

TABLE OF CONTENTS

4.11B QUANTIFICATION OF IN-RIVER RESIDENCY AND OPTIMIZATION OF RELEASE STRATEGIES FOR HATCHERY COHO SALMON SMOLTS IN THE LOWER LEWIS RIVER (2002) (AQU 11B).....	AQU 11B-1
4.11B.1 Study Objective.....	AQU 11B-1
4.11B.2 Study Area.....	AQU 11B-1
4.11B.3 Methods.....	AQU 11B-1
4.11B.4 Key Questions.....	AQU 11B-3
4.11B.5 Results.....	AQU 11B-3
4.11B.6 Discussion.....	AQU 11B-3
4.11B.7 Conclusions.....	AQU 11B-7
4.11B.8 Schedule.....	AQU 11B-9
4.11B.9 Literature Cited.....	AQU 11B-9
4.11B.10 Comments and Responses on Draft Report.....	AQU 11B-11

LIST OF FIGURES

Figure 4.11B-1. Comparison of 2001 and 2002 average daily flow rates (cfs) reported at Ariel Gage on the North Fork Lewis River: April 1 – May 31.....	AQU 11B-2
Figure 4.11B-2. Location of Pekins Ferry and Lewis River Hatchery release sites.	AQU 11B-17
Figure 4.11B-3. Detection summary of Coho: April 17, 2002.	AQU 11B-19
Figure 4.11B-4. Detection summary of Coho: April 18, 2002.	AQU 11B-21
Figure 4.11B-5. Detection summary of Coho: April 19, 2002.	AQU 11B-23
Figure 4.11B-6. Detection summary of Coho: April 22, 2002.	AQU 11B-25
Figure 4.11B-7. Detection summary of Coho: April 26, 2002.	AQU 11B-27
Figure 4.11B-8. Detection summary of Coho: April 29, 2002.	AQU 11B-29
Figure 4.11B-9. Detection summary of Coho: May 1, 2002.	AQU 11B-31
Figure 4.11B-10. Detection summary of Coho: May 3, 2002.	AQU 11B-33
Figure 4.11B-11. Detection summary of Coho: May 10, 2002.	AQU 11B-35

LIST OF TABLES

Table 4.11B-1. Tagging summary of coho smolts documenting length, frequency, and release location.	AQU 11B-4
Table 4.11B-2. Detection summary of radio-tagged coho released at Lewis River Hatchery on April 16, 2002.	AQU 14B-5
Table 4.11B-3. Comparison statistics between coho smolt released at the Lewis River Hatchery in 2001 and 2002.	AQU 14B-6

This page intentionally blank.

4.11B QUANTIFICATION OF IN-RIVER RESIDENCY AND OPTIMIZATION OF RELEASE STRATEGIES FOR HATCHERY COHO SALMON SMOLTS IN THE LOWER LEWIS RIVER (2002) (AQU 11B)

4.11B.1 Study Objective

Current Lewis River hatchery practices on the North Fork Lewis River recommend the on-site volitional release of coho and Chinook smolts. There is concern that smolts released at this location may interact negatively with species protected under the Endangered Species Act, namely fall Chinook. Determining residency time and migration behavior of coho smolts released into the Lewis River is therefore important information for fishery managers to use in assessing the effects of hatchery operations on protected species. Hawkins and Tipping (1999) estimated that, on average, 4.7 percent of hatchery coho smolts in the Lewis River system consumed at least one wild Chinook fry at the time of sampling. Preliminary investigations of coho predation rates on salmon fry show an evacuation period of approximately 25 hours. Therefore, recovered prey items in hatchery coho stomachs represent daily feeding rates (S. Hawkins, WDFW, pers. comm.). This indicates that the number of wild salmon fry consumed by hatchery coho smolts may be substantial in systems where hatchery smolts are residing in areas of concentrated wild fry.

In 2001, tracking studies evaluated the behavior and residency time of hatchery reared coho smolts released at the Lewis River hatchery (RM 15.7) and Pekins Ferry Boat launch (RM 3.4) (PacifiCorp and Cowlitz PUD 2002). After completion of the study and through discussions with the Aquatic Resources Group (ARG), it was decided that similar tracking would be initiated in 2002. This decision was based primarily on low flows experienced in 2001 and the concern that results may not have been representative of typical conditions. River flows in 2002 showed a more typical spring runoff pattern, and it was thought that results would be more indicative of normal conditions (Figure 4.11B-1). The comparison of the two studies should provide an indication as to whether the 2001 study results were influenced by low flow conditions, as well as provide additional information on migration patterns of coho smolts released at the Lewis River hatchery.

4.11B.2 Study Area

Radio-tagged smolts were tracked from the Lewis River Hatchery (RM 15.7) downstream to the mouth of the Lewis River where it enters the Columbia River (Figure 4.11B-2). All smolts were released at the Lewis River hatchery (Cedar Creek hole).

4.11B.3 Methods

Methods were identical to those followed in 2001 and described in Section 4.11A, subsection 4.11A.3 of the 2001 Technical Studies Status Report (PacifiCorp and Cowlitz PUD 2002). The only differences were (1) the release point and (2) the size of hatchery fish, which were smaller on average in 2002.

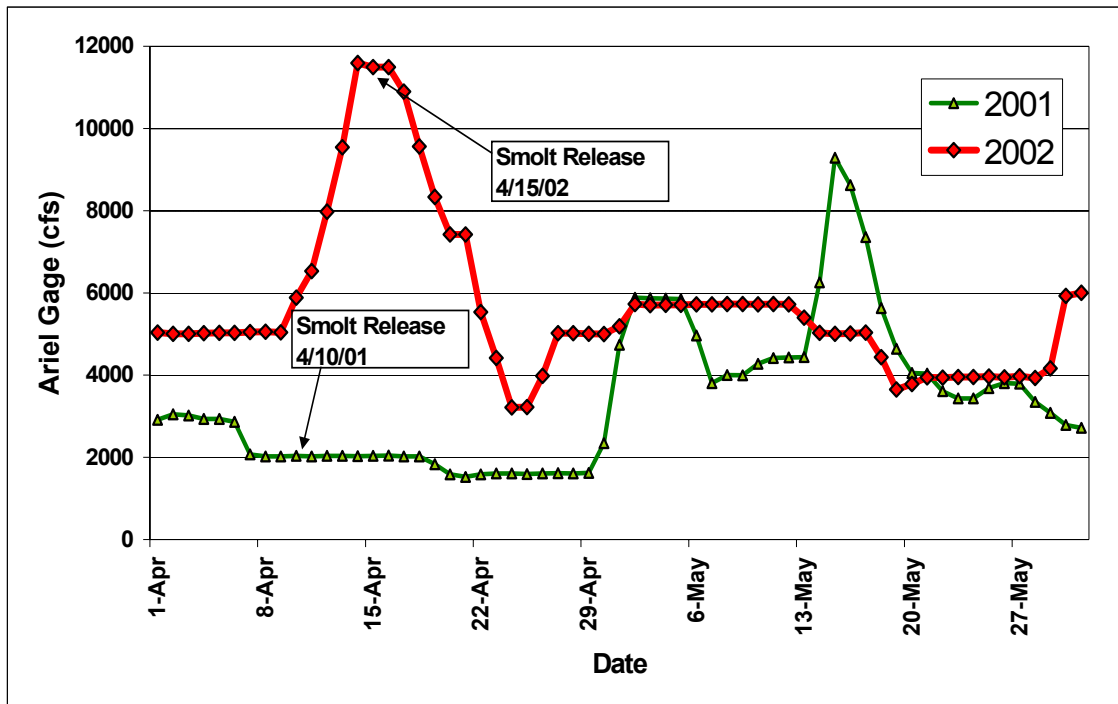


Figure 4.11B-1. Comparison of 2001 and 2002 average daily flow rates (cfs) reported at Ariel Gage on the North Fork Lewis River: April 1 – May 31.

