Creek	19607					96852		11643	85	0.4%
170501070301	Upper Middle Fork Owyhee River	36171	12886				177835	16485	94818	222	0.6%
170501070302	Pole Creek	21322					85550	16797	19824	90	0.4%
170501070303	Lower Middle Fork Owyhee River	13252	2599				98176			82	0.6%
170501070401	Pleasant Valley Creek	17281	53171		28250		71679	2630		153	0.9%
170501070402	Juniper Creek	24809	461				78234	22677	64137	113	0.5%
170501070403	Upper North Fork Owyhee River	26887	8321		28004		89118	13162	13378	129	0.5%
170501070404	Squaw Creek	30663	30693		36925		135469	46057	22193	226	0.7%
170501070405	Cherry Creek	30488	24664		39520		147320	9683	26728	213	0.7%
170501070406	Lower North Fork Owyhee River	11457	1496				51903			43	0.4%
170501070501	Owyhee River - Dukes Creek	23632	2052				10062	5686	80122	60	0.3%
170501070502	Oregon Lake Creek	10552					62495	5893		54	0.5%
170501070503	Owyhee River - Bull Creek	28515					108135		34847	107	0.4%
170501070504	Owyhee River - Warm Spring Canyon	22205	996				113853		13306	100	0.5%
170501070601	Upper Soldier Creek	39213	9466		63403		208260	7475	21027	267	0.7%
170501070602	Mud Flat Creek	29855	2503		12929		188158		11976	176	0.6%
170501070603	Willow Creek	16016	3036				133542	7433	4918	118	0.7%
170501070604	Spring Creek	19898	184		21846		134849		29458	151	0.8%
170501070605	Lower Soldier Creek	10515	2631		36008		42245	2315	3167	81	0.8%
170501070701	Whitehorse Creek	31614	1754		35083		104139			126	0.4%
170501070702	Skull Creek	29377	1427		39889		73809		11908	114	0.4%
170501070703	Sand Hollow	24633	6869				131094		6770	117	0.5%
170501070704	China Gulch	24694	9630	7270		1572	294648			257	1.0%
170501070705	Lower Middle Owyhee River	17308	7990	37090			209115		12070	227	1.3%
	Jordan—17050108										
170501080101	Sheep Creek	15433	17822				95872	29353	7037	118	0.8%
170501080102	Upper Rock Creek	29527	16054		9919		169248	11938	44647	198	0.7%
170501080103	Meadow Creek	22838			48939		130182	16617	18582	181	0.8%
170501080104	Josephine Creek	21543	1953				87907	12604	33776	99	0.5%
170501080105	Lower Rock Creek	14396	3218		11793		56710	4080	17472	75	0.5%
170501080201	Upper North Boulder Creek	22346			13300		68757	9489	70114	116	0.5%
170501080202	Lower North Boulder Creek	9742	1232				31817		19247	38	0.4%
170501080203	Upper South Boulder Creek	12227	12965				71598	17299	26429	98	0.8%
170501080204	Lower South Boulder Creek	13194	385				42576		41287	58	0.4%
170501080205	Big Boulder Creek	28056			28364		149967	14892	164938	256	0.9%
170501080301	Jordan Creek Headwaters	33343			64220	691	440804	9041	4674	436	1.3%
170501080302	Louse Creek	13741					69469	2778		57	0.4%
170501080303	Jordan Creek-Flint Creek	26411	629		34521		84078	6312	36393	132	0.5%
170501080401	Williams Creek	11944	6		45150		28875	14393	43423	108	0.9%
170501080402	Lone Tree Creek	27053	464		33611		43588	19483	99898	143	0.5%
170501080403	Trout Creek	18059	161		18736		56477	11630	24728	88	0.5%
170501080404	Rail Creek	28127	544		108078		111711		55492	246	0.9%
170501080501	Baxter Creek	16923	5289	39378	10335	2293	111034	4506	38760	179	1.1%
170501080502	Hooker Creek	24120	11391	28417	2060		157863	2815	32753	195	0.8%
170501080503	Sheep Spring Creek	22869	11650				207052		17004	189	0.8%
170501080504	Jack Creek	36099	968	13659			203476	4151	304	183	0.5%
170501080505	Downey Creek	33620	10340	45082	88043		179268		10356	315	0.9%
170501080601	Jackson Creek	34435			46642		172912	18242	121996	273	0.8%
170501080602	Posey Creek	22296	7305	26142	46976		155870	18101	35645	248	1.1%
170501080603	Spring Branch	14308	2000				44029		15274	46	0.3%
170501080604	Mahogany Creek	30842			13509		164625	27020	26236	178	0.6%
170501080605	Lower Upper Cow Creek	16756	235		22904		140253		7896	144	0.9%
170501080701	Cove Creek	40493	127				242569		18328	206	0.5%
170501080702	Jordan Craters	31121					156882		19240	137	0.4%
170501080703	Mouth Of Cow Creek	39045	4419		45687		216971		15933	241	0.6%
170501080801	Jordan Creek/Rock Creek Reservoir	17351	1790		6614		40841		33491	62	0.4%
170501080802	Rock Creek	21717		17349	24140		72986		9833	112	0.5%
170501080803	Jordan Creek/Merrill Springs	37622	5638	18026	9162		395111		43451	380	1.0%
170501080804	Dry Creek	36062	18221	29788	8409	1233	236115		61535	291	0.8%
170501080805	Boney Canyon	10638					43433				

Form H–6: Forest and Rural Road Worksheet

Subwatershed		Area	Unknown	Primary	Secondary	Local		Trail		Road Area	
	Crooked–Rattlesnake—17050109										
170501090101	Bowden Hills	24229					144064		33659	135	0.6%
170501090102	Black Hills	33936	5520	45909	12689		102308		32228	174	0.5%
170501090103	Headwaters Crooked Creek	42231	190	57705			271111	2053	23377	299	0.7%
170501090104	Three Man Butte Well	49461			36414		52277	17416	42859	118	0.2%
170501090105	Middle Upper Crooked Creek	30302	1036	34670	6142		39659		27534	96	0.3%
170501090106	Lower Upper Crooked Creek	27108	84				84175		12813	75	0.3%
170501090201	Upper Rattlesnake Creek	35584	277		77096		204074		29601	270	0.8%
170501090202	Middle Rattlesnake Creek	19734	96		13990		104457			100	0.5%
170501090203	Bull Creek	36918	985				83858		28891	85	0.2%
170501090204	Tree Springs	11939			45990		66979		15207	115	1.0%
170501090205	Battle Creek	31715	168		8452		175340			151	0.5%
170501090206	Red Hills	18424			18704		110553	4290		113	0.6%
170501090207	Lower Rattlesnake Creek	35349			40351		109519	11760	19232	152	0.4%
170501090301	Grassy Ridge	13803					52162		14630	50	0.4%
170501090302	Upper Wildcat Creek	28175					89622		24424	86	0.3%
170501090303	Bone Creek	21787	326				79065		33714	83	0.4%
170501090304	Lower Wildcat Creek	30549					80233		16492	74	0.2%
170501090401	Peacock Creek	25974					147985			119	0.5%
170501090402	Upper Dry Creek	29329	709				135526	1267		110	0.4%
170501090403	Middle Dry Creek	31080					41372	10474	29650	56	0.2%
170501090404	Indian Fort Creek	30306	2890				169731			140	0.5%
170501090405	Corbin Creek	22618	512				109833			89	0.4%
170501090406	The Basin	14971					46308			37	0.2%
170501090407	Lower Dry Creek	37011	1172				284384		3526	232	0.6%
170501090501	The Basin South	11245					65993			53	0.5%
170501090502	Drought Creek	40199	2410	57351			305018		18050	324	0.8%
170501090503	Palomino Lake	29800	781	50508			84537		10415	133	0.4%
170501090504	Upper Palomino Creek	26211	400	1539			72420		20858	72	0.3%
170501090505	Scott Butte Creek	16456					16726		25438	28	0.2%
170501090506	Lower Palomino Creek	24771		47411			82227		27919	137	0.6%
170501090507	Moth [*sic*] of Crooked Creek	19037	28038	13657			139747			160	0.8%

Form H-7: Urban and Residential Area Worksheet

Subwatershed Number	Subwatershed Name	Percent Urban	Dominant Type of Urban Land Use	Avg % Impervious	Percent Total Impervious Area	Relative Potential for Peak Flow Enhancement
	Middle Owyhee—17050107					
170501070101	Upper Toppin Creek	0.0%			0.0%	low
170501070102	Mustang Lake	0.0%			0.0%	low
170501070103	Lower Toppin Creek	0.0%			0.0%	low
170501070104	Jack Creek	0.0%			0.0%	low
170501070105	Headwaters West Little Owyhee River	0.0%			0.0%	low
170501070106	Upper West Little Owyhee River	0.0%			0.0%	low
170501070107	Middle West Little Owyhee River	0.0%			0.0%	low
170501070108	Lower West Little Owyhee River	0.0%			0.0%	low
170501070201	Upper Pole Creek	0.0%			0.0%	low
170501070202	Field Creek	0.0%			0.0%	low
170501070203	Lower Pole Creek	0.0%			0.0%	low
170501070204	Upper Antelope Creek	0.0%			0.0%	low
170501070205	Middle Antelope Creek	0.0%			0.0%	low
170501070206	Upper Little Antelope Creek	0.0%			0.0%	low
170501070207	Lower Little Antelope Creek	0.0%			0.0%	low
170501070208	Lower Antelope Creek	0.0%			0.0%	low
170501070301	Upper Middle Fork Owyhee River	0.0%			0.0%	low
170501070302	Pole Creek	0.0%			0.0%	low
170501070303	Lower Middle Fork Owyhee River	0.0%			0.0%	low
170501070401	Pleasant Valley Creek	0.0%			0.0%	low
170501070402	Juniper Creek	0.0%			0.0%	low
170501070403	Upper North Fork Owyhee River	0.0%			0.0%	low
170501070404	Squaw Creek	0.0%			0.0%	low
170501070405	Cherry Creek	0.0%			0.0%	low
170501070406	Lower North Fork Owyhee River	0.0%			0.0%	low
170501070501	Owyhee River - Dukes Creek	0.0%			0.0%	low
170501070502	Oregon Lake Creek	0.0%			0.0%	low
170501070503	Owyhee River - Bull Creek	0.0%			0.0%	low
170501070504	Owyhee River - Warm Spring Canyon	0.0%			0.0%	low
170501070601	Upper Soldier Creek	0.0%			0.0%	low
170501070602	Mud Flat Creek	0.0%			0.0%	low
170501070603	Willow Creek	0.0%			0.0%	low
170501070604	Spring Creek	0.0%			0.0%	low
170501070605	Lower Soldier Creek	0.0%			0.0%	low
170501070701	Whitehorse Creek	0.0%			0.0%	low
170501070702	Skull Creek	0.0%			0.0%	low
170501070703	Sand Hollow	0.0%			0.0%	low
170501070704	China Gulch	0.0%			0.0%	low
170501070705	Lower Middle Owyhee River	0.0%			0.0%	low
	Jordan—17050108					
170501080101	Sheep Creek	0.0%			0.0%	low
170501080102	Upper Rock Creek	0.0%			0.0%	low
170501080103	Meadow Creek	0.0%			0.0%	low
170501080104	Josephine Creek	0.0%			0.0%	low
170501080105	Lower Rock Creek	0.0%			0.0%	low
170501080201	Upper North Boulder Creek	0.0%			0.0%	low
170501080202	Lower North Boulder Creek	0.0%			0.0%	low
170501080203	Upper South Boulder Creek	0.0%			0.0%	low
170501080204	Lower South Boulder Creek	0.0%			0.0%	low
170501080205	Big Boulder Creek	0.0%			0.0%	low
170501080301	Jordan Creek Headwaters	0.1%	residence	38%	0.1%	low
170501080302	Louse Creek	0.5%	residence	38%	0.2%	low
170501080303	Jordan Creek-Flint Creek	0.0%			0.0%	low
170501080401	Williams Creek	0.0%			0.0%	low
170501080402	Lone Tree Creek	0.0%			0.0%	low
170501080403	Trout Creek	0.0%			0.0%	low
170501080404	Rail Creek	0.0%			0.0%	low
170501080501	Baxter Creek	1.7%	residence	65%	1.1%	low
170501080502	Hooker Creek	0.0%			0.0%	low
170501080503	Sheep Spring Creek	0.0%			0.0%	low
170501080504	Jack Creek	0.0%			0.0%	low
170501080505	Downey Creek	0.0%			0.0%	low
170501080601	Jackson Creek	0.0%			0.0%	low
170501080602	Posey Creek	0.0%			0.0%	low
170501080603	Spring Branch	0.0%			0.0%	low
170501080604	Mahogany Creek	0.0%			0.0%	low
170501080605	Lower Upper Cow Creek	0.0%			0.0%	low
170501080701	Cove Creek	0.0%			0.0%	low
170501080702	Jordan Craters	0.0%			0.0%	low
170501080703	Mouth Of Cow Creek	0.0%			0.0%	low
170501080801	Jordan Creek/Rock Creek Reservoir	0.0%			0.0%	low
170501080802	Rock Creek	0.0%			0.0%	low

Form H-7: Urban and Residential Area Worksheet

Subwatershed		Percent	Dominant Type of	Avg %	Percent Total	Relative Potential for
170501080803	Jordan Creek/Merrill Springs	0.1%	residence	38%	0.0%	low
170501080804	Dry Creek	0.0%			0.0%	low
170501080805	Boney Canyon	0.0%			0.0%	low
	Crooked–Rattlesnake—17050109					
170501090101	Bowden Hills	0.0%			0.0%	low
170501090102	Black Hills	0.5%	residence	38%	0.2%	low
170501090103	Headwaters Crooked Creek	0.0%			0.0%	low
170501090104	Three Man Butte Well	0.0%			0.0%	low
170501090105	Middle Upper Crooked Creek	0.0%			0.0%	low
170501090106	Lower Upper Crooked Creek	0.0%			0.0%	low
170501090201	Upper Rattlesnake Creek	0.0%			0.0%	low
170501090202	Middle Rattlesnake Creek	0.0%			0.0%	low
170501090203	Bull Creek	0.0%			0.0%	low
170501090204	Tree Springs	0.0%			0.0%	low
170501090205	Battle Creek	0.0%			0.0%	low
170501090206	Red Hills	0.0%			0.0%	low
170501090207	Lower Rattlesnake Creek	0.0%			0.0%	low
170501090301	Grassy Ridge	0.0%			0.0%	low
170501090302	Upper Wildcat Creek	0.0%			0.0%	low
170501090303	Bone Creek	0.0%			0.0%	low
170501090304	Lower Wildcat Creek	0.0%			0.0%	low
170501090401	Peacock Creek	0.0%			0.0%	low
170501090402	Upper Dry Creek	0.0%			0.0%	low
170501090403	Middle Dry Creek	0.0%			0.0%	low
170501090404	Indian Fort Creek	0.0%			0.0%	low
170501090405	Corbin Creek	0.0%			0.0%	low
170501090406	The Basin	0.0%			0.0%	low
170501090407	Lower Dry Creek	0.0%			0.0%	low
170501090501	The Basin South	0.0%			0.0%	low
170501090502	Drought Creek	0.0%			0.0%	low
170501090503	Palomino Lake	0.0%			0.0%	low
170501090504	Upper Palomino Creek	0.0%			0.0%	low
170501090505	Scott Butte Creek	0.0%			0.0%	low
170501090506	Lower Palomino Creek	0.0%			0.0%	low
170501090507	Moth [*sic*] of Crooked Creek	0.0%			0.0%	low

Form H-8: Summary of Potential Hydrologic Risk

Subwatershed		Timber Harvest		Agriculture & Rangeland		Forest & Rural Roads		Urban Impervious	
Number	Name	Result	Risk	Result	Risk	Result	Risk	Result	Risk
	Middle Owyhee—17050107								
170501070101	Upper Toppin Creek	none	low	0.26	moderate	0.4%	low	0.0%	low
170501070102	Mustang Lake	none	low	2.20	high	0.6%	low	0.0%	low
170501070103	Lower Toppin Creek	none	low	0.26	moderate	0.9%	low	0.0%	low
170501070104	Jack Creek	none	low	2.80	high	0.5%	low	0.0%	low
170501070105	Headwaters West Little Owyhee River	none	low	2.95	high	0.5%	low	0.0%	low
170501070106	Upper West Little Owyhee River	none	low	2.42	high	0.7%	low	0.0%	low
170501070107	Middle West Little Owyhee River	none	low	0.26	moderate	0.7%	low	0.0%	low
170501070108	Lower West Little Owyhee River	none	low	0.26	moderate	0.4%	low	0.0%	low
170501070201	Upper Pole Creek	none	low	2.46	high	0.3%	low	0.0%	low
170501070202	Field Creek	none	low	2.57	high	0.5%	low	0.0%	low
170501070203	Lower Pole Creek	none	low	0.27	moderate	0.4%	low	0.0%	low
170501070204	Upper Antelope Creek	none	low	2.89	high	0.5%	low	0.0%	low
170501070205	Middle Antelope Creek	none	low	2.40	high	0.7%	low	0.0%	low
170501070206	Upper Little Antelope Creek	none	low	2.25	high	0.6%	low	0.0%	low
170501070207	Lower Little Antelope Creek	none	low	2.31	high	0.7%	low	0.0%	low
170501070208	Lower Antelope Creek	none	low	0.26	moderate	0.8%	low	0.0%	low
170501070301	Upper Middle Fork Owyhee River	none	low	1.25	high	0.8%	low	0.0%	low
170501070302	Pole Creek	none	low	1.24	high	0.4%	low	0.0%	low
170501070303	Lower Middle Fork Owyhee River	none	low	2.10	high	0.4%	low	0.0%	low
170501070401	Pleasant Valley Creek	none	low	1.94	high	0.5%	low	0.0%	low
170501070402	Juniper Creek	none	low	2.24	high	1.0%	low	0.0%	low
170501070403	Upper North Fork Owyhee River	none	low	2.07	high	1.3%	low	0.0%	low
170501070404	Squaw Creek	none	low	1.87	high	0.0%	low	0.0%	low
170501070405	Cherry Creek	none	low	2.32	high	0.8%	low	0.0%	low
170501070406	Lower North Fork Owyhee River	none	low	2.28	high	0.7%	low	0.0%	low
170501070501	Owyhee River - Dukes Creek	none	low	2.02	high	0.8%	low	0.0%	low
170501070502	Oregon Lake Creek	none	low	2.20	high	0.5%	low	0.0%	low
170501070503	Owyhee River - Bull Creek	none	low	0.25	low	0.5%	low	0.0%	low
170501070504	Owyhee River - Warm Spring Canyon	none	low	2.24	high	0.5%	low	0.0%	low
170501070601	Upper Soldier Creek	none	low	2.62	high	0.4%	low	0.0%	low
170501070602	Mud Flat Creek	none	low	2.41	high	0.8%	low	0.0%	low
170501070603	Willow Creek	none	low	2.64	high	0.4%	low	0.0%	low
170501070604	Spring Creek	none	low	2.54	high	0.9%	low	0.0%	low
170501070605	Lower Soldier Creek	none	low	2.39	high	1.3%	low	0.0%	low
170501070701	Whitehorse Creek	none	low	2.43	high	0.4%	low	0.0%	low
170501070702	Skull Creek	none	low	2.39	high	0.5%	low	0.0%	low
170501070703	Sand Hollow	none	low	2.18	high	0.9%	low	0.0%	low
170501070704	China Gulch	none	low	1.76	high	0.5%	low	0.0%	low
170501070705	Lower Middle Owyhee Rive	none	low	1.78	high	0.5%	low	0.0%	low
	Jordan—17050108								
170501080101	Sheep Creek	none	low	2.85	high	1.1%	low	0.0%	low
170501080102	Upper Rock Creek	none	low	2.50	high	0.8%	low	0.0%	low
170501080103	Meadow Creek	none	low	3.00	high	0.8%	low	0.0%	low
170501080104	Josephine Creek	none	low	2.05	high	0.5%	low	0.0%	low
170501080105	Lower Rock Creek	none	low	2.11	high	0.9%	low	0.0%	low
170501080201	Upper North Boulder Creek	none	low	2.44	high	0.8%	low	0.0%	low
170501080202	Lower North Boulder Creek	none	low	2.16	high	1.1%	low	0.0%	low
170501080203	Upper South Boulder Creek	none	low	4.66	high	0.3%	low	0.0%	low
170501080204	Lower South Boulder Creek	none	low	2.29	high	0.6%	low	0.0%	low
170501080205	Big Boulder Creek	none	low	3.32	high	0.9%	low	0.0%	low
170501080301	Jordan Creek Headwaters	none	low	4.80	high	0.5%	low	0.1%	low
170501080302	Louse Creek	none	low	4.54	high	0.4%	low	0.2%	low
170501080303	Jordan Creek-Flint Creek	none	low	2.22	high	0.6%	low	0.0%	low
170501080401	Williams Creek	none	low	3.67	high	0.4%	low	0.0%	low
170501080402	Lone Tree Creek	none	low	2.80	high	0.5%	low	0.0%	low
170501080403	Trout Creek	none	low	3.25	high	1.0%	low	0.0%	low
170501080404	Rail Creek	none	low	3.02	high	0.8%	low	0.0%	low
170501080501	Baxter Creek	none	low	2.80	high	0.0%	low	1.1%	low
170501080502	Hooker Creek	none	low	2.43	high	0.0%	low	0.0%	low
170501080503	Sheep Spring Creek	none	low	2.42	high	0.6%	low	0.0%	low
170501080504	Jack Creek	none	low	2.43	high	0.5%	low	0.0%	low
170501080505	Downey Creek	none	low	2.33	high	0.7%	low	0.0%	low
170501080601	Jackson Creek	none	low	3.59	high	0.2%	low	0.0%	low
170501080602	Posey Creek	none	low	2.51	high	0.3%	low	0.0%	low
170501080603	Spring Branch	none	low	2.58	high	0.3%	low	0.0%	low

Form H-8: Summary of Potential Hydrologic Risk

Subwatershed		Timber Harvest		Agriculture & Rangeland		Forest & Rural Roads		Urban Impervious	
170501080604	Mahogany Creek	none	low	2.61	high	0.8%	low	0.0%	low
170501080605	Lower Upper Cow Creek	none	low	2.41	high	0.5%	low	0.0%	low
170501080701	Cove Creek	none	low	2.49	high	0.2%	low	0.0%	low
170501080702	Jordan Craters	none	low	2.36	high	1.0%	low	0.0%	low
170501080703	Mouth Of Cow Creek	none	low	2.33	high	0.5%	low	0.0%	low
170501080801	Jordan Creek/Rock Creek Reservoir	none	low	2.29	high	0.6%	low	0.0%	low
170501080802	Rock Creek	none	low	2.38	high	0.4%	low	0.0%	low
170501080803	Jordan Creek/Merrill Springs	none	low	2.13	high	0.4%	low	0.0%	low
170501080804	Dry Creek	none	low	2.19	high	0.3%	low	0.0%	low
170501080805	Boney Canyon	none	low	1.93	high	0.4%	low	0.0%	low
	Crooked–Rattlesnake—1705010(								
170501090101	Bowden Hills	none	low	0.25	low	0.5%	low	0	low
170501090102	Black Hills	none	low	1.81	high	0.4%	low	0	low
170501090103	Headwaters Crooked Creek	none	low	2.05	high	0.2%	low	0	low
170501090104	Three Man Butte Well	none	low	1.91	high	0.5%	low	0	low
170501090105	Middle Upper Crooked Creek	none	low	1.73	high	0.4%	low	0	low
170501090106	Lower Upper Crooked Creek	none	low	1.86	high	0.2%	low	0	low
170501090201	Upper Rattlesnake Creek	none	low	2.38	high	0.6%	low	0	low
170501090202	Middle Rattlesnake Creek	none	low	1.90	high	0.5%	low	0	low
170501090203	Bull Creek	none	low	1.99	high	0.8%	low	0	low
170501090204	Tree Springs	none	low	0.24	low	0.4%	low	0	low
170501090205	Battle Creek	none	low	0.25	low	0.3%	low	0	low
170501090206	Red Hills	none	low	1.77	high	0.2%	low	0	low
170501090207	Lower Rattlesnake Creek	none	low	1.77	high	0.6%	low	0	low
170501090301	Grassy Ridge	none	low	2.53	high	0.8%	low	0	low
170501090302	Upper Wildcat Creek	none	low	2.83	high	0.0%	low	0	low
170501090303	Bone Creek	none	low	2.79	high	0.0%	low	0	low
170501090304	Lower Wildcat Creek	none	low	2.17	high	0.0%	low	0	low
170501090401	Peacock Creek	none	low	2.36	high	0.0%	low	0	low
170501090402	Upper Dry Creek	none	low	2.46	high	0.0%	low	0	low
170501090403	Middle Dry Creek	none	low	2.18	high	0.0%	low	0	low
170501090404	Indian Fort Creek	none	low	2.18	high	0.0%	low	0	low
170501090405	Corbin Creek	none	low	2.19	high	0.0%	low	0	low
170501090406	The Basin	none	low	1.76	high	0.0%	low	0	low
170501090407	Lower Dry Creek	none	low	1.82	high	0.0%	low	0	low
170501090501	The Basin South	none	low	1.74	high	0.0%	low	0	low
170501090502	Drought Creek	none	low	1.99	high	0.0%	low	0	low
170501090503	Palomino Lake	none	low	2.50	high	0.0%	low	0	low
170501090504	Upper Palomino Creek	none	low	2.94	high	0.0%	low	0	low
170501090505	Scott Butte Creek	none	low	2.18	high	0.0%	low	0	low
170501090506	Lower Palomino Creek	none	low	2.26	high	0.0%	low	0	low
170501090507	Moth [*sic*] of Crooked Creel	none	low	1.99	high	0.0%	low	0	low

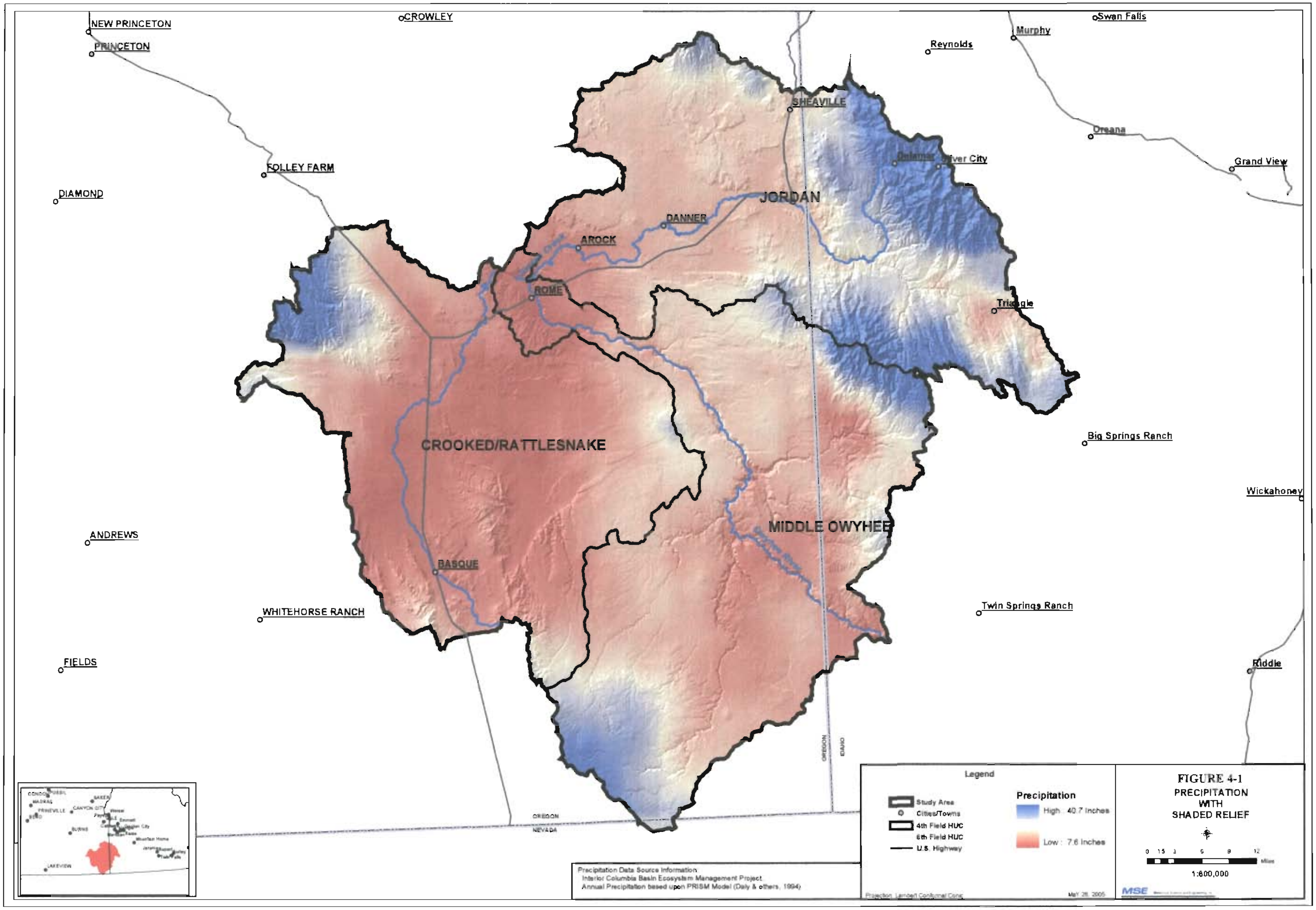


FIGURE 4-1
PRECIPITATION
WITH
SHADED RELIEF

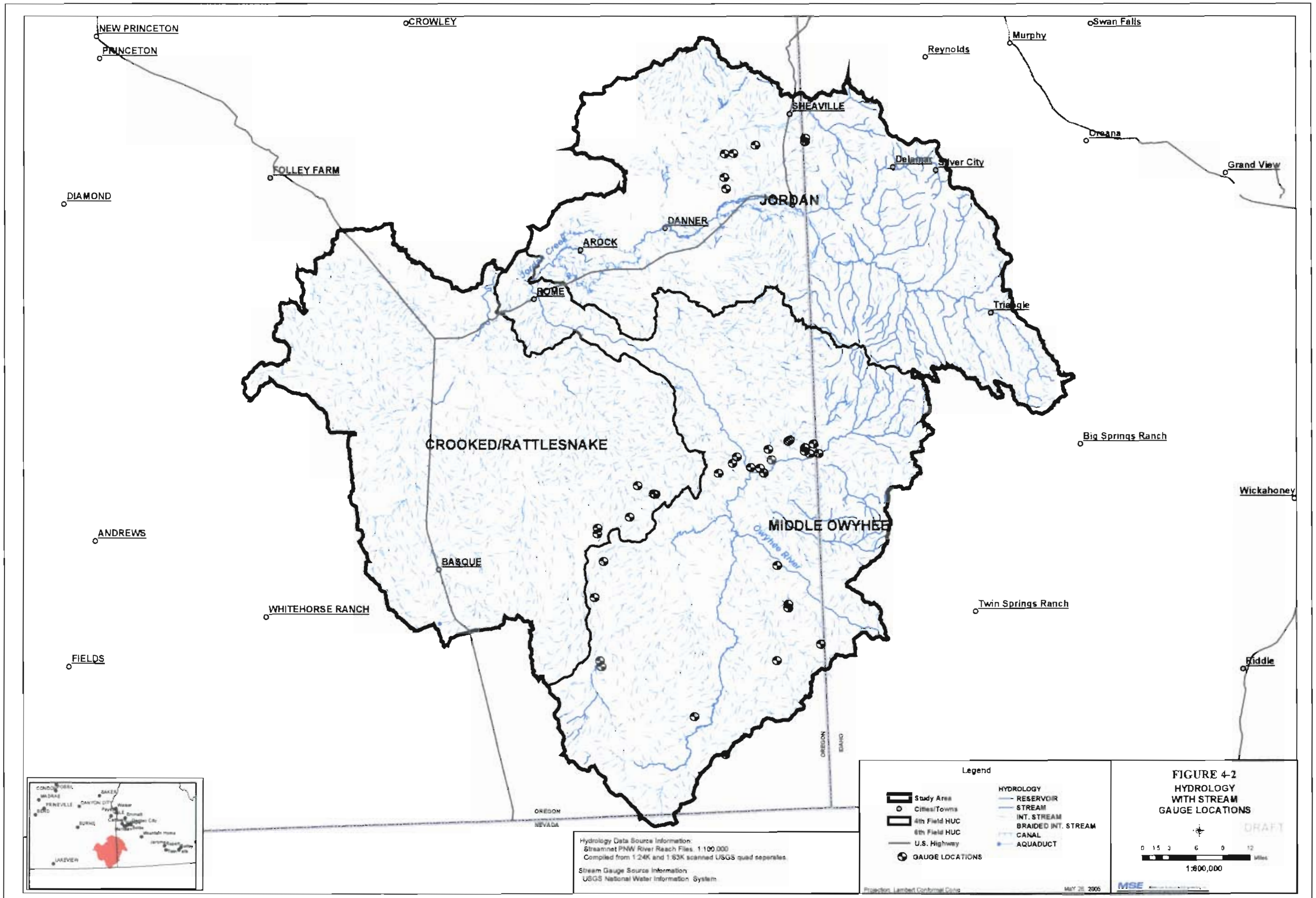


FIGURE 4-2
HYDROLOGY
WITH STREAM
GAUGE LOCATIONS

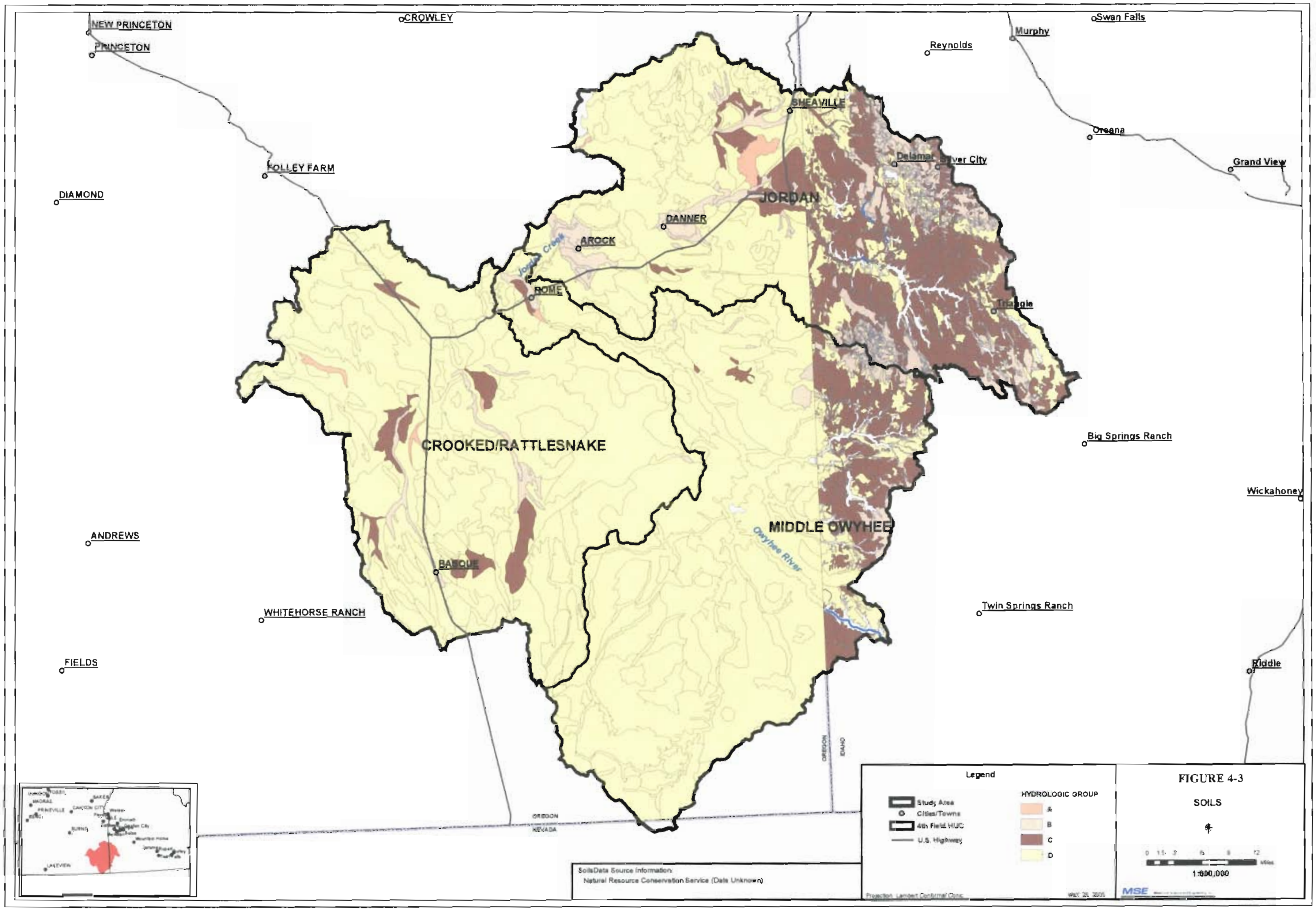


FIGURE 4-3
SOILS
NEW PRINCETON
PRINCETON
CROWLEY
Swan Falls
Murphy
Reynolds
Oreana
Grand View
SHEAVILLE
Delamar
Silver City
JORDAN
FOLLEY FARM
DIAMOND
DANNER
AROCK
Jordan Creek
ROME
Triangle
CROOKED/RATTLESNAKE
Big Springs Ranch
Wickahoney
ANDREWS
MIDDLE OWYHEE
Owyhee River
BASQUE
WHITEHORSE RANCH
Twin Springs Ranch
FIELDS
Riddle
OREGON
IDAHO
NEVADA
Legend
Study Area
Cities/Towns
4th Field HUC
U.S. Highway
HYDROLOGIC GROUP
A
B
C
D
1:600,000
Miles
SoilsData Source Information:
Natural Resource Conservation Service (Date Unknown)
MSE

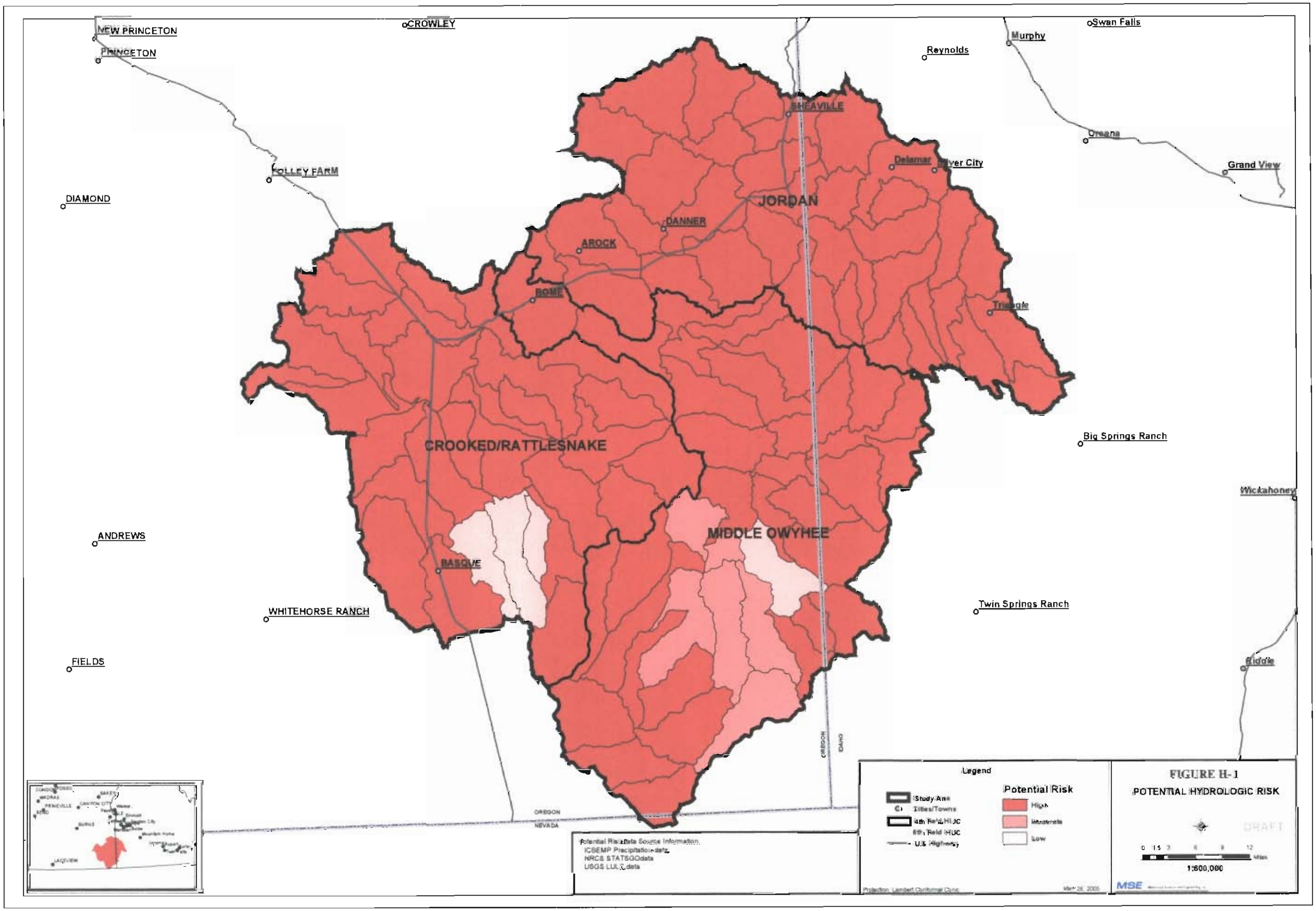


FIGURE H-1
POTENTIAL HYDROLOGIC RISK

COMPONENT 5—WATER USE

The water use component of the watershed assessment is directed at summarizing the water rights and beneficial uses for water in the basins, and assessing the impact of water use on low flows. Such impacts could reduce supply under low flow conditions. This analysis was conducted largely according to the methodology described in the Oregon Watershed Assessment Manual (OWAM; WPN 2001) with limitations due to information gaps. Data for this component included: water rights and water availability information obtained from the Oregon Water Resources Department (OWRD) Oregon Department of Fish and Wildlife (ODFW) and the Idaho Department of Water Resources (IDWR). A qualitative assessment of the impacts of water use on low flows was also performed.

- Water is primarily used for livestock from both groundwater and surface water sources;
- Only limited storage has been constructed in the basin (upstream of Owyhee Reservoir);
- No interbasin transfers occur; and
- Insufficient information is available to evaluate in detail the effect water use has on peak flows and low flows; however, flow restoration needs are primarily located within the Middle Owyhee watershed and upper reaches of the Jordan watershed.

Water Rights Summary

Form WU-1 presents the water rights summary. The data were obtained from the OWRD and IDWR. The data were summarized by Water Right Identification Number, Status, Priority Date, Diversion Rate, Type of Use, and Location (as shown on Form WU-1). Water right locations are summarized on Figure 5–1. Locations are indicated by section with the specific number of water rights in each section. This summary is limited to surface water rights.

Water Availability Summary

OWRD uses the concept of water availability to determine whether additional water rights can be issued within a designated Water Availability Basin (WAB). The water availability is the natural streamflow minus the consumptive use from existing water rights. This value varies with season and from year to year, so the 80% exceedance flow is used in practice. The 80% exceedance flow is the natural streamflow present at the pour point of the WAB in 80% of the months over the 30–year period from 1958 through 1987. Water rights may be issued if the 80% exceedance value is greater than the sum of the consumptive use, storage and in–stream water rights already issued (Cooper 2002).

Unlike the US Geological Survey (USGS) hydrologic units, the WAB do not tile across a map, they are nested. Flows at the pour points of lower WAB must by definition include the flows from upper WAB, so the boundaries of lower WAB effectively encompass upstream WABS within their boundaries. For this reason, few WAB correspond directly to a USGS hydrologic unit (Cooper 2002)

The OWRD's Water Availability Reporting System (WARS) model provides estimates of streamflows, calculated considering all relevant storages, out of stream consumptive uses, in-stream water rights, and scenic waterway flows. The WARS database was searched for the Owyhee watershed project area using watershed ID numbers and WAB numbers at the 50% exceedance level for streamflow. Only limited information was available.

Table 5-3 Flow Restoration Ranking by Water Use (ODFW)

WAB No.	Watershed ID	Description	Concern for Amount of Consumptive Use[1]			
			Winter	Spring	Summer	Fall
010500	31110901	Crooked Cr. > Owyhee R	1	1	1	1
010510	31110902	Dry Cr > Crooked Cr.	1	1	1	1
010520	31110903	Palomino Cr > Crooked Cr.	1	1	1	1
010530	31110904	Rattlesnake Cr > Crooked Cr.	1	1	1	1
010540	31110905	Drought Cr. > Crooked Cr.	1	1	1	1
010550	31110907	Unnamed > Crooked Cr.	1	1	1	1
010560	31110908	Crooked Cr. > Owyhee R.	1	1	1	1
010600	31110909	Owyhee River > Snake River ab Crooked Cr.	1	1	1	1
010610	72022	Jordan Cr. > Owyhee R	1	1	1	1
010611	31110801	Rock Cr. > Jordan Cr.	1	1	1	1
010612	31110802	Jack Cr. > Jordan Cr.	1	1	1	1
010613	31110803	Cow Cr. > Jordan Cr.	1	1	1	1
010614	72021	Jordan Cr. > Owyhee R ab Cow Cr.	1	1	1	1
010620	31110701	Soldier Cr. >Owyhee R	1	1	1	1
010630	70324	N. Fk Owyhee R > Owyhee R.	1	1	1	1
010631	31110702	M. Fk Owyhee R > N. Fk Owyhee R.				
010640	31110703	Antelope Cr > Owyhee R	1	1	1	1
010641	31110704	Unnamed > Antelope Cr	1	1	1	1
010642	31110705	Field Cr > Antelope Cr	1	1	1	1
010643	31110706	Antelope Cr > Owyhee R ab Field Cr	1	1	1	1
010650	31110707	W Little Owyhee R > Owyhee R	1	1	1	1
010651	31110708	Toppin Cr > W Little Owyhee R	1	1	1	1
010652	31110709	W Little Owyhee R > Owyhee R	1	1	1	1

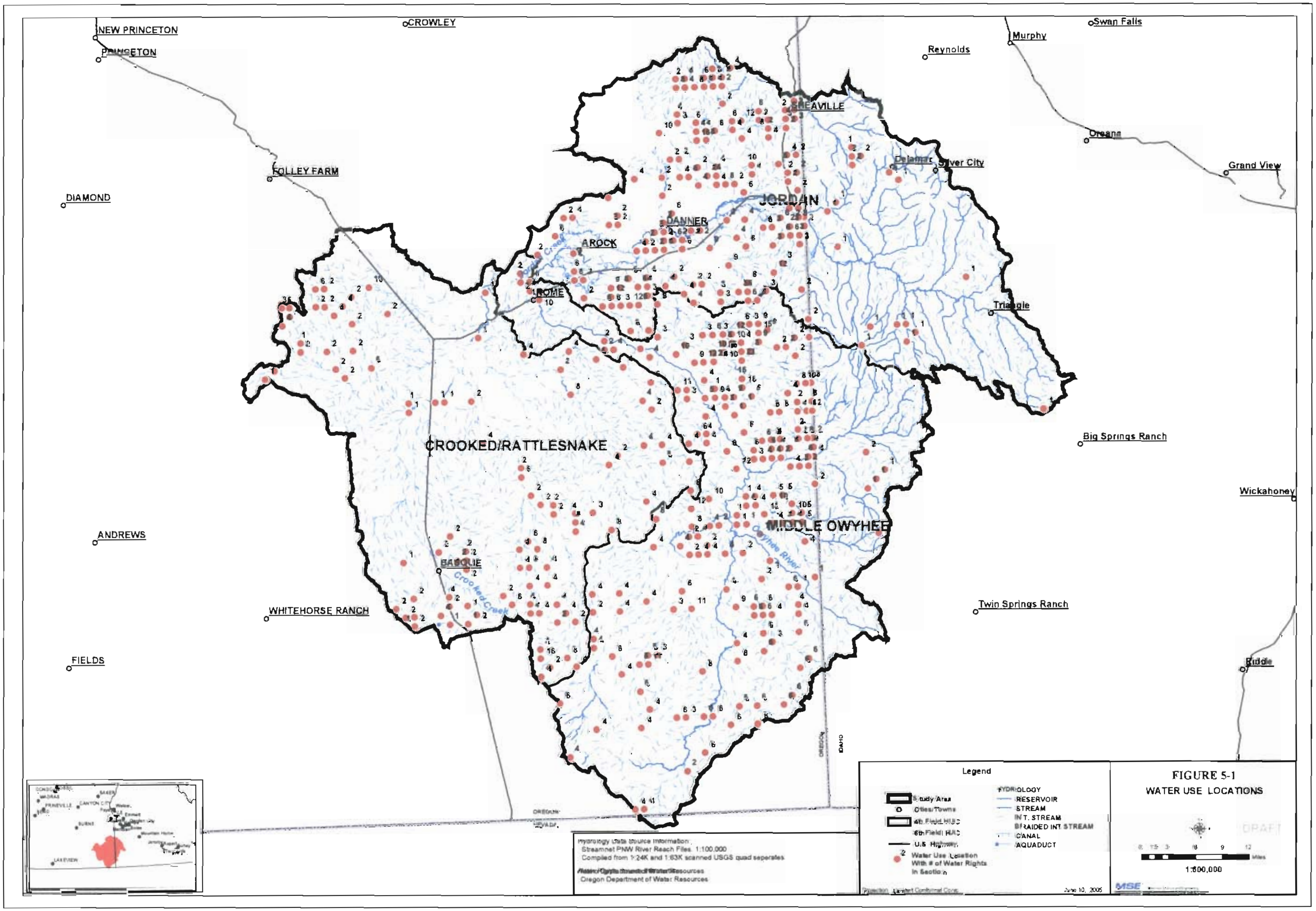
Note 1. Concern for amount of consumptive use is ranked as follows:
1 denotes <1%
2 denotes 1-10%
3 denotes 10-20%
4 denotes > 20%

OWRD 2005. *Water Availability Report System (WARS)*. http://www.wrd.state.or.us/OWRD/WR/index.shtml#Water_Availability_Report_System, accessed June 2005.

WPN 2001. *Hydrologic Process Identification for Eastern Oregon*. Prepared by Watershed Professionals Network for Watershed Enhancement Board, Salem, Oregon as Appendix 2 to the *Oregon Watershed Assessment Manual*.

WPN 1999. *Oregon Watershed Assessment Manual*. Watershed Professionals Network, prepared for the Governor's Watershed Enhancement Board, Salem, Oregon.

05-wateruse.doc



NEW PRINCETON
PRINCETON
CROWLEY
DIAMOND
FOLLEY FARM
ANDREWS
WHITEHORSE RANCH
FIELDS
Murphy
Swan Falls
Reynolds
Oreana
Grand View
Delamar
Silver City
Triangle
Big Springs Ranch
Wickahoney
Twin Springs Ranch
Riddle
JORDAN
DANNER
AROCK
ROME
CROOKED/RATTLESNAKE
BASQUE
Crooked Creek
MIDDLE OWYHEE
Owyhee River
OREGON
IDAHO
NEVADA
Legend
Study Area
Cities/Towns
4th Field HUC
6th Field HUC
U.S. Highway
Water Use Location With # of Water Rights in Section
HYDROLOGY
RESERVOIR
STREAM
INT. STREAM
BRAIDED INT STREAM
CANAL
AQUADUCT
Hydrology Data Source Information:
Streamnet PNW River Reach Files 1:100,000
Compiled from 1:24K and 1:63K scanned USGS quad seperates
Oregon Department of Water Resources
FIGURE 5-1
WATER USE LOCATIONS
DRAFT
1:600,000
Miles
June 10, 2005
MSE

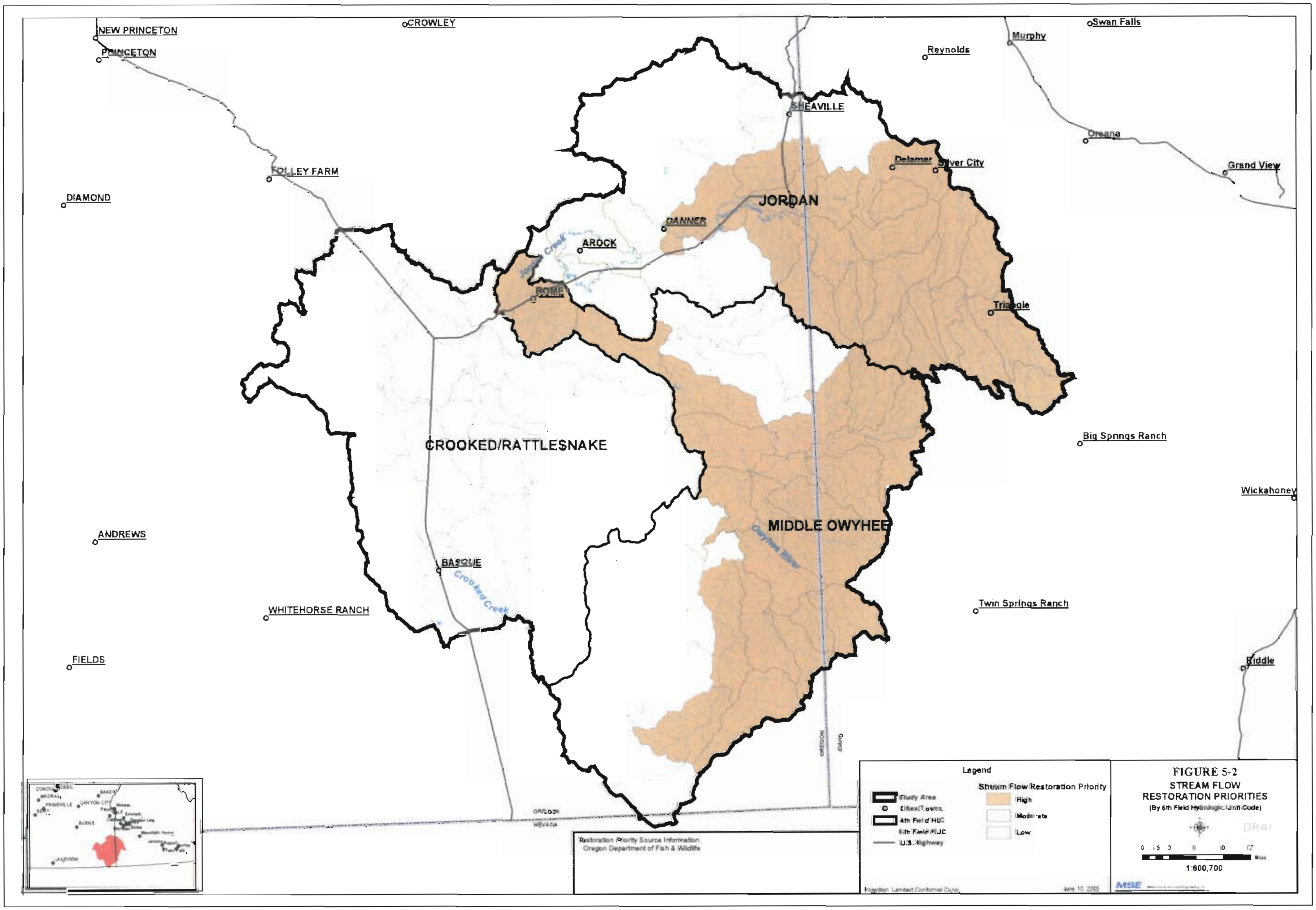


FIGURE 5-2
STREAM FLOW
RESTORATION PRIORITIES
(By 6th Field Hydrologic Unit Code)
1:600,700
Legend
Study Area
Cities/Towns
4th Field HUC
6th Field HUC
U.S. Highway
Stream Flow Restoration Priority
High
Moderate
Low
Restoration Priority Source Information:
Oregon Department of Fish & Wildlife
JORDAN
MIDDLE OWYHEE
CROOKED/RATTLESNAKE
Owyhee River
Crooked Creek
Jordan Creek
NEW PRINCETON
PRINCETON
CROWLEY
FOLLEY FARM
DIAMOND
ANDREWS
WHITEHORSE RANCH
FIELDS
BASQUE
ROME
AROCK
DANNER
SHEAVILLE
Reynolds
Murphy
Swan Falls
Oreana
Grand View
Delamar
Silver City
Triangle
Big Springs Ranch
Wickahoney
Twin Springs Ranch
Riddle
OREGON
NEVADA
IDAHO
MSE

COMPONENT 6—RIPARIAN ASSESSMENT

The purpose of this component is to provide information on the locations, attributes and current condition of riparian areas and their potential impact on the recruitment of coarse wood ("woody debris") to the stream channel. Information presented in this chapter was compiled from literature, agency databases, field visits and aerial photo review of limited portions of the study area. This component is organized into the following sections:

- Riparian Introduction
- Methods
- Results

Riparian Introduction

Riparian habitats have long been recognized in the arid west as one of the most limited and vulnerable plant communities. Riparian areas are generally defined as areas directly adjacent to the stream channel that interact and are dependent to the stream for biologic integrity. Riparian areas perform many of the same functions as classical wetlands do but do not possess the hydric soils or the hydrology to be defined as wetlands under the *Federal Manual for the Identification and Delineation of Wetlands,* even though they are classified as palustrine forested or palustrine scrub by the Natural Wetlands Inventory. Riparian habitats play a variety of important functions in protecting and enhancing water quality in streams, such as:

- Maintaining cool water temperatures through provision of shade and creation of a cool and humid microclimate over the stream;
- Providing food resources for the aquatic ecosystem in the form of leaves, branches, and terrestrial insects;
- Stabilizing stream banks through provision of root cohesion on banks and floodplains;
- Filtering sediment from upslope sources;
- Filtering chemicals and nutrients from upslope sources;
- Supplying coarse wood to the channel, which maintains channel form and improves in-stream habitat complexity;
- Helping maintain channel form and in-stream habitat through the restriction of sediment input or slowing of sediment moving through the system; and
- Moderating downstream flood peaks through temporary upstream storage of water.

A summary of potential riparian vegetation in the Snake River Basin/High Desert Ecoregion of southeastern Oregon is presented in Table 6-1.

Table 6-1. Potential Streamside Vegetation.

Channel Habitat Group	Riparian Area (RA1) Zone	RA1 Description
Constrained	0-25 ft.	**Type:** Hardwoods (black & narrow leaf cottonwoods, aspen) & shrubs (willows, mountain alder, hawthorn, chokecherry, wood's rose & silver sage). **Size:** Small **Density:** Dense
Semi-Constrained	0-50 ft.	**Type:** Hardwoods (black & narrow leaf cottonwoods, aspen) & shrubs (willows, mountain alder, hawthorn, chokecherry, wood's rose & silver sage). **Size:** Small **Density:** Dense
Un-Constrained	0-75 ft.	**Type:** Hardwoods (black & narrow leaf cottonwoods, aspen) & shrubs (willows, mountain alder, hawthorn, chokecherry, wood's rose & silver sage). **Size:** Small **Density:** Dense

From *Oregon Watershed Assessment Manual* – Ecoregion Description

Methods

Given the large extent of the study area (approximately 2.6 million acres) only limited evaluation of riparian conditions could be conducted. The conditions assessment was performed for 9 separate subwatershed areas where limited field visits were conducted (see Component 3). Riparian Condition Units (RCUs) were designated for each of the nine sites and the respective channel habitat types. RCUs were determined using aerial photography (digital orthoquadrangle; DOQ). An entire survey reach was used to determine the units, from one tributary to the next upstream. RCUs were broken out where there were changes in the vegetation pattern along the stream channel. Each CHT had a least one RCU.

Based on various information sources, a table of Riparian Condition Unit Information (Form R-1) was prepared in general conformance with the *Oregon Watershed Assessment Manual* (WPN, 1999). It includes the following information:

- **Riparian Condition Unit (RCU)** – An RCU is a portion of the riparian area for which riparian vegetation type, size, and density remain approximately the same. Each RCU was assigned an individual numeric identification.
- **Subwatershed** – Identification of subwatershed by HUC.
- **Ecoregion** – Level IV Ecoregions as defined by Omernik, *et al.*
- **Channel Habitat Type (CHT)** – Existing stream classification system based on 15 channel types, as determined in Component 3.
- **Stream Size** – Stream size (small, medium or large) was noted for each assessment. Small was used for intermittent streams and medium was used for perennial streams. Large streams were not evaluated within the 9 subwatersheds evaluated.
- **Shade Origin** – This was estimated from the land use/land cover as defined by USGS

- **Shade (%)** – This is an estimate of the amount of shade that the RCU receives. All areas displayed very limited stream cover of less than 40% (as defined by WFPB, 1997). For this evaluation rangeland/non-forested areas were assigned a <5% value and evergreen (juniper) forest land was assigned a 5-20% value

Limited field visits were conducted at each of the 9 subwatersheds, as described in Component 3. Field visits were conducted prior to performing the riparian assessment and provided a level of familiarity with each subwatershed, however, was not used to verify specific RCUs.

Results/Summary

The following section summarizes aerial photo interpretation and riparian assessment for selected areas.

Jordan Creek Headwaters (170501080301):

The vegetation in the riparian area was consistent with that of the ecoregion. RCUs were delineated where there was a change in the vegetation structure around the creek. For example, vegetation is located further off stream in some areas with increased shrubs, rather than mixed conifer and hardwood. Jordan Creek has riparian vegetation that is typical of this ecoregion.

Upper Rock Creek (170501080102):

The site that was visited in the field is covered with clouds on the DOQ. Delineation of the RCUs began directly upstream of this area. This stream has vegetation that is indicative of this ecoregion for riparian areas. Other comments: Moving downstream on the left bank there are increased areas of no riparian vegetation that is indicative to the ecoregion. Multiple meander bends have exposed gravel and bare ground throughout the reach. This is most likely be due to high discharge events that are frequent in semi-arid ecosystems, but may be impacted by land management practices.

Baxter Creek(170501080501):

The reach was mapped above the first tributary, starting right south of the farm. This creek is known to be intermittent. There is some evidence from aerial photography interpretation that the creek may go subsurface for part of the reach. Overall, this channel does not present typical vegetation of this ecoregion.

Headwaters Crooked Creek (170501090103):

The entire reach within this HUC was delineated for RCUs. This channel is intermittent and does not have typical riparian vegetation for this ecoregion.

Palomino Creek (170501090504):

This channel does not have vegetation indicative of the ecoregion, but this may be due to the intermittent nature of the stream. Two water impoundments are located upstream.

Drought Creek (170501090502):

The site sampled in the field was Bone Creek, not Drought Creek. Overall, the site indicates that native vegetation of this ecoregion is present.

Form R-1 provides a summary of preliminary attributes for each RCU identified in the nine sub-basins evaluated for this assessment. Map 6-1 displays the various RCU segments for each of the nine sub-basins. Map 6-3 displays the shade percentage as presented in Form R-1.

Conclusions

For each subwatershed the current riparian conditions were compared to potential vegetation descriptions for this ecoregion (Table 6-1). For Jordan Creek Headwaters (170501080301) and Upper Rock Creek (170501080102) recruitment potential for large woody debris was considered adequate for the ecoregion, although limited. For the remainder of the study areas recruitment potential was inadequate. These channels were generally intermittent and dominated by shrubs and grasses with limited to no potential for development of large woody debris. This is likely a reflection of a coarseness in the ecoregion data rather than a reflection of poor riparian health within these subwatersheds. Being located within a semi-arid portion of the region, the growth of large woody plants is very limited throughout most of the watershed outside of higher elevation areas.

Literature Cited

Watershed Professionals Network. 1999. *Oregon Watershed Assessment Manual.* June 1999. Prepared for the Governor's Watershed Enhancement Board, Salem, Oregon.

