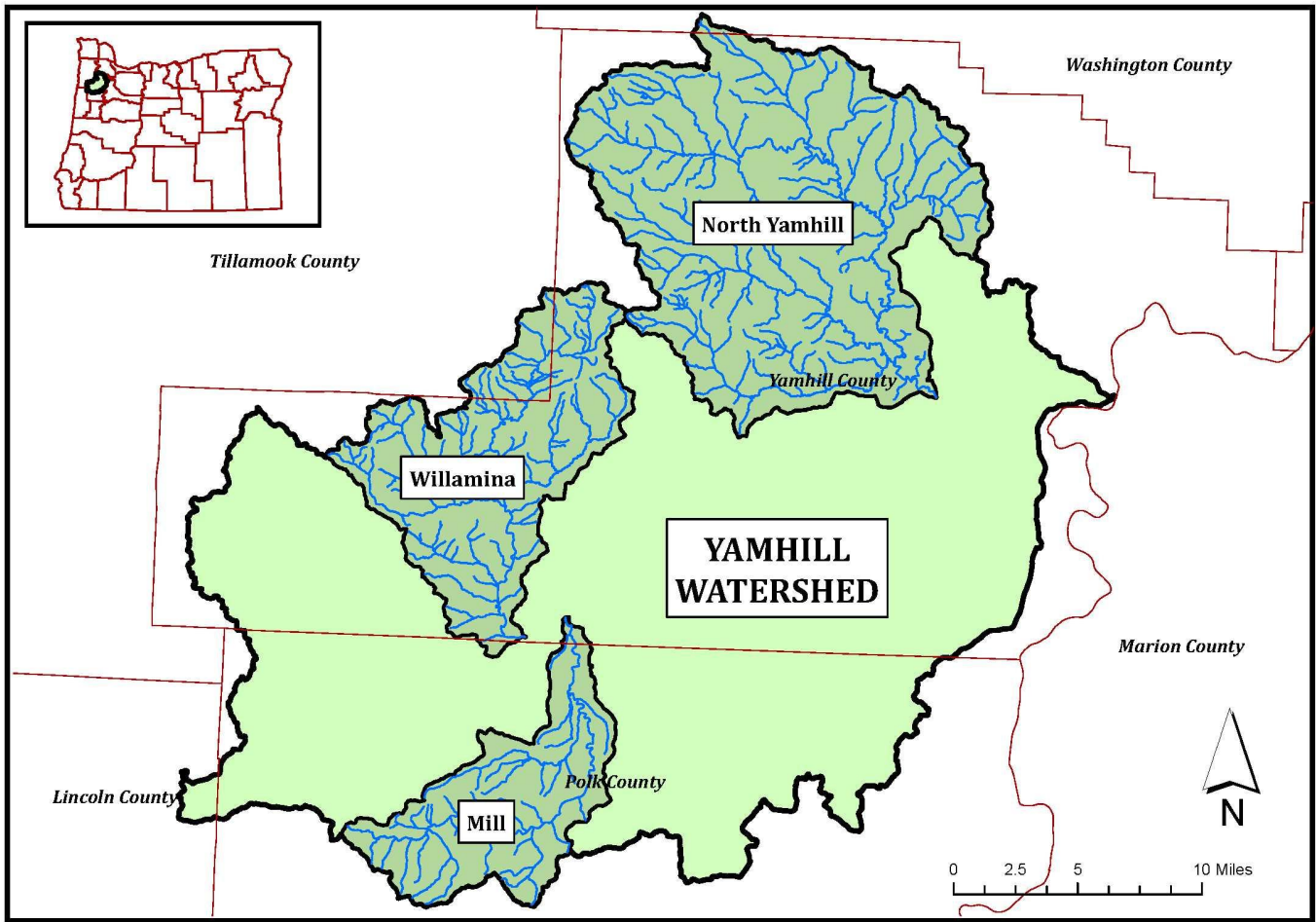


Yamhill Watershed Culvert Prioritization and Action Plan for Fish Passage





**GREATER YAMHILL
WATERSHED COUNCIL**

Prepared For:

**National Fish and Wildlife Foundation
U.S. Bureau of Land Management
Confederated Tribes of Grand Ronde**

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December 2012

Acknowledgements

This project was funded through two successive grants awarded by the National Fish and Wildlife Foundation (NFWF) and completed through a combined effort by the US Bureau of Land Management (BLM), the Confederated Tribes of Grand Ronde (CTGR) and the Greater Yamhill Watershed Council (GYWC), and by the following individuals:

Russ Chapman (Bureau of Land Management), Matt Walker (Bureau of Land Management), Scott Snedaker (Bureau of Land Management), Steve Wegner (Bureau of Land Management), Angela SanFilippo (Bureau of Land Management), Tom Murtagh (Oregon Department of Fish and Wildlife), Kelly Dirksen (Confederated Tribes of Grand Ronde), Jeff Kuust (Confederated Tribes of Grand Ronde), Kendra Kurst (Confederated Tribes of Grand Ronde), Rebecca McCoun (Confederated Tribes of Grand Ronde), John Runyon (Cascade Environmental Group), Kim Biafora (Cascade Environmental Group), Ginger Lofftus (Greater Yamhill Watershed Council), Jim Sanders (Greater Yamhill Watershed Council), Luke Westphal (Greater Yamhill Watershed Council), Alena Beltz (Polk County), Josh Togstad (Yamhill Soil and Water Conservation District), Pete Lindberg (Yamhill County), Frank Nasby (Stimson Lumber), and Jolynn Moore (North Yamhill Watershed Resident).

Abstract

From 2003 - 2012, the BLM, in collaboration with the Confederated Tribes of Grand Ronde and the Greater Yamhill Watershed Council, conducted an inventory of the culverts acting as fish passage barriers in select areas within the Yamhill watershed. Three subwatersheds were studied: Mill Creek, North Yamhill River, and Willamina Creek. Approximately 2056 modeled stream crossings were assessed, of which 178 culverts were surveyed and prioritized as barriers to migratory fish species. A local stakeholder group guided the prioritization process and reviewed the prioritization results. This project has identified seven high priority culverts, fifteen medium, and one hundred fifty-six low. Where appropriate, the high and medium priority culverts were grouped together to facilitate project development and funding efficiencies. Collectively, replacing all the high and medium ranked culverts in this Plan would improve access to **an estimated 78.7 miles** of habitat across the Mill Creek, North Yamhill River, and Willamina Creek watersheds.

Purpose

The intent of this document is to identify high and medium priority fish passage barriers and offer strategies for their replacements. Clustering schemes in the Action Plan describe potential strategies by which partners can leverage resources to implement barrier replacements efficiently and economically.

This prioritization was meant to be simple and part of an ongoing, iterative process. Extensive costs can be expended in developing prioritizations, estimating culvert replacement costs, and conducting analyses. For this prioritization, extensive analyses were not conducted since partners implementing the projects would be conducting them prior to implementation, regardless of whether the information was available in this document. Watershed partners have different goals, needs, and available funds, often with ties to land use or ownership. As such, this Plan provides available culvert data and potential clustering strategies for implementation. The landowner or user of this Plan is responsible for determining which culvert or cluster should be replaced based upon their goals.

Document Limitations

This report represents a “snapshot” of select data for the Yamhill watershed at the time of report production. Conditions within the watershed do not remain static and will change over time. Additionally, it is likely that some fish barriers were unintentionally overlooked or not surveyed and have therefore been excluded from this document. Some fish barriers were not viewed or surveyed due to property access limitations on privately held lands. For these reasons and more, it is imperative to complete due diligence and field verification prior to initiating a project based on this report.

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Introduction

Stream channel crossings by roads have created impediments to fish passage in Oregon that have significantly reduced the number of stream miles available to anadromous and resident fish populations. Improperly designed or placed structures such as culverts have caused significant losses of fish habitat. According to a 1998 report by the Oregon Department of Fish and Wildlife (ODFW), such barriers have seriously limited fish production in an unknown number of miles of historic habitat.

While barriers that affect fish movement have existed historically, they occurred in the form of natural features, including temporary log jams and the Willamette Falls at Oregon City. These natural fish barriers influenced anadromous fish species in the basin. The construction of a fish ladder at Willamette Falls has since allowed Coho salmon access to new habitat where as historically, Coho did not exist above the Willamette falls and within the Yamhill Basin.

Today, fish passage barriers in the Yamhill basin include culverts and other road crossing structures, dams, and waterfalls. These barriers impede fish migration, which is necessary to meet a number of life history needs, including: access to spawning and rearing areas; localized movement to adjust to changing habitat conditions; stream continuity to prevent population fragmentation; re-colonization after catastrophic events such as floods and drought (ODFW, 1998; OPSW; 1999).

In addition to problems associated with fish passage barriers are the potential impacts of climate change, which some scientific circles believe will likely begin to increase temperatures in rivers where native fish live. The lower reaches of most river systems are more susceptible to the potential impacts of climate change than the upper reaches. The impending effects of climate change emphasize the need to increase access to cool, clean headwater systems, which will provide quality spawning and rearing habitat for anadromous and resident fish populations.

Recognizing the need to increase access to quality fish habitat, stakeholders across a wide variety of Oregon watersheds have demonstrated a commitment to implement restoration strategies and projects to replace or remove fish passage barriers. Due to funding limitations and the large number of stream crossings that exist, it is important to implement a prioritization process that focuses efforts on the highest priority areas that will provide the greatest benefit to salmonids, while also working within the scope of the objectives and interests of multiple stakeholders.

This report describes current results of a multi-year, collaborative effort to prioritize fish passage barriers for restoration within the North Yamhill River, Willamina Creek, and Mill Creek Watersheds, located in the Yamhill Watershed. This study is adapted from a successful culvert prioritization model conducted in the Nestucca Basin by the Bureau of Land Management (BLM), Tillamook Estuaries Partnership (TEP), and other coastal stakeholders in 2006 (TEP, 2006).

Objectives

The overarching objective of the Yamhill culvert study is to create a prioritization document (this report) that identifies high priority fish passage projects, which can be used to efficiently and economically leverage funding to implement restoration actions into the future. Accomplishing the overall objective of the project required the following strategies:

1. Creation of a comprehensive inventory of culvert information across ownerships within the three watersheds.
2. Conduct an extensive outreach campaign to garner permissions to access private lands.
3. Collaborate with a volunteer stakeholder group to develop and implement a prioritization process/methodology.

Study Area

The Yamhill Basin is located in Northwest Oregon and encompasses almost all of Yamhill County and the northern portion of Polk County (Figure 1). The basin is defined as those waters that flow through various rivers, streams and tributaries and into the Yamhill River. The Yamhill River then flows into the Willamette River, which flows to the Columbia River and finally into the Pacific Ocean. The entire Yamhill Basin includes an area of approximately 529,000 acres from the crest of the coast range to the Willamette River. The Basin includes approximately 1,050 stream miles.

The majority (~ 87%) of the land in the Yamhill Basin is privately owned with predominant land uses of agriculture and industrial forestry. BLM and the U.S. Forest Service (USFS) manage properties in the upland portions of the basin. Roughly 70% of the basin lies in Yamhill County while the remaining 30% lies in northern Polk County. Within the Yamhill watershed there are ten subwatersheds, of which, the North Yamhill River, Willamina Creek and Mill Creek watersheds were chosen for this culvert prioritization study. These watersheds were selected by the BLM due to their ownership of lands within the upper reaches.

Limited surveys of fish and wildlife presence have been conducted in the Yamhill watershed. Populations of winter steelhead (*Oncorhynchus mykiss*), spring Chinook salmon (*Oncorhynchus tshawytscha*), cutthroat trout (*Oncorhynchus clarki*), and non-native Coho Salmon (*Oncorhynchus kisutch*) are known to occur in the coldwater streams and rivers of the Yamhill Basin. The National Oceanic and Atmospheric Administration (NOAA) lists winter steelhead and spring Chinook salmon in the Upper Willamette evolutionary significant unit (ESU) as threatened under the Endangered Species Act (ESA).

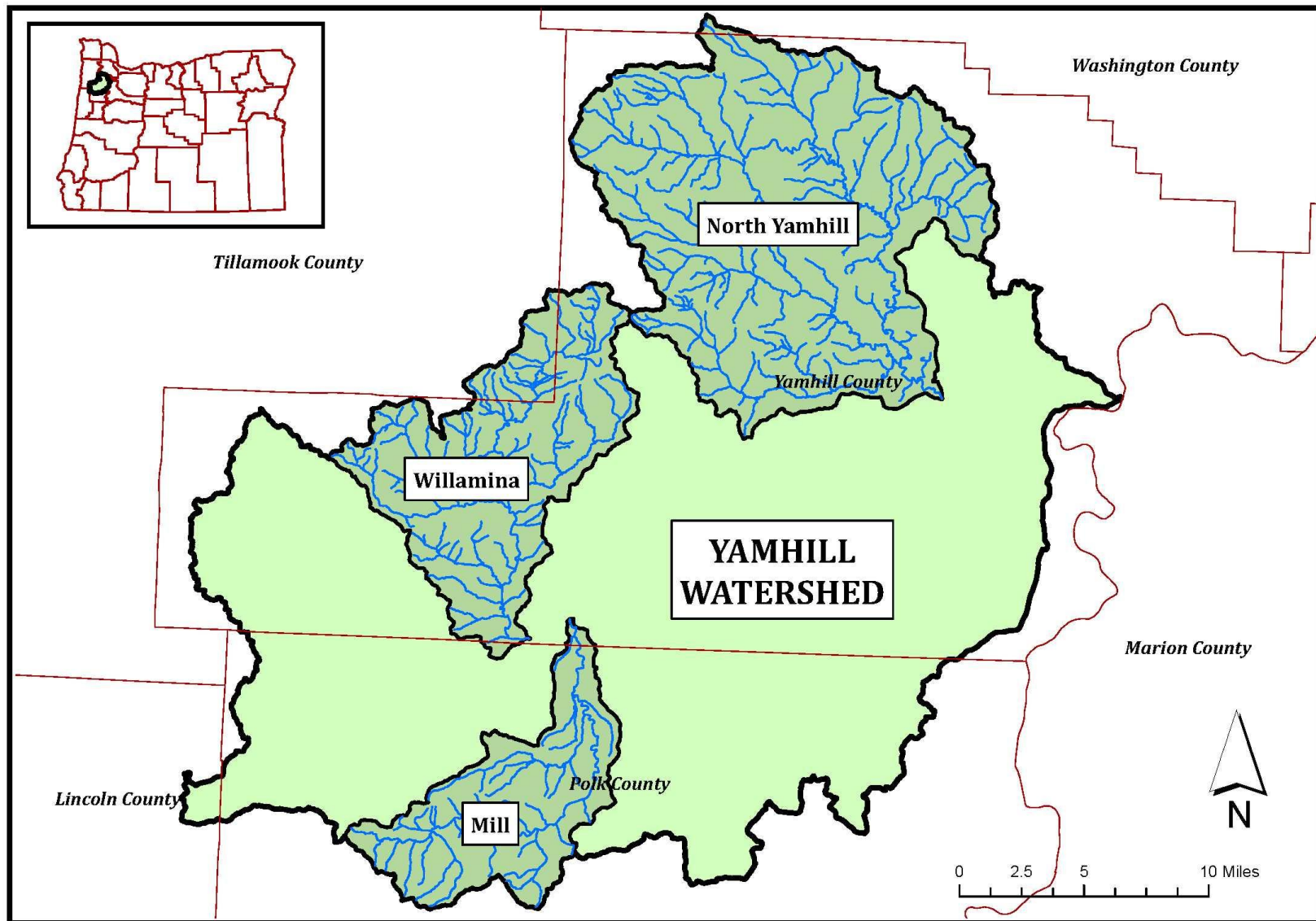


Figure 1: Study Area: Map depiction of the three subwatersheds (North Yamhill River, Willamina Creek, and Mill Creek) within the spatial context of the Yamhill Watershed and the State of Oregon.

Culvert Inventory

In 2003, the BLM Salem District's, Tillamook Resource Area initiated a project to inventory culverts across ownerships within the North Yamhill River, Willamina Creek, and Mill Creek watersheds. The BLM used Geographic Information Systems (GIS) to create a modeled stream crossing layer that identified all stream crossings with a gradient less than 15%, which is generally accepted as the probable end extent of fish use. A total of 2,056 modeled stream crossings were identified across all three watersheds.

Between 2003 and 2004, the BLM conducted a total of 729 field assessments of the GIS modeled crossings, focusing on culverts located within federal, state, and private industrial lands of the North Yamhill and Willamina watersheds. Methods for the field assessments and surveys followed existing protocols developed by the BLM for culvert survey work in the Nestucca basin (TEP, 2006). Of the 729 modeled stream crossings assessed, 93 culverts were fully surveyed, while the remaining crossings either did not exist (DNE), were not on fish bearing stream (NFC), or were bridges. Data from these assessments were compiled by the BLM into an ongoing Microsoft Access database.

In 2007, the BLM was awarded grant funding through the National Fish and Wildlife Fund (NFWF) to continue the inventory project started in 2003 and to extend the field assessment work onto private lands. The BLM worked in collaboration with the Confederated Tribes of Grand Ronde (CTGR) and the Greater Yamhill Watershed Council (GYWC - formerly the Yamhill Basin Council) to assess 784 modeled crossings within the North Yamhill River and Willamina Creek watersheds, 70 of which were fully surveyed. The remaining modeled crossings assessed were identified as either DNE, NFC, or were bridges. By the end of the 2007 NFWF grant, the BLM and partners had completed assessments for a majority of the modeled crossings in the North Yamhill and Willamina watersheds. The 2007 (and 2009) NFWF projects required outreach to landowners to garner permissions to access modeled stream crossings located on privately held lands.

In 2009, the BLM was awarded additional grant funding through the NFWF to conduct field assessments for the remaining modeled stream crossings and to develop a prioritization document to help facilitate the efficient and economical restoration of fish passage in the three watersheds. From 2010 to 2011, the BLM, CTGR, and GYWC assessed 260 modeled crossings, of which 45 were fully surveyed. The remaining modeled crossings assessed were identified as DNE, NFC, or bridges. Following the completion of the 2010/2011 survey work season, the BLM and partners had completed assessments of about 83% of the modeled stream crossings for the three watersheds.

The following tables demonstrate the results of the 2003 - 2011 Culvert Inventory process for the 2,056 modeled stream crossings. Each table summarizes one of the three watersheds (Table 1a, 1b, 1c). The three tables also include barrier determinations (CSFE) for surveyed culverts, which are described as a full barrier (red), a partial barrier (grey), and no barrier (green).

Table 1a: Mill Creek Watershed Inventory Summary; Describes the results of assessments conducted from 2003 - 2011 for modeled stream crossings in the Mill Creek Watershed. Also includes results of barrier determinations for surveyed culverts (red, green, grey = full barrier, no barrier, and partial barrier).

Mill Creek Watershed Inventory Summary			
Total Stream Crossings: 152			
SURVEYED	28		
		CSFE Red	24
		CSFE Green	4
BRIDGE	27		
NON-FISH-CULVERT (NFC) (Either non-fish culvert or habitat unlikely to support fish)	72		
DOES NOT EXIST (DNE) or CULVERT REMOVED (DNE Removed)	20		
GREEN (Culvert adequate when viewed)	2		
INCOMPLETE	3		
		Survey Status: "NoViewNeeded" No restricted access or no response, but probably not fish habitat	3

Table 1b: Willamina Creek Watershed Inventory Summary; Describes the results of assessments conducted from 2003 - 2011 for modeled stream crossings in the Willamina Creek Watershed. Also includes results of barrier determinations for surveyed culverts (red, green, grey = full barrier, no barrier, and partial barrier).