4.11B.3.1 Tagging and Release

On April 15, 2002, 30 coho smolts were tagged with Advanced Telemetry Systems (ATS)® 1.3 gram micro-transmitters (oral) with a pulse width of 15 milliseconds. Tag frequencies were between 40 and 41 megahertz. This pulse rate ensures at least one month of battery life for each transmitter. Smolts were individually anesthetized in a bath solution of MS-222. Once anesthetized, smolts were held in (gloved) hand and a tag was inserted orally into the stomach. A hypodermic syringe tube was used to guide the tag into the smolt’s stomach. The part of the tube that the needle would normally attach to was rounded and smoothed with a file and sandpaper to reduce trauma to the smolt.

All smolts were tagged and held at the Lewis River Hatchery. Each smolt was held for 24-hours in a fry raceway partitioned into 30 separate holding areas to determine tag regurgitation and delayed mortality. Two smolts regurgitated tags after the 24-hour hold time. The tags were reinserted and the smolts were released the following day. All fish were released the day after tag insertion in a backwater pool area just downstream of the fish ladder entrance in the Cedar Creek hole (Lewis River Hatchery). All fish swam freely away and no mortalities were observed.

4.11B.3.2 Radio-Tag Monitoring

Tagged fish were monitored from time of release until the expected battery life was depleted, suspected of depletion or no movement was recorded for one week. A jet sled

was used to track fish on all sampling days. An ATS® receiver with bi-directional antenna was used on board. Typically, the boat would drift downstream from the Lewis River Hatchery, recording fish position when a signal was received. This allowed excellent coverage of the river due to the very slow speed. In areas of slow water, the boat engine would be used to travel through pools and backwater areas. This was especially true in sections downstream of the City of Woodland. Often, the location of the signal (smolt) was able to be marked within a surface area of about 50 by 50 feet.

4.11B.4 Key Questions

The main objective of this study is to monitor the movement and in-river residency of hatchery coho smolts released in the Lewis River system. The following questions should be answered from the results of this study and the 2001 evaluation:

- What is the average length of time coho smolts reside in the Lewis River system following direct release from the Lewis River hatchery?
- After release, where do coho smolts move in relation to their release points?
- Are there patterns, trends or preferences expressed by emigrating smolts in the Lewis River?
- Do flow rates influence residency time of smolts in the North Fork Lewis River?
- Does smolt behavior or residency differ between the 2001 and 2002 releases?

4.11B.5 Results

This section provides a summary of tagged fish, including frequencies, fork lengths and release locations of individual fish (Table 4.11B-1). Also, detailed tracking maps are provided in Figures 4.11B-3 through 4.11B-11 illustrating the position of individual fish during the study period on each survey day. Data presented in these figures are also provided in tabular format (Table 4.11B-2). Fish detected downstream of RM 9.1 and then subsequently not detected on any other sampling period were considered to have left the Lewis River system. This is consistent with data obtained in 2001 in which all fish released at Pekins Ferry (RM 3.4) had exited the Lewis River within 24 hours, and most fish downstream of RM 9.1 emigrated from the Lewis system within 48 hours. To calculate detection rates, fish that were assumed to have left the Lewis River (determined from the criteria above) were not included in the calculation. Therefore, the detection rate is based on fish assumed to be present in the Lewis River system.

4.11B.6 Discussion

This study focused on documenting residency time and movement patterns of individually tagged smolts. Residency time is important to fishery managers, especially when protected species are present. The more time hatchery smolts reside in a river system that contains protected species, the more opportunity they have to prey on and

compete with the protected species. Thus, it is generally considered beneficial to reduce the amount of time hatchery reared smolts are present in the system.

This evaluation also compares the year 2002 smolt releases with results from the year 2001 releases at the Lewis River Hatchery. There were notable biological and physical differences between the two releases and these are described below.

Table 4.11B-1. Tagging summary of coho smolts documenting length, frequency, and release location.

Smolt No.	Frequency (MHz)	Fish Length (mm, fork length)
1	40.111	147
2	40.121	152
3	40.130	154
4	40.141	155
5	40.151	156
6	40.600	161
7	40.611	174
8	40.621	148
9	40.631	144
10	40.641	150
11	40.651	161
12	40.661	153
13	40.671	161
14	40.681	149
15	40.691	157
16	40.701	159
17	40.711	162
18	40.721	153
19	40.731	151
20	40.741	140
21	40.751	141
22	40.761	148
23	40.771	137
24	40.781	154
25	40.791	156
26	40.801	150
27	40.811	152
28	40.820	151
29	40.831	150
30	40.841	150



Table 4.11B-2. Detection summary of radio-tagged coho released at Lewis River Hatchery on April 16, 2002.

Fish No.	Survey Date in 2002								
	17-Apr	18-Apr	19-Apr	22-Apr	26-Apr	29-Apr	1-May	3-May	10-May
1	15.0	15.0	15.0	15.0	15.0	15.0	15.2	15.2	15.2
2	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
3									
4	15.4	15.4						11.8	11.8
5									
6	15.4	14.7	14.6	14.6	14.6	14.6	14.6	14.6	14.6
7		5.0	5.0	5.0					
8	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.2	15.2
9	15.4			11.6					
10	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.2	15.2
11	NR	15.4	15.4	15.4	14.8	14.8	14.8	14.8	14.8
12	15.5	15.5							
13	14.2	14.2	14.2	14.2	13	13	12.2	12.2	
14	NR			3.2					
15	15.6	8.2	3.6						
16	14.6	14.6	14.6	14.6					
17	13.1	13.1	13.1	13.1	13.1	13.1	10.2		
18	15.2								
19	14.3		3.0						
20	14.6	14.6	14.6	14.6	14.6	14.6	14.5		
21									
22	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
23	13.9	13.0	9.4	5.1					
24	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
25	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	14.8
26									
27	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
28	10.3								
29	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.3	14.3
30	NR		8.2	8.0					
Detection	81%	67%	67%	71%	58%	58%	58%	54%	50%

Note: Displayed values are point of detection in river miles.