Form R1: Riparuian Condition Units

RCU	Length (ft)	Stream/Lake	Subwatershed	Ecoregion	CHT	Stream Size	SHADE ORIGIN	Shade (%)
1	4784.61	Stream	170501080102	Owyhee Uplands and Canyons	FP3	Medium	MIXED RANGELAND	<5%
2	1463.62	Stream	170501080102	Owyhee Uplands and Canyons	FP3	Medium	MIXED RANGELAND	<5%
2	100.58	Stream	170501080102	Owyhee Uplands and Canyons	FP3	Medium	NONFORESTED WETLANDS	<5%
3	4958.80	Stream	170501080501	Owyhee Uplands and Canyons	MC	Small	MIXED RANGELAND	<5%
4	1710.50	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
5	701.49	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
6	821.46	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
7	1130.41	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
8	701.92	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
9	2609.31	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
10	1396.47	Stream	170501080102	Owyhee Uplands and Canyons	FP3	Medium	MIXED RANGELAND	<5%
10	2117.43	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
10	2850.41	Stream	170501080102	Owyhee Uplands and Canyons	FP3	Medium	NONFORESTED WETLANDS	<5%
11	645.12	Stream	170501080501	Owyhee Uplands and Canyons	LM	Small	MIXED RANGELAND	<5%
14	2506.66	Stream	170501090504	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
15	7330.69	Stream	170501090504	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
15	249.91	Stream	170501090504	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
15	557.24	Stream	170501090504	Dissected High Lava Plateau	FP2	Small	SHRUB AND BRUSH RANGELAND	<5%
16	7014.25	Stream	170501090504	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
17	971.71	Stream	170501090504	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
18	2068.56	Stream	170501090504	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
19	1682.21	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	EVERGREEN FOREST LAND	5-20%
20	1678.78	Stream	170501070301	Owyhee Uplands and Canyons	MC	Medium	EVERGREEN FOREST LAND	5-20%
21	2210.46	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	EVERGREEN FOREST LAND	5-20%
21	797.43	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	EVERGREEN FOREST LAND	5-20%
21	1207.92	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
21	301.99	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
22	144.76	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
22	505.52	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
23	1169.32	Stream	170501070301	Dissected High Lava Plateau	MC	Medium	EVERGREEN FOREST LAND	5-20%
23	3058.51	Stream	170501070301	Dissected High Lava Plateau	MC	Medium	MIXED RANGELAND	<5%
24	1298.10	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	EVERGREEN FOREST LAND	5-20%
24	164.87	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	EVERGREEN FOREST LAND	5-20%
24	353.26	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	EVERGREEN FOREST LAND	5-20%
24	459.49	Stream	170501070301	Dissected High Lava Plateau	LC	Medium	EVERGREEN FOREST LAND	5-20%

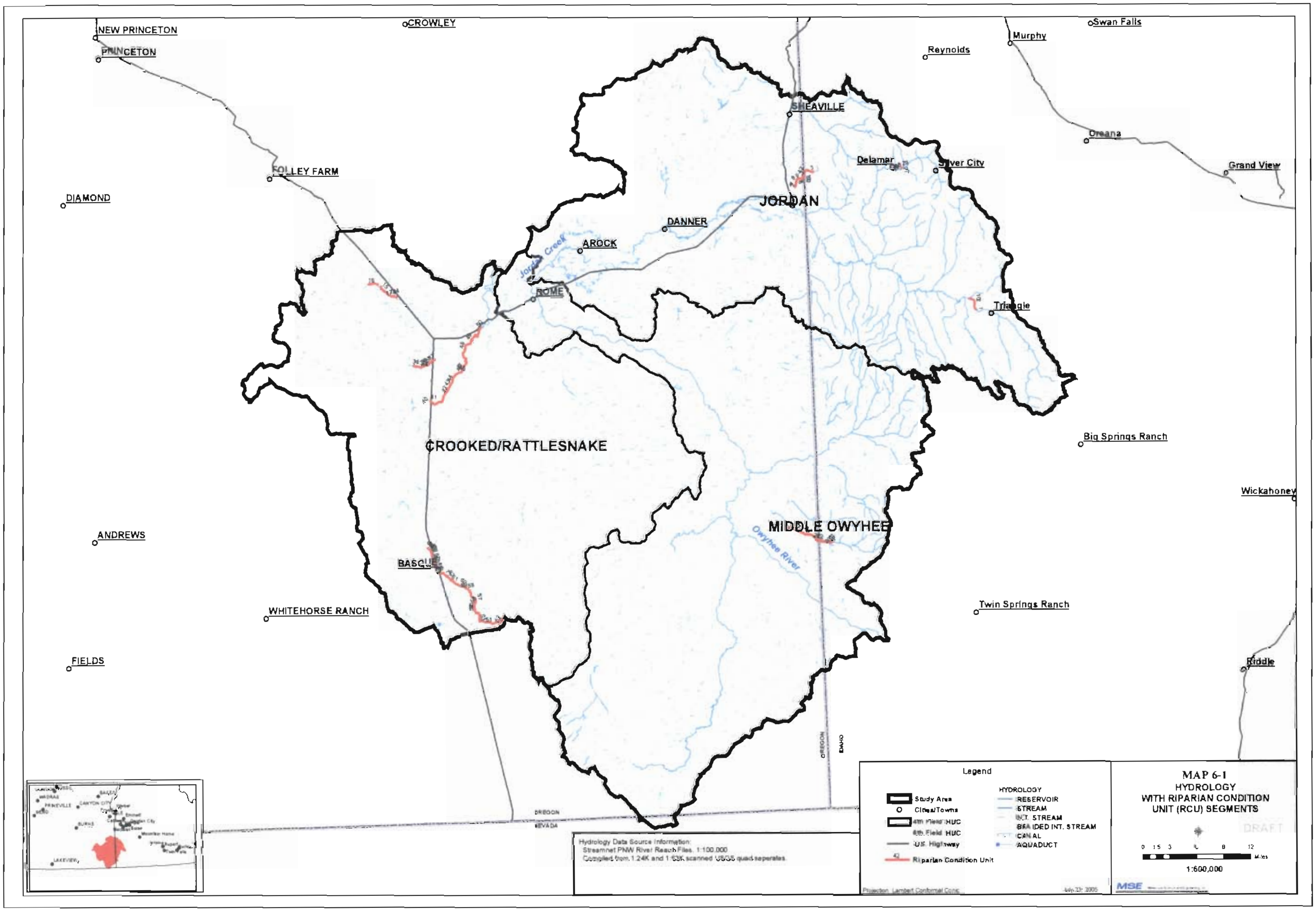
RCU	Length (ft)	Stream/Lake	Subwatershed	Ecoregion	CHT	Stream Size	SHADE ORIGIN	Shade (%)
24	5372.25	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	EVERGREEN FOREST LAND	5-20%
24	119.63	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
24	153.28	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
24	545.37	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
24	175.90	Stream	170501070301	Dissected High Lava Plateau	LC	Medium	MIXED RANGELAND	<5%
24	359.49	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
24	410.65	Stream	170501070301	Owyhee Uplands and Canyons	LC	Medium	MIXED RANGELAND	<5%
24	838.31	Stream	170501070301	Dissected High Lava Plateau	LC	Medium	MIXED RANGELAND	<5%
25	7269.37	Stream	170501070301	Dissected High Lava Plateau	LC	Medium	MIXED RANGELAND	<5%
26	361.16	Stream	170501080301	Semiarid Uplands	MM	Medium	EVERGREEN FOREST LAND	5-20%
27	322.31	Stream	170501080301	Semiarid Uplands	MM	Medium	EVERGREEN FOREST LAND	5-20%
28	982.12	Stream	170501080301	Semiarid Uplands	MM	Medium	EVERGREEN FOREST LAND	5-20%
29	175.64	Stream	170501080301	Semiarid Uplands	MM	Medium	EVERGREEN FOREST LAND	5-20%
30	128.50	Stream	170501080301	Semiarid Uplands	MM	Medium	EVERGREEN FOREST LAND	5-20%
34	130.34	Stream	170501090502	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
35	1565.80	Stream	170501090502	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
36	5096.14	Stream	170501090502	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
37	3727.44	Stream	170501090502	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
38	1523.10	Stream	170501090502	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
39	3667.99	Stream	170501090502	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
40	20.33	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
41	1947.27	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	MIXED RANGELAND	<5%
41	5180.17	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	MIXED RANGELAND	<5%
41	4079.32	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	MIXED RANGELAND	<5%
41	18.24	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	MIXED RANGELAND	<5%
41	5058.38	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	NONFORESTED WETLANDS	<5%
41	802.13	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	NONFORESTED WETLANDS	<5%
41	577.67	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	NONFORESTED WETLANDS	<5%
41	137.03	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	RESERVOIRS	<5%
42	1069.50	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	MIXED RANGELAND	<5%
43	3629.67	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	MIXED RANGELAND	<5%
44	4519.18	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	CROPLAND AND PASTURE	<5%
44	2456.63	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
44	724.32	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	SANDY AREAS OTHER THAN BEACHES	<5%
45	403.69	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%

Form R1: Riparuian Condition Units

RCU	Length (ft)	Stream/Lake	Subwatershed	Ecoregion	CHT	Stream Size	SHADE ORIGIN	Shade (%)
45	27.56	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
45	182.14	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	SANDY AREAS OTHER THAN BEACHES	<5%
45	1178.17	Stream	170501090502	Dissected High Lava Plateau	FP2	Small	SANDY AREAS OTHER THAN BEACHES	<5%
46	754.07	Stream	170501090502	Dissected High Lava Plateau	LC	Small	MIXED RANGELAND	<5%
47	15410.59	Stream	170501090502	Dissected High Lava Plateau	LC	Small	MIXED RANGELAND	<5%
48	6944.14	Stream	170501090502	Dissected High Lava Plateau	LC	Small	MIXED RANGELAND	<5%
49	850.22	Stream	170501090502	Dissected High Lava Plateau	LC	Medium	CROPLAND AND PASTURE	<5%
49	3200.29	Stream	170501090502	Dissected High Lava Plateau	LC	Medium	MIXED RANGELAND	<5%
49	1062.82	Stream	170501090502	Dissected High Lava Plateau	LC	Medium	MIXED RANGELAND	<5%
49	857.19	Stream	170501090502	Dissected High Lava Plateau	LC	Medium	MIXED RANGELAND	<5%
49	20.99	Stream	170501090502	Dissected High Lava Plateau	LC	Medium	MIXED RANGELAND	<5%
49	3061.68	Stream	170501090502	Dissected High Lava Plateau	LC	Medium	SANDY AREAS OTHER THAN BEACHES	<5%
49	3212.20	Stream	170501090502	Dissected High Lava Plateau	LC	Medium	SANDY AREAS OTHER THAN BEACHES	<5%
50	1393.44	Stream	170501090502	Dissected High Lava Plateau	FP2	Medium	MIXED RANGELAND	<5%
51	8094.95	Stream	170501090103	Dissected High Lava Plateau	MM	Small	SHRUB AND BRUSH RANGELAND	<5%
52	2615.32	Stream	170501090103	High Lava Plains	MH	Small	MIXED RANGELAND	<5%
52	4517.31	Stream	170501090103	Dissected High Lava Plateau	MH	Small	SHRUB AND BRUSH RANGELAND	<5%
52	792.76	Stream	170501090103	High Lava Plains	MH	Small	SHRUB AND BRUSH RANGELAND	<5%
53	2273.09	Stream	170501090103	Dissected High Lava Plateau	LC	Small	MIXED RANGELAND	<5%
53	5334.74	Stream	170501090103	Dissected High Lava Plateau	LC	Small	SHRUB AND BRUSH RANGELAND	<5%
53	292.07	Stream	170501090103	Dissected High Lava Plateau	LC	Small	SHRUB AND BRUSH RANGELAND	<5%
54	1161.67	Stream	170501090103	Dissected High Lava Plateau	LC	Small	SHRUB AND BRUSH RANGELAND	<5%
55	296.88	Stream	170501090103	Dissected High Lava Plateau	LC	Small	MIXED RANGELAND	<5%
55	2371.48	Stream	170501090103	Dissected High Lava Plateau	LC	Small	SHRUB AND BRUSH RANGELAND	<5%
56	2585.88	Stream	170501090103	Dissected High Lava Plateau	LC	Small	MIXED RANGELAND	<5%
57	1010.38	Stream	170501090103	Dissected High Lava Plateau	LM	Small	CROPLAND AND PASTURE	<5%
57	6352.34	Stream	170501090103	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
57	1035.20	Stream	170501090103	Dissected High Lava Plateau	LM	Small	MIXED RANGELAND	<5%
58	1382.60	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
59	3084.15	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
60	4897.96	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
61	5100.58	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
62	3535.70	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
63	861.53	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	MIXED RANGELAND	<5%
64	1391.11	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	MIXED RANGELAND	<5%

Form R1: Riparuian Condition Units

RCU	Length (ft)	Stream/Lake	Subwatershed	Ecoregion	CHT	Stream Size	SHADE ORIGIN	Shade (%)
65	1216.07	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	MIXED RANGELAND	<5%
66	758.41	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	MIXED RANGELAND	<5%
67	4930.47	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	MIXED RANGELAND	<5%
68	338.80	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	CROPLAND AND PASTURE	<5%
68	268.16	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	MIXED RANGELAND	<5%
68	691.96	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	SANDY AREAS OTHER THAN BEACHES	<5%
68	886.15	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	SANDY AREAS OTHER THAN BEACHES	<5%
69	3613.43	Stream	170501090103	Dissected High Lava Plateau	FP1	Small	SANDY AREAS OTHER THAN BEACHES	<5%
70	835.19	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	CROPLAND AND PASTURE	<5%
70	2389.89	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%
70	1421.65	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	SANDY AREAS OTHER THAN BEACHES	<5%
71	1478.29	Stream	170501090103	Dissected High Lava Plateau	FP2	Small	MIXED RANGELAND	<5%



MAP 6-1
HYDROLOGY
WITH RIPARIAN CONDITION
UNIT (RCU) SEGMENTS
1:600,000
Legend
Study Area
Cities/Towns
4th Field HUC
6th Field HUC
U.S. Highway
Riparian Condition Unit
HYDROLOGY
RESERVOIR
STREAM
INT. STREAM
BRAIDED INT. STREAM
CANAL
AQUADUCT
Hydrology Data Source Information:
Streamnet PNW River Reach Files, 1:100,000
Compiled from 1:24K and 1:63K scanned USGS quad seperates
JORDAN
MIDDLE OWYHEE
CROOKED/RATTLESNAKE
Owyhee River
Jordan Creek
NEW PRINCETON
PRINCETON
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Oreana
Grand View
Big Springs Ranch
Wickahoney
Twin Springs Ranch
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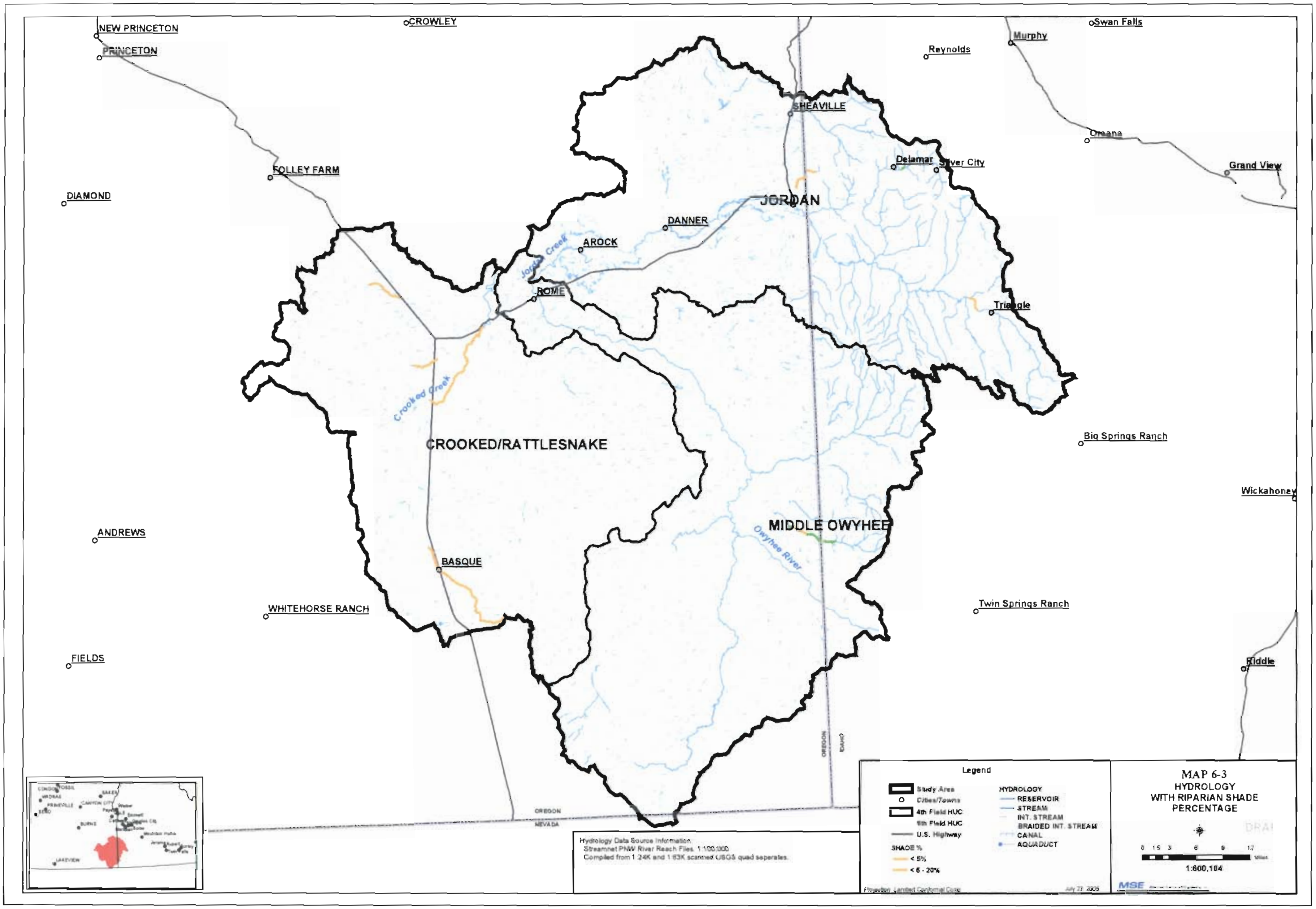
MAP 6-3
HYDROLOGY
WITH RIPARIAN SHADE
PERCENTAGE
1:600,104
Legend
Study Area
Cities/Towns
4th Field HUC
5th Field HUC
U.S. Highway
SHADE %
< 5%
< 5 - 20%
HYDROLOGY
RESERVOIR
STREAM
INT. STREAM
BRAIDED INT. STREAM
CANAL
AQUADUCT
Hydrology Data Source Information:
Streamnet PNW River Reach Files, 1:100,000
Compiled from 1:24K and 1:63K scanned USGS quad seperates.
CROOKED/RATTLESNAKE
JORDAN
MIDDLE OWYHEE
Owyhee River
Crooked Creek
Jordan Creek
NEW PRINCETON
PRINCETON
CROWLEY
FOLLEY FARM
DIAMOND
ANDREWS
WHITEHORSE RANCH
FIELDS
BASQUE
ROME
AROCK
DANNER
SHEAVILLE
Delamar
Silver City
Triangle
Reynolds
Murphy
Swan Falls
Oreana
Grand View
Big Springs Ranch
Wickahoney
Twin Springs Ranch
Riddle
OREGON
NEVADA
IDAHO

Component 7—Wetlands Assessment

The purpose of this component is to provide information on the locations, attributes and functioning condition and to summarize the current conditions (when information was available) of wetlands in the study area. Wetland attributes include size, habitat type, surrounding land use, connectivity, and opportunities for restoration (WPN, 1999). Information presented in this chapter was compiled from literature, agency documents, agency field notes, agency databases, and interviews with government personnel familiar with wetland habitats in the study area. This chapter is organized into the following sections:

- Wetland Introduction
- Methods
- Results

Wetland Introduction

Wetlands are defined by regulatory agencies as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil condition" (ACOE, 1987). Wetland characteristics include hydrophytic (water-loving) vegetation, hydric soils, and semi-permanent or permanent water.

Wetlands provide many critical functions to watersheds, such as water quality improvement, floodwater storage, fish and wildlife habitat, biological productivity and aesthetics (EPA, 2002). Water quality improvement functions include nutrient retention and transformation, sediment collection, and trace metal and organic material retention. Not all wetlands can perform all of these functions, rather the functions that wetlands perform depend upon the quantity of water in the wetland, wetland size, and wetland position within the watershed. For example, wetlands located low in the watershed play a more significant role in floodwater retention than wetlands located high in the watershed. Wetlands located high in the watershed may provide a year-round water supply to streams.

Wetlands vary in hydrologic conditions, size, location, and degree of human influence (Mitsch and Gosselink, 1993). Many wetland classification systems have been developed in an attempt to categorize their diversity. This report uses the Cowardin classification system, also used in the National Wetland Inventory (NWI) being conducted by the FWS (Cowardin *et al.*, 1979). This system uses wetland type, vegetation or substrate type and hydrology to classify wetlands. It is a hierarchical approach, progressing from more general levels (System and Subsystems) to more specific levels (Classes, Subclasses, and Dominance Types). Table 7.1 lists the more common wetland types occurring in the study area.

Table 7-1. Common NWI wetland types in the study area.

Code	System	Class	Water Regime
PEMA	P = Palustrine	EM = Emergent	A = Temporarily flooded
PEMB	P = Palustrine	EM = Emergent	B = Saturated
PEMC	P = Palustrine	EM = Emergent	C = Seasonally flooded
PEMCh	P = Palustrine	EM = Emergent	C = Seasonally flooded H = Diked/Impounded
PEMCx	P = Palustrine	EM = Emergent	C = Seasonally flooded X = Excavated
PEMF	P = Palustrine	EM = Emergent	F = Semipermanently flooded
PEMFh	P = Palustrine	EM = Emergent	F = Semipermanently flooded H = Diked/Impounded
PEMFx	P = Palustrine	EM = Emergent	F = Semipermanently flooded X = Excavated
PSSA	P = Palustrine	SS = Scrub/Shrub	A = Temporarily flooded
PSSC	P = Palustrine	SS = Scrub/Shrub	C = Seasonally flooded
PSSF	P = Palustrine	SS = Scrub/Shrub	F = Semipermanently flooded
PSSJ	P = Palustrine	SS = Scrub/Shrub	J = Intermittently flooded
PUSC	P = Palustrine	US = Unconsolidated Shore	C = Seasonally flooded
PUSCh	P = Palustrine	US = Unconsolidated Shore	C = Seasonally flooded H = Diked/Impounded
PUSCx	P = Palustrine	US = Unconsolidated Shore	C = Seasonally flooded X = Excavated
PUBFx	P = Palustrine	UB = Unconsolidated Bottom	F = Semipermanently flooded X = Excavated
PUBH	P = Palustrine	UB = Unconsolidated Bottom	H = Permanently flooded
PABF	P = Palustrine	AB = Aquatic Bed	F = Semipermanently flooded
PABFh	P = Palustrine	AB = Aquatic Bed	F = Semipermanently flooded H = Diked/Impounded
PABHh	P = Palustrine	AB = Aquatic Bed	H = Permanently flooded H = Diked/Impounded
PFOC	P = Palustrine	FO = Forested	C = Seasonally flooded

Wetlands codes are from the Cowardin Wetland Classification used by NWI (Cowardin, 1979).

The "System" taxonomic unit is the most general and is intended to group wetlands that share similar hydrologic, geomorphologic, chemical, or biological characteristics. Palustrine wetlands are non-tidal wetlands dominated by trees, shrubs, and persistent emergents. The majority of the wetlands in the study area fall into the Palustrine system. The "Class" taxonomic unit describes the general appearance of the wetland in terms of either the dominant life form of the vegetation or the physiography and composition of the substrate. These are features that can be recognized without the aid of detailed field measurements (Cowardin *et al.*, 1979). Emergents are rooted herbaceous plants such as cattails, sedge, and rush. A scrub/shrub class includes wetlands land are dominated by shrubs and sapling trees less than 20 feet tall.

Naturally occurring wetlands in the study area are relatively uncommon. Many wetlands have been created as a result of human activities such as constructed impoundments.

Methods

Primary sources of wetland information in the study area included the land use and land cover geographic information system (GIS) data set created by the U.S. Geologic Survey (USGS) and 1:24,000 scale NWI maps created by the U.S. Fish and Wildlife Service (FWS). None of the NWI maps within the study area had been digitized, so we gathered data from the hard copy maps, which were obtained from the Oregon Department of State Lands (Oregon maps) and the University of Massachusetts (Idaho maps). Given the large extent of the study area (approximately 2.6 million acres) and lack of digitized data, it was not feasible to examine all of the NWI maps that the study area included. As a result, we employed the following methods to obtain the most reasonably ascertainable information about wetland locations and conditions in the study area.

First, the USGS land use and land cover data set was examined to locate areas that have been categorized as wetlands. These wetland areas were then compared to the NWI maps. Each wetland identified by both the USGS data set and the NWI maps was assigned a unique identifier, and the three dominant Cowardin classification codes were recorded. There are many limitations to this approach. First, the NWI maps identified many other wetland areas that were not included in the USGS land use and land cover data set. Second, the NWI maps are based on aerial photo interpretation and not on-ground field inventories of wetlands. Field inventories generally identify wetlands in addition to those included on the NWI maps. Third, the USGS land use and land cover data set is based on aerial photography dated between 1970 and 1980. This data set often overestimated wetland areas because the scale was too coarse to identify the exact wetland boundaries. Other land cover data sets (such as those used in the Interior Columbia Basin Ecosystem Management Project) lacked the resolution required for detecting wetland areas within the study area. Given the combination of these factors, it is probable that the wetland acreages we present in the Results section of this chapter are different from actual conditions in the study area.

Information regarding current wetland conditions, wetland reserve programs, and restoration initiatives in the study area was sought from various agencies including the Oregon BLM, Idaho BLM, Oregon Fish and Wildlife Wetlands Joint Venture Program, Oregon NRCS Wetlands Reserve Program, Malheur County Soil and Water Conservation District, Idaho Soil Conservation Commission, Oregon Department of Lands, and Idaho Department of Lands.

Based on various information sources, a table of wetland attributes (Form W-1) was prepared according to the Oregon Watershed Assessment Manual (WPN, 1999). It includes the following information:

- **Wetland ID** – Each wetland was assigned an individual alpha-numeric identification. This was created by combining a subbasin abbreviation then a consecutive number within the subbasin. For example, the first wetland in the Jordan Creek subbasin was assigned JO-1.
- **Subbasin** – Middle Owyhee (17050107), Jordan (17050108), and Crooked-Rattlesnake (1705109).
- **Size** – Acreage of the wetland, calculated using ArcMap.
- **Connected** – It was determined whether each wetland was connected to a surface water body (Y = yes, N = no, U = unknown).

- **Cowardin Code** – This is a classification system that provides information about each type of wetland. Table 7-1 summarizes the most common types of wetland Cowardin codes found in the study area.
- **Buffer** – This is the dominant land use surrounding the wetland. Land uses common in the study area include rangeland, agriculture, and forested.
- **Restoration/Enhancement Potential** – This identifies any recent impacts in or near the wetland. Information for this attribute was not available since agency information was minimal and no field visits have been conducted as part of this assessment.
- **Position** – The position of the wetland in a 5th field watershed was determined by visually dividing the watershed into thirds. The bottom third = low, middle third = mid, and upper third = high.
- **Field** – It was indicated whether a field visit would be helpful to clarify conditions at the watershed.
- **Source** – This is the identified source of information for the wetland.

Summary

The USGS land use and land cover data set identified approximately 73 wetland areas in the study area. Figures 7-1, 7-2, and 7-3 illustrate the general distribution of wetlands in the Jordan, Middle Owyhee, and Crooked-Rattlesnake subbasins, respectively. Based on the land use land cover data set, these wetland areas encompass approximately 20,310 acres, representing about 0.8% of the study area. Form W-1 provides a summary of preliminary attributes for each wetland identified in the land use land cover data set.

The majority of wetland types within the study areas were classified as PEMC (palustrine, emergent, seasonally flooded) and PEMA (palustrine, emergent, temporarily flooded). In combination, these wetland types represented approximately 72% of the total wetlands in the study area. In addition, the majority of wetlands had a direct connection to surface water bodies in the study area.

The position of a wetland within each subbasin was determined according to the methods outlined in the Oregon Watershed Assessment Manual (WPN, 1999). The relief (highest elevation minus lowest elevation) of each subbasin was calculated using digital elevation models in ArcMap. The subbasin relief was divided by three and the resulting number represents the change in elevation that occurs within each third of the watershed. Low, middle, and high position categories were developed based on elevation ranges. Table 7-2 summarizes the position category elevation ranges for each subbasin.

Table 7-2. Wetland Acres by Position within Subbasin.

Subbasin	Position	Elevation Range (feet)	Area (acres)	% of Total
Jordan Creek	Low	3342-4699	14,241	92
	Mid	4699-6056	1,262	8
	High	6056-7413	0	0
Middle Owyhee	Low	3363-5023	1,416	43
	Mid	5023-6683	1,866	57
	High	6683-8343	0	0
Crooked-Rattlesnake	Low	3341-4829	1,527	100
	Mid	4829-6317	0	0
	High	6317-7805	0	0

The position of each wetland was assigned by comparing the elevation of each wetland to the elevation range for each position category (low, mid, and high). As indicated earlier, the position of a wetland within a watershed provides insight into general functions a particular wetland can provide. Table 7-2 provides a summary of the wetland acreages by subbasin and by position in the subbasin (high, mid, or low). As shown in Table 7-2, most of the wetlands in the study area occur at low locations within the watersheds. This is not uncommon because the subbasin was divided into thirds topographically. As such, the lowest third of the watershed generally contains a disproportionate amount of land area. Generally, the most important functions of wetlands that occur in the lower portions of a watershed include water quality improvement and flood control. Water quality improvements could be nutrient reduction, metals retention, and sediment retention (to name a few). Flood control in the study area is an important function due to the flashy nature of the area. Wetlands associated with rivers low in the watershed provide are able to temporarily store floodwaters by spreading water out over a large area. This also decreases flow velocities and distributes storm flows over longer time periods. A third important function of wetlands, especially in high desert environments like the study area, is biological productivity/wildlife habitat.

Agency information for wetlands in the study area was limited. The Oregon NRCS Wetlands Reserve Program did not have any information for wetlands within the study area. Similarly, the Idaho Soil Conservation Commission and NRCS did not have any information on the current condition of wetlands or wetland projects in the study area. The hydrography point file obtained from the Oregon BLM geographic information center website provided insight into the distribution of known springs in the study area; however, there was no data regarding the condition of these springs. Figure 7-4 illustrates the distribution of known springs within the study area. Proper functioning condition assessments have been conducted on springs and seeps in the Louse Canyon Geographic Management Area; however, these data were not available for public use. The Idaho BLM office did not provide usable PFC data for wetlands within the study area. To date, no response has been received from the Malheur Office of the Oregon NRCS regarding wetland conditions/projects in the study area. Furthermore, local wetland inventories for the towns in the study area have not been conducted.

Conclusions

Overall, available data were insufficient to assess the current condition of wetlands in the study area. Furthermore, data were not available at the appropriate spatial scale to evaluate changes in wetland areas over time.

Data gaps

The most significant data gap that currently exists is the lack of digitized NWI maps. Once this information is available, it will be feasible to more accurately assess the extent and location of various wetland types in the subbasins. Once this is done, a more accurate assessment of the role of wetlands and the significance of those roles in the subbasins can be completed. A second data gap is lack of wetland assessments in the study area, including proper functioning condition assessments and Oregon freshwater assessments. A third data gap is a lack of geospatial data for wetland locations, assessments, restoration, and enhancement projects.

Literature Cited

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Form W-1: Table of Wetland Attributes

Name of Analyst: Johnna Evans

Date: May 13, 2004

Sub-basin (4th) MO = Middle Owyhee (17050107)

JO = Jordan (17050108)

CR = Crooked Rattlesnake (17050109)

Wetland ID	4th Sub-basin	Size (ac.)	Connected	Cowardin Code	Cowardin Code	Cowardin Code	Buffer	Watershed Position	Restoration Potential	Field?	Source	Comments
MO-1	17050107	134.06	Y	PEMC	PSSC	PUBFx	R	Mid	Unknown	N	LULC/NWI	
MO-2	17050107	85	Y	PEMC	PEMA	PSSC	R	Mid	Unknown	N	LULC/NWI	
MO-3	17050107	81.70	Y	PEMC	PSSC	L2UbFh PUSCH	R	Mid	Unknown	N	LULC/NWI	
MO-4	17050107	38.38	Y	PEMC	PEMB	-	R	Mid	Unknown	N	LULC/NWI	
MO-5	17050107	188.69	Y	PEMC	PSSC	PABHh	R	Mid	Unknown	N	LULC/NWI	
MO-6	17050107	108.35	Y	PEMC	PEMA	-	R/Ag	Mid	Unknown	N	LULC/NWI	
MO-7	17050107	222.91	Y	PEMC	PUSC	-	R	Mid	Unknown	N	LULC/NWI	also includes R45BC
MO-8	17050107	144.62	Y	PSSJ	-	-	R	Mid	Unknown	N	LULC/NWI	8 & 9 may be joined
MO-9	17050107	83.55	Y	PSSJ	-	-	R	Mid	Unknown	N	LULC/NWI	R4SBC present as well
MO-10	17050107	40.42	Y	PSSA	PUSCx	PUSCh	R	Mid	Unknown	N	LULC/NWI	
MO-11	17050107	86.06	Y	PSSA	PUSCx	PUSCh	R	Mid	Unknown	N	LULC/NWI	
MO-12	17050107	204.83	Y	PEMC	PSSC	PEMF	R	High	Unknown	N	LULC/NWI	
MO-13	17050107	99.94	Y	PEMCx PEMC	PSSC	PEMF PEMA	R	High	Unknown	N	LULC/NWI	
MO-14	17050107	280.97	Y	PEMC	PSSC	PSSCh	R/Fo	High	Unknown	N	LULC/NWI	
MO-15	17050107	129.21	Y	PEMC	PEMCx	-	R	Mid	Unknown	N	LULC/NWI	
MO-16	17050107	119.08	Y	PEMC	PEMA	-	R	Mid	Unknown	N	LULC/NWI	
MO-17	17050107	23.67	Y	PEMC	-	-	R/Fo	Mid	Unknown	N	LULC/NWI	
MO-18	17050107	147.84	Y	PEMC	PSSC	PEMF/PSSIF	R/Fo	Mid	Unknown	N	LULC/NWI	R4/R3 present M11as well
MO-19	17050107	45.34	Y	PEMC	-	-	R	Mid	Unknown	N	LULC/NWI	

Form W-1: Table of Wetland Attributes

Name of Analyst: Johnna Evans

Date: May 13, 2004

Sub-basin (4th) MO = Middle Owyhee (17050107)

JO = Jordan (17050108)

CR = Crooked Rattlesnake (17050109)

Wetland ID	4th Sub-basin	Size (ac.)	Connected	Cowardin Code	Cowardin Code	Cowardin Code	Buffer	Watershed Position	Restoration Potential	Field?	Source	Comments
MO-20	17050107	187.91	Y	PEMA	PUSA PUSC	PSSA	R	High	Unknown	N	LULC/NWI	Dry Lakes LULC probably over-estimates the area
MO-21	17050107	162.94	Y	PEMCh	PABHh	-	R	High	Unknown	N	LULC/NWI	The Difficulty Reservoir
MO-22	17050107	91.50	Y	PSSJ	-	-	R	High	Unknown	N	LULC/NWI	
MO-23	17050107	43.87	N	PSSJ	PUSCx	-	R	High	Unknown	N	LULC/NWI	Intermittent Lake?
MO-24	17050107	68.59	Y	PUSCh	-	-	R	High	Unknown	N	LULC/NWI	compared to NWI, LULC over estimated
MO-25	17050107	250.03	Y	PEMC	PEMB	R45BC	R	High	Unknown	N	LULC/NWI	series of wetlands
MO-26	17050107	152.7	Y	PEMA	PUBFx	R45BC	R/Ag	High	Unknown	N	LULC/NWI	LULC overestimates area compared to NWI
MO-27	17050107	22.31	N	PUSA	-	-	R	High	Unknown	N	LULC/NWI	Emmets Hole
MO-28	17050107	37.46	Y	PEMC	PEMA PUBH	R3USC	R/Ag	Low	Unknown	N	LULC/NWI	
JO-1	17050108	588.91	Y	PEMC	PSSC	PFOC PEMCx	R	Low	Unknown	N	LULC/NWI	intermixed with uplands and river
JO-2	17050108	39.8	Y	PEMC	PEMCh	PAB Fh	R/Ag	Low	Unknown	N	LULC/NWI	
JO-3	17050108	66.22	Y	PEMC	PEMF PEMB	PUBH	R/Ag	Low	Unknown	N	LULC/NWI	intermixed with uplands and river
JO-4	17050108	2878.96	Y	PSSC	PEMCx PEMC	PUSCh PEMF PABF	R/Ag	Low	Unknown	N	LULC/NWI	
JO-5	17050108	89.02	Y	PEMC	PSSC	PUBH	R/Ag	Mid	Unknown	N	LULC/NWI	
JO-6	17050108	8319.76	Y	PEMCx PEMC	PSSC	PEMB/PEMA/ PEMF/PUBFx	R/Ag	Mid	Unknown	N	LULC/NWI	
JO-7	17050108	58.54	Y	PEMA	PEMC	-	R	Mid	Unknown	N	LULC/NWI	
JO-8	17050108	332.03	Y	PSSC	PEMC	PEMF	R/Ag	Mid	Unknown	N	LULC/NWI	
JO-9	17050108	241.50	Y	PSSC	PEMC	PEMF	R/Ag	Mid	Unknown	N	LULC/NWI	
JO-10	17050108	204.17	Y	PSSC	PEMC	PABF PEMF	R	Mid	Unknown	N	LULC/NWI	

Form W-1: Table of Wetland Attributes

Name of Analyst: Johnna Evans

Date: May 13, 2004

Sub-basin (4th) MO = Middle Owyhee (17050107)

JO = Jordan (17050108)

CR = Crooked Rattlesnake (17050109)

Wetland ID	4th Sub-basin	Size (ac.)	Connected	Cowardin Code	Cowardin Code	Cowardin Code	Buffer	Watershed Position	Restoration Potential	Field?	Source	Comments
JO-11	17050108	371.54	Y	PSSC	PEMCx PEMC	PABHh PSSA	R	Mid	Unknown	N	LULC/NWI	
JO-12	17050108	51.03	Y	PSSC	PEMC	PSSA	R	High	Unknown	N	LULC/NWI	
JO-13	17050108	77.09	Y	PSGC	PEMC	-	R	High	Unknown	N	LULC/NWI	
JO-14	17050108	177.28	Y	PFOC	PEMC	PSSC	R	High	Unknown	N	LULC/NWI	
JO-15	17050108	59.68	Y	PEMC	PSSC	PFOC	R/Fo	High	Unknown	N	LULC/NWI	
JO-16	17050108	89.73	Y	PEMC	PSSC	-	R	High	Unknown		LULC/NWI	
JO-17	17050108	74.83	Y	PEMC	PSSC	R3USA R3UBH	R	High	Unknown	N	LULC/NWI	
JO-18	17050108	75.57	Y	PEMC	PSSC	PEMB PSSB	R	High	Unknown	N	LULC/NWI	areas likely over estimated
JO-19	17050108	167.69	Y	PEMC	PSSC	-	R	High	Unknown	N	LULC/NWI	areas likely over estimated
JO-20	17050108	187.45	Y	PEMC	PSSC	PSSA PEMF PFOC	R/Fo	High	Unknown	N	LULC/NWI	
JO-21	17050108	63.39	Y	PEMC	PEMA	PEMB PSSC	R	High	Unknown	N	LULC/NWI	
JO-22	17050108	45.50	Y	PSSC	PEMC	-	R	High	Unknown	N	LULC/NWI	
JO-23	17050108	124.67	Y	PEMCh PEMC	PEMF	PEMFh	R	High	Unknown	N	LULC/NWI	
JO-24	17050108	38.76	Y	PSSC	PEMC	-	R	High	Unknown	N	LULC/NWI	
JO-25	17050108	85.06	Y	PEMC	PSSC	PSSA/PUBF	R	High	Unknown	N	LULC/NWI	
JO-26	17050108	117.13	Y	PEMCh PEMC	PSSC PSSCh	-	R	High	Unknown	N	LULC/NWI	
JO-27	17050108	129.07	Y	PEMC	PSSC	PSSA	R	High	Unknown	N	LULC/NWI	
JO-28	17050108	378.59	Y	PEMA PEMC	PSSC/PSSB	PEMFx PUBFh	R/Fo	High	Unknown	N	LULC/NWI	R3UBH and R45BCx also included
JO-29	17050108	41.24	Y	PSSC	PEMC	PUBFh	R	High	Unknown	N	LULC/NWI	

Form W-1: Table of Wetland Attributes

Name of Analyst: Johnna Evans

Date: May 13, 2004

Sub-basin (4th) MO = Middle Owyhee (17050107)

JO = Jordan (17050108)

CR = Crooked Rattlesnake (17050109)

Wetland ID	4th Sub-basin	Size (ac.)	Connected	Cowardin Code	Cowardin Code	Cowardin Code	Buffer	Watershed Position	Restoration Potential	Field?	Source	Comments
JO-30	17050108	108.18	Y	PEMC	PSSC	-	R	Mid	Unknown	N	LULC/NWI	
JO-31	17050108	50.88	Y	PEMC	PSSC	R45BA	Fo	High	Unknown	N	LULC/NWI	
JO-32	17050108	129.14	Y	PEMAH	LIUBHh	-	R	Low	Unknown	N	LULC/NWI	
JO-33	17050108	40.65	Y	PSSA	R3USA	-	R/Fo	Mid	Unknown	N	LULC/NWI	
CR-1	17050109	61.75	Y	PEMAh	PUSCh	R45BA PEMA	R	High	Unknown	N	LULC/NWI	
CR-2	17050109	154.52	Y	PEMA	PEMC	-	R	Mid	Unknown	N	LULC/NWI	
CR-3	17050109	71.10	Y	PEMA	PEMCH		R	Mid	Unknown	N	LULC/NWI	
CR-4	17050109	43.53	Y	PEMA	-	-	R	Mid	Unknown	N	LULC/NWI	
CR-5	17050109	265.19	Y	PEMA	PEMC	PEMCh PEMCx PEMFh	R	Mid	Unknown	N	LULC/NWI	
CR-6	17050109	54.56	Y	PEMC	-	-	R	Mid	Unknown	N	LULC/NWI	
CR-7	17050109	40.70	Y	PEMC	-	-	R/Ag	Mid	Unknown	N	LULC/NWI	
CR-8	17050109	248.42	Y	PEMCx PEMC	PEMB	-	R/Ag	Mid	Unknown	N	LULC/NWI	
CR-9	17050109	106.11	Y	PEMB	PEMC	PUBHh	R/Fo	Mid	Unknown	N	LULC/NWI	
CR-10	17050109	350.94	Y	PEMA	PEMC	-	R/Fo	Mid	Unknown	N	LULC/NWI	
CR-11	17050109	68.14	Y	PEMA	-	-	R	High	Unknown	N	LULC/NWI	
CR-12	17050109	62.28	Y	PEMA	PEMB	PEMC	R/Ag	High	Unknown	N	LULC/NWI	

Form W-2: Wetland Confidence Evaluation

Watershed: Crooked Rattlesnake (17050109) Date: May 13, 2004

Name of Analyst: Johnna Evans

Analyst's wetland experience:

☐	Low:	No prior experience
■	Moderate:	Some experience
☐	High:	Extensive experience

Analyst's overall familiarity with watershed during different seasons:

☐	Low:	Unfamiliar
■	Moderate:	Somewhat familiar
☐	High:	Very familiar (live and/or work in the watershed)

Origin of wetland base map:

☐	Low:	NWI map based on photos 1980 or earlier
■	Moderate:	NWI map based on photos 1981 or later
☐	High:	Other recent wetland inventory information available

Aerial photo interpretation:

■	Low:	No aerial photos used
☐	Moderate:	Photos greater than 5 years old were used
☐	High:	Recent (within 5 years) photos were used.

Seasonality of photos: N/A

☐	Low:	Photos taken during July, August, or September
☐	Moderate:	Photos taken October through February
☐	High:	Photos taken March through June

Level of field verification:

■	Low:	None
☐	Moderate:	Some field verification (50% or fewer of wetlands visited)
☐	High:	Extensive (Greater than 50% of wetlands verified)

Conditions in watershed:

☐	Low:	Greater than 50% of watershed forested
■	High:	Less than 50% of watershed forested

Recommendations for additional field assessment; unanswered questions *(if any)* and why (complete on back of form):

COMPONENT 8—SEDIMENT SOURCES

The hydrology component of the watershed assessment is directed at assessing the potential for land use practices to affect peak and low flows of surface water. Such changes to flows could promote flooding under certain conditions, or reduced supply under others. This analysis was conducted largely according to the methodology described in the Oregon Watershed Assessment Manual (OWAM; WPN 2001). It makes some simplifying assumptions and aggregates data that a more sophisticated analysis might keep separated, in order to screen a large watershed area for *potential* problems. Data for this component included: precipitation, topography, land use and land cover, stream reaches, surface water peak flows, and the like.

Sediment Sources

The sediment sources component of the watershed assessment is directed at evaluating potential sources of sediment from a subset of the following sources:

- Road instability;
- Slope instability unrelated to roads;
- Rural road runoff;
- Urban runoff;
- Surface erosion from crop land;
- Surface erosion from range land;
- Surface erosion from burned land; and
- Other discrete sources of sediment.

The OWAM protocol is not intended to evaluate all potential sediment sources, but to concentrate on those expected to be of most concern in the watershed. Data limitations also affect the choice of potential sediment sources examined in this assessment.

Road Instability

The stability of rural roads depends on both the construction method and the stability of the underlying land surface. In full-bench construction, the road surface is excavated to a stable location. With sidecast construction, part of the road grade is built from material excavated from downslope. On steep slopes, this tends to result in road failure when wet or heavily loaded. Roads constructed on ridge lines are inherently more stable than those constructed on steep slopes or along streams. This sediment source was not evaluated, since detailed information about road grade, culvert locations and capacity, and road construction method were not available.

Slope Instability Unrelated to Roads

This sediment source was not evaluated, due to a lack of usable data on landslides and debris flows.

Rural Road Runoff

Water draining from roads can deposit sediment into streams from unpaved road surfaces and drainage ditches. The OWAM basic assessment protocol determines how many road miles are within 200 feet of a stream channel and/or on slopes of grater than 50%, and what the road surface and usage rates are. The more detailed protocol requires detailed information about road grade, culvert locations and capacity, and road construction method, similar to that used for the road instability source assessment.

GIS data available for this project include hydrology and road coverages. However, the horizontal position uncertainties in these data sets is about 120 feet, making them unsuitable for reliably estimating which road segments are within 200 feet of a stream. Even the basic assessment could not be performed for this potential sediment source.

A map of roads compiled from the TIGER/Line® line files (US Census Bureau 2000) has been presented previously as Figure 1–A. These line files were in turn derived from 1:100,000 US Geological Survey topographic maps. Map 8–01 displays roads, populated places and urban land use areas on a shaded relief map. Form H–6 in the Hydrology component summarized the mileages, types and densities of roads in each of the subwatersheds.

Urban Runoff

The study area has very little urbanized area. Table 8–1 shows the acreages attributed to urban land use in the national land use/land cover data set derived from aerial photographs taken in the 1970s and 1980s (USGS undated). This data set shows that five of the subwatersheds contain "urban" land. The land use/land cover data appear to contain errors of two kinds. First, the assignment of urban areas to subwatersheds is doubtful in some cases. Second, the urban areas listed in the database are significantly larger than those estimated by inspection of the aerial photos.

Table 8–1. Subwatersheds with "Urban" Land Use

Subwatershed	Name	Populated Place	Area (ac)	Urban Area (ac)	% Urban
170501080301	Jordan Creek Headwaters	Delamar Silver City	33,343	44	0.132%
170501080302	Louse Creek	none	13,741	64	0.466%
170501080501	Baxter Creek	Jordan Valley	16,923	292	1.73%
170501080803	Jordan Creek/Merrill Springs	Arock	37,622	36	0.0956%
170501090102	Black Hills	none	33,936	180	0.530%

Source: USGS __

The assignment of urban land use to portions of the Louse Creek and Black Hills subwatersheds is doubtful. No populated places appear to be located in these subwatersheds. Idaho populated places appearing on our maps (Delamar, Silver City and Triangle) are derived from the Idaho Department of Water Resources (IDWR) GIS coverage (Ciscell, *et al.*, 1990). IDWR obtained its locations and names from a 1976 1:500K BLM map and an Idaho State Highway Map produced in about 1980 by the Idaho Transportation Department (ITD). Oregon populated places (Arock, Basque, Danner, Jordan Valley, Rome and Sheaville) were taken from the Oregon State Service Center for GIS 1:24K populated place names coverage (SSGIS 1990), which was in turn created from US Geological Survey's Geographic Names Information System (GNIS). Visual comparison shows that our locations are similar to those on recent published highway maps (AAA 1993a, 1993b).

The US Census Bureau maintains a fact sheet on only one of these nine locations, Jordan Valley. Jordan Valley is a small incorporated city located in the Baxter Creek subwatershed. The population and density, according to the 2000 census, was 239 people, or 115 people per square mile. US Highway 95 is the main thoroughfare in the city.

An aerial photograph of Jordan Valley's urban core is shown in Figure 1 (OGDC 2000). The visible developed area is approximately 139 acres, which is substantially less than the 292 acres listed in the USGS land use database. The commercial strip along US–95 at the south end of town covers approximately 8 acres out of a total urban area of approximately 139 acres. A new storm sewer and settling basins are currently under construction, with project completion expected around October 2005. The City does not conduct a street cleaning program, but the Oregon Department of Transportation (ODOT) sweeps US–95 annually with a vacuum truck (Warn 2005).

Figure 1. Jordan Valley (1 inch ≈ 1,000 feet)

As shown by the aerial photos (Figures 2 through 6), other "populated places" consist of at most a few houses. They present negligible urban sediment risks, and any inaccuracy in their area estimates is moot.

Figure 2. Basque (1 inch ≈ 1,000 feet)

Figure 3. Arock (1 inch ≈ 1,000 feet)

Figure 4. Danner (1 inch ≈ 1,000 feet)

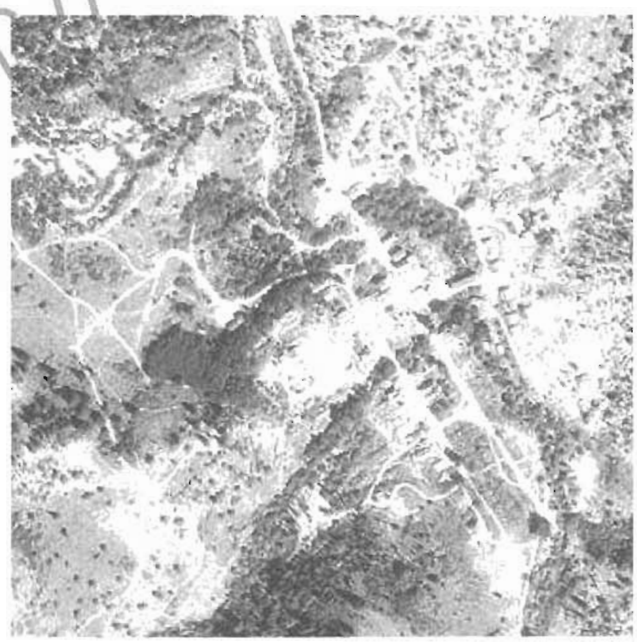

Figure 5. Silver City (1 inch ≈ 1,000 feet)

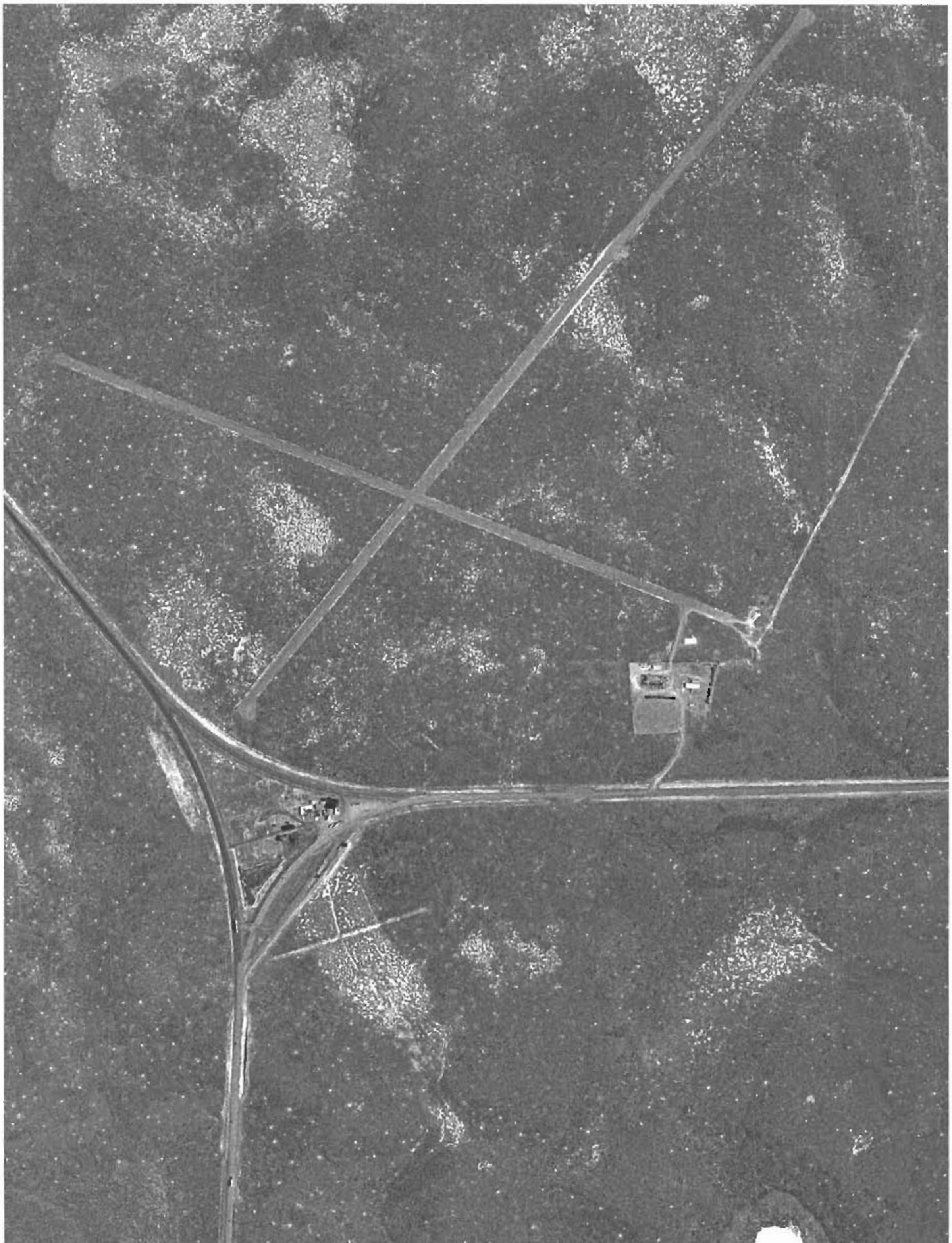

Figure 6. Burns Junction and Airport (1 inch ≈ 1,000 feet)

The OWAM protocol (WPN 1999) for estimating sediment generation risk from urban roads produces a rating and code for each polygon, based on the urban area type, method and frequency of street cleaning and method of sediment removal from storm water (Table 8–2). This analysis allows identifying opportunities to reduce urban storm water sediment loads. Detailed engineering studies would be required to assess the magnitude of the opportunities, or to evaluate alternatives.

Table 8–2. Factors Influencing Urban Storm Water Sediment Loads

Factor	Classification	Rating	Code
Urban Area Type	residential	low	L1
	commercial	moderate	M1
	heavy industrial	high	H1
	developing urban	very high	VH1
Street Cleaning	none or infrequent	small	S2
	frequent mechanical	moderate	M2
	vacuum–assisted	large	L2
Sediment Removal	none	none	N3
	detention ponds/basins	moderate	M3
	treatment plant processing	high	H3

Source: OWAM

Form S–12 shows the result of applying the OWAM protocol to Jordan Valley. Sediment production is low from the residential area, and moderate from the commercial strip. Although street cleaning is performed on the highway, it is done infrequently enough that its effect on sediment loads is expected to be minimal. Sediment removal for both zones will be moderate when the storm sewer construction project is completed. No obvious opportunities for sediment load reduction will remain after completion of this project.

Form S–12. Information on Urban Runoff Polygons

Huc No.	HUC Name	Type	Polygon Area (ac)	Polygon % of HUC Total	Sediment Production	Street Cleaning	Sediment Removal
170501080501	Baxter Creek	residential	139	0.821%	L1	S2	M3
		commercial	8	0.047%	M1	S2	M3
		total	16,923	100%			

Surface Erosion from Cropland and Rangeland

Similar mechanisms result in soil erosion in cropland and rangeland. The main difference is the land condition. Cropland is usually tilled, and slopes rarely exceed 20%. Rangeland is rarely tilled, often sparsely vegetated, and the slopes are often higher than 40%.

The OWAM protocol calls for accumulating data models for predicting soil erosion from cropland and rangeland are similar, but differ in some details. However, the available data do not provide sufficient detail to use different protocols for these two land uses. Form S–14 displays the available data by subwatershed for cropland and rangeland erosion. This includes the amount and percentage of area having high erodibility (K>0.48), as well as maximum and minimum elevations as an indicator of subwatershed slope.

Surface Erosion from Burned Lands

Fires can leave land subject to erosion for a time due to rain splash erosion, lower infiltration rates and higher runoff velocities. Over time, the erosion danger lessens as the vegetation recovers. The OWAM protocol identifies burn areas with sediment production risk in the vicinity of a burn from the soil erodibility (K), slope class, grazing practice and vegetation density.

Information about recent (1986–1992) fires was obtained from the Interior Columbia Basin Ecosystem Management Project (ICBEMP). Form S–15 summarizes available information about these fires. Slopes were estimated as steep (greater than 40%) or not based on visual inspection of the 1:250K topographic maps in the vicinity of the fires. In the absence of specific information about grazing practices in each burn area, they are assumed to be normal (as opposed to controlled stocking). All of the burned areas have sparse vegetation. The burn intensities were not included in the GIS data. Map 13–02 displays Surface Erosion Sources, showing soil types, K-values, and fire locations.

Form S–15. Fire Data

Subwatershed	Steep[1]	Longitude (°W)	Latitude (°N)	Area (ac)	Agency	Date
170501070205		117.3170	42.4170	200.00	BLM	8/2/1986
170501070301		116.9830	42.3670	5.00	BLM	8/21/1992
170501070302		116.9830	42.4830	20.00	BLM	8/7/1986
170501070402		116.8830	42.6830	5.00	BLM	8/12/1988
170501070403		116.9330	42.5830	20.00	BLM	7/28/1988
170501070404		116.9500	42.5000	1.00	BLM	7/4/1987
170501070404		116.9170	42.5330	15.00	BLM	6/23/1992
170501070404		117.0000	42.5500	60.00	BLM	7/5/1986
170501070404		116.9000	42.5670	2.00	BLM	7/1/1986
170501070406		117.0500	42.5500	0.10	BLM	8/8/1990
170501070501		116.9830	42.3500	757.00	BLM	7/17/1992
170501070601		117.0670	42.6670	30.00	BLM	6/16/1988
170501070601		117.0830	42.6830	30.00	BLM	8/8/1990
170501070601		117.0000	42.7170	1.00	BLM	8/6/1989
170501070601		117.0670	42.7500	5.00	BLM	8/12/1988
170501070602		117.1000	42.6330	0.10	BLM	9/7/1990
170501070604		117.1830	42.8000	120.00	BLM	8/12/1988
170501070701	Yes	117.2000	42.5670	8.00	BLM	7/3/1987
170501070701	Yes	117.1830	42.5830	11.00	BLM	8/11/1989
170501070701		117.2670	42.6170	225.00	BLM	6/24/1992
170501070701		117.3000	42.6330	40.00	BLM	8/6/1988
170501070702		117.2500	42.7000	3.00	BLM	7/11/1990
170501070702	Yes	117.3500	42.7330	6.00	BLM	8/13/1992
170501070703		117.3670	42.7170	30.00	BLM	8/18/1992
170501070703		117.4830	42.7500	700.00	BLM	6/11/1992
170501070703		117.5170	42.8170	3000.00	BLM	8/10/1986
170501080102		116.6500	42.7670	1.00	BLM	7/20/1988
170501080105	Yes	116.7170	42.7500	1.00	BLM	7/10/1988
170501080105	Yes	116.7330	42.7500	1.00	BLM	7/10/1988
170501080201	Yes	116.7500	42.8330	750.00	BLM	8/26/1991
170501080205	Yes	116.8000	42.8670	81.00	BLM	3/3/1987
170501080303	Yes	116.9170	42.9500	2.00	BLM	7/25/1989
170501080401		116.9330	42.7830	230.00	BLM	9/11/1990
170501080402		117.0330	42.7830	5.50	BLM	9/5/1987
170501080403		116.9670	42.9670	0.20	BLM	9/6/1990
170501080404		117.0000	42.9500	1.00	BLM	7/15/1987
170501080501		117.0830	43.0000	5.00	BLM	7/31/1986
170501080501		117.0170	43.0330	720.00	BLM	8/23/1986
170501080503		117.0830	42.8670	0.10	BLM	7/21/1991
170501080503	Yes	117.0670	42.9500	7.00	BLM	8/6/1987

170501080503	Yes	117.0830	42.9500	5.00	BLM	7/14/1989
170501080504		117.1170	42.8830	60.00	BLM	7/30/1990

Form S–15, continued. Fire Data

Subwatershed	Steep[1]	Longitude (°W)	Latitude (°N)	Area (ac)	Agency	Date
170501080505		117.2000	43.0170	12920.00	BLM	8/11/1986
170501080601		116.9000	43.0830	170.00	BLM	9/1/1986
170501080603		117.0670	43.1330	2.00	BLM	8/24/1987
170501080604		117.1900	43.1450	0.00	R5	5/18/1987
170501080604		117.2500	43.1000	0.50	BLM	6/21/1988
170501080604		117.2000	43.2000	1824.00	BLM	9/11/1992
170501080605		117.1830	43.0830	20.00	BLM	5/17/1992
170501080605		117.2830	43.0830	150.00	BLM	6/10/1992
170501080702		117.4170	43.0500	2.00	BLM	8/10/1990
170501080702		117.4330	43.0830	1085.00	BLM	6/23/1992
170501080702		117.5000	43.1500	250.00	BLM	8/11/1988
170501080703		117.2830	42.9830	3.00	BLM	6/26/1989
170501080703		117.3330	43.0000	1.00	BLM	6/10/1992
170501080703		117.2830	43.0000	0.10	BLM	6/24/1992
170501080703		117.4000	43.0500	20.00	BLM	8/10/1986
170501080703		117.2830	43.0500	1500.00	BLM	6/10/1992
170501080801		117.4000	42.9170	15.00	BLM	6/11/1992
170501080802		117.3000	42.8830	25.00	BLM	8/10/1986
170501080802		117.3830	42.8830	1.00	BLM	6/11/1992
170501080802		117.3830	42.9000	1.00	BLM	6/11/1992
170501080803		117.5000	42.9170	15.00	BLM	7/31/1988
170501080804		117.4500	42.8000	100.00	BLM	8/10/1986
170501080804		117.5170	42.8500	2.00	BLM	6/11/1992
170501080805		117.6333	42.9500	0.30	BIA	7/1/1986
170501090103		117.8170	42.4170	2.00	FWS	7/27/1990
170501090103		117.8330	42.3500	3800.00	BLM	7/26/1987
170501090103	Yes	117.8330	42.3670	2600.00	BLM	7/30/1987
170501090103	Yes	117.8500	42.3830	2.00	BLM	10/12/1987
170501090105		117.9250	42.5083	0.10	BIA	7/11/1989
170501090105		117.8830	42.4500	720.00	BLM	8/2/1986
170501090201	Yes	117.6170	42.2830	6.00	BLM	7/28/1986
170501090202		117.5733	42.3883	1.00	R6	7/26/1989
170501090203		117.5830	42.6000	5500.00	BLM	9/7/1986
170501090205	Yes	117.6830	42.4170	5.00	BLM	8/2/1986
170501090401		117.4000	42.5000	450.00	BLM	8/2/1986
170501090406		117.7000	42.6670	80.00	BLM	6/14/1987
170501090407		117.7167	42.7167	4.00	BIA	7/28/1986
170501090502		117.8670	42.7500	3.00	BLM	8/23/1986
170501090504	Yes	118.0830	42.8330	3.00	BLM	7/28/1986

170501090506		117.8830	42.8330	1.00	BLM	8/20/1986
170501090506		117.9170	42.8500	15.00	BLM	8/9/1987
170501090507		117.6667	42.7667	0.10	BIA	5/9/1987

NOTES: 1. Steep means greater than about 40%, according to the 1:250K topographic maps

Other Sediment Sources

Since there is little construction in the study area, the largest remaining sediment source in the study area is probably mining. The Kinross DeLamar mine is the largest recently active mine, with 1,072 acres of disturbed area (Kuipers 2003). A large open pit mine with mill and tailings facility produced silver and gold from 1977 through 1998. Historic operations were also conducted from about 1880 until 1940. Final reclamation of the mine began in 2002, with large–scale earthwork expected to be complete in 2006. Low permeability caps are being applied to most mine facilities. Engineered storm water controls are being installed, and enhanced evaporation and land application will be used to dispose of process and tailings water. Sulfate–reducing bioreactors are planned to treat small residual flows (Smith 2004). Mine closure in Idaho is regulated by the Idaho Department of Lands under the 1971 Surface Mining Act. The financial assurance for closure provided by Kinross Delamar is estimated at just over 10 million dollars (Kuipers 2003).