Willamina Creek Watershed Inventory Summary			
Total Stream Crossings : 549			
SURVEYED	85		
		CSFE Red	73
		CSFE GREY	4
		CSFE Green	8
BRIDGE	25		
NON-FISH-CULVERT (NFC) (Either non-fish culvert or habitat unlikely to support fish)	320		
DOES NOT EXIST (DNE) or CULVERT REMOVED (DNE Removed)	74 4		
GREEN (Culvert adequate when viewed)	0		
INCOMPLETE	41		
		Survey Status: Needs Survey Permission granted or no response –Not surveyed or issues with culverts that keep them from being surveyed	3
		Survey Status: Permission Access Approved/Needs View	5
		SurveyStatus: No Permission Access Denied/Needs View or survey	8
		Survey Status: "NoViewNeeded" No restricted access or no response, but probably not fish habitat	7
		Survey Status: No Response culvert can be viewed or not viewed and may or may not need surveyed	12
		Survey Status: NoInfo From BLM '03, '04 database with no other survey data captured	6

Table 1c: North Yamhill River Watershed Inventory Summary; Describes the results of assessments conducted from 2003 - 2011 for modeled stream crossings in the North Yamhill River Watershed. Also includes results of barrier determinations for surveyed culverts (red, green, grey = full barrier, no barrier, and partial barrier).

North Yamhill River Watershed Inventory Summary			
Total Stream Crossings : 1355			
SURVEYED	95		
		CSFE Red	81
		CSFE GREY	2
		CSFE Green	12
AQUEDUCT	5		
BRIDGE	78		
NON-FISH-CULVERT	733		
DOES NOT EXIST or CULVERT REMOVED	146 3		
GREEN (Culvert adequate when viewed)	6		
INCOMPLETE	289		
		Survey Status: Needs Survey Permission granted or no response –Not surveyed or issues with culverts that keep them from being surveyed	29
		Survey Status: Permission Access Approved/Needs View	11
		Survey Status: No Permission Access Denied/Needs View or survey	67
		Survey Status: NoViewNeeded No restricted access or no response, but probably not fish habitat	3
		Survey Status: No Response culvert can be viewed or not viewed and may or may not need surveyed	114
		Survey Status: NoInfo From BLM '03, '04 database with no other survey data captured	65

Landowner Outreach and Private Property Access

Recognizing the importance of fish passage barriers located within lower stream reaches, which are predominantly privately owned, the 2007 and 2009 NWF projects included funding for outreach programs to garner access to and assess modeled stream crossings under private ownership.

From 2008 to 2011, the BLM and CTGR contracted with the GYWC to identify and contact private landowners associated with modeled stream crossings. The GYWC obtained landowner contact information and tax lot maps from the Yamhill and Polk County clerk's offices. The GYWC then mailed notices to each of the identified landowners. These notices provided an explanation of the project, contact information for project partners, and a self-addressed, postage-paid response card with three options for the landowner; 1) Provide permission for a survey team to access the property, assess the stream crossing, and survey the culvert if needed; 2) Deny permission for access and 3) Request for more information.

As response cards were returned, the GYWC contacted the survey crew and provided a list of those modeled stream crossings for which access was granted. For response cards returned that indicated access was denied, the landowner's response was recorded, and no further attempts to gain permissions to access the property were made. In several cases where access was denied, the stream crossing was assessed via observation from a public road or using existing maps and aerial photographs. For the cards that indicated "additional information needed" the GYWC contacted the landowner by phone or in-person. In the event that no response was received, the GYWC made further attempts to contact the landowners with mixed results.

Culvert Prioritization Development

Starting in 2010, the BLM and CTGR contracted with the GYWC to develop and carry out a prioritization process to analyze the 208 surveyed culverts. This required the following actions:

1. Compilation and consolidation of multiple datasets into one master Microsoft Access database and a complementary ArcGIS geospatial database.
2. Formation and meetings of a local stakeholder group to develop the prioritization process.
3. Finalize the prioritization process
4. Conduct prioritization analysis of the 208 culverts.
5. Review, comment, and approval of the analysis results by the stakeholder group.
6. Production of a prioritization report (this report) and distribution of the report and databases to stakeholders.

Database Compilation and Consolidation

Data collected from 2003 - 2011 was compiled and consolidated into a master Microsoft Access database and a complementary Access geospatial database. This process was a significant challenge to complete. Multiple databases had been created over the life history of the data collection and inventorying phase. These databases were generated using a mixture of programs, including Microsoft Access, Microsoft Excel, and ArcGIS. Additionally, the GYWC identified a variety of data entry errors, duplications, missing information, and other database issues. Transitions of staff and project management within the project partners added to the complexity of remediating identified database concerns.

In 2012, after making significant headway with this task, the GYWC contracted with Cascade Environmental Group (CEG) from Portland, Oregon to complete the compilation of a master database in Microsoft Access and to create a complementary Access geospatial database.

Stakeholder Group

Starting in 2011, the GYWC formed a stakeholder group of other resource management professionals and representatives of local interests to assist in developing the prioritization model (identified under the Acknowledgements). The stakeholders met in May of 2011 to discuss potential prioritization schemes. Transitions in GYWC staff and challenges in completing the database compilation (discussed above) delayed further development of the prioritization process until 2012.

In 2012, the GYWC contracted with the CEG to finalize the culvert prioritization model and to eventually carry out the analysis. The GYWC and CEG collaborated with a subset of the stakeholder group in October 2012 to finalize the prioritization approach. The group decided on a three-phased approach adapted from the model used in the Nestucca Basin by the BLM, TEP, and other coastal stakeholders (TEP, 2006):

- 1) Barrier Determination Model
- 2) Prioritization Analysis for full barrier culverts;
- 3) Review of the analysis results by the stakeholder group.

Barrier Determination Model

Based on meetings of the stakeholder group, the BLM Coarse Screen Filter Evaluation Version 2.2 (CSFE) was used to determine barrier severity of the surveyed culverts (Appendix 1). The filter identifies a culvert's barrier level based on the requirements of juvenile salmonids. This model was selected due to its successful application in other culvert prioritization projects (TEP, 2006; WCLU, 2006), its stringent ratings, and its compatibility with the surveys performed. The model evaluates culverts based on observations and measurements from the culvert surveys.

Determinations resulting from the CSFE model are not absolute. For instance, if the model characterizes a culvert as a full barrier to juvenile passage, the culvert may actually pass juveniles at some flows.

Using the CSFE model, the 208 surveyed culverts were ranked as, “green” (no barrier), “grey” (possible or partial barrier) and “red” (full barrier). As demonstrated in the earlier tables, 178 culverts were ranked red, 6 grey, and 24 green (Table 1a - 1c). The 178 red culverts are depicted in Figure 2.

The stakeholder group decided to use CSFE rankings as a filter to reduce the number of culverts to include in the prioritization analysis process. Culverts ranked as either green or grey were excluded from further prioritization analyses.

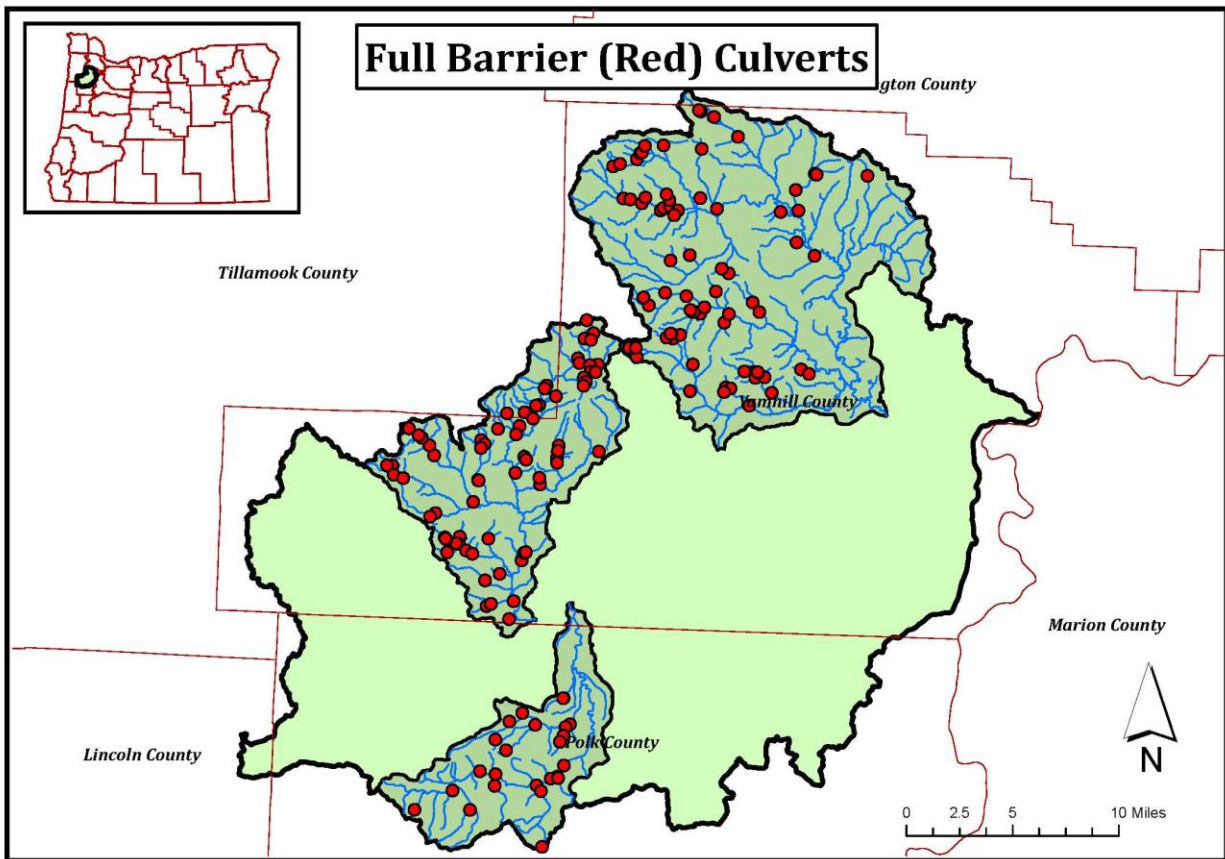


Figure 2: Full Barrier (Red) Culverts: Map depiction of the 178 culverts identified as Full Barriers (Red) using the BLM Coarse Screen Filter (CSFE) referenced in the Appendix.

Final Culvert Prioritization Model

The stakeholder group decided to use the Nestucca Basin culvert prioritization model with modifications to accommodate for data available for the Yamhill watershed study areas. (TEP, 2006). Based on input from the stakeholder group, Cascade Environmental Group developed the final culvert prioritization model described below and outlined in Table 2.

The method developed for scoring culvert priorities is based on combined measures of steelhead habitat length, habitat quality, and fish presence. The highest rating is 10 (the maximum value is achieved for each indicator). Culverts were ranked in three priority categories: high (8-10), medium (6-7), or low (less than 5).

Table 2: Culvert Prioritization Model; Outline of the ranking parameters, criteria, and data sources for the prioritization model. Note: CFSE barrier severity was not included as only red (full barrier) culverts were included in the prioritization analysis.

Step	Parameter	Points	Criteria	Criteria Data Source(s)
1	Upstream Habitat Length	1	< 0.75	Stream Gradient (CLAMS)
		2	0.75 - 1.99	
		3	2 - 2.99	
		4	3 - 3.99	
		5	≥ 4	
2	Upstream Habitat Quality	1	< 0.7	Intrinsic Potential (CLAMS)
		2	0.7 - 2	
		3	> 2	
3	Fish Presence	1	No	Fish Presence (ODF)
		2	Yes	
Total Points Available		10		

Upstream Habitat length

Habitat length was determined by the length (miles) of channel upstream of a culvert mapped as potential steelhead habitat by the Coastal Landscape and Modeling Study (CLAMS) (Miller et al. 2008). Based on digital elevation models, all streams were mapped as potential steelhead habitat up to a point where the upstream gradient increases to greater than 10%. Juvenile steelhead can normally occupy stream reaches up to 6% gradient, but they have been observed in higher gradient stream channels up to approximately 10% gradient (Burnett et al. 2007). Cutthroat trout can also occupy habitats within stream channels of up to 10% gradient (Reeves et al. 1998).

Upstream Habitat Quality

The CLAMS' Intrinsic Potential (IP) score for juvenile steelhead habitat was used to determine the quality of the habitat above the culvert (Burnett et al. 2007). The IP score is based on combining three key landscape-level indicators of fish habitat quality: mean annual stream flow, valley constraint, and channel gradient. Mean annual stream flow, determined from watershed area-precipitation relationships, provides a measure of the minimum watershed area that can support juvenile steelhead. Valley constraint quantifies the constrained stream channel habitats preferred by Juvenile steelhead. Finally, channel gradient is an indicator of the stream gradients preferred by juvenile steelhead; 1.5% to 4.5%. The three indicators of juvenile steelhead quality are combined and multiplied by the habitat length to provide the final IP score of habitat quality, ranging from less than 0.7 (low quality) to greater than 2 (high quality).

Fish Presence

Fish presence was determined from the Oregon Department of Forestry (ODF) fish distribution dataset. This dataset provided an indication of whether fish are known ("yes" or "no") to occupy areas above the culvert. Due to limited and inconsistent data available of species distributions, the ranking process did not assign values based on fish species.

Analysis

Based on the culvert prioritization model outlined in Table 2, CEG used ArcGIS to rank each of the 178 red (full barrier) culverts and compiled the preliminary results into the master database. The prioritization model identified 11 high ranked culverts, 14 medium, and 153 low.

Review of Analysis Results by Stakeholder Group

In November 2012, the GYWC convened a third stakeholder meeting, which 6 partners attended, to review and discuss the prioritization analysis results. The partners led an open discussion of the culvert rankings, the accuracy of the rankings, and additional considerations that could alter the final prioritization rankings. In most cases, the CLAM's habitat length and IP scores either matched or underestimated the stakeholder group's rankings. The stakeholder's experience was very beneficial for identifying culverts with anadromous and resident fish species use. The stakeholders identified 7 high priority culverts and 15 medium priority culverts. Table 3 demonstrates the final list of high and medium priority culverts as determined by the prioritization analysis and stakeholder review. Figure 3 depicts the spatial distribution of the high and medium priority culverts across the study area. Due to the significant number of low priority culverts, those culverts were excluded from this prioritization report and the Action Plan. Data for all culverts is available upon request.

Table 3: High and Medium Ranked Culverts; Summary of culvert prioritization rankings following stakeholder review. Sorted by Priority, Watershed, Ranking, Stream

Culvert ID	Watershed Name	Stream Name	Road Name	T	R	S	Culvert Shape	Length (ft)	Width (in)	Outlet Drop (ft)	Culvert Slope (%)	Habitat Length (mi)	IP Score	Step			Rank	Final Priority
														1	2	3		
4166	Mill Cr	Gooseneck Cr	Gooseneck Cr Rd	6S	6W	31	Circular	55.50	72.00	1.70	1.00	2.22	0.90	3	2	2	7	High
47	N. Yamhill	Turner Cr	Turner Cr Rd	2S	5W	10	Pipe Arch	50.00	144.00	1.02	2.00	5.68	2.03	5	3	2	10	High
262	N. Yamhill	Cedar Cr	Old Railroad Grade Rd	2S	5W	28	Circular	75.00	102.00	1.00	1.00	6.74	3.48	5	3	2	10	High
3327	N. Yamhill	N. Yamhill Trib	Old Railroad Grade Rd	3S	4W	6	Circular	45.00	120.00	0.00	2.00	5.33	2.39	5	3	2	10	High
3093	N. Yamhill	N. Yamhill Trib	Tanager Ln	2S	5W	24	Circular	16.00	72.00	1.48	-1.00	3.20	1.46	4	2	2	8	High
3048	N. Yamhill	N. Yamhill Trib	Garrish Valley Rd	2S	4W	19	Circular	30.00	96.00	0.00	1.00	5.44	2.38	5	3	2	10	High
11090	Willamina Cr	Baltimore Cr	Baltimore Cr Rd	4S	6W	27	Circular	20.25	70.80	-0.68	3.00	8.52	3.33	5	3	2	10	High
4226	Mill Cr	Bear Cr	Bear Cr Rd	7S	6W	18	Circular	40.60	72.00	5.30	13.00	2.20	1.13	3	2	2	7	Med
4238	Mill Cr	Wind Cr	Wind Cr Rd	7S	7W	14	Pipe Arch	48.42	86.00	1.75	0.20	3.94	1.55	4	2	2	8	Med
3444	N. Yamhill	Beaver Cr	Near Panther Cr Rd	3S	5W	23	Circular	61.00	70.00	1.16	4.00	1.80	0.72	2	2	2	6	Med
3475	N. Yamhill	Kane Cr	Near Panther Cr Rd	3S	5W	28	Circular	49.00	69.00	0.70	10.00	2.43	0.48	3	1	2	6	Med
10040	N. Yamhill	Petch Cr	Private Rd	NA	NA	NA	Circular	24.00	84.00	1.13	NA	1.95	1.15	2	2	2	6	Med
847	Willamina Cr	Cedar Cr	Peavine Rd	4S	6W	4	Pipe Arch	41.00	72.00	0.20	20.00	4.08	2.38	5	3	2	10	Med
1314	Willamina Cr	Canada Cr	Canada Cr Rd	5S	7W	10	Open Bottom Arch	48.00	168.00	-1.20	1.00	5.70	4.02	5	3	2	10	Med
1058	Willamina Cr	Willamina Cr Trib	Willamina Cr Rd	4S	7W	24	Circular	114.00	78.00	2.84	5.00	4.08	1.75	5	2	2	9	Med

Culvert ID	Watershed Name	Stream Name	Road Name	T	R	S	Culvert Shape	Length (ft)	Width (in)	Outlet Drop (ft)	Culvert Slope (%)	Habitat Length (mi)	IP Score	Step			Rank	Final Priority
														1	2	3		
1110	Willamina Cr	Gilbert Cr	Gilbert Cr Rd	5S	7W	27	Circular	50.00	36.00	0.60	3.00	2.56	1.08	3	2	2	7	Med
10016	Willamina Cr	Gilbert Cr	Gilbert Cr Rd	5S	7W	3	Pipe Arch	50.00	84.00	-0.67	2.00	2.02	1.27	3	2	2	7	Med
10017	Willamina Cr	Gilbert Cr	Gilbert Cr Rd	5S	7W	3	Pipe Arch	29.00	72.00	0.60	1.00	2.02	1.27	3	2	2	7	Med
4009	Willamina Cr	Willamina Cr Trib	Fort Hill Rd	5S	7W	36	Circular	16.00	60.00	1.48	5.00	2.21	1.13	3	2	2	7	Med
10019	Willamina Cr	Willamina Cr Trib	Allen Rd	5S	7W	27	Circular	55.50	91.20	1.45	3.00	2.51	1.24	3	2	2	7	Med
1116	Willamina Cr	La Tautena Mary Cr	NA	4S	6W	29	Circular	33.00	54.00	2.50	2.00	2.02	0.64	3	1	2	6	Med
10018	Willamina Cr	La Tautena Mary Cr	NA	4S	6W	29	Circular	47.00	48.00	21.00	4.00	2.02	0.64	3	1	2	6	Med