River Mile Guide

- 3.4 = Pekins Ferry Boat Launch
- 5.5 = I-5 Bridge
- 9.9 = Downstream end of Eagle Island
- 11.8 = Island Boat Ramp (top of the island)
- 13.0 = Golf Course
- 14.5 = Haapa Access
- 15.4 = Lower Hatchery Pool
- 15.7 = Lewis River Hatchery

-  = Non Detect
-  = Emigrated from system (assumed)
- NR = Not released yet

4.11B.6.1 Flow Patterns

River flows downstream of Merwin Dam differed substantially between 2001 and 2002, especially the timing of peak flows. This is significant because smolt releases may be affected differently by flow rates. For example, in 2001, coho smolts were released when the average daily flow (ADF) was 2,000 cfs. In contrast, the 2002 release occurred at an ADF of nearly 12,000 cfs (Figure 4.11B-1). Additionally, the peak flow in 2001 did not occur until after the study ended on May 11. While it is generally considered that higher flows allow a faster emigration rate, the data obtained during the last two years does not show a clear relationship between emigration and flow rates (see Section 4.11B.6.3). This determination, of course, only applies to the flows experienced during the study periods and says nothing about the effect of flows in excess of 12,000 cfs.

4.11B.6.2 Comparisons of Smolt Length Between 2001 and 2002

The mean length of smolts tagged and released at the Lewis River Hatchery differed significantly ($\alpha = 0.05$) between 2001 and 2002 (Table 4.11B-3). This difference is the result of natural variation in growth rates in the hatchery rearing ponds between the two years. This difference is noted for informational purposes since its effect on migration rates is not an objective of this evaluation. Such variations are natural and the intent of this study is to describe migration rates of smolts released during normal hatchery operations at the Lewis River Hatchery. Although, the mean length of smolts was smaller in 2002 than in 2001, the minimum tagging size of 130 mm was not violated.

Table 4.11B-3. Comparison statistics between coho smolt released at the Lewis River Hatchery in 2001 and 2002.

Statistic	2001	2002
Sample Size (n)	15	30
Mean Smolt Length (FL, mm)	161	153
Fork Length Range (mm)	150 - 185	137 - 174
Standard Error	2.50	1.35
Standard Deviation	9.67	7.38
RESIDENCY TIME		
% remaining after 3 days	87	80
% remaining after 10 days	73	50
% remaining after 15 days	60	50
% remaining after 22 days	40	40

4.11B.6.3 Residency Time and Migration Behavior

Residency time is defined as the length of time smolts remain in the North Fork Lewis River. Once smolts enter the Columbia River, they are no longer considered residents of the North Fork Lewis River. Migration behavior is associated with residency time, but focuses on the movement pattern while in the river system.

Residency time varied over the 2002 study period. Four smolts were never detected after release and it is assumed that they emigrated from the system immediately. The majority of smolts however, chose to stay in the deep pools and glides at or just downstream of the Lewis River Hatchery. At the end of the study period, 12 of the 30 original smolts (40 percent) either remained in the Cedar Creek hole or could be found within a mile of the hatchery.

As in 2001, once smolts began to outmigrate they often did not hold for prolonged periods in the Lewis River. This was especially true the farther downstream the smolts were. The significance of RM 9.1 noted in 2001 was still significant as both a holding area and marker. Smolts moving past this point would typically leave the Lewis River within 24-48 hours. There were, however, occasions when smolts passing this area would still hold downstream of RM 9.1. For example, smolts No. 7 and 30 held in areas downstream of RM 9.1 for 3-4 days before emigrating from the Lewis River. Another area that appears to be preferred by coho smolts in both 2001 and 2002 during their outmigration is the large river bend near the Golf Course (RM 13). In both years, smolts would hold in a large glide just downstream of the bend. Smolt No. 17 held in this area 9 days before moving towards the Columbia River. Once smolt No. 17 began to move from the Golf Course area, it took 48 hours for the smolt to reach the mouth of the Lewis River. The fastest documented emigration rate through tracking was smolt No. 19. This smolt traveled 12.7 miles in just under 48 hours.

Despite differences in mean length and peak flow rates between the two release years, the average residency time was identical towards the end of the study. Specifically, 22 days after release, the same percentage (40 percent) of smolts remained in the North Fork Lewis River for both years (Table 4.11B-3). Migration rates differed slightly between the two years early in the study. This difference is probably attributed to the higher flows in 2002 that likely flushed some of the smolts downstream of hatchery after release. Ten days after release, about 70 percent of the smolts released in 2001 remained, as opposed to only 50 percent of the smolts from the 2002 release. For both years, it appears that after about 20 days, smolts that left the Cedar Creek hole emigrated from the Lewis River. In contrast, smolts that resided in or near the Cedar Creek area for a week or more tended to remain in this area for the duration of the study. This resiliency to outmigrate is significant when evaluating the effect of hatchery releases on protected species. If smolts do not emigrate from the Lewis River for prolonged periods, the potential for predation by coho smolts on fall Chinook fry increases.

4.11B.7 Conclusions

The purpose of this study was to describe smolt migration behavior of hatchery-reared coho smolts in the Lewis River, specifically residency time and migration behavior. Residency time is one of many indices used in assessing the effect hatchery programs may have on native stocks within the same watershed. It is generally considered detrimental to have hatchery smolts interspersed with native stocks due to predation and intraspecific competition concerns. Large hatchery programs, such as the Lewis, can have significant effects on native populations (Hawkins and Tipping 1999).

Given the results of this study and the comparisons made with the previous year's study, the following statements can be made about the data.

- The difference in flow rates between 2001 and 2002 did not appear to have a significant influence on smolt emigration near the end of the study period as both years had the same percentage of smolt retention (40 percent at the 22 day mark). There does however, appear to be a minor influence just after release, as emigration rates in 2002 were faster than in 2001 (Table 4.11B-3). Perhaps generation flows are not substantial enough to stimulate smolt emigration and “flush” smolts from the Lewis. The data suggest that flushing flows cannot be provided by turbine discharge alone.
- There are areas in which smolts tended to congregate and reside for prolonged periods. Migrating smolts released from the Lewis River Hatchery (excluding the Cedar Creek area) prefer two areas. These are the large glide just downstream of the large bend at the Golf Course (RM 13) and the deep pools and glides near Woodland at RM 9.
- Based on the data obtained in 2001 and 2002, the average time fish reside in the Lewis River depends largely upon the behavior of the smolts after release. Fish that tend to stay in the same area for a few days tended to stay in that same area for the duration of the study; however, fish that tended to move within a few days typically left the system within 3 weeks after release. The time it takes smolts to move from the Lewis River Hatchery to the Lewis River mouth appears to be on average about 4 days. It is also assumed that smolts in active emigration can reach the mouth in less than 24 hours, although the typical range is between 2 and 7 days.
- The number of fish remaining in the Lewis River 22 days after release is substantial for both the 2001 and 2002 releases. Using the 40 percent retention value observed in both 2001 and 2002 and the current annual hatchery release of 1.8 million smolts, approximately 700,000 smolts remain in the Lewis system after 22 days (less mortality). If one applies the consumption rate of fall Chinook fry by coho smolts (4.7 percent) as provided by Tipping and Hawkins (1999), the number of fry consumed by coho smolts at the 22 day mark would be over 30,000 fry per day.
- Emigration rate did not appear to be affected by smolt length. Despite the differences in smolt lengths, the emigration rate did not appear to be affected either way. In fact, the smaller coho release in 2002 had faster emigration rates in the beginning, but as noted, this was probably a result of higher flow rates than smolt size.
- Releases at Pekins Ferry result in faster emigration rates than releases at the Lewis River Hatchery. The 2002 release of smolts from the hatchery proved to have slower emigration rates than those observed from Pekins Ferry in 2001. As reported in 2001, emigration rates are most likely the result of tidal influences rather than specific Lewis River flows.