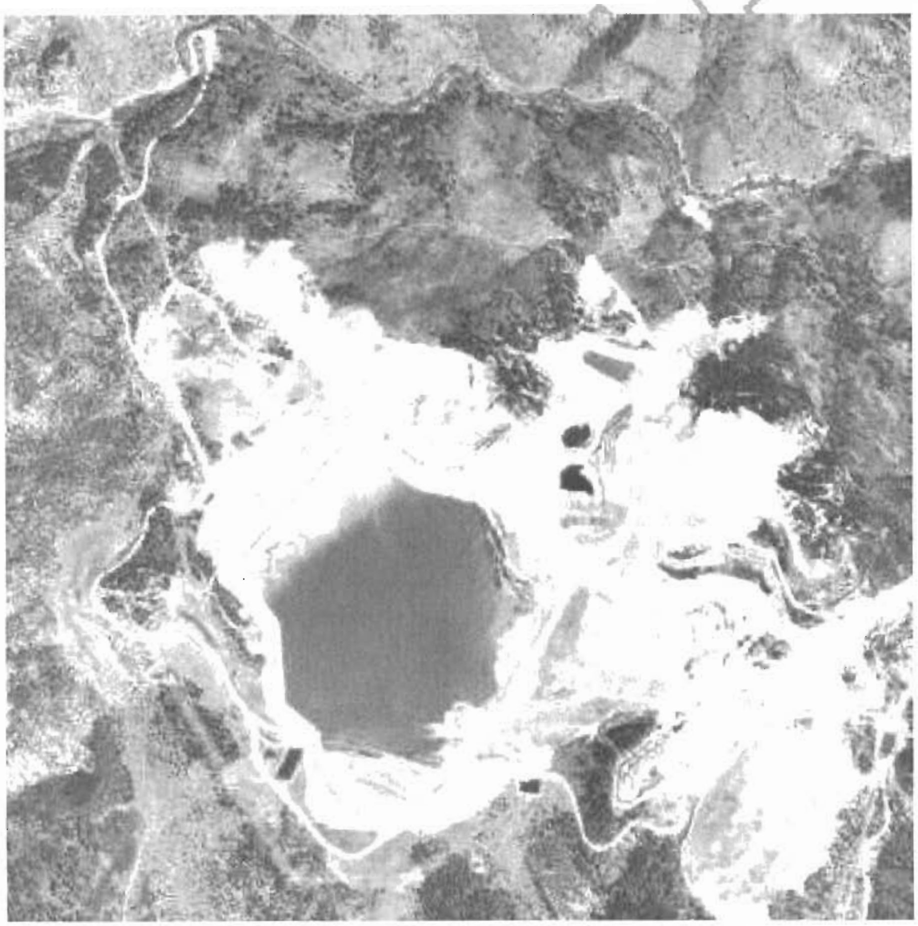

Figure 7. Kinross DeLamar silver/gold mine (1 inch ≈ 2,000 feet)

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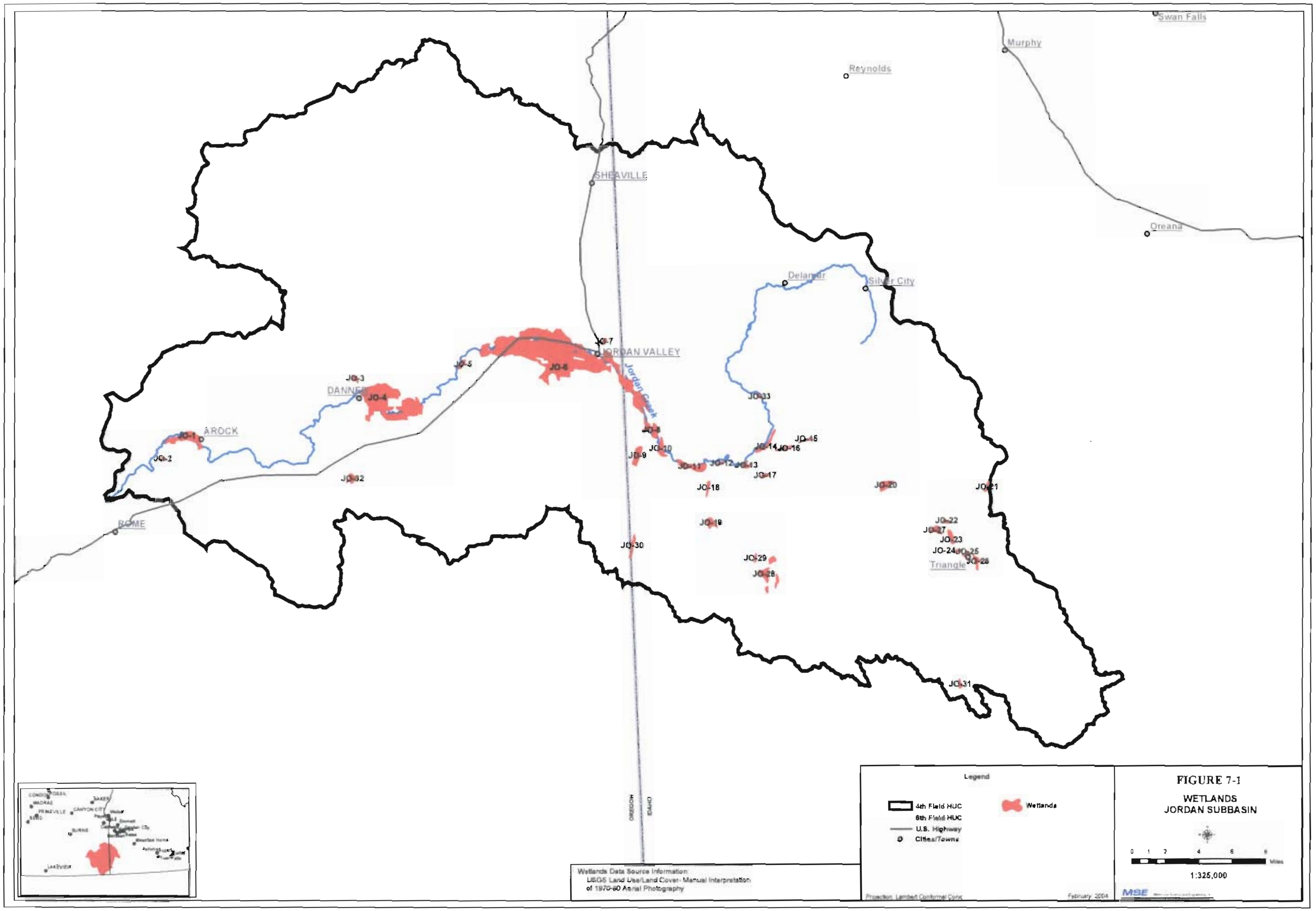
08-sediments.doc

Form S-14: Ag/ Range Erosion Characteristics

Subwatershed Number	Name	Area (ac)	Minimum Elevation (ft)	Maximum Elevation (ft)	Mean Annual Precipitation (in)	K>0.48 Area	K>0.48 % Area
	Middle Owyhee—17050107						
170501070101	Upper Toppin Creek	32414	5263	6076	11.9	24698.25	76%
170501070102	Mustang Lake	15621	5105	5585	11.6	13581.1	87%
170501070103	Lower Toppin Creek	27683	4160	5442	10.7	23195.68	84%
170501070104	Jack Creek	22952	5577	6458	17.9	4468.965	19%
170501070105	Headwaters West Little Owyhee River	25808	5567	6682	20.2	2336.341	9%
170501070106	Upper West Little Owyhee River	31490	5076	6489	13.5	18822.78	60%
170501070107	Middle West Little Owyhee River	34464	4157	5585	10.5	22606.14	66%
170501070108	Lower West Little Owyhee River	7851	4017	5307	10.7	5313.015	68%
170501070201	Upper Pole Creek	25783	5106	6387	13.9	17062.3	66%
170501070202	Field Creek	16965	5034	6460	15.0	11052.27	65%
170501070203	Lower Pole Creek	34260	4839	5889	12.6	28277.05	83%
170501070204	Upper Antelope Creek	35414	5605	6650	19.3	9153.025	26%
170501070205	Middle Antelope Creek	32010	4597	6058	13.3	24358.98	76%
170501070206	Upper Little Antelope Creek	22572	5011	5816	11.9	18774.06	83%
170501070207	Lower Little Antelope Creek	33196	4609	5511	12.4	27794.4	84%
170501070208	Lower Antelope Creek	19607	3996	5167	12.0	6374.301	33%
170501070301	Upper Middle Fork Owyhee River	36171	4622	6808	12.0	4234.485	12%
170501070302	Pole Creek	21322	4175	6303	11.6	3166.785	15%
170501070303	Lower Middle Fork Owyhee River	13252	3962	5102	10.8	2898.788	22%
170501070401	Pleasant Valley Creek	17281	4935	6538	14.6	834.957	5%
170501070402	Juniper Creek	24809	4839	7804	20.9	486.4738	2%
170501070403	Upper North Fork Owyhee River	26887	4415	6785	16.9	1520.577	6%
170501070404	Squaw Creek	30663	4413	6804	13.4	1749.553	6%
170501070405	Cherry Creek	30488	4203	6721	12.6	4828.787	16%
170501070406	Lower North Fork Owyhee River	11457	3956	5782	12.2	1709.006	15%
170501070501	Owyhee River - Dukes Creek	23632	4177	6135	10.2	8173.154	35%
170501070502	Oregon Lake Creek	10552	4177	5427	11.5	9152.998	87%
170501070503	Owyhee River - Bull Creek	28515	4016	5543	10.4	16271.56	57%
170501070504	Owyhee River - Warm Spring Canyon	22205	3942	5091	11.9	3903.726	18%
170501070601	Upper Soldier Creek	39213	4542	7152	15.6	7183.57	18%
170501070602	Mud Flat Creek	29855	4536	5285	13.4	849.9323	3%
170501070603	Willow Creek	16016	4423	5983	15.9	214.5468	1%
170501070604	Spring Creek	19898	4360	6053	14.7	55.92362	0%
170501070605	Lower Soldier Creek	10515	3612	4970	13.2	10.4028	0%
170501070701	Whitehorse Creek	31614	3843	5414	13.6	1475.278	5%
170501070702	Skull Creek	29377	3610	5414	13.2	628.9856	2%
170501070703	Sand Hollow	24633	3409	4758	11.3	2194.423	9%
170501070704	China Gulch	24694	3382	4131	8.5	8207.952	33%
170501070705	Lower Middle Owyhee Rive	17308	3343	3978	8.6	6838.172	40%
	Jordan—17050108						
170501080101	Sheep Creek	15433	5535	6536	18.6	308.596	2%
170501080102	Upper Rock Creek	29527	5002	6579	14.3	1348.335	5%
170501080103	Meadow Creek	22838	5024	8067	21.1	1878.874	8%
170501080104	Josephine Creek	21543	5002	6607	16.6	430.7909	2%
170501080105	Lower Rock Creek	14396	4845	6859	17.8	451.2506	3%
170501080201	Upper North Boulder Creek	22346	4843	8402	28.1	112.8435	1%
170501080202	Lower North Boulder Creek	9742	4571	6861	19.0	194.8165	2%
170501080203	Upper South Boulder Creek	12227	5082	7770	25.5	138.1649	1%
170501080204	Lower South Boulder Creek	13194	4726	6843	22.5	224.7624	2%
170501080205	Big Boulder Creek	28056	4576	7773	18.2	1520.114	5%
170501080301	Jordan Creek Headwaters	33343	4755	8022	27.0	443.049	1%
170501080302	Louse Creek	13741	4760	7923	24.3	96.3876	1%
170501080303	Jordan Creek-Flint Creek	26411	4564	7919	20.5	1230.98	5%
170501080401	Williams Creek	11944	4519	7793	21.9	493.7263	4%
170501080402	Lone Tree Creek	27053	4456	7361	17.9	3865.054	14%
170501080403	Trout Creek	18059	4403	5937	17.5	1925.479	11%
170501080404	Rail Creek	28127	4401	7376	15.6	5480.995	19%
170501080501	Baxter Creek	16923	4323	6127	14.0	6447.106	38%
170501080502	Hooker Creek	24120	4315	6119	13.5	10273.97	43%
170501080503	Sheep Spring Creek	22869	4323	6114	13.5	9907.568	43%

Form S-14: Ag/ Range Erosion Characteristics

Subwatershed Number	Name	Area (ac)	Minimum Elevation (ft)	Maximum Elevation (ft)	Mean Annual Precipitation (in)	K>0.48 Area	K>0.48 % Area
170501080504	Jack Creek	36099	4234	6088	13.6	8458.689	23%
170501080505	Downey Creek	33620	4215	4924	12.7	10162	30%
170501080601	Jackson Creek	34435	4685	7412	21.0	6585.702	19%
170501080602	Posey Creek	22296	4421	6099	14.4	9034.692	41%
170501080603	Spring Branch	14308	4423	5990	15.1	709.2206	5%
170501080604	Mahogany Creek	30842	4349	6500	15.5	1518.4	5%
170501080605	Lower Upper Cow Creek	16756	4349	4911	13.4	4522.255	27%
170501080701	Cove Creek	40493	4342	6434	14.2	42.77777	0%
170501080702	Jordan Craters	31121	4308	4877	12.9	0	0%
170501080703	Mouth Of Cow Creek	39045	4216	4871	12.7	1689.368	4%
170501080801	Jordan Creek/Rock Creek Reservoir	17351	4035	4730	12.3	112.8445	1%
170501080802	Rock Creek	21717	4049	4817	13.1	0	0%
170501080803	Jordan Creek/Merrill Springs	37622	3579	4638	11.0	873.4344	2%
170501080804	Dry Creek	36062	3622	4844	11.4	7820.722	22%
170501080805	Boney Canyor	10638	3361	4229	9.5	4628.152	44%
	Crooked–Rattlesnake—17050109						
170501090101	Bowden Hills	24229	4491	5945	9.8	13683.98	56%
170501090102	Black Hills	33936	3871	5450	8.8	21733.08	64%
170501090103	Headwaters Crooked Creek	42231	4355	7408	10.3	15003.79	36%
170501090104	Three Man Butte Well	49461	4137	7414	9.4	16080.78	33%
170501090105	Middle Upper Crooked Creek	30302	3979	5074	8.3	16161.73	53%
170501090106	Lower Upper Crooked Creek	27108	3850	4579	9.1	14317.26	53%
170501090201	Upper Rattlesnake Creek	35584	5036	6513	13.1	22621	64%
170501090202	Middle Rattlesnake Creek	19734	4014	5563	9.3	12606.67	64%
170501090203	Bull Creek	36918	3958	5335	9.9	10441.03	28%
170501090204	Tree Springs	11939	4035	5227	8.8	6573.155	55%
170501090205	Battle Creek	31715	4015	6399	9.5	14070.64	44%
170501090206	Red Hills	18424	3811	5088	8.5	10291.5	56%
170501090207	Lower Rattlesnake Creek	35349	3769	5158	8.5	16760.55	47%
170501090301	Grassy Ridge	13803	4035	5134	14.6	3235.084	23%
170501090302	Upper Wildcat Creek	28175	4038	6128	18.3	8422.636	30%
170501090303	Bone Creek	21787	3933	6014	17.8	1335.457	6%
170501090304	Lower Wildcat Creek	30549	3867	4808	11.3	9748.027	32%
170501090401	Peacock Creek	25974	4490	5136	12.9	5734.785	22%
170501090402	Upper Dry Creek	29329	4490	5407	13.9	3048.55	10%
170501090403	Middle Dry Creek	31080	3979	5413	11.3	1765.729	6%
170501090404	Indian Fort Creek	30306	3768	5405	11.3	6707.642	22%
170501090405	Corbin Creek	22618	3981	5307	11.4	1930.912	9%
170501090406	The Basin	14971	3737	4637	8.5	6403.708	43%
170501090407	Lower Dry Creek	37011	3574	4505	8.8	8926.182	24%
170501090501	The Basin South	11245	3770	4383	8.3	6111.2	54%
170501090502	Drought Creek	40199	3567	4653	9.9	14552.43	36%
170501090503	Palomino Lake	29800	4036	5346	14.3	3693.102	12%
170501090504	Upper Palomino Creek	26211	4037	5998	20.1	2738.742	10%
170501090505	Scott Butte Creek	16456	3725	4257	11.3	0	0%
170501090506	Lower Palomino Creek	24771	3578	5268	12.0	3568.131	14%
170501090507	Moth [*sic*] of Crooked Creel	19037	3342	4007	9.9	154.6123	1%


Swan Falls
Murphy
Reynolds
Oreana
SHEAVILLE
Delamar
Silver City
JORDAN VALLEY
Jordan Creek
AROCK
DANNER
ROME
Triangle
JO-1
JO-2
JO-3
JO-4
JO-5
JO-6
JO-7
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JO-33
OREGON
IDAHO
Wetlands Data Source Information:
USGS Land Use/Land Cover- Manual Interpretation of 1970-80 Aerial Photography
Legend
4th Field HUC
6th Field HUC
U.S. Highway
Cities/Towns
Wetlands
Projection: Lambert Conformal Conic
February 2004
FIGURE 7-1
WETLANDS
JORDAN SUBBASIN
0 1 2 4 6 8
Miles
1:325,000
MSE

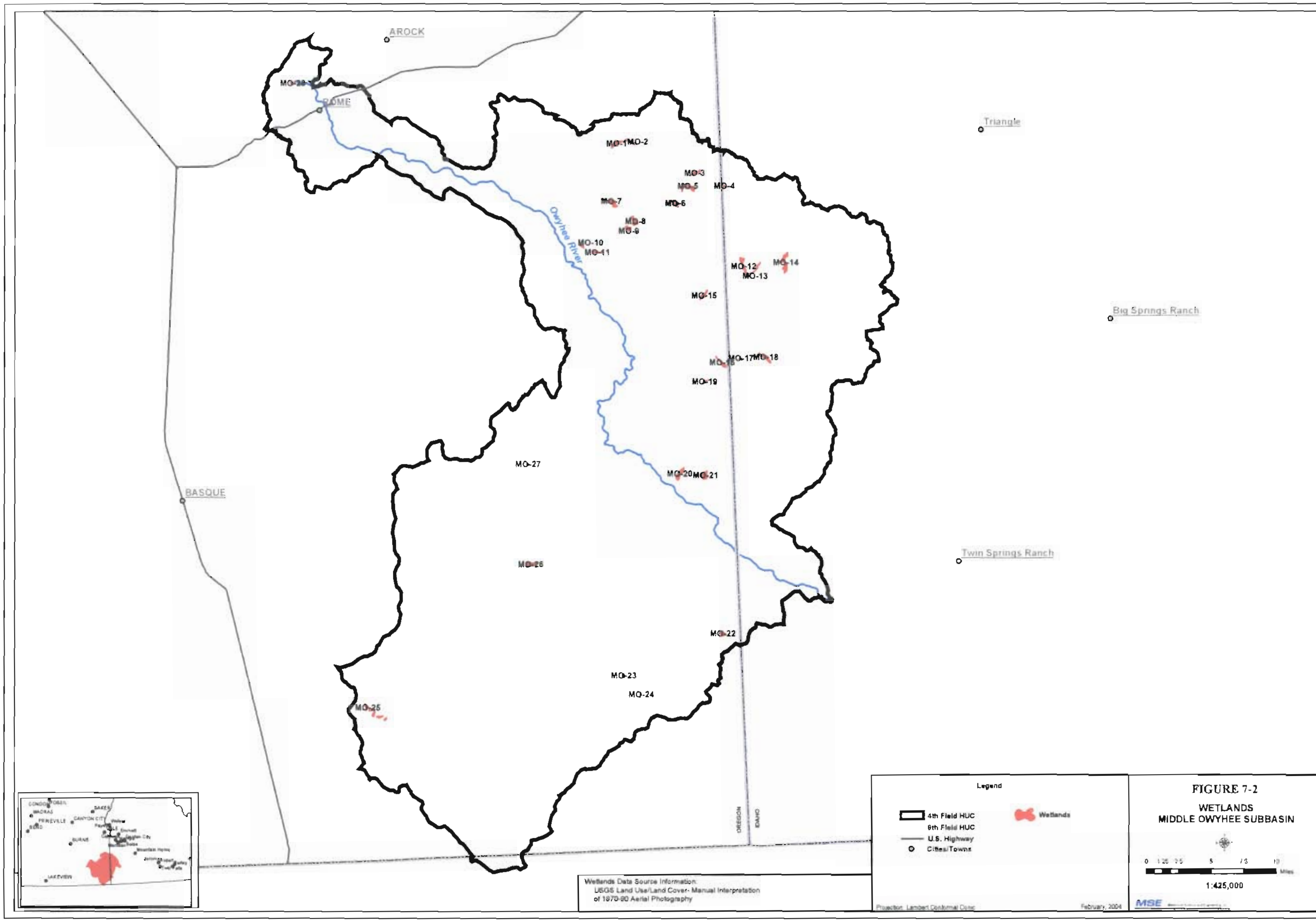


FIGURE 7-2
WETLANDS
MIDDLE OWYHEE SUBBASIN

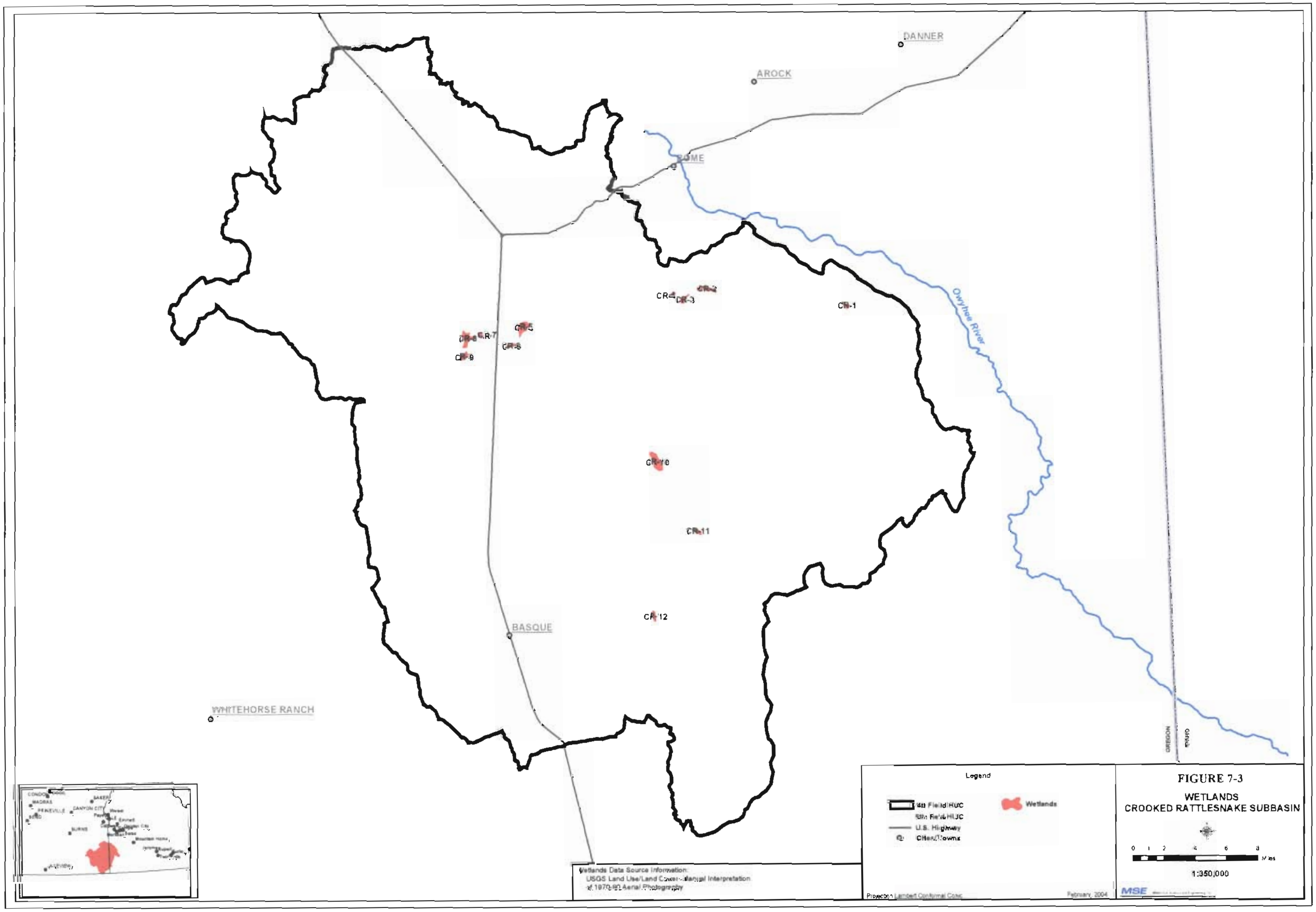
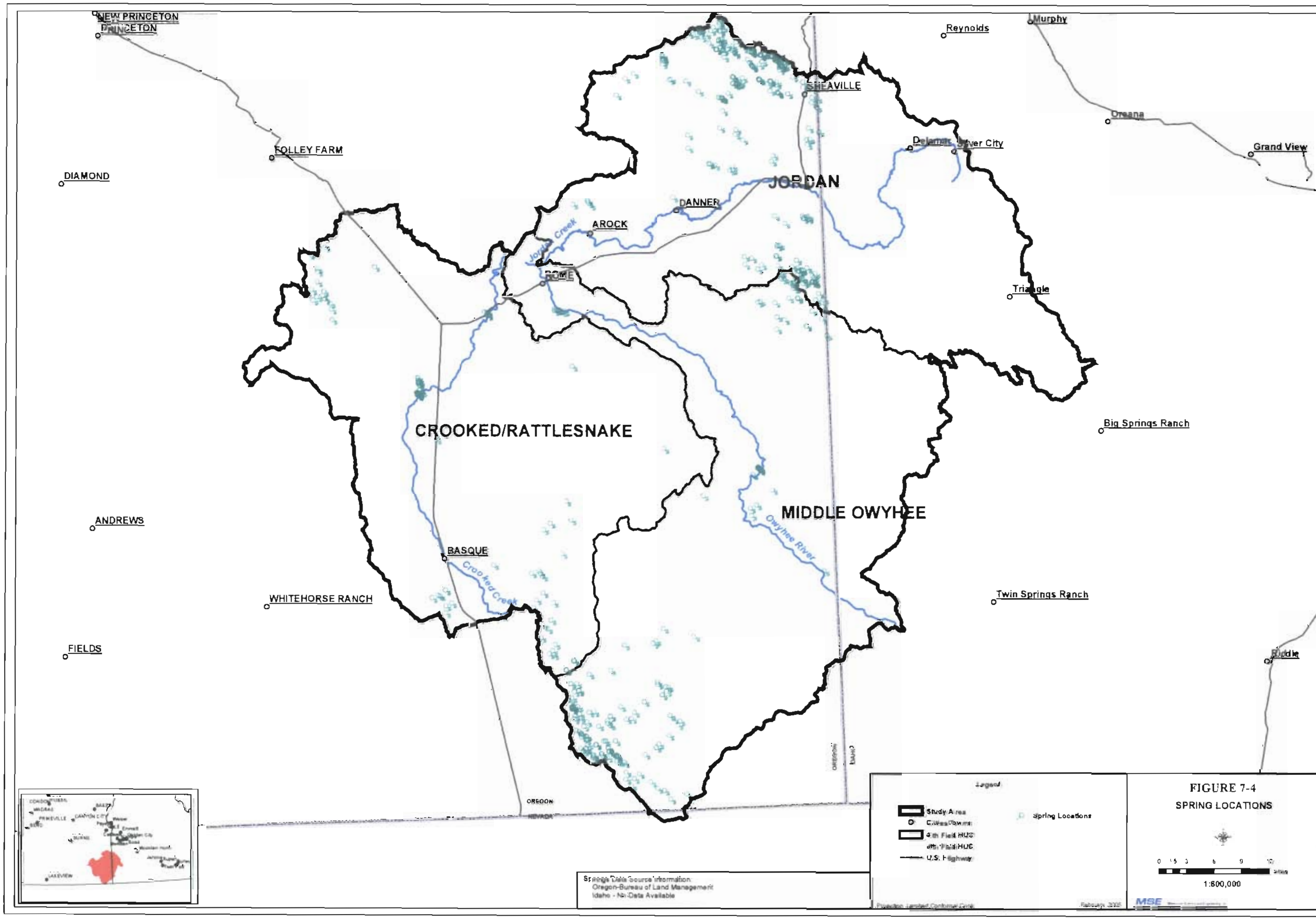


FIGURE 7-3
WETLANDS
CROOKED RATTLESNAKE SUBBASIN



Springs Data Source Information:
Oregon-Bureau of Land Management
Idaho - No Data Available

COMPONENT 8—SEDIMENT SOURCES

The hydrology component of the watershed assessment is directed at assessing the potential for land use practices to affect peak and low flows of surface water. Such changes to flows could promote flooding under certain conditions, or reduced supply under others. This analysis was conducted largely according to the methodology described in the Oregon Watershed Assessment Manual (OWAM; WPN 2001). It makes some simplifying assumptions and aggregates data that a more sophisticated analysis might keep separated, in order to screen a large watershed area for *potential* problems. Data for this component included: precipitation, topography, land use and land cover, stream reaches, surface water peak flows, and the like.

Sediment Sources

The sediment sources component of the watershed assessment is directed at evaluating potential sources of sediment from a subset of the following sources:

- Road instability;
- Slope instability unrelated to roads;
- Rural road runoff;
- Urban runoff;
- Surface erosion from crop land;
- Surface erosion from range land;
- Surface erosion from burned land; and
- Other discrete sources of sediment.

The OWAM protocol is not intended to evaluate all potential sediment sources, but to concentrate on those expected to be of most concern in the watershed. Data limitations also affect the choice of potential sediment sources examined in this assessment.

Road Instability

The stability of rural roads depends on both the construction method and the stability of the underlying land surface. In full–bench construction, the road surface is excavated to a stable location. With sidecast construction, part of the road grade is built from material excavated from downslope. On steep slopes, this tends to result in road failure when wet or heavily loaded. Roads constructed on ridge lines are inherently more stable than those constructed on steep slopes or along streams. This sediment source was not evaluated, since detailed information about road grade, culvert locations and capacity, and road construction method were not available.

Slope Instability Unrelated to Roads

This sediment source was not evaluated, due to a lack of usable data on landslides and debris flows.

Rural Road Runoff

Water draining from roads can deposit sediment into streams from unpaved road surfaces and drainage ditches. The OWAM basic assessment protocol determines how many road miles are within 200 feet of a stream channel and/or on slopes of grater than 50%, and what the road surface and usage rates are. The more detailed protocol requires detailed information about road grade, culvert locations and capacity, and road construction method, similar to that used for the road instability source assessment.

GIS data available for this project include hydrology and road coverages. However, the horizontal position uncertainties in these data sets is about 120 feet, making them unsuitable for reliably estimating which road segments are within 200 feet of a stream. Even the basic assessment could not be performed for this potential sediment source.

A map of roads compiled from the TIGER/Line® line files (US Census Bureau 2000) has been presented previously as Figure 1–A. These line files were in turn derived from 1:100,000 US Geological Survey topographic maps. Map 8–01 displays roads, populated places and urban land use areas on a shaded relief map. Form H–6 in the Hydrology component summarized the mileages, types and densities of roads in each of the subwatersheds.

Urban Runoff

The study area has very little urbanized area. Table 8–1 shows the acreages attributed to urban land use in the national land use/land cover data set derived from aerial photographs taken in the 1970s and 1980s (USGS undated). This data set shows that five of the subwatersheds contain "urban" land. The land use/land cover data appear to contain errors of two kinds. First, the assignment of urban areas to subwatersheds is doubtful in some cases. Second, the urban areas listed in the database are significantly larger than those estimated by inspection of the aerial photos.

Table 8–1. Subwatersheds with "Urban" Land Use

Subwatershed	Name	Populated Place	Area (ac)	Urban Area (ac)	% Urban
170501080301	Jordan Creek Headwaters	Delamar Silver City	33,343	44	0.132%
170501080302	Louse Creek	none	13,741	64	0.466%
170501080501	Baxter Creek	Jordan Valley	16,923	292	1.73%
170501080803	Jordan Creek/Merrill Springs	Arock	37,622	36	0.0956%
170501090102	Black Hills	none	33,936	180	0.530%

Source: USGS __

The assignment of urban land use to portions of the Louse Creek and Black Hills subwatersheds is doubtful. No populated places appear to be located in these subwatersheds. Idaho populated places appearing on our maps (Delamar, Silver City and Triangle) are derived from the Idaho Department of Water Resources (IDWR) GIS coverage (Ciscell, *et al.*, 1990). IDWR obtained its locations and names from a 1976 1:500K BLM map and an Idaho State Highway Map produced in about 1980 by the Idaho Transportation Department (ITD). Oregon populated places (Arock, Basque, Danner, Jordan Valley, Rome and Sheaville) were taken from the Oregon State Service Center for GIS 1:24K populated place names coverage (SSGIS 1990), which was in turn created from US Geological Survey's Geographic Names Information System (GNIS). Visual comparison shows that our locations are similar to those on recent published highway maps (AAA 1993a, 1993b).

The US Census Bureau maintains a fact sheet on only one of these nine locations, Jordan Valley. Jordan Valley is a small incorporated city located in the Baxter Creek subwatershed. The population and density, according to the 2000 census, was 239 people, or 115 people per square mile. US Highway 95 is the main thoroughfare in the city.

An aerial photograph of Jordan Valley's urban core is shown in Figure 1 (OGDC 2000). The visible developed area is approximately 139 acres, which is substantially less than the 292 acres listed in the USGS land use database. The commercial strip along US–95 at the south end of town covers approximately 8 acres out of a total urban area of approximately 139 acres. A new storm sewer and settling basins are currently under construction, with project completion expected around October 2005. The City does not conduct a street cleaning program, but the Oregon Department of Transportation (ODOT) sweeps US–95 annually with a vacuum truck (Warn 2005).

Figure 1. Jordan Valley (1 inch ≈ 1,000 feet)

As shown by the aerial photos (Figures 2 through 6), other "populated places" consist of at most a few houses. They present negligible urban sediment risks, and any inaccuracy in their area estimates is moot.

Figure 2. Basque (1 inch ≈ 1,000 feet)

Figure 3. Arock (1 inch ≈ 1,000 feet)

Figure 4. Danner (1 inch ≈ 1,000 feet)

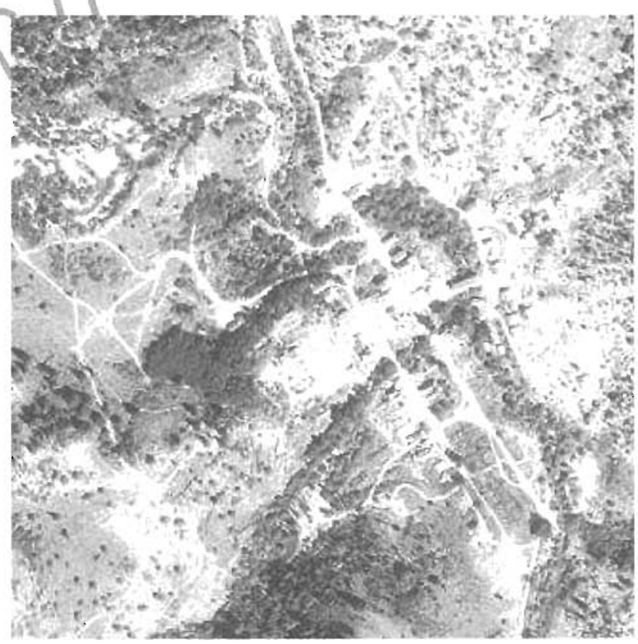


Figure 5. Silver City (1 inch ≈ 1,000 feet)

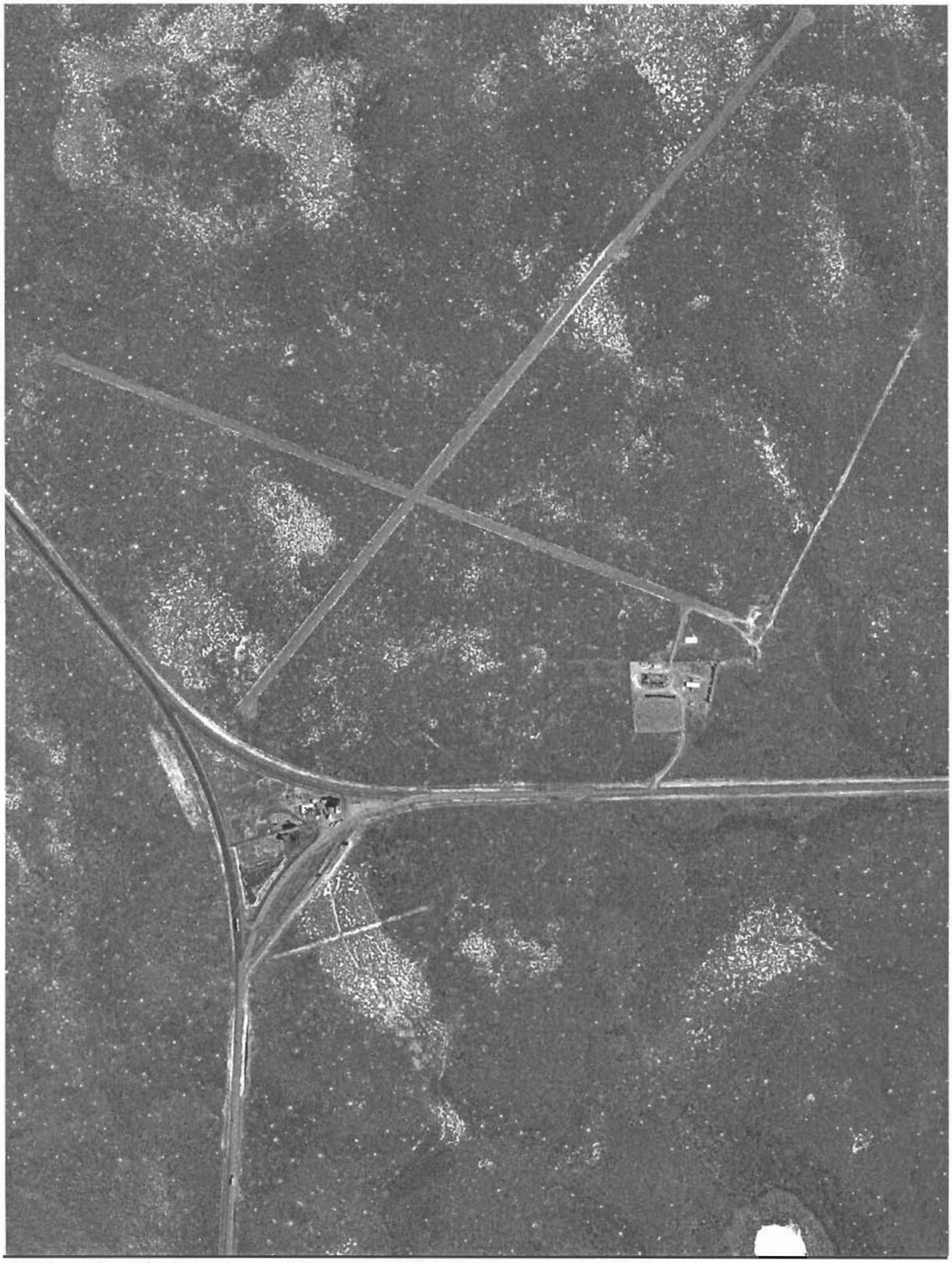


Figure 6. Burns Junction and Airport (1 inch ≈ 1,000 feet)

The OWAM protocol (WPN 1999) for estimating sediment generation risk from urban roads produces a rating and code for each polygon, based on the urban area type, method and frequency of street cleaning and method of sediment removal from storm water (Table 8–2). This analysis allows identifying opportunities to reduce urban storm water sediment loads. Detailed engineering studies would be required to assess the magnitude of the opportunities, or to evaluate alternatives.

Table 8–2. Factors Influencing Urban Storm Water Sediment Loads

Factor	Classification	Rating	Code
Urban Area Type	residential	low	L1
	commercial	moderate	M1
	heavy industrial	high	H1
	developing urban	very high	VH1
Street Cleaning	none or infrequent	small	S2
	frequent mechanical	moderate	M2
	vacuum–assisted	large	L2
Sediment Removal	none	none	N3
	detention ponds/basins	moderate	M3
	treatment plant processing	high	H3

Source: OWAM

Form S–12 shows the result of applying the OWAM protocol to Jordan Valley. Sediment production is low from the residential area, and moderate from the commercial strip. Although street cleaning is performed on the highway, it is done infrequently enough that its effect on sediment loads is expected to be minimal. Sediment removal for both zones will be moderate when the storm sewer construction project is completed. No obvious opportunities for sediment load reduction will remain after completion of this project.

Form S–12. Information on Urban Runoff Polygons

Huc No.	HUC Name	Type	Polygon Area (ac)	Polygon % of HUC Total	Sediment Production	Street Cleaning	Sediment Removal
170501080501	Baxter Creek	residential	139	0.821%	L1	S2	M3
		commercial	8	0.047%	M1	S2	M3
		total	16,923	100%			

Surface Erosion from Cropland and Rangeland

Similar mechanisms result in soil erosion in cropland and rangeland. The main difference is the land condition. Cropland is usually tilled, and slopes rarely exceed 20%. Rangeland is rarely tilled, often sparsely vegetated, and the slopes are often higher than 40%.

The OWAM protocol calls for accumulating data models for predicting soil erosion from cropland and rangeland are similar, but differ in some details. However, the available data do not provide sufficient detail to use different protocols for these two land uses. Form S–14 displays the available data by subwatershed for cropland and rangeland erosion. This includes the amount and percentage of area having high erodibility (K>0.48), as well as maximum and minimum elevations as an indicator of subwatershed slope.

Surface Erosion from Burned Lands

Fires can leave land subject to erosion for a time due to rain splash erosion, lower infiltration rates and higher runoff velocities. Over time, the erosion danger lessens as the vegetation recovers. The OWAM protocol identifies burn areas with sediment production risk in the vicinity of a burn from the soil erodibility (K), slope class, grazing practice and vegetation density.

Information about recent (1986–1992) fires was obtained from the Interior Columbia Basin Ecosystem Management Project (ICBEMP). Form S–15 summarizes available information about these fires. Slopes were estimated as steep (greater than 40%) or not based on visual inspection of the 1:250K topographic maps in the vicinity of the fires. In the absence of specific information about grazing practices in each burn area, they are assumed to be normal (as opposed to controlled stocking). All of the burned areas have sparse vegetation. The burn intensities were not included in the GIS data. Map 13–02 displays Surface Erosion Sources, showing soil types, K-values, and fire locations.

Form S–15. Fire Data

Subwatershed	Steep[1]	Longitude (°W)	Latitude (°N)	Area (ac)	Agency	Date
170501070205		117.3170	42.4170	200.00	BLM	8/2/1986
170501070301		116.9830	42.3670	5.00	BLM	8/21/1992
170501070302		116.9830	42.4830	20.00	BLM	8/7/1986
170501070402		116.8830	42.6830	5.00	BLM	8/12/1988
170501070403		116.9330	42.5830	20.00	BLM	7/28/1988
170501070404		116.9500	42.5000	1.00	BLM	7/4/1987
170501070404		116.9170	42.5330	15.00	BLM	6/23/1992
170501070404		117.0000	42.5500	60.00	BLM	7/5/1986
170501070404		116.9000	42.5670	2.00	BLM	7/1/1986
170501070406		117.0500	42.5500	0.10	BLM	8/8/1990
170501070501		116.9830	42.3500	757.00	BLM	7/17/1992
170501070601		117.0670	42.6670	30.00	BLM	6/16/1988
170501070601		117.0830	42.6830	30.00	BLM	8/8/1990
170501070601		117.0000	42.7170	1.00	BLM	8/6/1989
170501070601		117.0670	42.7500	5.00	BLM	8/12/1988
170501070602		117.1000	42.6330	0.10	BLM	9/7/1990
170501070604		117.1830	42.8000	120.00	BLM	8/12/1988
170501070701	Yes	117.2000	42.5670	8.00	BLM	7/3/1987
170501070701	Yes	117.1830	42.5830	11.00	BLM	8/11/1989
170501070701		117.2670	42.6170	225.00	BLM	6/24/1992
170501070701		117.3000	42.6330	40.00	BLM	8/6/1988
170501070702		117.2500	42.7000	3.00	BLM	7/11/1990
170501070702	Yes	117.3500	42.7330	6.00	BLM	8/13/1992
170501070703		117.3670	42.7170	30.00	BLM	8/18/1992
170501070703		117.4830	42.7500	700.00	BLM	6/11/1992
170501070703		117.5170	42.8170	3000.00	BLM	8/10/1986
170501080102		116.6500	42.7670	1.00	BLM	7/20/1988
170501080105	Yes	116.7170	42.7500	1.00	BLM	7/10/1988
170501080105	Yes	116.7330	42.7500	1.00	BLM	7/10/1988
170501080201	Yes	116.7500	42.8330	750.00	BLM	8/26/1991
170501080205	Yes	116.8000	42.8670	81.00	BLM	3/3/1987
170501080303	Yes	116.9170	42.9500	2.00	BLM	7/25/1989
170501080401		116.9330	42.7830	230.00	BLM	9/11/1990
170501080402		117.0330	42.7830	5.50	BLM	9/5/1987
170501080403		116.9670	42.9670	0.20	BLM	9/6/1990
170501080404		117.0000	42.9500	1.00	BLM	7/15/1987
170501080501		117.0830	43.0000	5.00	BLM	7/31/1986
170501080501		117.0170	43.0330	720.00	BLM	8/23/1986
170501080503		117.0830	42.8670	0.10	BLM	7/21/1991
170501080503	Yes	117.0670	42.9500	7.00	BLM	8/6/1987

170501080503	Yes	117.0830	42.9500	5.00	BLM	7/14/1989
170501080504		117.1170	42.8830	60.00	BLM	7/30/1990

Form S–15, continued. Fire Data

Subwatershed	Steep[1]	Longitude (°W)	Latitude (°N)	Area (ac)	Agency	Date
170501080505		117.2000	43.0170	12920.00	BLM	8/11/1986
170501080601		116.9000	43.0830	170.00	BLM	9/1/1986
170501080603		117.0670	43.1330	2.00	BLM	8/24/1987
170501080604		117.1900	43.1450	0.00	R5	5/18/1987
170501080604		117.2500	43.1000	0.50	BLM	6/21/1988
170501080604		117.2000	43.2000	1824.00	BLM	9/11/1992
170501080605		117.1830	43.0830	20.00	BLM	5/17/1992
170501080605		117.2830	43.0830	150.00	BLM	6/10/1992
170501080702		117.4170	43.0500	2.00	BLM	8/10/1990
170501080702		117.4330	43.0830	1085.00	BLM	6/23/1992
170501080702		117.5000	43.1500	250.00	BLM	8/11/1988
170501080703		117.2830	42.9830	3.00	BLM	6/26/1989
170501080703		117.3330	43.0000	1.00	BLM	6/10/1992
170501080703		117.2830	43.0000	0.10	BLM	6/24/1992
170501080703		117.4000	43.0500	20.00	BLM	8/10/1986
170501080703		117.2830	43.0500	1500.00	BLM	6/10/1992
170501080801		117.4000	42.9170	15.00	BLM	6/11/1992
170501080802		117.3000	42.8830	25.00	BLM	8/10/1986
170501080802		117.3830	42.8830	1.00	BLM	6/11/1992
170501080802		117.3830	42.9000	1.00	BLM	6/11/1992
170501080803		117.5000	42.9170	15.00	BLM	7/31/1988
170501080804		117.4500	42.8000	100.00	BLM	8/10/1986
170501080804		117.5170	42.8500	2.00	BLM	6/11/1992
170501080805		117.6333	42.9500	0.30	BIA	7/1/1986
170501090103		117.8170	42.4170	2.00	FWS	7/27/1990
170501090103		117.8330	42.3500	3800.00	BLM	7/26/1987
170501090103	Yes	117.8330	42.3670	2600.00	BLM	7/30/1987
170501090103	Yes	117.8500	42.3830	2.00	BLM	10/12/1987
170501090105		117.9250	42.5083	0.10	BIA	7/11/1989
170501090105		117.8830	42.4500	720.00	BLM	8/2/1986
170501090201	Yes	117.6170	42.2830	6.00	BLM	7/28/1986
170501090202		117.5733	42.3883	1.00	R6	7/26/1989
170501090203		117.5830	42.6000	5500.00	BLM	9/7/1986
170501090205	Yes	117.6830	42.4170	5.00	BLM	8/2/1986
170501090401		117.4000	42.5000	450.00	BLM	8/2/1986
170501090406		117.7000	42.6670	80.00	BLM	6/14/1987
170501090407		117.7167	42.7167	4.00	BIA	7/28/1986
170501090502		117.8670	42.7500	3.00	BLM	8/23/1986
170501090504	Yes	118.0830	42.8330	3.00	BLM	7/28/1986

170501090506		117.8830	42.8330	1.00	BLM	8/20/1986
170501090506		117.9170	42.8500	15.00	BLM	8/9/1987
170501090507		117.6667	42.7667	0.10	BIA	5/9/1987

NOTES 1 Steep means greater than about 40%, according to the 1:250K topographic maps

Other Sediment Sources

Since there is little construction in the study area, the largest remaining sediment source in the study area is probably mining. The Kinross DeLamar mine is the largest recently active mine, with 1,072 acres of disturbed area (Kuipers 2003). A large open pit mine with mill and tailings facility produced silver and gold from 1977 through 1998. Historic operations were also conducted from about 1880 until 1940. Final reclamation of the mine began in 2002, with large–scale earthwork expected to be complete in 2006. Low permeability caps are being applied to most mine facilities. Engineered storm water controls are being installed, and enhanced evaporation and land application will be used to dispose of process and tailings water. Sulfate–reducing bioreactors are planned to treat small residual flows (Smith 2004). Mine closure in Idaho is regulated by the Idaho Department of Lands under the 1971 Surface Mining Act. The financial assurance for closure provided by Kinross Delamar is estimated at just over 10 million dollars (Kuipers 2003).

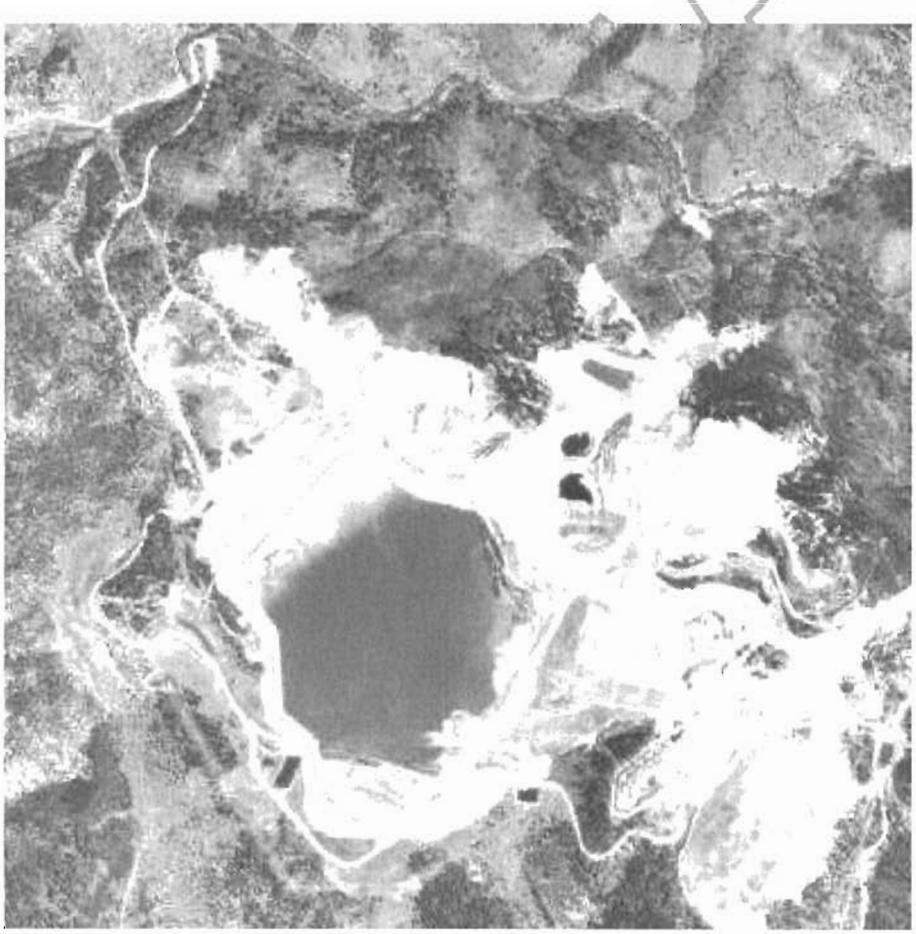


Figure 7. Kinross DeLamar silver/gold mine (1 inch ≈ 2,000 feet)

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08-sediments doc

Form S-14: Ag/ Range Erosion Characteristics

Subwatershed Number	Name	Area (ac)	Minimum Elevation (ft)	Maximum Elevation (ft)	Mean Annual Precipitation (in)	K>0.48 Area	K>0.48 % Area
	Middle Owyhee—17050107						
170501070101	Upper Toppin Creek	32414	5263	6076	11.9	24698.25	76%
170501070102	Mustang Lake	15621	5105	5585	11.6	13581.1	87%
170501070103	Lower Toppin Creek	27683	4160	5442	10.7	23195.68	84%
170501070104	Jack Creek	22952	5577	6458	17.9	4468.965	19%
170501070105	Headwaters West Little Owyhee River	25808	5567	6682	20.2	2336.341	9%
170501070106	Upper West Little Owyhee River	31490	5076	6489	13.5	18822.78	60%
170501070107	Middle West Little Owyhee River	34464	4157	5585	10.5	22606.14	66%
170501070108	Lower West Little Owyhee River	7851	4017	5307	10.7	5313.015	68%
170501070201	Upper Pole Creek	25783	5106	6387	13.9	17062.3	66%
170501070202	Field Creek	16965	5034	6460	15.0	11052.27	65%
170501070203	Lower Pole Creek	34260	4839	5889	12.6	28277.05	83%
170501070204	Upper Antelope Creek	35414	5605	6650	19.3	9153.025	26%
170501070205	Middle Antelope Creek	32010	4597	6058	13.3	24358.98	76%
170501070206	Upper Little Antelope Creek	22572	5011	5816	11.9	18774.06	83%
170501070207	Lower Little Antelope Creek	33196	4609	5511	12.4	27794.4	84%
170501070208	Lower Antelope Creek	19607	3996	5167	12.0	6374.301	33%
170501070301	Upper Middle Fork Owyhee River	36171	4622	6808	12.0	4234.485	12%
170501070302	Pole Creek	21322	4175	6303	11.6	3166.785	15%
170501070303	Lower Middle Fork Owyhee River	13252	3962	5102	10.8	2898.788	22%
170501070401	Pleasant Valley Creek	17281	4935	6538	14.6	834.957	5%
170501070402	Juniper Creek	24809	4839	7804	20.9	486.4738	2%
170501070403	Upper North Fork Owyhee River	26887	4415	6785	16.9	1520.577	6%
170501070404	Squaw Creek	30663	4413	6804	13.4	1749.553	6%
170501070405	Cherry Creek	30488	4203	6721	12.6	4828.787	16%
170501070406	Lower North Fork Owyhee River	11457	3956	5782	12.2	1709.006	15%
170501070501	Owyhee River - Dukes Creek	23632	4177	6135	10.2	8173.154	35%
170501070502	Oregon Lake Creek	10552	4177	5427	11.5	9152.998	87%
170501070503	Owyhee River - Bull Creek	28515	4016	5543	10.4	16271.56	57%
170501070504	Owyhee River - Warm Spring Canyon	22205	3942	5091	11.9	3903.726	18%
170501070601	Upper Soldier Creek	39213	4542	7152	15.6	7183.57	18%
170501070602	Mud Flat Creek	29855	4536	5285	13.4	849.9323	3%
170501070603	Willow Creek	16016	4423	5983	15.9	214.5468	1%
170501070604	Spring Creek	19898	4360	6053	14.7	55.92362	0%
170501070605	Lower Soldier Creek	10515	3612	4970	13.2	10.4028	0%
170501070701	Whitehorse Creek	31614	3843	5414	13.6	1475.278	5%
170501070702	Skull Creek	29377	3610	5414	13.2	628.9856	2%
170501070703	Sand Hollow	24633	3409	4758	11.3	2194.423	9%
170501070704	China Gulch	24694	3382	4131	8.5	8207.952	33%
170501070705	Lower Middle Owyhee Rive	17308	3343	3978	8.6	6838.172	40%
	Jordan—17050108						
170501080101	Sheep Creek	15433	5535	6536	18.6	308.596	2%
170501080102	Upper Rock Creek	29527	5002	6579	14.3	1348.335	5%
170501080103	Meadow Creek	22838	5024	8067	21.1	1878.874	8%
170501080104	Josephine Creek	21543	5002	6607	16.6	430.7909	2%
170501080105	Lower Rock Creek	14396	4845	6859	17.8	451.2506	3%
170501080201	Upper North Boulder Creek	22346	4843	8402	28.1	112.8435	1%
170501080202	Lower North Boulder Creek	9742	4571	6861	19.0	194.8165	2%
170501080203	Upper South Boulder Creek	12227	5082	7770	25.5	138.1649	1%
170501080204	Lower South Boulder Creek	13194	4726	6843	22.5	224.7624	2%
170501080205	Big Boulder Creek	28056	4576	7773	18.2	1520.114	5%
170501080301	Jordan Creek Headwaters	33343	4755	8022	27.0	443.049	1%
170501080302	Louse Creek	13741	4760	7923	24.3	96.3876	1%
170501080303	Jordan Creek-Flint Creek	26411	4564	7919	20.5	1230.98	5%
170501080401	Williams Creek	11944	4519	7793	21.9	493.7263	4%
170501080402	Lone Tree Creek	27053	4456	7361	17.9	3865.054	14%
170501080403	Trout Creek	18059	4403	5937	17.5	1925.479	11%
170501080404	Rail Creek	28127	4401	7376	15.6	5480.995	19%
170501080501	Baxter Creek	16923	4323	6127	14.0	6447.106	38%
170501080502	Hooker Creek	24120	4315	6119	13.5	10273.97	43%
170501080503	Sheep Spring Creek	22869	4323	6114	13.5	9907.568	43%

Form S-14: Ag/ Range Erosion Characteristics

Subwatershed Number	Name	Area (ac)	Minimum Elevation (ft)	Maximum Elevation (ft)	Mean Annual Precipitation (in)	K>0.48 Area	K>0.48 % Area
170501080504	Jack Creek	36099	4234	6088	13.6	8458.689	23%
170501080505	Downey Creek	33620	4215	4924	12.7	10162	30%
170501080601	Jackson Creek	34435	4685	7412	21.0	6585.702	19%
170501080602	Posey Creek	22296	4421	6099	14.4	9034.692	41%
170501080603	Spring Branch	14308	4423	5990	15.1	709.2206	5%
170501080604	Mahogany Creek	30842	4349	6500	15.5	1518.4	5%
170501080605	Lower Upper Cow Creek	16756	4349	4911	13.4	4522.255	27%
170501080701	Cove Creek	40493	4342	6434	14.2	42.77777	0%
170501080702	Jordan Craters	31121	4308	4877	12.9	0	0%
170501080703	Mouth Of Cow Creek	39045	4216	4871	12.7	1689.368	4%
170501080801	Jordan Creek/Rock Creek Reservoir	17351	4035	4730	12.3	112.8445	1%
170501080802	Rock Creek	21717	4049	4817	13.1	0	0%
170501080803	Jordan Creek/Merrill Springs	37622	3579	4638	11.0	873.4344	2%
170501080804	Dry Creek	36062	3622	4844	11.4	7820.722	22%
170501080805	Boney Canyor	10638	3361	4229	9.5	4628.152	44%
	Crooked–Rattlesnake—17050109						
170501090101	Bowden Hills	24229	4491	5945	9.8	13683.98	56%
170501090102	Black Hills	33936	3871	5450	8.8	21733.08	64%
170501090103	Headwaters Crooked Creek	42231	4355	7408	10.3	15003.79	36%
170501090104	Three Man Butte Well	49461	4137	7414	9.4	16080.78	33%
170501090105	Middle Upper Crooked Creek	30302	3979	5074	8.3	16161.73	53%
170501090106	Lower Upper Crooked Creek	27108	3850	4579	9.1	14317.26	53%
170501090201	Upper Rattlesnake Creek	35584	5036	6513	13.1	22621	64%
170501090202	Middle Rattlesnake Creek	19734	4014	5563	9.3	12606.67	64%
170501090203	Bull Creek	36918	3958	5335	9.9	10441.03	28%
170501090204	Tree Springs	11939	4035	5227	8.8	6573.155	55%
170501090205	Battle Creek	31715	4015	6399	9.5	14070.64	44%
170501090206	Red Hills	18424	3811	5088	8.5	10291.5	56%
170501090207	Lower Rattlesnake Creek	35349	3769	5158	8.5	16760.55	47%
170501090301	Grassy Ridge	13803	4035	5134	14.6	3235.084	23%
170501090302	Upper Wildcat Creek	28175	4038	6128	18.3	8422.636	30%
170501090303	Bone Creek	21787	3933	6014	17.8	1335.457	6%
170501090304	Lower Wildcat Creek	30549	3867	4808	11.3	9748.027	32%
170501090401	Peacock Creek	25974	4490	5136	12.9	5734.785	22%
170501090402	Upper Dry Creek	29329	4490	5407	13.9	3048.55	10%
170501090403	Middle Dry Creek	31080	3979	5413	11.3	1765.729	6%
170501090404	Indian Fort Creek	30306	3768	5405	11.3	6707.642	22%
170501090405	Corbin Creek	22618	3981	5307	11.4	1930.912	9%
170501090406	The Basin	14971	3737	4637	8.5	6403.708	43%
170501090407	Lower Dry Creek	37011	3574	4505	8.8	8926.182	24%
170501090501	The Basin South	11245	3770	4383	8.3	6111.2	54%
170501090502	Drought Creek	40199	3567	4653	9.9	14552.43	36%
170501090503	Palomino Lake	29800	4036	5346	14.3	3693.102	12%
170501090504	Upper Palomino Creek	26211	4037	5998	20.1	2738.742	10%
170501090505	Scott Butte Creek	16456	3725	4257	11.3	0	0%
170501090506	Lower Palomino Creek	24771	3578	5268	12.0	3568.131	14%
170501090507	Moth [*sic*] of Crooked Creel	19037	3342	4007	9.9	154.6123	1%

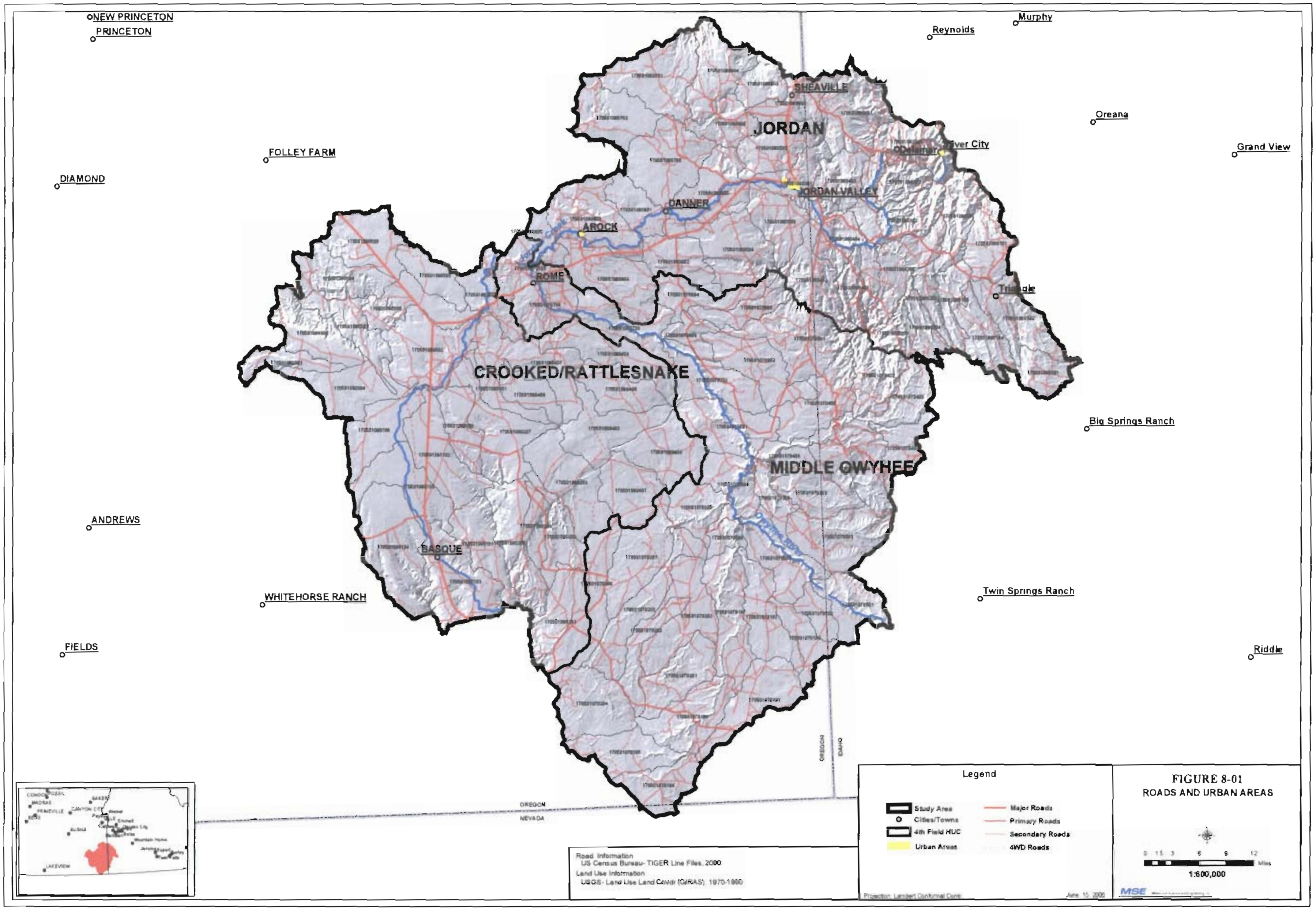

FIGURE 8-01
ROADS AND URBAN AREAS

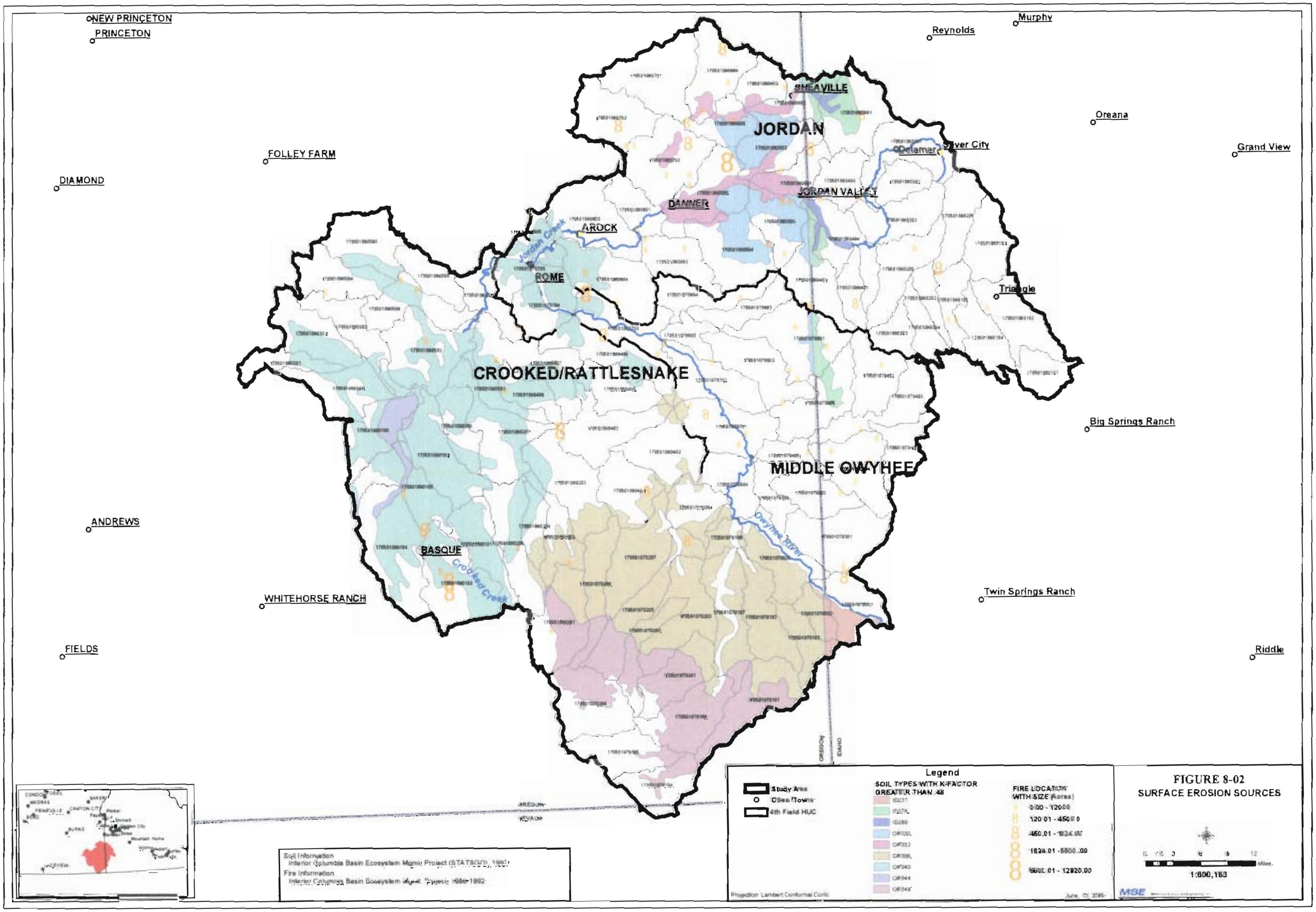

FIGURE 8-02
SURFACE EROSION SOURCES

COMPONENT 9—CHANNEL MODIFICATION

This component of the watershed assessment is directed at assessing the potential for channel modifications to alter the physical characteristics of the streams in ways that could affect aquatic habitat. Stream channels are dynamic systems that change in response to both natural and anthropogenic effects. This component identifies how human activities have directly changed channel morphology and aquatic habitat. The degree of impact to habitat will depend on the type of channel and the amount of channel modification. Information analyzed in this component is then synthesized with information from the other components to assess overall watershed health and function. This analysis was conducted largely according to the methodology described in the Oregon Watershed Assessment Manual (OWAM; WPN 1999). However, it makes some simplifying assumptions and aggregates data that a more sophisticated analysis might keep separated, in order to screen a large watershed area for *potential* problems. Results of the channel modification assessment are summarized in the following sections, on Forms CM-1 and CM-2 and Maps 09-01 and 09-02.

Data Sources

Data for assessment of channel modifications was obtained from the Bureau of Reclamation, Oregon Water Resources Department (OWRD), Idaho Department of Water Resources (IDWR), select aerial and topographic maps for specific watershed locations, and TIGER line files from the 2000 census for road networks. Due to the large watershed area detailed aerial photo or topographic map review was impractical. Therefore, existing databases were relied on for dam/diversion identification. GIS analysis was used to identify roads that cross or are near stream channels. A 100-foot buffer was generated around all stream segments that intersected with the road network. All roads that fell within the buffer have the potential to modify the channel with the loss of side-channels, lateral pools and riparian function. Based on the orientation of the road segment with respect to the stream channel, road crossings were also identified by GIS screening. Road crossings were assumed to have modified the channel through placement of fill, local loss of habitat complexity, and downstream erosion.

Inventory of Channel Modifications

The types of channel modifications identified included dams (irrigation, impoundment, flood control, fire protection and mine related); irrigation diversions; road crossings, and roads next to streams. Channel modifications are summarized on Form CM-1 with dams and diversions identified on a site specific basis. Due to the number and diversity of road crossings and roads next to streams (over 3,000 individual sections identified within the watershed) these features were grouped and summarized by (sixth field) subbasin. Individual locations of these various site features are presented on Map 09-01 for dams and Map 09-02 for roads. Approximate irrigation diversion locations are summarized on Figure 5-1 Water Use Locations (Component 5).

The length of affected stream channel was estimated based on the type of channel modification. For dams, the length of channel modification was estimated at a factor of 20 times the dam height (corresponding to an assumed average channel slope of 5%). For road crossings a value of 25 feet per crossing was assumed. For roads next to streams the length of the road section within the 100-foot buffer was used.

Due to the large watershed area, channel habitat type has only been evaluated for 20 of the 105 subbasins (see Component 3). Most of channel modifications are located outside these areas. For example, 15 dam sites are within the 20 typed subbasins out of a total of 58 sites identified within the entire study area. Channel modification sites that are located within all 105 subbasins are included on the forms and maps.