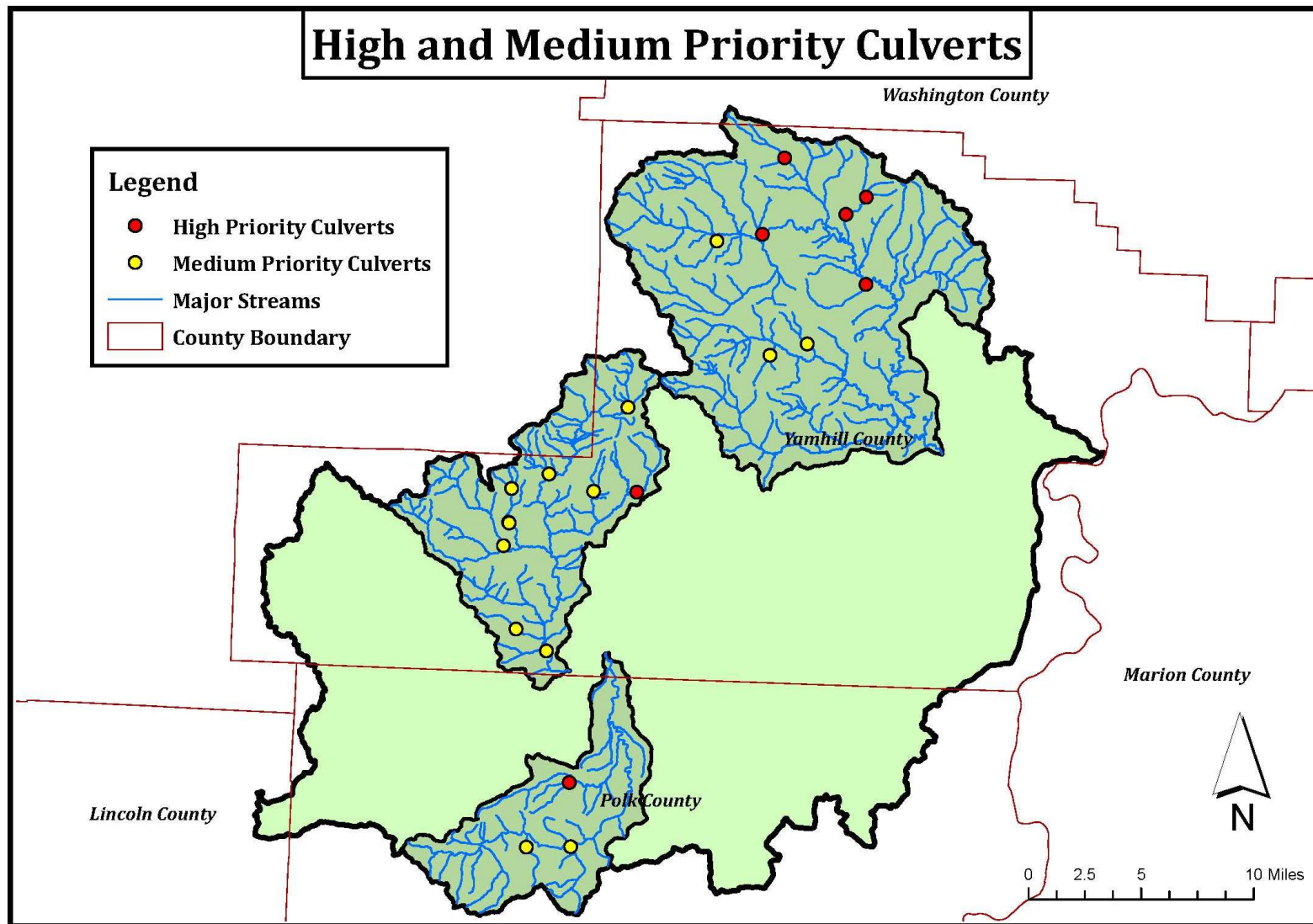


Figure 3: High and Medium Priority Culverts: Map depiction of the 7 high priority and 15 medium culverts as determined by the prioritization model and stakeholder review. Of the medium priority culverts, two are not visible in this figure due to their proximity to other medium priority culverts.

Action Plan and Clustering Strategies

After the final meeting, the GYWC developed this Action Plan to facilitate the replacement of fish passage barrier culverts in the watersheds. Collectively, replacing all the high and medium ranked culverts in this Plan would improve access to an **estimated 78.7 miles** of habitat across the Mill Creek, North Yamhill River, and Willamina Creek watersheds.

The primary goal of this Plan is to enable resource leveraging during project implementation. Many of the identified fish passage barriers will be replaced through grant funding. Numerous federal grant funding sources exist, but they are often accompanied by difficult match funding requirements (i.e. 1:1 from a non-federal source). Sources of non-federal grant funds, however, can be limited. With effective partnerships and communication between stakeholders, it is possible to leverage a variety of nonfederal funding. Match funding may include donated supplies, equipment, technical assistance, labor, or other services that may otherwise be contracted and paid for through grant funds. Such collaboration can make a project more competitive and facilitates the implementation of larger projects

This Plan identifies the high and medium priority fish passage barrier culverts to replace. For the most part, these culverts could be efficiently handled as standalone projects. However, where appropriate, priority culverts have been grouped or clustered to facilitate project development. Table 4 illustrates the clustering strategy that is the framework for the culvert datasheets and maps.

Table 4: Action Plan / Clustering of Culverts; Summary of action plan and clustering strategy for high and medium priority culverts. Most culverts are isolated and not clustered. Sorted by Watershed, Priority, Ranking.

Watershed / Cluster	Culvert #	Priority / Score	Stream	Upstream Habitat
Mill Creek Watershed				
1 – Gooseneck Creek	4166	H / 10	Gooseneck Creek	2.22 Miles
2 – Wind Creek	4238	M / 8	Wind Creek	3.94 Miles
3 – Bear Creek	4226	M / 7	Bear Creek	2.20 Miles
North Yamhill Watershed				
4 – Turner Creek	47	H / 10	Turner Creek	5.68 Miles
5 – Cedar Creek	262	H / 10	Cedar Creek	6.74 Miles
6 – North Yamhill Trib	3327	H / 10	North Yamhill Trib	5.33 Miles
7 – North Yamhill Trib	3093	H / 8	North Yamhill Trib	8.64 Miles
	3048	H / 10	North Yamhill Trib	
8 – Beaver Creek	3444	M / 6	Beaver Creek	1.80 Miles
9 – Kane Creek	3475	M / 6	Kane Creek	2.43 Miles
10 – Petch Creek	10040	M / 6	Petch Creek	1.95 Miles
Willamina Creek Watershed				
11 – Baltimore Creek	11090	H / 10	Baltimore Creek	8.52 Miles
12 – Canada Creek	1314	M / 10	Canada Creek	5.70 Miles
13 – Cedar Creek	847	M / 10	Cedar Creek	4.08 Miles
14 – Willamina Creek Trib	1058	M / 9	Willamina Cr Trib	4.08 Miles
15 – Willamina Creek Trib	4009	M / 7	Willamina Cr Trib	2.21 Miles
16 – Willamina Creek Trib	10019	M / 7	Willamina Cr Trib	2.51 Miles
17 – Gilbert Creek	1110	M / 7	Gilbert Creek	6.6 Miles
	10016	M / 7	Gilbert Creek	
	10017	M / 7	Gilbert Creek	
18 – La Tautena Mary Cr	1116	M / 6	La Tautena Mary Cr	2.20 Miles
	10018	M / 6	La Tautena Mary Cr	

Data Sheets for High and Medium Priority Culverts

The following is a series of tables and maps containing data on each high and medium priority culvert. The datasheets and maps follow the organizational structure found in Table 4.

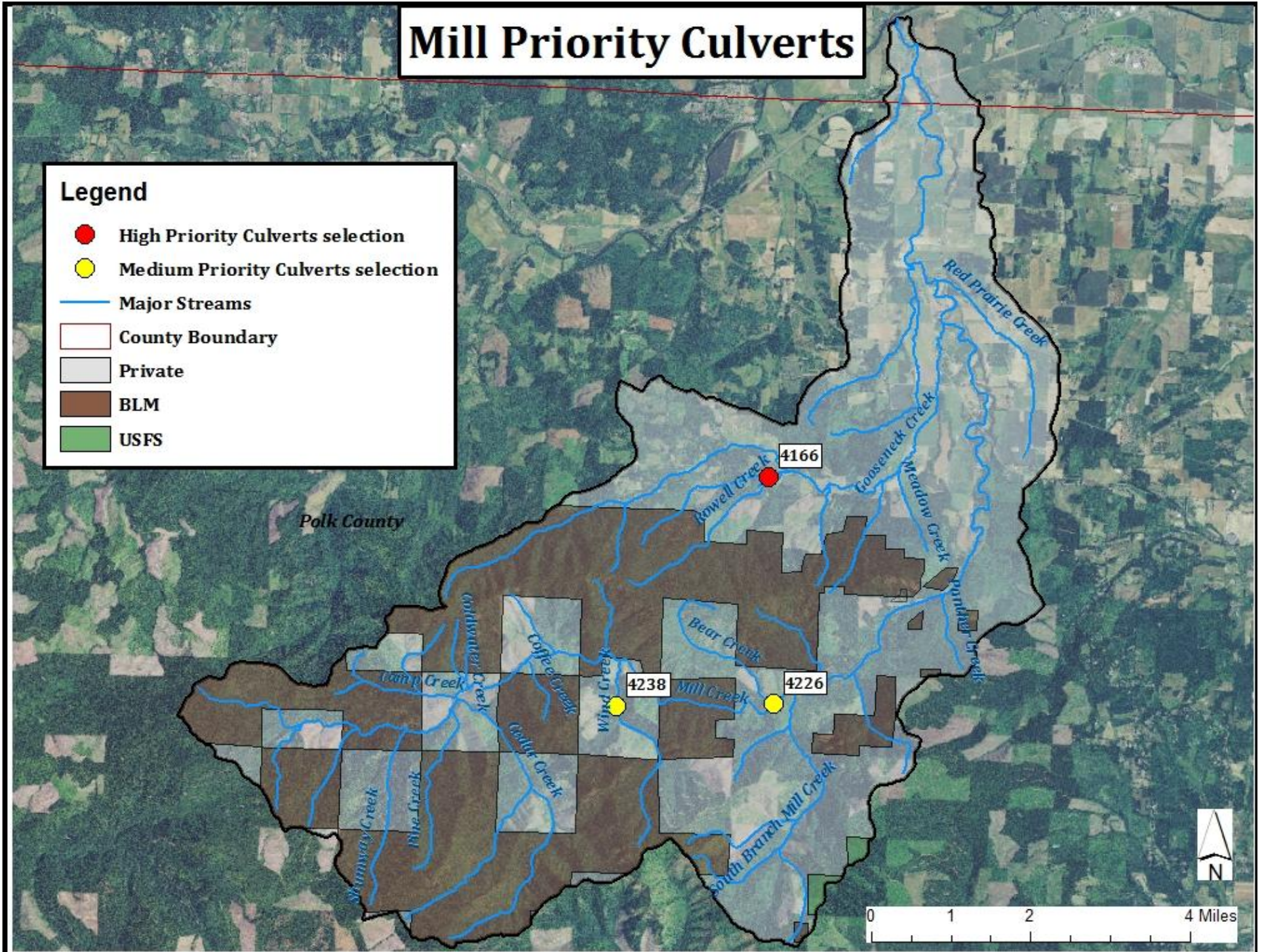
The following terms are used in the datasheets:



1. **Inlet Gradient %:** Channel gradient from the inlet of the culvert, upstream one pipe diameter.
2. **Upstream Gradient:** Channel gradient beginning at a point upstream of the inlet (above the culvert influence area) and ending approximately 50 feet upstream of that point.
3. **Bankfull Width:** Bankfull flow is a winter high or peak flow that usually occurs on average every 1 to 2 years. Look for indicators of the highest annual water scour marks on each bank, such as a change in vegetation, bank topography, or the size of streambed material. Other indicators include a line defining the lower limit of lichen colonization, exposed roots, a stain line visible on bare substrate, or an undisturbed line of organic debris on the ground. These measuring points should be well above any influence the stream crossing may have on channel width.
4. **Bankfull Ratio:** $[\text{Inlet Width} / \text{Bankfull Width}]$ The bankfull ratio is a measure of channel constriction as water flows into the culvert. In order for a culvert crossing structure to meet the criteria for stream simulation, this ratio must be one or greater. Structures that do not constrict the channel at most flows are generally more successful at passing fish and other biota.

Mill Priority Culverts

Legend

- High Priority Culverts selection
- Medium Priority Culverts selection
- Major Streams
- County Boundary
- Private
- BLM
- USFS

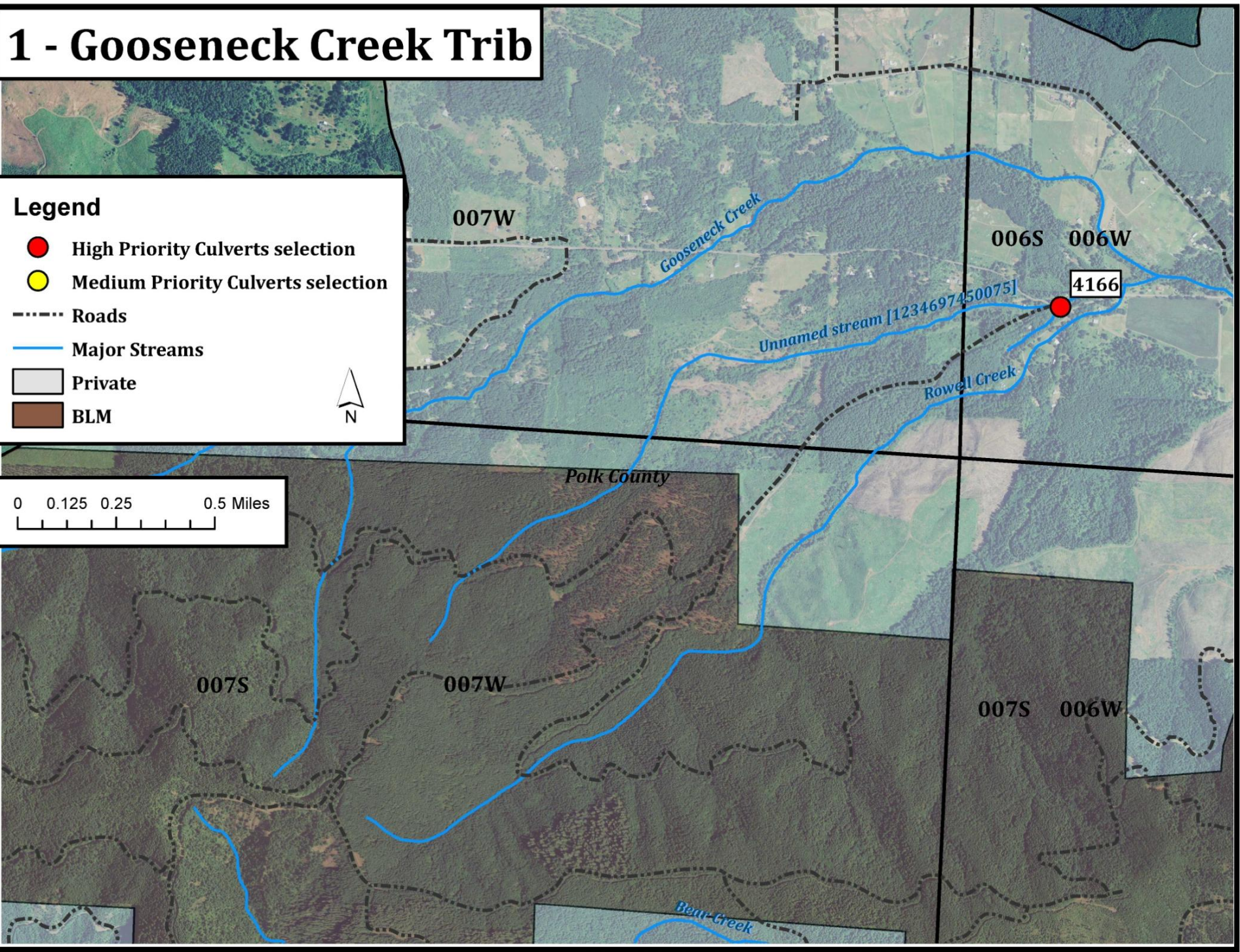
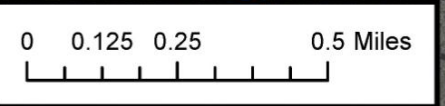




Culvert ID #	4166	Priority Ranking	High
Location Information			
Watershed	Mill Creek	Township-Range-Section-1/4	6S 6W 31 NE of SW
Stream Name	Gooseneck Creek	UTM Easting/Northing	NA
Road Name	Gooseneck Creek Rd	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	55.50
Culvert Material	Annular CMP	Horizontal Width (in)	72.00
Slope (%)	1.00	Vertical Height (in)	68.00
Overall Culvert Condition	Good	Outlet Drop(ft)	1.70
Channel Information			
Inlet Gradient (%)	5.00	Upstream Bankfull Width (ft)	10.30
Upstream Channel Gradient (%)	2.00	Downstream Bankfull Width (ft)	18.40
Bankfull Ratio	0.42		
Prioritization Analysis			
Habitat Length (miles)	2.22	(1) Habitat Length Points	3
Habitat Quality	0.90	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	7
Comments			
<p>Survey Date: 7/21/2010; Survey Comments: Culvert perched; November 29 2012 TAC Meeting: (ODFW): Actually a County-owned pipe; Very High Priority; High quality habitat upstream. (BLM): BLM replaced a pipe upstream six years ago; GIS stream layer is wrong - tributary is actually upstream, thus more habitat upstream.</p>			
Photographs			
Inlet		Outlet	
			

1 - Gooseneck Creek Trib

Legend

- High Priority Culverts selection
- Medium Priority Culverts selection
- - - Roads
- Major Streams
- Private
- BLM