4.11B.8 Schedule

This study is complete.

4.11B.9 Literature Cited

Hawkins, S.W., and J.M. Tipping. 1999. Predation by juvenile hatchery salmonids on wild fall Chinook salmon fry in the Lewis River, Washington. *California Fish and Game* 85(3):124-129.

PacifiCorp and Cowlitz County PUD. 2002. Licensee's 2001 Technical Study Status Report for the Lewis River Hydroelectric Projects, Volume 1. Portland, OR and Longview, WA. (AQU-11A).

This page intentionally blank.

4.11B.10 Comments and Responses on Draft Report

This section presents stakeholder comments on the draft report, followed by the Licensees' response.

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
WDFW – Curt Leigh	1	AQU 11B		Whether coho can effectively bypass concentrated Chinook spawning locations was not answered.	This is addressed in both reports to the extent that juvenile coho remain in the Lewis system. That is, it is assumed that the less time juveniles remain in the Lewis River, the less effect they would have on the wild fall Chinook population. To ascertain the specific effects and whether releasing fish at Pekins Ferry as opposed to the hatchery is more or less effective depends on other factors, such as, survival, straying rates, and costs. None of these were part of the objectives of this study.	
WDFW – Curt Leigh	1	AQU 11B		Release sites differed between 2001 and 2002. This did not allow for comparison of the data that were collected. The study plan called for release at 2 sites.	This was discussed at the February 7, 2002 ARG meeting. It was determined that it would be best to concentrate efforts and dollars on the hatchery release site, as smolts released at the Pekins Ferry would likely be lost within 24 hours (due to emigration) as was the case in 2001. (see page 4 of the meeting notes).	