The type of impact was evaluated for each general class of channel modification. For dams and irrigation diversions, channel impacts were generally considered to be flow alteration, loss of spawning gravels and migration barriers . Within the upper reaches of Jordan Creek (Rich Gulch) waste rock deposits associated with recent open-pit mining activities fill the entire upper drainage. In addition, ore processing areas and tailings storage dams are also present. While these modifications have the potential to affect habitat complexity they are generally within intermittent drainages that are likely to be dry much of the year or along ridgetops outside channel areas. Roads next to streams and road crossings are likely to create a loss of side-channels, lateral pools, riparian function, loss of habitat complexity and potential downstream erosion.

Due to the large number of features and large watershed area identifying the magnitude of channel impact for each stream channel was impractical. Therefore, the following simplifying assumptions were used. Roads next to streams and road crossings are generally considered to have a low to moderate impact. Dams and stream diversions are considered to have a moderate to high impact depending on the size of the feature.

Location of Channel Modifications

Channel modifications are widely distributed throughout the watershed with certain exceptions. Dam sites associated with recent mining activity are concentrated within the upper reaches of Jordan Creek. However, these channel modifications are primarily associated with dry or intermittent drainages. Although not identified in this assessment, additional channel modification associated with historic mining activity are likely to be present within the upper reaches of Jordan Creek.

Irrigation diversions are primarily associated with agricultural valleys along Jordan Creek. These diversions include both local ditches and larger canal companies.

Roads along streams and road crossings appear fairly evenly distributed throughout the watershed.

Types and Magnitude of Channel Modifications

The types of channel modifications identified include dams (irrigation, impoundment, flood control, fire protection and mine related); irrigation diversions; road crossings, and roads next to streams. The magnitude of impact was difficult to evaluate with the limitations of the study; however, is generally considered to be low to moderate for roads next to streams and road crossings. Dams and stream diversions are considered to have a moderate to high impact depending on the size and location of the feature.

Affected Channel Habitat Types

Channel modifications can affect a variety of channel habitat types. Since only about 20% of the study area was evaluated for CHT the identification of affected CHT should be considered of limited representation. For the very limited number of sites that were typed, affected CHT consisted primarily of low gradient confined to moderately confined channel types, followed by low gradient with small to medium floodplains, steep narrow valleys, and moderate gradient channels that are confined.

REFERENCES

WPN 1999. *Oregon Watershed Assessment Manual.* Watershed Professionals Network, prepared for the Governor's Watershed Enhancement Board, Salem, Oregon.

09-Channel Mod doc

FORM CM-1
CHANNEL MODIFICATION INVENTORY - DAMS

DAM_#	PURPOSES	DAM HEIGHT (ft)	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
2122	Dam (I)	12.60	LM	0.047727273	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01324	Dam	13.40	LM	0.050757576	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01889	Dam (IFR)	24.50	LC	0.09280303	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
4150	Dam (J)	41.00	MC	0.15530303	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
XX14	Dam (BE)	42.00	SV	0.159090909	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
2165A1	Dam (L)	15.00	FP3	0.056818182	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01462	Dam	10.20	LM	0.038636364	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
7251	Dam (SG)	19.00	MC	0.071969697	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
2208	Dam (I)	28.00	MM	0.106060606	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00053	Dam (I)	34.00	FP2	0.128787879	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
7079C	Dam (B)	24.00	SV	0.090909091	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00027	Dam (I)	14.00	FP2	0.053030303	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
7079D	Dam (B)	21.50	SV	0.081439394	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01366	Dam	10.00	LM	0.037878788	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00081	Dam (I)	17.00	FP3	0.064393939	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
7079A	Dam (T)	315.00		1.193181818	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
2165A2	Dam (AUX)	6.00		0.022727273	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
4059	Dam (J)	8.50		0.03219697	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
2017	Dam (L)	23.00		0.087121212	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
XX07	Dam (O)	11.50		0.043560606	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR02313	Dam	10.00		0.037878788	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01085	Dam (P)	16.90		0.064015152	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
XX12	Dam (O)	20.00		0.075757576	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00061	Dam (I)	12.00		0.045454545	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
XX11	Dam (O)	18.00		0.068181818	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
XX09	Dam (O)	17.00		0.064393939	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
7165	Dam (IR)	16.00		0.060606061	Moderate to High	flow alteration, loss of spawning gravel, migration barriers

FORM CM-1
CHANNEL MODIFICATION INVENTORY - DAMS

DAM_#	PURPOSES	DAM HEIGHT (ft)	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
2172	Dam (K)	16.00		0.060606061	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01643	Dam	24.00		0.090909091	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01998	Dam	10.00		0.037878788	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00623	Dam (I)	15.00		0.056818182	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01599	Dam (PF)	11.60		0.043939394	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00253	Dam (I)	24.00		0.090909091	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00254	Dam (I)	21.00		0.079545455	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
2065	Dam (L)	9.00		0.034090909	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00758	Dam (PF)	26.00		0.098484848	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR02598	Dam	10.80		0.040909091	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR01806	Dam (PF)	15.00		0.056818182	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00762	Dam ©	20.00		0.075757576	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00085	Dam (I)	11.00		0.041666667	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00664	Dam (I)	22.00		0.083333333	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00089	Dam (I)	23.00		0.087121212	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00051	Dam (I)	18.00		0.068181818	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
2180	Dam (L)	12.00		0.045454545	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00310	Dam (I)	16.00		0.060606061	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00068	Dam (I)	24.00		0.090909091	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
4037	Dam (J)	22.50		0.085227273	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00019	Dam (I)	30.00		0.113636364	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00122	Dam (I)	56.00		0.212121212	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00086	Dam (I)	27.00		0.102272727	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR02394	Dam	15.00		0.056818182	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR03698	Dam (PF)	25.00		0.09469697	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR02666	Dam (PF)	14.30		0.054166667	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR02218	Dam	12.40		0.046969697	Moderate to High	flow alteration, loss of spawning gravel, migration barriers

FORM CM-1
CHANNEL MODIFICATION INVENTORY - DAMS

DAM_#	PURPOSES	DAM HEIGHT (ft)	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
OR02908	Dam	10.70		0.040530303	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR03336	Dam	11.00		0.041666667	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00338	Dam (I)	25.00		0.09469697	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
OR00625	Dam (I)	38.00		0.143939394	Moderate to High	flow alteration, loss of spawning gravel, migration barriers
Oregon						
I - irrigation, H - hydroelectric, C - flood control and storm						
water management, N - navigation, S - water supply, R - recreation, P - fire						
protection, stock, or small farm pond, D - debris control, T - tailings, O - other						
Idaho	x					
I - Irrigation, L-Domestic, Irrigation, K - Domestic, stock, J - Stockwater						
T - Mine Tailings, B - Mining, SG - Stockwater, Wildlife, O - Other						
BE - Mining, Erosion Control						

FORM CM-1:
CHANNEL MODIFICATION INVENTORY - DIVERSIONS

HUC 6	Channel Modification Activity Description	Data Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070101	Irrigation Diversion	OWRD, IDWR		0.20	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070102	Irrigation Diversion	OWRD, IDWR		0.10	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070103	Irrigation Diversion	OWRD, IDWR		0.18	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070104	Irrigation Diversion	OWRD, IDWR		0.05	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070105	Irrigation Diversion	OWRD, IDWR		0.02	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070106	Irrigation Diversion	OWRD, IDWR		0.10	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070107	Irrigation Diversion	OWRD, IDWR		0.12	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070108	Irrigation Diversion	OWRD, IDWR		0.05	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070201	Irrigation Diversion	OWRD, IDWR		0.10	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070203	Irrigation Diversion	OWRD, IDWR		0.24	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070204	Irrigation Diversion	OWRD, IDWR		0.05	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070205	Irrigation Diversion	OWRD, IDWR		0.11	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070206	Irrigation Diversion	OWRD, IDWR		0.12	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070207	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070208	Irrigation Diversion	OWRD, IDWR		0.14	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070301	Irrigation Diversion	OWRD, IDWR		0.02	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070302	Irrigation Diversion	OWRD, IDWR		0.19	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070303	Irrigation Diversion	OWRD, IDWR		0.15	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070401	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070403	Irrigation Diversion	OWRD, IDWR		0.07	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070404	Irrigation Diversion	OWRD, IDWR		0.03	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070405	Irrigation Diversion	OWRD, IDWR		0.17	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070406	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070502	Irrigation Diversion	OWRD, IDWR		0.02	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070503	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070504	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070601	Irrigation Diversion	OWRD, IDWR		0.50	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers

FORM CM-1:
CHANNEL MODIFICATION INVENTORY - DIVERSIONS

HUC 6	Channel Modification Activity Description	Data Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070602	Irrigation Diversion	OWRD, IDWR		0.67	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070603	Irrigation Diversion	OWRD, IDWR		0.25	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070604	Irrigation Diversion	OWRD, IDWR		0.10	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070605	Irrigation Diversion	OWRD, IDWR		0.16	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070701	Irrigation Diversion	OWRD, IDWR		0.33	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070702	Irrigation Diversion	OWRD, IDWR		0.22	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070703	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070704	Irrigation Diversion	OWRD, IDWR		0.05	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501070705	Irrigation Diversion	OWRD, IDWR		0.04	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080101	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080103	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080203	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080204	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080205	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080301	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080302	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080402	Irrigation Diversion	OWRD, IDWR		0.03	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080403	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080404	Irrigation Diversion	OWRD, IDWR		0.02	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080501	Irrigation Diversion	OWRD, IDWR		0.08	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080502	Irrigation Diversion	OWRD, IDWR		0.17	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080503	Irrigation Diversion	OWRD, IDWR		0.24	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080504	Irrigation Diversion	OWRD, IDWR		0.27	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080505	Irrigation Diversion	OWRD, IDWR		0.29	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080601	Irrigation Diversion	OWRD, IDWR		0.03	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080602	Irrigation Diversion	OWRD, IDWR		0.16	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080603	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers

FORM CM-1:
CHANNEL MODIFICATION INVENTORY - DIVERSIONS

HUC 6	Channel Modification Activity Description	Data Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501080604	Irrigation Diversion	OWRD, IDWR		0.39	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080605	Irrigation Diversion	OWRD, IDWR		0.13	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080701	Irrigation Diversion	OWRD, IDWR		0.14	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080702	Irrigation Diversion	OWRD, IDWR		0.05	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080703	Irrigation Diversion	OWRD, IDWR		0.15	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080801	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080802	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080803	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080804	Irrigation Diversion	OWRD, IDWR		0.50	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501080805	Irrigation Diversion	OWRD, IDWR		0.03	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090101	Irrigation Diversion	OWRD, IDWR		0.06	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090103	Irrigation Diversion	OWRD, IDWR		0.11	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090104	Irrigation Diversion	OWRD, IDWR		0.05	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090106	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090201	Irrigation Diversion	OWRD, IDWR		0.21	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090202	Irrigation Diversion	OWRD, IDWR		0.07	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090203	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090204	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090205	Irrigation Diversion	OWRD, IDWR		0.11	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090206	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090207	Irrigation Diversion	OWRD, IDWR		0.06	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090301	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090302	Irrigation Diversion	OWRD, IDWR		0.11	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090303	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090304	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090401	Irrigation Diversion	OWRD, IDWR		0.02	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090402	Irrigation Diversion	OWRD, IDWR		0.14	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers

FORM CM-1:
CHANNEL MODIFICATION INVENTORY - DIVERSIONS

HUC 6	Channel Modification Activity Description	Data Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501090403	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090404	Irrigation Diversion	OWRD, IDWR		0.09	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090405	Irrigation Diversion	OWRD, IDWR		0.03	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090407	Irrigation Diversion	OWRD, IDWR		0.07	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090502	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090504	Irrigation Diversion	OWRD, IDWR		0.11	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090506	Irrigation Diversion	OWRD, IDWR		0.01	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers
170501090507	Irrigation Diversion	OWRD, IDWR		0.00	Moderate to High	Flow Alteration, Loss of Spawning Gravels, Migration Barriers

FORM CM-1
CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070101	Road Along Stream	**TIGER LINE FILES**		2.2119	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070101	Road Crossing	**TIGER LINE FILES**		0.9243	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070102	Road Along Stream	**TIGER LINE FILES**		0.2715	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070102	Road Crossing	**TIGER LINE FILES**		0.5404	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070103	Road Along Stream	**TIGER LINE FILES**		0.6685	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070103	Road Crossing	**TIGER LINE FILES**		0.9501	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070104	Road Along Stream	**TIGER LINE FILES**		0.6678	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070104	Road Crossing	**TIGER LINE FILES**		0.7182	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070105	Road Along Stream	**TIGER LINE FILES**		0.2456	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070105	Road Crossing	**TIGER LINE FILES**		0.2621	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070106	Road Along Stream	**TIGER LINE FILES**		0.8029	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070106	Road Crossing	**TIGER LINE FILES**		0.5340	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070107	Road Along Stream	**TIGER LINE FILES**		1.0452	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

FORM CM-1
CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070107	Road Crossing	**TIGER LINE FILES**		0.6613	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070108	Road Along Stream	**TIGER LINE FILES**		0.0612	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070108	Road Crossing	**TIGER LINE FILES**		0.1221	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070201	Road Along Stream	**TIGER LINE FILES**		0.6238	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070201	Road Crossing	**TIGER LINE FILES**		0.4880	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070202	Road Along Stream	**TIGER LINE FILES**		0.2333	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070202	Road Crossing	**TIGER LINE FILES**		0.6638	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070203	Road Along Stream	**TIGER LINE FILES**		0.8893	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070203	Road Crossing	**TIGER LINE FILES**		0.9646	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070204	Road Along Stream	**TIGER LINE FILES**		0.5293	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070204	Road Crossing	**TIGER LINE FILES**		0.4495	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070205	Road Along Stream	**TIGER LINE FILES**		0.5944	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070205	Road Crossing	**TIGER LINE FILES**		0.6187	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

FORM CM-1
CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070206	Road Along Stream	**TIGER LINE FILES**		0.2366	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070206	Road Crossing	**TIGER LINE FILES**		0.4253	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070207	Road Along Stream	**TIGER LINE FILES**		0.3006	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070207	Road Crossing	**TIGER LINE FILES**		0.8038	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070208	Road Along Stream	**TIGER LINE FILES**		0.6054	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070208	Road Crossing	**TIGER LINE FILES**		0.2348	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070301	Road Along Stream	**TIGER LINE FILES**		0.8409	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070301	Road Crossing	**TIGER LINE FILES**		0.7180	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070302	Road Along Stream	**TIGER LINE FILES**		1.3600	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070302	Road Crossing	**TIGER LINE FILES**		0.4342	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070303	Road Along Stream	**TIGER LINE FILES**		0.0943	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070303	Road Crossing	**TIGER LINE FILES**		0.4803	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070401	Road Along Stream	**TIGER LINE FILES**		0.8841	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

FORM CM-1
CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070401	Road Crossing	**TIGER LINE FILES**		0.6184	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070402	Road Along Stream	**TIGER LINE FILES**		1.7783	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070402	Road Crossing	**TIGER LINE FILES**		0.5352	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070403	Road Along Stream	**TIGER LINE FILES**		0.9440	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070403	Road Crossing	**TIGER LINE FILES**		0.2906	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070404	Road Along Stream	**TIGER LINE FILES**		1.1359	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070404	Road Crossing	**TIGER LINE FILES**		1.0119	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070405	Road Along Stream	**TIGER LINE FILES**		0.9850	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070405	Road Crossing	**TIGER LINE FILES**		0.9758	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070406	Road Along Stream	**TIGER LINE FILES**		0.2736	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070406	Road Crossing	**TIGER LINE FILES**		0.3029	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070501	Road Along Stream	**TIGER LINE FILES**		0.0594	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070501	Road Crossing	**TIGER LINE FILES**		0.2608	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070502	Road Along Stream	**TIGER LINE FILES**		0.4371	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070502	Road Crossing	**TIGER LINE FILES**		0.4836	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070503	Road Along Stream	**TIGER LINE FILES**		0.7704	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070503	Road Crossing	**TIGER LINE FILES**		0.3609	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070504	Road Along Stream	**TIGER LINE FILES**		0.6586	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070504	Road Crossing	**TIGER LINE FILES**		0.4219	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070601	Road Along Stream	**TIGER LINE FILES**		2.0054	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070601	Road Crossing	**TIGER LINE FILES**		1.3392	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070602	Road Along Stream	**TIGER LINE FILES**		1.1734	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070602	Road Crossing	**TIGER LINE FILES**		0.9815	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070603	Road Along Stream	**TIGER LINE FILES**		0.3648	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070603	Road Crossing	**TIGER LINE FILES**		0.7700	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070604	Road Along Stream	**TIGER LINE FILES**		1.5550	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501070604	Road Crossing	**TIGER LINE FILES**		0.7569	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070605	Road Along Stream	**TIGER LINE FILES**		0.3632	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070605	Road Crossing	**TIGER LINE FILES**		0.2600	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070701	Road Along Stream	**TIGER LINE FILES**		0.4689	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070701	Road Crossing	**TIGER LINE FILES**		0.9658	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070702	Road Along Stream	**TIGER LINE FILES**		1.0844	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070702	Road Crossing	**TIGER LINE FILES**		0.5847	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070703	Road Along Stream	**TIGER LINE FILES**		0.9212	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070703	Road Crossing	**TIGER LINE FILES**		0.4695	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070704	Road Along Stream	**TIGER LINE FILES**		2.3896	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070704	Road Crossing	**TIGER LINE FILES**		1.5825	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070705	Road Along Stream	**TIGER LINE FILES**		1.7731	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501070705	Road Crossing	**TIGER LINE FILES**		1.0193	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501080101	Road Along Stream	**TIGER LINE FILES**		0.8810	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080101	Road Crossing	**TIGER LINE FILES**		0.7790	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080102	Road Along Stream	**TIGER LINE FILES**		2.5427	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080102	Road Crossing	**TIGER LINE FILES**		0.8403	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080103	Road Along Stream	**TIGER LINE FILES**		0.8837	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080103	Road Crossing	**TIGER LINE FILES**		0.7511	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080104	Road Along Stream	**TIGER LINE FILES**		0.9433	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080104	Road Crossing	**TIGER LINE FILES**		0.7155	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080105	Road Along Stream	**TIGER LINE FILES**		0.5620	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080105	Road Crossing	**TIGER LINE FILES**		0.3937	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080201	Road Along Stream	**TIGER LINE FILES**		0.7197	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080201	Road Crossing	**TIGER LINE FILES**		0.1964	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080202	Road Along Stream	**TIGER LINE FILES**		0.1214	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501080202	Road Crossing	**TIGER LINE FILES**		0.0820	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080203	Road Along Stream	**TIGER LINE FILES**		2.0360	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080203	Road Crossing	**TIGER LINE FILES**		0.3717	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080204	Road Along Stream	**TIGER LINE FILES**		0.6427	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080204	Road Crossing	**TIGER LINE FILES**		0.2549	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080205	Road Along Stream	**TIGER LINE FILES**		2.8175	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080205	Road Crossing	**TIGER LINE FILES**		1.1308	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080301	Road Along Stream	**TIGER LINE FILES**		2.4693	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080301	Road Crossing	**TIGER LINE FILES**		1.3168	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080302	Road Along Stream	**TIGER LINE FILES**		0.0902	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080302	Road Crossing	**TIGER LINE FILES**		0.0928	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080303	Road Along Stream	**TIGER LINE FILES**		0.5195	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080303	Road Crossing	**TIGER LINE FILES**		0.4450	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501080401	Road Along Stream	**TIGER LINE FILES**		1.0350	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080401	Road Crossing	**TIGER LINE FILES**		0.3709	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080402	Road Along Stream	**TIGER LINE FILES**		2.1835	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080402	Road Crossing	**TIGER LINE FILES**		0.6862	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080403	Road Along Stream	**TIGER LINE FILES**		0.7543	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080403	Road Crossing	**TIGER LINE FILES**		0.5114	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080404	Road Along Stream	**TIGER LINE FILES**		1.3705	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080404	Road Crossing	**TIGER LINE FILES**		0.8735	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080501	Road Along Stream	**TIGER LINE FILES**		1.0526	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080501	Road Crossing	**TIGER LINE FILES**		0.4633	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080502	Road Along Stream	**TIGER LINE FILES**		1.1680	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080502	Road Crossing	**TIGER LINE FILES**		1.2514	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080503	Road Along Stream	**TIGER LINE FILES**		1.6304	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501080503	Road Crossing	**TIGER LINE FILES**		0.8024	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080504	Road Along Stream	**TIGER LINE FILES**		2.4074	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080504	Road Crossing	**TIGER LINE FILES**		1.0365	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080505	Road Along Stream	**TIGER LINE FILES**		0.9741	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080505	Road Crossing	**TIGER LINE FILES**		1.3357	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080601	Road Along Stream	**TIGER LINE FILES**		2.6483	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080601	Road Crossing	**TIGER LINE FILES**		0.9564	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080602	Road Along Stream	**TIGER LINE FILES**		2.1905	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080602	Road Crossing	**TIGER LINE FILES**		1.3139	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080603	Road Along Stream	**TIGER LINE FILES**		0.5528	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080603	Road Crossing	**TIGER LINE FILES**		0.5008	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080604	Road Along Stream	**TIGER LINE FILES**		2.0481	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080604	Road Crossing	**TIGER LINE FILES**		0.9248	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501080605	Road Along Stream	**TIGER LINE FILES**		1.5561	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080605	Road Crossing	**TIGER LINE FILES**		0.5560	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080701	Road Along Stream	**TIGER LINE FILES**		1.4706	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080701	Road Crossing	**TIGER LINE FILES**		1.2052	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080703	Road Along Stream	**TIGER LINE FILES**		1.3578	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080703	Road Crossing	**TIGER LINE FILES**		0.6561	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080801	Road Along Stream	**TIGER LINE FILES**		0.2476	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080801	Road Crossing	**TIGER LINE FILES**		0.1987	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080802	Road Along Stream	**TIGER LINE FILES**		1.1030	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080802	Road Crossing	**TIGER LINE FILES**		0.4035	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080803	Road Along Stream	**TIGER LINE FILES**		2.3441	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080803	Road Crossing	**TIGER LINE FILES**		1.3800	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501080804	Road Along Stream	**TIGER LINE FILES**		2.7052	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501080805	Road Crossing	**TIGER LINE FILES**		1.9534	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090101	Road Along Stream	**TIGER LINE FILES**		1.9131	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090101	Road Crossing	**TIGER LINE FILES**		0.5545	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090102	Road Along Stream	**TIGER LINE FILES**		0.9161	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090102	Road Crossing	**TIGER LINE FILES**		0.5960	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090103	Road Along Stream	**TIGER LINE FILES**		1.7807	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090103	Road Crossing	**TIGER LINE FILES**		1.7541	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090104	Road Along Stream	**TIGER LINE FILES**		1.3375	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090104	Road Crossing	**TIGER LINE FILES**		0.4728	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090105	Road Along Stream	**TIGER LINE FILES**		0.6275	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090105	Road Crossing	**TIGER LINE FILES**		0.4057	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090106	Road Along Stream	**TIGER LINE FILES**		0.0611	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090106	Road Crossing	**TIGER LINE FILES**		0.3942	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501090201	Road Along Stream	**TIGER LINE FILES**		3.1277	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090201	Road Crossing	**TIGER LINE FILES**		0.7153	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090202	Road Along Stream	**TIGER LINE FILES**		1.3391	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090202	Road Crossing	**TIGER LINE FILES**		0.1981	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090203	Road Along Stream	**TIGER LINE FILES**		0.5290	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090203	Road Crossing	**TIGER LINE FILES**		0.2814	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090204	Road Along Stream	**TIGER LINE FILES**		0.9160	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090204	Road Crossing	**TIGER LINE FILES**		0.3820	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090205	Road Along Stream	**TIGER LINE FILES**		1.8567	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090205	Road Crossing	**TIGER LINE FILES**		0.7418	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090206	Road Along Stream	**TIGER LINE FILES**		1.6677	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090206	Road Crossing	**TIGER LINE FILES**		0.6848	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090207	Road Along Stream	**TIGER LINE FILES**		1.0397	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501090207	Road Crossing	**TIGER LINE FILES**		0.7498	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090301	Road Along Stream	**TIGER LINE FILES**		1.2144	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090301	Road Crossing	**TIGER LINE FILES**		0.2156	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090302	Road Along Stream	**TIGER LINE FILES**		0.8784	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090302	Road Crossing	**TIGER LINE FILES**		0.3854	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090303	Road Along Stream	**TIGER LINE FILES**		1.5838	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090303	Road Crossing	**TIGER LINE FILES**		0.5552	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090304	Road Along Stream	**TIGER LINE FILES**		0.7620	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090304	Road Crossing	**TIGER LINE FILES**		0.4397	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090401	Road Along Stream	**TIGER LINE FILES**		1.5442	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090401	Road Crossing	**TIGER LINE FILES**		0.3873	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090402	Road Along Stream	**TIGER LINE FILES**		0.5972	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090402	Road Crossing	**TIGER LINE FILES**		0.6599	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

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HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501090403	Road Along Stream	**TIGER LINE FILES**		0.0578	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090403	Road Crossing	**TIGER LINE FILES**		0.2426	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090404	Road Along Stream	**TIGER LINE FILES**		1.3606	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090404	Road Crossing	**TIGER LINE FILES**		0.7368	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090405	Road Along Stream	**TIGER LINE FILES**		0.3471	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090405	Road Crossing	**TIGER LINE FILES**		0.8086	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090406	Road Along Stream	**TIGER LINE FILES**		0.2366	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090406	Road Crossing	**TIGER LINE FILES**		0.2603	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090407	Road Along Stream	**TIGER LINE FILES**		0.9783	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090407	Road Crossing	**TIGER LINE FILES**		0.8977	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090501	Road Along Stream	**TIGER LINE FILES**		0.0770	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090501	Road Crossing	**TIGER LINE FILES**		0.1282	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090502	Road Along Stream	**TIGER LINE FILES**		1.3887	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

FORM CM-1
CHANNEL MODIFICATION INVENTORY - ROADS AND CROSSINGS

HUC 6	Channel Modification Activity Description	Data/Information Source	Channel Habitat Type	Channel Length (mi)	Degree of Impact	Type of Impact
170501090502	Road Crossing	**TIGER LINE FILES**		1.0421	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090503	Road Along Stream	**TIGER LINE FILES**		0.2835	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090503	Road Crossing	**TIGER LINE FILES**		0.1832	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090504	Road Along Stream	**TIGER LINE FILES**		2.1913	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090504	Road Crossing	**TIGER LINE FILES**		0.3030	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090505	Road Along Stream	**TIGER LINE FILES**		0.3503	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090505	Road Crossing	**TIGER LINE FILES**		0.1672	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090506	Road Along Stream	**TIGER LINE FILES**		2.3891	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090506	Road Crossing	**TIGER LINE FILES**		1.0325	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090507	Road Along Stream	**TIGER LINE FILES**		1.7553	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion
170501090507	Road Crossing	**TIGER LINE FILES**		0.5779	Low to Moderate	Loss of side channels, lateral pools, riparian function, loss of habitat complexity, potential downstream erosion

FORM CM-2
CHANNEL MODIFICATION SUMMARY

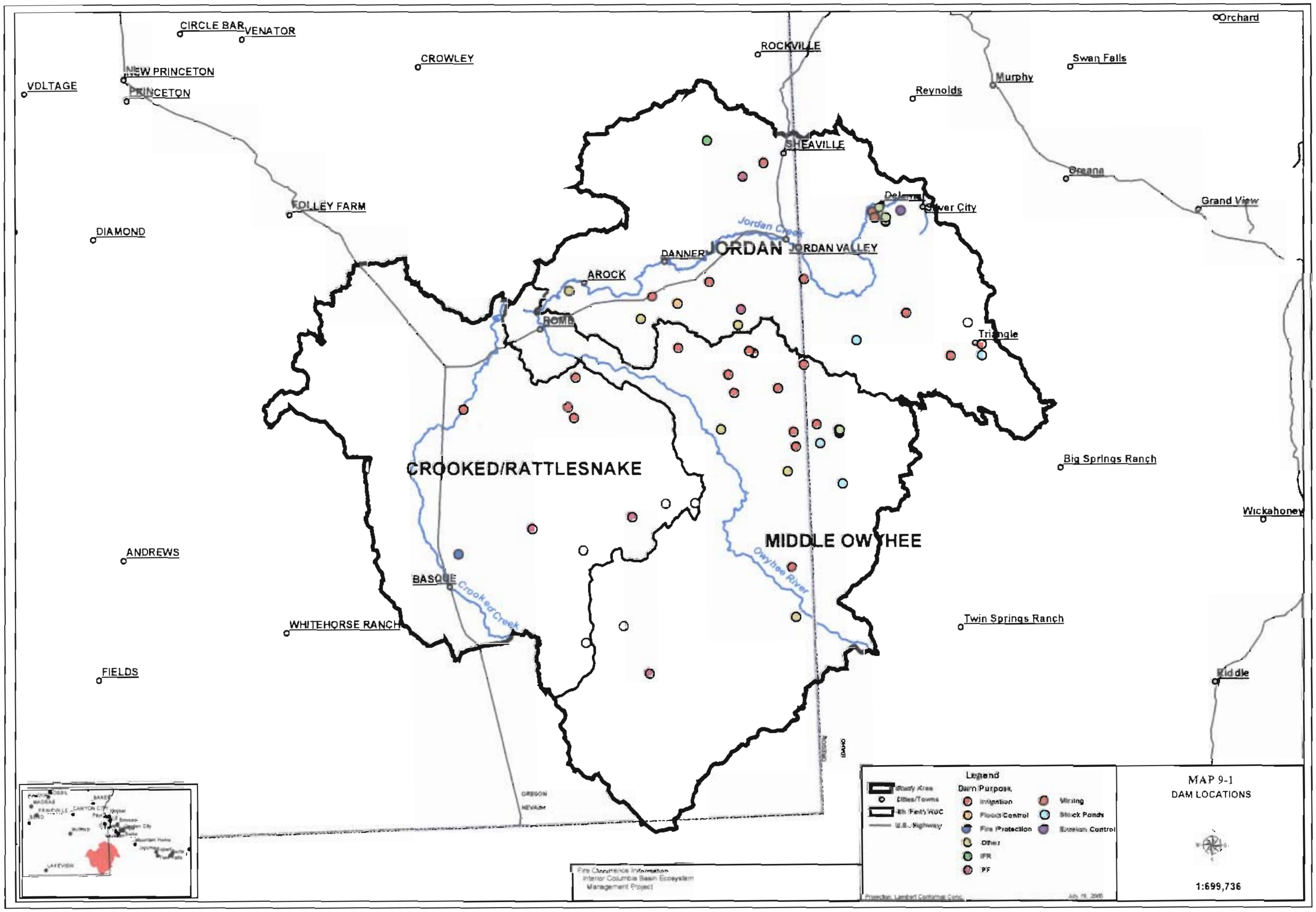
Subwatershed	Miles Potentially Affected By:				Total Miles
	Dams	Streamside Roads	Road Crossings	Irrigation Diversions	
170501070101		2.21	0.10	0.20	**2.41**
170501070102		0.27	0.06	0.10	**0.38**
170501070103		0.67	0.10	0.18	**0.85**
170501070104		0.67	0.08	0.05	**0.72**
170501070105		0.25	0.03	0.02	**0.26**
170501070106		0.80	0.06	0.10	**0.90**
170501070107		1.05	0.07	0.12	**1.16**
170501070108		0.06	0.01	0.05	**0.11**
170501070201		0.62	0.06	0.10	**0.73**
170501070202		0.23	0.08		**0.23**
170501070203	0.10	0.89	0.11	0.24	**1.22**
170501070204		0.53	0.05	0.05	**0.58**
170501070205		0.59	0.07	0.11	**0.71**
170501070206		0.24	0.05	0.12	**0.36**
170501070207	0.04	0.30	0.09	0.09	**0.44**
170501070208		0.61	0.02	0.14	**0.75**
170501070301	0.05	0.84	0.08	0.02	**0.92**
170501070302		1.36	0.05	0.19	**1.55**
170501070303		0.09	0.06	0.15	**0.24**
170501070401		0.88	0.07	0.00	**0.89**
170501070402	0.02	1.78	0.06		**1.80**
170501070403		0.94	0.03	0.07	**1.01**
170501070404	0.07	1.14	0.11	0.03	**1.24**
170501070405	0.33	0.98	0.11	0.17	**1.48**
170501070406		0.27	0.03	0.09	**0.36**
170501070501		0.06	0.03		**0.06**
170501070502	0.04	0.44	0.06	0.02	**0.50**
170501070503		0.77	0.04	0.09	**0.86**
170501070504		0.66	0.05	0.09	**0.75**
170501070601	0.26	2.01	0.15	0.50	**2.76**
170501070602	0.11	1.17	0.11	0.67	**1.95**
170501070603	0.24	0.36	0.09	0.25	**0.85**
170501070604	0.11	1.56	0.09	0.10	**1.77**
170501070605		0.36	0.03	0.16	**0.52**
170501070701		0.47	0.11	0.33	**0.80**
170501070702	0.04	1.08	0.07	0.22	**1.34**
170501070703		0.92	0.05	0.09	**1.01**
170501070704		2.39	0.18	0.05	**2.44**
170501070705		1.77	0.11	0.04	**1.82**
170501080101		0.88	0.09	0.00	**0.89**
170501080102	0.26	2.54	0.09		**2.80**
170501080103	0.06	0.88	0.09	0.00	**0.95**
170501080104	0.06	0.94	0.08		**1.00**
170501080105		0.56	0.04		**0.56**
170501080201		0.72	0.02		**0.72**
170501080202		0.12	0.01		**0.12**
170501080203		2.04	0.04	0.01	**2.05**
170501080204		0.64	0.03	0.01	**0.65**
170501080205	0.05	2.82	0.13	0.01	**2.87**

FORM CM-2
CHANNEL MODIFICATION SUMMARY

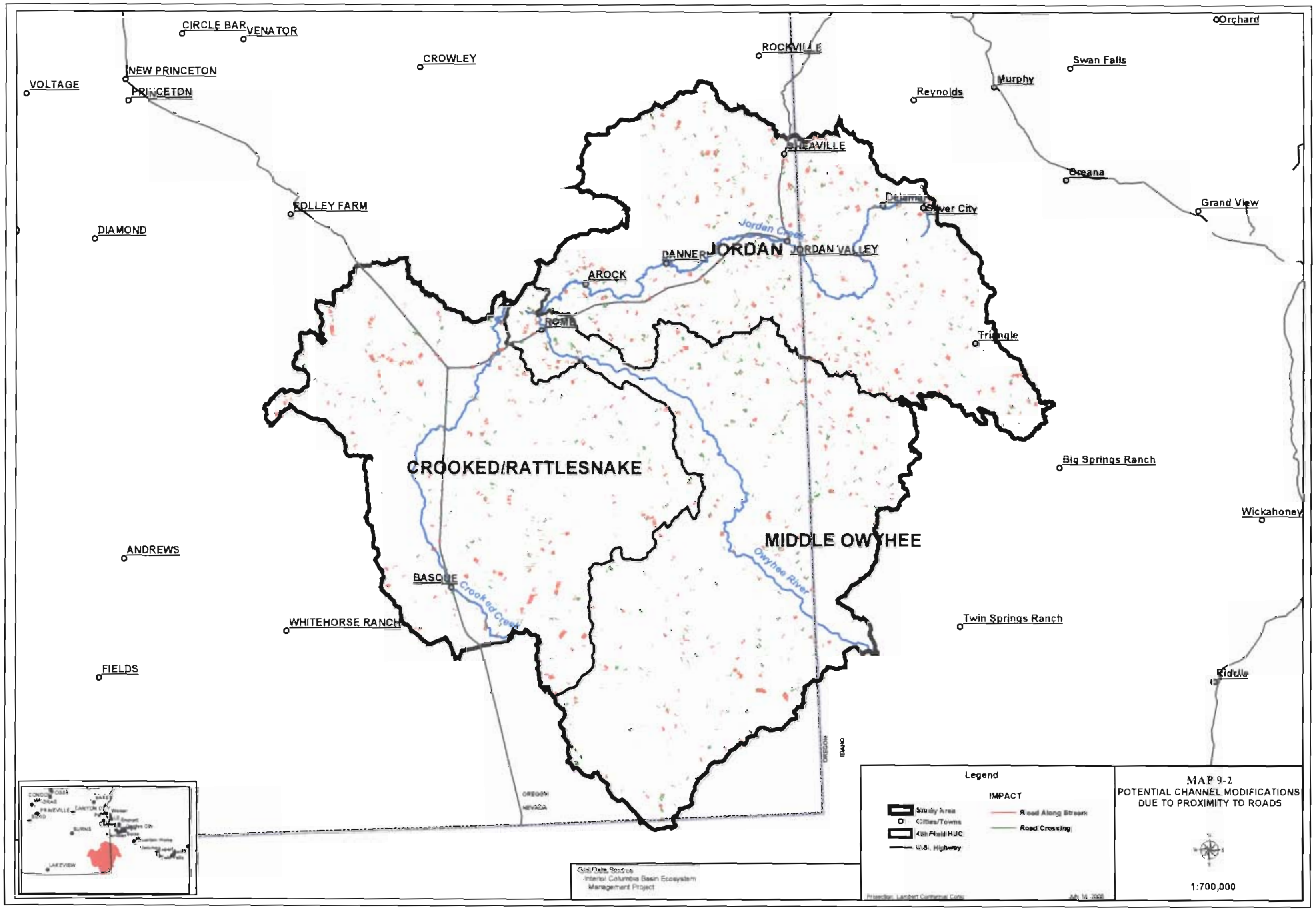
Subwatershed	Miles Potentially Affected By:				Total Miles
	Dams	Streamside Roads	Road Crossings	Irrigation Diversions	
170501080301	1.57	2.47	0.15	0.00	**4.04**
170501080302	0.21	0.09	0.01	0.00	**0.30**
170501080303		0.52	0.05		**0.52**
170501080401		1.03	0.04		**1.03**
170501080402	0.03	2.18	0.08	0.03	**2.25**
170501080403		0.75	0.06	0.01	**0.76**
170501080404	0.09	1.37	0.10	0.02	**1.48**
170501080501		1.05	0.05	0.08	**1.13**
170501080502		1.17	0.14	0.17	**1.34**
170501080503		1.63	0.09	0.24	**1.87**
170501080504	0.35	2.41	0.12	0.27	**3.03**
170501080505		0.97	0.16	0.29	**1.27**
170501080601		2.65	0.11	0.03	**2.68**
170501080602	0.08	2.19	0.15	0.16	**2.43**
170501080603		0.55	0.06	0.09	**0.65**
170501080604	0.09	2.05	0.10	0.39	**2.53**
170501080605	0.06	1.56	0.06	0.13	**1.75**
170501080701		1.47	0.14	0.14	**1.61**
170501080702			0.00	0.05	**0.05**
170501080703		1.36	0.08	0.15	**1.51**
170501080801		0.25	0.02	0.09	**0.33**
170501080802	0.17	1.10	0.05	0.09	**1.36**
170501080803		2.34	0.16	0.09	**2.44**
170501080804	0.13	2.71	0.19	0.50	**3.34**
170501080805			0.03	0.03	**0.03**
170501090101		1.91	0.06	0.06	**1.97**
170501090102		0.92	0.07		**0.92**
170501090103		1.78	0.19	0.11	**1.89**
170501090104		1.34	0.05	0.05	**1.38**
170501090105	0.06	0.63	0.05		**0.69**
170501090106		0.06	0.04	0.00	**0.07**
170501090201	0.05	3.13	0.08	0.21	**3.38**
170501090202		1.34	0.02	0.07	**1.41**
170501090203	0.06	0.53	0.03	0.09	**0.68**
170501090204		0.92	0.04	0.09	**1.01**
170501090205	0.05	1.86	0.08	0.11	**2.02**
170501090206		1.67	0.08	0.01	**1.68**
170501090207		1.04	0.08	0.06	**1.10**
170501090301		1.21	0.02	0.01	**1.22**
170501090302		0.88	0.04	0.11	**0.99**
170501090303		1.58	0.06	0.09	**1.67**
170501090304		0.76	0.05	0.00	**0.77**
170501090401	0.04	1.54	0.04	0.02	**1.61**
170501090402	0.09	0.60	0.08	0.14	**0.83**
170501090403		0.06	0.03	0.01	**0.07**
170501090404	0.09	1.36	0.09	0.09	**1.54**
170501090405		0.35	0.09	0.03	**0.38**
170501090406		0.24	0.03		**0.24**
170501090407	0.17	0.98	0.10	0.07	**1.22**

FORM CM-2
CHANNEL MODIFICATION SUMMARY

Subwatershed	Miles Potentially Affected By:				Total Miles
	Dams	Streamside Roads	Road Crossings	Irrigation Diversions	
170501090501		0.08	0.01		**0.08**
170501090502	0.13	1.39	0.12	0.01	**1.53**
170501090503		0.28	0.02		**0.28**
170501090504		2.19	0.03	0.11	**2.30**
170501090505		0.35	0.02		**0.35**
170501090506		2.39	0.12	0.01	**2.40**
170501090507		1.76	0.06	0.00	**1.76**
Total Miles by Modification Type	**5.36**	**113.44**	**7.50**	**9.66**	**128.46**



Owyhee Watershed



MAP 9-2
POTENTIAL CHANNEL MODIFICATIONS DUE TO PROXIMITY TO ROADS
1:700,000
Legend
Study Area
Cities/Towns
4th Field HUC
U.S. Highway
IMPACT
Road Along Stream
Road Crossing
GIS Data Source
Interior Columbia Basin Ecosystem Management Project
JORDAN
CROOKED/RATTLESNAKE
MIDDLE OWYHEE
Jordan Creek
Owyhee River
Crooked Creek
CIRCLE BAR
VENATOR
CROWLEY
ROCKVILLE
Orchard
Swan Falls
Murphy
Reynolds
VOLTAGE
NEW PRINCETON
PRINCETON
SHEAVILLE
Oreana
Grand View
Silver City
FOLLEY FARM
DIAMOND
DANNER
JORDAN VALLEY
AROCK
ROME
Triangle
Big Springs Ranch
Wickahoney
ANDREWS
BASQUE
WHITEHORSE RANCH
Twin Springs Ranch
FIELDS
Riddle
OREGON
NEVADA
IDAHO

Component 10—Water Quality

The subbasins of interest to this assessment span three states – Oregon, Idaho, and Nevada. All of the water quality data presented in this chapter were obtained from existing sources and no new data were collected for use in this analysis. Furthermore, this chapter addresses the quality of waters within Oregon and Idaho. The area of the Middle Owyhee subbasin that falls within the Nevada border was left out of this discussion for the following reasons:

- The area of the Middle Owyhee subbasin within Nevada is approximately 292 acres, which is less than 1% of the total study area;
- There are no water bodies within this portion of the subbasin listed on the Nevada's 1998 303(d) list; and
- Data availability for this area are limited.

Regulatory Background

The goal of the Clean Water Act (CWA) is to "*restore and maintain the physical, chemical, and biological integrity of the Nation's waters*" (33 U.S.C. Chapter 26 Subchapter I Section 1251). Each state is required to establish water quality standards necessary for meeting the objective of the CWA. The Oregon Department of Environmental Quality (ODEQ) and the Idaho Department of Environmental Quality (IDEQ) are the state agencies responsible for implementing the CWA within their borders. The Environmental Protection Agency (EPA) provides oversight of each state's fulfillment of CWA requirements. Two components of water quality standards are beneficial uses and water quality criteria.

Beneficial Uses

Beneficial uses refer to the purpose, benefits, or uses to be derived from waters of the state(s). Oregon assigns beneficial uses by basin, whereas Idaho assigns beneficial uses to individual water bodies and their tributaries. Beneficial uses assigned to all of the water bodies within the three subbasins by the ODEQ are listed in Table 10-1.

Table 10-1: Beneficial Uses for the Owyhee River and Tributaries Upstream from Owyhee Reservoir

Domestic Water Supply Industrial Water Supply Irrigation Livestock Watering Fish & Aquatic Life Redband Trout/Lahontan Cutthroat Trout	Wildlife & Hunting Fishing Boating Water Contact Recreation Aesthetic Quality

1. Source: OAR 340-041-0250 (December 15, 2003).

The IDEQ has determined there to be fourteen water body units within the Middle Owyhee Subbasin, of which, eight have been designated beneficial uses. The Jordan Subbasin has twenty-three water body units, of which, three have been assigned beneficial uses. For undesignated water body units, IDEQ applies the cold water aquatic life and contact recreation beneficial uses to the waters until uses can be designated based on review of new and existing data (IDAPA 58.01.02.101.01.a). Beneficial uses designated to water body units within these two subbasins are listed in Table 10-2.

Table 10-2. Beneficial Uses for Selected Water bodies in Idaho—Middle Owyhee and Jordan Subbasins

Water Body	Beneficial Uses
Middle Owyhee Subbasin (17050107)	
Owyhee R. (SF Owyhee R. to ID/OR border)	COLD, SS, PCR, DWS
MF Owyhee R. (source to ID/OR border)	COLD, SS, PCR, DWS
Squaw Cr. (source to ID/OR border)	COLD, SS, PCR, DWS
NF Owyhee R. (source to ID/OR border)	COLD, SS, PCR, DWS
Pleasant Valley Cr. (source to mouth)	COLD, PCR
Noon Cr. (source to mouth)	COLD, SS, PCR
Cabin Cr. (source to mouth)	COLD, SS, PCR
Juniper Creek (source to mouth)	COLD, SS, PCR
Jordan Subbasin (17050108)	
Jordan Cr. (source to Williams Cr.)	COLD, SS, PCR
Jordan Cr. (Williams Cr. to ID/OR border)	COLD, SS, PCR
Williams Cr. (source to mouth)	COLD, PCR

COLD – cold water aquatic life, SS – salmonid spawning; PCR – primary contact recreation; DWS – drinking water supply.
Source: IDAPA 58.01.02.140.07-08 (2003)

ODEQ has designated the mainstem of the South Fork of the Owyhee River from the Oregon-Idaho border to Three Forks and the mainstem of the Owyhee River from Crooked Creek (river mile 22) to the mouth of Birch Creek (river mile 76) as a Scenic Waterway. According to ORS 390-815, scenic waterways are those free-flowing rivers and adjacent lands that possess "outstanding scenic, fish, wildlife, geological, botanical, historic, archaeologic, and outdoor recreation values of present and future benefit to the public." In addition, IDEQ designated the Owyhee River (South Fork Owyhee River to Idaho/Oregon border), the Middle Fork Owyhee River (source to Idaho/Oregon border) and the North Fork Owyhee River (source to Idaho/Oregon border) as special resource waters. According to IDAPA 58.01.02, a special resource water is a specific segment or body of water that requires intensive protection to either 1) preserve outstanding or unique characteristics; or 2) maintain current beneficial uses.

Water Quality Criteria

Each state has developed narrative and numeric water quality criteria to protect the beneficial uses assigned to the basin and water body units. When there are multiple beneficial uses designated, EPA requires the most sensitive beneficial use be protected. When assessing whether the water body is fully supporting its designated beneficial uses, IDEQ and ODEQ must determine whether the water quality criteria are being met and whether a healthy biological community exists, based on available monitoring data.

Section 303(d) of the CWA requires each state to identify those water bodies that do not meet state water quality standards and submit a list to EPA every 2 years. Both ODEQ and IDEQ are currently in the process of submitting an updated list (presented in Integrated 303(d)/305(b) Reports) to the EPA for approval; however, this process is not likely to be complete in the near future. Mrs. Marilyn Fonseca, the ODEQ 303(d) List Coordinator, indicated that completion of the 2004 integrated report is anticipated to be during the summer or fall of 2004 (personal communication 2004). According to Mike Edmondson of the IDEQ, the Idaho 2002 Integrated 303(d)/305(b) report has not been officially submitted to the EPA, and won't likely be reviewed by EPA until at least March or April of 2004 (personal communication 2004). As a result, this assessment relies upon information provided in the ODEQ 2002 303(d) list and the IDEQ 1998 303(d) list. No stream segments within the Crooked-Rattlesnake Subbasin have been listed on Oregon's 2002 303(d) list. Stream segments within the remaining two subbasins that have been placed on the 303(d) lists are presented below (Table 10-3).

Table 10-3. 2002 Oregon and 1998 Idaho 303(d) lists—Middle Owyhee & Jordan Subbasins.

Water Body	Segment	Parameter
Middle Owyhee Subbasin (17050107)		
North Fork Owyhee R. (OR)	0 to 9.6	TEMP
Juniper Cr. (ID)	HW to NF Owyhee R.	FA, SED, TEMP
MF Owyhee R. (ID)	HW to OR/ID border	FA, SED, TEMP
Noon Cr. (ID)	HW to NF Owyhee R.	SED, TEMP
Pleasant Valley Cr. (ID)	HW to NF Owyhee R.	FA, SED, TEMP
Squaw Cr. (ID)	HW to OR/ID border	FA, SED, TEMP
NF Owyhee R. (ID)	HW to OR/ID border	BACT
Jordan Subbasin (17050108)		
Antelope Reservoir/Jack Cr. (OR)	4.1 to 8.4	Hg
Jordan Cr. (OR)	0 to 54.4	Hg
Jordan Cr. (ID)	HW to Williams Cr.	BACT, Hg, OIL, PEST, SED
Jordan Cr. (ID)	Williams Cr. to OR/ID border	BACT, OIL, PEST, SED
Cow Cr. (ID)	HW to OR/ID border	FA, SED, TEMP
Louisa Cr. (ID)	HW to Triangle Res.	FA, SED, TEMP
Louse Cr. (ID)	HW to Jordan Cr.	FA, MET, pH, SED
Meadow Cr. (ID)	HW to Rock Cr.	FA, TEMP
Rock Cr. (ID)	HW to Triangle Res.	FA, SED, TEMP
Soda Cr. (ID)	HW to Cow Cr.	SED

HW – headwaters; SED – sediment; TEMP – temperature; FA – flow alteration; BACT – bacteria; Hg – mercury; OIL – oil/gas; PEST – pesticides; MET – metals.

Section 303(d) of the CWA requires that Total Maximum Daily Loads (TMDLs) be written for each water body included on the 303(d) list. The ODEQ's target date for completing TMDLs for 303(d) listed water bodies in the Jordan and Middle Owyhee Subbasins is 2006. The IDEQ's target data for completing TMDLs for 303(d) listed water bodies in the Jordan Subbasin is 2005. The IDEQ completed a Subbasin Assessment and TMDL for the Middle Owyhee Subbasin, which was approved by EPA in February 2000.

The 2002 Integrated 305(b)/303(d) Report for the state of Oregon presents additional categories (aside from 303(d)-listed) for water bodies within the states. Categories of interest to this assessment include:

- potential concern;
- insufficient or no data; and
- water quality limited not needing a TMDL.

According to Mrs. Fonseca of ODEQ, water bodies categorized as potential concern have limited data (less than 5 samples) but the available data indicates possible violations of the water quality standards. Water bodies categorized as insufficient or no data are those that have less than 5 samples. Water bodies with flow and/or habitat modifications have been listed as water quality limited not needing a TMDL because these parameters do not need a TMDL. The listing status for Oregon water bodies that have been placed in one of these categories is listed in Table 10-4.

Table 10-4. Listing Status of Water bodies in Oregon

Water Body	Segment	Parameter
Middle Owyhee Subbasin (17050107)		
Antelope Cr.	0 to 44.6	TEMP[1], SED[1]
MF Owyhee R.	0 to 13.5	TEMP[1], SED[1], HM[2], FM[2]
NF Owyhee R.	0 to 9.6	SED[1], HM[2], FM[2], TEMP[3, 4]
West Little Owyhee R.	50.4 to 60.8	TEMP[3], SED[1], HM[2], FM[2]
Jordan Subbasin (17050108)		
Antelope Reservoir/Jack Cr.	4.1 to 8.4	AWA[1], N[1]
Fish Cr.	0 to 6.7	TEMP[1], SED[1], HM[2], FM[2]
Jordan Cr.	0 to 54.4	TEMP[1], SED[1], FC[1], N[1], HM[2], FM[2]
Mahogany Cr.	5.4 to 14.8	TEMP[1], SED[1], HM[2], FM[2]
Upper Cow Lake/Cow Cr.	11.9 to 16.3	AWA[1], N[1]
Crooked-Rattlesnake Subbasin (17050109)		
Bull Cr.	0 to 16.4	TEMP[1], SED[1], HM[2], FM[2]

Notes: 1. TEMP – temperature; SED – sediment; HM – habitat modification; FM – flow modification, AWA – aquatic weeds or algae; N – nutrients; FC – fecal coliform Insufficient/No Data
2. Water Quality Limited Not Needing a TMDL
3 Potential Concern
From March 1 – June 30.

Water Quality Parameters

Each parameter listed in Table 10-3 and/or Table 10-4 is discussed in detail in the following sections. These discussions are structured as follows:

- Description of the parameter;
- State regulatory limits;
- Factors that influence the parameter;
- Available data; and
- Impairment determination.

Most of the readily available data were gathered by state and federal agencies such as the ODEQ, IDEQ, BLM, and USGS. No new data were collected for this assessment. When sufficient data were present, form WQ-2 was completed for each subbasin (4th field HUC). Figure 1 illustrates the sample locations from which surface water quality data were obtained.

Impairment determinations were made based on the guidelines provided in the *Oregon Watershed Assessment Manual* (WPN 1999). According to WPN, the following table presents the criteria for determining the level of water quality impairment.

Table 10-5. Criteria for determining water quality impairment

Percent Exceedance of Criteria	Level of Impairment
<15%	*No Impairment:* No or few exceedances of criteria
15 – 50%	*Moderately Impaired:* Regular exceedances of criteria
>50%	*Impaired:* Criteria exceedances occur regularly
Data Insufficient/Lacking	*Unknown*

Temperature

The most sensitive beneficial uses for water bodies within the Crooked-Rattlesnake, Jordan, and Middle Owyhee subbasins are redband trout and/or Lahontan Cutthroat trout (OR), salmonid fish spawning (ID), and cold water aquatic life (ID). Cold water is required for the survival and propagation of native trout in the subbasins; however, there is much debate about the numerical values to use for setting temperature criteria. This is because fixed criteria do not allow for environmental variations such as climate or species diversity (Essig 1998). Stream temperature criteria for these beneficial uses are presented in Table 10-6.

Table 10-6. Stream Temperature Criteria for Oregon and Idaho

Beneficial Use	State	Critieria[1]
Salmonid Fish Spawning[2]	Oregon	Not to exceed a 7-day average of daily maximum water temperatures of 55°F (12.8°C) at any time.
Salmonid Fish Rearing	Oregon	Not to exceed a 7-day average of daily maximum water temperatures of 64°F (17.8°C) at any time.
Redband Trout or Lahontan Cutthroat[2] Trout	Oregon	No to exceed a 7-day average maximum water temperature of 68°F (20.0°C) at any time.
Cold Water Aquatic Life	Idaho	Not to exceed 72°F (22°C) at any time, or 66°F (19°C) for the daily average.
Salmonid Spawning[3]	Idaho	Not to exceed 55°F (13°C) at any time, or 48°F (9°C) for the daily average.

1. Oregon Criteria obtained from OAR 340-041-0845 (Dec. 13, 2002). Idaho Criteria obtained from IDAPA 58.01.02 250 (2003).
2. Oregon Criteria obtained from OAR 340-041-0028(4)(e) (Dec. 15, 2003).
3. Salmonid spawning criteria apply only during the spawning period.

A number of factors influence water temperature in streams. These include water source, ground water, precipitation runoff, solar radiation (including shading), air temperature, climate, and geologic setting (Stevens *et al.* 1975). As part of the natural temperature cycle, streams warm during the summer months due to increased solar radiation and warmer air temperatures (EPA, 2003). However, anthropogenic activities can increase water temperatures by increasing the heat load into the river, by decreasing the river's ability to absorb heat, and by reducing the quantity of groundwater flow through one or more of the following mechanisms:

- Removing streamside vegetation;
- Withdrawing water;
- Discharging water from industrial/commercial facilities and irrigation return flows;
- Channeling, straightening, or diking rivers;
- Removing upland vegetation and the creation of impervious surfaces; and
- Constructing dams.

For this analysis, we compiled available continuous temperature data from various state and federal agencies, including the BLM (Owyhee Field Office and Vale District Office), ODEQ, IDEQ, IDFG, ODFW, and USGS. We compared existing stream temperature data for water bodies within the three subbasins to the state criteria and calculated percent exceedances. Results are discussed in the sections below.

Middle Owyhee

As indicated in Table 3, one water body (NF Owyhee River) is listed on Oregon's 303(d) list as being temperature impaired. The ODEQ has listed four additional water bodies as having insufficient data to determine whether temperature criteria are being violated. Those water bodies include Antelope Creek, West Little Owyhee River, MF Owyhee River, and NF Owyhee River (during the salmonid spawning period of March 1 through June 30). The IDEQ included five water bodies as being temperature impaired on the 1998 303(d) list, including Juniper Creek, MF Owyhee River, Noon Creek, Pleasant Valley Creek, and Squaw Creek.

Continuous temperature data for rivers and streams within this subbasin is limited. Recent data from the Oregon BLM, Idaho BLM, USGS, IDFG, and ODFW has not been received to date. The ODEQ provided continuous temperature monitoring data for three water bodies in this subbasin within the Oregon border. The streams, collection times, and locations are presented in Table 10-7 below.

Table 10-7. Thermograph Locations and Sampling Period

Stream	Agency	Location	From	To	% Exceedance
NF Owyhee R.	ODEQ	42.5439°N 117.1564°W	7/99	10/99	80%
NF Owyhee R.	ODEQ	42.5439°N 117.1564°W	6/01	10/01	88%
Owyhee R.	ODEQ	42.8051°N 117.6094°W	7/99	10/99	91%
Owyhee R.	ODEQ	42.8051°N 117.6094°W	6/00	10/00	91%
Owyhee R.	ODEQ	42.5263°N 117.1809°W	7/99	10/99	91%
Owyhee R.	ODEQ	42.5263°N 117.1809°W	6/00	10/00	91%
Owyhee R.	ODEQ	42.5263°N 117.1809°W	6/01	10/01	97%

In accordance with the Oregon Watershed Assessment Manual (WPN, 1999), the 7-day moving average of the daily maximum temperature was calculated and compared with Oregon's temperature criteria for salmonid rearing, resulting in a percent exceedance. The salmonid rearing temperature criteria was chosen because it is unlikely that salmonid spawning occurs in the stream reaches where the thermographs were placed. Graphs of the 7-day moving average of the daily maximum temperature for each sampling location are presented as Figures 2, 3, and 4. The 7-day moving average of the daily maximum temperature exceeded state temperature criteria for salmonid rearing at least 80% of the time. According to the *Oregon Watershed Assessment Manual* (WPN 1999), this percent exceedance of the criteria indicates these water bodies are "impaired."

The 1999 *North and Middle Fork Owyhee Subbasin Assessment and Total Maximum Daily Load* (IDEQ) assessed all available temperature data for water bodies in this subbasin within the Idaho border. IDEQ utilized temperature data from the BLM, IDEQ, and IDFG for the following water bodies: NF Owyhee River, MF Owyhee River, Juniper Creek, Cabin Creek, Corral Creek, Noon Creek, Big Spring Creek, Pleasant Valley Creek, and Squaw Creek. Based on the available data, IDEQ concluded that "many of the streams within this hydrologic unit exceed current Idaho water quality standards for cold water biota, and all of the streams with available data exceed current Idaho water quality standards for redband trout spawning during the designated spawning period. Also, the North and Middle Fork Owyhee Rivers exceed Oregon water quality temperature standards for salmonid rearing and spawning."

MSE has requested more recent (2000 and beyond) continuous temperature monitoring data for water bodies on the Idaho side of this subbasin from IDEQ, IDFG, BLM – Owyhee field office, and USGS. The IDEQ has not collected continuous temperature monitoring data since the 1999 subbasin assessment and TMDL. No response has been received by the IDFG, BLM, or USGS to date.

Jordan

The ODEQ did not place any water bodies on the 303(d) list for temperature impairments. However, ODEQ listed three water body units (Fish Creek, Jordan Creek, and Mahogany Creek) as not having sufficient data to determine whether there were temperature criteria exceedances. The IDEQ included three water body units on the Idaho 303(d) list as being water-quality limited for temperature, including Cow Creek, Louisa Creek, and Rock Creek.

The ODEQ has continuous temperature monitoring data for one water body in this subbasin, within the Oregon border. The stream, collection time, and location are listed in the table below.

Table 10-8. Thermograph Sample Locations and Sampling Period

Stream	Agency	Location	From	To	% Exceedance
Jordan Cr.	ODEQ	42.9114°N 116.9953°W	6/00	10/00	81%

In accordance with the Oregon Watershed Assessment Manual (WPN, 1999), the 7-day moving average of the daily maximum temperature was calculated and compared with Oregon's temperature criteria for salmonid rearing, resulting in a percent exceedance. The salmonid rearing temperature criteria was chosen because it is unlikely that salmonid spawning occurs in the stream reaches where the thermographs were placed. The 7-day moving average of the daily maximum temperature exceeded state temperature criteria for salmonid rearing 81% of the time. As a result, the level of impairment for temperature at this location within Jordan Creek can be rated as "impaired."

Crooked-Rattlesnake

As indicated in Table 10-4, there was insufficient data for determining whether or not Bull Creek met temperature criteria. No temperature data for streams within this subbasin was available through the ODEQ, ODFW, USGS, or the Vale District office of BLM.

Sediment

Both Oregon and Idaho have developed numeric and narrative criteria for sediment. The numeric criteria use turbidity as a surrogate for measuring suspended sediment. The narrative criteria for sediment rely on assessing impairment to beneficial uses as a result of excessive sediment being deposited in the stream channel. More specifically, evaluation of sediment impairment relies on documenting the status of aquatic communities (fish and/or macroinvertebrates). For the purposes of this component, we will only discuss the numeric criteria and available data for turbidity. Assessment of sediment impairment relating to the narrative criteria will be done in the Fish and Fish Habitat Component.

Turbidity is a measure of the amount of light that is scattered in a sample. Turbidity is influenced not only by suspended sediment, but also by organic solids such as algae. Suspended sediment can negatively impact salmonids by damaging their gills and decrease their ability to locate and capture prey (WPN, 1999). Oregon's numeric sediment standard is predicated on comparing a specific activity relative to the background condition. More specifically, it states "no more than a ten percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity" (OAR 340-041-0036). Similarly, Idaho set its turbidity standard as not to exceed background conditions by more than 50 nephelometric turbidity units (NTU) instantaneously or 25 NTU for more than ten consecutive days (IDAPA 58.01.02.250). The standard for turbidity in this assessment has been set at 50 NTU, as recommended by the WPN *Draft Watershed Assessment Manual* (1999). According to the manual, turbidity at this level interferes with the feeding capability of salmonids due to its interference with sight; however, it is not lethal to the fish at this level, thereby providing a direct indicator of biological effect.

Both the natural environment and anthropogenic activities influence turbidity levels in streams. The natural environment includes physical and biological factors. Physical factors that influence turbidity in streams include landscape, geology, vegetative cover, and climate. The geologic setting determines the erodibility of the soils. The climate determines the frequency, strength, and duration of storm events. Biological factors include seasonal variations in algal biomass. Turbidity in streams is likely to fluctuate as a result of these biological and physical factors. Anthropogenic activities that impact turbidity levels in streams include agriculture (such as cropland or grazing), urban development, or road construction. These activities decrease upland and riparian vegetation, decreased soil permeability, and increased rate off storm runoff. These cause increases in erosion, particulate matter, and nutrients, which promote increased algal growth.

For this analysis, we compiled available turbidity data from various state and federal agencies, including the BLM (Owyhee Field Office and Vale District Office), ODEQ, IDEQ, and USGS. We compared existing turbidity data for water bodies within the three subbasins to the standard of 50 NTU recommended by WPN (1999) and calculated percent exceedances.

Middle-Owyhee

As indicated in Table 10-3, Oregon's 303(d) list does not have any water bodies listed for sediment impairment. The ODEQ has listed four water bodies as having insufficient data to determine whether sediment criteria are being violated. Those water bodies include Antelope Creek, West Little Owyhee River, MF Owyhee River, and NF Owyhee River. The IDEQ included five water bodies as being sediment impaired on the Idaho 1998 303(d) list, including Juniper Creek, MF Owyhee River, Noon Creek, Pleasant Valley Creek, and Squaw Creek.

Available turbidity data was retrieved from ODEQ, IDEQ, and the USGS. Data requests from the Idaho BLM and Oregon BLM have not been fulfilled to date. The streams, agency, collection times, number of samples, and locations are presented in Table 10-9 below.

Table 10-9. Turbidity Sample Locations and Sample Period

Stream	Agency	Location	From	To	# of Samples	% Exceedance
NF Owyhee R.	ODEQ	42.5439°N 117.1564°W	5/93	10/02	15	0%
NF Owyhee R.	USGS	42.5444°N 117.1683°W	4/01	4/02	3	0%
Owyhee R.	ODEQ	42.8051°N 117.6094°W	5/92	10/02	12	0%
Owyhee R.	ODEQ	42.5263°N 117.1809°W	5/93	10/02	15	0%
Owyhee R.	USGS	42.5444°N 117.1697°W	4/01	4/02	3	33%
Owyhee R.	ODEQ	42.8407°N 117.6228°W	9/96	7/99	4	0%

Available turbidity data for rivers and streams within this subbasin indicate most of the sites sampled are well below the 50 NTU standard. Of the 52 turbidity measurements, only one exceeded the standard of

50 NTU. That sample was collected from the Owyhee River above its confluence with the NF Owyhee River on April 17, 2001 and measured 53 NTU.

Jordan

As indicated in Table 3, Oregon's 303(d) list does not have any water bodies listed for sediment impairment. The ODEQ has listed three water bodies as having insufficient data to determine whether sediment criteria are being violated. Those water bodies include Fish Creek, Jordan Creek, and Mahogany Creek. The IDEQ included six water bodies as being sediment impaired on the Idaho 1998 303(d) list, including Jordan Creek, Cow Creek, Louisa Creek, Louse Creek, Rock Creek, and Soda Creek.

Available turbidity data was retrieved from ODEQ, IDEQ, and the USGS. Data requests from the Idaho BLM and Oregon BLM have not been fulfilled to date. The streams, agency, collection times, number of samples, and locations are presented in Table 10-10 below.

Table 10-10. Turbidity Sample Locations and Sample Period

Stream	Agency	Location	From	To	# of Samples	% Exceedance
Jordan Cr.	ODEQ	42.8625°N 117.6406°W	5/92	7/99	7	0%
Jordan Cr.	USGS	42.8642°N 117.6386°W	4/01	4/02	3	0%
Jordan Cr.	ODEQ	42.9114°N 116.9953°W	5/92	10/02	12	0%

Available turbidity data for Jordan Creek indicate all of the measurements were well below the 50 NTU standard.

Crooked-Rattlesnake

The ODEQ did not place any water bodies within the subbasin on the Oregon 303(d) list as being impaired for sediment. The ODEQ classified Bull Creek as having insufficient data to determine whether sediment criteria are being violated.

Bacteria

Microorganisms naturally occur in terrestrial and aquatic ecosystems; however, there is a small subset of microorganisms, also known as pathogens, which can be harmful to humans. Coliform bacteria are unicellular organisms found in feces of warm-blooded animals such as humans, domestic pets, livestock, and wildlife. Coliform bacteria enter water bodies through point and nonpoint sources. The contribution of coliform bacteria to a water body from a point source is generally low since point sources are typically permitted and are required to reduce the level of bacteria in their effluent. Non-point sources are difficult to characterize, yet they have the greatest impact on bacteria concentrations in water bodies. The sources include agricultural areas, urban run-off, and undeveloped areas where wildlife is abundant. Beneficial uses of water bodies within this assessment area include contact recreation; therefore, it is important to protect these water bodies against pathogenic contamination.