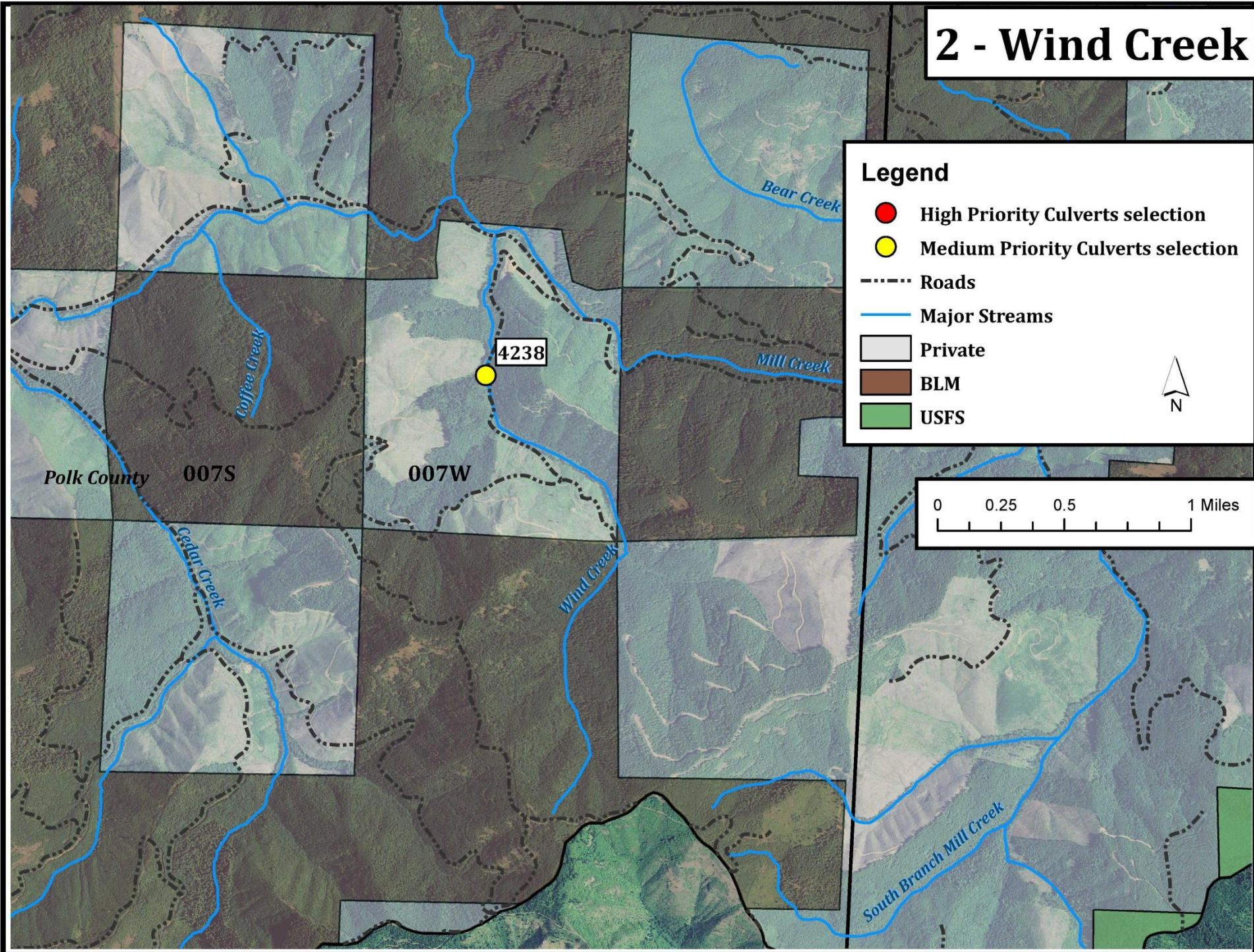
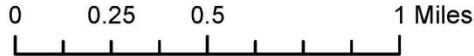


Culvert ID #	4238	Priority Ranking	Med
Location Information			
Watershed	Mill Creek	Township-Range-Section-1/4	7S 7W 14 SE of NW
Stream Name	Wind Creek	UTM Easting/Northing	NA
Road Name	Wind Creek Road	Owner Type	Private Industrial
Culvert Information			
Barrel Shape	Pipe-Arch	Length (ft)	48.42
Culvert Material	Annular CMP	Horizontal Width (in)	86.00
Slope (%)	0.20	Vertical Height (in)	66.00
Overall Culvert Condition	Good	Outlet Drop(ft)	1.75
Channel Information			
Inlet Gradient (%)	11.00	Upstream Bankfull Width (ft)	12.28
Upstream Channel Gradient (%)	12.00	Downstream Bankfull Width (ft)	19.80
Bankfull Ratio	0.48		
Prioritization Analysis			
Habitat Length (miles)	3.94	(1) Habitat Length Points	4
Habitat Quality	1.55	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	8
Comments			
<p>Survey Date: 9/1/2010; Survey Comments: Bent inlet and sections folded apart; November 29 2012 TAC Meeting: (BLM): Culvert almost washed out this year - debris jams; WYCO mainline. (ODFW): Downstream barriers (slots) to steelhead access; Need more information on fish distributions and habitat.</p>			
Photographs			
Inlet		Outlet	
			

2 - Wind Creek

Legend

- High Priority Culverts selection
- Medium Priority Culverts selection
- Roads
- Major Streams
- Private
- BLM
- USFS



Polk County 007S

007W

4238

Bear Creek



Coffee Creek

Cedar Creek

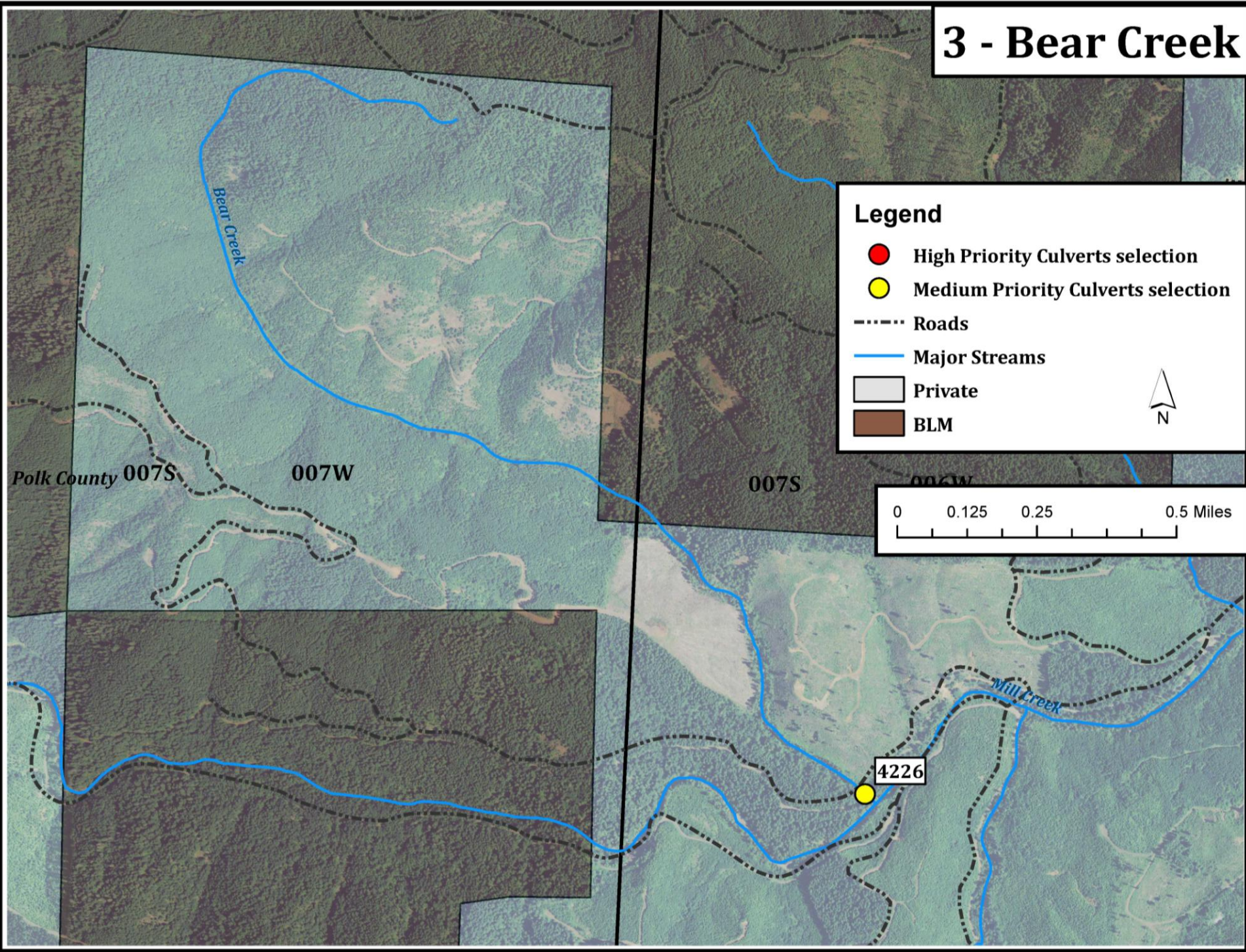
Wind Creek

Mill Creek

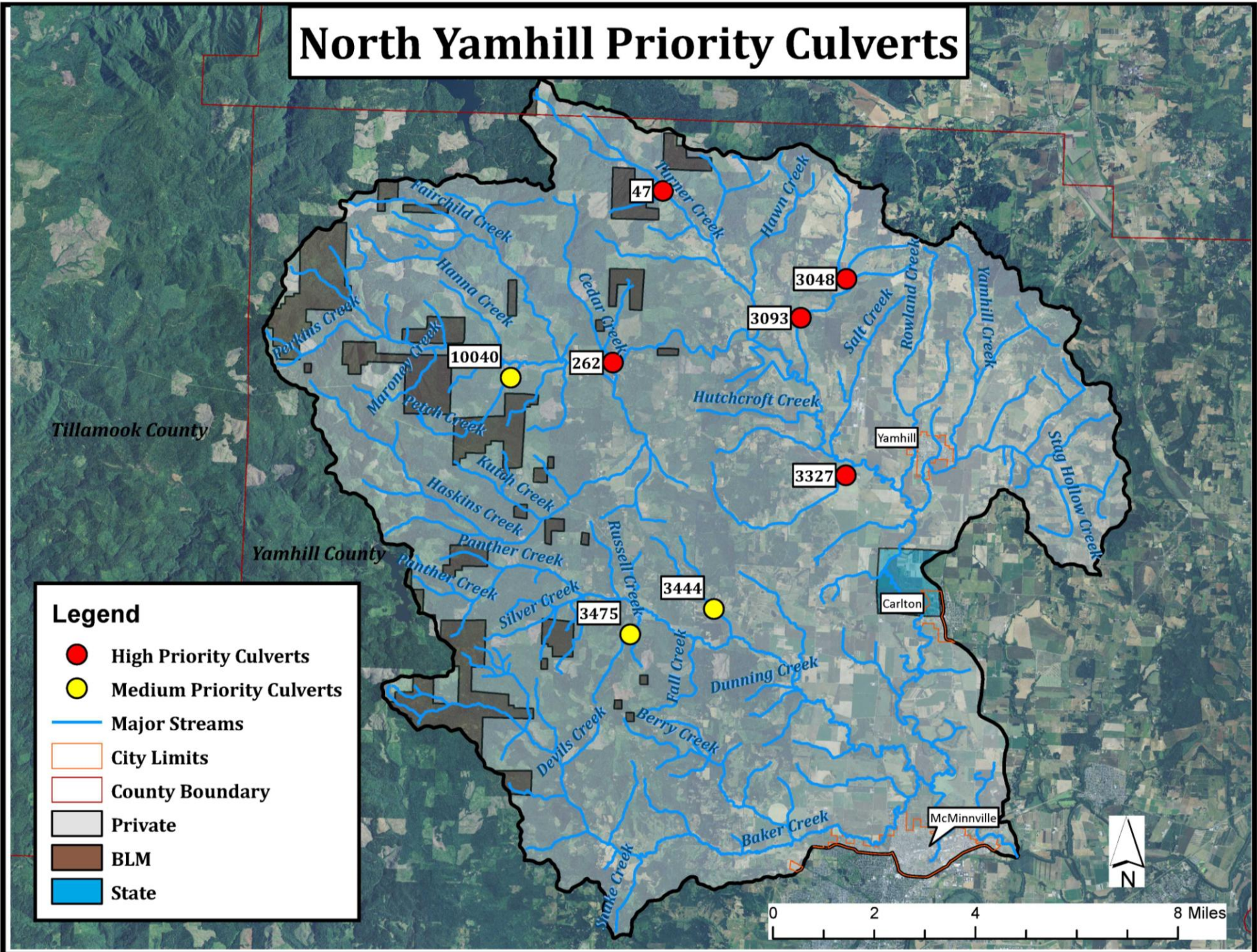
South Branch Mill Creek

Culvert ID #	4226	Priority Ranking	Med
Location Information			
Watershed	Mill Creek	Township-Range-Section-1/4	7S 6W 18 SE of NW
Stream Name	Bear Creek	UTM Easting/Northing	NA
Road Name	Bear Creek Road	Owner Type	Private Industrial
Culvert Information			
Barrel Shape	Circular	Length (ft)	40.6
Culvert Material	Annular CMP	Horizontal Width (in)	72.00
Slope (%)	3.00	Vertical Height (in)	72.00
Overall Culvert Condition	Good	Outlet Drop(ft)	5.30
Channel Information			
Inlet Gradient (%)	13.00	Upstream Bankfull Width (ft)	11.93
Upstream Channel Gradient (%)	6.00	Downstream Bankfull Width (ft)	11.13
Bankfull Ratio	0.52		
Prioritization Analysis			
Habitat Length (miles)	2.20	(1) Habitat Length Points	3
Habitat Quality	1.13 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	7
Comments			
Survey Date: 8/31/2010; Survey Comments: NA; November 29 2012 TAC Meeting: (ODFW): Does not have anadromy; Cutthroat trout present in streams.			
Photographs			
Inlet		Outlet	
			

3 - Bear Creek



North Yamhill Priority Culverts





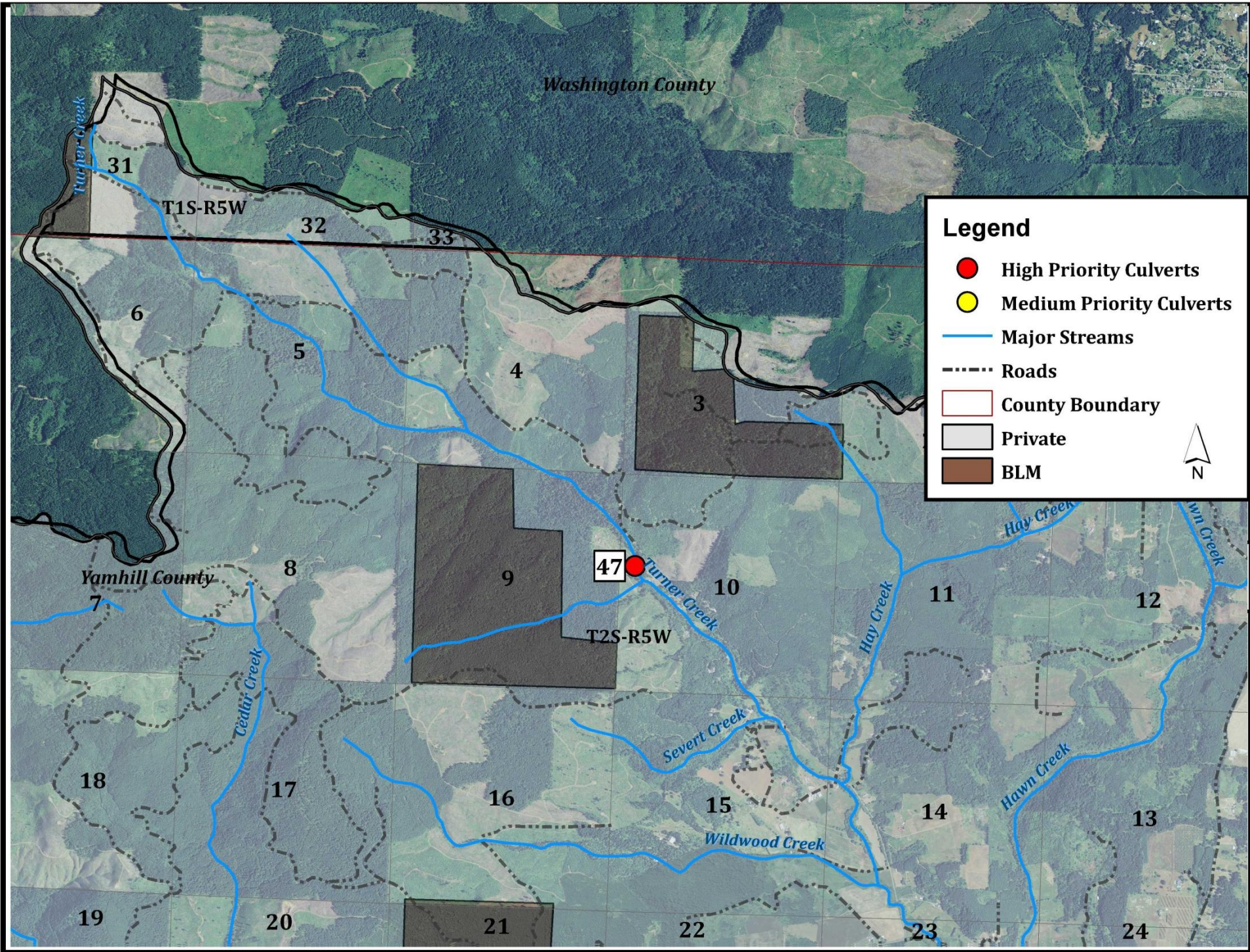
Legend



- High Priority Culverts
- Medium Priority Culverts
- Major Streams
- ▭ City Limits
- ▭ County Boundary
- ▭ Private
- ▭ BLM
- ▭ State

0 2 4 8 Miles

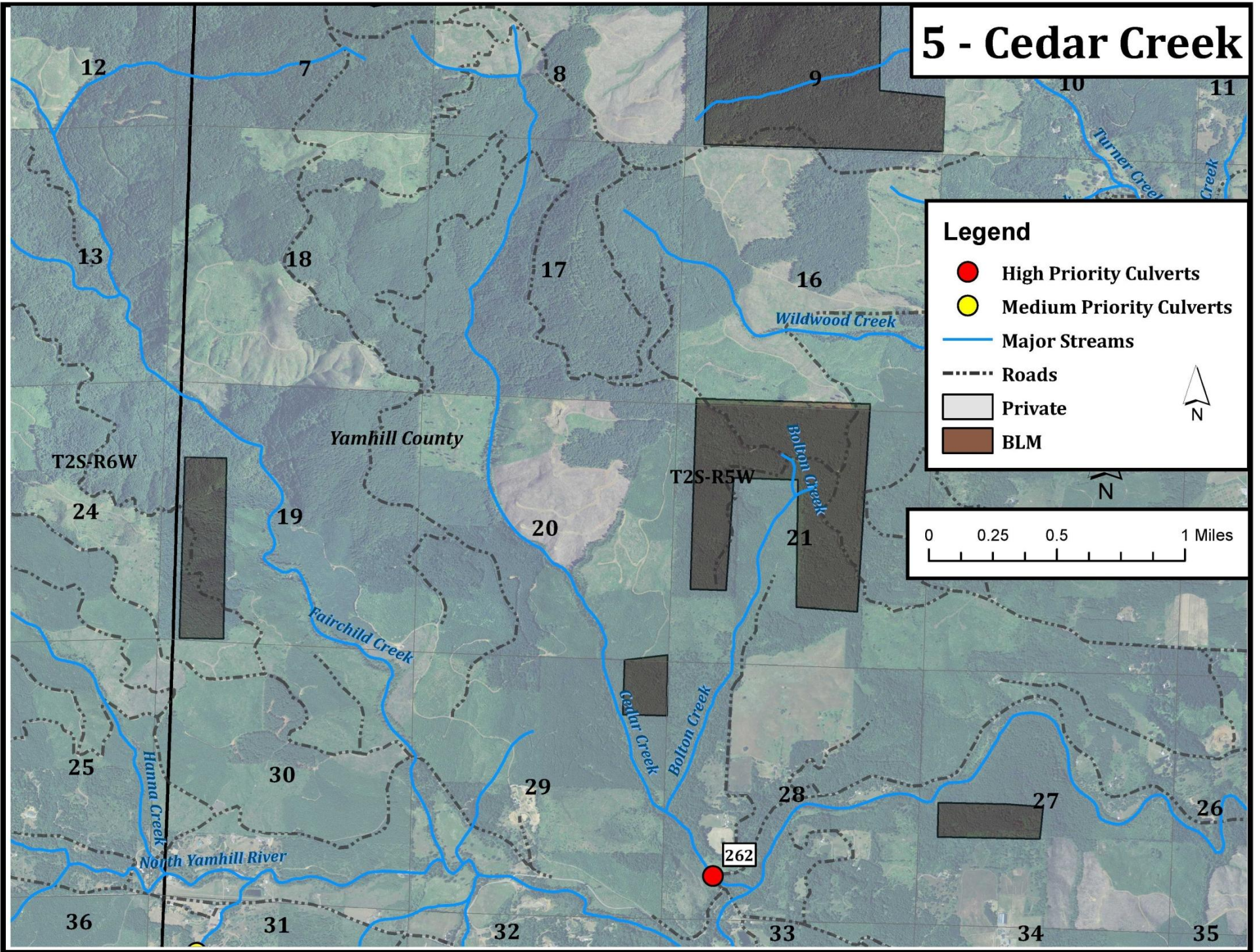




Culvert ID #	47	Priority Ranking	High
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	2S 5W 10 SW of NW
Stream Name	Turner Creek	UTM Easting/Northing	NA
Road Name	Turner Creek Road	Owner Type	Private
Culvert Information			
Barrel Shape	Pipe Arch	Length (ft)	50.00
Culvert Material	SSP	Horizontal Width (in)	144.00
Slope (%)	2.00	Vertical Height (in)	96.00
Overall Culvert Condition	Good	Outlet Drop(ft)	1.02
Channel Information			
Inlet Gradient (%)	7.00	Upstream Bankfull Width (ft)	22.00
Upstream Channel Gradient (%)	5.00	Downstream Bankfull Width (ft)	27.00
Bankfull Ratio	0.48		
Prioritization Analysis			
Habitat Length (miles)	5.68	(1) Habitat Length Points	5
Habitat Quality	2.03 - High	(2) Habitat Quality Points	3
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	10
Comments			
<p>Survey Date: 8/23/2007; Survey Comments: A little water flows under left side (looking downstream); Fish Sighted; November 29 2012 Meeting: Steep. Undersized. Probably velocity barrier. Access to some good habitat quality. Steelhead. Confirmed Coho. Probable bridge given the bankfull width.</p>			
Photographs			
Inlet		Outlet	
			