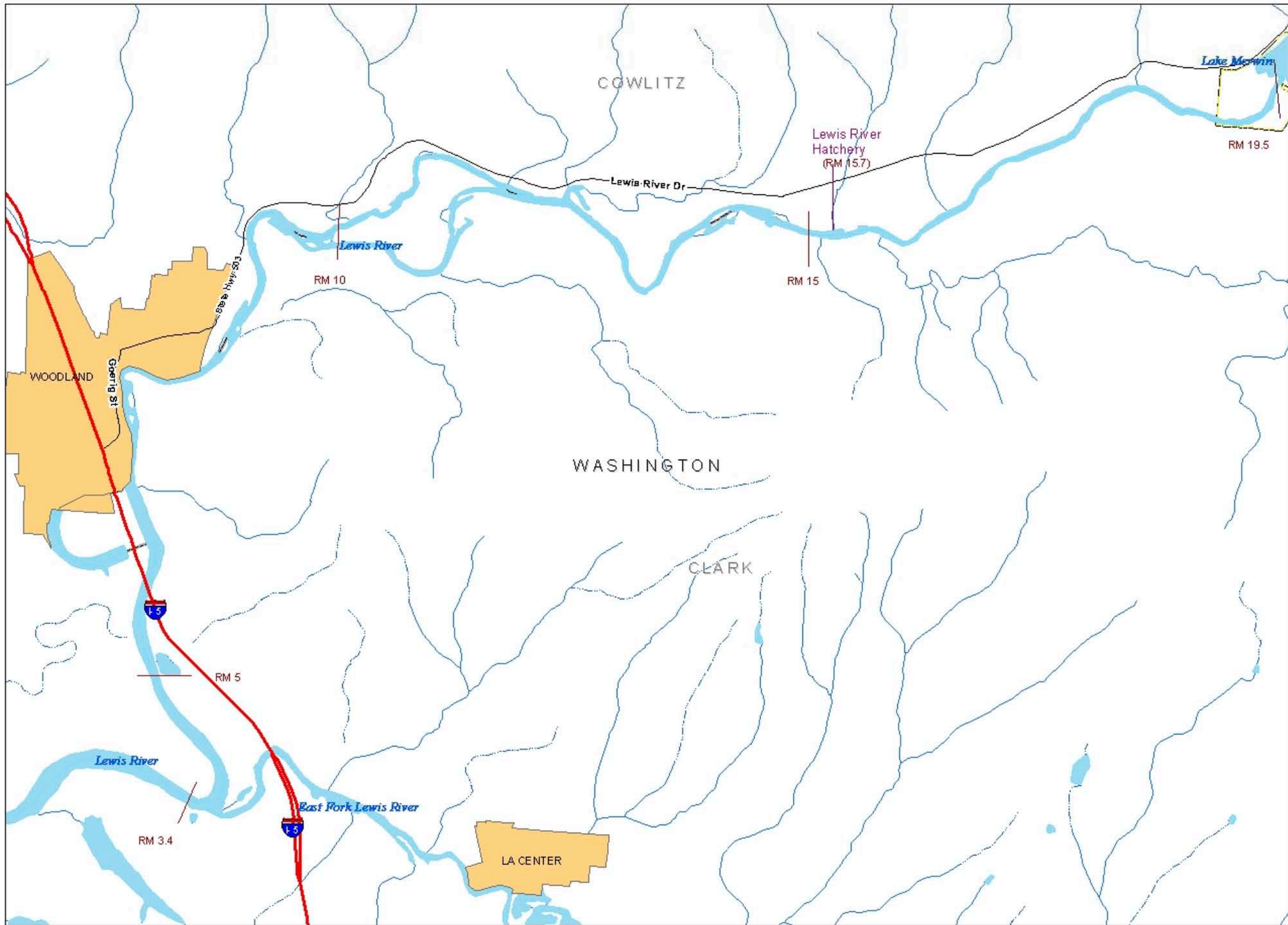
Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
					Also, the draft report contained a general study area map depicting both release sites, which likely caused some confusion. This will be corrected in the final.	
WDFW – Curt Leigh	1	AQU 11B		Inconsistencies in methodology exist between the 2001 and 2002 studies, including: differences in release sites, number of surveys conducted, number of fish released and mark-recapture monitoring.	During the February meeting, as well as the preceding meeting in January, it was determined that mark-recapture monitoring would not be done in favor of continuation of the radio tracking studies. The mark-recapture monitoring was very labor intensive and there were no clear signs that data obtained from mark-recapture would provide better results. The number of surveys conducted depended on river conditions, equipment, and personnel. While the original plan called for surveys every other day, PacifiCorp believes the number of surveys conducted was adequate to provide a description of movement patterns in the Lewis River.	
WDFW – Curt Leigh	1	AQU 11B		Key Questions differ between the study plan and 2002 report.	The key questions did not change; however, the objectives changed based on discussions with the ARG. Basically, this study was	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
					<p>conducted to compare migration rates of smolts based on 2 different spring runoff scenarios in 2001 and 2002. A secondary concern was tied to determining whether releasing radio-tagged smolts along, with the normal 1.6 million hatchery smolts, at the hatchery, would affect migration rates. The main objectives of determining smolt behavior and migration rates remained intact.</p>	
WDFW – Curt Leigh	1	AQU 11B		<p>Results are not consistent in the table 4.11B-1: (1) there are fewer surveys than the plan calls for (2) smolt detection percentages are incorrect.</p>	<p>Detection percentage is based on the number of detects / the number of available smolts. The number of available smolts is 30 minus those that were assumed to have left the system. This is a more accurate representation as it reduces error by not counting smolts that are assumed to have left the system. Language will be added to the report to make this clearer. The number of surveys was less than originally planned in study plan, but was dependent on resources and smolt behavior. For the first 3 days, smolts were monitored daily and</p>	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
					then every subsequent 2-4 days.	
WDFW – Curt Leigh	1	AQU 11B		Differences exist between the 2001 and 2002 releases with regard to migration behavior and residency time. 2002 results do not support the assumption that 4 smolts emigrated from the Lewis River (Hatchery release) within 24 hours. Also, there is conflicting information regarding the actual percentage of fish remaining the Lewis River at the conclusion of the study.	This will be changed to reflect that these smolts will be treated as unknowns. That is, it is not known whether these smolts emigrated from the system, tags malfunctioned, or were subject to avian (or other) predators.	
WDFW – Curt Leigh	1	AQU 11B		Why wasn't the mark-recapture work done?	This was discussed at the January ARG meeting. See the third response in this table.	
WDFW – Curt Leigh	1	AQU 11B		Release locations not depicted in 4.11B-1.	There was only one release location - Lewis River Hatchery.	
WDFW – Curt Leigh	1	AQU 11B		Where is the April 29th, tracking map.	The April 29th map did not make it to print, but will be included in the final.	
WDFW – Curt Leigh	1	AQU 11B		Survey dates are not consistent with the every other day methodology - only 9 days were surveyed.	See the fifth response in this table.	
WDFW – Curt Leigh	1	AQU 11B		Inconsistency between Table 4.11B-2 and text. Table indicates 12 of 30 smolts remained whereas text indicates 11 of 30 remain at the end of survey. Which is correct?	The text will be corrected.	
WDFW – Curt Leigh	1	AQU 11B		The significance of Pekins Ferry should be acknowledged and discussed more.	It was discussed in the 2001 report, but will be included in the conclusion of the 2002 report as well.	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
WDFW – Curt Leigh	1	AQU 11B		Table 4.11B-3 needs to be reviewed for accuracy regarding the percentages. The statement that after 22 days the same percentage of coho remained in the river for both 2001 and 2002.	This was checked and found to be correct.	
WDFW – Curt Leigh	1	AQU 11B		Table 4.11B-2 show many fish that did not move. Please discuss in report the possibility that transmitter malfunctioned or fish may have died.	This will be clarified.	
WDFW – Curt Leigh	1	AQU 11B		In 2001, the report discussed tidal influences, but these were not discussed in 2002.	This will be added to the report.	
WDFW – Curt Leigh	1	AQU 11B		Objective No. 5 suggest that smaller size at release may be of benefit. However, there is no data to support that releasing smaller sized smolts will (1) reduce predation, (2) speed migration, or (3) reduce residualization. Also, larger fish have better survival rates. The current science needs to be referenced and included in this analysis.	Any recommendation related to hatchery practices will be deleted as they do not support the objectives of the report. However, the differences that exist between the 2001 and 2002 releases will be retained as they describe differences which will be subject to further investigation in another venue.	
WDFW – Curt Leigh	1	AQU 11B		This report should have provided full analysis of the 2001 and 2002 data.	The Licensees believes that the final 2002 report provides full analysis of the 2-year study. Relevant results from the 2001 study are included in the 2002 report.	

This page intentionally blank.



Lewis River

Legend

- Regional Lakes
- Rivers**
- PERENNIAL RIVER
- INTERMITTENT RIVER
- PERENNIAL CANAL
- INTERMITTENT CANAL
- UNKNOWN
- FERC License
- City Limit
- County
- State Boundary