The new limits are 406 *E. coli* organisms per 100 mL in a single sample or a geometric mean concentration of 126 *E. coli* organisms per 100 mL for a minimum of five samples taken every three to five days over a thirty day period.

Escherichia coli (*E. coli*) is a coliform bacterium commonly used as an indicator of water quality for freshwater ecosystems. *E. coli* naturally occurs in the intestinal tract and feces of warm-blooded animals, and although typically non-pathogenic, its presence in water indicates fecal contamination and the *potential* for waterborne diseases. Oregon and Idaho regulations were revised in January 1996 and April

2000, respectively, to set a water quality standard for primary recreational contact waters based on the concentration of *E. coli* rather than fecal coliform. This is because the presence of *E. coli* is considered to be more reflective of feces contamination from warm–blooded animals than is fecal coliform. Both states have set the single sample numeric criteria for *E. coli* to 406 organisms per 100 milliliters (mL) in a single sample (OAR 340-041-0009 [2003] and IDAPA 58.01.02.251 [2003]). In addition, Oregon has set a 30-day log mean of 126 *E. coli* organisms per 100 mL based on a minimum of five samples and Idaho has set a geometric mean concentration of 126 *E. coli* organisms per 100 mL for a minimum of five samples taken every three to five days over a thirty day period.

For this analysis, we compiled available bacteria data from state and federal agencies, including the BLM (Owyhee Field Office and Vale District Office), USGS, ODEQ, and IDEQ. We compared existing bacteria data for water bodies within the three subbasins to the single sample numeric criteria and calculated percent exceedances.

Middle Owyhee

According to the ODEQ 2002 Integrated Report, all water bodies that were assessed within this subbasin supported their contact recreation and water supply beneficial uses. Only one water body, NF Owyhee River, is on the Idaho 303(d) list developed by IDEQ.

According to the 1999 *North and Middle Fork Owyhee Subbasin Assessment and TMDL* (IDEQ), listing of the NF Owyhee River was "based on a one time sampling event by the BLM in July 1997 where a result of 1100 fecal coliform [a measure of fecal coliform was the criteria previously] per 100 mL or water was discovered." Additional sampling conducted by IDEQ in 1999 indicated there were no bacteria exceedances in the NF Owyhee River. The assessment also examined bacteria data for other water bodies within the subbasin. Bacteria data for Corral, Big Springs, and Squaw Creek indicated these streams did not meet water quality standards (based on fecal coliform at that time) for secondary contact recreation.

Neither ODEQ nor IDEQ had current bacteria data. Bacteria data has not been received from the Oregon or Idaho BLM district offices. The USGS collected bacteria data from two water bodies within this subbasin. The stations, locations, and summarized results are listed in the table below.

Table 10-11. *E. coli* Sample Locations and Average Results

Stream	Agency	Location	Sample Date	# of Samples	Average Result*	% Exceedance
NF Owyhee R.	USGS	42.5444°N 117.1683°W	4/01 to 4/02	3	7	0%
Owyhee R.	USGS	42.5444°N 117.1697°W	4/01 to 4/02	3	6	0%

Based on these results, the Owyhee River and NF Owyhee River are fully supporting the primary contact recreation beneficial use during the sampling period.

Jordan

According to the ODEQ 2002 Integrated Report, all water bodies that were assessed within this subbasin supported their contact recreation and water supply beneficial uses. The IDEQ listed Jordan Creek, from its headwaters to the Oregon/Idaho border, as not fully supporting its contact recreation beneficial use due to bacteria concentrations.

Neither ODEQ nor IDEQ had recent bacteria data for water bodies within this subbasin. Data has not yet been received from the Vale and Owyhee district offices of the BLM. The USGS collected bacteria data from Jordan Creek in 2001 and 2002. The station location, dates sampled, and analytical results are presented in the table below.

Table 10-12. *E. coli* Sample Locations and Results

Stream	Agency	Location	Sample Date	# of Samples	Average Result*	% Exceedance
Jordan Cr.	USGS	42.8625°N 117.6406°W	4/01 to 6/01	2	41	0%

These results indicated that Jordan Creek is supporting its water contact recreation beneficial use.

Crooked Rattlesnake

ODEQ did not place any water bodies within the subbasin on the Oregon 303(d) list as being impaired for bacteria. Furthermore, ODEQ did not classify any water bodies as having insufficient data to determine whether bacteria criteria are being violated. No *E. coli* data was available from ODEQ or BLM. As a result, we are unable to determine whether water bodies within this subbasin are supporting the contact recreation beneficial use.

Contaminants

Contaminants are those chemicals that may cause toxicity in aquatic organisms (WPN, 1999) and include organic as well as inorganic compounds. Organic compounds are used for a variety of industrial and agricultural purposes (herbicides and pesticides). Inorganic compounds include metals such as mercury, arsenic, antimony, and silver. Metals occur naturally in the environment; however, anthropogenic activities such as mining, agriculture, or transportation may result in artificially elevated levels of metals in aquatic ecosystems.

Assessing the status of all possible contaminants in water bodies where there is available data is beyond the scope of this assessment. Rather, this assessment will focus on those parameters that may be of concern as indicated on the 2002 Oregon 303(d) list and the 1998 Idaho 303(d) list. Mercury was the primary contaminant of concern on the 303(d) lists. The acute and chronic mercury criteria for Oregon and Idaho are:

- Acute (Oregon) – 0.024 mg/L;
- Acute (Idaho) – 0.021 mg/L ;
- Chronic (Oregon) – 0.00012 mg/L; and
- Chronic (Idaho) – 0.00012 mg/L.

Oregon is currently in the process of revising its mercury criteria such that the chronic criteria will increase and the acute criteria will decrease. However, a final decision about the recommended criteria will not be made until after the completion of this assessment. As a result, the recommended criteria were not used in the assessment.

Available data for the constituents of concern was gathered and compared to the state criteria. Results are discussed below.

Middle Owyhee

ODEQ did not place any water bodies within the subbasin on the Oregon 303(d) list as being impaired for contaminants. Furthermore, ODEQ did not classify any water bodies as having insufficient data to determine whether contaminant (organic compounds and metals) criteria are being violated. As a result, we did not gather contaminant data for this subbasin.

Need a statement about the presence of mining in this subbasin. How about dry farmland where pesticides/herbicides might be used?

Jordan

The ODEQ placed Jordan Creek and Antelope Reservoir/Jack Creek on the 2002 303(d) list as being impacted by mercury. These systems were listed in 1998 based on mercury concentrations in fish tissues being detected at almost three times the level allowed by the Food and Drug Administration for commercial fish (1.0 mg/kg). Idaho also placed Jordan Creek on its 1998 303(d) list as being impacted by mercury.

Available mercury data was requested from ODEQ, IDEQ, Kinross Gold Corporation (owner of the DeLamar Mine), and USGS. Data from IDEQ were not used because it was collected in the 1970s. Current data have not yet been received from Kinross Gold Corporation. The USGS assessed the concentration of mercury within the bed sediment; therefore, the results are not directly comparable to the water quality criteria. A report discussing the results from the USGS survey is currently in press and is expected to be released in December 2003. Once available, information from their report will be summarized here. The ODEQ had data for one location within the subbasin. That station, location, and analytical results are listed in the table below.

Table 10-13. Mercury Sample Locations and Results

Stream	Agency	Location	Sample Date	# of Samples	Result (mg/L)	% Exceedance
Jordan Cr.	ODEQ	42.8625°N 117.6406°W	8/9/94	1	0.61	100

As evidenced, the mercury concentration in the water column was significantly greater than the chronic and acute criteria. Given that this sample was collected almost ten years ago, it is difficult to definitively conclude Jordan Creek is impaired for mercury. Additional data is required to determine whether elevated mercury concentrations are still problematic in Jordan Creek and whether the concentrations are persistent throughout the year. Furthermore, additional data are required to determine whether elevated concentrations can be attributed primarily to natural conditions or anthropogenic activities (such as mining).

Idaho has also identified Jordan Creek as being impacted by pesticides and oil and grease. In addition, Idaho listed Louse Creek, a tributary to Jordan Creek, as being impacted by unknown metals. IDEQ has been contacted about the basis for these listings, but to date, no response has been given.

Crooked-Rattlesnake

ODEQ did not place any water bodies within the subbasin on the Oregon 303(d) list as being impaired for contaminants. Furthermore, ODEQ did not classify any water bodies as having insufficient data to determine whether contaminant (organic compounds and metals) criteria are being violated. As a result, we did not gather contaminant data for this subbasin.

pH

Potentia hydrogenii (pH) is an indicator of the acidity or alkalinity of a water body, as measured by the hydrogen ion activity in the water. A pH value of 7.0 is neutral with values less than 7 being acidic and values greater than 7 being alkaline. According to the EPA, pH levels in the range of 6.5 to 9.0 are suitable for aquatic life. Extreme levels of pH can be toxic to aquatic life. Under acidic conditions, metal ions can be released from the sediments and become toxic to aquatic life.

pH levels naturally vary among water bodies within a particular region due to rainfall and the chemical composition of the local geology. Levels of pH can be altered by industrial or municipal wastes, agricultural runoff, ammonia production during organic matter decomposition, or by excessive algal growth due to the carbon dioxide released during respiration.

The ODEQ has set its pH criteria as 7.0 to 9.0 in the Owyhee basin. Similarly, Idaho determined pH values within the range of 6.5 to 9.0 would be sufficient for the protection of aquatic life. For this analysis, we compiled available pH data from state and federal agencies, including the BLM (Owyhee Field Office and Vale District Office), USGS, ODEQ, and IDEQ. We compared existing pH data for water bodies within the three subbasins to the single sample numeric criteria and calculated percent exceedances.

Middle Owyhee

As indicated in Table 3, Oregon's 303(d) list does not have any water bodies listed for pH impairment. In addition, ODEQ did not list any water bodies as having insufficient data to determine whether pH criteria are being violated. Similarly, Idaho's 1998 303(d) list does not have any water bodies listed as being water quality limited due to pH levels.

Data requests to the Idaho BLM and Oregon BLM have not been fulfilled to date. Available pH data was received from ODEQ, IDEQ, and the USGS. The stations, locations, and number of sample events are listed in the table below.

Table 10-14. pH Sample Locations and Sample Period

Stream	Agency	Location	From	To	# of Samples	% Exceedance
NF Owyhee R.	ODEQ	42.5439°N 117.1564°W	5/92	09/02	19	0%
NF Owyhee R.	USGS	42.5444°N 117.1683°W	4/01	4/02	3	0%
Owyhee R.	ODEQ	42.8051°N 117.6094°W	5/92	10/02	13	0%
Owyhee R.	ODEQ	42.5263°N 117.1809°W	5/92	09/02	20	10%
Owyhee R.	USGS	42.5444°N 117.1697°W	4/01	4/02	3	0%
Owyhee R.	ODEQ	42.8407°N 117.6228°W	5/96	7/99	6	0%

Available pH data for rivers and streams within this subbasin indicate most of the sites sampled are within the range specified by the ODEQ. Given the few exceedances, it can be concluded that the water bodies sampled within this subbasin are not considered to be impaired for pH.

Jordan

As indicated in Table 10-3, Oregon's 303(d) list does not have any water bodies listed for pH impairment. In addition, ODEQ did not list any water bodies as having insufficient data to determine whether pH criteria are being violated. Louse Creek, from its headwaters to its mouth, was placed on the 1998 303(d) list for Idaho as being water-quality limited for pH.

Data have been requested from the Oregon BLM, Idaho BLM, and Kinross Gold Corporation, the current owner of DeLamar Mine. Data has been received from the ODEQ and USGS. Table 10-15 summarizes the streams, sample locations, and number of sample events.

Table 10-15. pH Sample Locations and Sample Period

Stream	Agency	Location	From	To	# of Samples	% Exceedance
Jordan Cr.	ODEQ	42.8625°N 117.6406°W	5/92	7/99	11	9 %
Jordan Cr.	USGS	42.8642°N 117.6386°W	4/01	4/02	3	33 %
Jordan Cr.	ODEQ	42.9114°N 116.9953°W	5/92	09/02	15	0 %

Available pH data for rivers and streams within this subbasin indicate most of the sites sampled are within the range specified by the ODEQ. Given the few exceedances, it can be concluded that the water bodies sampled on the Oregon side of this subbasin are not considered to be impaired for pH. More data are needed to assess the condition of water bodies in this subbasin within the Idaho border.

Crooked Rattlesnake

ODEQ did not place any water bodies within the subbasin on the Oregon 303(d) list as being impaired for pH. Furthermore, ODEQ did not classify any water bodies as having insufficient data to determine whether pH criteria are being violated. Limited pH data were available from ODEQ. Furthermore, this data was collected in the 1970s and early 1980's; therefore, it is not representative of current conditions. As a result, we are unable to determine whether water bodies within this subbasin are characterized by pH levels within the range of 7.0 and 9.0.

Nutrients

Phosphorus and nitrogen are two of the important nutrients required by plants and algae for growth. Both of these nutrients can limit plant growth and, therefore, are typically used to monitor water quality. In flowing waters, elevated levels of either of these nutrients promote accelerates growth of aquatic plants. The excessive growth of aquatic plants can reduce the level of dissolved oxygen, which negatively impacts aquatic organisms. It can also reduce the recreational value of the water.

Both nitrogen and phosphorus occur naturally in aquatic ecosystems; however, numerous anthropogenic activities can result in artificially elevated concentrations. Such sources include urban runoff, agricultural runoff, and discharges from wastewater treatment facilities, food-processing plants, and other industrial facilities.

No specific numeric criteria for phosphorus or nitrogen have been established in Oregon or Idaho. Typically, specific numeric criteria for nutrients are developed on a basin-wide basis during the process of preparing a TMDL. Evaluation criteria for this assessment, as recommended by WPN (1999) are as follows:

- Total phosphorus: 0.05 mg/L; and
- Total nitrates: 0.3 mg/L.

For this analysis, we compiled available nutrient data from state and federal agencies, including the USGS, ODEQ, and IDEQ. We compared existing nutrient data for water bodies within the three subbasins to the recommended standard and calculated percent exceedances. Results for each of the subbasins are discussed below.

Middle Owyhee

No water bodies are listed on the Oregon 2002 303(d) list or the Idaho 1998 303(d) list as being water quality limited for nutrients. Furthermore, ODEQ did not list any water bodies as having insufficient data or as being of potential concern for nutrients. The Idaho 1998 303(d) list does not have any water bodies listed for nutrients.

Total phosphate and nitrate plus nitrite data was available from ODEQ and USGS for a few water bodies within this subbasin. Monitoring station locations, average analytical results, and percent exceedances are presented in the tables below.

Table 10-16. Levels of Nitrate/Nitrite

Stream	Agency	Location	Sample Date	N[1]	Average Result[2]	% Exceedance
NF Owyhee R.	ODEQ	42.5439°N 117.1564°W	5/92 - 9/02	18	0.02	0%
NF Owyhee R.	USGS	42.5444°N 117.1683°W	4/01 - 4/02	3	0.04	0%
Owyhee R.	ODEQ	42.8051°N 117.6094°W	5/92 - 10/02	12	0.09	0%
Owyhee R.	ODEQ	42.5263°N 117.1809°W	5/92 - 9/02	18	0.14	6%
Owyhee R.	USGS	42.5444°N 117.1697°W	4/01 - 4/02	3	0.09	0%
Owyhee R.	ODEQ	42.8407°N 117.6228°W	5/96 - 7/99	5	0.09	0%

N = Number of Samples
Analytical results reported in mg/L of nitrate plus nitrite For samples below detection limits, half the detection limit was used.

Based on the information presented above, nitrates/nitrites in the NF Owyhee River and Owyhee River do not appear to be impacting the beneficial uses of those water bodies.

Table 10-17. Levels of Phosphate

Stream	Agency	Location	Sample Date	N[1]	Average Result[2]	% Exceedance
NF Owyhee R.	ODEQ	42.5439°N 117.1564	5/92 - 9/02	18	0.02	0%
NF Owyhee R.	USGS	42.5444°N 117.1683	4/01 - 4/02	3	0.05	0%
Owyhee R.	ODEQ	42.8051°N 117.6094	5/92 – 10/02	12	0.06	33%
Owyhee R.	ODEQ	42.5263°N 117.1809	5/92 - 9/02	18	0.05	33%
Owyhee R.	USGS	42.5444°N 117.1697	4/01 - 4/02	3	0.08	67%
Owyhee R.	ODEQ	42.8407°N 117.6228	5/96 - 7/99	5	0.07	40%

N = Number of samples.
Analytical results reported in mg/L of phosphate. For samples below detection limits, ½ the detection limit was used.

Based on the information presented above, the level of impairment from phosphorus concentrations in the Owyhee River at the mouth of the Owyhee Canyon and near Rome is considered to be moderate. The level of impairment from phosphorus concentrations in the Owyhee River near 3-Forks is moderate to high.

Jordan

No water bodies are listed on the Oregon 2002 303(d) list or the Idaho 1998 303(d) list as being water quality limited for nutrients. ODEQ listed three water bodies as having insufficient data for determining whether nutrients are impairing the beneficial use of water bodies. Those water bodies include Antelope Reservoir/Jack Creek, Jordan Creek, and Upper Cow Lake/Cow Creek.

Total phosphate and nitrate plus nitrite data was available from ODEQ and USGS for Jordan Creek. Monitoring station locations, average analytical results, and percent exceedances are presented in the tables below.

Table 10-18. Levels of Nitrate/Nitrite

Stream	Agency	Location	Sample Date	N[1]	Average Result[2]	% Exceedance
Jordan Cr.	ODEQ	42.8625°N 117.6406°W	5/92-7/99	10	0.08	10%
Jordan Cr.	USGS	42.8642°N 117.6386°W	4/01-4/02	3	0.33	67%
Jordan Cr.	ODEQ	42.9114°N 116.9953°W	5/92-9/02	14	0.09	7%

N = Number of samples
Analytical results reported in mg/L of nitrate plus nitrite For samples below detection limits, half the detection limit was used.

Based on the information presented above, nitrates/nitrites in the NF Owyhee River and Owyhee River do not appear to be impacting the beneficial uses of those water bodies.

Table 10-19. Levels of Phosphate

Stream	Agency	Location	Sample Date	N[1]	Average Result[2]	% Exceedance
Jordan Cr.	ODEQ	42.8625°N 117.6406°W	5/92-7/99	10	0.11	70 %
Jordan Cr.	USGS	42.8642°N 117.6386°W	4/01-4/02	3	0.12	100 %
Jordan Cr.	ODEQ	42.9114°N 116.9953°W	5/92-9/02	14	0.07	43 %

N = Number of samples
Analytical results reported in mg/L of phosphate For samples below detection limits, half the detection limit was used.

Based on the information presented in Table 10-19, Jordan Creek at its mouth is impacted from phosphate levels. Similarly, the level of phosphate impairment in Jordan Creek upstream of its confluence with Lone Tree Creek is moderate.

Crooked-Rattlesnake

ODEQ did not place any water bodies within the subbasin on the Oregon 303(d) list as being impaired for nutrients. Furthermore, ODEQ did not classify any water bodies as having insufficient data to determine whether nutrients are of concern. Limited nutrient data were available from ODEQ. These data were collected in the 1970s and early 1980's; therefore, they do not represent current conditions. As a result, we are unable to determine whether water bodies within this subbasin are characterized by nutrient levels within the recommended standard.

Aquatic Weeds or Algae

As indicated in the previous section, excessive growth of aquatic plants can be deleterious to aquatic life and recreation value of the water. Oregon has established a narrative criterion for this parameter. It states "The development of fungi or other growths having a deleterious effect on stream bottoms, fish or other aquatic life, or which are injurious to health, recreation, or industry shall not be allowed" (OAR 340-41 – (basin)(2)(h)). The ODEQ categorized two water bodies as having insufficient or no data for determining whether this narrative criteria is being violated. Those water bodies are Antelope Reservoir and Upper Cow Lake.

Need to conduct further research with BLM/BOR

Flow & Habitat Modification (Alteration)

Water bodies are no longer being placed on the Oregon 303(d) list for flow and/or habitat modifications because these parameters are not considered to be pollutants. However, the ODEQ continues to document water bodies where flow or habitat modifications adversely impact aquatic life. Given this, the ODEQ has classified seven water bodies as being water quality limited from flow and/or habitat modifications in the three subbasins of concern to this assessment (Table 4). The IDEQ includes water bodies with flow alterations that adversely affect aquatic life on its 1998 303(d) list. There are a total of 9 water bodies listed on Idaho's 1998 303(d) list for flow alteration in the Jordan and Middle Owyhee subbasins (Table 10-3).

Detailed discussions for flow modification and habitat modification are presented in the Water Use and Fish and Fish Habitat sections of this assessment, respectively.

Information In Processing

USGS

2001 sample event. Appear to be 6, maybe 7 sample sites in our study area. Data includes temperature (thermograph and instantaneous), turbidity, pH, nutrients, *E. coli*, and mercury.

Oregon BLM

1994 data – *E. coli* at 2 locations

1995, 1996, and 1997 temperature data at 4 locations

Information Requests Not Yet Fulfilled

DeLamar Mine

Idaho BLM – although there may be some information in the allotment assessments we have received.

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Stevens, H. H., Jr., J. F. Ficke, and G. F. Smoot. Water temperature – influential factors, field measurement, and data presentation. In *Techniques of water-resources investigations of the United States Geological Survey*, Book 1, Chapter D1. U. S. Department of the Interior. U. S. Government Printing Office, Washington, DC. 65 p.

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Component 11—Fish and Fish Habitat

The purpose of this component is to: 1) document fish species present in the study area; 2) assess the distribution and population status of selected fish species; and 3) assess the condition of aquatic habitats. Information presented in this chapter was compiled from literature, agency documents, agency databases, and interviews with government personnel familiar with fisheries in the study area (such as field biologists). This chapter is organized into two major sections: fish habitat and fish species.

The fish habitat discussion provides a general description of the streams/rivers (lotic) and lake/reservoir (lentic) aquatic habitats that occur within the study area. Where data allows, a discussion of the current condition of the habitats will be presented. The fish discussion presents a synopsis of species that historically occurred in the study area, as well as species that are currently present. Present fisheries are further broken into warmwater and coldwater game species and non-game species. Only one fish species, the inland redband trout, is considered to be a species of concern for federal and state agencies. Most of our effort was focused on this species, followed by game species. Due to the remoteness of the study area in addition to limited resources, federal and state agencies have not gathered much information on the distribution and status of most fish species nor on aquatic habitat condition within the study area.

Fish Habitat

Fishery habitat in the study area consists of perennial and intermittent streams and rivers, lakes, and reservoirs. Federal and state agencies responsible for collecting habitat information on public lands in the study area include BLM, ODFW, IDFG, ODSL, and IDSL. The USDA-NRCS works collaboratively with the public to collect habitat information on private lands.

Information in this subsection has been categorized into stream/rivers (lotic) and reservoir (lentic) habitats. The following discussions will include information on important characteristics for fish propagation and survival in each habitat as well as any available habitat information for the study area.

Stream/River Habitat

There are a total of approximately 6,000 stream miles in the study area. Stream mileages were calculated using the Pacific Northwest hydrography data obtained from StreamNet (2001a). Table 11-1 provides a summary of the stream miles in the study area.

Table 11-1. Study Area Stream Mileages

Stream Category	Study Area	Middle Owyhee	Jordan	Crooked-Rattlesnake
Perennial	848.72	340.3	490.19	18.23
Intermittent	5137.43	1916.68	1311.17	1909.58
Total	5986.15	2256.98	1801.36	1927.81

Of the 6,000 stream miles in the study area, approximately 1,800 miles are considered to be fish bearing. Figure 11-1 illustrates the fish bearing stream reaches in the study area. Information obtained from the Oregon Department of Fish and Wildlife (2005) and the Idaho Department of Fish and Game (2004). A variety of habitat characteristics are important for the propagation and survival of fishes in stream and river environments including riparian condition, water temperature, water quality, oxygen, stream flows, substrate, and habitat diversity. Each of these is briefly discussed below.

Riparian areas include those plant communities influenced by surface and subsurface hydrologic characteristics of perennial or intermittent streams, rivers, ponds, lakes, or reservoirs (FISRWG, 1998).

Riparian areas are essential to the aquatic habitat because they provide nutrient and organic matter input, solar energy reduction, woody debris, fish food and cover, and energy dissipation from flood flows. The condition of the riparian area is hypothesized to be most influential for spawning and incubation and summer rearing life stages of redband trout (QHA, 2003). Specific information about the riparian condition within the study area is discussed in the Riparian Assessment Component of this report.

Water temperature influences many biochemical and physiological processes of aquatic organisms, including some behaviors, metabolic activity, and life cycle changes. As a result, water temperature strongly influences the type of biological communities that exist in particular habitats. Many fish or aquatic invertebrates have specific temperature ranges in which they can flourish, and temperatures outside of this range may result in death of the organism(s). Information regarding stream temperatures within the study area is presented in the Water Quality Component of this assessment.

Dissolved oxygen is essential to the survival of fish and other aquatic organisms. Low dissolved oxygen concentrations affect growth, metabolic activity, swimming performance, and survival. The incubation of embryos is considered the most sensitive life stage to dissolved oxygen concentrations (Bauer and Burton, 1993). Dissolved oxygen concentrations varies with water temperature. As water temperatures increase, the saturation level of dissolved oxygen decreases; therefore, warmer waters cannot hold as much oxygen as colder waters. This presents a problem for aquatic organisms, because as water temperatures increase, the organism's demand for oxygen also increases to support the increase in metabolic rates. However, the water is less able to hold adequate concentrations of dissolved oxygen. Information about dissolved oxygen concentrations in the study area is presented in the Water Quality Component of this assessment.

Streamflow or discharge is the quantity of water passing through a stream channel per unit time. The discharge of a stream varies with the local geology, topography, climate, season, drainage area, vegetation, and land use. Stream discharge is especially important in the study area because the climate is typified by hot, dry summers, and annual precipitation is low. As a result of the climate (hydrologic cycle), many of the streams and rivers in the study area are intermittent, meaning they carry water on a seasonal basis (such as during the spring and winter). Some streams are interrupted channels, meaning stream flows are discontinuous along the stream's length. The West Little Owyhee River is an interrupted channel because it is has a few perennial reaches that are interspersed with intermittent reaches. In addition to climatic factors, water withdrawals are another important factor to consider when assessing stream discharge in the study area. Stream discharge affects in-stream habitat composition, riparian vegetation, and substrate composition, which in turn, impact the composition of the biotic community. It is a critical factor in determining suitable spawning habitat for salmonid species. A more detailed discussion regarding the hydrology in the study area is presented in the Hydrology Component of this assessment.

Substrate in aquatic systems refers to the bottom material of the channel. Substrate is an important component of aquatic habitats because it determines the roughness of stream channels, which influences the hydraulics (depth, width, and velocity) of the stream, and it provides specific microhabitats used by fishes (spawning and incubation) and aquatic macroinvertebrates. Substrate is categorized by its size and typical substrate classifications include silt and clay, sand, gravel, pebble, cobble, and boulder. Fine sediments including silt, clay, and sand degrade substrate habitat quality in lotic environments by filling in interstitial spaces. The interstitial space occurs between larger particles (such as gravel, pebble, cobble, and boulder). Salmonid eggs require open interstitial spaces to allow for the flow of water, which supplies dissolved oxygen and removes excreted wastes. Open interstitial spaces also provide room for fry emergence. Fine sediments fill in the interstitial spaces and effectively block the flow of water, thereby reducing embryo survival and fry emergence. Fine sediments also alter the aquatic macroinvertebrate community, which is a food source for fishes. There is limited information regarding substrate condition in waterbodies within the study area. Any available information is discussed in the separate 4th field HUC sections below. Information about sediment sources in the watershed is presented in the Sediment Sources Component of this assessment.

Habitat diversity in lotic environments is characterized by riffles, pools, runs, undercut banks, side channels, and large woody debris. A diverse habitat has the potential for supporting a wide array of fish and aquatic macroinvertebrate species. Fish utilize a variety of habitats during their life for feeding, breeding, spawning, and escaping from predators or environmental extremes (such as temperature). Moore *et al.* (1997) developed standardized methods for stream habitat surveys that are used by the ODFW. Data collected during these surveys includes pool area, depth, and frequency, substrate composition, width:depth ratios, large woody debris counts, and percent shading.

There is very little quantitative data, if any, in the study area. As a result, it was not feasible to complete the habitat condition summary forms (F2a, F2b, and F2c). According to Mr. Raymond Perkins, fisheries biologist for the ODFW, no stream habitat survey data exists within the Oregon portion of our study area. Mrs. Cynthia Tait, fisheries biologist for the BLM, also indicated that BLM did not have any quantitative stream habitat survey data for the Oregon portion of the study area. She indicated that a qualitative habitat assessment has been performed for selected reaches within the study area as part of the Owyhee Subbasin Plan (Shoshone-Paiute Tribes & Owyhee Watershed Council, 2004). The qualitative habitat assessment technique relies on the knowledge of natural resource professionals with experience in a particular area. Based on their experience and best professional judgement, these individuals provide a qualitative description of target stream habitats and a hypothesis about how a target species utilizes that particular area. Information from the QHA process was not used in this assessment due to controversy over its accuracy (Owyhee Watershed Council, 2004). IDFG has collected stream habitat data on a few reaches in the Jordan Creek drainage; however, they did not follow the standard protocols established by Moore *et al.* (1997) for Oregon ODFW stream surveys. Available quantitative habitat information is summarized and presented in tables (modifications of the F2 forms) within the text.

Middle Owyhee

There are approximately 2,260 stream miles (perennial and intermittent) in this subbasin. Discharge for most of the streams in this hydrologic unit are dependent upon snowmelt, although there are some that receive much of their flow from groundwater discharge (spring sources). The ODFW, BLM, and IDFG had limited information regarding fish habitat in the Middle Owyhee hydrologic unit. Qualitative information about aquatic habitats was obtained from previous reports, and is summarized below.

According to the BLM (2003), the West Little Owyhee River has limited potential for fisheries due to its interrupted nature with low-to-no summer flows. However, the stream provides good spawning and rearing fish habitat (cool water and clean substrate) in the perennial reach downstream of Cold Springs. The lower reaches of Antelope Creek were reported to provide good habitat for native fishes. Aquatic habitats in the upper portion of Antelope Creek, as well as Pole Creek, Field Creek, and Tent Creek were reportedly impacted by grazing activities (BLM, 2003). The IDFG collected in-stream habitat data for reaches in this watershed during the 1996 and 1997 field seasons. They used standard IDFG methodologies to determine substrate composition, instream fish cover, cross section measurements, and gradient. Table 11-2 presents the data collected by IDFG personnel (Allen *et al.*, 1997; Allen *et al.*, 1998).

Table 11-2. 1996-1997 IDFG In-stream Habitat Data

Waterbody	Reach	Length	Average W:D ratio	% Gradient	% Sand	% Riffle	% Pool	% Cover	% Shade
NF Owyhee	NFOWY014.4	61	30	0.82	14	20	10	41	14.6
NF Owyhee	NFOWY011.8	61	27.5	0.85	7	29.6	0	25	6.42
Juniper	JUNIP002.0	61	32	0.29	27	26.7	20	28	15.7
Cabin	CABIN003.4	61	21	1.55	18	70	0	1	10.7

Personnel from IDL and IDFG evaluated the fish habitat condition of Corral, Cabin, Juniper, and Lone Tree Creek reaches on state lands. Joe DuPont, fisheries biologist for IDL, stated that the fish habitat in these streams on state lands was adequate to support a thriving fish population (1999). He based this observation on the condition of pools, pool frequency, overhanging vegetation, stream temperatures, and quantity of fine sediment. He further indicated that historically, the streams were likely less incised and had a wider floodplain. Currently, streams in the area appear to be downcutting. Factors that may be contributing to this include the loss of beaver, climate change, or grazing history (Dupont, 1999; IDEQ, 1999).

Jordan Creek

There are approximately 1,800 stream miles (perennial and intermittent) in this subbasin. Much of Jordan Creek is on private property; therefore, state and federal agencies have not actively gathered stream habitat information for this creek. There is no information available for in-stream habitat conditions on the Oregon side of this watershed. The IDFG conducted in-stream habitat surveys during redband trout population surveys in 1996 and 1997. They used standard IDFG methodologies to determine substrate composition, instream fish cover, cross section measurements, and gradient. Table 11-3 presents the data collected by IDFG personnel (Allen *et al.*, 1997; Allen *et al.*, 1998).

Table 11-3. 1996-1997 IDFG In-stream Habitat Data

Waterbody	Reach	Length	Average W:D ratio	% Gradient	% Sand	% Riffle	% Pool	% Cover	% Shade
Jordan	JORDA097.9	57	38	1.62	17	60	26.7	13	ND
Jordan	JORDA095.4	66	32	ND	26	53.3	0	10	ND
Jordan	JORDA088.3	66	53	ND	11	53.3	26.7	17	ND
Jordan	JORDA075.9	61	15	ND	15	60	40	32	ND
Jordan	JORDA067.7	61	26	0.49	17	16.7	3.3	38	13
Mcbride	MCBRI010.0	46	5.5	1.95	73	0	100	50	ND
Cow	COW032.8	52.9	18	1.99	23	53.3	13.3	29	49.6
Pickett	PICKE010.2	80	22	ND	41	23.3	43.3	65	73.1
NF Castle	NFCAS003.7	61	15	1.13	67	16.7	20	32	33.7
Rock	ROCK003.7	61	21	0.86	20	10	0	48	5.2
Josephine	JOSEP000.6	61	18	0.62	19	0	0	54	11.7
Big Boulder	BOULD008.0	61	18	1.44	21	6.7	26.7	67	25.2
South Mountain	SMOUN006.6	61	17	1.88	29	60	0	5	42.4
SF Boulder	SFBOU001.6	61	32	1.01	22	36.7	3.3	9	42
Flint	FLINT003.9	43	36.5	ND	7	26.7	40	0	ND

Crooked-Rattlesnake

There is no available in-stream habitat data for waterbodies in this subbasin.

Lake/Reservoir Habitats

Lake and reservoir habitats encompass approximately 8,500 acres throughout the study area. Lake/reservoir acreages were calculated using the Pacific Northwest hydrography data obtained from StreamNet (2001b). Table 11-4 provides a summary of the acres of lakes/reservoirs in the study area. Figure 11-2 illustrates the distribution of lakes and reservoirs across the study area.

Table 11-4. Study Area Lake/Reservoir Acres

Area	Flat Water Acreage
Middle Owyhee	2144.31
Jordan	6033.29
Crooked-Rattlesnake	304.56
Total	8482.16

The majority of flatwater acreage in the study area was created for irrigation purposes, which is discussed in detail in Component 9 "Channel Modification Assessment." Historically, fish stocking of these reservoirs was done for recreational purposes. Although fish stocking does occur in some of the BLM ponds in the study area, this practice appears to have decreased over the entire study area. Trout stocking frequency in the BLM ponds depends on general road conditions, fish availability, and water levels. The pond fisheries are managed under the "Basic Yield" option of the Trout Management Plan, meaning each pond is stocked annually or when conditions permit (Perkins and Bowers, 2000).

The habitats of lakes and reservoirs are highly variable. Habitat parameters important for aquatic communities in lakes and reservoirs include water quality (such as dissolved oxygen, water temperature, and nutrient concentrations), habitat diversity, and trophic status. These parameters are strongly influenced by the physical characteristics of a lake such as its surface area and depth. Habitat diversity in lakes includes both vertical and horizontal habitats. Lakes and reservoirs are typically stratified into thermal layers, which have different physio-chemical characteristics. Horizontal habitats include the littoral zone and the limnetic zone. The littoral zone occurs near the shore where light can penetrate down to the substrate. Aquatic plants grow in this zone and provide a food source and substrate for algae and aquatic invertebrates as well as habitat for fish. The limnetic zone is the open water area where light does not generally penetrate all the way to the bottom and this zone generally supports a vastly different aquatic community than that of the littoral zone. The trophic status of lakes and reservoirs is influenced by a variety of factors; however, the three main factors include nutrient concentrations, climate, and lake morphology. The overriding effects of a waterbodies' trophic status its fish community are: 1) primary and secondary production as food sources and 2) availability of dissolved oxygen. Lakes with low concentrations of nutrients (oligotrophic) are generally less productive than lakes with higher nutrient concentrations (eutrophic). Warmwater fish such as bass, bullheads, and sunfish generally thrive in more eutrophic conditions than do coldwater fishes such as trout.

Quantitative and qualitative habitat information for lakes and reservoirs in the study area was not available.

Middle Owyhee

There are many small reservoirs scattered throughout this subbasin. The five largest reservoirs in this subbasin include: Little Grassy Reservoir (328 acres), Coyote Creek Reservoir (179 acres), Drummond Butte Reservoir (147 acres), Gartin Reservoir (140 acres), and Jaca Reservoir (138 acres). Information regarding the presence of fish (stocking practices) and condition of fish habitat in these reservoirs was not available.

Jordan

In combination, Upper Cow Lake, Lower Cow Lake, and Antelope Reservoir account for approximately 63% of the total flatwater acreage in the study area and approximately 90% of the total flatwater acreage in the Jordan subbasin. Fish stocking practices occurred during the 1960s and 1970s at Cow Lakes. Fish species stocked included white crappie, cutthroat trout, rainbow trout, and largemouth bass. Stocking practices ceased during the 1970s; however, white crappie and largemouth bass continued to naturally reproduce. Antelope Reservoir was historically stocked with trout; however stocking ceased in 1990 as a result of elevated mercury content in fish tissues. With the loss of the trout fishery in Antelope Reservoir, the crappie and bass fisheries in Cow Lakes gained more importance to the local communities. There is no available information regarding the habitat condition of Cow Lakes.

Crooked-Rattlesnake

There are very few reservoirs in this subbasin. The two largest reservoirs in this subbasin include: Rockhouse Reservoir (98 acres) and Blevens Reservoir (48 acres). Information regarding the presence of fish and condition of fish habitat in these reservoirs was not available.

Fish

There are 30 species of fish that currently occur in our study area. Of these, 22 are native to the region and 6 have been introduced. No federally listed threatened, endangered, or candidate fish species occur in the study area. One BLM-sensitive species, the interior redband trout (*Onchorhynchus mykiss gibbsi*), occurs at various locations in each of the three subbasins. There are 7 game species, of which 3 are coldwater fish and 4 are warmwater fish. Table 11-5 lists species, their origin and status, and the subbasin(s) they have been documented in the study area (USDA – FS and USDI – BLM 1996).

Table 11-5. Fish species occupying aquatic habitats in the study area.

Common Name	Scientific Name	Origin	Status	Jordan	Middle Owyhee	Crooked-Rattlesnake
Black bullhead	*Ameiurus melas*	Exotic	GF	X	X	
Bridgelip sucker	*Catostomus columbianus*	Native	U	X	X	X
Carp	*Cyprinus carpio*	Exotic	U	X	X	
Channel catfish	*Ictalurus punctatus*	Exotic	GF		X	
Chiselmouth	*Acrocheilus alutaceus*	Native	U	X	X	X
Coastrange sculpin	*Cottus aleuticus*	Native	U		X	
Cutthroat trout	*Onchorhynchus clarki spp.*	Native	GF		X	X
Dace	*Rhinichthys sp.*	Native	U	X	X	
Interior redband trout	*Onchorhynchus mykiss gairdneri*	Native	GF C2	X	X	X
Largemouth bass	*Micropterus salmoides*	Exotic	GF	X		
Largescale sucker	*Catostomus macrocheilus*	Native	U	X	X	
Leopard dace	*Rhinichthys falcatus*	Native	U		X	
Longnose dace	*Rhinichthys cataractae*	Native		X	X	
Mottled sculpin	*Cottus bairdi*	Native	U		X	
Mountain whitefish	*Prosopium williamsoni*	Native	GF		X	
Northern squawfish	*Ptychocheilus oregonensis*	Native	U	X	X	X
Paiute sculpin	*Cottus beldingi*	Native	U		X	
Prickly sculpin	*Cottus asper*	Native	U		X	X
Rainbow trout	*Oncorhynchus mykiss*	Exotic	GF	X	X	X
Redside shiner	*Richardsonius balteatus*	Native	U	X	X	X
Reticulate sculpin	*Cottus perplexus*	Native	U			X
Riffle sculpin	*Cottus gulosus*	Native	U			X
Sculpin	*Cottus sp.*	Native	U	X	X	
Smallmouth bass	*Micropterus dolomieu*	Exotic	GF	X	X	
Speckled dace	*Rhinichthys osculus*	Native	U	X	X	X
Sucker	*Catostomus sp.*	Native	U		X	
Three spine stickelback	*Gasterosteus aculeatus*	Native		X		
Torrent sculpin	*Cottus rhotheus*	Native	U		X	X
White crappie	*Pomoxis annularis*		GF			
Yellow Perch	*Perca flavescens*	Exotic	GF	X		

Abbreviations: U - Unknown; GF – Game Fish; C2- Federal Category II

<u>Historical Species</u>

The study area historically supported anadromous fisheries (Perkins and Bowers, 2000; Quigley and Arbelbide, 1997) including runs of summer steelhead (*Onhorhynchus mykiss*), stream-type Chinook salmon (*Oncorhynchus twhawytscha*), and Pacific lamprey (*Lampetra tridentata*). Steelhead are an anadromous form of rainbow/redband trout, and it is thought that they historically migrated into the south and east forks of the Owyhee River. Spring Chinook were documented in the Owyhee River, Jordan Creek, and Cow Creek (Perkins and Bowers, 2000). Completion of the Owyhee Dam in 1932 (USBR, undated) resulted in the extirpation of anadromous fishes from the study area (Perkins and Bowers, 2000). In the late 1980's, efforts were proposed to reintroduce anadromous salmonids into the Owyhee River basin, but it was determined that such an undertaking was logistically and monetarily prohibitive (Perkins and Bowers, 2000).

Coldwater Game Fishes

Native coldwater gamefish included anadromous salmonids (prior to construction of the Owyhee Dam) and resident inland redband trout, and mountain whitefish. Rainbow trout, cutthroat trout, and brook trout are the only coldwater game species that have been introduced to streams in the study area through state agency stocking efforts. Discussions of these species are presented below.

<u>Redband Trout</u>

The interior redband trout (*Oncorhynchus mykiss gairdneri)* is classified as sensitive species by the U.S. Bureau of Land Management (BLM) and as a species of concern in Idaho and Oregon (Quigley and Arbelbide, 1997). A petition to list the inland redband trout of Idaho and Oregon under the Endangered Species Act (ESA) was filed in 1995. The U.S. Fish and Wildlife Service (FWS) concluded the data did not warrant proposing the species for listing (IDEQ, 1999). This species is of concern to various state and federal agencies due to its seemingly low populations and fragmented distribution.

Redband trout within the study area are thought to be the non-anadromous form historically derived from or associated with steelhead (Quigley and Arbelbide, 1997). Prior to construction of the Owyhee Dam in 1932, genetic interaction between the summer steelhead and resident forms of redband trout likely occurred (Perkins and Bowers, 2000). The loss of this interaction may be a potential limiting factor to population stability and genetic diversity (Ecovista, 2002).

There has been little to no research done on the life history of inland redband trout within the Owyhee Basin, and much of the life history information presented here was obtained from studies on redband trout in nearby drainages including the Malheur. Redband trout are primarily spring spawners (March – July), depending on water temperatures (Quigley and Arbelbide, 1997; Perkins and Bowers, 2000). Growth of redband trout is variable and is probably dependent on genetic and environmental conditions. According to Perkins and Bowers (2000), redband trout are generally less than 10-inches in tributary streams, and some may reach up to 18 inches in length in the mainstem of the Owyhee. This species reaches sexual maturity between three and four years of age (Quigley and Arbelbide, 1997; Perkins and Bowers, 2000), and most trout die after spawning.

Based on field observations, it has been proposed that redband trout have evolved adaptations to function in habitats characterized by high summer temperatures (Behnke, 1992; Zoellick, 1999; BLM 2001). Although Rodnick *et al.* (2004) found no difference between the T_{crit} (temperature at which a fish was negatively affected after short-term exposure to elevated temperatures) of redband and rainbow trout, they did find that redband trout had higher metabolic power and R_{max} than rainbow trout. These results, in addition to research conducted by Gamperl *et al.* (2002), strongly support the thought that redband trout have a better capacity to function at warmer water temperatures than most salmonids. Another factor that may influence the capacity of redband trout to survive in areas characterized by temperature extremes is the presence of thermal refugia. Thermal refugia are cold water patches in the stream that are created by tributaries, groundwater seeps, springs, and temperature stratification (Ebersole *et al.*, 2003; Ebersole, *et al.*, 2001).

Redband trout have been documented at various locations within the study area by the BLM, ODFW, and IDFG (Table 11-6). Figure 11-3 illustrates the distribution of redband trout in the study area. Information for this figure was obtained from the Idaho Fish and Game – Idaho Fish Database. In addition, information obtained from Ray Perkins of ODFW was included.

Table 11-6. Redband trout locations within the study area.

Waterbody	Estimated Miles of Habitat	Genetic Testing	Results of Genetic Testing
Jordan Cr.	5	YES	Redband
Amtelope Cr.	1	NO	
Owyhee R.	159	NO	
N.F. Owyhee R.	62	NO	
W.L. Owyhee R.	5	YES	Redband
M.F. Owyhee R.	35	NO	
Juniper Cr.	47	NO	
Cabin Cr.	35	NO	
Corral Cr.	25	NO	
Noon Cr.	67	NO	
Big Spring Cr.	30	NO	
Pleasant Valley Cr.	30	NO	
Squaw Cr.	56	NO	
Flint Cr.		NO	

Source: Perkins and Bowers, 2000; IDEQ, 1999;

Overall, redband populations in Oregon are very small and appear to be restricted to tributary streams and confined to stream reaches near perennial springs. Most populations and suitable habitat occur further upstream in the watershed in Idaho (BLM, 2001; Perkins and Bowers, 2000). In Oregon, populations of redband trout have been found in the North Fork Owyhee River, Jordan Creek, Antelope Creek, West Little Owyhee River, and mainstem of the Owyhee River. Redband trout abundance in the mainstem of the Owyhee River above the dam is unknown (Perkins and Bowers, 2000). In Idaho, redband trout have been identified in Jordan Creek and most of its tributaries. According to Brian Flatter (2004), a biologist for the IDFG, there isn't enough information to assess long-term trends in redband trout populations in the study area; however, the populations appear to fluctuate, depending on the water year. He indicated that during times of drought, the fish retreat to certain refuges, and during good water years, redband trout seem to disperse. Although field observations have been made, the presence of thermal refugia and redband trout use of these refugia has not been specifically examined in our study area. Although the current population status of redband trout within the study area is largely unknown, ICBEMP predicted certain areas within the Jordan Creek subbasin as redband trout strongholds (Quigley and Arbelbide, 1997).

Perkins and Bowers (2000) indicate the populations of redband trout upstream of the Owyhee Dam behave like a metapopulation. A metapopulation is comprised of one or more local populations that interact through dispersal of individuals. Local populations are connected to each other by corridors, through which individuals can migrate. If a local population is lost due to natural or human-caused events, individuals from extant populations can migrate to and recolonize the habitat. Maintaining the interconnectivity among local populations in the basin is important to long-term survival and genetic viability of inland redband trout populations (Perkins and Bowers, 2000).

Factors that negatively impact inland redband trout populations include: hybridization and competition with other species; habitat fragmentation and isolation, and habitat degradation, and unscreened diversions (Quigley and Arbelbide, 1997 and Perkins and Bowers, 2000). Throughout much of the Columbia River basin, resident redband trout have hybridized with hatchery rainbow trout (BLM 2003). Limited genetic analysis of redband trout has been conducted in the study area. In 1994, allozyme genetic testing of 25 trout form Cold Spring on West Little Owyhee River resulted in no evidence of hybridization with hatchery rainbow trout (BLM 2003). BLM (2001) cited other genetic testing of trout populations in the Malheur and Jordan planning areas indicated the populations were genetically pure on were only slightly hybridized. They did not specify what streams the redband trout were collected from. Investigations of potential hybridization in redband trout populations in Idaho tributaries (Jordan Creek, Little Boulder, Cabin Creek, and Current Creek) resulted in no evidence of hybridization (Wichard *et al.*, 1984). Perkins and Bowers (2000) attributed a combination of habitat alterations (loss of riparian vegetation) and natural conditions (drought) that constrain redband trout distributions. The restriction of populations to short perennial reaches increases their susceptibility to genetic bottlenecks or extirpation from catastrophic events.

Habitat connectivity is crucial for the survival and propagation of redband trout. One of the many factors contributing to decreased habitat connectivity includes migration barriers created by road-stream crossings. Historically, road infrastructures were designed to optimize transportation and culverts were designed to optimize water flow-through. Allowing for adequate fish passage has not been a consideration when designing culvert installations at crossings until relatively recently. Improperly designed culvert crossings can impede fish passage by creating impassable jumps at the culvert outlet, lack of adequate resting pools at the culvert outlet, or velocity barriers through the culvert. There are 322 road crossings on redband trout streams in the study area (Figure 11-4). Of these, 214 (67%) occur on the Idaho side of the study area. There is no information regarding the type of crossings (bridge, culvert, or ford) or whether the crossing impedes fish passage. As a result, completion of forms F-3 and F-4 was not possible. Documenting the quantity and distribution of crossing barriers would be a useful step toward understanding redband trout distributions in these subbasins.

Mountain Whitefish

There is limited information about the abundance and distribution of mountain whitefish in the study area. This species has been documented in the Owyhee River in the Three Forks area (Perkins and Bowers, 2000). Mountain whitefish are more commonly found in larger stream systems than that of the Owyhee River Basin. This species is hardy, and, compared to trout, it is more tolerant of warmer, more turbid water (Behnke, 2002).

Mountain whitefish become sexually mature between three and six years of age, when they reach a size of 9 to 12 inches (Perkins and Bowers, 2000; Behnke, 2002). They spawn in the fall, typically from October through December. The embyos develop over the winter, and fry emerge in March and April. Mountain whitefish are insectivorous and typically feed near the stream bottom, although they will feed opportunistically on hatching aquatic insects at the waters surface (Behnke, 2002).

Mountain whitefish are not considered to be a popular sport fish by anglers or management agencies. Perkins and Bowers indicated there is no known fishery targeting this species in the planning area. This, in addition to the fact that this species is not a conservation concern, may contribute to the general lack of effort to gain information on the distribution and abundance of mountain whitefish in the study area.

Hatchery trout

The Oregon Department of Fish and Wildlife (ODFW) and the Idaho Department of Fish and Game (IDFG) are the two state agencies responsible for implementing fish stocking programs in Oregon and Idaho, respectively. In Oregon, fingerlings make up the majority of the hatchery rainbow trout stocked; however, legal sized trout are occasionally used to jump-start a fishery while the fingerling trout grow (Perkins and Bowers, 2000).

According to Perkins and Bowers (2000), hatchery rainbow trout are not currently stocked in the mainstem Owhyee River or its tributaries in Oregon. In 1970, ODFW treated the main Owyhee River with chemicals applied at Three Forks (where the Middle Fork, North Fork, and South Fork Owyhee Rivers join) and subsequently introduced hatchery rainbow trout (BLM 2003). ODFW currently stocks rainbow trout in BLM stock watering ponds throughout the study area. The number of fish stocked in a pond varies from 100 to 1,000 each year, depending on the water year and size of the pond. None of the populations reproduce consistently in the wild because most ponds do not have suitable spawning habitat (Perkins and Bowers, 2000). Occasionally, hatchery rainbow trout have access to the Owyhee River or its tributaries from pond outflows or from upstream stocking programs in Idaho and Nevada. To minimize the potential of hatchery rainbow trout being introduced to the West Little Owyhee River, BLM negotiated an agreement with ODFW to terminate planting of hatchery trout in reservoirs with outflows to the West Little Owyhee (BLM, 2003). In 1963, ODFW treated Upper Cow Lake and its tributaries with chemicals to remove populations of coarse scale suckers, bridge lip suckers, squawfish, black bullheads, shiners, and dace. The lake was restocked with trout fry and fingerlings in 1964 (Bisbee, 1964). Antelope reservoir in the Jordan Creek watershed was historically stocked with rainbow trout. ODFW stocked 60,000 fingerling trout in Antelope Reservoir each spring (Myers, 1987). ODFW ceased stocking this reservoir in 1990 due to mercury concentrations in fish tissue exceeding the federal standards (Perkins, 2004).

According to the IDFG fish stocking database (accessed April 2004), Jordan Creek and Juniper Creek are the only waterbodies in the study area on the Idaho side that have been actively stocked with hatchery trout. Catchable size rainbow trout were stocked in Jordan Creek from as early as 1968 to 1990. IDFG planted 1,800 – 2,000 legal size rainbow trout in Jordan Creek each spring. IDFG's management direction for 1986-1990 was for a yield rainbow trout fishery. Now, the direction of IDFG is to manage the redband trout population as wild to preserve its genetic integrity (IDEQ, 1999). Rainbow trout were stocked once in 1952 in Juniper Creek. No other stocking efforts have been made in this subbasin (IDEQ, 1999).

Although a specific date was not available, brook trout have been stocked in Jordan Creek. Three brook trout were observed in the upper reaches of Jordan Creek, above Silver City (Allen *et al.,* 1997). Given their size (mean length of 117 mm), fisheries biologists concluded natural reproduction occurred since the last date brook trout were stocked by IDFG in Jordan Creek was during the 1970's.

Warmwater Game Fishes

No native warmwater game fish occur within the study area. Warmwater game fish that have been introduced to the waterbodies within the study area include largemouth bass, smallmouth bass, white crappie, black bullheads, channel catfish, and yellow perch. A brief discussion of the distribution and abundance of the major warmwater gamefish species in the study area follows.

Bass

Largemouth and smallmouth bass occur in the study area. Largemouth bass are only known from Cow Lakes, and information about the current population status is unknown. According to Perkins and Bowers (2000), smallmouth bass (*Micropterus dolomieu*) abundance has increased since they were first introduced into the Owyhee River upstream of the dam in 1970. ODFW treated the Main Owyhee River with chemicals applied at Three Forks and then introduced smallmouth bass (BLM, 2003). Fish surveys conducted in 1988, 1996, and 1997 by ODFW on the upper sections of the Main Owhyee recorded an abundance of smallmouth bass. Of the stream segments surveyed in 1988, the greatest abundance of smallmouth bass was observed at Three Forks (Perkins and Bowers, 2000). Smallmouth bass have also been documented in the lower reaches of Jordan Creek. BLM personnel recorded bass spawning sites during surveys of tributaries to the Owyhee River.

The smallmouth bass fishery in the Owyhee River upstream of the reservoir is known to produce many small fish (Perkins and Bowers, 2000). The stretch of the Owyhee River within the study area is difficult to access. There are a few boat launches along the river; however, the best boating time is during the early spring when fishing is poor. Most anglers hike into the canyon during the summer when angling is best.

Crappies

White crappies (*Pomoxis annularus*) are found in Cow Lakes in the Jordan Creek subbasin. This fishery on Cow Lakes is important to residents of southern Malheur County, and has gained importance since the loss of the trout fishery in Antelope Reservoir (Perkins and Bowers, 2000). Crappie abundance in these lakes has varied over the years from relatively scarce to abundant as a result of large variations in the water elevations.

Channel catfish

Channel catfish (*Ictalurus punctatus*) were first introduced in the mainstrem of the Owyhee River by ODFW in 1970 (Perkins and Bowers, 2000; BLM 2003). Subsequent releases occurred in 1971 and 1973. In 1988, ODFW conducted fish surveys at ten sites in the Owyhee River from Birch Creek (outside of the study area) upstream to Three Forks. Channel catfish were found in the river near Rome, Oregon; however, they were not observed near Three Forks. There is little information regarding the current status of channel catfish in the study area.

The channel catfish fishery upstream of the reservoir is limited primarily due to the rivers accessibility. Most of the access to the river requires hiking across rough terrain or by floating between input and takeout points for rafts; however, there are a couple of road access points to the river.

Non-game Fishes

Nongame fish include those that are not typically harvested by humans. Native nongame fish species that occur in the study area include dace, redside shiners, sculpin, largescale suckers, bridgelip suckers, and the northern pike minnow. The common carp is the only exotic nongame fish species that is known to occur in the study area. The common carp is known to have extended its distribution up the Owyhee River to the junction of the East Fork and South Fork Owyhee (Perkins and Bowers, 2000).

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Form F-1: Fisheries Information Summary

Analyst's Name: Johnna Evans **Date:** April 8, 2004

This sheet summarizes key information about fish populations, important habitat areas, and the locations of known barriers. This informtion will provide the basic information needed for mapping fish distributions in the watershed.

1) List all salmonid or other fish species of concern occurring in the watershed:

Species	ESA Status	Watershed(s)	ODFW Status and Population Trends	Source
Redband trout	-	Middle Owyhee; Jordan	Vulnerable. Trends cannot be established based on current data	Perkins and Bowers, 2000; Brian Flatter, 2004

Make notes on any documented or anecdotal changes in historic fish distribution (cite your sources):

The Crooked-Rattlesnake watershed is located within the natural range of the species and historical colonization may have been possible, but there is no data to support or refute this notion definitively. The upper reaches of the Jordan Creek watershed are considered to be strongholds. Redband status in many subwatersheds of the study area are unknown (primarily on the Oregon side). Some subwatersheds, are characterized as "depressed," meaning populations are declining or one or more life history stages are missing, or total abundance in the subwatershed is less than 500 adults or 5,000 total fish (Quigley and Arbelbide, 1997).

2) List fish species that occurred historically in the watershed and are no longer present:

Species	Watershed(s)	Source
Summer Steelhead	Middle Owyhee; Jordan; Crooked-Rattlesnake	Perkins & Bowers, 2000; BLM, 2003; and Quigley and Arbelbide, 1997
Stream-type chinook		
Pacific Lamprey		

3) List species that have been or are currently stocked in the watershed:

Species	Stocking Notes	Native or Exotic	Source
RT	Antelope Res (1990); Crooked Cr (1960s); Juniper Cr (1952); Owyhee R (1973); Jordan Cr (1990); BLM ponds (ongoing)	EX	Perkins & Bowers, 2000; IDEQ, 1999; IDFG, 2004
BT	Jordan Cr. (1970s)	EX	Allen, 1997
CC	Owyhee R (1973);	EX	Perkins & Bowers, 2000
SMB	Owyhee R (1973);	EX	Perkins & Bowers, 2000
LMB	Cow Lakes (1970s)	EX	Perkins & Bowers, 2000
WC	Cow Lakes (1970s)	EX	Perkins & Bowers, 2000
LCT	Crooked Cr (1960)	EX	Perkins & Bowers, 2000

Abbreviations: RT - rainbow trout; BT - brook trout; CC - channel catfish; SMB - smallmouth bass; LMB - largemouth bass; WC - white crappie; LCT - Lahontan cutthroat trout

Notes:

Stocking notes includes waterbody name and (time stocking ceased). Stocking ceased in Antelope Reservoir due to mercury concentrations in fish tissue. ODFW occaissionally stocks the BLM ponds in the study area. This is done when conditions allow and generally the fish do not naturally reproduce in the ponds.

Form F-1: page 2

4) Identify life history patterns of key fish species:

Species	Anadromous/ Resident	Location	Spawning time	Outmigration time
RBT	Resident	Middle Owyhee; Jordan	March - July	N/A

Abbreviations: RBT - redband trout

Notes:

5) Identify important locations for adult holding, spawning, summer, and winter rearing:

Location	Species/Purpose	Source
West Little Owyhee	RBT/spawning-rearing	C.Tait/BLM, 2003

Notes:

There is limited information available regarding important stream reaches for particular redband trout life stages. Local experts developed a general ranking of relative importance for particular stream reaches in the Qualitative habitat assessment conducted as part of the Owyhee Basin plan; however, this information was not used in this assessment.

6) Identify locations of known migration barriers:

Location	Barrier Type	Source

Notes:

There are 322 stream-road crossings in the study area. It is unknown whether these crossings are fish passage barriers. Due to lack of data, this table could not be completed.

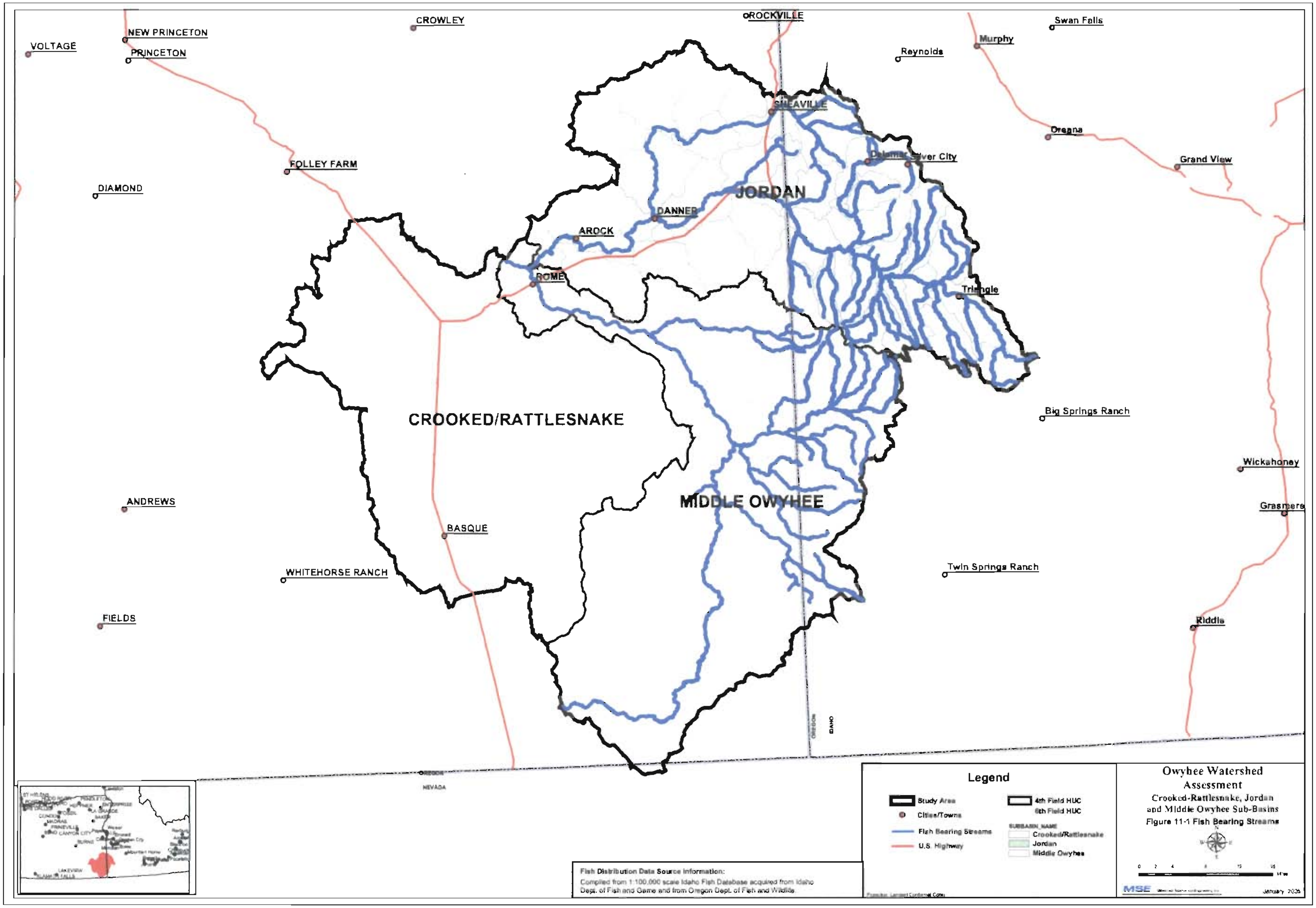
7) Does the watershed contain the following combinations of fish?

Brook trout/bull trout (competition, interbreeding)	**No**
Rainbow/cutthroat (competition, interbreeding)	**No**
Hatchery/wild-stock interactions?	**Unknown**

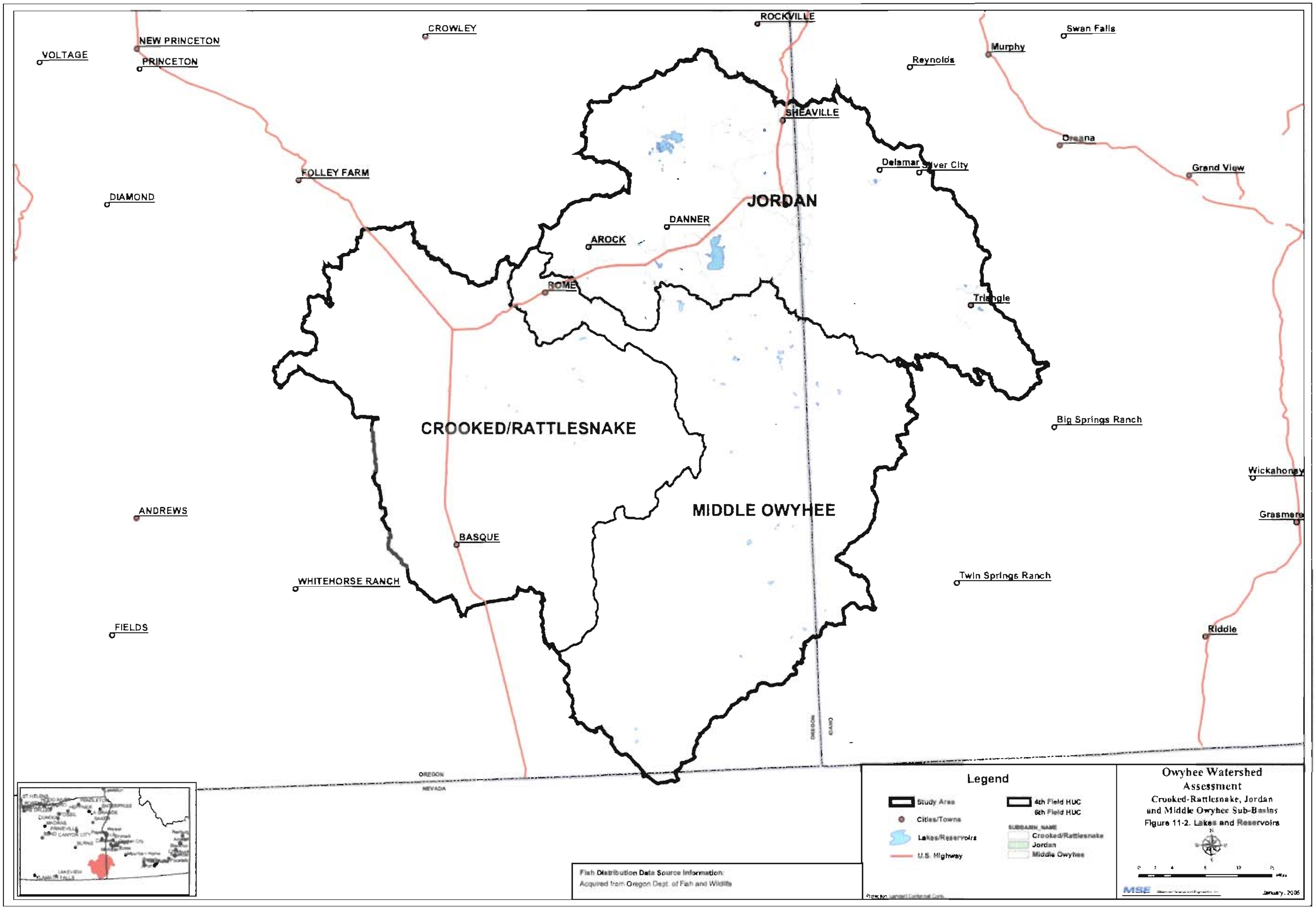
If you answered yes to any of these items consult with a local ODFW fisheries biologist to determine the extent of the potential interactions. If this is unknown, more analysis may be warranted.