Culvert ID #	262	Priority Ranking	High
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	2S 5W 28 SW of SW
Stream Name	Cedar Creek	UTM Easting/Northing	NA
Road Name	Old RailRd Grade Rd	Owner Type	County
Culvert Information			
Barrel Shape	Circular	Length (ft)	75.00
Culvert Material	Annular CMP	Horizontal Width (in)	102.00
Slope (%)	1.00	Vertical Height (in)	120.00
Overall Culvert Condition	Good	Outlet Drop(ft)	1.00
Channel Information			
Inlet Gradient (%)	13.00	Upstream Bankfull Width (ft)	24.00
Upstream Channel Gradient (%)	3.00	Downstream Bankfull Width (ft)	16.00
Bankfull Ratio	0.50		
Prioritization Analysis			
Habitat Length (miles)	6.74	(1) Habitat Length Points	5
Habitat Quality	3.48 - High	(2) Habitat Quality Points	3
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	10
Comments			
<p>Survey Date: 10/29/2007; Survey Comments: Will be good habitat. Restoration zone. Outlet drop but nice deep pool; November 29 2012 TAC Meeting: (BLM): Velocity barrier; probable bridge; BLM has done evaluation of the channel downstream - found Clams; Steelhead verified; Good habitat but needs wood. One culvert way upstream.</p>			
Photographs			
Inlet		Outlet	
			

5 - Cedar Creek

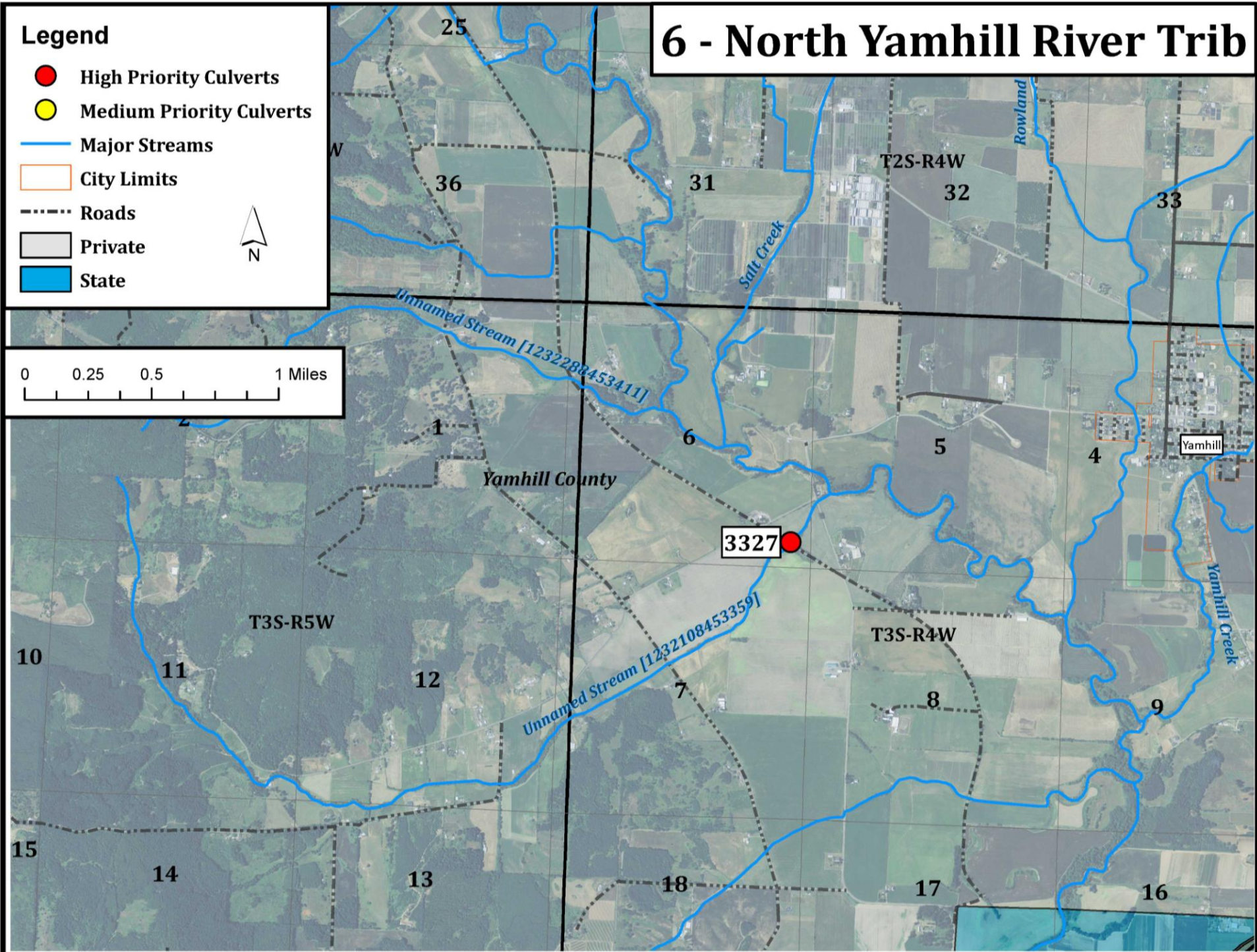
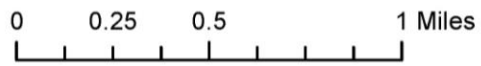





Culvert ID #	3327	Priority Ranking	High
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	3S 4W 6 SE of SE
Stream Name	Unnamed Trib of North Yamhill River	UTM Easting/Northing	NA
Road Name	Old RailRd Grade Rd	Owner Type	County
Culvert Information			
Barrel Shape	Circular	Length (ft)	45.00
Culvert Material	Annular CMP	Horizontal Width (in)	120.00
Slope (%)	2.00	Vertical Height (in)	72.00
Overall Culvert Condition	Fair	Outlet Drop(ft)	0.00
Channel Information			
Inlet Gradient (%)	13.00	Upstream Bankfull Width (ft)	35.00
Upstream Channel Gradient (%)	1.00	Downstream Bankfull Width (ft)	10.00
Bankfull Ratio	2.85		
Prioritization Analysis			
Habitat Length (miles)	5.33	(1) Habitat Length Points	5
Habitat Quality	2.39 - High	(2) Habitat Quality Points	3
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	10
Comments			
<p>Survey Date: 10/30/2007; Survey Comments: Not good habitat, no real channel; Backwater; Channelized upstream; Oily film/murky; November 29 2012 TAC Meeting: (ODFW) Surrounded by fields; need more information on fish distributions. Upstream 35' BFW; downstream 10' (incised?).</p>			
Photographs			
Inlet		Outlet	
			



6 - North Yamhill River Trib

Legend

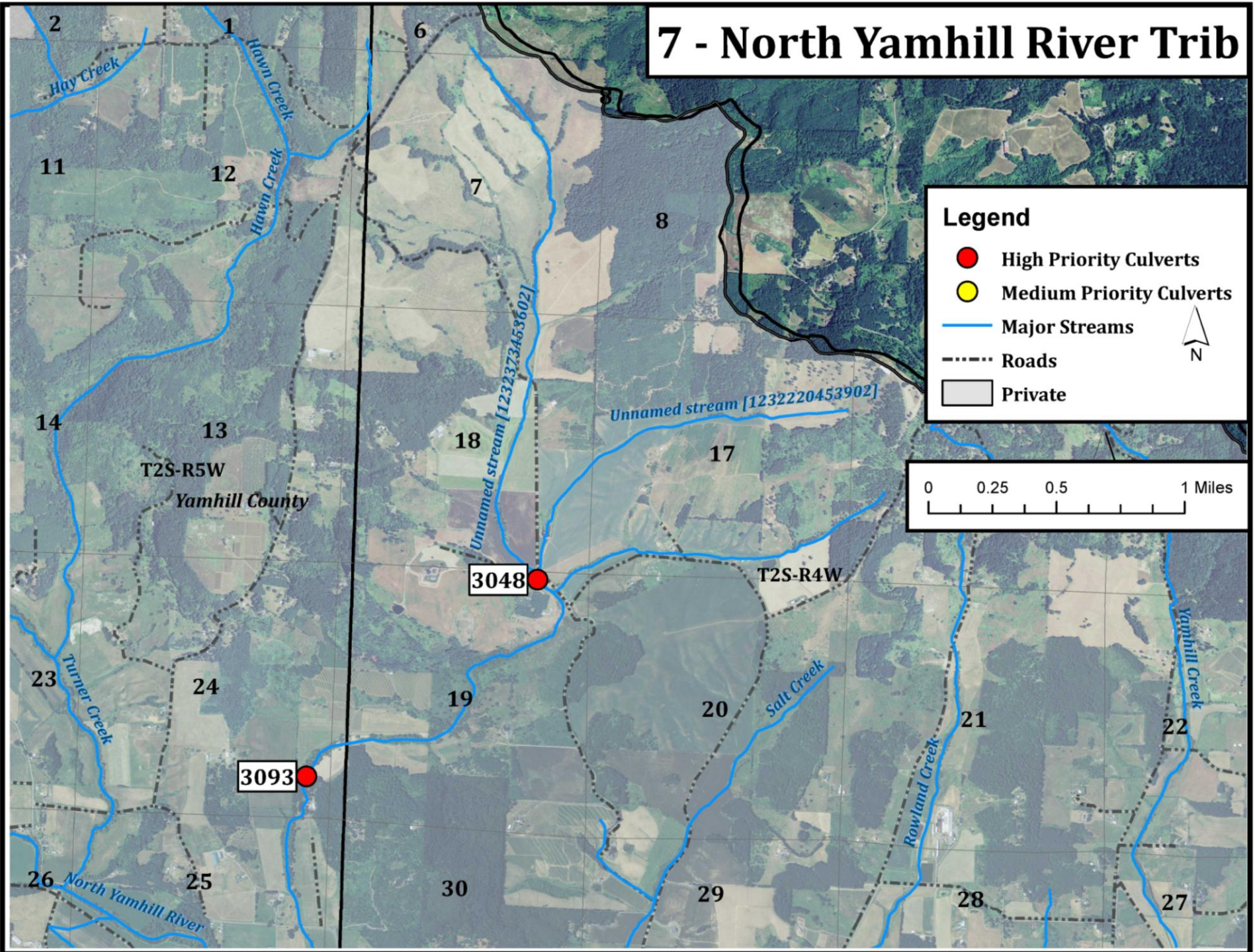
- High Priority Culverts
- Medium Priority Culverts
- Major Streams
- ▭ City Limits
- - - Roads
- ▭ Private
- ▭ State





Culvert ID #	3093	Priority Ranking	High
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	2S 5W 24
Stream Name	Unnamed Trib of North Yamhill River	UTM Easting/Northing	481222 / 5025030
Road Name	Tanager Lane	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	16.00
Culvert Material	Spiral CMP	Horizontal Width (in)	72.00
Slope (%)	- 1.00	Vertical Height (in)	72.00
Overall Culvert Condition	Poor	Outlet Drop(ft)	1.48
Channel Information			
Inlet Gradient (%)	4.00	Upstream Bankfull Width (ft)	50.00
Upstream Channel Gradient (%)	3.00	Downstream Bankfull Width (ft)	80.00
Bankfull Ratio	NA		
Prioritization Analysis			
Habitat Length (miles)	3.20	(1) Habitat Length Points	4
Habitat Quality	1.46 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	8
Comments			
<p>Survey Date: 5/16/2011; Survey Comments: Located on Lazy River Vineyard. Owners willing to participate in any restoration needed. Heavy Bank Erosion, perched, water flows over and around culvert in high flows, Debris Plugging Inlet; Bottom Worn Thru; November 29 2012 TAC Meeting: (ODFW) Downstream Culvert #10037 being replaced soon; Habitat to 3093 should be next on the list.</p>			
Photographs			
Inlet		Outlet	
			

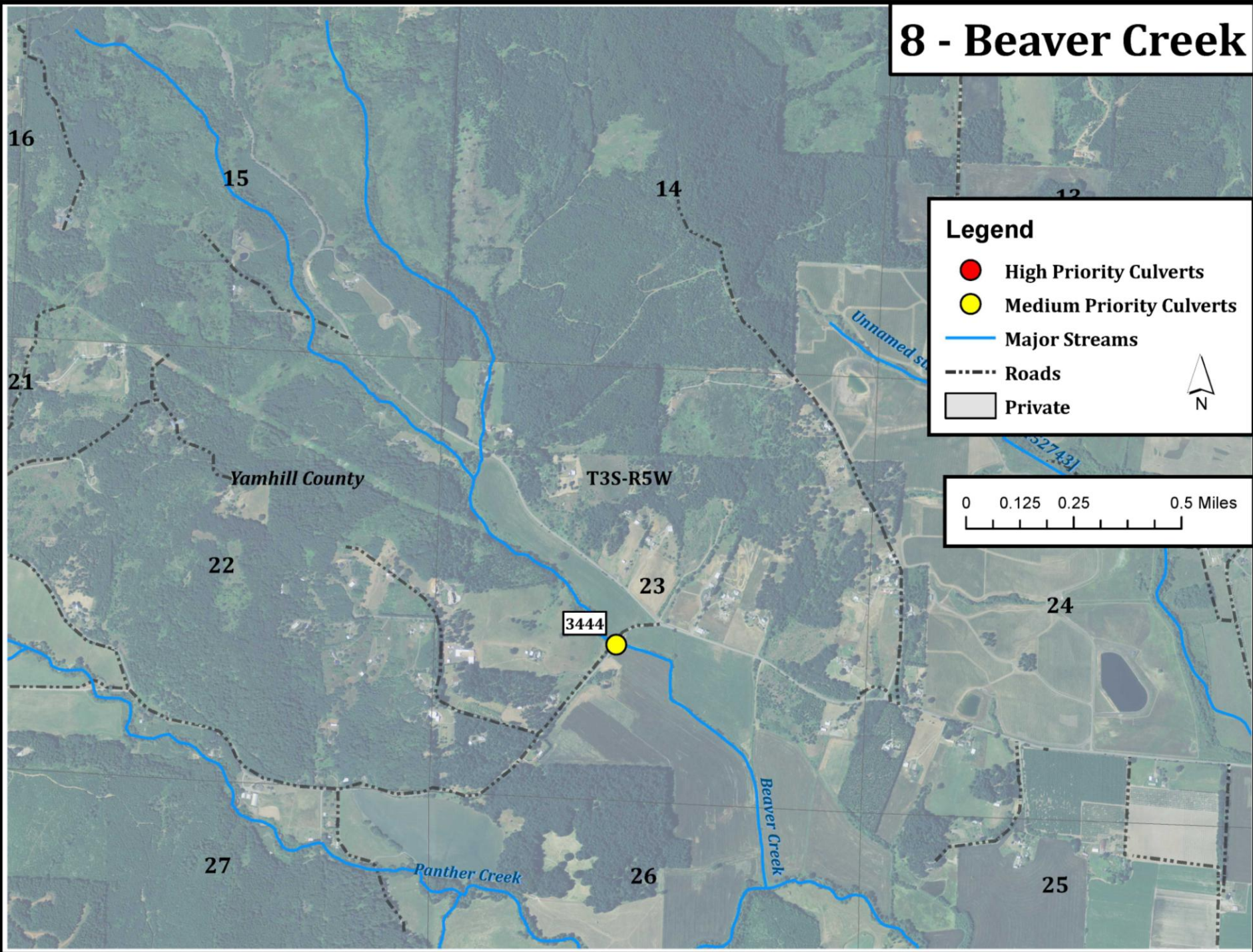
Culvert ID #	3048	Priority Ranking	High
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	2S 4W 19 NE of NE
Stream Name	Unnamed Trib of North Yamhill River	UTM Easting/Northing	NA
Road Name	Garrish Valley Rd	Owner Type	County
Culvert Information			
Barrel Shape	Circular	Length (ft)	30.00
Culvert Material	Annular CMP	Horizontal Width (in)	96.00
Slope (%)	1.00	Vertical Height (in)	65.00
Overall Culvert Condition	Good	Outlet Drop(ft)	
Channel Information			
Inlet Gradient (%)	4.00	Upstream Bankfull Width (ft)	12.00
Upstream Channel Gradient (%)	1.00	Downstream Bankfull Width (ft)	12.00
Bankfull Ratio	0.67		
Prioritization Analysis			
Habitat Length (miles)	5.44	(1) Habitat Length Points	5
Habitat Quality	2.38 - High	(2) Habitat Quality Points	3
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	10
Comments			
<p>Survey Date: 10/29/2007; Survey Comments: Stagnant water, silty downstream, no habitat/riparian area, oil slick/film on water; November 29 2012 TAC Meeting: (ODFW): Not a spawning stream for steelhead; Juvenile steelhead will use the system; Poor habitat quality; Needs restoration; Fish are probably moving upstream - partial barrier; Coho probably all of the way up; Low gradient agricultural stream. (BLM): Downstream barrier being addressed.</p>			
Photographs			
Inlet		Outlet	
			