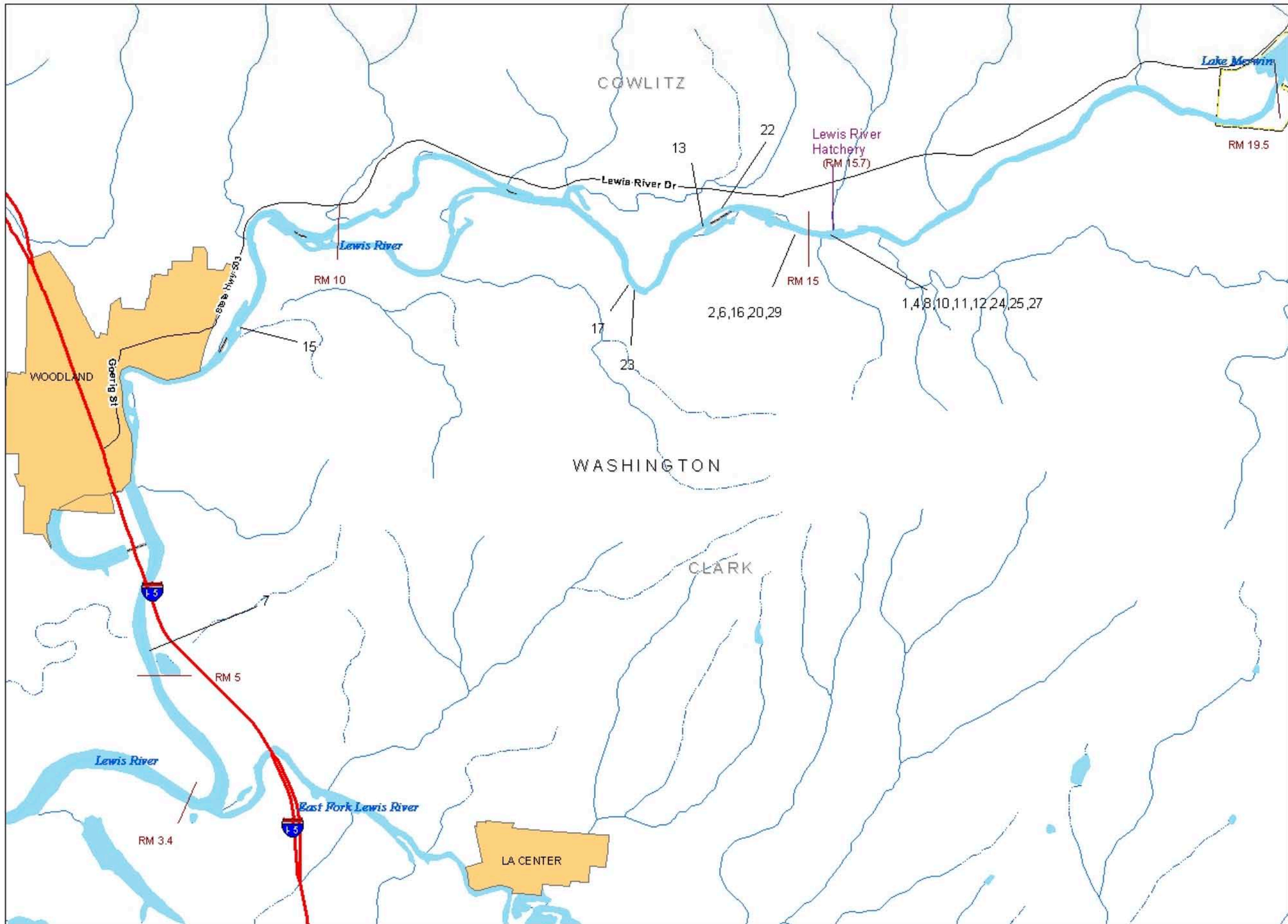
FIGURE 4.11 B-2

Study Area depicting release location at Lewis River hatchery



1:48,014

2/29/03
 Data collected from a variety of City, County, State, Federal and Private sources. PacificCorp GIS makes no warranty as to the accuracy, reliability, or completeness of this data for individual or aggregate use.



Lewis River

Legend

- Regional Lakes
- Rivers**
- PERENNIAL RIVER
- INTERMITTENT RIVER
- PERENNIAL CANAL
- INTERMITTENT CANAL
- UNKNOWN
- FERC License
- City Limit
- County
- State Boundary

FIGURE 4.11 B-4

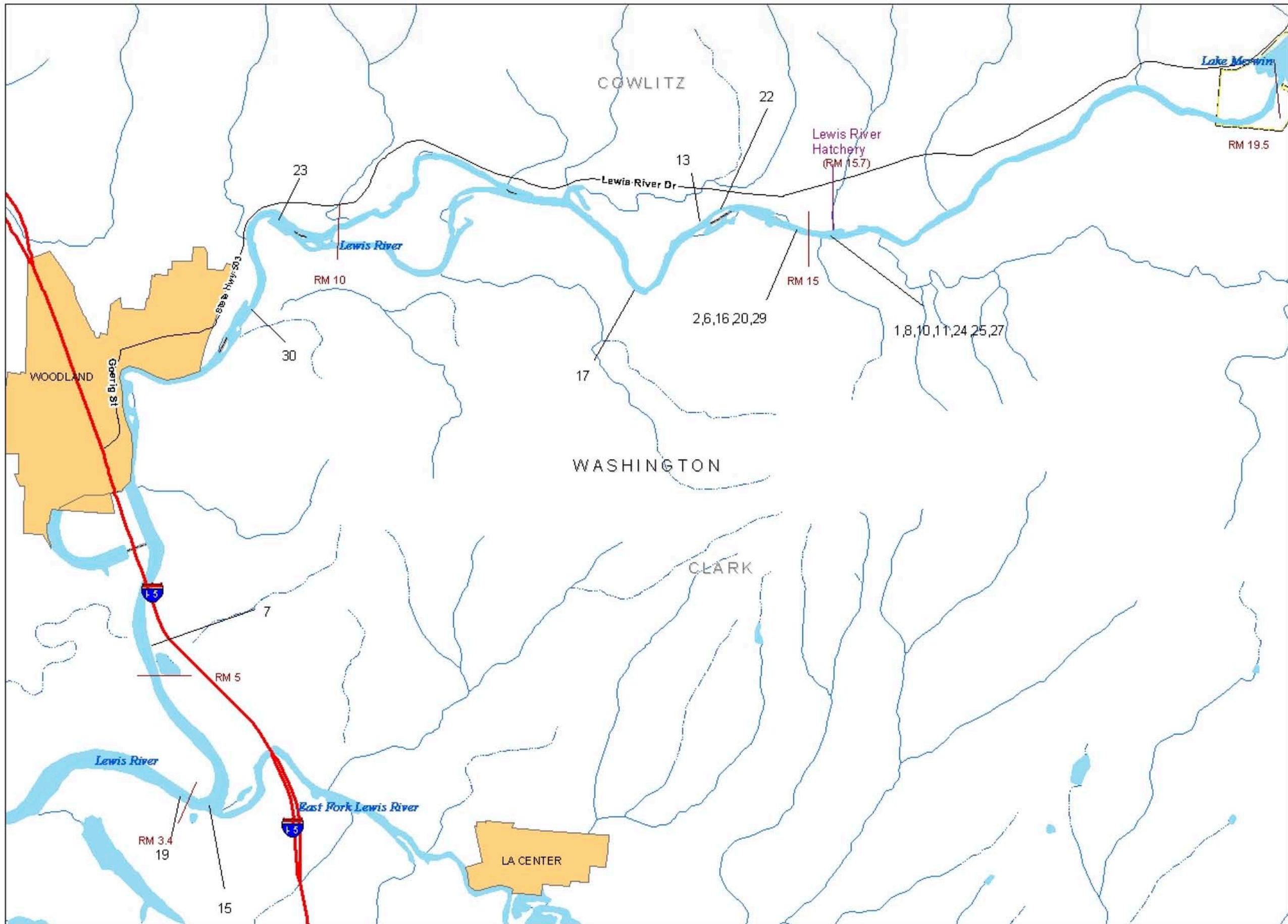
Detection summary of Coho released from the Lewis River hatchery on April 16, 2002

Survey Date: April 18, 2002
 Detection Rate = 67%



1:48,014

2/29/03
 PacificCorp Copyright 2003
 Database collected from a variety of City, County, State, Federal and Private sources. PacificCorp GIS makes no warranty as to the accuracy, reliability, or completeness of this data for individual or aggregate use.