Notes:

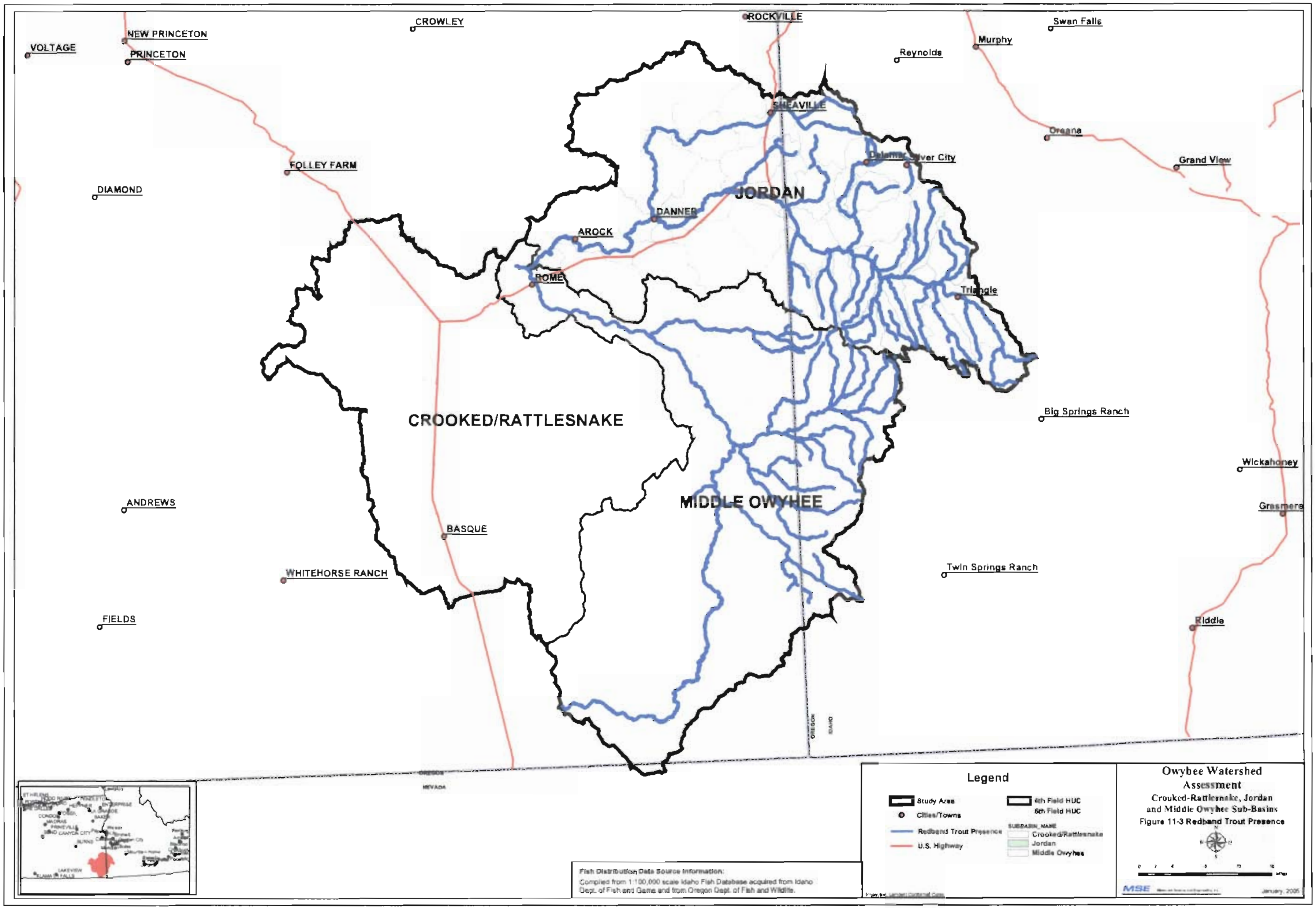
It is unknown whether there is interactions between redband and rainbow in the study area. Limited genetic

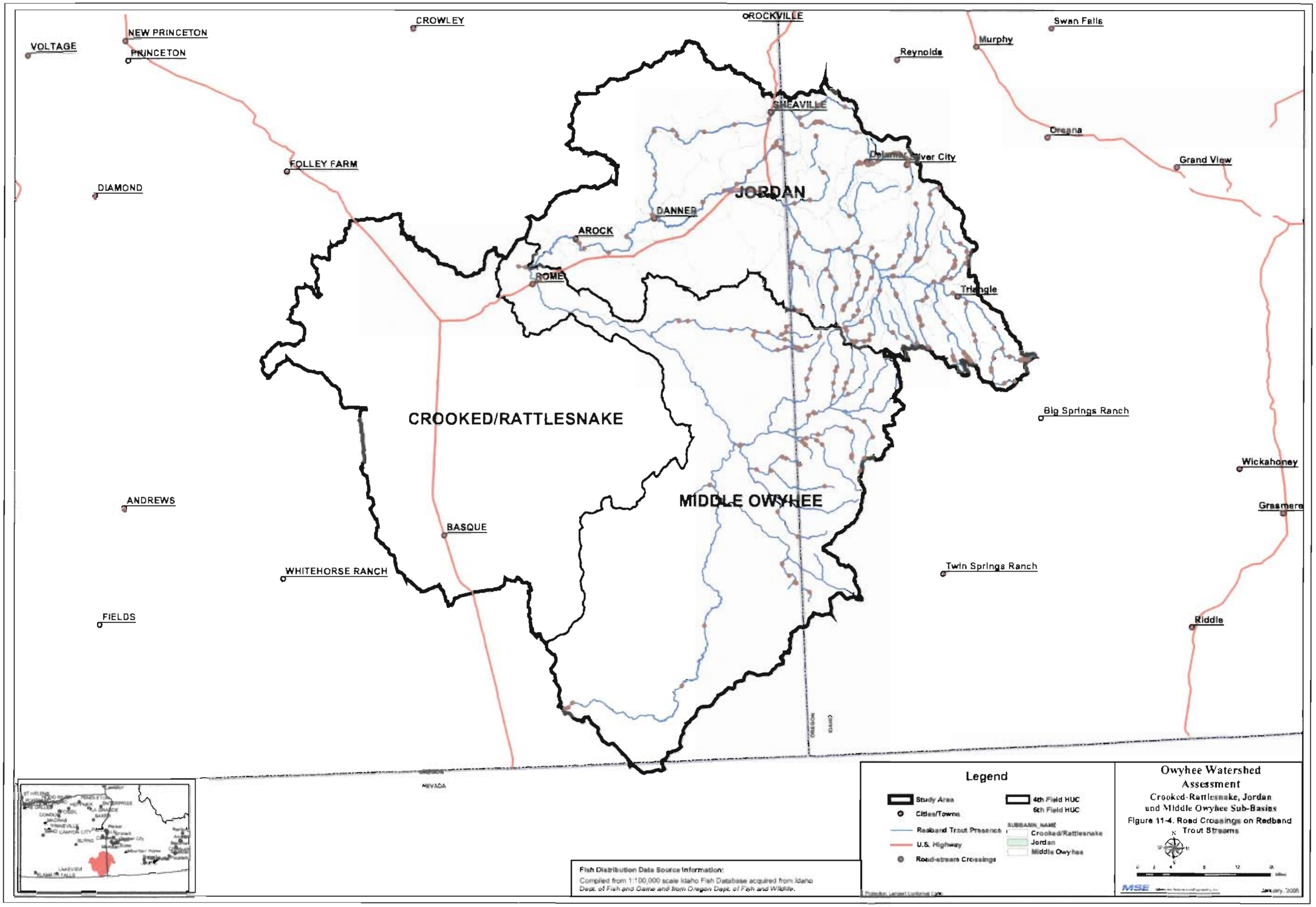


Owyhee Watershed Assessment
Crooked-Rattlesnake, Jordan and Middle Owyhee Sub-Basins
Figure 11-1 Fish Bearing Streams
Legend
Study Area
Cities/Towns
Fish Bearing Streams
U.S. Highway
4th Field HUC
6th Field HUC
SUBBASIN_NAME
Crooked/Rattlesnake
Jordan
Middle Owyhee
Fish Distribution Data Source Information:
Compiled from 1:100,000 scale Idaho Fish Database acquired from Idaho Dept. of Fish and Game and from Oregon Dept. of Fish and Wildlife
CROOKED/RATTLESNAKE
JORDAN
MIDDLE OWYHEE
VOLTAGE
NEW PRINCETON
PRINCETON
CROWLEY
ROCKVILLE
Swan Falls
Murphy
Reynolds
Oreana
Grand View
FOLLEY FARM
DIAMOND
DANNER
AROCK
ROME
Silver City
Triangle
Big Springs Ranch
Wickahoney
Grasmere
ANDREWS
BASQUE
WHITEHORSE RANCH
Twin Springs Ranch
FIELDS
Riddle
NEVADA
OREGON
IDAHO
MSE
January 2005



Owyhee Watershed Assessment
Crooked-Rattlesnake, Jordan and Middle Owyhee Sub-Basins
Figure 11-2. Lakes and Reservoirs


Owyhee Watershed Assessment
Crooked-Rattlesnake, Jordan and Middle Owyhee Sub-Basins
Figure 11-3 Redband Trout Presence
Legend
Study Area
Cities/Towns
Redband Trout Presence
U.S. Highway
4th Field HUC
5th Field HUC
SUBBASIN_NAME
Crooked/Rattlesnake
Jordan
Middle Owyhee
Fish Distribution Data Source Information:
Compiled from 1:100,000 scale Idaho Fish Database acquired from Idaho Dept. of Fish and Game and from Oregon Dept. of Fish and Wildlife.
January, 2005
MSE
CROOKED/RATTLESNAKE
JORDAN
MIDDLE OWYHEE
VOLTAGE
NEW PRINCETON
PRINCETON
CROWLEY
ROCKVILLE
Swan Falls
Murphy
Reynolds
SHEAVILLE
Oreana
Grand View
FOLLEY FARM
DIAMOND
DANNER
AROCK
ROME
Triangle
Big Springs Ranch
Wickahoney
Grasmere
ANDREWS
BASQUE
WHITEHORSE RANCH
Twin Springs Ranch
FIELDS
Riddle
OREGON
IDAHO
NEVADA



VOLTAGE
NEW PRINCETON
PRINCETON
CROWLEY
ROCKVILLE
Reynolds
Murphy
Swan Falls
SHEAVILLE
Oreana
Silver City
Grand View
FOLLEY FARM
DIAMOND
JORDAN
DANNER
AROCK
ROME
Triangle
CROOKED/RATTLESNAKE
Big Springs Ranch
Wickahoney
ANDREWS
MIDDLE OWYHEE
Grasmere
BASQUE
WHITEHORSE RANCH
Twin Springs Ranch
FIELDS
Riddle
OREGON
IDAHO
NEVADA
Legend
Study Area
Cities/Towns
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U.S. Highway
Road-stream Crossings
4th Field HUC
6th Field HUC
SUBBASIN_NAME
Crooked/Rattlesnake
Jordan
Middle Owyhee
Fish Distribution Data Source Information:
Compiled from 1:100,000 scale Idaho Fish Database acquired from Idaho Dept. of Fish and Game and from Oregon Dept. of Fish and Wildlife.
Owyhee Watershed Assessment
Crooked-Rattlesnake, Jordan and Middle Owyhee Sub-Basins
Figure 11-4. Road Crossings on Redband Trout Streams
MSE
January, 2005

Component 12—WILDLIFE AND WILDLIFE HABITAT

The purpose of this component is to provide the reader with a general understanding of the types of wildlife habitats and wildlife species that occur in the Jordan, Crooked-Rattlesnake, and Middle Owyhee subbasins (the "study area"). Information presented in this chapter was compiled from literature, agency documents, agency field notes, agency databases, and interviews with government personnel familiar with wildlife and wildlife habitat in the study area (such as field biologists). This chapter is organized into the following three sections:

1. Government agencies;
2. Wildlife habitat; and
3. Wildlife species.

The government agencies discussion is intended to provide the reader with an overview of the primary agencies that are involved in wildlife and wildlife habitat monitoring and management in the study area. In addition, this section briefly discusses the various species classifications that each agency uses. The wildlife habitat discussion provides a general description of the major wildlife habitat types that occur within the study area. The wildlife species discussion focuses on federally-listed, BLM sensitive, and game species that occur in the study area. For the purposes of this chapter, wildlife species will include vertebrate species (excluding fishes, which are discussed in Chapter 11 of this assessment) and some invertebrate species.

A list of acronyms used throughout this chapter is provided in Appendix 12-A. A comprehensive list of species that potentially exist in the study area is presented as Appendix 12-B.

GOVERNMENT AGENCIES

Numerous federal and state agencies play a role in wildlife and wildlife habitat monitoring and management. The U.S. Bureau of Land Management (BLM) owns and manages approximately 78% (22,090,775 acres) of the study area. The BLM consults with state and federal wildlife agencies on wildlife issues. The state wildlife agencies (Oregon Department of Fish and Wildlife and Idaho Fish and Game) determine species management goals, and BLM works collaboratively with those agencies to meet the goals by providing appropriate amount and quality of habitat (BLM, 2001).

The following discussion summarizes the top seven agencies that are active in the study area.

U.S. Fish and Wildlife Service (FWS)

The mission of the FWS is to "...conserve, protect, and enhance fish, wildlife, and plants and their habitat for the continued benefit of the American people." As part of this mission, the FWS is responsible for implementing the Endangered Species Act of 1973 (ESA) for non-anadromous fish (fish that do not migrate to the ocean) and wildlife species. Under the ESA, the FWS classifies and lists species as endangered, threatened, or candidate. An endangered species is "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. 1532(6)). A threatened species is defined as "any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C. 1532(20). A candidate species is any species that the FWS has enough information to warrant proposing it as endangered or threatened, but listing is precluded by other higher priority listing activities. Candidate species have no protection under the ESA; however, they are often considered for planning purposes. The Oregon office of the FWS developed a list of "Species of Concern" (previously known as Category 2 Candidates). This list includes those taxa whose conservation status is of concern to the FWS; however, further information is required before listing under the Endangered Species Act (ESA) can occur.

U.S. Bureau of Land Management (BLM)

The mission of the BLM is to "sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations." The BLM administers programs for identification and conservation of declining species before population or habitat losses reach critical levels. In consultation with biologists and state wildlife agencies, each BLM state office publishes a list of species occurring on public lands whose populations or habitats are rare or in significant decline. The plants and animals on these lists are called "BLM sensitive species." The BLM manages public lands to protect and improve habitat for all federally-listed, BLM sensitive, and state-listed species.

Oregon Department of Fish and Wildlife (ODFW)

The mission of ODFW is to "protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations." The ODFW is responsible for implementing the Oregon Endangered Species Act of 1987. This act requires state agencies to develop programs for the management and protection of endangered species. In addition, the ODFW must develop and maintain a state list of sensitive species for vertebrates that are likely to become threatened or endangered throughout all or a portion of their range in Oregon. Sensitive species are placed in one of the following four categories:

- Critical – species for which listing as threatened or endangered is pending; or those for which such listing may be appropriate if conservation actions are not implemented;
- Vulnerable – species for which listing as threatened or endangered is not imminent and can be avoided through continued or expanded use of protective measures and monitoring;
- Peripheral or Naturally Rare – any species whose population in Oregon is at the edge of their range or those species with low population numbers due to naturally limiting factors; and
- Undetermined Status – any species whose status can not be assessed due to lack of scientific information.

Oregon Natural Heritage Program (ONHP)

The mission of the ONHP is "to acquire, maintain and distribute information on the organisms and ecosystems that constitute Oregon's natural heritage, and to ensure, through a public planning process and through voluntary public and private efforts, that the full range of Oregon's natural heritage resources is represented within a statewide system of recognized natural areas." This program is a cooperative, interagency effort to identify the plant, animal, and plant community resources of Oregon. The ONHP is responsible for managing a comprehensive database of rare, threatened and endangered species that occur in the state. It is also responsible for assigning a rank to the rangewide (global rank) and statewide (state rank) status of wildlife species. Species are ranked on a sliding scale of 1 to 5 based on an international system developed by the Nature Conservancy. A rank of 1 means the species is critically imperiled, and a rank of 5 means the species is widespread, abundant, and secure. Rankings are primarily based on the number of known occurrences; however, other factors such as habitat quality, estimated number of individuals, narrowness of range of habitat, trends in populations and habitat, threats to the element, and other factors are also considered. In addition, the ONHP is responsible for rare and endangered invertebrates in Oregon and has been granted limited authority (by the FWS) to administer and manage a program for federally-listed invertebrates.

Idaho Department of Fish and Game (IDFG)

The mission of the IDFG wildlife program is to "preserve, protect, perpetuate and manage the wildlife resources of Idaho to provide continued supplies of wildlife for hunting, trapping and wildlife viewing and to ensure the persistence of native wildlife species." The IDFG is responsible for developing and maintaining a list of species of special concern for the state. There are three categories of species of special concern including:

- Priority species – native species which are either low in numbers, limited in distribution, or have suffered significant habitat loss AND which have (or had) a significant portion of their range in the State of Idaho;
- Peripheral species – native species whose breeding populations in Idaho are at the edge of their range and which are either low in numbers, limited in distribution, or have suffered significant habitat loss
- Undetermined status species – species that might be rare in the state but for which there is little information on their population status, distribution, and/or habitat requirements.

Idaho Conservation Data Center (IDCDC)

The IDCDC (previously known as the Idaho Natural Heritage Program) is the central repository in Idaho for information related to the state's rare plant and animal populations. The mission of the IDCDC is to "collect, analyze, maintain, and disseminate scientific information necessary for the management and conservation of Idaho's biological diversity." Similar to the ONHP, the IDCDC is responsible for assigning a rank to the rangewide and statewide status of wildlife species on a scale of 1 to 5.

WILDLIFE HABITAT

Wildlife habitats are places where organisms are able to obtain basic necessities of life including water, shelter, and food. Wildlife habitats are commonly characterized based on the plant community types and their structural conditions (Maser and Thomas, 1983). Plant communities are defined by the plant species present and typically reflect the environmental conditions of the site such as soil type, precipitation, temperature, elevation, solar radiation, slope, and aspect. Plant community structural conditions refer to the vertical layering of vegetation. Structural conditions that may occur within the study area include grass-forb, low shrub, tall shrub, tree/shrub, and any combination thereof (Maser et al., 1984; Anderson *et al.*, 1998; Schaaf, 1996). Wildlife species are adapted to an array of plant community types and vegetative structural and seral stages to meet their life history requirements (Maser *et al.,* 1984).

Wildlife habitat in the study area is diverse and a discussion of all the different habitat types is beyond the scope of this assessment; therefore, we adopted the following three broad wildlife habitat types discussed in the SEORMP (BLM, 2001) including: sagebrush steppe/salt desert; riparian, and juniper woodlands. Each of these is discussed below.

Sagebrush Steppe/Salt Desert

Sagebrush steppe habitats comprise the majority of the study area. Sagebrush steppe habitats can consist of a variety of upland vegetative communities with a shrubland aspect and understory of grass and forbs (BLM, 2001). Shrub steppe communities are characterized by a overstory of shrubby species and a understory of bunchgrasses and forbs. Big sagebrush communities dominate much of the Owyhee Uplands (Schaaf, 1996). Low sagebrush and rigid sagebrush communities are interspersed within the big sagebrush at sites with shallow, rocky soil. The most common tall overstory shrubs in the Owyhee Uplands include Wyoming sagebrush (*Artemesia tridentata* var. *wyomingensis*), mountain sagebrush (*A. tridentata* var. *vaseyana*), and basin big sagebrush (*A. tridentata* var. *t.*). Common native bunchgrass species in the Owyhee Uplands include Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), Sandberg's bluegrass (*Poa sandbergii*), Nevada bluegrass (*Poa nevadensis*), and bottlebrush squirreltail (*Sitanion hystrix*), to name a few (Schaaf, 1996).

Sagebush steppe habitats are extremely important to a variety of wildlife species. According to Thomas *et.al,* a sagebrush overstory is strongly associated with diversity in the wildlife community (1984). Sagebrush directly benefits many species, such as the western greater sagegrouse and pronghorn antelope, by providing food and cover. Numerous other species benefit indirectly from the sagebrush, such as raptors prey upon species that inhabit sagebrush communities. The bunchgrasses and forbs also provide food and cover to many other wildlife species, and are actually preferable to the sagebrush vegetation as a food source (BLM, 2001). The most significant sources of impacts to the sagebrush steppe habitat within the study area include increased fire frequency, introduction of exotic vegetation (such as cheat grass), and grazing. A discussion of these impacts as well as the condition of the rangelands within our study area is presented in the "Range and Rangeland Condition" component of this watershed assessment.

Salt desert habitats much less abundant in the study area, occurring only where there are highly alkaline soils (Schaaf, 1996). Plant communities that occur in salt desert habitats are dominated primarily by greasewood on playas that are seasonally flooded and by species of the *Atriplex* genus (shadscale species) on slopes. Salt desert shrub habitats tend to have lower vegetation cover and fewer bunchgrasses than the sagebrush steppe habitat (Schaaf, 1996). Salt desert habitats have been found near Crooked Creek and Rattlesnake Creek. Although less abundant, salt desert habitats are important to the survival of some species, most notably the kit fox (BLM, 2001).

Riparian/Wetlands

Riparian habitats occur along stream and river corridors as well as around springs or seeps. Wetlands occur in areas that are flooded or saturated at or near the ground surface for varying periods of time during the year. Wetlands can occur along rivers, streams, lakes, or at a location isolated from a surface water body in various landscape settings. Vegetation in riparian and wetland habitats includes any combination of grasses, forbs, sedges, rushes, shrubs, and trees.

Riparian and wetland areas are known to be the most diverse and productive habitats for wildlife. They are transition zones between aquatic and upland environments. Since the study area is within an arid region, the riparian and wetland habitats are extremely important to wildlife and domestic livestock. The greatest threats posed to riparian and wetland habitats within the study area include domestic livestock use and water withdrawal. These threats and the condition of riparian and wetland habitats are discussed further in the "Riparian Assessment" and "Wetlands Assessment" components of this watershed assessment.

Juniper Woodlands

Juniper woodlands are largely present in the Idaho portion of the study area, with limited overlap into Oregon. They are ecologically important elements for wildlife habitat and soil protection and formation. Juniper trees provide shade, cover, and nesting habitat for a variety of animals, including birds, bats, deer, and elk. Western juniper woodlands vary in their habitat value depending on understory vegetation composition, age of the trees, height, and density (BLM, 2001).

Prior to Euro-American settlement, juniper trees were present in open, savannah-like woodlands or were confined to rocky areas (Quigley and Arbelbide, 1997). Livestock pressure, climate change, and fire suppression contributed to the expansion of western juniper as well as to increased densities of trees in the woodlands (Eddleman *et.al.*, 1994; Campbell *et al.*, 2004). Fire is an effective control agent of western juniper to prevent expansion into associated plant communities, to reduce stand densities, and to create a mosaic of plant communities on a landscape. Old growth stands experience mostly light understory burning which reduce recruitment of understory vegetation such as sagebrush as well as young junipers. Younger stands appear to be less resistant to fires and are typically replaced by fire. Decreased fire frequencies have been attributed to fire suppression, livestock grazing on understory vegetation, and a warmer, drier climate producing less fuel (Eddleman *et al.*, 1994).

Expansion of the juniper woodlands into neighboring plant communities has become a concern for land managers because it has potential implications on understory productivity, biodiversity, wildlife habitat, and hydrology. As juniper densities increase, understory vegetation production decreases (Quigley and Arbelbide, 1997; Bates *et al.*, 2000). Juniper trees are capable of outcompeting other vegetation because their extensive lateral roots remove water from the soils (Campbell *et al.*, 2004). While a decreased vegetative understory may benefit some species, the decrease in understory vegetation (forage) negatively impacts grazing animals such as mule deer or cattle. Research conducted by Bates *et al.* (2000) and past research summarized by Quigley and Arbelbide (1997), indicates habitat complexity (plant species richness and abundance) decreases with increased juniper density and canopy. The impact of juniper woodland expansion on overall biodiversity has not yet been determined because species lists of non-vascular plants, invertebrates, or microorganisms associated with these woodlands have not been developed (Quigley and Arbelbide, 1997). Expansion of juniper woodlands into adjacent sagebrush steppe community is of particular concern to land managers. Alteration of sagebrush communities has deleterious impacts on sagebrush obligate species such as the sage grouse. Hydrologic impacts of juniper expansion are thought to relate to precipitation interception and infiltration, water runoff, and erosion (Quigley and Arbelbide, 1997). There is a widespread belief that juniper trees decrease the quantity of water reaching springs and streams. There have been studies on the quantity of water that juniper trees are capable of intercepting and/or utilizing; however, there are no scientific studies for short-term or long-term impacts of this phenomenon on surface water quantity. Wilcox and Davenport (1995) developed the following four hypotheses regarding the impact of juniper expansion on soil erosion and soil morphology:

1. Understory cover diminishes as juniper increases, creating a mosaic landscape of canopy and intercanopy areas, each with different water, nutrient, and soil characteristics;
2. Most runoff and erosion from pinyon-juniper and juniper woodlands is generated from intercanopy areas;
3. Runoff and erosion in juniper woodlands is scale dependent and generally diminishes as scale increases; and
4. Although juniper encroachment will in many cases, increase erodibility of sites, erosion rates will generally be low.

In conclusion, more research is needed in the juniper woodlands to make any definitive conclusions of the role junipers play in the hydrologic cycle.

WILDLIFE

There are 279 vertebrate wildlife species known or thought to potentially occur in the study area. A list of these species is presented in Appendix 12-B. This list was compiled from information in *A GAP Analysis of Idaho* (Scott *et al.,* 2002), the *Oregon GAP Analysis Project* (Kagan et.al. 1999), and the Interactive Biodiversity Information System (IBIS, 2003). The GAP (geographic approach to planning) analysis for each state utilized occurrence and habitat association information and land cover information to predict (model) the range boundaries of vertebrate wildlife species known to occur in each state. The models were then reviewed and modified by wildlife biologists familiar with wildlife distributions in the states. It is important to note that there may not be documented observations for some of the species listed in Appendix 12-A in the study area. Rather, these species have the potential to be in the study area based on the type of vegetation and habitat. A list of species that potentially occur within the Owyhee subbasin was obtained from IBIS on February 6, 2004. Similar to the GAP analysis, this list was compiled based on current wildlife-habitat types (IBIS, 2003).

Due to the vast numbers of species potentially present in the study area, emphasis was placed on the 56 federally listed endangered, threatened, candidate, Oregon BLM sensitive species, or Idaho BLM sensitive species as well as important game species. For simplicity, we have broken this section into discussion for the invertebrates and vertebrates. The wildlife vertebrate discussion is further broken into four classes: amphibians, reptiles, birds, and mammals.

Invertebrate Wildlife

There has been relatively little research on the status and distribution of invertebrate species in the study area. Most of the available information focuses on aquatic invertebrates rather than terrestrial species. Compiling a list of aquatic and terrestrial invertebrates that are known or thought to occur in the study area is beyond the scope of this assessment, as a result, we have exluded the invertebrates from the list provided in Appendix 12-A. Table 12-1 lists the four federally-listed invertebrate species that potentially occur within the study area.

TABLE 12-1: Federally listed invertebrate species.

Common Name	Scientific Name	FWS[1]	Oregon BLM[2]	ODFW[1]	Idaho BLM[3]	IDFG[3]
Hotspring physa	*Physella sp.*	--	SEN	--	--	--
Crooked Creek springsnail	*Pyrgulopsis intermedia*	--	SEN	--	--	--
Owyhee hot springsnail	*Pyrgulopsis sp.*	--	SEN	--	--	--
Malheur springsnail	*Pyrgulopsis sp. nov.*	--	SEN	--	--	--

Notes:

Abbreviations –

FWS: E = endangered; T = threatened; C = candidate; SC = species of concern.

BLM: SEN = sensitive; TRA = tracking; ASM = assessment.

ODFW: E = endangered; T = threatened; C = critical; V = vulnerable; P = peripheral or naturally rare; U = undetermined.

IDFG: E = endangered; T = threatened; C = species of special concern; P = protected nongame; U = unprotected nongame; G = game.

1. ONHP, 2001
2. BLM, 2002
3. IDFG & BLM, 2003

Information about the life history, distribution, and population status of these species is limited. Cynthia Tait, fisheries biologist for the Oregon BLM, stated that although the BLM lists the Hotspring physa and Owhyee hot springsnail as separate species, they have not been officially described as species and may not be valid species. Ms. Tait also indicated that there does not appear to be any immediate threat to the hotspring snails, and the only apparent threat posed to the Crooked Creek springsnail is introduction of the New Zealand mud snails, which may eventually overwhelm the springsnail population (Tait, 2004).

Vertebrate Wildlife

Amphibians

Table 12-2 lists the four federally listed amphibian species thought to occur in the study area. There is little information about the status of these species within the study area. The following discussions provide general information about those species having some available distribution information.

TABLE 12-2: Federally listed amphibian species

Common Name	Scientific Name	FWS[1]	Oregon BLM[2]	ODFW[1]	Idaho BLM[3]	IDFG[3]
Western toad	*Bufo boreas*	--	TRA	V	SEN	C
Woodhouse's toad	*Bufo woodhousei*	--	TRA	P	SEN	U
Columbia spotted frog	*Rana luteiventris*	C	--	U	SEN	C
Northern leopard frog	*Rana pipiens*	--	SEN	C	SEN	C

NOTE: See Table 12-1 for abbreviations and footnotes.

Western toad

The western toad is a terrestrial species, but is generally found near aquatic environments such as springs, streams, ponds, lakes, and wetlands (IDVMD, undated). Although the western toad is the most common toad in Oregon and is listed as a tracking species, the Idaho BLM has determined this species to be sensitive based on the thought that the population and/or its habitat have significantly declined and the species is in danger of regional or local extinctions in the state if factors contributing to such declines continue. There is little available information regarding the status and distribution of this species within the study area. Western toad adults, metamorphs, or tadpoles have been observed in Dougal Reservoir, Split Rock Canyon, Rail Creek Reservoir, Juniper Creek, Owyhee River at north fork crossing, Owyhee River upstream of three forks, Castro Spring reservoir, unnamed springs along Crooked Creek, and Owyhee River south of Rome (IDCDC, 2003; ONHIC, undated). Alan St. John found this species along the Upper Owyhee River, about 4 miles south of Rome and at hot springs located about 1 mile upstream from Three Forks ((1985). Figure 12-1 illustrates toad observation locations as well as the dates the observations were made.

Columbia spotted frog

This species is listed as a candidate species under the Endangered Species Act (Engle, 2003). Spotted frogs require permanent water bodies and inhabit spring seeps, meadows, marshes, ponds, streams, and rivers (Thomas, 2001; BLM, 2001). They have been found to migrate along riparian corridors between habitats used for spring breeding, summer foraging, and winter hibernation (Engle and Munger, 2003). According to the BLM (2001), the Columbia spotted frog population "appears to be fragmented into small, isolated units;" however, due to the lack of information regarding historic and current distributions of this species in the study area, it is not possible to determine the extent of population fragmentation or whether such fragmentation is a result of natural or anthropogenic influences.

Numerous surveys have been conducted in southwestern Idaho to locate Columbia spotted frog populations; however, many of these studies have been outside of the study area. When surveys have been conducted within the study area, Columbia spotted frogs were observed in Soda Creek, Rail Creek, Trout Creek, Cottonwood Creek, Castro Spring Reservoir, and Willow Creek (IDCDC, 2003; ONHIC, undated). BLM is conducting annual Columbia spotted frog surveys along segments of Dry Creek, a tributary to the Owyhee River (outside of the project area). The goals of the annual surveys is to obtain population estimates, assess habitat conditions, and assess breeding success. The long-term goal of these surveys is to detect population trends over a 10 year period. Mark-recapture methodologies were used to survey the frog populations and mark-recapture numbers were used to calculate the Lincoln Index (a population estimate). In 2001, the population estimate along a portion of the study reach was 74 frogs (Engle, 2001). In 2003, the population estimate for the State section of the study area was 62 frogs (Engle, 2003). Population estimates for 2002 were not calculated due to inoperable equipment (Engle, 2002). Many metamorphs were observed in the stream transect during the 2001, 2002, and 2003 August surveys, indicating there is successful reproductive recruitment.

In general, threats to this species include predation by introduced species (bull frogs and fishes), habitat loss and fragmentation from such things as drought, fire, and other developments (Thomas, 2001; Engle, 2003). Water diversions are another potential threat to this species;

however, such diversions may also be beneficial to the species by creating or enhancing wetland habitats. Given the lack of information within the study area, no definitive conclusions can be made about the population status and trends, habitat loss, or habitat fragmentation within the study area. Figure 12-2 illustrates the locations where this species was observed and the observation dates.

Reptiles

Table 12-3 lists the five federally listed reptile species thought to occur in the study area.

TABLE 12-3: Federally listed reptile species

Common Name	Scientific Name	FWS[1]	Oregon BLM[2]	ODFW[1]	Idaho BLM[3]	IDFG[3]
Mohave black-collared lizard	*Crotaphytus bicinctores*	--	TRA	V	SEN	C
Longnose snake	*Rhinocheilus lecontei*	--	---	--	SEN	C
Northern sagebrush lizard	*Sceloporus graciosus*	SC	TRA	P		C
Western ground snake	*Sonora simiannulata*	--	TRA	--	SEN	C
Common garter snake	*Thamnophis sirtalis*	--	--	--	SEN	U

NOTE: See Table 12-1 for abbreviations and footnotes.

Mohave black-collared lizard

The Mohave black-collared lizard inhabits a variety of desert shrub vegetation types, but is most reliant on habitats of rock outcrops, boulders, or talus (Csuti *et al.*, 2001). Southeast Oregon and adjacent Idaho comprise the northern portion of this species range. This lizard is uncommon and has a discontinuous distribution in southeastern Oregon (Csuti *et al.*, 2001). According to BLM (2003), this species was not observed in the Louse Canyon resource management area during the 2000 field surveys; however, there was habitat suitable for the lizard. Maurita Smyth observed these lizards during her surveys in the Sheepshead Mountains within the Crooked Rattlesnake subbasin (1996). Alan St. John also found these lizards along Crooked Creek and north of Rome (1985). Figure 12-3 illustrates the locations of species observations.

Northern sagebrush lizard

The northern sagebrush lizard primarily occupies sagebrush habitats, but can also be found in chapparal, juniper woodlands, and coniferous forests (Csuti *et al.*, 2001). It is the most common lizard in the sagebrush habitat types of southeast Oregon and southwest Idaho (Groves *et al.*, 1997). This species was observed in almost all of the pastures within the Louse Canyon geographic management area that were assessed during the 2000 field season (BLM, 2003). This species has been observed at various locations in the Sheepshead Mountains, Saddle Butte lava fields, and north of the guard station at Burns Junction (Smyth, 1996; ONHIC, undated). Mr. Werschkul cited two historical records of this species in the Jordan Creek subbasin (1980).

Birds

Based on information obtained from Idaho and Oregon GAP analysis and the Northwest Habitat Institute website, 175 avian species potentially occur within the study area. Of these, 26 are listed as federally threatened, endangered, candidates, species of concern, or BLM sensitive (Table 12-4).

TABLE 12-4: Federally listed or sensitive avian species

Common Name	Scientific Name	FWS[1]	Oregon BLM[2]	ODFW[1]	Idaho BLM[3]	IDFG[3]
Northern goshawk	*Accipiter gentiles*	SC	SEN	C	SEN	C
Sage sparrow	*Amphispiza belli*	--	--	C	SEN	P
Black-throated sparrow	*Amphispiza bilineata*	--	--	P	SEN	P
Western burrowing owl	*Athene cunicularia*	SC	SEN	C	WAT	P
Upland sandpiper	*Bartramia longicauda*	SC	SEN	C	SEN	C
Ferruginous hawk	*Buteo regalis*	SC	SEN	C	SEN	P
Greater sage grouse	*Centrocercus urophasianus phaios*	SC	ASM	V	SEN	--
Black tern	*Chilodonius niger*	SC	SEN		SEN	C
Yellow-billed cuckoo	*Coccyzyus americanus*	C	SEN	C	--	C
Olive-sided flycatcher	*Contopus borealis*	SC	--	V	SEN	
Hammond's flycatcher	*Empidonax hammondii*	--	--	--	SEN	
Willow flycatcher	*Empidonax trailii*	SC	--	U	SEN	P
Prairie falcon	*Falco mexicanus*	--	--	--	SEN	
Peregrine falcon	*Falco peregrinus ssp.*	--	SEN	E	SEN	E
Bald eagle	*Haliaeetus leucocephalus*	T	--	T	--	E
Yellow-breasted chat	*Icteria virens*	SC	--	C	--	--
Least bittern	*Ixobrychus exilis*	SC	ASM	P	--	
Loggerhead shrike	*Lanius ludovicianus*	--	SEN	V	SEN	C
Lewis' woodpecker	*Melanerpes lewis*	SC	--	C	SEN	--
Mountain quail	*Oreortyx pictus*	SC	SEN	U	SEN	C
Flammulated owl	*Otus flammeolus*	--	SEN	C	SEN	C
American white pelican	*Pelecanus erythrorhynchos*	--	ASM	V	SEN	C
White-faced ibis	*Plegadis chihi*	SC	SEN	--	SEN	P
Williamson's sapsucker	*Sphyrapicus thyroideus*	--	TRA	U	SEN	--
Brewer's sparrow	*Spizella breweri*	--	--	--	SEN	P
Columbian sharp-tailed grouse	*Tympanuschus phasianellus columbianus*	SC	--	--	SEN	G,C

NOTE: See Table 12-1 for abbreviations and footnotes.

There is limited inventory and monitoring data for many of these species within the study area. As a result, little is known about their distribution, population status or trend. Many of these species are thought to occur within the study area because the area either falls within their known range or contains habitat types that are potentially capable of supporting the species. Some bird species were observed along designated North American Breeding Bird Survey (BBS) routes (Sauer *et al.*, 2003). Each survey BBS route is 24.5 miles long with 3-minute counts occurring every 0.5 miles. Although measures of abundance and overall trends along these BBS routes are not adequate for assessing the overall condition of species populations within the study area; information from the BBS is useful in confirming the presence of particular species. The discussions below focus on those species that have survey or monitoring data collected within the study area.

White-faced ibis

The white-faced ibis prefers areas of shallow waters in habitats such as ponds, marshes, and rivers and builds its nests among emergent hardstem bulrush (Csuti, 2001). It breeds in western North America south to Mexico and in South America. According to Csuti (2001), the location of ibis colonies is related to runoff. Records over the past few decades indicate the number of breeding pairs of this species in Oregon have increased (Csuti, 2001). Idaho BLM biologists have observed ibis at Dougal Reservoir in 1991, 1995, and 1997 (IDCDC, 2003). Dougal reservoir is northwest of Cliffs, Idaho in the Middle Owyhee subbasin (Figure 12-4).

Northern goshawk

Northern goshawks inhabit montane coniferous and deciduous woodland in the western U.S., preferring woodlands of intermediate canopy coverage interspersed with small openings, fields, or wetlands (DeGraaf *et al.,* 1991). Goshawks generally nest in large trees with clear access, often near openings provided by streams, wetlands, or fields. This species is often associated with mature to old growth stands. Three northern goshawks were observed at Cinnabar Mountain during a raptor migration monitoring effort in autumn 1998 (Bates, 1999). Little is known about whether goshawk's nest and breed within the study area.

Ferruginous hawk

The ferruginous hawk is a species of special concern to the FWS. Ferruginous hawks inhabit communities of sagebrush/shrub-steppe and grassland (Dechant *et al.,* 2003). The pinyon-juniper/shrub steppe ecotone is thought to be of particular importance to this species since it provides trees for nesting adjacent to open foraging areas (Olendorff, 1993). Although these hawks prefer tall trees for nesting, they are opportunistic nesters and can nest on the ground or on rock ledges, large shrubs, power line structures, or haystacks (BLM, 2001; Dechant *et al.,* 2003; DeGraaf & Rappole, 1995; DeGraff *et al.,* 1991; and Olendorff, 1993).

According to the BLM, this species is a documented breeder in the Jordan Resource Area JRA), which includes the area pertinent to this study (BLM, 2002; BLM, 2001). An Idaho BLM biologist observed two ferruginous hawks and a nest site in 1994 just south of SW Gate Gulch Reservoir. In 1996 a BLM biologist documented a single hawk in the same area. Ferruginous hawks have been documented while conducting a breeding bird surveys from 1989 to 1998 along the Battle Mountain (Ore-063) North American breeding bird survey route (USGS, undated). Historic falcon observations were recorded by BLM in 1978 (field notes).

Peregrine falcon

Historically, the peregrine falcon had a widespread distribution across North America; however, by 1975 this species was extirpated east of the Rockies and the population in the west was reduced by 80 to 90 percent. This was largely attributed to pesticides, although habitat loss also contributed to their decline (FWS, 1999). The American peregrine falcon was listed as endangered in 1970 under the Endangered Species Conservation Act of 1969 (FWS, 1999). As part of the recovery effort, over 6,000 falcons have been released since 1974 (FWS, 1999). The recovery effort resulted in the removal of this species from the endangered species list in August 1999 (FWS, undated). Although the falcon was delisted, there is ongoing concern for illegal harvest of young from nests (Pagel, 2003)

Peregrine falcons nest on cliffs or buildings that generally overlook open areas with an abundant food supply (Csuti, 2001; Groves, 1997). These falcons are not known to nest within the study area; however they may migrate through the area in spring and fall (BLM, 2001). In 2003, Joel Pagel, a peregrine falcon specialist for the USFS, conducted a peregrine falcon habitat analysis for the Vale District BLM. He used a variety of factors including cliff rock type, height, width, ledge availability, human disturbance, prey availability, and distance from water, to rank potential peregrine habitat from zero to high (2003). He surveyed 12 sites within the study area. Of the twelve, four were rated as having a high potential for peregrine falcon nesting habitat including the Pillars of Rome and three portions of the Owyhee Canyon.

Bald eagle

Bald eagles are listed as threatened by the FWS and ODFW and as endangered by the IDFG. During the winter, bald eagles are known to occupy the Owyhee River within the study area, and they may roost on the canyon walls (BLM, 2003). Bald eagles have been sighted in the Owyhee River canyon within the Idaho border (Schaaf, 1996). This species is not known to nest in the canyons of the Owyhee River.

Prairie falcon

The prairie falcon is listed as a BLM sensitive species in Idaho. This falcon inhabits deserts, prairies, canyons, foothills, and mountains in relatively arid western regions. Typically nests on cliffs that overlook open terrain for foraging (DeGraaf, *et al.,* 1991; DeGraaf & Rappole, 1995). Gap analysis for this species in both Oregon (1999) and Idaho (2002) predict it to occur throughout the study area based on the presence of suitable habitat.

Prairie falcons have been documented while conducting breeding bird surveys (BBS) from 1989 to 1998 along the Battle Mountain (Ore-063) and Dougal Reservoir (Ida-223) North American BBS routes (USGS, undated). Additional falcon observations were recorded by BLM in 1978 (field notes). A map illustrating prairie falcon observations was not generated because geographic information coordinates were not available. Other accounts of prairie falcons in the study area were not reasonably ascertainable.

Greater sage-grouse

The greater sage-grouse is a sagebrush obligate species, meaning it cannot survive in areas without sagebrush vegetation (FWS, 2004; Miller & Eddleman, 2001; Connelly *et al.,* 2000; IDFG, 1998). This species is dependent on a variety of species and subspecies of shrubs such as the Wyoming, mountain, and great basin sagebrush (BLM, 2001). Nesting habitats are typically characterized by big sage/low sagebrush complexes. Breeding grounds (leks) consist of open areas with surrounding sagebrush vegetation (Connelly *et al.,* 2000). During the winter months, the greater sage grouse forages on the leaves and buds of sagebrush species (Sadowski, 2002; Smurthwaite, 1998; and Connelly *et al.,* 2000). The greater sage grouse is considered to be an umbrella species for sagebrush habitats (BLM, 2001).

In the study area, sage grouse populations are currently lower than populations estimated in the 1960's; however, the current populations appear to be stable (BLM, 2001; Van Dyke, 2004). Public attention to sage grouse has been heightened due to population declines, and the species is proposed for listing under the ESA. A decision regarding the listing has not been made to date.

Sage grouse populations have declined by approximately 30% over the past three decades throughout much of their range and have been extirpated from five states (BLM, 2003a; Connelly *et al.*, 2000; USGS, 2003; USGS, 2002). Numerous authors (Sadowski, 2002; Miller & Eddleman, 2001; Connelly *et al.*, 2000; and BLM, 2003a) have attributed the decline in greater sage grouse population to habitat loss or fragmentation that result from one or more of the following factors:

- Fire (natural or prescribed);
- Development (agricultural or urban);
- Livestock grazing; and
- Shifts in vegetative cover (from perennial shrub grasslands to exotic grasslands or pinyon/juniper woodlands).

These authors also indicated population declines across their range can be a result of natural population fluctuations, availability of alternative prey sources for sage grouse predators, and weather. Between 1999 and 2003, seven petitions were filed with the FWS to protect sage grouse under the ESA (BLM, 2003a). On April 15, 2004, the FWS determined that "substantial biological information exists to warrant a more in-depth examination of the status of the greater sage-grouse" (FWS, 2004). According to Mr. Rich Howard, biologist at the FWS – Snake River Basin Office, status review is expected to be completed by December 29th, 2004.

The BLM, ODFW, and IDFG have participated in ongoing efforts to monitor sage grouse populations and habitats (BLM, 2001; IDFG, 2004). Figure 12-5 illustrates lek locations that have been documented in the study area (IDFG, 2004). A challenge cost share project between the Idaho BLM and IDFG was initiated in 2001 (Commons Kemner, 2004). The purpose of this project was to document general movements and habitat use of Greater sage grouse in the Cow Creek area of western Owyhee County. A total of 19 hens and 33 males were captured during the 2001 and 2002 season. All the hens and six of the males were fitted with radio collars and tracked during the study period. Results of this study indicated there was no apparent pattern of movement between leks and nests. This study also found, although the sample size was small, a higher nest success rate than similar studies conducted in other subbasins. The USGS, Western Association of Fish and Wildlife Agencies and the national Sage-grouse conservation Planning Framework Team are conducting a range-wide conservation assessment of greater sage-grouse and sagebrush habitats. This assessment will be an extensive analysis of environmental, habitat, and population factors that impact this species across its entire distribution (USGS, 2003). The draft report is anticipated to be completed in March 2004.

Song birds

The Brewer's sparrow and sage sparrow are obligate sagebrush steppe species that are considered to be sensitive by the BLM. These species depend on sagebrush habitats during the breeding season or year-round (Paige and Ritter, 1999). Additional sensitive songbird species that use sagebrush steppe habitats and potentially occur in the study area include the black-throated sparrow and loggerhead shrike.

The Brewer's sparrow, sage sparrow and black-throated sparrow were observed during surveys along the Lookout Lake (Ore-064), Silver City (Ida-217), and Battle Mountain (Ore-063) BBS routes. The Brewer's sparrow and sage sparrow were also observed during surveys along the Dougal Reservoir (Ida-223) BBS route. The loggerhead shrike was observed during surveys along the Silver City (Ida-217), Dougal Reservoir (Ida-223), and Battle Mountain (Ore-063) BBS routes (Sauer *et al.*, 2003). All four species were observed during point-count surveys conducted in the study area from 2000-2002 (Holmes and Barton, 2003). Due to the lack of more specific location information, a figure illustrating observations points was not created.

Western burrowing owl

The Western burrowing owl is listed by the FWS as a species of concern and is federally protected by the Migratory Bird Treaty Act (1918). This owl inhabits open area with short vegetation and bare ground in desert, grassland, and shrub-steppe environments (Klute *et al.*, 2003). It is dependent on the presence of fossorial mammals such as prairie dogs and ground squirrels, whose burrows are used for nesting and roosting. The decrease of fossorial mammal populations has been identified as the primary factor responsible for declines of burrowing owls. Other factors that potentially impact burrowing owl populations across their range include habitat loss or fragmentation as a result of agricultural and urban development, predation, illegal shooting, and contaminants. BBS estimates of population trends are limited by small sample sizes and the species is not adequately sampled over a large part of their breeding range; however, when taken as a whole, populations in the northwest interior appear to be increasing (Klute *et al.*, 2003).

The assessment area is within the current breeding range of the burrowing owls. Burrowing owl populations are thought to be stable and possibly increasing with conversion of shrub-steppe to annual grasses, in southeast Oregon (Klute *et al.*, 2003). Burrowing owls were spotted on the BBS routes Lookout Lake (Ore-064), Silver City (Ida-217), and Battle Mountain (Ore-063). Historic observations of burrowing owls were made by a BLM biologist in 1978 (field notes). Burrowing owls have also been observed along Jacks Creek, Little Antelope Creek, and the Upper Owyhee River. Figure 12-6 illustrates locations of reported burrowing owl sitings.

Game Birds

There are 27 species of game birds in the study area (Table 12-5). Some of the game species may also be BLM sensitive species, such as the greater sage grouse.

TABLE 12-5: Game bird species

Common Name	Scientific Name	Common Name	Scientific Name
American coot	*Fulica Americana*	Green-winged teal	*Anas crecca*
American crow	*Corvus brachyrhynchos*	Lesser scaup	*Aythya affinis*
American wigeon	*Anas Americana*	Mallard	*Anas platyrhynchos*
Blue-winged teal	*Anas discors*	Mountain quail	*Oreortyx pictus*
California quail	*Callipepla californica*	Mourning dove	*Zenaida macroura*
Canada goose	*Branta Canadensis*	Northern pintail	*Anas acuta*
Canvasback	*Aythya valisineria*	Northern shoveler	*Anas clypeata*
Chukar partridge	*Alectoris chukar*	Redhead	*Aythya Americana*
Cinnamon teal	*Anas cyanoptera*	Ring-necked duck	*Aythya collaris*
Common merganser	*Mergus merganser*	Ring-necked pheasant	*Phasianus colchicus*
Common snipe	*Gallinago gallinago*	Ruddy duck	*Oxyura jamaicensis*
Gadwall	*Anas streperus*	Wild turkey	*Meleagris gallopavo*
Gray partridge	*Perdix perdix*	Wood duck	*Aix sponsa*
Greater sage grouse	*Centrocercus urophasianus*		

The chukar is an introduced game bird that inhabits rocky, arid, and mountainous regions. Chukars are widespread throughout the study area (BLM, 2001). According to Mr. Don Kemner and Mr. Brian Wolfer, wildlife biologists for the IDFG and ODFW (respectively), chukar populations are not surveyed in great detail; however, they appear to be stable in the study area (Wolfer, 2004). Mr. Wolfer indicated that chuckar populations vary from year to year because the mortality rate for these birds are high. Furthermore, chukar populations are highly dependent on the nest success during spring (Wolfer, 2004).

California quail inhabit early-successional shrubby habitats in foothills and stream valleys. They typically inhabit the lower elevation, agricultural areas. According to Messrs. Kemner and Wolfer, populations of quail appear to be stable overall. Similar to the chukar, quail populations are dependent on nest success and typically vary year to year.

Ring-necked pheasant are an introduced species and are mostly associated with agricultural lands. Mr. Wolfer indicated that pheasant populations vary from year to year, but they have been on an overall downward trend for the past 20 years. He stated that this downward trend is primarily due to the loss of suitable habitat, which occurred as a result of changing farming practices (Wolfer, 2004). Predation by red fox is an additional factor contributing to the decline of the pheasant population. According to Walt VanDyke (biologist at the ODFW), loss of adequate wintering habitat has resulted in greater predation pressures from red fox due to lack of cover (2004).

Mammals

Based on information obtained from Idaho and Oregon GAP analysis and the Northwest Habitat Institute website, 70 mammalian species potentially occur within the study area. Of these, 17 are listed as federally threatened, endangered, candidates, species of concern, or BLM sensitive (Table 12-6).

TABLE 12-6: Federally listed mammalian species

Common Name	Scientific Name	FWS[1]	Oregon BLM[2]	ODFW[1]	Idaho BLM[3]	IDFG[3]
Pygmy rabbit	*Brachylagus idhoensis*	SC	SEN	V		C
Pale western big-eared bat	*Corynorhinus townsendii pallescens*	SC	SEN	C		--
Townsend's big-eared bat	*Corynorhinus townsendii townsendii*	SC	--	--	SEN	C
Spotted bat	*Euderma maculatum*	SC	SEN	--	SEN	C
Silver-haired bat	*Lasionycteris noctivagans*	SC	--	U	--	--
Dark kangaroo mouse	*Microdipodops megacephalus*	--	--	--	SEN	C
Small-footed myotis	*Myotis ciliolabrum*	SC	--	U	WAT	U
Long-eared myotis	*Myotis evotis*	SC	SEN	U	WAT	U
Fringed myotis	*Myotis thysanodes*	SC	SEN	V	SEN	C
Long-legged myotis	*Myotis volans*	SC	SEN	U	WAT	U
Yuma myotis	*Myotis yumanensis*	SC	SEN	--	WAT	U
California bighorn sheep	*Ovis canadensis californiana*	SC	SEN	--	SEN	G
Preble's shrew	*Sorex preblei*	SC	SEN	--	--	--
Kit fox	*Vulpes macrotis ssp.*	--	ASM	T	SEN	C
Meriam's ground squirrel	*Spermophilus canus vigilis*	--	--	--	SEN	--
Wyoming ground squirrel	*Spermophilus elegans nevadensis*	--	--	EX	SEN	--
Little pocket mouse	*Perognathus longimembris*	--	--	--	SEN	C

NOTE: See Table 12-1 for abbreviations and footnotes.

There is limited inventory and monitoring data for many of these species within the study area. As a result, little is known about their distribution, population status or trend. Many of these species are thought to occur within the study area because the area either falls within their known range or contains habitat types that are potentially capable of supporting the species. The discussions below focus on those species that have survey or monitoring data collected within the study area.

Pygmy rabbit

The pygmy rabbit is the smallest rabbit in North America. It typically inhabits areas with dense stands of big sagebrush in deep, friable soils (Groves *et al.,* 1997; Csuti *et al.,* 2001). The distribution of this species appears to be discontinuous throughout the Great Basin (Csuti *et al.,* 2001). The Idaho (Scott, 2002) and Oregon GAP (Kagan, 1999) analysis models predict pygmy rabbits to be present within our study area based on the vegetation; however, little is known about the existence, population status, trend, or distribution in the study area. In 2001, an Idaho BLM biologist located what appeared to be an active burrowing system, but did not observe any rabbits. Information obtained from the ORNHIC indicated two pygmy rabbit specimens were collected near Rome and an additional specimen was collected near Cow Creek. The collection date was not included in the ORNHIC database.

Pygmy rabbit survey work was conducted in the Louse canyon geographic management area (BLM, 2003). During this survey, there were no confirmed observations of the rabbit or burrows; however, some areas appeared to be potential habitat. Helen Ulmschneider, a wildlife management biologist for the Idaho BLM, is currently investigating the status and distribution of pygmy rabbits in the Owyhee mountains (Ulmschneider, 2004). She indicated that she has observed old sign of pygmy rabbits north and south of Jordan Valley, along the Idaho/Oregon border. Ms. Ulmschneider indicated the pygmy rabbits have been in the area historically, and are likely scattered throughout the county at the present time. She stated that the 2001 observations of pygmy rabbit burrows were accurate; however, the burrows don't appear to be active to date. BLM is continuing its efforts to determine the population status and distribution of the pygmy rabbit.

Bats

There are nine federally listed bats species that may occur within the study area. Most of these species are able to use a variety of structures for their roosts, such as caves, cliffs, mines, trees, and buildings; however, the silver-haired bat is dependent on trees for roosts (Perkins and Peterson, 1997). Little is known about the distribution of these species, especially within the study area.

A cooperative study funded by the BLM and IDFG was conducted in 1996 to determine bat species present in the Juniper forest habitat of the Owyhee Mountains in Idaho (Perkins and Peterson, 1997). A few of the survey sites were within the Jordan and Middle Owyhee subbasins. Bat species either captured or heard (recorded) at these locations included the Yuma myotis and the spotted bat. Data obtained from the ORNHP listed numerous observations made in the 1970's and 1980's of long-eared myotis, long-legged myotis, Pale Western big-eared bat, and western small-footed bat. In addition, the IDCDC information listed two sightings of the spotted bat and confirmed trappings of a long-eared myotis, long-legged myotis, and a Yuma myotis. Figure 12-7 illustrates the locations of bat observations.

Perkins and Peterson (1997) concluded that bat populations and species diversity in the Juniper forests of the Owyhee uplands are low. The authors attributed this to the lack of suitable roosting habitats, which may be a result of the type of ecosystem, degradation of cottonwood riparian zone, and fire suppression, which has likely resulted in a decline in large juniper snags.

Bighorn sheep

There are two subspecies of bighorn sheep that are native to Oregon, the Rocky Mountain subspecies and the California subspecies (ODFW, 2003). Historically, the California bighorn sheep ranged over southeast Oregon. As a result of anthropogenic impacts (overhunting, land use, and diseases transmission from domestic livestock), the bighorn sheep populations plummeted and the species was gone from Oregon by 1915 (BLM, 2001). The current populations in Oregon and Idaho are a result of reintroduction efforts by ODFW and IDFG that began as early as 1954 (ODFW, 2003). However, bighorn populations still occupy only a small portion of their historic range.

Bighorn sheep inhabits areas characterized by remote, rugged, and open terrain. Most of the herds are non-migratory, and herd ranges are typically contiguous winter and summer habitat.

There are two bighorn sheep sub-herds in the study area. The Upper Owyhee sub-herd (above Rome, Oregon) is thought to be declining in numbers, and the Rattlesnake sub-herd is thought to be stable (ODFW, 2003). The population estimates for these two sub-herds are 200 and 100 animals, respectively.

Threats to the bighorn sheep include predation by cougar, poisoning from poor water quality of water developments (blue-green algae blooms and *Clostridia* toxin), disease transmission from domestic sheep, habitat loss and/or fragmentation, and illegal harvest (ODFW, 2003).

Kit fox

The kit fox inhabits salt desert shrub habitat. According to Csuti *et al.* (2001), southeast Oregon is the northern most portion of the kit fox's range, and this species has always been rare in Oregon. BLM (2001) wrote that the kit fox is common in Nevada and some other western states and Oregon populations are thought to be naturally limited by the amount of suitable habitat available.

Game Species

There are 12 game species that occur within the study area (Table 12-7). Some of these species may also be BLM sensitive species, such as the bighorn sheep.

TABLE 12-7: Game mammal species

Common Name	Scientific Name	Common Name	Scientific Name
American badger	*Taxidea taxus*	Mule deer	*Odocoileus hemionus*
American beaver	*Castor canadensis*	Northern raccoon	*Procyon lotor*
Bighorn sheep	*Ovis canadensis*	Northern river otter	*Lontra Canadensis*
Bobcat	*Lynx rufus*	Pronghorn	*Antilocapra americana*
Cougar	*Puma concolor*	Pygmy rabbit	*Brachylagus idohensis*
Elk	*Cervus elaphus*	Red fox	*Vulpes vulpes*

Pronghorn Antelope are native and widely distributed in the study area. Pronghorn typically inhabit low sagebrush plant communities. During the fall and winter months pronghorn utilize lower elevation habitats, then migrate to fawning grounds and higher summer ranges. Water shortages in the late summer often restrict pronghorn distribution, leaving herds to gather at available waterholes (ODFW, undated). According to information in the *Draft Owyhee Subbasin Summary* (Ecovista, 2002), pronghorn populations have been relatively stable since experiencing a decline during the winter of 1992-1993. Result from an aerial pronghorn population survey conducted by ODFW from January through March 2001 in the Owyhee Management Unit indicate there were approximately 2.3 pronghorns per mile. This estimate is slightly higher than the 2.1 pronghorn per mile estimate made in 1999. Harvest information obtained from the ODFW indicate 75 pronghorn were killed in the Owyhee Management Area during the 2000 hunting season. A total of 40 pronghorn were harvested from Idaho's unit 40 during the 2002 archery season (IDFG, 2004).

Elk are present in low numbers within the study area. According to Mr. Neal Johnson of the IDFG, it is the intention of the IDFG to keep the populations at their current levels. According to the harvest statistics for elk in the Owyhee-South Hills elk zone (which encompasses the study area), no elk were killed in this zone during the 2002 season.

Mule Deer occupy a wide range of habitat types including desert shrubs, woodlands, and conifer forests. There are lower densities of mule deer in the study area, as compared to other areas in Oregon, due to the lack of water (ODFW, undated). ODFW did not have population trend data for mule deer in the Owyhee unit portion of Oregon. Similarly, current population trend data for southwest Idaho are lacking. Mr. Johnson indicated that mule deer populations in southwest Idaho experienced a decline in the early 1990's.