7 - North Yamhill River Trib



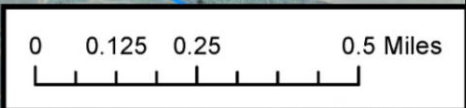
Culvert ID #	3444	Priority Ranking	Med
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	3S 5W 23 NE of SW
Stream Name	Beaver Creek	UTM Easting/Northing	NA
Road Name	Panther Creek Road	Owner Type	County
Culvert Information			
Barrel Shape	Circular	Length (ft)	61.00
Culvert Material	Concrete	Horizontal Width (in)	70.00
Slope (%)	2.00	Vertical Height (in)	70.00
Overall Culvert Condition	Good	Outlet Drop(ft)	1.16
Channel Information			
Inlet Gradient (%)	4.00	Upstream Bankfull Width (ft)	NA
Upstream Channel Gradient (%)	NA	Downstream Bankfull Width (ft)	14.00
Bankfull Ratio	NA		
Prioritization Analysis			
Habitat Length (miles)	1.80	(1) Habitat Length Points	2
Habitat Quality	0.72 Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	6
Comments			
<p>Survey Date: 11/01/2007; Survey Comments: Railroad ties underneath culvert; dip in culvert near outlet; downstream old car upside down in creek; beaver activity upstream; November 29 2012 TAC Meeting: N/A</p>			
Photographs			
Inlet		Outlet	
			



8 - Beaver Creek



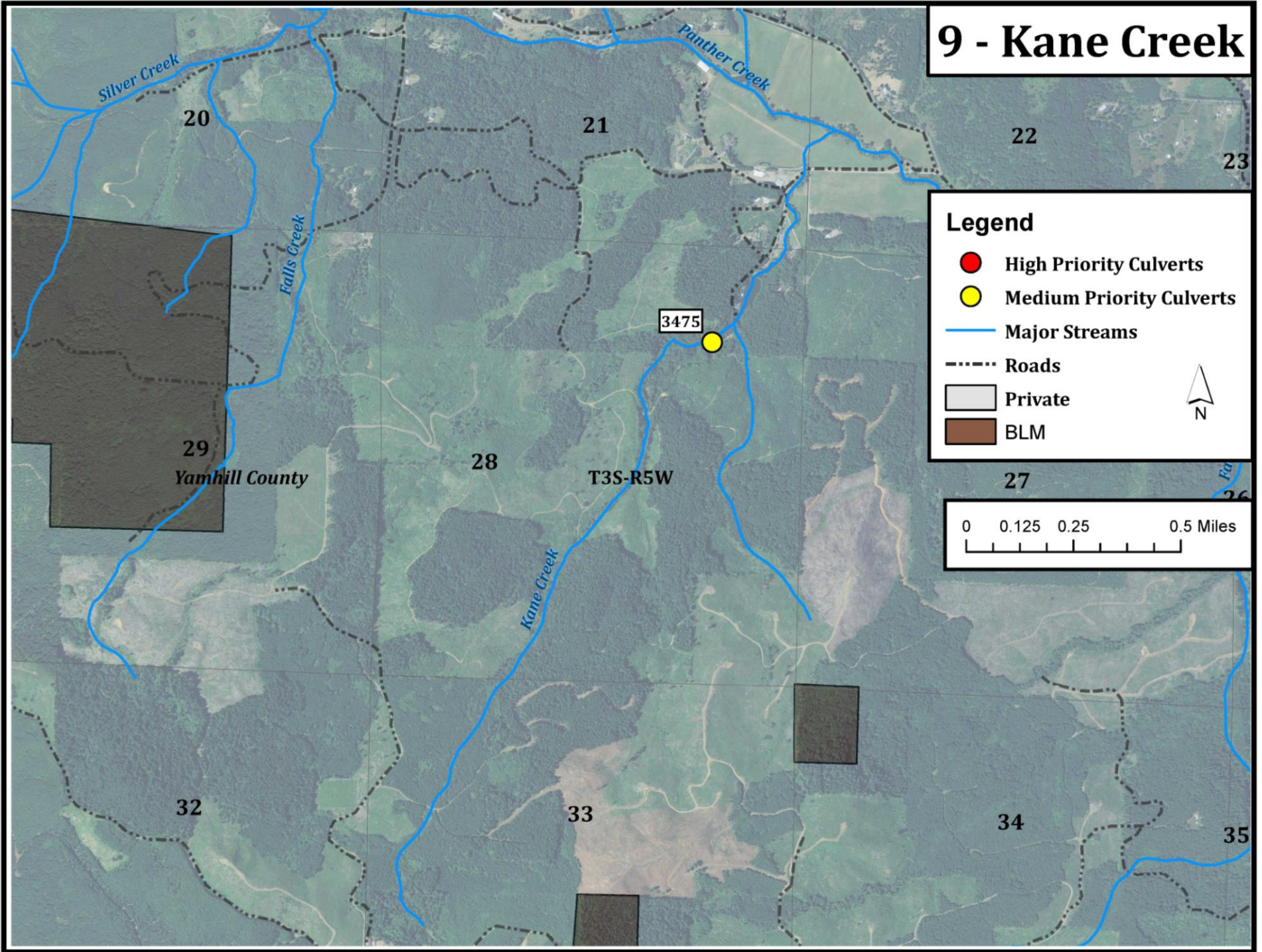
Legend



- High Priority Culverts
- Medium Priority Culverts
- Major Streams
- - - Roads
- Private



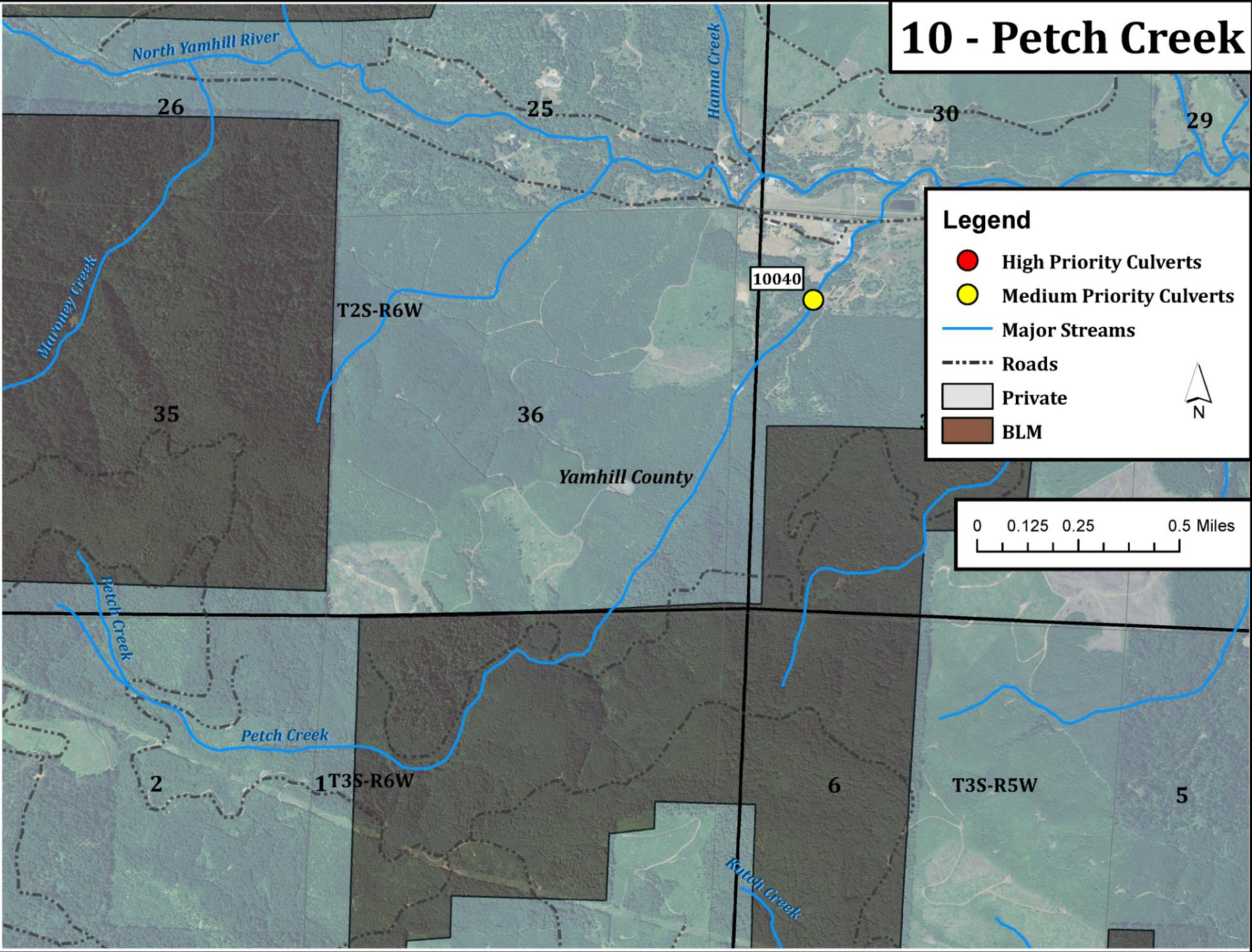
Culvert ID #	3475	Priority Ranking	Med
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	3S 5W 28 SE of NE
Stream Name	Kane Creek	UTM Easting/Northing	NA
Road Name	Panther Creek Road	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	49.00
Culvert Material	Spiral CMP	Horizontal Width (in)	69.00
Slope (%)	3.00	Vertical Height (in)	71.00
Overall Culvert Condition	Poor	Outlet Drop(ft)	0.70
Channel Information			
Inlet Gradient (%)	10.00	Upstream Bankfull Width (ft)	12.00
Upstream Channel Gradient (%)	7.00	Downstream Bankfull Width (ft)	14.00
Bankfull Ratio	0.48		
Prioritization Analysis			
Habitat Length (miles)	2.43	(1) Habitat Length Points	3
Habitat Quality	0.48 - Low	(2) Habitat Quality Points	1
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	6
Comments			
Survey Date: 10/5/2007; Survey Comments: Hydro power "station" connected at outlet from holes in the bottom of the pipe. Good habitat; November 29 2012 TAC Meeting: N/A			
Photographs			
Inlet		Outlet	
			

9 - Kane Creek

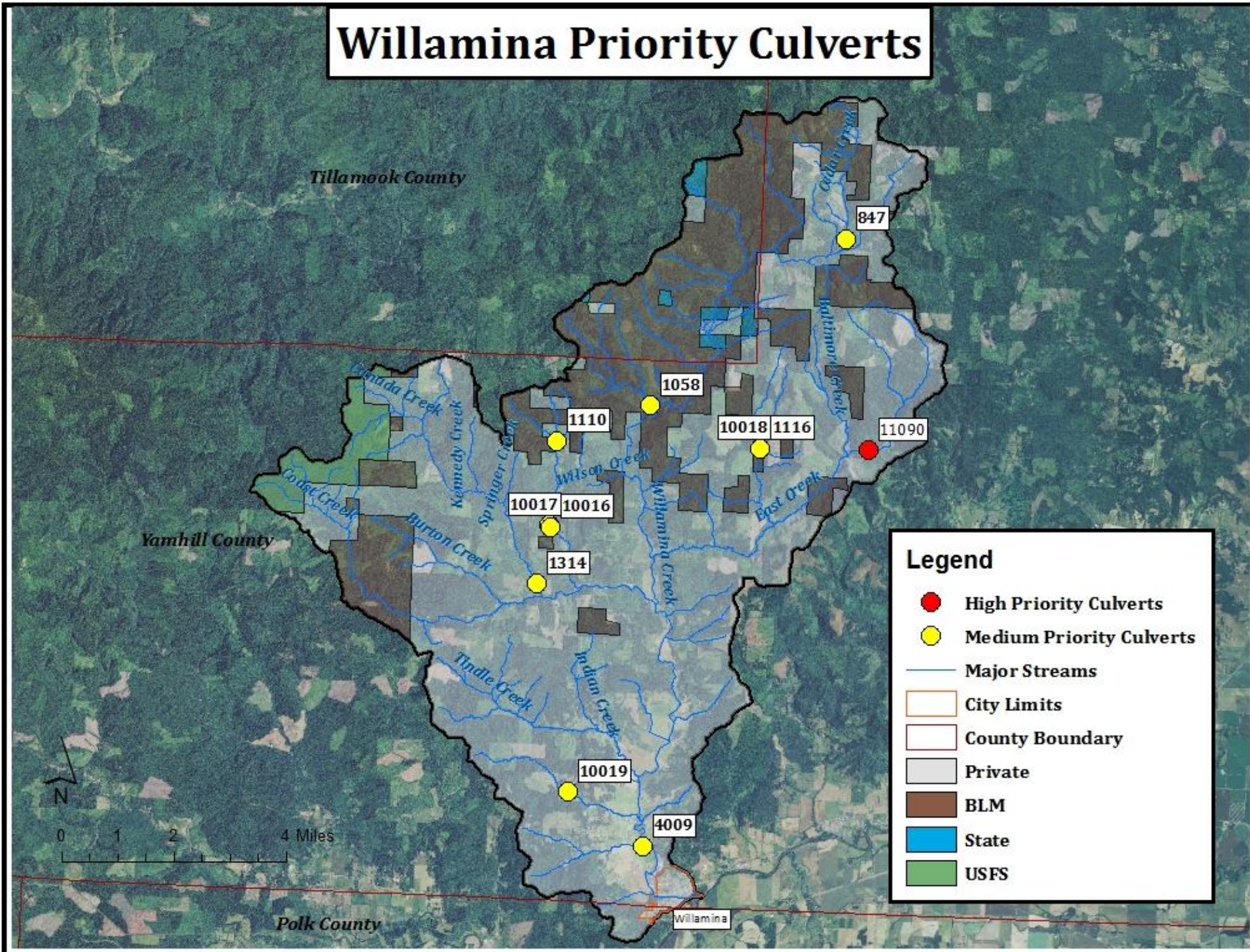




Culvert ID #	10040	Priority Ranking	Med
Location Information			
Watershed	North Yamhill	Township-Range-Section-1/4	NA
Stream Name	Petch Creek	UTM Easting/Northing	NA
Road Name	Flying M Road	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	24.00
Culvert Material	Concrete	Horizontal Width (in)	84.00
Slope (%)	6.00	Vertical Height (in)	84.00
Overall Culvert Condition	Good	Outlet Drop(ft)	1.13
Channel Information			
Inlet Gradient (%)	NA	Upstream Bankfull Width (ft)	60.00
Upstream Channel Gradient (%)	3.00	Downstream Bankfull Width (ft)	30.00
Bankfull Ratio	NA		
Prioritization Analysis			
Habitat Length (miles)	1.95	(1) Habitat Length Points	2
Habitat Quality	1.15 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	6
Comments			
Survey Date: 6/6/2011; Survey Comments: Well known by landowners as having a salmon run ; November 29 2012 TAC Meeting: N/A			
Photographs			
Inlet		Outlet	
			

10 - Petch Creek

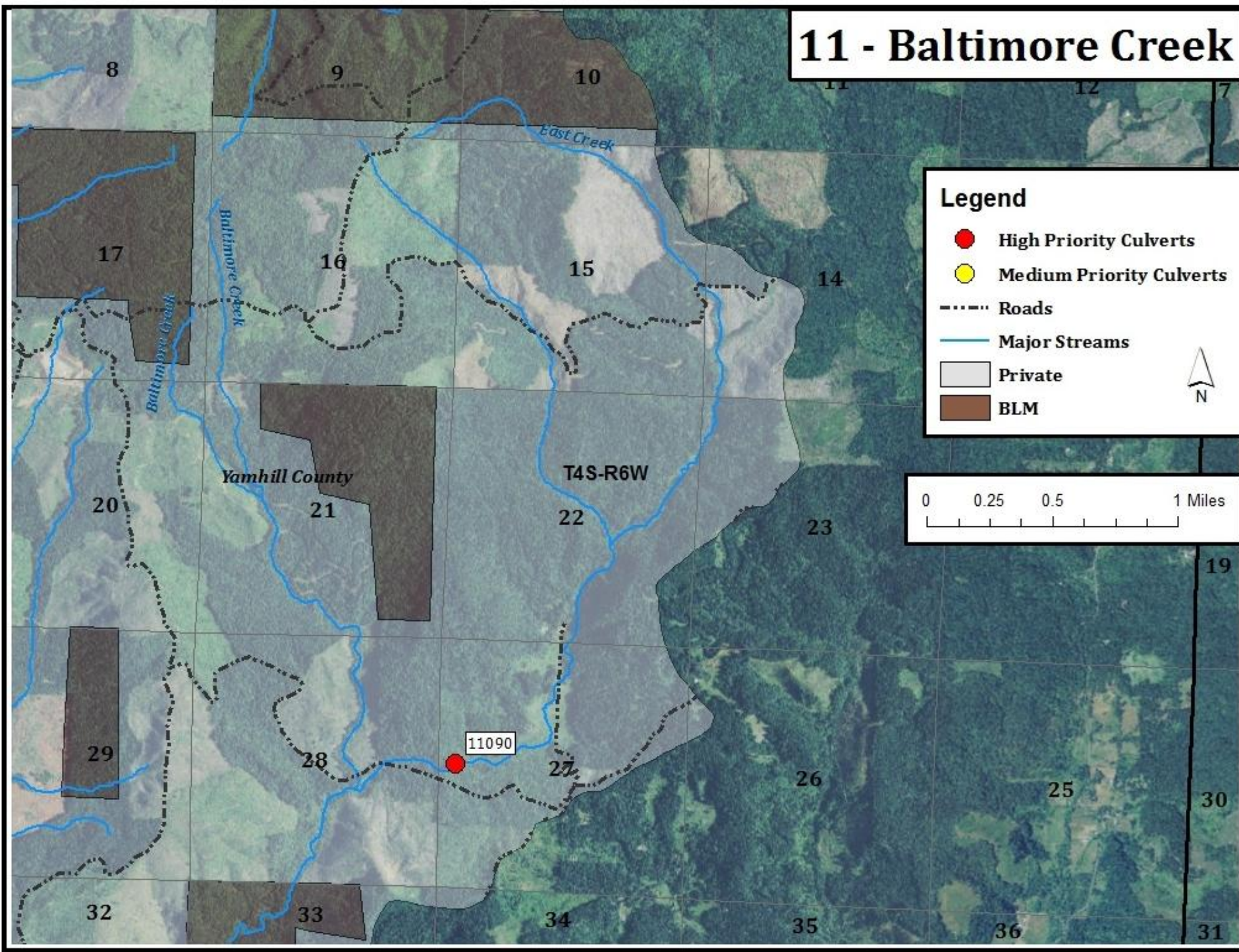


Willamina Priority Culverts



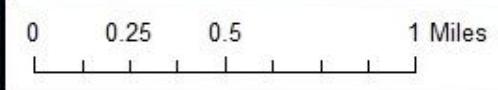
Culvert ID #	11090	Priority Ranking	High
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	4S 6W 27 SW of NW
Stream Name	Baltimore Creek	UTM Easting/Northing	NA
Road Name	Baltimore Creek Rd	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	20.25
Culvert Material	Spiral CMP	Horizontal Width (in)	70.8
Slope (%)	3.00	Vertical Height (in)	61.2
Overall Culvert Condition	Poor	Outlet Drop(ft)	- 0.68
Channel Information			
Inlet Gradient (%)	22.00	Upstream Bankfull Width (ft)	12.00
Upstream Channel Gradient (%)	0.50	Downstream Bankfull Width (ft)	12.00
Bankfull Ratio	0.49		
Prioritization Analysis			
Habitat Length (miles)	8.52	(1) Habitat Length Points	5
Habitat Quality	3.33 - High	(2) Habitat Quality Points	3
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	10
Comments			
<p>Survey Date: 7/5/2007; Survey Comments: 2 culverts, both dammed by beaver; Debris plugging inlet; November 29 2012 TAC Meeting: (ODFW)Coho uses system; probable steelhead; Good habitat upstream; City has water rights upstream; Need more information on fish distributions.</p>			
Photographs			
Inlet		Outlet	
			