Lewis River

Legend

- Regional Lakes
- Rivers**
- PERENNIAL RIVER
- INTERMITTENT RIVER
- PERENNIAL CANAL
- INTERMITTENT CANAL
- UNKNOWN
- FERC License
- City Limit
- County
- State Boundary

FIGURE 4.11 B-5

Detection summary of Coho released from the Lewis River hatchery on April 16, 2002

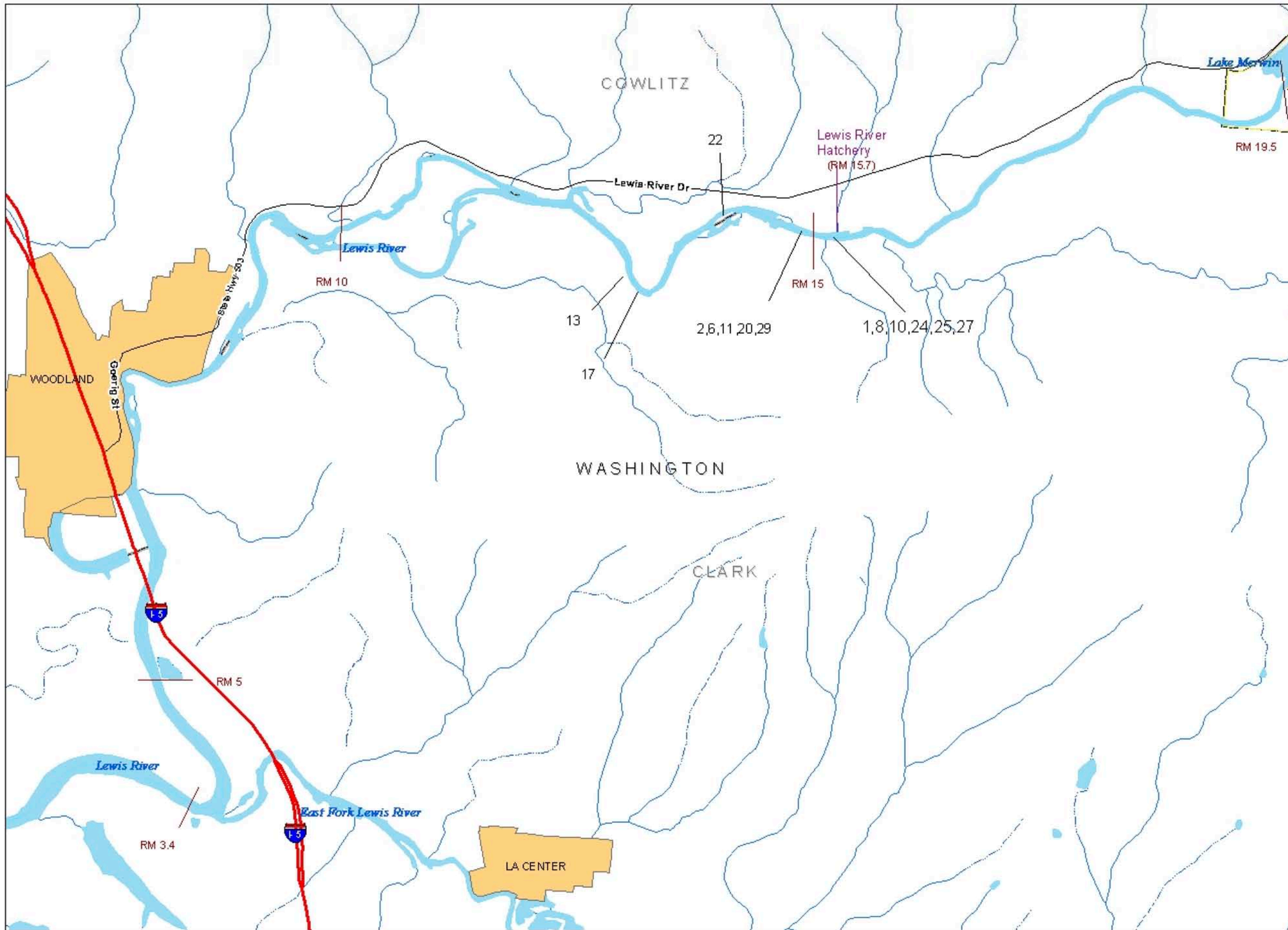
Survey Date: April 19, 2002
 Detection Rate = 67%



1:48,014

2/29/03
 PacificCorp Copyright 2003
 Database collected from a variety of City, County, State, Federal and Private sources. PacificCorp GIS makes no warranty as to the accuracy, reliability, or completeness of this data for individual or aggregate use.

Lewis River



Legend

- Regional Lakes
- Rivers**
- PERENNIAL RIVER
- INTERMITTENT RIVER
- PERENNIAL CANAL
- INTERMITTENT CANAL
- UNKNOWN
- FERC License
- City Limit
- County
- State Boundary

FIGURE 4.11 B-8

Detection summary of Coho released from the Lewis River hatchery on April 16, 2002

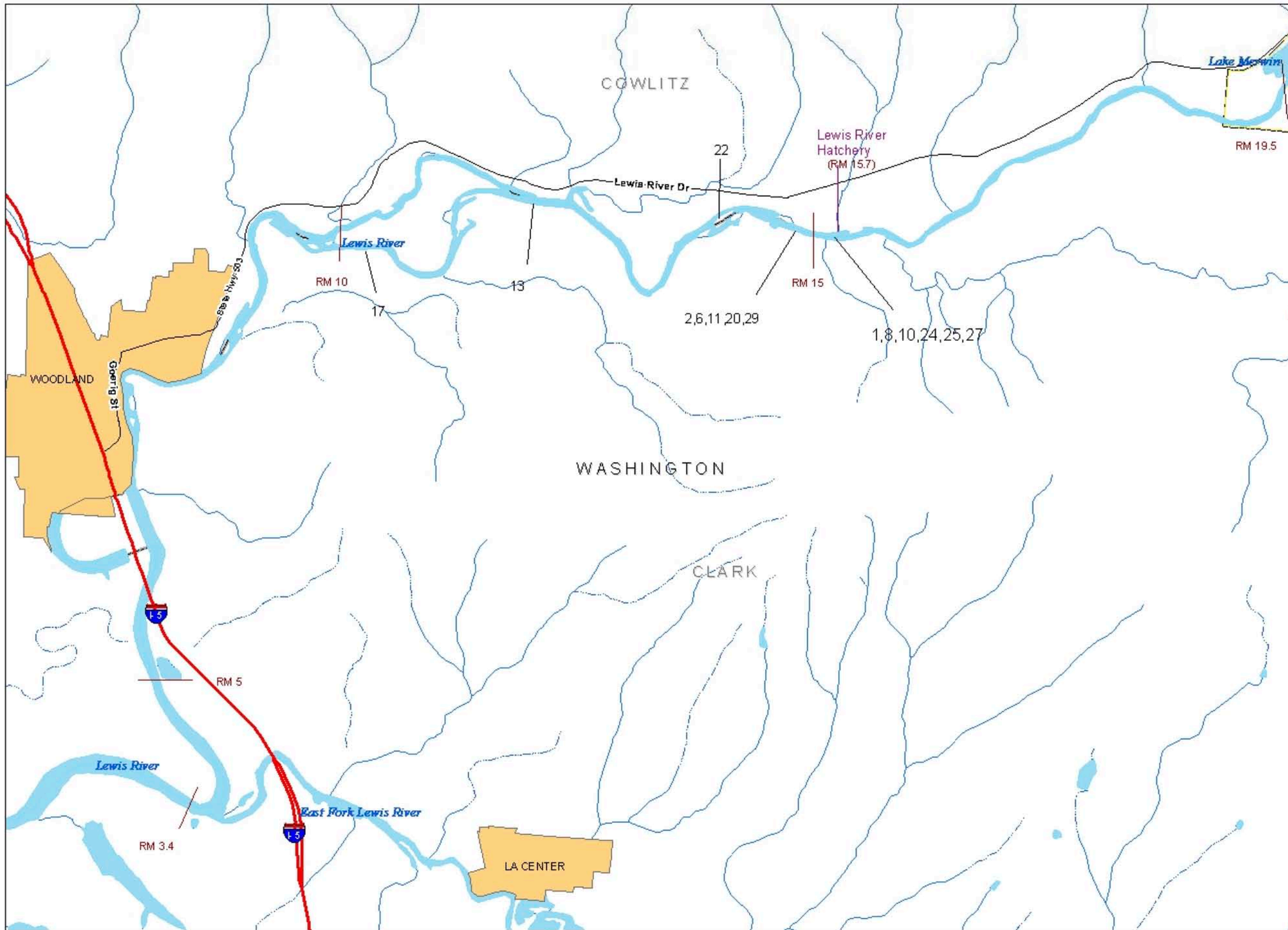
Survey Date: April 29, 2002
 Detection Rate = 58%