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APPENDIX 12-A: LIST OF ACRONYMS

Acronym	Explanation
BBS	Breeding Bird Survey
BLM	U.S. Bureau of Land Management
ESA	Endangered Species Act
FWS	U.S. Fish and Wildlife Service
GAP	Geographic Approach to Planning
IDFG	Idaho Department of Fish and Game
IDCDC	Idaho Conservation Data Center
ODFW	Oregon Department of Fish and Wildlife
ONHP	Oregon Natural Heritage Program
ORNHIC	Oregon Natural Heritage Information Center
USGS	U.S. Geological Survey

APPENDIX 12-B: WILDLIFE SPECIES POTENTIALLY OCCURRING IN STUDY AREA

INVERTEBRATES	
Hotspring physa	*Physella sp.*
River mussel	*Margaritifera sp.*
Threeforks pyrg	*Pyrgulopsis sp.*
Crooked Creek springsnail	*Pyrgulopsis intermedia*
Owyhee hot springsnail	*Pyrgulopsis sp.*
Malheur springsnail	*Pyrgulopsis sp. nov.*
AMPHIBIANS	
Blotched tiger salamander	*Ambystoma tigrinum melanostictum*
Bullfrog	*Rana catesbeiana*
Columbia spotted frog	*Rana luteiventris*
Great Basin spadefoot	*Scaphiopus intermontanus*
Northern leopard frog	*Rana pipiens*
Pacific treefrog	*Hyla regilla*
Western toad	*Bufo boreas*
Woodhouse's toad	*Bufo woodhousii*
REPTILES	
Barred tiger salamander	*Ambystoma mavortium*
Common garter snake	*Thamnophis sirtalis*
Desert horned lizard	*Phrynosoma platyrhinos*
Gopher snake	*Pituophis catenifer*
Longnose leopard lizard	*Gambelia wislizenii*
Longnose snake	*Rhinocheilus lecontei*
Mojave black collared lizard	*Crotaphytus bicinctores*
Night snake	*Hypsiglena torquata*
Northern sagebrush lizard	*Sceloporus graciosus*
Racer	*Coluber constrictor*
Rubber boa	*Charina bottae*
Short horned lizard	*Phyrnosoma douglassi*
Side blotched lizard	*Uta stansburianas*
Striped whipsnake	*Masticophis taeniatu*
Western terrestrial garter snake	*Thamnophis elegans*
Western fence lizard	*Sceloporus occidentalis*
Western ground snake	*Sonora semiannulata*
Western rattlesnake	*Crotalus viridis*
Western skink	*Eumeces skiltonianus*
Western whiptail lizard	*Cnemidophorus tigris*

BIRDS	
American avocet	*Recurvirostra americana*
American bittern	*Botaurus lentiginosus*
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Caruelis tristis*
American kestrel	*Falco sparverius*
American robin	*Turdus migratorius*
American white pelican	*Pelecanus erythrorhynchos*
American wigeon	*Anas americana*
Ash-throated flycatcher	*Myiarchus cinerascens*
Bald eagle	*Haliaeetus leucocephalus*
Bank swallow	*Riparia riparia*
Barn owl	*Tyto alba*
Barn swallow	*Hirundo rustica*
Belted kingfisher	*Ceryle alcyon*
Black tern	*Chlidonias niger*
Black-billed magpie	*Pica hudsonia*
Black-capped chickadee	*Poecile atricapilla*
Black-chinned hummingbird	*Archilochus alexandri*
Black-crowned night-heron	*Nycticorax nycticorax*
Black-headed grosbeak	*Pheucticus melanocephalus*
Black-throated gray warbler	*Dendroica nigrescens*
Black-throated sparrow	*Amphispiza bilineata*
Blue-gray gnatcatcher	*Polioptila caerulea*
Blue-winged teal	*Anas discors*
Bobolink	*Dolichonyx oryzivorous*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewer's sparrow	*Spizella breweri*
Broad-tailed hummingbird	*Selasphorus platycercus*
Brown creeper	*Certhia americana*
Brown-headed cowbird	*Molothrus ater*
Bullock's oriole	*Icterus bullockii*
Bushtit	*Psaltriparus minimus*
California quail	*Callipepla californica*
Calliope hummingbird	*Stellula calliope*
Canada goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Canyon wren	*Catherpes mexicanus*
Cassin's finch	*Carpodacus cassinii*
Cassin's vireo	*Vireo cassinii*
Cedar waxwing	*Bombycilla cedrorum*
Chipping sparrow	*Spizella passerina*
Chukar partridge	*Alectoris chukar*
Cinnamon teal	*Anas cyanoptera*

Clark's grebe	*Aechmophorus clarkii*
Cliff swallow	*Petrochelidon pyrrhonota*
Columbian sharp-tailed grouse	*Tympanuschus phasianellus columbianus*
Common merganser	*Mergus merganser*
Common nighthawk	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Common raven	*Corvus corax*
Common snipe	*Gallinago gallinago*
Common yellowthroat	*Geothlypis trichas*
Cooper's hawk	*Accipiter cooperi*
Dark-eyed junco	*Junco hyemalis*
Double-crested cormorant	*Phalacrocorax auritus*
Downy woodpecker	*Picoides pubescens*
Dusky flycatcher	*Empidonax oberholseri*
Eared grebe	*Podiceps nigricollis*
Eastern kingbird	*Tyrannus tyrannus*
European starling	*Sturnus vulgaris*
Evening grosbeak	*Coccothraustes vespertinus*
Ferruginous hawk	*Buteo regalis*
Flammulated owl	*Otus flammeolus*
Fox sparrow	*Passerella iliaca*
Gadwall	*Anas streperus*
Golden eagle	*Aquila chrysaetos*
Grasshopper sparrow	*Ammodramus savannarum*
Gray catbird	*Dumetella carolinensis*
Gray flycatcher	*Empidonax wrightii*
Gray partridge	*Perdix perdix*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Great horned owl	*Bubo virginianus*
Greater sage-grouse	*Centrocercus urophasianus*
Green-tailed towhee	*Pipilo chlorurus*
Green-winged teal	*Anas crecca*
Hairy woodpecker	*Picoides villosus*
Hammond's flycatcher	*Empidonax hammondii*
Hermit thrush	*Catharus guttatus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
House wren	*Troglodytes aedon*
Killdear	*Charadrius vociferus*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passerina amoena*
Least bittern	*Ixobrychus exilis*
Lesser scaup	*Aythya affinis*
Lewis' woodpecker	*Melanerpes lewis*

Lincoln's s[parrow	*Melospiza lincolnii*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Long-eared owl	*Asio otus*
Macgillivray's warbler	*Oporornis tolmiei*
Mallard	*Anas platyrhynchos*
Marsh wren	*Cistothorus palustris*
Merlin	*Falco columbarius*
Mountain bluebird	*Sialia currucoides*
Mountain chickadee	*Poecile gambeli*
Mountain quail	*Oreortyx pictus*
Mourning dove	*Zenaida macroura*
Northern flicker	*Colaptes auratus*
Northern goshawk	*Accipiter gentilis*
Northern harrier	*Circus cyaneus*
Northern mockingbird	*Mimus polyglottos*
Northern pintail	*Anas acuta*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Northern saw-whet owl	*Aegolius acadicus*
Northern shoveler	*Anas clypeata*
Olive-sided flycatcher	*Contopus borealis*
Orange-crowned warbler	*Vermivora celata*
Peregrine falcon	*Falco peregrinus anatum*
Pied-billed grebe	*Podilymbus podiceps*
Pine siskin	*Carduelis tristis*
Prairie falcon	*Falco mexicanus*
Red-breasted nuthatch	*Sitta canadensis*
Red-eyed vireo	*Vireo olivaceus*
Redhead	*Aythya americana*
Red-naped sapsucker	*Sphyrapicus nuchalis*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-necked duck	*Aythya collaris*
Ring-necked pheasant	*Phasianus colchicus*
Rock dove	*Columba livia*
Rock wren	*Salpinctes obsoletus*
Ruby-crowned kinglet	*Regulus calendula*
Ruddy duck	*Oxyura jamaicensis*
Rufous hummingbird	*Selasphorus rufus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Sandhill crane	*Grus canadensis*
Savannah sparrow	*Passerculus sandwichensis*
Say's phoebe	*Sayornis saya*
Sharp-shinned hawk	*Accipiter striatus*
Short-eared owl	*Asio flammeus*

Snowy egret	*Egretta thula*
Song sparrow	*Melospiza melodia*
Sora	*Porzana carolina*
Spotted sandpiper	*Actitus macularia*
Spotted towhee	*Pipilo crissalis*
Swainson's hawk	*Buteo swainsoni*
Swainson's thrush	*Catharus ustulatus*
Townsend's solitaire	*Myadestes townsendi*
Tree swallow	*Tachycineta bicolor*
Turkey vulture	*Cathartes aura*
Upland sandpiper	*Bartramia longicauda*
Vesper sparrow	*Pooecetes gramineus*
Violet-green swallow	*Tachycineta thalassina*
Virginia rail	*Rallus limicola*
Warbling vireo	*Vireo gilvus*
Western bluebird	*Sialia mexicana*
Western Burrowing owl	*Athene cunicularia*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*
Western screech-owl	*Otus kennicottii*
Western snowy plover	*Charadrius alexandrinus*
Western tanager	*Piranga ludoviciana*
Western wood-pewee	*Contopus sordidulus*
White-breasted nuthatch	*Sitta carolinensis*
White-crowned sparrow	*Zonotrichia leucophrys*
White-faced ibis	*Plegadis chihi*
White-throated swift	*Aeronautes saxatalis*
Wild turkey	*Meleagris gallopavo*
Willet	*Catoptrophorus semipalmatus*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Willow flycatcher	*Empidonax trailii*
Wilson's phalarope	*Phalaropus tricolor*
Wilson's warbler	*Wilsonia pusilla*
Wood duck	*Aix sponsa*
Yellow warbler	*Dendroica petechia*
Yellow-billed cuckoo	*Coccyzus americanus*
Yellow-breasted chat	*Icteria virens*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow-rumped warbler	*Dendroica coronata*

Mammals	
American badger	*Taxidea taxus*
American beaver	*Castor canadensis*
American mink	*Mustela vison*
Belding's ground squirrel	*Spermophilus beldingi*
Big brown bat	*Eptesicus fuscus*
Black-tailed jack rabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Bushy-tailed woodrat	*Neotoma cinerea*
California bighorn sheep	*Ovis canadensis californiana*
California myotis	*Myotis californicus*
Canyon mouse	*Peromyscus crinitus*
Chisel-toothed kangaroo rat	*Dipodomys microps*
Cougar	*Puma concolor*
Coyote	*Canis latrans*
Dark kangaroo mouse	*Microdipodops megacephalus*
Deer mouse	*Peromyscus maniculatus*
Desert woodrat	*Neotoma lepida*
Elk	*Cervus elaphus*
Ermine	*Mustela erminea*
Fringed myotis	*Myotis thysanodes*
Golden-mantled ground squirrel	*Spermophilus lateralis*
Great basin pocket mouse	*Perognathus parvus*
Hoary bat	*Lasiurus cinereus*
House mouse	*Mus musculus*
Kit fox	*Vulpes macrotis velox*
Least chipmunk	*Tamias amoenus*
Little brown bat	*Myotis lucifugus*
Little pocket mouse	*Perognathus longimembris*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Long-tailed vole	*Microtus longicaudus*
Long-tailed weasel	*Mustela frenata*
Merriam's ground squirrel	*Spermophilus canus*
Merriam's shrew	*Sorex merriami*
Montane vole	*Microtus montanus*
Mule deer	*Odocoileus hemionus*
Muskrat	*Ondatra zibethicus*
North American porcupine	*Erethizon dorsatum*
Northern grasshopper mouse	*Onychomys leucogaster*
Northern pocket gopher	*Thomomys talpoides*
Northern raccoon	*Procyon lotor*
Northern river otter	*Lontra canadensis*
Norway rat	*Rattus norvegicus*
Nuttall's (mountain) cottontail	*Sylvilagus nuttallii*

Ord's kangaroo rat	*Dipodomys ordii*
Pale western big-eared bat	*Corynorhinus townsendii pallescens*
Pallid bat	*Antrozous pallidus*
Pinyon mouse	*Peromyscus truei*
Piute ground squirrel	*Spermophilus mollis*
Preble's shrew	*Sorex preblei*
Pronghorn	*Antilocapra americana*
Pygmy rabbit	*Brachylagus idohensis*
Red fox	*Vulpes vulpes*
Sagebrush vole	*Lemmiscus curtatus*
Silver-haired bat	*Lasionycteris noctivagans*
Spotted bat	*Euderma maculatum*
Striped skunk	*Mephitis mephitis*
Townsend's big eared bat	*Corynorhinus townsendii*
Townsend's pocket gopher	*Thomomys townsendii*
Vagrant shrew	*Sorex vagrans*
Western harvest mouse	*Reithrodontomys megalotis*
Western jumping mouse	*Zapus princeps*
Western pipistrelle	*Pipistrellus hesperus*
Western small-footed myotis	*Myotis ciliolabrum*
Western spotted skunk	*Spilogale gracilis*
White-tailed antelope squirrel	*Ammospermophilus leucurus*
White-tailed jackrabbit	*Lepus townsendi*
Wyoming ground squirrel	*Spermophilus elegans*
Yellow-bellied marmot	*Marmota flaviventris*
Yuma myotis	*Myotis yumanensis*

Sources: IBIS, 2003; Csuti *et al.*, 2001; Scott *et al.*, 2002

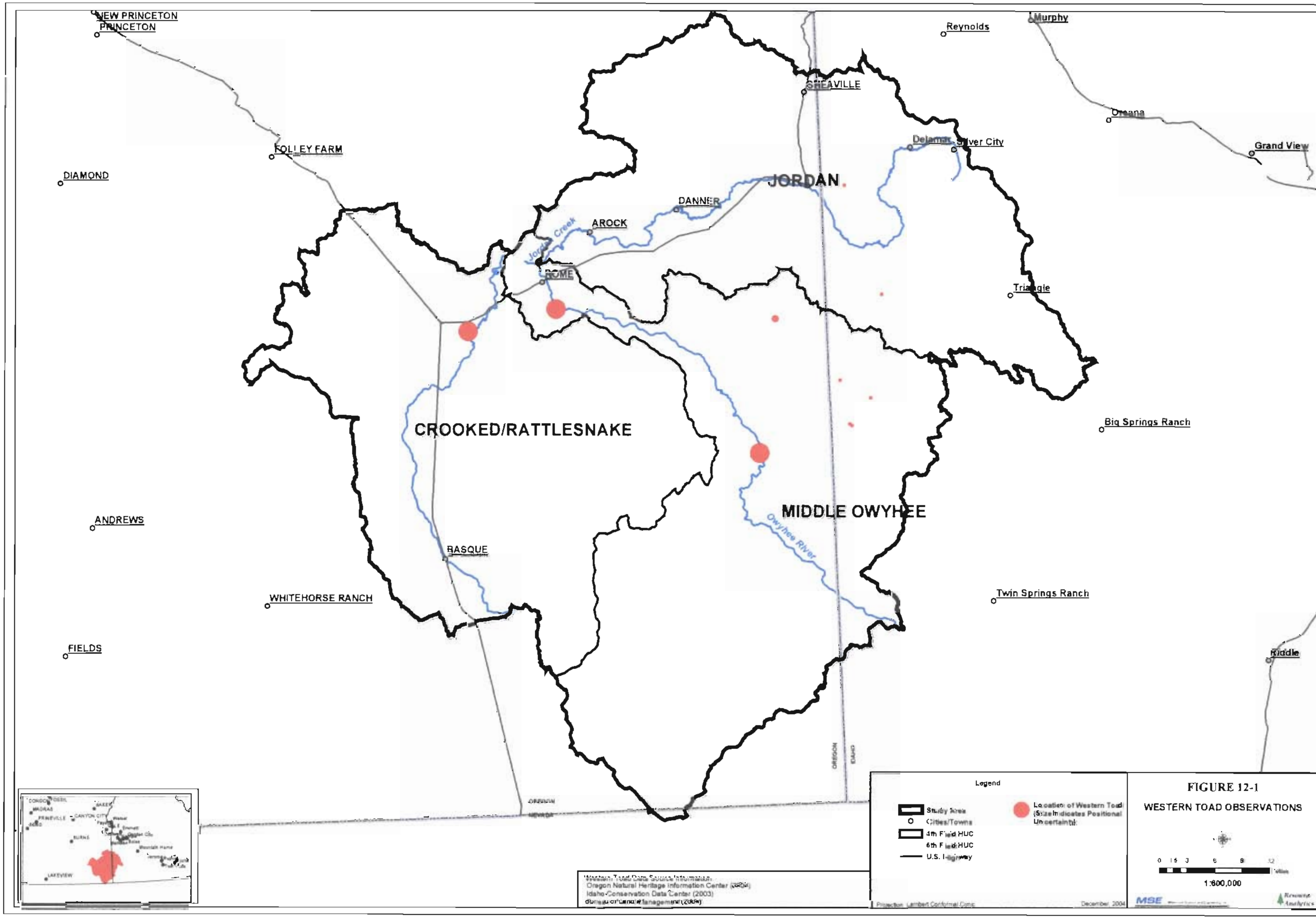


FIGURE 12-1
WESTERN TOAD OBSERVATIONS

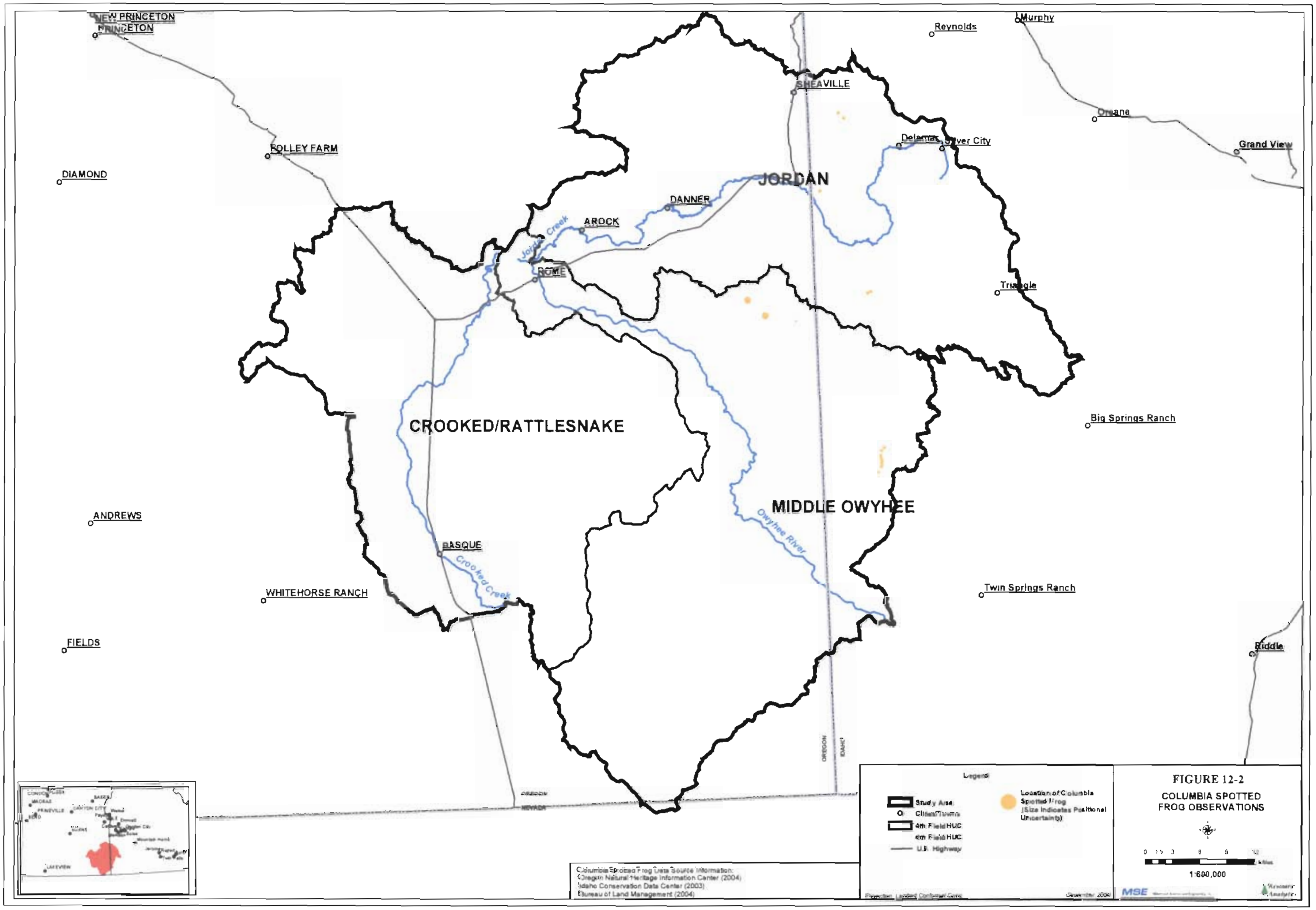


FIGURE 12-2
COLUMBIA SPOTTED FROG OBSERVATIONS

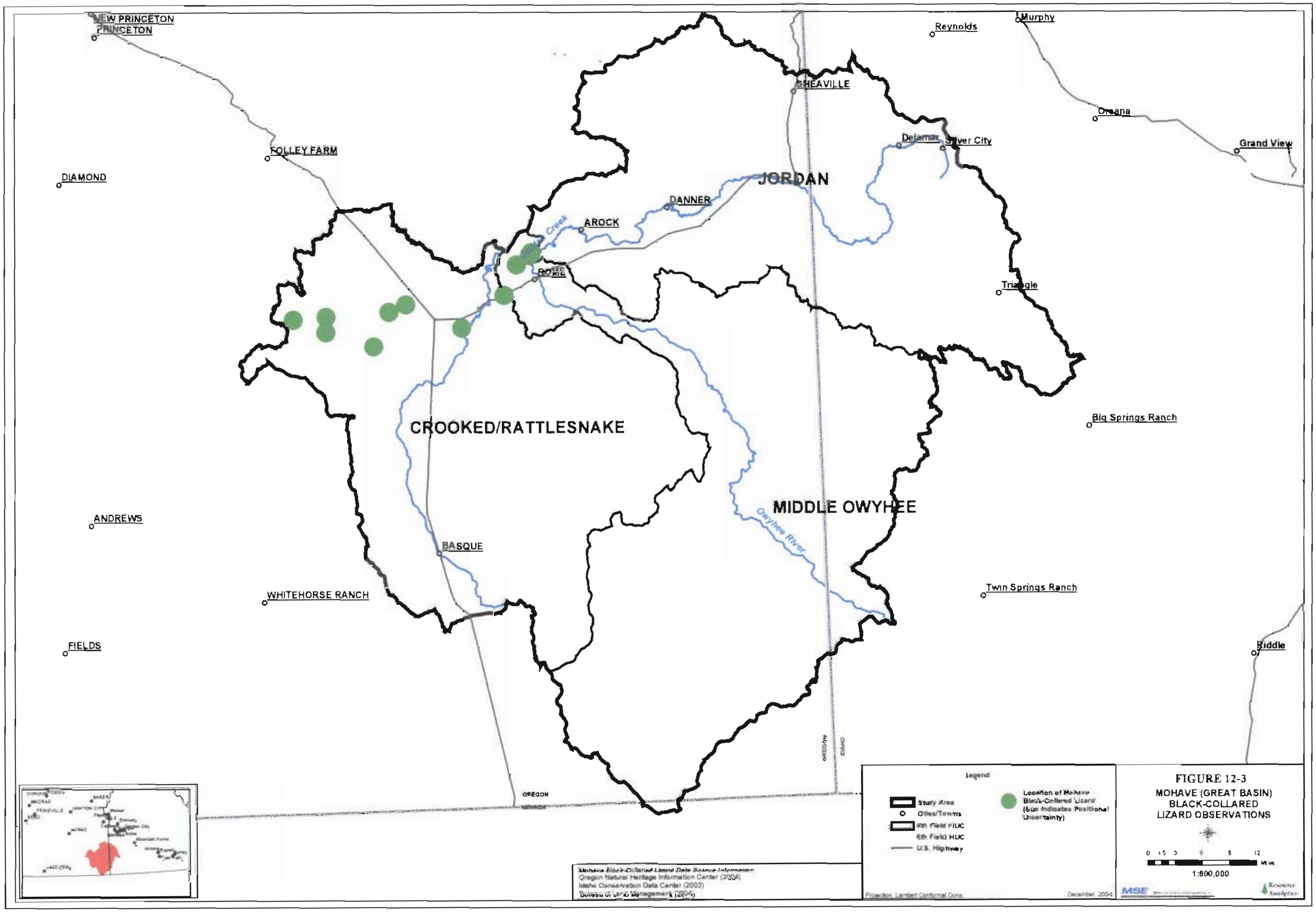


FIGURE 12-3
MOHAVE (GREAT BASIN) BLACK-COLLARED LIZARD OBSERVATIONS

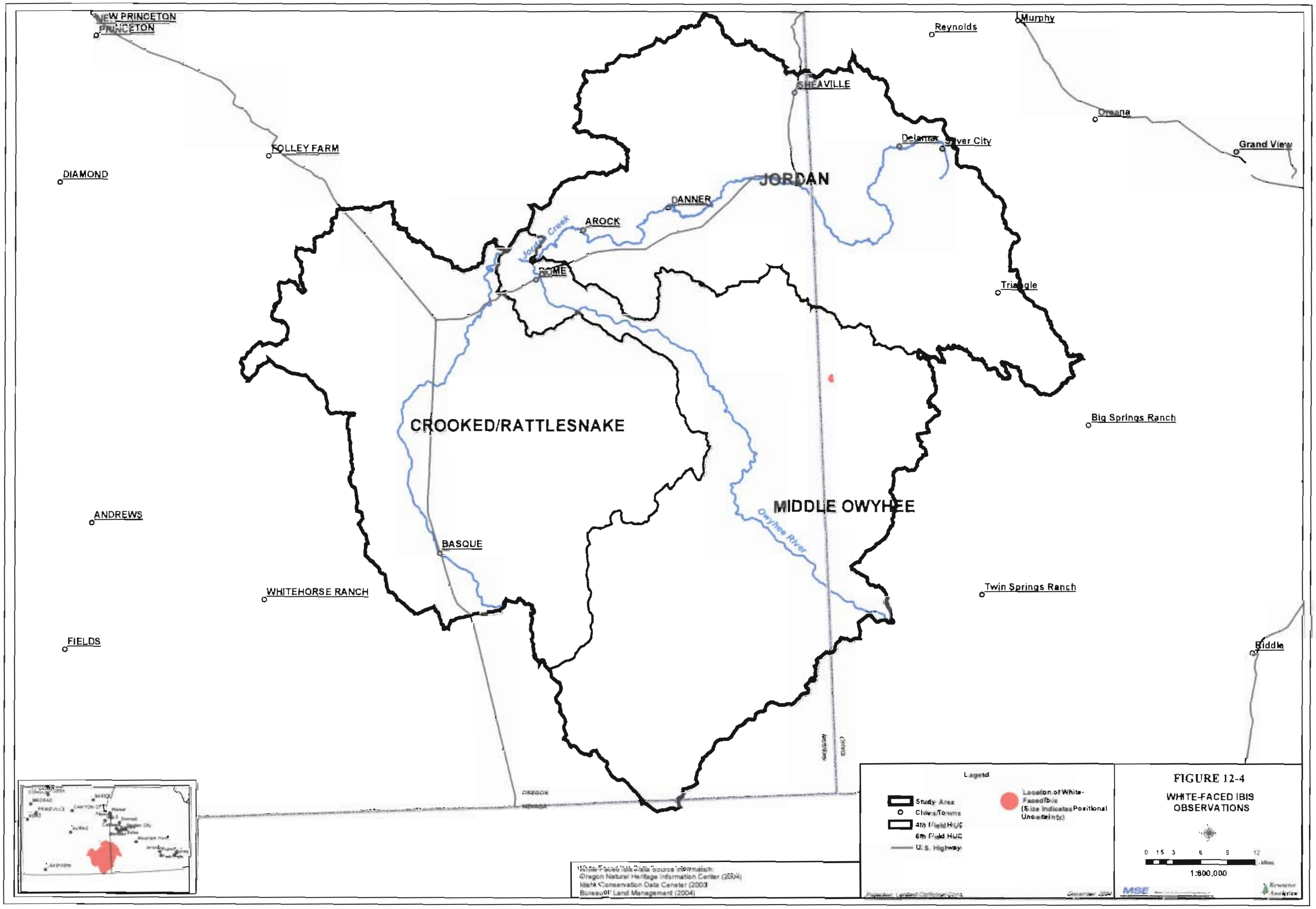


FIGURE 12-4
WHITE-FACED IBIS OBSERVATIONS
NEW PRINCETON
PRINCETON
FOLLEY FARM
DIAMOND
ANDREWS
FIELDS
WHITEHORSE RANCH
BASQUE
CROOKED/RATTLESNAKE
MIDDLE OWYHEE
JORDAN
ROME
AROCK
DANNER
Jordan Creek
Owyhee River
SHEAVILLE
Delamar
Silver City
Reynolds
Murphy
Oreana
Grand View
Triangle
Big Springs Ranch
Twin Springs Ranch
Riddle
OREGON
NEVADA
IDAHO
Legend
Study Area
Cities/Towns
4th Field HUC
6th Field HUC
U.S. Highway
Location of White-Faced Ibis (Size Indicates Positional Uncertainty)
White-Faced Ibis Data Source Information:
Oregon Natural Heritage Information Center (2004)
Idaho Conservation Data Center (2003
Bureau of Land Management (2004)
1:800,000
MSE

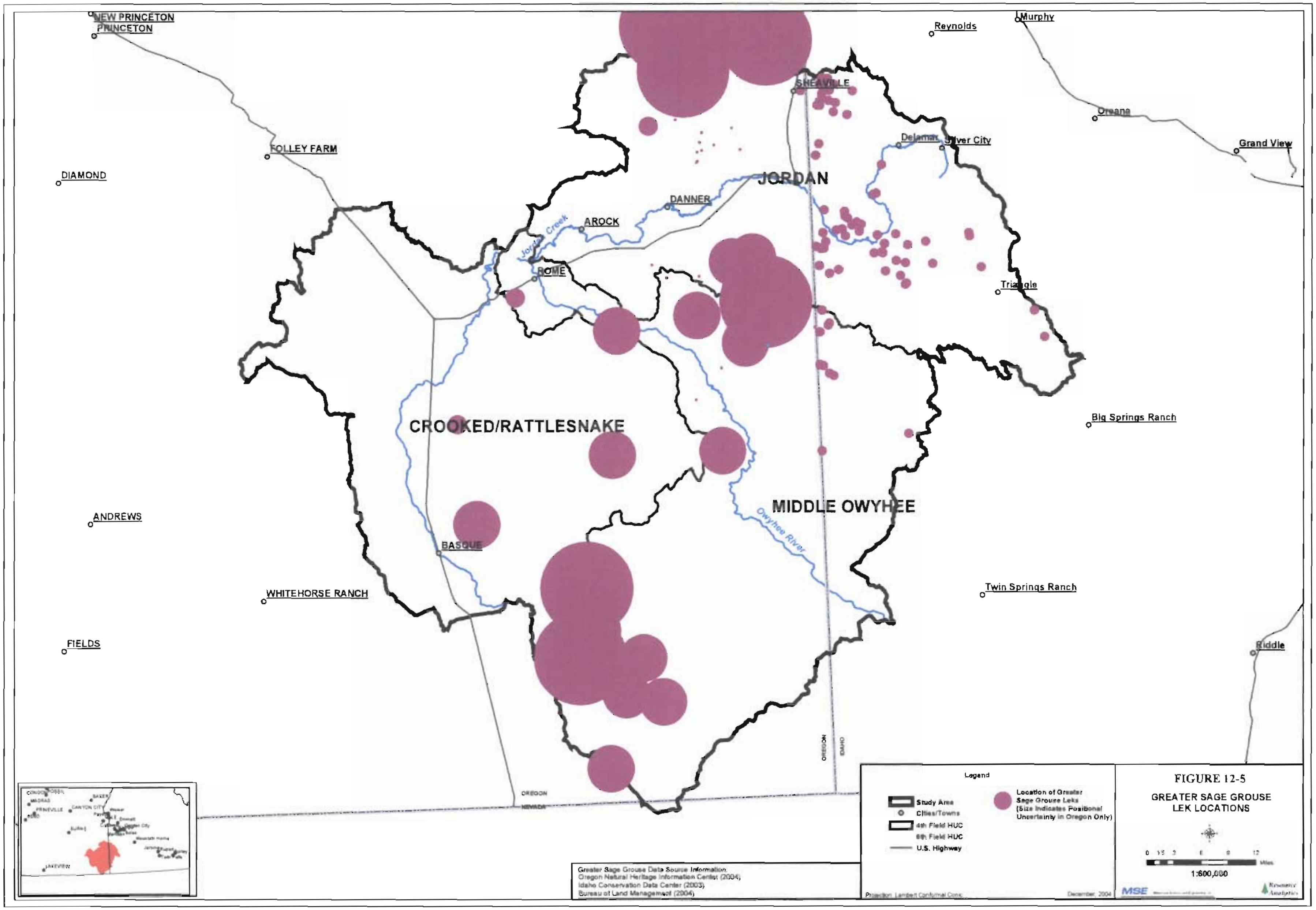
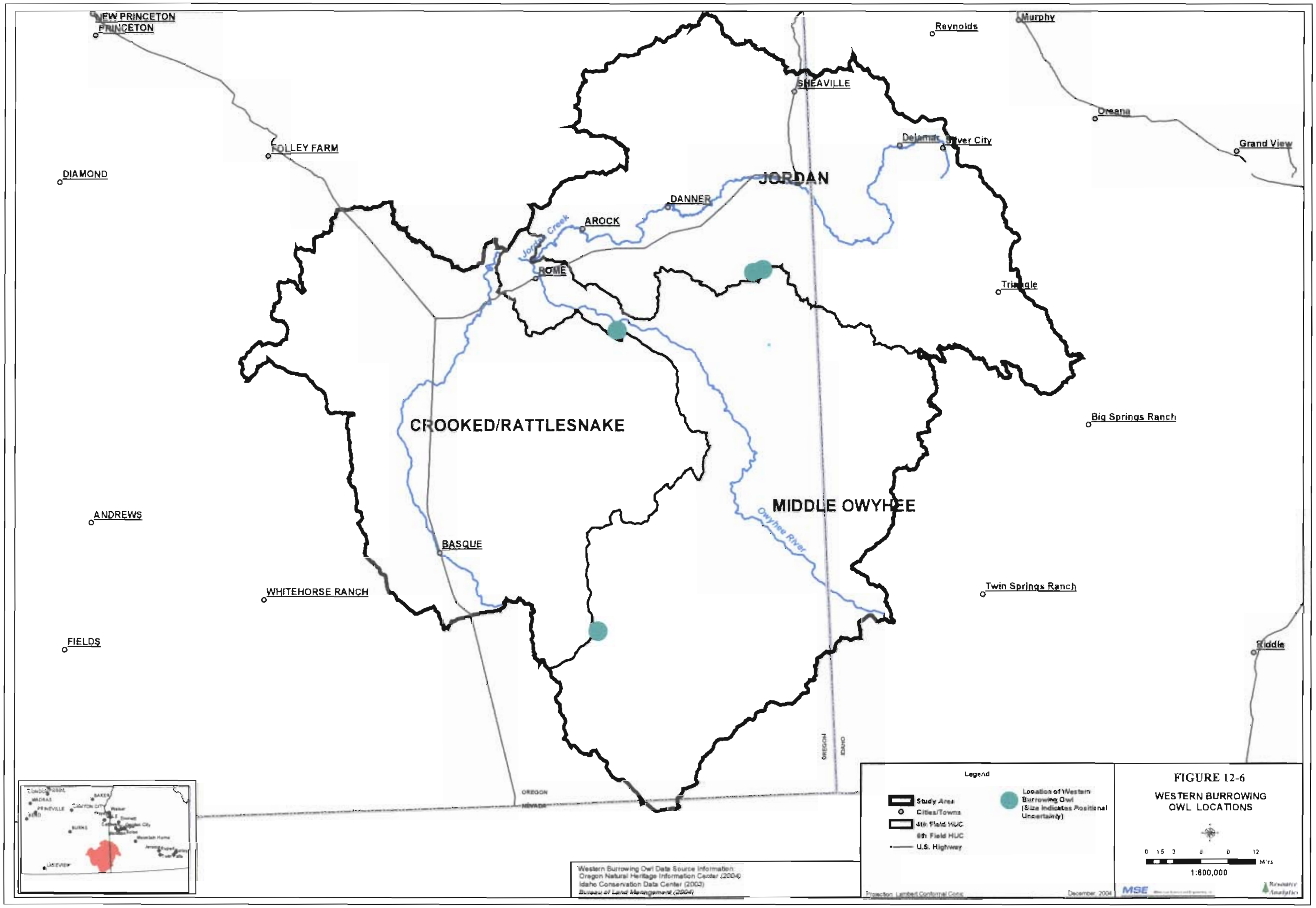
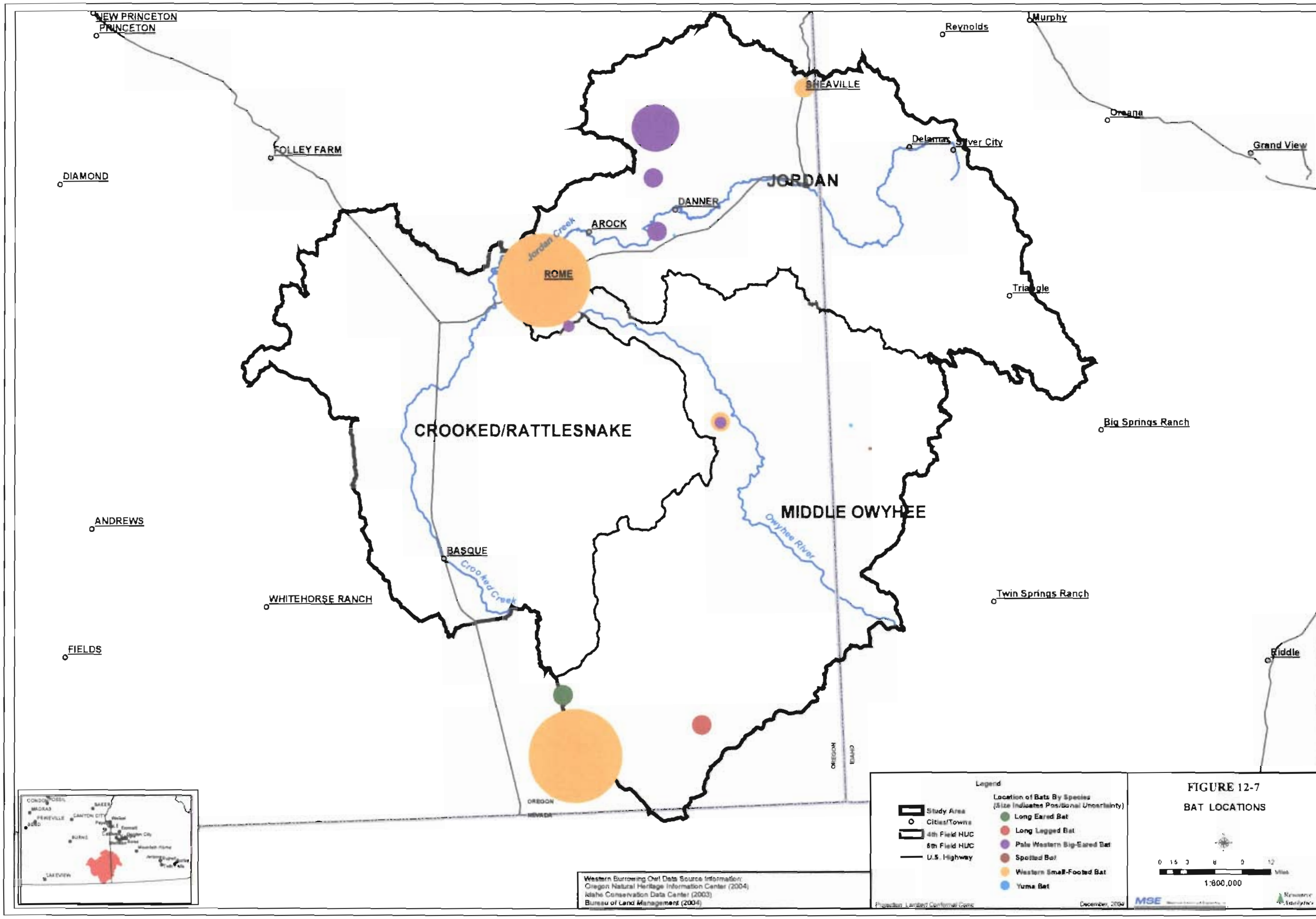


FIGURE 12-5

GREATER SAGE GROUSE LEK LOCATIONS


NEW PRINCETON
PRINCETON
FOLLEY FARM
DIAMOND
ANDREWS
WHITEHORSE RANCH
FIELDS
BASQUE
CROOKED/RATTLESNAKE
ROME
AROCK
Jordan Creek
DANNER
JORDAN
SHEAVILLE
Reynolds
Murphy
Oreana
Grand View
Delamar
Silver City
Triangle
Big Springs Ranch
MIDDLE OWYHEE
Owyhee River
Twin Springs Ranch
Riddle
OREGON
IDAHO
NEVADA
Western Burrowing Owl Data Source Information:
Oregon Natural Heritage Information Center (2004)
Idaho Conservation Data Center (2003)
Bureau of Land Management (2004)
Legend
Study Area
Cities/Towns
4th Field HUC
6th Field HUC
U.S. Highway
Location of Western Burrowing Owl (Size Indicates Positional Uncertainty)
Projection: Lambert Conformal Conic
December, 2004
FIGURE 12-6
WESTERN BURROWING OWL LOCATIONS
1:800,000
MSE


NEW PRINCETON
PRINCETON
FOLLEY FARM
DIAMOND
ANDREWS
FIELDS
WHITEHORSE RANCH
BASQUE
CROOKED/RATTLESNAKE
Crooked Creek
ROME
Jordan Creek
AROCK
DANNER
JORDAN
SHEAVILLE
Reynolds
Murphy
Oreana
Grand View
Delamar
Silver City
Triangle
Big Springs Ranch
MIDDLE OWYHEE
Owyhee River
Twin Springs Ranch
Riddle
OREGON
IDAHO
NEVADA
Western Burrowing Owl Data Source Information:
Oregon Natural Heritage Information Center (2004)
Idaho Conservation Data Center (2003)
Bureau of Land Management (2004)
Legend
Study Area
Cities/Towns
4th Field HUC
6th Field HUC
U.S. Highway
Location of Bats By Species
(Size Indicates Positional Uncertainty)
Long Eared Bat
Long Legged Bat
Pale Western Big-Eared Bat
Spotted Bat
Western Small-Footed Bat
Yuma Bat
Projection: Lambert Conformal Conic
December, 2004
FIGURE 12-7
BAT LOCATIONS
1:800,000
MSE

Component 13—Rangeland Condition

The purpose of this component is to provide information on the existing condition of rangelands within the study area. Information presented in this component was compiled from literature, agency documents, agency field notes, agency databases, and interviews with government personnel familiar with the study area. Rangelands are defined by the NRCS as "land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing use" (NRCS, 1983). Rangelands provide many important functions to watersheds including habitat for a diverse and wide array of native plant species, full renewable food and fiber production systems of grazing industries, and recreation opportunities.

The study area, which includes the Jordan, Middle Owyhee, and Crooked/Rattlesnake 4th Field Hydrologic Unit Code, encompasses approximately 2,643,231 acres. Of these 2,643,231 acres there are approximately 2,275,567 acres of rangeland (86%). Within the watershed area 2,052,233 acres are federally owned and managed by the Bureau of Land Management (BLM); the Oregon Department of State Lands owns 128,883 acres; 626 acres are owned by Reservations; 78,461 acres are owned by the State of Idaho; and 382,515 acres are privately owned. The remaining acres are attributed to open water.

This component is broken down into the following categories:

- Standards for Rangeland Health and Guidelines for Livestock Grazing Management
- Vegetation types
- Grazing allotments
- Fire
- Data gaps

Standards for Rangeland Health and Guidelines for Livestock Grazing Management

According to the Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM, 1997) there are several indicators of rangeland health. The condition or degree of a site in relation to the standards and its trend toward or away from any standard is determined through the use of reliable and scientifically sound indicators). The following standards for rangeland health have been established (BLM, 1997):

Standard 1 "Watersheds provide the proper infiltration, retention, and release of water appropriate to soil type, vegetation, climate, and landform to provide for proper nutrient cycling, hydrologic cycling, and energy flow."

Indicators may include, but are not limited to, the following:

1. The amount and distribution of ground cover (including litter) for identified ecological site or soil-plant associations are appropriate for site stability.
2. Evidence of accelerated erosion in the form of rills and/or gullies, erosional pedestals, flow patterns, physical soil crusts/ surface sealing, and compaction layers below the soil surface is minimal for soil type and landform.

<u>Standard 2</u> "Riparian-wetland areas are in proper functioning condition (PFC) appropriate to soil type, climate, geology, and landform to provide for proper nutrient cycling, hydrologic cycling, and energy flow."

Indicators may include, but are not limited to, the following:

1. The riparian/wetland vegetation is controlling erosion, stabilizing streambanks, shading water areas to reduce water temperature, stabilizing shorelines, filtering sediment, aiding in floodplain development, dissipating energy, delaying floodwater, and increasing recharge of groundwater appropriate to site potential.
2. Riparian/wetland vegetation with deep strong binding roots is sufficient to stabilize streambanks and shorelines. Invader and shallow rooted species are a minor component of the floodplain.
3. Age class and structural diversity of riparian/wetland vegetation is appropriate for the site.
4. Noxious weeds are not increasing.

<u>Standard 3</u> "Stream channels and floodplains are properly functioning relative to the geomorphology (e.g., gradient, size, shape, roughness, confinement, and sinuosity) and climate to provide for proper nutrient cycling, hydrologic cycling, and energy flow."

Indicators may include, but are not limited to, the following:

1. Stream channels and floodplains dissipate energy of high water flows and transport sediment. Soils support appropriate riparian-wetland species, allowing water movement, sediment filtration, and water storage. Stream channels are not entrenching.
2. Stream width/depth ratio, gradient, sinuosity, and pool, riffle and run frequency are appropriate for the valley bottom type, geology, hydrology, and soils.
3. Streams have access to their floodplains and sediment deposition is evident.
4. There is little evidence of excessive soil compaction on the floodplain.
5. Streambanks are within an appropriate range of stability according to site potential.
6. Noxious weeds are not increasing.

<u>Standard 4</u> "Healthy, productive, and diverse native animal habitat and population of native plants are maintained or promoted as appropriate to soil type, climate, and landform to provide for proper nutrient cycling, hydrologic cycling, and energy flow."

Indicators may include, but are not limited to, the following:

1. Native plant communities (flora and microbiotic crusts) are maintained or improved to ensure the proper functioning of ecological processes and continued productivity and diversity of native plant species.
2. The diversity of native species is maintained.
3. Plant vigor (total plant production, seed and seedstalk production, cover, etc.) is adequate to enable reproduction and recruitment of plants when favorable climatic events occur.
4. Noxious weeds are not increasing.
5. Adequate plant litter and standing dead plant material are present for site protection and for decomposition to replenish soil nutrients relative to site potential.

<u>Standard 5</u> "Rangelands seeded with mixtures, including predominately non-native plants, are functioning to maintain life form diversity, production, native animal habitat, nutrient cycling, energy flow and the hydrologic cycle."

Indicators may include, but are not limited to, the following:

1. In established seedings, the diversity of perennial species is not diminishing over time.

2. Plant production, seed production, and cover are adequate to enable recruitment when favorable climatic events occur.
3. Noxious weeds are not increasing.
4. Adequate litter and standing dead plant material are present for site protection and for decomposition to replenish soil nutrients relative to site potential.

Standard 6 "Exotic plant communities, other than seedings, will meet minimum requirements of soil stability and maintenance of existing native and seeded plants. These communities will be rehabilitated to perennial communities when feasible cost effective methods are developed."

Indicators may include, but are not limited to, the following:

1. Noxious weeds are not increasing.
2. Perennial species numbers are being maintained.
3. Native and introduced perennial species are vigorous enough to reproduce when climatic and other environmental conditions are favorable.
4. Litter and standing dead plant material is adequate to replenish soil nutrients relative to site potential.

Standard 7 "Surface and groundwater on public lands comply with Idaho Water Quality Standards."

Indicators may include, but are not limited to, the following:

1. Physical, chemical, and biologic parameters described in the Idaho Water Quality Standards.

Standard 8 "Habitats are suitable to maintain viable populations of threatened and endangered, sensitive, and other special status species."

Indicators may include, but are not limited to, the following:

1. Parameters described in the Idaho Water Quality Standards.
2. Riparian/wetland vegetation with deep, strong, binding roots is sufficient to stabilize streambanks and shorelines. Invader and shallow rooted species are a minor component of the floodplain.
3. Age class structure diversity or riparian/wetland vegetation is appropriate for the site.
4. Native plant communities (flora and microbiotic crusts) are maintained or improved to ensure the proper functioning of ecological processes and continued productivity and diversity of native plant species.
5. The diversity of native species is maintained.
6. The amount and distribution of ground cover, including litter, for identified ecological site(s) or soil-plant associations are appropriate for site stability.
7. Noxious weeds are not increasing.

General Vegetation Types

Historically the general vegetation types for the Owyhee rangelands discussed in this component are comprised mainly of shrub-steppe/Salt Desert Shrub communities, which can also be referred to as mixed rangeland. Invasive and agricultural species have replaced these communities in some areas. Figure 13-1 illustrates the different rangeland vegetation associated with the watershed area.

Sagebrush Steppe/Salt Desert

Sagebrush steppe habitats comprise the majority of the rangeland study area. Sagebrush steppe habitats can consist of a variety of upland vegetative communities with a shrubland aspect and understory of grass and forbs (BLM, 2001). Shrub steppe communities are characterized by an overstory of shrubby species and an understory of bunchgrasses and forbs. Big sagebrush communities dominate much of the Owyhee Uplands (Schaaf, 1996). Associations typically occur on north facing slopes with deeper soils, and low sagebrush/bunchgrass associations occur on ridge tops with rocky soil types at intermediate and high elevations. Low sagebrush and rigid sagebrush communities are interspersed within the big sagebrush at sites with shallow, rocky soil. The most common tall overstory shrubs in the Owyhee Uplands include Wyoming sagebrush (*Artemesia tridentata* var. *wyomingensis*), mountain sagebrush (*A. tridentata* var. *vaseyana*), and basin big sagebrush (*A. tridentata* var. *t.*). Common native bunchgrass species in the Owyhee Uplands include Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), Sandberg's bluegrass (*Poa sandbergii*), Nevada bluegrass (*Poa nevadensis*), and bottlebrush squirreltail (*Sitanion hystrix*), to name a few (Schaaf, 1996).

The most significant sources of impacts to the sagebrush steppe habitat within the study area include increased fire frequency, introduction of exotic vegetation (such as cheat grass), and grazing.

Salt desert habitats are much less abundant in the study area, occurring only where there are highly alkaline soils (Schaaf, 1996). Salt desert habitats have been found near Crooked Creek and Rattlesnake Creek. Plant communities that occur in salt desert habitats are dominated primarily by greasewood on playas that are seasonally flooded and by species of the *Atriplex* genus (shadscale species) on slopes. Salt desert shrub habitats tend to have lower vegetation cover and fewer bunchgrasses than the sagebrush steppe habitat (Schaaf, 1996). Decreased moisture availability, low soil fertility, and a high soil alkalinity contribute to the decreased production. Livestock grazing on these communities is less preferred because of the lack of forage, but one species common to valleys, winterfat (*Eurotia lanata*), has long been sought after for livestock grazing because of its high nutritional value that is carried into winter (Schaaf, 1996).

Juniper Woodlands

Juniper woodlands are largely present in the Idaho portion of the study area, with limited overlap into Oregon. They are ecologically important elements for wildlife habitat and soil protection and formation.

Prior to Euro-American settlement, juniper trees were present in open, savannah-like woodlands or were confined to rocky areas (Quigley and Arbelbide, 1997). Livestock pressure, climate change, and fire suppression contributed to the expansion of western juniper *(Juniperus occidentalis*) as well as to increased densities of trees in the woodlands (Eddleman *et.al.*, 1994; Campbell *et al.*, 2004). Fire is an effective control agent of western juniper to prevent expansion into associated plant communities, to reduce stand densities, and to create a mosaic of plant communities on a landscape. Old growth stands experience mostly light understory burning which reduce recruitment of understory vegetation such as sagebrush as well as young junipers. Younger stands appear to be less resistant to fires and are typically replaced by the presence of fire. Decreased fire frequencies have been attributed to fire suppression, livestock grazing on understory vegetation, and a warmer, drier climate producing less fuel (Eddleman *et al.*, 1994).

Expansion of the juniper woodlands into neighboring plant communities has become a concern for land managers because it has potential implications on understory productivity, biodiversity, wildlife habitat, and hydrology. As juniper densities increase, understory vegetation production decreases (Quigley and

Arbelbide, 1997; Bates *et al.*, 2000). Juniper trees are capable of outcompeting other vegetation because their extensive lateral roots remove water from the soils (Campbell *et al.*, 2004). While a decreased vegetative understory may benefit some species, the decrease in understory vegetation (forage) negatively impacts grazing animals such as mule deer or livestock. Research conducted by Bates *et al.* (2000) and past research summarized by Quigley and Arbelbide (1997), indicates habitat complexity (plant species richness and abundance) decreases with increased juniper density and canopy. The impact of juniper woodland expansion on overall biodiversity has not yet been determined because species lists of non-vascular plants, invertebrates, or microorganisms associated with these woodlands have not been developed (Quigley and Arbelbide, 1997). Expansion of juniper woodlands into adjacent sagebrush steppe community is of particular concern to land managers. Alteration of sagebrush communities has deleterious impacts on sagebrush obligate species such as the sage grouse. Hydrologic impacts of juniper expansion are thought to relate to precipitation interception and infiltration, water runoff, and erosion (Quigley and Arbelbide, 1997). There is a widespread belief that juniper trees decrease the quantity of water reaching springs and streams. There have been studies on the quantity of water that juniper trees are capable of intercepting and/or utilizing; however, there are no scientific studies for short-term or long-term impacts of this phenomenon on surface water quantity. Wilcox and Davenport (1995) developed the following four hypotheses regarding the impact of juniper expansion on soil erosion and soil morphology:

1. Understory cover diminishes as juniper increases, creating a mosaic landscape of canopy and intercanopy areas, each with different water, nutrient, and soil characteristics;
2. Most runoff and erosion from pinyon-juniper and juniper woodlands is generated from intercanopy areas;
3. Runoff and erosion in juniper woodlands is scale dependent and generally diminishes as scale increases; and
4. Although juniper encroachment will in many cases increase erodibility of sites, erosion rates will generally be low.

In conclusion, more research is needed in the juniper woodlands to make any definitive conclusions of the role junipers play in the hydrologic cycle.

Invasive Species

The most significant invasive species in the watershed area is Cheatgrass (Bromus tectorum). Cheatgrass (*B. tectorum*) and downy brome are the two most frequently used common names for this grass in North America. Additional common names include downy chess, early chess, drooping brome, downy cheat, cheatgrass brome, slender chess, downy bromegrass, military grass, broncograss, and Mormon oats. The following is a description of *B. tectorum* as printed in Carpenter and Murray.

B. tectorum is an erect winter-or spring-annual grass. At maturity the foliage and seedheads often become purplish before drying completely and becoming brown or tan. The species grows quickly in the spring and often matures and sets seeds before most other species. It typically grows 50-60 cm (20-24 inches) tall, with a finely divided fibrous root system that may reach a depth of about 30 cm (12 inches). When environmental conditions are poor and/or when grazing animals crop the plants, cheatgrass plants *that reach heights of just 5-10 cm (2-4 in) can still flower and produce viable seed. The stems are erect, slender, and glabrous or may be slightly soft-hairy. The spikelets readily penetrate fur, socks and pants and its seeds may thus be widely dispersed by people and animals.* (Carpenter and Murray, Undated).

B. tectorum typically dies early, thus avoiding the hottest portion of the year. Since the seeds mature early cheatgrass is safe from most wildfires. It uses the nutrients produced from the fire to enhance seed production. It frequently invades landscapes after wildfire, forming dense stands with fine fuels that shorten typical fire intervals. Cheatgrass infested areas burn at a much greater frequency, every 3-5 years. At this frequency, native shrubs and perennial grasses cannot recover and after a few wildfire cycles a cheatgrass monoculture develops. This monoculture further increases the frequency of fires and increases the dominance by cheatgrass in the area (Carpenter and Murray, Undated). Thus *B. tectorum* and wildfire form a positive feedback mechanism that threatens native ecosystems and often impact the rare and endangered species those ecosystems host.

Historic Vegetation vs. Current Vegetation

Historic and current vegetation data was compiled from The Interior Columbia Basin Ecosystem Management Project (ICBEMP) and is summarized in Table 13.1. According to Table 13.1 historic vegetation typically yielded more bunchgrass communities compared to the current vegetation, which supports an increase in exotic forbs/annual grass communities. Vegetation types that have declined from historic landscapes include Agropyron bunchgrass, wheatgrass, Mountain Big Sagebrush, Salt Desert Shrub, and Fescue-bunchgrass. Vegetation types that have increased from historic landscapes include juniper/sagebrush, juniper/woodlands, mountain mahogany, and Big Sagebrush. Exotic forbs/annual grass and cropland/hay/pasture have no historic data; therefore this is the reason for the increase in percentage change.

Table 13.1 Vegetation Types

Vegetation type	Historic % Total	Current % Total	change
Shrub or Herb/Tree Regenerate	0.60	0.09	-0.51
Herbaceous Wetlands	0.00	0.07	0.07
Juniper Woodlands	0.38	0.59	0.21
Juniper / Sagebrush	2.02	3.28	1.25
Shrub Wetlands	0.01	0.00	-0.01
Agropyron Bunchgrass	2.86	0.24	-2.62
Exotic Forbs/Annual Grass	0.00	0.69	0.69
Water	0.24	0.24	0.00
Interior Douglas-fir	0.06	1.29	1.24
Aspen	0.22	0.22	0.00
Interior Ponderosa Pine	0.65	0.07	-0.58
Antelope Bitterbrush/Bluebunch Wheatgrass	0.05	0.00	-0.05

Mountain Mahogany	0.00	0.13	0.13
Mountain Big Sagebrush	21.36	20.50	-0.86
Low Sage	14.67	14.67	0.01
Salt Desert Shrub	9.15	9.00	-0.15
Cropland/Hay/Pasture	0.00	1.49	1.49
Fescue-Bunchgrass	2.05	1.16	-0.89
Big Sagebrush	45.69	46.27	0.58

Grazing Allotments

MSE compiled GIS data from ICBEMP summarizing grazing allotment seasonal usage within the watershed area. Table 13.2 reflects the acreage associated with seasonal grazing usage. For example, 518,345 acres of the 2,643,231 acres represents two seasons of use (e.g. spring and summer). Three seasons of grazing usage per year is the most widely used in the watershed area.

Table 13.2 Allotment Seasonal Usage

Seasons of Use/Year	Acres
0 Seasons/Year	33,443
1 Season/Year	280,917
2 Seasons/Year	518,345
3 Seasons/Year	1,087,119
4 Seasons/Year	473,363
Total	2,393,189[1]

[1]Total number of Acres does not equal study Watershed acreage due to private land ownership

Allotments can be broken down into different grazing systems to promote optimal forage and proper management. The following is a brief summary of grazing allotment management approaches (systems):

Not Regulated

Grazing systems that are not regulated do not have any defined management plan.

High Intensity/Short Duration (HISH)

The basic premise of intensive grazing is that livestock at relatively high stock density, but not necessarily stocking rate, are rotated through areas based on plant growth and recovery time. The goal is to distribute livestock use evenly over the pasture, and reduce regrazing of individual plants.

Deferred System

A simple deferred system delays grazing on specified pastures until the key forage species passes through a critical phenological stage, such as seed set. This reduces the length of the grazing season for deferred pastures and may lead to reduced palatability of forage plants. On the positive side, it provides protection for decreaser species and leads to higher protein levels in the remaining winter forage.

Rest Rotation

Rest rotation grazing is similar to deferred-rotation grazing but it has the addition of a yearlong rest period once during a three year grazing cycle. This yearly rest period ensures establishment of new grass seedlings and allows for buildup of carbohydrate reserves. The deferred grazing system defers grazing on several pasture units in a planned rotation. Reducing selective grazing and overgrazing is achieved by concentrating more livestock on a smaller area and encouraging better overall utilization. Range condition often improves over time with this system, but livestock may gain less than with other systems but gain/acre is higher.

Continuous Grazing
In continuous grazing systems, livestock are turned onto a grazing allotment at the beginning of the grazing season and remain there until the season ends.

Table 13.3 displays the acreage associated with the different grazing systems.

Table 13.3 Grazing Systems

Grazing Systems	Acres
Not regulated	6,659.1
HISH	968.5
Deferred	972,763.6
Rest/Rotational	355,112.9
Rest/Rotational and Deferred	105,928.5
Continuous	700,823.2
Continuous and Deferred	250,933.6
Total	2,393,189.5

Table 13.4 represents acreage associated with different livestock usage. Federal and State lands composed the majority of the study area. The majority of the land (45%) is delegated to cattle usage and the combination of cattle and horses (32%) is the second most utilized animal group.

Table 13.4 Acres/Animal Group

Animal use	Acres
Cattle	1,080,917
Horse/mule	224,096
Cattle, Sheep	7,502
Cattle, Horse/Mule	762,524
Cattle, Sheep, Horse/Mule	19,315
Acres not used	298,835
Total	2,393,189

Allotment assessment summaries

Allotment boundaries for the entire watershed are illustrated in Figure 13-2 with the majority of the acreage located in Oregon. Current and reliable range condition information is available for only a small portion of the study area. This information was derived from summarizing existing allotment assessments from Idaho Bureau of Land Management (BLM) reports. BLM allotment assessments were used to determine rangeland health as reported by proper functioning conditioning (PFC) utilizing Standards 2 and 3 from the Standards for Rangeland Health and Guidelines for Livestock Grazing Management (BLM, 1997). Allotments were summarized by acres, date reported, seasonal use/type, stream names, PFC rating for each stream within the allotment, median stubble height, and AUM's. Figure 13-3 displays the PFC ratings for each allotment assessed. In Idaho, the majority of the areas assessed in the allotments rated as Functioning At Risk (FAR) with limited areas rating as PFC. Areas denoted on Figure 13-3 with hatch markings recognize multiple ratings (FAR/PFC/NF). Areas marked as NA did not have streams on the allotments or were not assessed. See appendix A for a complete list of allotment assessment summaries.

Fire

Fire regime

Sagebrush in general is intolerant to fire. Most species and subspecies of sagebrush do not resprout, and therefore must regenerate from seed. This suggests that, in general, sagebrush is not well-adapted to fire. Only *A. tripartita, A. cana* and *Artemisia tridentata vaseyana (*form *spiciformis*) can resprout from root crowns or lower stem bases after being top-killed by fire (Winward 1985). The ability of most *Artemisia* species to maintain themselves over time, where the natural fire regime has not been altered due to invasion by cheatgrass or other weeds in spite of periodic burning, however, suggests that *Artemisia* might be considered fire-tolerant (Winward 1985). Historically, fire return intervals were 12-15 years for mountain big sagebrush *(A. t. vaseyana)* (Miller and Rose 1999) and 60-110 years or longer for other taxa, such as Wyoming big sagebrush *(t. wyomingensis)* on the driest sites (Whisenant 1990, Peters and Bunting 1994). Some low sagebrush (*A. arbuscula* ssp. *arbuscula*) sites probably never burned because they never had enough fuel to carry a fire under any conditions. Cheatgrass invasion has drastically changed the burning schedules. Return intervals in cheatgrass-dominated landscapes are under five (5) years (Whisenant 1990). On these sites, sagebrush can quickly be eliminated, especially if a second fire occurs before new plants can produce seed (4-6 years).

Historic vs. Recent Fire

Data for historic fire regimes is extremely limited. In the Meadow Creek subwatershed of the Jordan 4th Field HUC data reported from ICBEMP states that there is some historic evidence of fires based on data recovered from fire scars. It appears that the fires occurred during 1695, 1755, 1765, 1785, 1825, 1845, 1885, 1895, and 1905. In the Pleasant Valley Creek subwatershed of the Middle Owyhee 4th Field HUC historic evidence retrieved from fire scars indicates that fires burned in that area during 1715, 1775, 1795, 1825, 1845, 1853, 1857, 1885, and 1915. Figure 13-3 illustrates the recent fire locations within the study area.

Data Gaps

Information from private landowners was the biggest data gap that was encountered. Without this information summaries/conclusions could not be made regarding irrigation practices, cultivation methods, acres devoted to cultivation etc. Allotment assessments were also a limiting factor. Information contained within the assessments was not consistent throughout and was difficult to summarize. Oregon allotment assessments were not currently summarized but
information is expected. Historic and current fire data was also limiting.