11 - Baltimore Creek



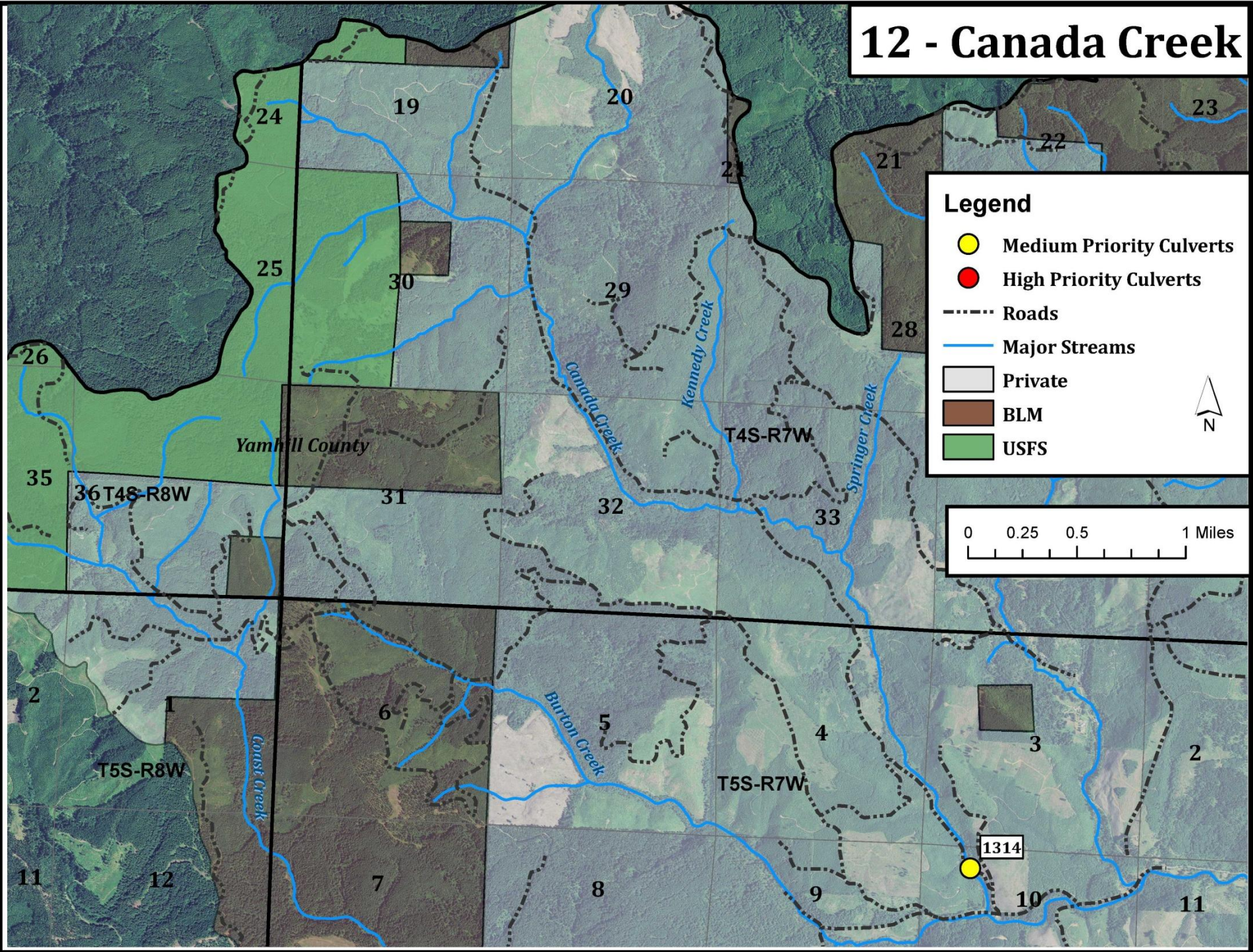
Legend



- High Priority Culverts
- Medium Priority Culverts
- - - - Roads
- Major Streams
- Private
- BLM



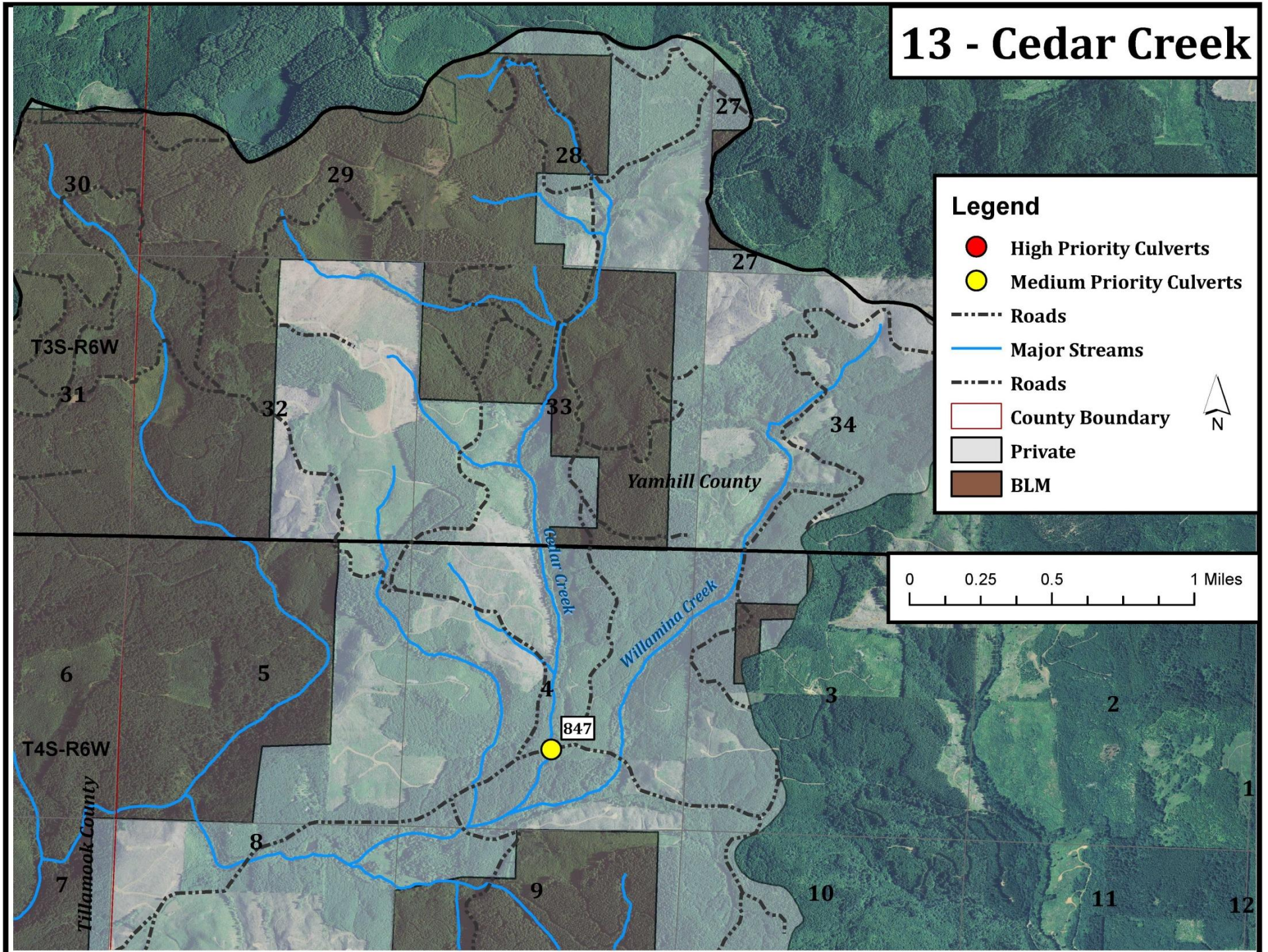
Culvert ID #	1314	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	5S 7W 10 NW of NW
Stream Name	Canada Creek	UTM Easting/Northing	457530 / 5000415
Road Name	Canada Creek Road	Owner Type	Private Industrial
Culvert Information			
Barrel Shape	Open Bottom Arch	Length (ft)	48.00
Culvert Material	SSP (Steel)	Horizontal Width (in)	168.00
Slope (%)	1.00	Vertical Height (in)	120.00
Overall Culvert Condition	Good	Outlet Drop(ft)	- 1.20
Channel Information			
Inlet Gradient (%)	10.00	Upstream Bankfull Width (ft)	27.00
Upstream Channel Gradient (%)	2.00	Downstream Bankfull Width (ft)	24.00
Bankfull Ratio	0.52		
Prioritization Analysis			
Habitat Length (miles)	5.70	(1) Habitat Length Points	5
Habitat Quality	4.02 - High	(2) Habitat Quality Points	3
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	10
Comments			
<p>Survey Date: 7/6/2004; Survey Comments: Backwater pool; Culvert sits on a 2ft concrete footwall; Fill eroding; November 29 2012 TAC Meeting: (BLM): Undersized culvert; May have washed out; Not scheduled to be replaced; Possibly still used as access road - low water ford.</p>			
Photographs			
Inlet		Outlet	
			



12 - Canada Creek



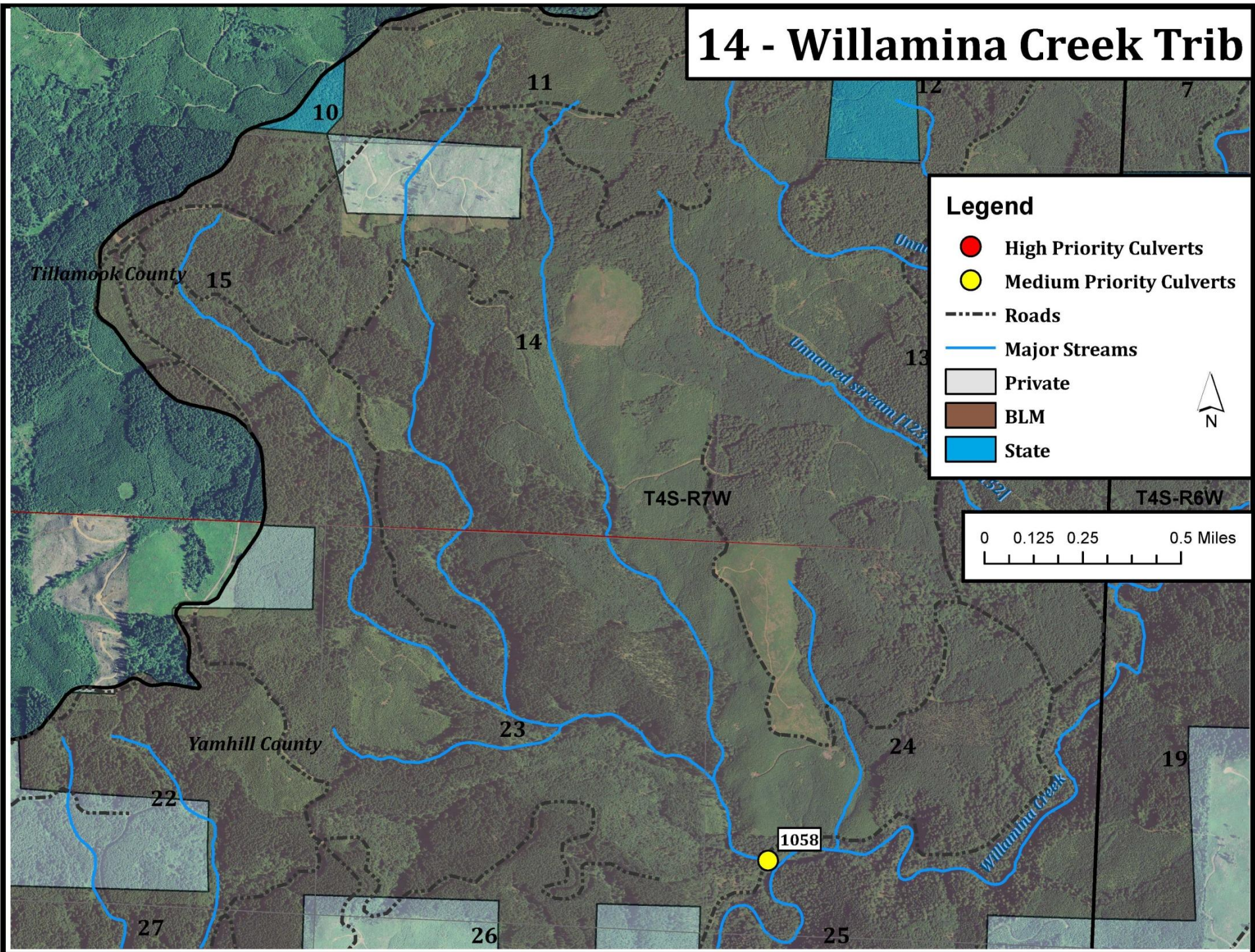
Culvert ID #	847	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	4S 6W 4 NW of SE
Stream Name	Cedar Creek	UTM Easting/Northing	466145 / 5010553
Road Name	Peavine Road	Owner Type	Private Industrial
Culvert Information			
Barrel Shape	Pipe-Arch	Length (ft)	41.00
Culvert Material	Annular CMP	Horizontal Width (in)	72.00
Slope (%)	1.00	Vertical Height (in)	42.00
Overall Culvert Condition	Fair	Outlet Drop(ft)	0.20
Channel Information			
Inlet Gradient (%)	2.00	Upstream Bankfull Width (ft)	16.50
Upstream Channel Gradient (%)	1.00	Downstream Bankfull Width (ft)	16.50
Bankfull Ratio	0.36		
Prioritization Analysis			
Habitat Length (miles)	4.08	(1) Habitat Length Points	5
Habitat Quality	2.38 - High	(2) Habitat Quality Points	3
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	10
Comments			
Survey Date: 6/28/2004; Survey Comments: Fish presence verified; November 29 2012 TAC Meeting: (ODFW): Above anadromous use; 50' waterfall downstream.			
Photographs			
Inlet		Outlet	
			



13 - Cedar Creek



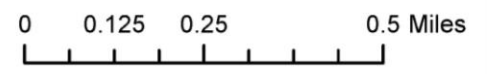
Culvert ID #	1058	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	4S 7W 24 SW of SW
Stream Name	Trib to Willamina Creek	UTM Easting/Northing	460697 / 5005596
Road Name	Willamina Creek Road	Owner Type	USDI-BLM
Culvert Information			
Barrel Shape	Circular	Length (ft)	114.00
Culvert Material	Annular CMP	Horizontal Width (in)	78.00
Slope (%)	5.00	Vertical Height (in)	78.00
Overall Culvert Condition	Fair	Outlet Drop(ft)	2.84
Channel Information			
Inlet Gradient (%)	25.00	Upstream Bankfull Width (ft)	27.00
Upstream Channel Gradient (%)	10.00	Downstream Bankfull Width (ft)	NA
Bankfull Ratio	0.24		
Prioritization Analysis			
Habitat Length (miles)	4.08	(1) Habitat Length Points	5
Habitat Quality	1.75 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	9
Comments			
<p>Survey Date: 9/30/2003; Survey Comments: Culvert outlet influenced by another stream; no channel downstream; November 29 2012 TAC Meeting: (ODFW): Most stream crossings in this area have waterfalls upstream. (BLM): May not be fish upstream; Need more information on fish distribution; BLM recently cleaned debris from the culvert; Willamina Creek is downstream and backwaters; BLM does not rank highly – Low Priority for BLM.</p>			
Photographs			
Inlet		Outlet	
			

14 - Willamina Creek Trib



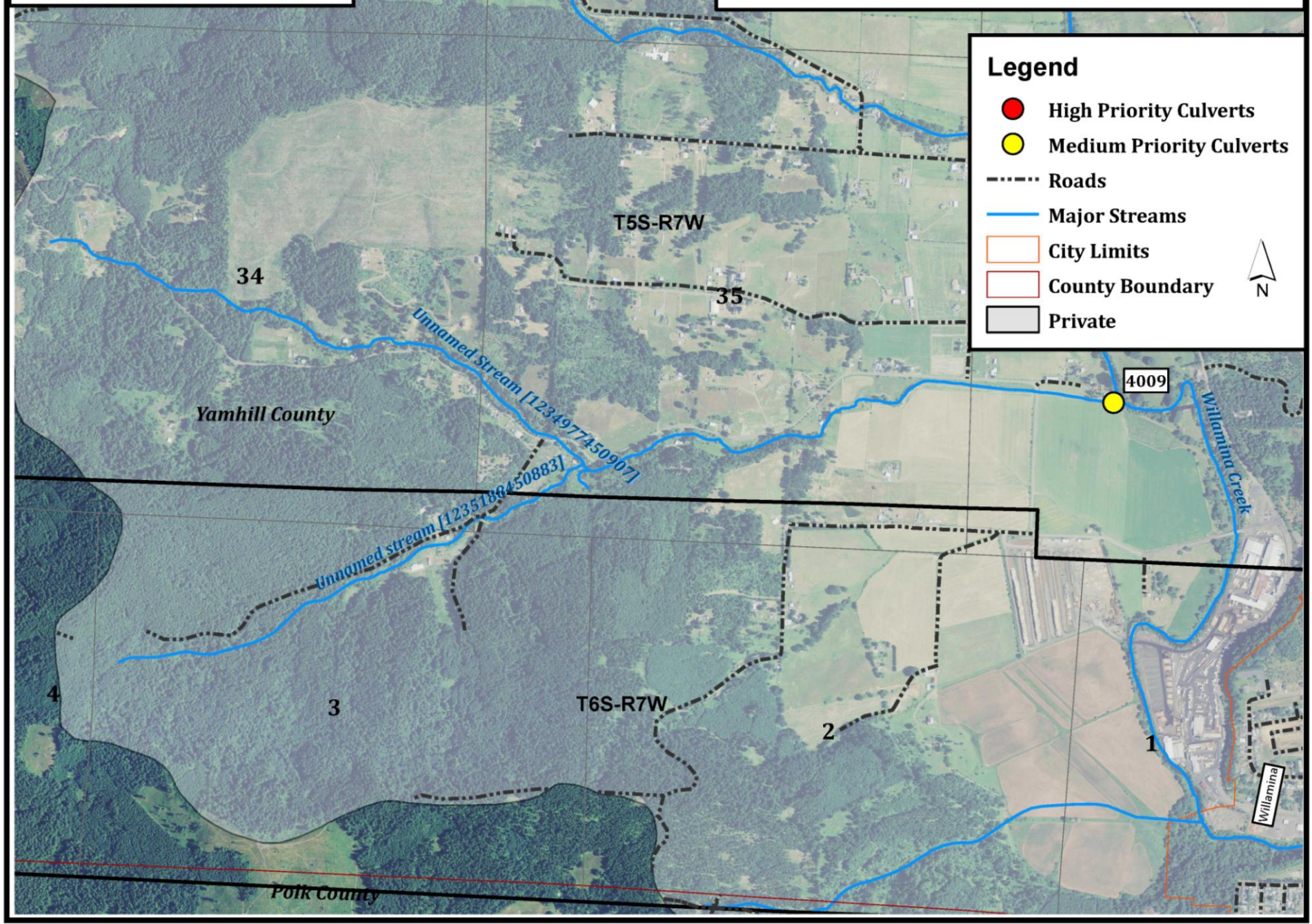
Culvert ID #	4009	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	5S 7W 36 NE of SW
Stream Name	Trib to Willamina Creek	UTM Easting/Northing	NA
Road Name	Fort Hill Road	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	16.00
Culvert Material	Spiral CMP	Horizontal Width (in)	60.00
Slope (%)	5.00	Vertical Height (in)	60.00
Overall Culvert Condition	Poor	Outlet Drop(ft)	1.48
Channel Information			
Inlet Gradient (%)	15.00	Upstream Bankfull Width (ft)	7.00
Upstream Channel Gradient (%)	3.00	Downstream Bankfull Width (ft)	6.00
Bankfull Ratio	0.76		
Prioritization Analysis			
Habitat Length (miles)	2.21	(1) Habitat Length Points	3
Habitat Quality	1.13 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	7
Comments			
Survey Date: 7/24/2007; Survey Comments: Outlet 7' to Willamina Creek; Culvert bottom worn through; November 29 2012 TAC Meeting: N/A			
Photographs			
Inlet		Outlet	
			