1:48,087

2/29/03
 Pacific Corp Copyright 2003
 Database collected from a variety of City, County, State, Federal and Private sources. Pacific Corp GIS makes no warranty as to the accuracy, reliability, or completeness of this data for individual or aggregate use.

Lewis River



Legend

- Regional Lakes
- Rivers**
- PERENNIAL RIVER
- INTERMITTENT RIVER
- PERENNIAL CANAL
- INTERMITTENT CANAL
- UNKNOWN
- FERC License
- City Limit
- County
- State Boundary

FIGURE 4.11 B-9

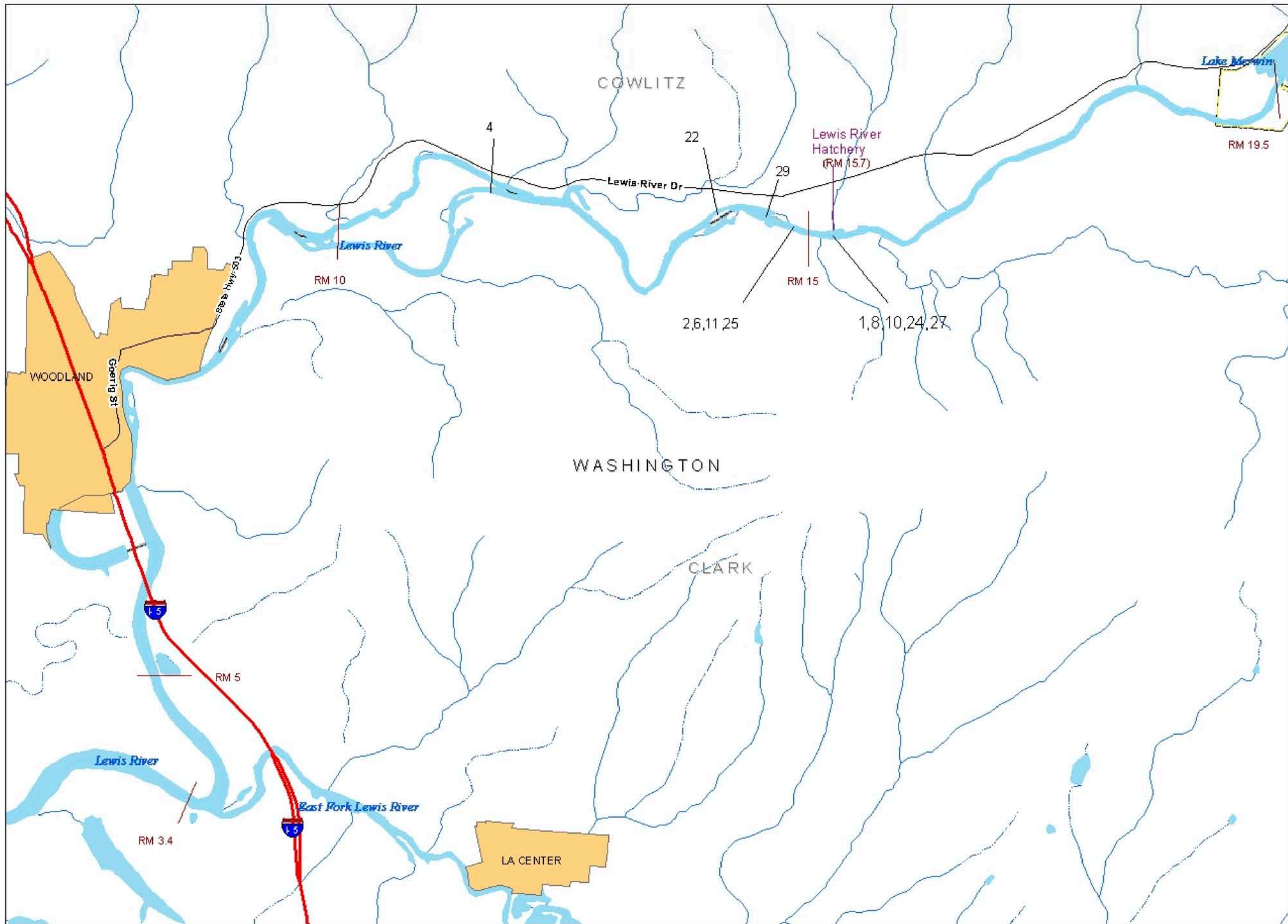
Detection summary of Coho released from the Lewis River hatchery on April 16, 2002

Survey Date: May 1, 2002
Detection Rate = 58%



1:48,014

2/29/03
Data collected from a variety of City, County, State, Federal and Private sources. PacificCorp GIS makes no warranty as to the accuracy, reliability, or completeness of this data for individual or aggregate use.



Lewis River

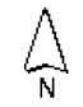
Legend

- Regional Lakes
- Rivers**
- PERENNIAL RIVER
- INTERMITTENT RIVER
- PERENNIAL CANAL
- INTERMITTENT CANAL
- UNKNOWN
- FERC License
- City Limit
- County
- State Boundary

FIGURE 4.11 B-11

Detection summary of Coho released from the Lewis River hatchery on April 16, 2002

Survey Date: May 10, 2002
 Detection Rate = 50%



1:48,014

2/29/03
 PacificCorp Copyright 2003
 Database collected from a variety of City, County, State, Federal and Private sources. PacificCorp GIS makes no warranty as to the accuracy, reliability, or completeness of this data for individual or aggregate use.