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Appendix 13A—Allotment Assessments

Allotment/ Pasture	Hydrologic Unit Code	Acres	Date	Seasonal use/Type	Stream(s)	PFC Rating	Median Stubble Height	AUM's
Indian Creek (0649)		5,181	Oct-02	Su	Bogus Ck	**FAR**	NA	568
Indian Meadows (0520)								
Pasture 1		14,376	Oct-02	Su	Mill Ck, William's Ck	Mill Ck-**FAR**, William's Ck-**FAR**	Mill Ck=<1", William's Ck= <1"	254-745
Pasture 2		5,017		Su	Noon Ck., N.Fk Owyhee R., Current Ck.	Noon-**1/2 NF, 1/2 FAR** NF Owyhee **FAR**, Current Ck- **NF**	NF Owyhee=2.5"-5.0"	218-241
Pasture 3		367						
Stone (0650)		797	Oct-02	Def/Fall	South Fork Boulder Ck	PFC	1-5"	59
Howl Creek (0655)		2,031	Oct-02	Sp/Fall	none	NA	NA	12
Johnstone (0618)								
Pasture 1		3,810	Oct-02	Fall	Coyote Ck	NA	NA	52
Pasture 2		1,533		Fall	Coyote Ck	NA	NA	
Staples (0610)		315	Oct-02	Sp,Su	NA	NA	NA	33
Jump Creek (0570)								
Pasture 1		10,397	May-03	Su/Fall	Jordan Ck, China Ck, E Fk Reynolds Ck, Blue Ck	Jordan Ck-**FAR**, China Ck-**FAR**, E Fk Reynolds Ck-**FAR**, Blue Ck-**FAR**	Jordan Ck=2-8.5" China Ck=5.5"	1,175
Pasture 2		7,502		Su	Jacobs Ck, Last Chance Gulch, Slaughterhouse Ck	Jacobs Ck-**FAR**, Last Chance Gulch-**FAR** Slaughterhouse Ck-**FAR**	Jacobs Ck=<4" Last Chance Gulch=8.5	
West Antelope (0574)								
Pasture 1		3,357	Jul-02	Def	Rock Cr, Rose Ck, Triangle Ck, N. Boulder Ck	Rock Ck-**FAR**, Rose Ck-PFC, Triangle Ck.-**FAR**, N. Boulder Ck-**PFC**	Rock Ck-=0-8.5" Triangle Ck=heavy/severe Rose Ck- NA	2,603
Pasture 2		5,809		Def				
Pasture 3		2,675		Def				
Miller FFR (0575)		4,249	Jul-02	Fall	Rock Cr, Rose Ck, Josephine Ck	Rock Ck-**FAR**, Rose Ck-**PFC**, Josephine Ck- **FAR**	Rock/Rose=0-2" Josephine Ck=NA	54
Boone Peak (0589)		14,960	Jul-03	Su/Fall	N. Boulder Ck, Bridge Ck, Pickett Ck	N. Boulder Ck- **FAR**, Bridge Ck- **FAR**, Pickett Ck- **FAR**	N. Boulder Ck= 6", Bridge Ck-4", Pickett Ck=1"	2,094
Bridge Creek (0590)		2,571	Jul-03	Sp	N. Boulder Ck, Bridge Ck	N. Boulder Ck- **FAR**, Bridge Ck-**FAR**	N. Boulder Ck=2", Bridge Ck=1-4"	664
Quicksilver FFR (0483)								
Pasture 1		666	Jul-03	Fall	None	None	Na	12
Pasture 2		1,916		Sp	N. Boulder Ck, Bridge Ck	N. Boulder Ck- **FAR**, Bridge Ck-**FAR**	N. Boulder Ck=2", Bridge Ck=1-4"	
Pasture 3		721		Sp				
Pasture 4		904		Fall	None	None	NA	

Appendix 13A—Allotment Assessments

Allotment/ Pasture	Hydrologic Unit Code	Acres	Date	Seasonal use/Type	Stream(s)	PFC Rating	Median Stubble Height	AUM's
45 Allotment (0629)								
1-Winter Pasture		36,365	Sep-00	Winter	Sf Owyhee, Spring Ck, Nf Spring Ck	Sf Owyhee-**PFC**, Spring Ck-**PFC,** Nf Spring Ck-PFC-**FAR**	NA	2,400
2-Summer Pasture		21,567		Su				
3-Spring Ck. Basin		5,489		Sp/Su				
4-Juniper Basin		2,014		NA				
Silver City (0569)								
1-Briar		4,750	Jun-03	Sp	Rabbit Ck, Gerdie Ck	All Streams rated **FAR**	NA	8,703
2-Striker		5,408		Sp				
3-Diamond		5,104		Sp				
4-Gurdy		4,139		Sp				
5A- Silver City		24,015		Su/Fall	Cosmopolitan Ck, Horse Ranch Ck, N. Fk. Sinker Ck, Presby Ck, Jordan Ck, Scotch Ck			
5B-South Sinker		15,371		Su/Fall	Oro Fino Gulch, Pedracini Fk, Gerdie Ck, Bates Ck, S Fk Sinker Ck,			
Con Shea (0571)								
Pasture 1		1,625	Jun-03	Winter	Snake River	Snake River-**PFC**	NA	990
Pasture 2		9,874		Winter	NA	NA		
Pasture 3		809		Sp	Sinker Ck	Sinker Ck-**PFC**		
Pasture 4		570		Sp				
Pasture 5		484		Winter	NA	NA		
Joyce FFR (0487)								
1-Sinker Creek Ranches		5,149	Jun-03	Sp	Sinker Ck	Sinker Ck-**PFC**	NA	87
2-Bates Creek Field		1,934		Su/Fall	Bates Ck	NA		
Murphy FFR (0486)		306	Jun-03	Sp	NA	NA	NA	5
Bull Basin (0540)								
Pasture 1		16,673	Sep-01	NA	Bear Ck, Bull Basin Ck, Buck Springs Ck, Cottonwood Spring Ck, Granite Spring Ck, Cow Ck, Mid Fk Owyhee, Petes Ck, Summit Ck, West Red Canyon Ck	Bear Ck-**FAR**, Bull Basin Ck-**FAR**, Buck Springs Ck-**FAR**, Cottonwood Spring Ck-**FAR**, Granite Spring Ck-**FAR**, Cow Ck-**PFC**, Mid Fk Owyhee-**NF-FAR**, Petes Ck-**FAR-PFC**, Summit Ck-**FAR**, West Red Canyon Ck- **FAR-PFC**	NA	3,932
Pasture 2		15,769	Sep-01	NA	Buck Springs Ck, Bull Basin Ck, Cow Ck, Pete's Ck. Red Canyon Ck	Buck Springs Ck-**FAR**, Bull Basin Ck-FAR-**FAR-PFC**, Cow Ck-**FAR**, Pete's Ck-**FAR-PFC**, Red Canyon Ck-**FAR**	NA	3,932

Appendix 13A—Allotment Assessments

Allotment/ Pasture	Hydrologic Unit Code	Acres	Date	Seasonal use/Type	Stream(s)	PFC Rating	Median Stubble Height	AUM's
Bull Basin (0540)								
Pasture 3		17,827	Sep-01	NA	Berry Gulch, Dukes V Ck	Berry Gulch-**FAR**, Dukes V Ck-**FAR-PFC**	NA	3,932
Louse Creek (0580)								
Pasture 1		15,935	Jun-03	Su/Fall	Louse Ck, Sawmill Ck, Washington Gulch	Louse Ck-**FAR**, Sawmill Ck-**FAR**, Washington Gulch-**FAR**	Louse Ck-(top) 18.0" (mid) 2.0" (low) 4.5"	3,084
Pasture 3		2,134		Rest/Rotation	Jordan Ck	Jordan Ck-**PFC**	4.0"	
Pasture 5		6,262		Rest/Rotation	Duck Ck, Goose Ck, E. Fk Goose Ck	Duck Ck-**FAR**, Goose Ck-**PFC**, E. Fk Goose Ck-**FAR**	NA	
Pasture 6		3,216		Rest/Rotation	Washington Gulch	Washington Gulch-**FAR**	NA	
Louse Creek FFR (0658)								
Pasture 1		769	Jun-03	NA	NA	NA	NA	219
Pasture 2		2,578			Jordan Ck	Jordan Ck-**FAR-PFC**		
Pasture 3		377			NA	NA		
Goose Ck (0582)		958	Jun-03	NA	NA	NA	NA	43
Anderson FFR (0454)		1,650	Feb-00	Continuous	Dougherty Ck	Dougherty Ck-**FAR**	NA	121
Gusman (0554)								
Pasture 1		3,422	Dec-00	NA	Stonehouse Ck, Connor's Canyon Ck	Stonehouse Ck-NA, Connor's Canyon Ck-**FAR**	NA	1,304
Pasture 1A		2,908						
Pasture 2		4,535			Jordan Ck, Wood Canyon Ck, E. Fk Goose Ck, W. Fk Goose Ck	Jordan Ck-**FAR**, Wood Canyon Ck-**FAR**, E. Fk Goose Ck-**FAR**, W. Fk Goose Ck-**FAR**		
Pasture 3		6,405			W. Fk Trout Ck, E. Fk Trout Ck, Nichols Fk Trout Ck, Cottonwood Ck, Split Rock Ck, Big Spring Ck	W. Fk Trout Ck-**FAR**, E. Fk Trout Ck-**FAR**, Nichols Fk Trout Ck-**FAR**, Cottonwood Ck-**FAR**, Split Rock Ck-**FAR**, Big Spring Ck-NA		

Appendix 13A—Allotment Assessments

Allotment/ Pasture	Hydrologic Unit Code	Acres	Date	Seasonal use/Type	Stream(s)	PFC Rating	Median Stubble Height	AUM's
Pole Creek (0635)								
Pasture 1		21,529	NA	NA	Helen Ck, Peach Ck, Dukes Hole Ck, Lunch Ck, Scott Ck, Big Willow Ck, Pole Ck, Little Willow Ck, Two Springs Ck, CCC Spring Ck, Scott Spring Ck, Dutcher Ck, Mid Fk Owyhee	Helen Ck-**FAR**, Peach Ck-**FAR**, Dukes Hole Ck-**FAR**, Lunch Ck-NA, Scott Ck-NA, Big Willow Ck-NA, Pole Ck-**FAR-PFC**, Little Willow Ck-**FAR-PFC**, Two Springs Ck-**FAR**, CCC Spring Ck-**FAR**, Scott Spring Ck-**FAR**, Dutcher Ck-NA, Mid Fk Owyhee-**NF,FAR,PFC**	Mid Fk Owyhee R.=1.5-2.0" Pole Ck=2.5" Scott Ck=2.0"	1,515
Pasture 2		1,401			Squaw Ck, Dutcher Ck	Squaw Ck-**PFC**, Dutcher Ck-NA	Squaw Ck=2.0"	
Pasture 3		1,549			Berry Gulch	Berry Gulch-**FAR-PFC**	NA	
Cliffs (0501)								
1-Cherry Creek		1,660	Feb-00	Sp/Su	NA	NA	NA	1,969
2-Lower Cliffs		9,701		Su/Fall	Cabin Ck, Corral Ck, Dougherty Ck, Juniper Ck, N. Fk Owyhee R.	Cabin Ck-**FAR-PFC**, Corral Ck **FAR-PFC**, Dougherty Ck-**FAR**, Juniper Ck-**FAR-PFC**, N. Fk Owyhee R.-**FAR-PFC**	Cabin Ck=2.0-3.5" Corral Ck (crossing)=2.0-4.0" Corral Ck (lower)=3.0-3.5" Juniper Ck=1.2-3.0"	
3-Upper Cliffs		10,270		Su/Fall	Bangeshea Ck, Big Springs Ck, Noon Ck	Bangeshea Ck-**FAR**, Big Springs Ck-**FAR-PFC**, Noon Ck-**FAR-PFC**		
Hanley FFR (0453)		661	Jul-01	Continuous	NA	NA	NA	7
Squaw Creek FFR (0611)		1,438	May-01	Continuous	Helen Ck, Squaw Ck	No assessments done	NA	35
Pleasant Valley (0546)								
Pasture 1		2,463	May-01	Continuous	Cottonwood Ck, Pleasant Valley Ck, N.Fk Owhyee R.	Cottonwood Ck-**FAR**, Pleasant Valley Ck-**FAR-PFC**, N.Fk Owhyee R-**PFC**.	NA	949
Pasture 2		5,807		Continuous	Pleasant Valley Ck, N.Fk Owhyee R.	Pleasant Valley Ck-**FAR-PFC**, N.Fk Owhyee R-**PFC**.		
Pasture 4		4,100		Continuous	Cottonwood Ck, Pleasant Valley Ck	Cottonwood Ck-**FAR**, Pleasant Valley Ck-**FAR-PFC**		
South Mountain Area (0561)		17,418		Sp/Su	Corral Ck, Cabin Ck, Corral Trib, Cabin Trib, Lone Ck	All Streams Rated **FAR**	Corral Ck=1.5-3.0"	745

Appendix 13A—Allotment Assessments

Allotment/ Pasture	Hydrologic Unit Code	Acres	Date	Seasonal use/Type	Stream(s)	PFC Rating	Median Stubble Height	AUM's
Trout Springs (0539)								
Pasture 1		12,518	Jul-00	Sp/Su	Squaw Ck, Hells Ck, Salt Ck, Mid Fk Owyhee, Granite Springs Trib, Smith Ck, Little Smith Ck, Thomas Ck, W. Fk Red Canyon	Squaw Ck-**FAR**, Hells Ck-**FAR**, Salt Ck-**PFC**, Mid Fk Owyhee-**FAR**, Granite Springs Trib-**FAR**, Smith Ck-**FAR**, Little Smith Ck-**FAR**, Thomas Ck-**FAR**, W. Fk Red Canyon-**FAR**	Mid Fk Owyhee=2.0" W.Fk Red Canyon=1.5	2,927
Pasture 2		12,016		Sp/Su	Cottonwood Ck, Grave Ck, Squaw Ck,Twin Springs Ck, N. Fk Owyhee	Cottonwood Ck-**FAR-PFC**, Grave Ck-NA, Squaw Ck-**FAR**,Twin Springs Ck-**NF**, N. Fk Owyhee-**FAR-PFC**	N.Fk Owyhee=4.25" Cottonwood Ck=2.0"	
Pasture 3		3,402		Sp/Su	Little Thomas Ck, Twin Springs Ck, Pleasant Valley Ck, Payne Cabin Ck, Payne Cabin Ck Trib, Squaw Ck	Little Thomas Ck-**FAR**, Twin Springs Ck-**FAR**, Pleasant Valley Ck-**FAR**, Payne Cabin Ck-**NF**, Payne Cabin Ck Trib-**FAR**, Squaw Ck-**FAR**	Pleasant Valley Ck=1.5" Payne Cabin Ck=1.5"	
Pasture 4		1,754		Sp	Squaw Ck	Squaw Ck-**PFC**	NA	
Nickel Creek (0548)								
2-Stoneman		4,717	Jul-03	Sp	*Streams associated with Spring Pastures-* Stoneman Ck, Current Ck, Beaver Ck, Castle Ck	26% Rated as **PFC** 74% Rated as **FAR** (2 reaches of Current Ck were located in rocky confined canyons)	Beaver Ck=8.0" Castle Ck= 3.0" Current Ck=3.1-12.0" Stoneman Ck=2.2-6.0"	5,756
16A-Star Table		2,016						
16B-Castro Table		3,172						
20-School Section		1,302						
22-Rock Field		423						
23-Airport Field		1,256						
1-Battleground		8,850		Sp/Su	*Streams associated with Summer/Spring Pastures-* N. Fk Owyhee, Don's Ck, Nickel Ck, Hidden Valley Ck, Castle Ck, Deep Ck	66% Rated as **FAR** 33% Rated as **PFC** (PFC rated reaches generally in rocky canyons with limited access to riparian vegetation)	NA	
3-Beaver Dam		1,109						
5-Spring Field		2,316						
8-Boni		11,307						
18- Ben Mills		3,193						
7-Fall Field		7,832		Su	*Streams associated with Summer Pastures-* Smith Ck, Thomas Ck, Little Thomas Ck, Skunk Ck, Jobe Ck, Castle Ck	86% Rated as **FAR** 14% Rated **PFC** (PFC rated reaches generally in rocky canyons with limited access to riparian vegetation)	Smith Ck=3.0" Castle Ck=2.0" Thomas Ck=2.5"	
13-Castle Creek		1,567						
17-Big Field		2,424						
10-Upper Smith Creek		1,045		Fall	*Streams associated with Fall Pastures-* Smith Ck, Little Smith Ck	68% Rated as **PFC** 32% Rated as **FAR**	Smith Ck=2.0" Castle Ck=2.0"	

Appendix 13A—Allotment Assessments

Allotment/ Pasture	Hydrologic Unit Code	Acres	Date	Seasonal use/Type	Stream(s)	PFC Rating	Median Stubble Height	AUM's
Nickel Creek (0548)								
26A-Sheep Hills		5,586	Jul-03	Spring Rest/ Rotation	*Streams associated with Spring Rest Rotation*- Porcupine Ck, Trap Ck,	75% Rated as **PFC** 25% Rated as **FAR** (other springs and streams are accessible but were not assessed for Proper Functioning Condition)	NA	5,756
26B-Sheep Hills		6,833						
27-Brace Flat		7,593						
Nickel Creek FFR (0657)								
4-Boni Ranch		1,214	Jul-03	Continuous	NA	NA	NA	109
6-Brooks Meadow		320			Deep Ck	NA		
9-Wilson Field		1,029			NA	NA		
11-Smith Ck		1,472			Smith Ck	Smith Ck-**FAR**	Smith Ck=2.0"	
14-Jack Wilson/Star Meadow		1,494			NA	NA	NA	
19-Castro #1 & 2		423			Castle Ck	Castle Ck-NA	Castle Ck=2.0"	
21-Wiseman		671			Deep Ck	Deep Ck-**PFC**	NA	
24-Brace Ranch		880			NA	NA		
25-Twin Spring		592			Porcupine Ck	Porcupine Ck-NA		
Jordan Valley (0592)		323		Sp/Su	NA	NA	NA	30
Long Valley (0502)								
Pasture 1		1,873	Jun-03	Sp/Su	Josephine Ck	Josephine Ck-**FAR**	Josephine Ck=1.5->4.0"	1,084
Pasture 2		1,907						
Flint Creek (0503)								
Pasture 1		19,274	Jun-03	Su/Fall	Deer Ck, Flint Ck, French Ck, Mammoth Ck, Twilight Ck, East Ck	All Streams Rated **FAR**	Flint Ck=3.0-4.5"	2,475
Pasture 2		205						
Old Man (0564)		913		Sp	Old Man Ck	Old Man Ck-**FAR**	NA	115

Appendix 13A—Allotment Assessments

Allotment/ Pasture	Hydrologic Unit Code	Acres	Date	Seasonal use/Type	Stream(s)	PFC Rating	Median Stubble Height	AUM's
Upper Deer Ck (0630)								
Pasture 1		392	Jun-03	Rest/Rotation	No Streams	No Streams	NA	787
Pasture 2		1,360						
Pasture 3		1,474						
Pasture 4a		823			Deer Ck, North Boulder Ck	Deer Ck-**PFC**, North Boulder Ck-**FAR**	N.Boulder Ck=10.0"	787
Pasture 4b		802			Big Boulder Ck, Deer Ck, N. Boulder Ck	Big Boulder Ck-**FAR**, Deer Ck-**PFC**, N. Boulder Ck-**PFC**		
Lower Deer Creek (0631)								
Pasture 1		977	Jun-03	Rest/Rotation	Big Boulder Ck	Big Boulder Ck-**FAR**	NA	126
Pasture 2		764			Big Boulder Ck	Big Boulder Ck-**FAR**		
Pasture 3		746			Big Boulder Ck, Deer Ck	Big Boulder Ck-**FAR**, Deer Ck-**PFC**		
Kershner FFR (0632)								
Pasture 1		527	Jun-03	Continuous	NA	NA	NA	63
Pasture 2		348						
Bahem FFR (0633)								
Pasture 5,6		527	Jun-03	Continuous	NA	NA	NA	52
Pasture 7		348						
Quintana Indiv (0465)								
Pasture 1		1,120	Jun-03	Continuous	North Boulder Ck	North Boulder Ck-**PFC**	NA	38
Pasture 2		4,852						

PFC-Proper Functioning Conditioning
NF-Non Functioning
FAR-Functioning at Risk
AUM's-Animal Unit Months
DEF-Deferred Grazing system
Sp-Spring
Su-Summer
NA-Not available

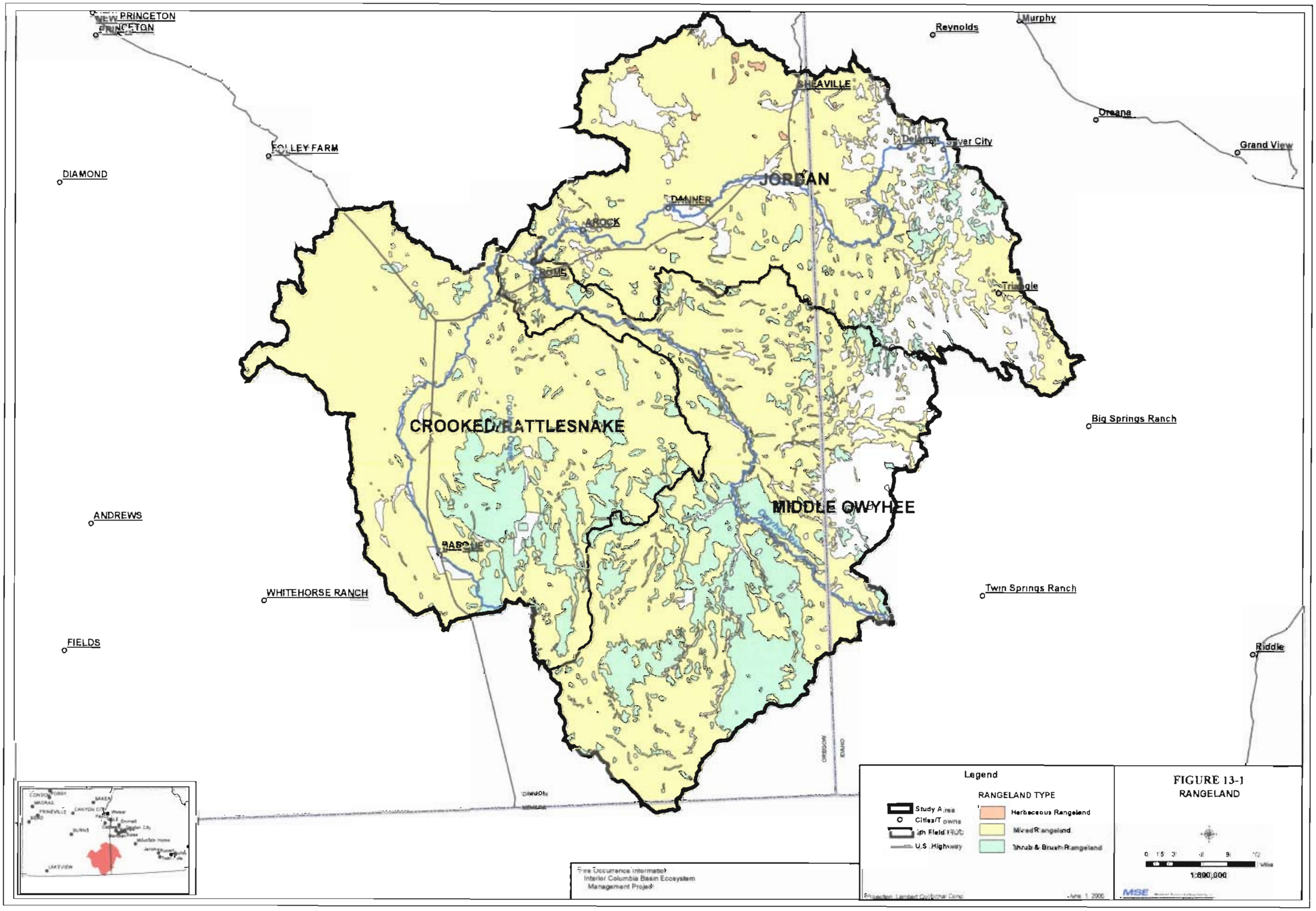
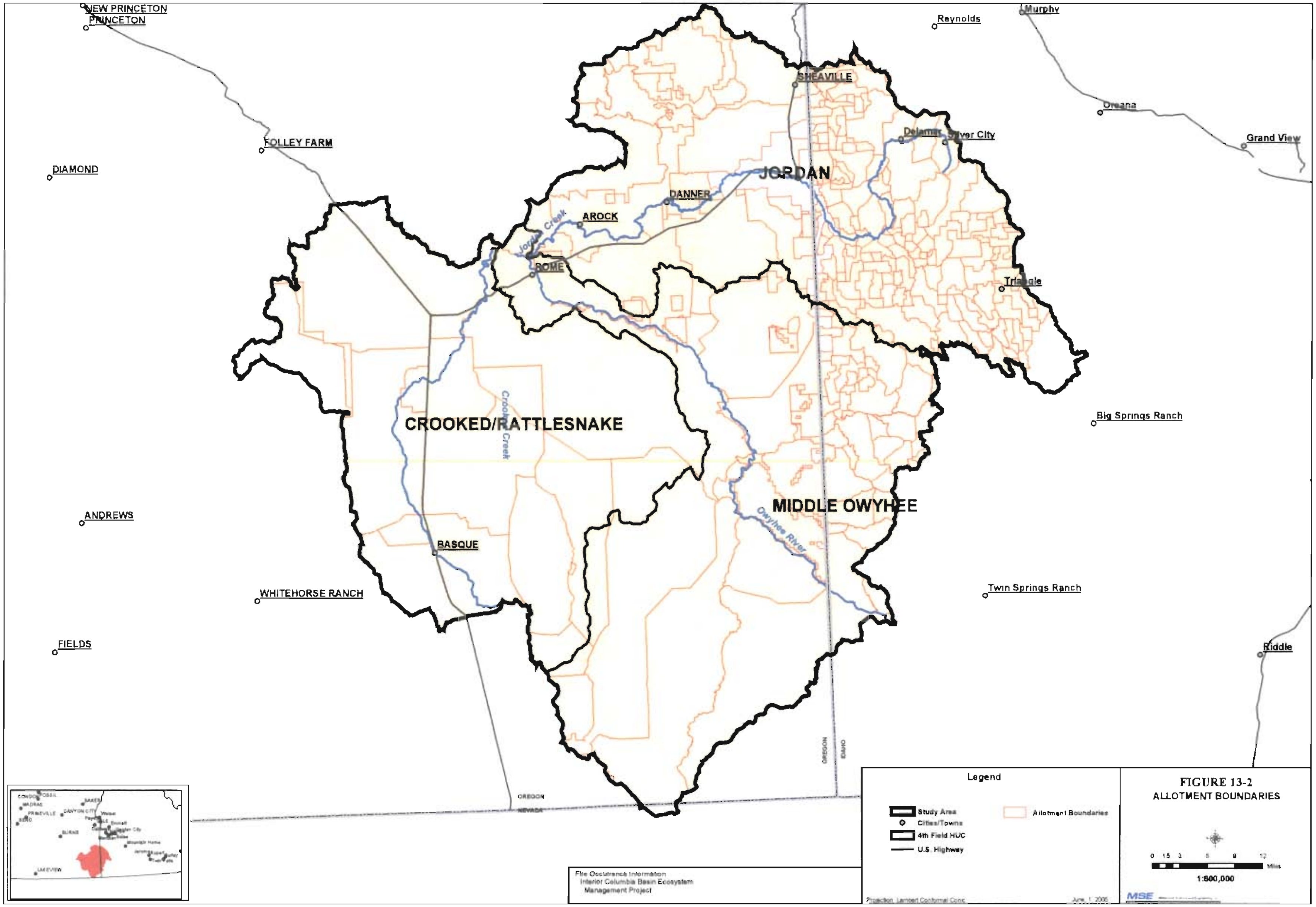


FIGURE 13-1
RANGELAND



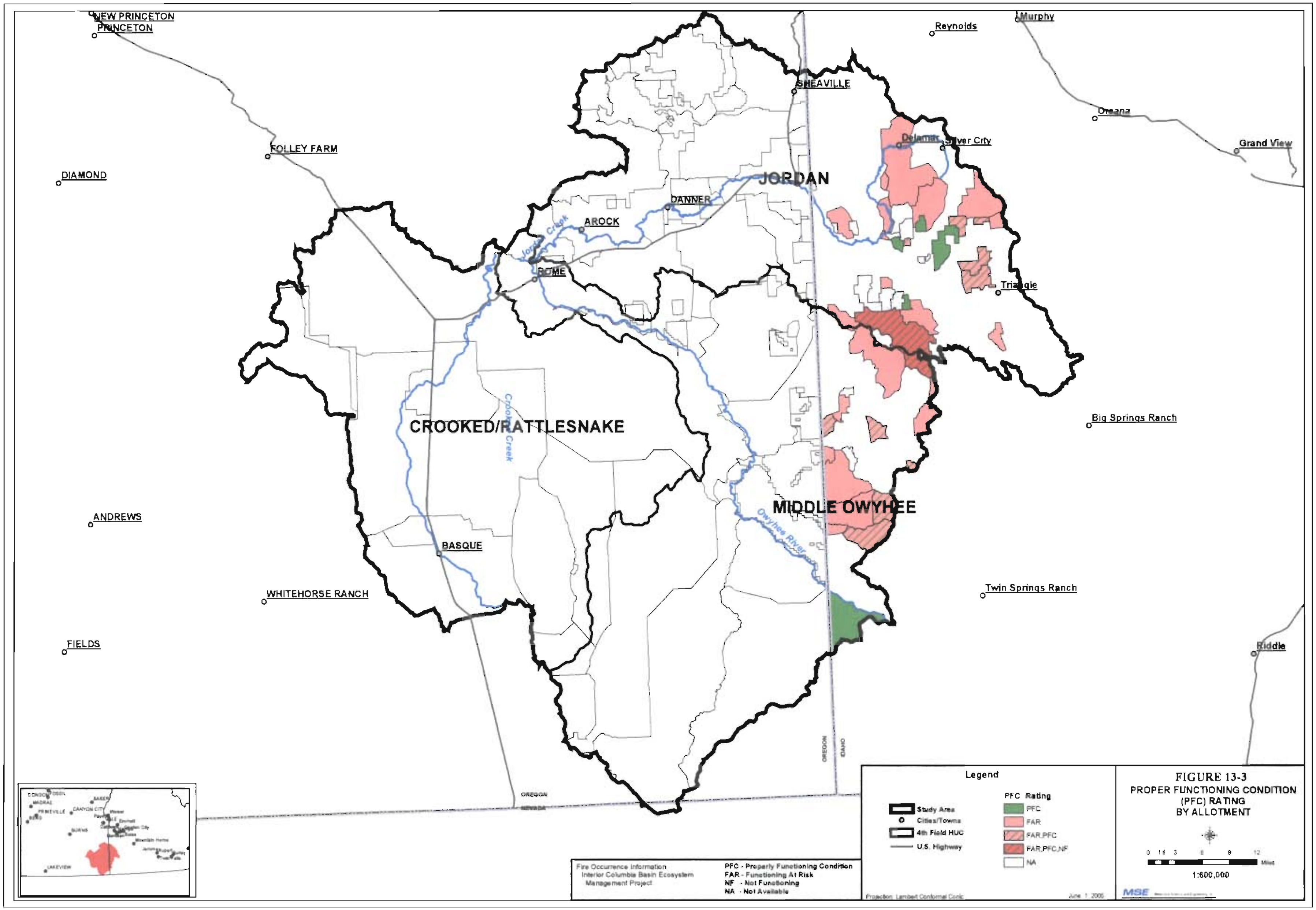
Fire Occurrence Information
Interior Columbia Basin Ecosystem
Management Project

FIGURE 13-2
ALLOTMENT BOUNDARIES

Projection: Lambert Conformal Conic

June 1, 2006

MSE


NEW PRINCETON
PRINCETON
FOLLEY FARM
DIAMOND
ANDREWS
FIELDS
WHITEHORSE RANCH
BASQUE
CROOKED/RATTLESNAKE
Crooked Creek
Jordan Creek
AROCK
DANNER
ROME
JORDAN
SHEAVILLE
Reynolds
Murphy
Oreana
Grand View
Silver City
Triangle
Big Springs Ranch
MIDDLE OWYHEE
Owyhee River
Twin Springs Ranch
Riddle
OREGON
IDAHO
NEVADA
Legend
Study Area
Cities/Towns
4th Field HUC
U.S. Highway
PFC Rating
PFC
FAR
FAR,PFC
FAR,PFC,NF
NA
Fire Occurrence Information
Interior Columbia Basin Ecosystem
Management Project
PFC - Properly Functioning Condition
FAR - Functioning At Risk
NF - Not Functioning
NA - Not Available
FIGURE 13-3
PROPER FUNCTIONING CONDITION
(PFC) RATING
BY ALLOTMENT
1:600,000
Miles
MSE

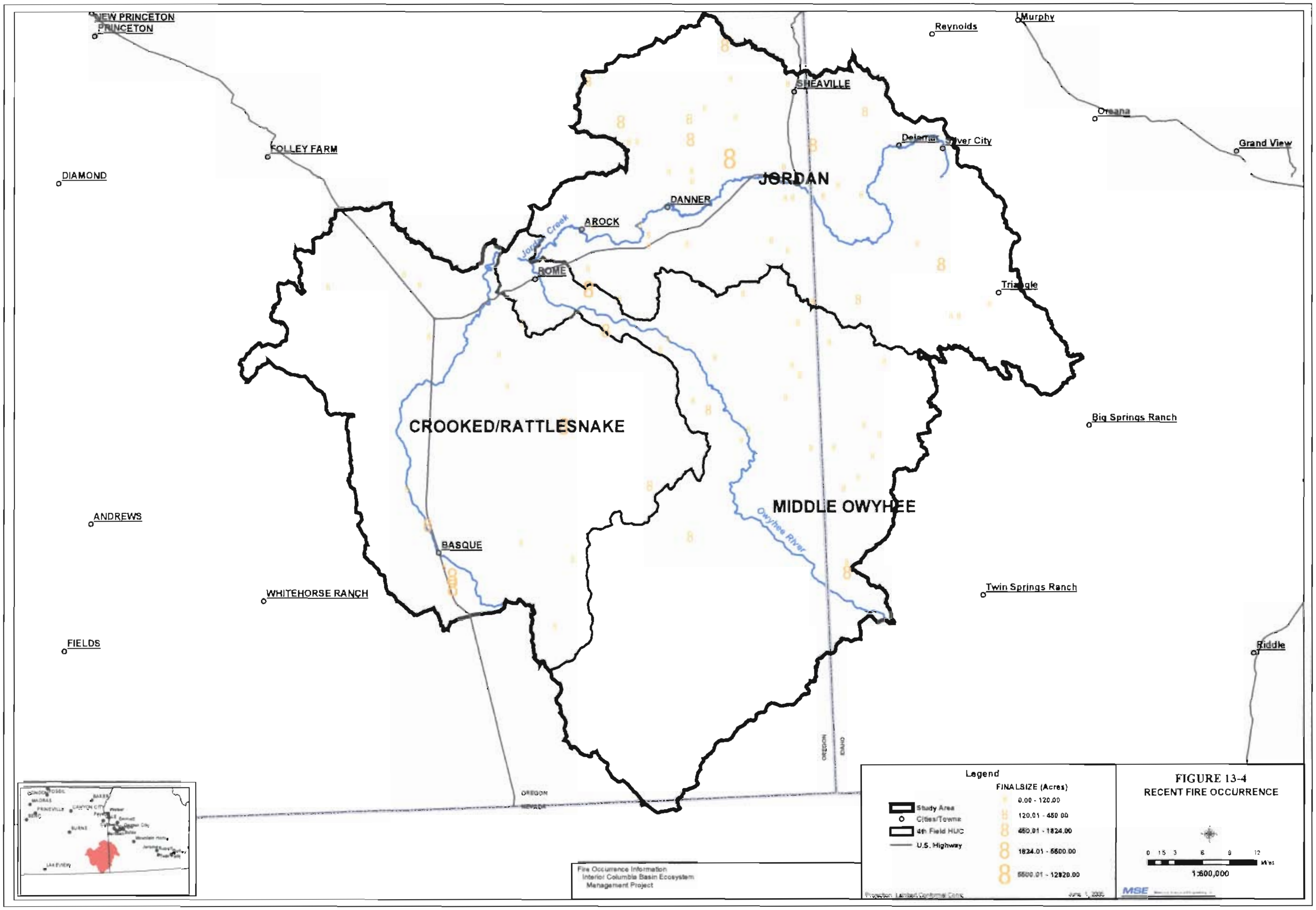


FIGURE 13-4
RECENT FIRE OCCURRENCE

COMPONENT 14—GEOLOGY

The Owyhee River watershed is within the Owyhee Uplands Physiographic Province of southeastern Oregon. The Owyhee Uplands area is characterized by an erosional landscape where a high elevation plateau has been dissected by the downcutting action of the Owyhee River and its tributaries (Figure 14-1). Successive layers of primarily volcanic rocks dominate the geology. Erosional processes that have carved deep river canyons in the area have exposed these various layers. The geology of the area has great impact on watershed characteristics through both the erosional characteristics of the bedrock and geochemistry of the deposits.

The significant geology of the region began developing approximately 100 million years ago, when the western edge of the continental margin was located along what is now the Oregon–Idaho border. As oceanic crust moved northeast relative to the continental crust, it was subducted under the western edge of the continent. A series of islands and miniature continents were scraped off the oceanic crust and attached to the continental crust. The remnants of these former islands form the Blue and Wallowa Mountains of eastern Oregon. As the continent grew, the plate subduction zone shifted further west. The area of eastern Oregon became fairly stable, with periods of erosion and deposition interspersed with occasional volcanic activity. During the Cretaceous Period (approximately 70 million years ago), heat generated by the subduction of oceanic crust caused large masses of magma to rise under the continent. These igneous intrusions occurred along the eastern portion of the Owyhee Uplands, and the magma cooled and crystallized as granite beneath the surface to form the core of the Owyhee Mountains in southwestern Idaho (Alt and Hyndman 1993).

Volcanism in eastern Oregon changed dramatically approximately 17 million years ago, when large flood basalts covered much of the Columbia Basin region. The massive basalt flows erupted along north–trending fissures that paralleled the ancestral edge of the continent. The Columbia Basalt flows inundated much of central and eastern Oregon (as well as Washington and western Idaho). In the Owyhee region these flows are referred to as Owyhee Basalt. During the Miocene (approximately 14 million years ago), large lake basins formed in the area behind basalt flow dams and filled primarily with fluvial and lacustrine (river and lake) sediments of fine-grained tuffaceous sand-, silt-, and mudstones. Several extensive sedimentary deposits were formed during this time, including the Sucker Creek, Deer Butte, and Grassy Mountain Formations, as well as thick sequences of tuffaceous sediments exposed in the Rome area (identified as Qs, Ts and Tts on Figure 14-2). These sedimentary deposits were interbedded with and subsequently overlain by basalt and rhyolite lava flows and ash-flow tuffs. The thickness of the volcanic deposits varies significantly across the region, allowing the underlying sedimentary rocks to be exposed in some areas. Recent volcanism also occurred in the region during the Pleistocene (approximately 10,000 years ago) with eruptions of basaltic lava at Jordan Craters (Gray and others, 1983; Kittleman and others, 1965; Kittleman, 1973).

Structurally, the Owyhee Uplands area is characterized by an area of broad uplift of a relatively featureless plateau. Basin and range topography characterized by linear basins and fault-block mountains is generally limited or subdued and is present along the headwaters of Crooked Creek to the south, Steens Mountain to the west and the Owyhee Mountains to the east. The predominate structural feature of the area is a high elevation, uplifted plateau that has created a dissected landscape of steep-walled river canyons (Gray and others, 1983; Kittleman and others, 1965).

The geology of the Owyhee Uplands can have a significant effect on regional water quality. Drainages eroding through lacustrine deposits may experience naturally elevated levels of phosphorus as natural deposits are re-mobilized. Figure 14-2 displays the location of mapped lacustrine and fluvial deposits exposed at the surface. These areas are concentrated around Rome and Jordan Valley. In addition, streams draining the historic mining districts of the Owyhee Mountains (*e.g.* Jordan Creek) may also experience elevated concentrations of metals due to naturally elevated background levels as well as the anthropogenic effects of recent mining activities. Geochemical studies for wilderness study areas in the Owyhee Uplands indicate that mercury–bearing ores (cinnabar) are present in the Steens Mountain and Pueblo Mountain area. Anomalous levels of mercury were also identified throughout the region (Gray and others, 1983).

Sediment generation is also strongly related to watershed geology. More resistant rock types such as basalt and rhyolite are eroded to form the characteristic steep walled cliffs and river canyons of the Owyhee Uplands. These more resistant rock types usually generate less fine–grained sediment. Weakly cemented alluvial deposits (lake and stream sediments) and volcanic ash and tuff deposits are more easily eroded (scoured) and can generate significant fine–grained sediment. As displayed on Figure 14-2, the rock types around Rome and Jordan Valley typify these more erodible deposits. Canyon areas along the Owyhee River, south of Rome, also display landslide deposits (identified on Figure 14-2 as Qls). These are likely the result of slope failure of weakly consolidated sedimentary deposits, and can result in temporary massive sediment influx into surface water.

REFERENCES CITED

Alt and Hyndman, 1993, *Roadside Geology of Idaho*, Mountain Press Publishing Company, Missoula, 388p.

Gray, J.J., N.N. Peterson, J. Clayton, and G. Baxter, 1983, *Geology and Mineral Resources of 18 BLM Wilderness Study Areas Harney and Malheur Counties, Oregon*, State of Oregon Department of Geology and Mineral Industries Open-File Report 0-83-2, 105p.

Kittleman, L.R., 1973, *Guide to the Geology of the Owyhee Region of Oregon*, Bulletin No. 21 of the Museum of Natural History, University of Oregon, 56p.

Kittleman, L.R., A.R. Green, A.R. Hagood, A.M. Johnson, J.M. McMurray, R.G. Russell, D.A. Weeden, 1965, *Cenozoic Stratigraphy of the Owyhee Region, Southeastern Oregon*, Bulletin No. 1of the Museum of Natural History, University of Oregon, 43p.

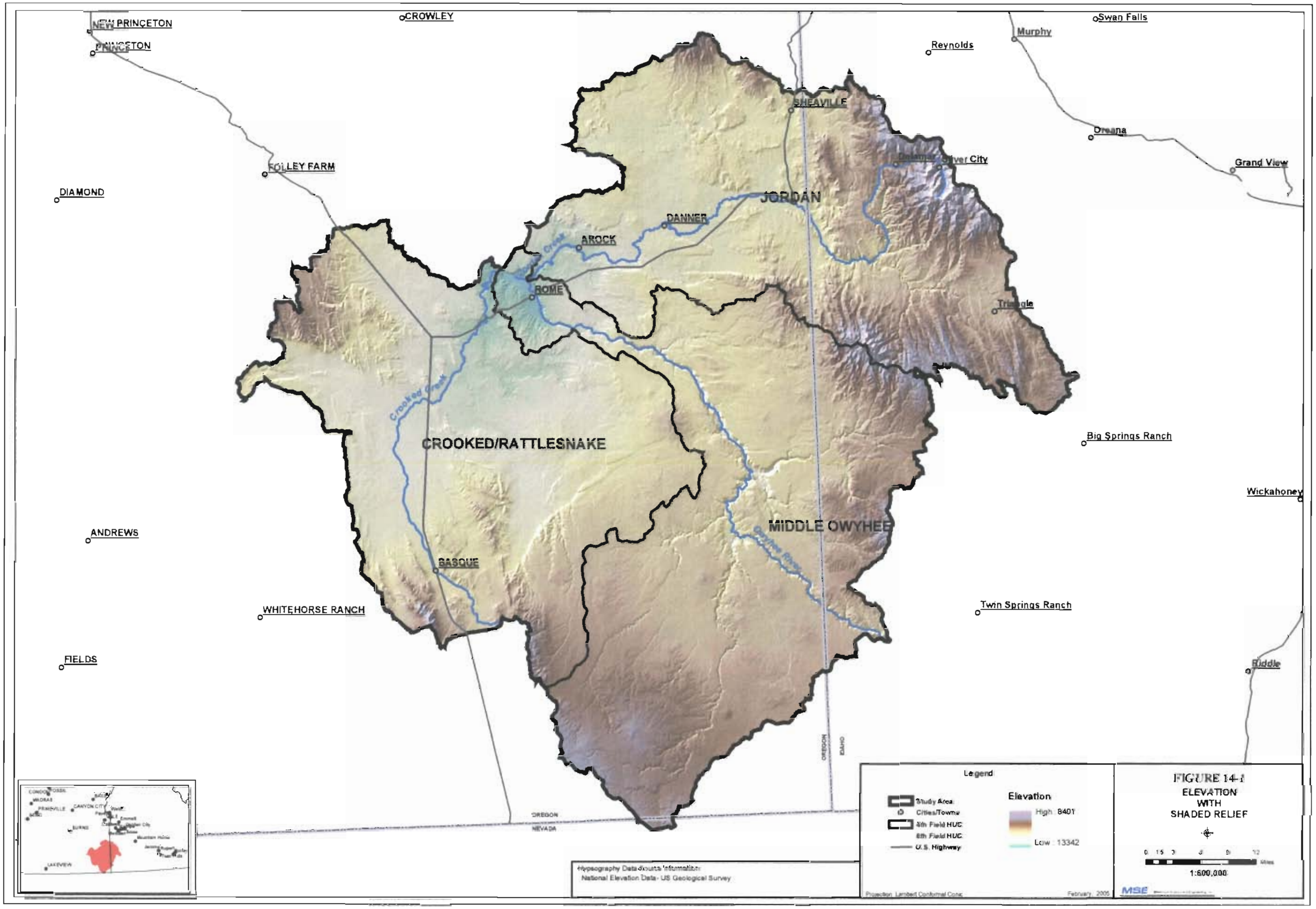


FIGURE 14-1
ELEVATION
WITH
SHADED RELIEF

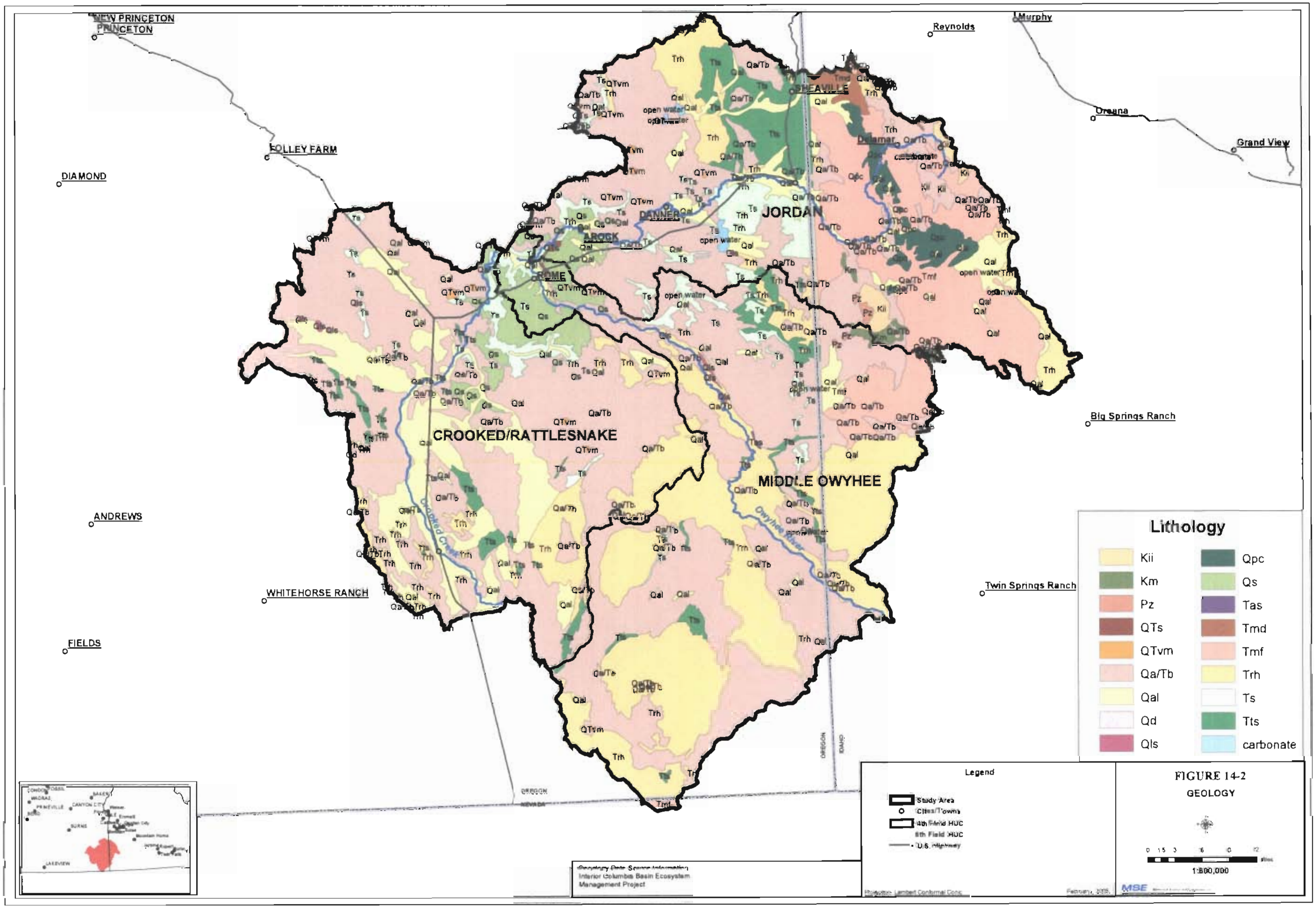


FIGURE 14-2
GEOLOGY

COMPONENT 15—WATERSHED CONDITION EVALUATION

This component of the watershed assessment is directed at summarizing the results of the other components, identifying data gaps, and describing areas and issues that should be focus for action. This analysis was conducted largely according to the methodology described in the Oregon Watershed Assessment Manual (OWAM; WPN 2001). Key findings are presented on Form CE–2.

References

WPN 1999. *Oregon Watershed Assessment Manual.* Watershed Professionals Network, prepared for the Governor's Watershed Enhancement Board, Salem, Oregon.

15-wca-internaldraft.doc

Form CE–2: Summary of Key Findings by Assessment Component

Assessment Component Questions	Summary of Key Findings	Missing or Incomplete Information or Data Limitations	Locations of Impacts Currently Constraining Habitat, Populations or Water Quality
2. Historical Conditions • What were the characteristics of the watershed's resources at the time of European exploration/settlement? • What are the historical trends and locations of land use and other management impacts in the watershed? • What are the historical accounts of fish population and distribution? • Where are the locations of historic floodplain, riparian area, channel and wetland modifications, and what was the type and extent of the disturbance?	•	•	•
3. Channel Habitat Type Classification • What is the distribution of CHTs throughout the watershed? • What is the location of CHTs that are likely to provide specific aquatic habitat features, as well as those areas which may be the most sensitive to changes in watershed condition?	• Most common CHTs are: 21% Low gradient Moderately confined 13% Low gradient Confined 11% Moderate gradient Confined 11% Moderately steep narrow Valley 10% Moderate gradient Moderately Conf. 11% low gradient med. floodplain (FP2)	• Field verification limited to nine locations • Topographic map contour resolution of limited value for assessment of confinement on small and intermittent streams	• About 40% of stream mileage is CHTs usually amenable to enhancement
4. Hydrology • What land uses are present in your watershed? • What is the flood history in your watershed? • Is there a probability that land uses in the basin have a significant effect on low flows? For what beneficial use is water primarily used in your watershed?	• 87% Ag & range 10% Forest 0.02% Urban	• Only 7 flow gauges available in entire study area; only 2 of these have records longer than 7 years • Flood history not available • Resolution of soil and cover data is poor • Cover condition data limited • Land use/land cover derived from 1970s/1980s air photos	• Ag/range areas mostly screen as high *potential* risk (Form H–8), but this is sensitive to assumptions about cover condition
5. Water Use • Is water derived from a groundwater or surface–water source? • What type of storage has been constructed in the basin? • Are there any withdrawals of water for use in another basin (interbasin transfer)? Is any water being imported for use in the basin? • Do water uses in the basin have an effect on peak flows? • Do water uses in the basin have an effect	• Water is used primarily for livestock from both groundwater and surface water sources • Only limited storage has been constructed in study area (upstream of Owyhee Res.) • No interbasin transfers (in or out)	• Insufficient data for detailed basin–wide analysis of affects of water use on high and low flows • Water availability data not available for WABs in either Oregon or Idaho	• Flow restoration needs are primarily in Middle Owyhee and upper reaches of Jordan (based on ODF&W) • "High" Priority WABs (Table 5–3): Owyhee R. > Snake R. abv Crooked Ck Jordan Ck > Owyhee R abv Cow Ck N. Fk. Owyhee R > Owyhee R. M. Fk. Owyhee R. > N. Fk. Owyhee R. Toppin Ck > W. Little Owyhee R. W. Little Owyhee R. > Owyhee R.

on low flows?			
6. Riparian Assessment • What are the current conditions of riparian areas in the watershed? • How do current conditions compare to those potentially present or typically present for this ecoregion? • How can the current riparian areas be grouped within the watershed to increase our understanding of what areas need protection and what the appropriate restoration/enhancement opportunities might be?	• Jordan Ck Headwaters and Upper Rock Ck recruitment potential adequate for ecoregion; • Rest of study area has inadequate recruitment potential per OWAM criteria, but see next column	• Field verification limited to nine locations (See Component 3) • Use of Level 3 ecoregions may overstate expected coarse wood recruitment potential over actual study area conditions (e g , arid lands dominated by grasses and shrubs)	• Most of study area has inadequate recruitment potential per OWAM criteria, but see previous column
7. Wetlands • Where are the wetlands in this watershed? • What are the general characteristics of wetlands within the watershed? • What opportunities exist to restore wetlands in the watershed?	• 73 wetlands identified: 20,310 acres • Almost all wetlands at low elevation, except in Middle Owyhee, where split between low and mid • 72% of wetlands are palustrine, emergent and seasonally or temporarily flooded	• NWI maps not digitized • NWI maps based on air photos rather than field surveys • Outdated land use/land cover (1970s-80s) • Properly Functioning Condition (PFC) data not available	• unknown
8. Sediment Sources • What are the important current sediment sources in the watershed? • What are the important future sources of sediment in the watershed? • Where are erosion problems most severe and qualify as high priority for remedying conditions in the watershed?	• Potential sources: Road instability—insufficient data Slope instability—insufficient data Rural road runoff—could be significant along streams, insufficient data Urban road runoff—minor Surface erosion from ag/range—some potential, but most erodible areas are in low–precip. zones Surface erosion from burned land—generally minor	• No usable landslide/debris flow data • Detailed road construction data not available • Accuracy of road and hydrology data inadequate for digital determination of 200ft buffer zone • Discrepancies between Census urban data and air photos • K>0.40 data unavailable; used K>0.48 • Resolution of soil and cover data is poor • Cover condition data limited • Land use/land cover derived from 1970s/1980s air photos • Spatially-segregated farming/grazing practices not available • Old fire data (1986–92), no intensities	• subwatersheds with highest erosion potential are shown on Map 08-02
9. Channel Modification • Where are channel modifications located? • Where are historic channel disturbances, such as dam failures, splash damming, hydraulic mining and stream cleaning, located? • What CHTs have been impacted by channel modification? • What are the types and relative magnitude of past and current channel modifications?	• Approx 128 stream miles estimated to be potentially affected by channel modifications out of 6,000 total stream miles: 113 mi: streamside roads 10 mi: irrigation diversions 8 mi. road crossings 5 mi: dams • Potential locations shown on Maps 9-1 and 9-2		• Potentially impacted locations shown on Maps 9-1 and 9-2
10. Water Quality • What are the designated beneficial uses of water for the stream segment?	• Beneficial uses in Oregon are: Domestic water supply Industrial water supply	• Very little publicly available data, much of that is old (1970-80s) • ODEQ lists insufficient nutrient data for	• Mercury: Jordan Ck, Antelope Res./Jack Ck listed; need recent data • Flow alteration/modification: 16 water

• What are the water quality criteria that apply to the stream reaches? • Are the stream reaches identified as water quality limited segments on the 303(d) list by state? • Are any stream reaches identified as high–quality waters or Outstanding Resource Waters? • Do water quality studies or evaluations indicate that water quality has been degraded or is limiting the beneficial uses?	Irrigation Livestock watering Fish & aquatic life Redband trout/Lahontan cutthroat trout Wildlife & hunting Fishing Boating Water contact recreation Aesthetic quality • Beneficial uses in Idaho are: cold water aquatic life salmonid spawning primary contact recreation drinking water supply • The most common exceedances are for: temperature sediment flow alteration/modification • Other listed exceedances are for: bacteria pH mercury and/or metals oil pesticides habitat modification aquatic weeds or algae nutrients • Listed water bodies are shown in Tables 10-3 and 10-4 •	status determination in: Antelope Res./Jack Ck, Jordan Ck Upper Cow Lake/Cow Ck • ODEQ lists insufficient aquatic weeds/algae data for: Antelope Res., Upper Cow Lake • ODEQ lists insufficient sediment data for: Antelope Ck, W. Little Owyhee R., M Fk Owyhee R , N. Fk. Owyhee R., Fish Ck, Jordan Ck, Mahogany Ck, Bull Ck	bodies in Tables 10-3 and 10-4 • pH: Louse Ck • Bacteria. Jordan Ck, N Fk. Owyhee R. • Sediment: Juniper Ck, M Fk Owyhee R., Noon Ck, Pleasant Valley Ck, Squaw Ck, Jordan Ck, Cow Ck, Louisa Ck, Louse Ck, Rock Ck, Soda Ck • Temperature: omitted from this column because of questionable validity of temperature standards in this location
11. Fish and Fish Habitat • What fish species are documented in the watershed? Are any of these currently state– or federally listed as endangered or candidate species? Are there any fish species that historically occurred in the watershed which no longer occur in the watershed? • What is the distribution, relative abundance and population status of salmonid species in the watershed? • Which salmonid species are native to the watershed, and which have been introduced to the watershed? • Are there potential interactions between native and introduced species? • What is the condition of fish habitat in the watershed (by sub–basin) according to existing habitat data? • Where are potential barriers to fish	• 30 spp occur, 22 of these are native (Table 11-5) • No federal endangered, threatened or candidate spp. • Salmonids: interior redband trout (small population dispersed in thermal refuges), cutthroat trout, rainbow trout (hatchery), mountain whitefish, brook trout (hatchery) • 322 road crossings on redband trout streams could be migration barrier • No evidence of redband trout hybridization	• Very little quantitative data available • Insufficient data to assess long–term redband trout trends • No data on the 322 road crossings on redband trout streams	• 322 road crossing on redband trout streams (probably)

migration?			
12. Wildlife and Wildlife Habitat • What kinds of wildlife habitat are present in the study area? • Are any species listed as endangered, threatened, etc.? • Is there evidence of population trends within the study area? Are there active population studies?	• Wildlife habitat types: Sagebrush steppe/salt desert Riparian/wetlands Juniper woodlands • 279 vertebrate spp are present (App 12B) • 56 spp. are federally listed as endangered, threatened or candidate, or BLM sensitive spp.(Tables 12-1 through 12-6) • Stable but variable from year to year: chukar • Stable: California quail pronghorn antelope (stable since 1993) • Downward trend: ring-necked pheasant (habitat loss, predation by red fox) mule deer (declined in 1990s; no data) • Active population studies: sage grouse (BLM/ODFW/IDFG) pygmy rabbit (BLM) bighorn sheep (reintroduction) • Limited spatial data presented on Maps	• Limited inventory and monitoring data for most spp.	• unknown
13. Rangeland • What types of rangeland are present? • What are the standards for rangeland health? • What habitat trends are evident? • What invasive species are present? • What is the condition of grazing allotments?	• Types: herbaceous, mixed and shrub/brush (Map 13-01) • 7 BLM standards and associated indicators are listed in Component 13 • Habitat trends: Sagebrush steppe/salt desert impacted by increased fire frequency, exotic vegetation, grazing Juniper woodlands expanding but due to grazing, drier climate and fire suppression • Invasive species: cheatgrass is most important • Allotment Assessment ratings are shown on Map 13-03	• Limited data for private lands • Inconsistent information provided in allotment assessments • Allotment assessments for Oregon not available at time of preparation	• Allotment assessment ratings are shown on Map 13-03, fires on Map 13-04
14. Geology • What is the geology of the study area? • How can the geology potentially affect water quality?	• Geologic map and narrative description provided • Eroding lacustrine deposits could increase phosphorus loads • Basalt and rhyolite erode to form steep cliffs, generate less fine sediment • Weakly–cemented alluvial deposits erode more easily, give more fine sediment • Weak deposits can result in slope failures and temporary large sediment loads		• unknown

COMPONENT 16—MONITORING PLAN

Because of the large extent of the study area (approximately 2.6 million acres) and limited existing and available data, this assessment component cannot provide a detailed "road map" for watershed monitoring. Rather, it presents a number of monitoring options that should be considered. These will focus primarily on filling data gaps of critical importance to watershed health.

Monitoring programs fall into several types, depending on their purposes:

- Data gap filling: obtaining data needed to complete or refine the assessment;
- Trend monitoring: collecting data over several years to determine whether there is a trend;
- Baseline monitoring: establishing conditions before implementing a best management practice (BMP);
- Implementation monitoring: confirming that a BMP was correctly implemented;
- Effectiveness monitoring: determining whether an implemented BMP actually works; and
- Validation monitoring: research-level investigation to understand watershed processes.

Most of the monitoring activities described in this plan are intended to address specific data gaps, with some trend or baseline monitoring. Normally, these would precede any restoration activities. Some monitoring activities would best be conducted by or in conjunction with other agencies, such as BLM, ODEQ, IDEQ or ODFW. In many cases, the person or agency that implements a BMP would perform BMP monitoring. For example, the City of Jordan Valley should conduct storm water monitoring for a few seasons, to confirm that their new storm water facility is accomplishing its goals.

Data Gaps

The study area size and limited data availability led to an incomplete watershed assessment, as described in the various components of this report. This lack of coverage presents a significant limitation to accurate and comprehensive evaluation of watershed health, and created significant data gaps throughout the process. As an example: to provide partial site-specific information and representative screening for the assessment, 20 subbasins were identified in which to focus assessment efforts. Field verification was limited to only nine sites among these subbasins. This left 85 subbasins with no detailed evaluation. In addition, GIS techniques were used extensively to summarize and analyze large amounts of data. Much of this data was on a very coarse scale, and not conducive to detailed and accurate evaluation. This approach required the extensive use of professional judgment and analysis based on limited data availability.

Specific data gaps are summarized on Table 16-1 by assessment component.

Problem Definition

- Extensive data gaps limiting accurate watershed assessment
- Water quality concerns with respect to temperature, sediment, flow alteration and urban storm water
- Barriers to fish migration

Goals and Objectives

- Collect sufficient data to allow for more accurate evaluation and assessment
- Identify specific areas of concern to facilitate selection and implementation of restoration projects
- Set up monitoring program to evaluate effectiveness of restoration projects

Table 16–1. Data Gaps by Assessment Component

Assessment Component	Missing or Incomplete Information or Data Limitations (Data Gap)	Monitoring Needs
3. Channel Habitat Type Classification	• Field verification limited to nine locations • Topographic map contour resolution of limited value for assessment of confinement on small and intermittent streams	• Field Verification within additional subbasin locations
4. Hydrology	• Only 7 flow gauges available in entire study area; only 2 of these have records longer than 7 years • Flood history not available • Resolution of soil and cover data is poor • Cover condition data limited • Land use/land cover derived from 1970s/1980s air photos	• Expanded gauge network • Long term flow monitoring
5. Water Use	• Insufficient data for detailed basin–wide analysis of affects of water use on high and low flows • Water availability data not available for WABs in either Oregon or Idaho	• Monitoring/measurement and compilation of water use rates
6. Riparian Assessment	• Field verification limited to nine locations (See Component 3) • Use of Level 3 ecoregions may overstate expected coarse wood recruitment potential over actual study area conditions (e.g., arid lands dominated by grasses and shrubs)	• Field verification at additional subbasin locations • Refinement of LWD recruitment potential for higher elevation drainages
7. Wetlands	• NWI maps not digitized • NWI maps based on air photos rather than field surveys • Outdated land use/land cover (1970s-80s) • Properly Functioning Condition (PFC) data not available	• Field verification • Proper functioning condition assessment of wetland areas
8. Sediment Sources	• No usable landslide/debris flow data • Detailed road construction data not available • Accuracy of road and hydrology data inadequate for digital determination of 200ft buffer zone • Discrepancies between Census urban data and air photos • K>0.40 data unavailable; used K>0.48 • Resolution of soil and cover data is poor • Cover condition data limited • Land use/land cover derived from 1970s/1980s air photos • Spatially-segregated farming/grazing practices not available • Old fire data (1986–92), no intensities	• Collection and compilation of additional road data (culverts, construction data) • Collection of erosion data for both cultivated agricultural land and rangeland • Post–wildfire soil and vegetation assessment
9. Channel Modification	• Field verification of channel modification	• Field verification
10. Water Quality	• Very little publicly available data, much of that is old (1970-80s) • ODEQ lists insufficient nutrient data for status determination in Antelope Res./Jack Ck, Jordan Ck Upper Cow Lake/Cow Ck • ODEQ lists insufficient aquatic weeds/algae data for: Antelope Res., Upper Cow Lake • ODEQ lists insufficient sediment data for. Antelope Ck, W. Little Owyhee R., M. Fk. Owyhee R., N. Fk. Owyhee R., Fish Ck, Jordan Ck, Mahogany Ck, Bull Ck	• Collection of additional water quality data for sediment, temperature and flow alteration
11. Fish and Fish Habitat	• Very little quantitative data available • Insufficient data to assess long–term redband trout trends • No data on the 322 road crossings on redband trout streams	• Collection of additional fisheries data • Fish passage assessment needs
12. Wildlife and Wildlife Habitat	• Limited inventory and monitoring data for most spp.	• Collection of additional data on wildlife conditions and habitat
13. Rangeland	• Limited data for private lands • Inconsistent information provided in allotment assessments • Allotment assessments for Oregon not available at time of preparation	• Collection of additional data from private lands • Collection/review of allotment assessments

The results of the data gap and monitoring needs analysis indicate that additional data collection and field verification is necessary for a more complete and accurate assessment. This information can also be used to identify potential restoration activities and evaluate their effectiveness over time. A summary of monitoring needs is presented in Table 16-2 by Assessment Component. This table provides a general overview of monitoring methods for each of the identified needs. Tables 16-3 through 16-8 describe in more detail a monitoring outline for selected issues

Table 16–2. Monitoring Needs by Assessment Component

Assessment Component	Monitoring Needs	Monitoring Method
3. Channel Habitat Type Classification	• Field Verification within additional subbasin locations	• Protocol described in Channel Habitat Classification Component
4. Hydrology	• Expanded gauge network • Long term flow monitoring	• Installation of expanded flow monitoring network
5. Water Use	• Estimate Water Availability • Monitoring/measurement and compilation of water use rates	• (Table 16-8) below
6. Riparian Assessment	• Field verification at additional subbasin locations • Refinement of LWD recruitment potential for higher elevation drainages	• Protocol described in Riparian Assessment Component
7. Wetlands	• Field verification • Proper functioning condition assessment of wetland areas	• USACOE manual • BLM PFC protocol
8. Sediment Sources	• Collection and compilation of additional road data (culverts, construction data • Erosion from adjacent roads • Post–wildfire erosion assessment • Collection of erosion data for both cultivated agricultural land and rangeland	• Road survey (part of Table 16-3) • Road survey and turbidity measurements (Table 16-3) • Inspection, WDPT test (Table 16-6) • Inspection
9. Channel Modification	• Field verification	• Protocol described in Channel Modification Component
10. Water Quality	• Collection of additional water quality data for sediment, temperature and flow alteration	• e.g., see Tables below
11. Fish and Fish Habitat	• Fish passage assessment • Collection of additional fisheries data	• Fish passage assessment (Table 16-7)
12. Wildlife and Wildlife Habitat	• Collection of additional data on wildlife conditions and habitat	•
13. Rangeland	• Post–wildfire revegetation assessment • Collection of additional data from private lands • Collection/review of allotment assessments	• Inspection, WDPT test (Table 16-6) • Use of volunteers for data collection activities

The following tables present some details for selected monitoring activities listed in Table 16–1 above.

Table 16–3. Monitoring Outline for Suspended Sediments from Roads

Primary Monitoring Issue:	*Fine Suspended Sediment (turbidity)*
Subwatershed:	various, see Map 09–02
Background	Unpaved roads (especially unpaved roads) adjacent to streams often produce large amounts of sediment load in streams by erosion of the road surface. This erosion can be caused by traffic or by precipitation.
Monitoring Question/Data Gap to be Addressed	Are roads and/or vehicle traffic the primary source of fine sediment in this stream segment?
Study Objectives	1. Determine the severity of fine sediment inputs to the stream. 2. Identify the sources of sediment delivery. 3. Specifically, assess the condition of the adjacent roads during periods of sediment runoff.
Parameters	• Turbidity (as a surrogate for suspended sediments. Note that turbidity measures fine soil particles – silts and clays – but not sand-sized particles). • Road condition
Methods	Turbidity: Portable turbidimeter provides ability to process samples quickly in the field. Samples can also be taken to a laboratory. Road Condition: Detailed Rural Road Runoff Survey (OWAM Component VI).
Study Design (& critical period)	Sample turbidity at locations along the stream and incoming sources during the wet weather period. Repeated surveys should show a pattern of obvious source areas. The road survey provides a detailed assessment by section which will link the sources to road segments needing improvement.
Station Locations	Identify potential source areas prior to sample collection such as road fill that is adjacent to the stream, cross-drain outlets, and other drainage sources. Flag and record these on a map as sample locations
Study Duration	Several repeated visits should be adequate to identify source areas. The survey can be repeated after road improvements are made (during comparable conditions) to evaluate effectiveness of the treatments
Sample Frequency	As described above.
Analyses	The turbidity levels during a survey can be plotted on a detailed map in relation to road features and other sources. Areas of higher turbidity may be linked to specific source areas using the Road Runoff Survey.

Table 16–4. Monitoring Outline for Stream Temperature

Primary Monitoring Issue:	*Stream Temperature*
Subwatershed:	various, see Maps 11–01, 11–03 and 06–03
Background	High stream temperatures are thought to be deleterious to salmonids and other coldwater fish; however, the use of a single criterion is disputed by some (*e.g.,* Essig 1998)
Monitoring Question/Data Gap to be Addressed	Are high temperatures impacting fish populations? If so, are these high temperatures related to lack of riparian canopy cover, water withdrawals, or both?
Study Objectives	Identify temperature patterns in the stream and key tributaries Verify riparian cover findings identified from aerial photos
Parameters	Temperature, Canopy cover (shade)
Methods	Temperature data loggers (OWEB, 1999; Zaroban 2000)
Study Design (& critical period)	Use upstream-downstream approach to bracket areas of high and low canopy cover. Locate data loggers in upper watershed in areas of know fish occurrence to determine temperature zones in which fish appear to be thriving. Install data loggers with sufficient time prior to and after expected warm period (June-August) to document the duration of high temperatures.
Station Locations	Locate stations at mouth of tributaries to document temperature regime in these sub-basins. Locate stations above and below canopy openings, and at land use breaks.
Study Duration	A study during one season provides comparison between locations to identify areas of warming or cooling. Annual monitoring may be needed to verify those results, to note differences between years, or as a follow-up to restoration activities.
Sample Frequency	Temperature data loggers should be set to short intervals (*e.g.*, 15-20 minutes) to capture the daily extremes in temperature accurately.
Analyses	Calculate the number of days that temperature exceeds the 7-day moving average in the state water quality standards.

Table 16–5. Monitoring Outline for Storm Water BMP Monitoring

Primary Monitoring Issue:	*Urban Storm Water*
Subwatershed:	Baxter Creek 170501080501
Background	New storm sewers and settling basins are under construction (completion expected October 2005)
Monitoring Question/Data Gap to be Addressed	Are settling basins and sewers effective at reducing sediment loads?
Study Objectives	Determine effectiveness of new storm water facilities.
Parameters	Total Suspended Sediment; other parameters may be required by municipal storm water discharge permit
Methods	Manual or automated sampling; see EPA (1992; 1999)
Study Design (& critical period)	• Sampling at discharge point during first three hours of a storm (often at night); analysis by lab or portable turbidimeter • Measure depth of sediment collected in basin over water year • Measure volume of "floatables" (trash) captured in basin over year
Station Locations	Jordan Valley, Oregon
Study Duration	Typically three years, or as required by permit
Sample Frequency	Typically three storms per water year
Analyses	• Calculate annual sediment loads • Compare concentrations to regulatory requirements or benchmarks

Table 16–6. Monitoring Outline for Wildfire Erosion Potential

Primary Monitoring Issue:	*Erosion and sediment loads from wild fire*
Subwatershed:	various, see Map 08–02
Background	Wildfires can remove vegetation that holds soils together. Intense fires can create hydrophobic soils that resist infiltration, increasing the potential for erosion.
Monitoring Question/Data Gap to be Addressed	• Are recent wildfires contributing to erosion and sedimentation problems in the stream segment? • Have soils become hydrophobic? • Is natural succession (revegetation) occurring?
Study Objectives	Inspect fire area, check hydrophobicity of soil
Parameters	• From data sources: fire area, slope, soil hydrologic group, stream proximity • From inspection: soil hydrophobicity, evidence of erosion, vegetation health
Methods	Water Drop Penetration Test (Wessell 1988, described in Doerr, undated), requires only distilled water, a dropper and a stopwatch
Study Design (& critical period)	• Choose areas based on recent (1990-2005) fire locations and intensity; focus on those occurring in areas with steep slopes and high erodibility, especially those within ¼ mile of a stream (see Component 8) • Inspect burned area for evidence of erosion and for succession condition of vegetation • Conduct Water Drop Penetration Time field test to check hydrobobicity (Doerr undated) • Optional: measure soil moisture in burned and unburned areas with tensiometer (perhaps best done in late spring, before dry season) Could probably be performed by volunteers, students or scouts with minimal training.
Station Locations	see *Study Design*
Study Duration	Depends on the number of recent fires
Sample Frequency	Desirable to do every year or two, but would be useful even if only done once.
Analyses	Sites showing evidence of erosion, hydrophobic soils or impeded revegetation are candidates for further monitoring and/or intervention.

Table 16–7. Monitoring Outline for Fish Passage

Primary Monitoring Issue:	*barriers to salmonid migration*
Subwatershed:	various in Jordan and Middle Owyhee subbasins, see Map 11–04
Background	322 road crossing are identified on redband trout streams, 67% on Idaho side
Monitoring Question/Data Gap to be Addressed	Do road crossings present a barrier to salmonid migration?
Study Objectives	Inventory and assess road crossings as barriers
Parameters	Culvert type, design, elevation, slope, drop, condition, water velocity, fish presence
Methods	Road crossing inventory/inspection (Clarkin 2003; OWAM App. IX-C)
Study Design (& critical period)	Inspect culverts and evaluate design and condition for barriers to fish passage
Station Locations	322 road crossings shown on Map 11–04
Study Duration	• Field work could possibly be done in one summer by full–time experienced crew; allocate 1-2hr per culvert or ½hr per bridge or grade crossing, plus travel; data compilation and reporting would take a few months for this number of crossings • Could be done by trained volunteers
Sample Frequency	One time only
Analyses	Compare water velocity, culvert drop and slope to barrier values for fish passage

Table 16–8. Monitoring Outline for Water Availability

Primary Monitoring Issue:	*water availability*
Subwatershed:	all
Background	water availability (see Component 5) was not available for Water Availability Basins in the study area
Monitoring Question/Data Gap to be Addressed	How much water is available each month? Does it exceed the water consumption?
Study Objectives	Estimate water availability from the very limited data available
Parameters	Water availability (80% exceedance flow)
Methods	Spreadsheet calculations using gauge data and PRISM precipitation and subwatershed areas obtained from GIS
Study Design (& critical period)	This is a computer process, not involving field monitoring. Note that WABs enclose all upstream subwatersheds! • Find highest stream gauge below each subwatershed • Calculate monthly average stream flow for each gauge during 1958-87 or available recent period closest to 30 year duration • Proportion the gauge flows to each WAB based on its area Also proportion the gauge flows to each WAB based on its precipitation from the PRISM model (Daly, et al. 1994; see Map 04–01) • Rank the monthly flows, and report the flow exceed in 80% of the monthse
Station Locations	Pour points of all 105 subwatersheds
Study Duration	1-2 months, depending on analyst availability
Sample Frequency	One time only
Analyses	see *Study Design*

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