15 - Willamina Creek Trib



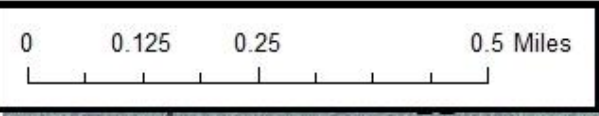
Legend

- High Priority Culverts
- Medium Priority Culverts
- Roads
- Major Streams
- ▭ City Limits
- ▭ County Boundary
- ▭ Private



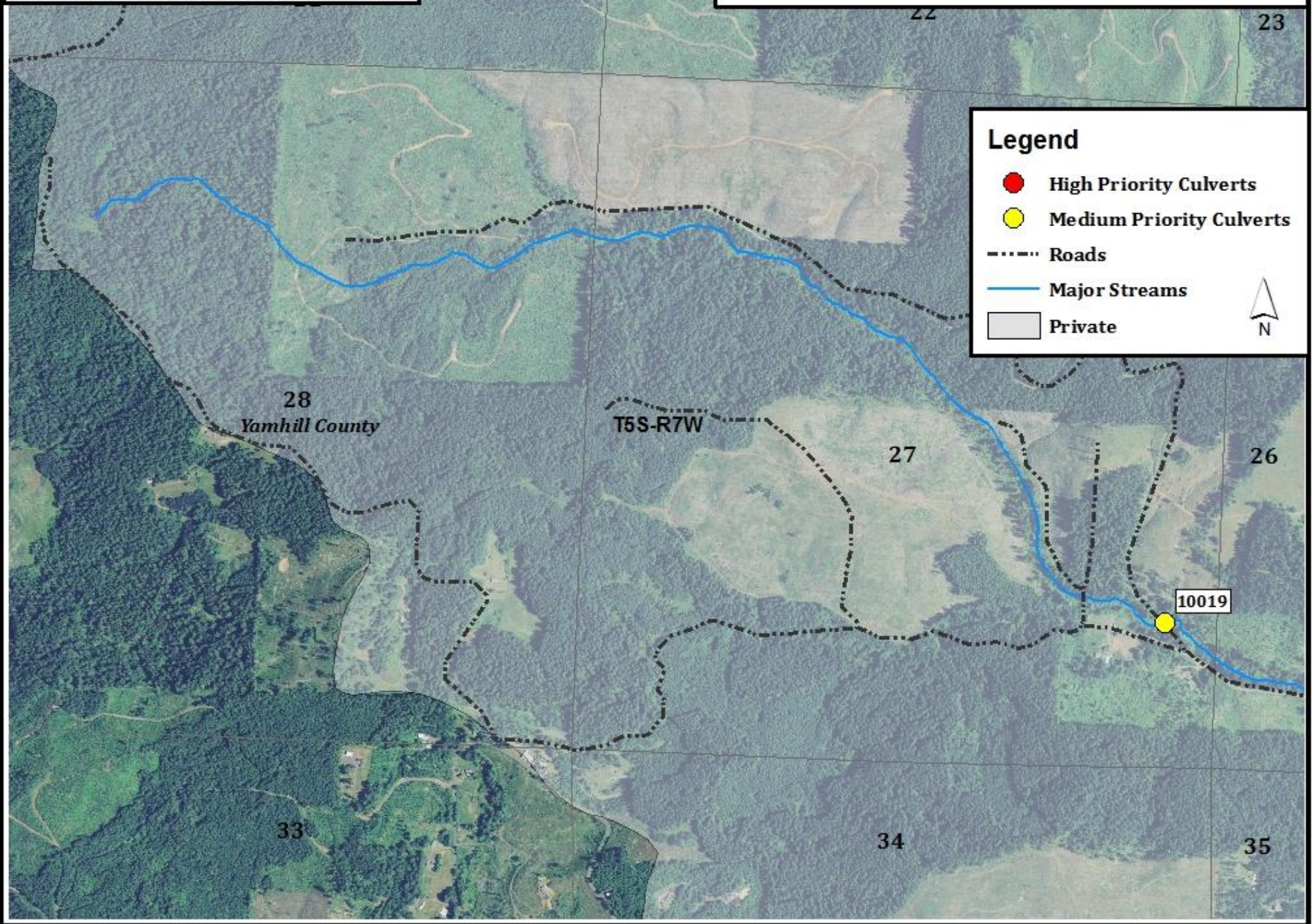
Culvert ID #	10019	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	5S 7W 27 NE OF SE
Stream Name	Trib to Willamina	UTM Easting/Northing	NA
Road Name	Allen Road	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	55.00
Culvert Material	Annular CMP	Horizontal Width (in)	76.80
Slope (%)	3.00	Vertical Height (in)	91.20
Overall Culvert Condition	Fair	Outlet Drop(ft)	1.45
Channel Information			
Inlet Gradient (%)	0.00	Upstream Bankfull Width (ft)	11.50
Upstream Channel Gradient (%)	1.00	Downstream Bankfull Width (ft)	11.00
Bankfull Ratio	0.56		
Prioritization Analysis			
Habitat Length (miles)	2.51	(1) Habitat Length Points	3
Habitat Quality	1.24 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	7
Comments			
<p>Survey Date: 6/19/2007; Survey Comments: Beaver pools upstream; Culvert bottom rusting through; November 29 2012 TAC Meeting: (ODFW) Lower end occupied by steelhead but not far up; Need more information on fish distributions and habitat.</p>			
Photographs			
Inlet		Outlet	
			



16 - Willamina Creek Trib







Legend

- High Priority Culverts
- Medium Priority Culverts
- Roads
- Major Streams
- Private

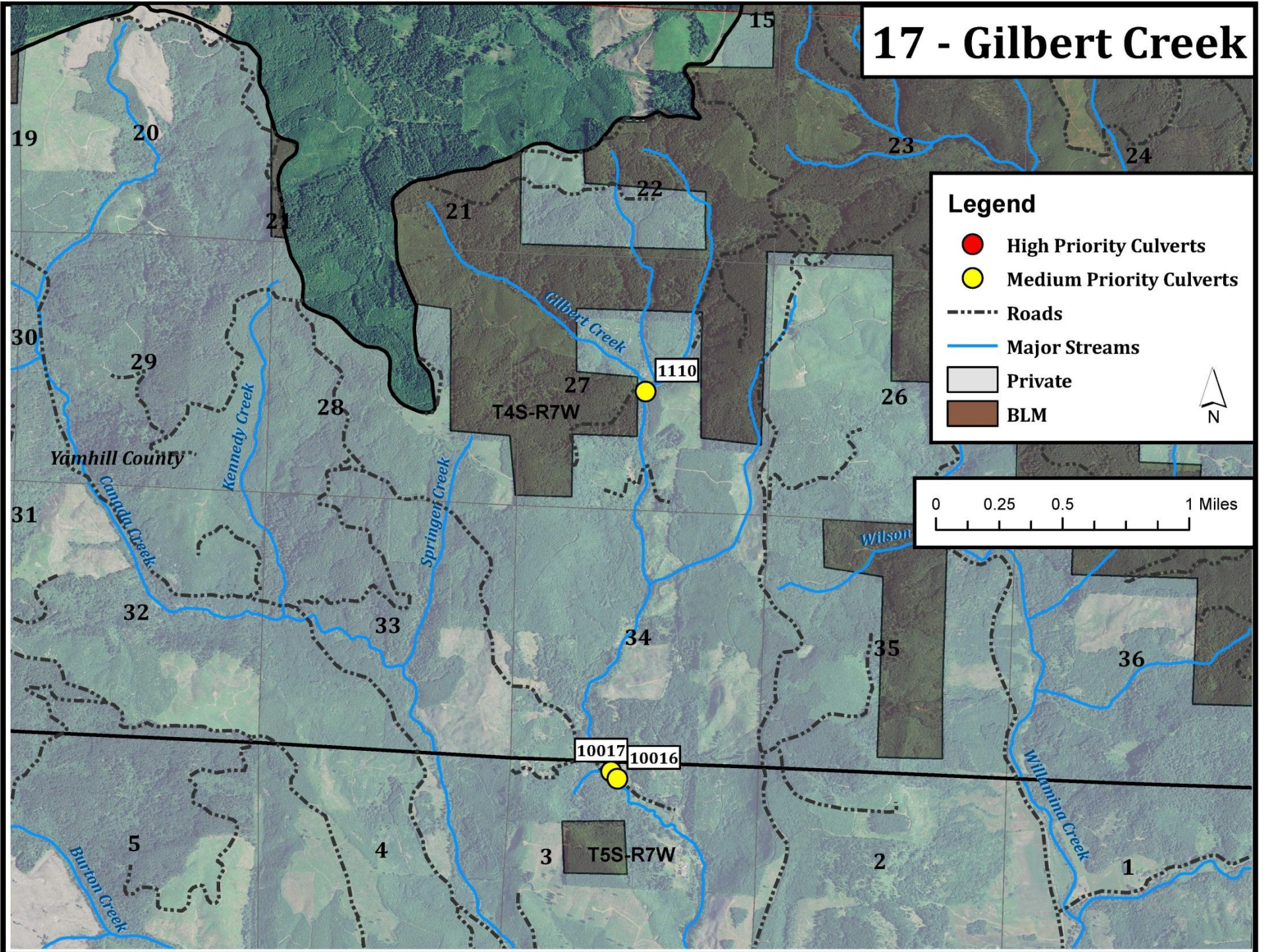




Culvert ID #	1110	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	4S 7W 27 NW of SE
Stream Name	Gilbert Creek	UTM Easting/Northing	458052 / 5004468
Road Name	Gilbert Creek Road	Owner Type	Private
Culvert Information			
Barrel Shape	Circular	Length (ft)	50.00
Culvert Material	Concrete	Horizontal Width (in)	36.00
Slope (%)	3.00	Vertical Height (in)	36.00
Overall Culvert Condition	Poor	Outlet Drop(ft)	0.60
Channel Information			
Inlet Gradient (%)	24.00	Upstream Bankfull Width (ft)	14.00
Upstream Channel Gradient (%)	2.00	Downstream Bankfull Width (ft)	14.00
Bankfull Ratio	0.21		
Prioritization Analysis			
Habitat Length (miles)	2.56	(1) Habitat Length Points	3
Habitat Quality	1.08 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	7
Comments			
<p>Survey Date: 7/15/2004; Survey Comments: Culvert sections pulling apart, breaks in slope, undersized; November 29 2012 TAC Meeting: (ODFW) Above anadromous use; Waterfall downstream; Resident Cutthroat above and possibly lamprey to consider.</p>			
Photographs			
Inlet		Outlet	
			



Culvert ID #	10016	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	5S 7W 3 NE of NW
Stream Name	Gilbert Creek	UTM Easting/Northing	457963 / 5002006
Road Name	Gilbert Creek Road	Owner Type	Private
Culvert Information			
Barrel Shape	Pipe-Arch	Length (ft)	50.00
Culvert Material	Annular CMP	Horizontal Width (in)	84.00
Slope (%)	2.00	Vertical Height (in)	54.00
Overall Culvert Condition	Good	Outlet Drop(ft)	- 0.67
Channel Information			
Inlet Gradient (%)	16.00	Upstream Bankfull Width (ft)	15.00
Upstream Channel Gradient (%)	3.00	Downstream Bankfull Width (ft)	17.00
Bankfull Ratio	0.47		
Prioritization Analysis			
Habitat Length (miles)	2.02	(1) Habitat Length Points	3
Habitat Quality	1.27 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	7
Comments			
<p>Survey Date: 7/15/2004 ; Survey Comments: Fish presence verified; November 29 2012 TAC Meeting: (ODFW) Above anadromous use; Isolated cutthroat and lamprey potential; Lower mile of Gilbert Creek - steelhead are on the map, but there is a waterfall about 300' upstream of the mainstem of Coast Fork; would be good to fix for trout.</p>			
Photographs			
Inlet		Outlet	
			

Culvert ID #	10017	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	5S 7W 3 NE of NW
Stream Name	Gilbert Creek	UTM Easting/Northing	457926 / 5002062
Road Name	Gilbert Creek Road	Owner Type	Private
Culvert Information			
Barrel Shape	Pipe-Arch	Length (ft)	29.00
Culvert Material	Spiral CMP	Horizontal Width (in)	72.00
Slope (%)	1.00	Vertical Height (in)	60.00
Overall Culvert Condition	Fair	Outlet Drop(ft)	0.60
Channel Information			
Inlet Gradient (%)	10.00	Upstream Bankfull Width (ft)	16.00
Upstream Channel Gradient (%)	2.00	Downstream Bankfull Width (ft)	15.00
Bankfull Ratio	0.38		
Prioritization Analysis			
Habitat Length (miles)	2.02	(1) Habitat Length Points	3
Habitat Quality	1.27 - Med	(2) Habitat Quality Points	2
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	7
Comments			
<p>Survey Date: 07/15/2004; Survey Comments: Fish presence verified; Top of culvert slightly collapsing; Bent inlet; November 29 2012 TAC Meeting: (ODFW) Above anadromy; Isolated cutthroat and lamprey potential; Lower mile of Gilbert Creek - steelhead are on the map, but there is a waterfall about 300' upstream of the mainstem Coast Fork; Would be good to fix for trout.</p>			
Photographs			
Inlet		Outlet	
			

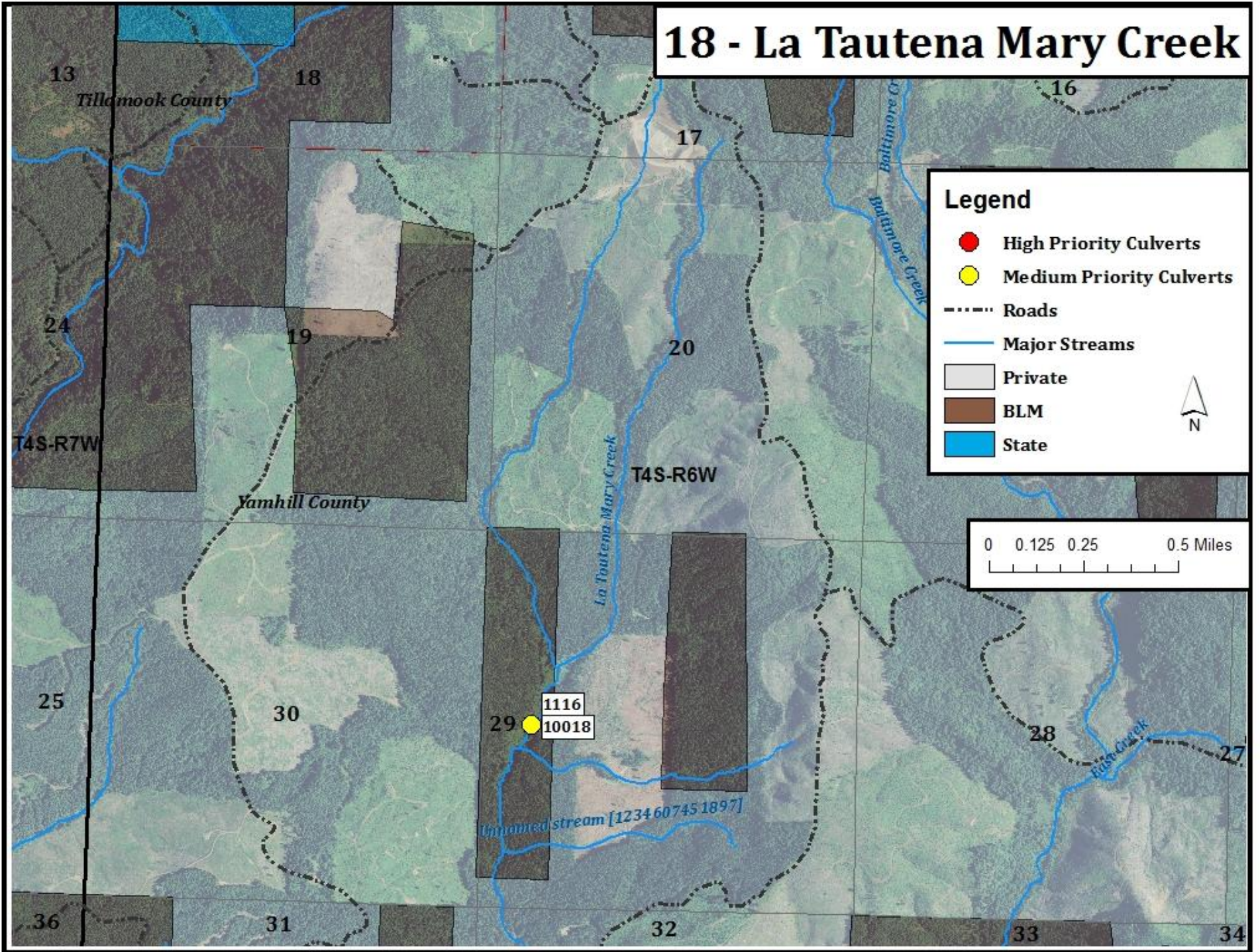
17 - Gilbert Creek



Culvert ID #	1116	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	4S 6W 29 NW of SW
Stream Name	La Tautena Mary Cr	UTM Easting/Northing	463912 / 5004442
Road Name	N/A	Owner Type	USDI-BLM
Culvert Information			
Barrel Shape	Circular	Length (ft)	33.00
Culvert Material	Annular CMP	Horizontal Width (in)	54.00
Slope (%)	2.00	Vertical Height (in)	54.00
Overall Culvert Condition	Poor	Outlet Drop(ft)	2.50
Channel Information			
Inlet Gradient (%)	21.00	Upstream Bankfull Width (ft)	13.00
Upstream Channel Gradient (%)	1.00	Downstream Bankfull Width (ft)	12.00
Bankfull Ratio	0.35		
Prioritization Analysis			
Habitat Length (miles)	2.02	(1) Habitat Length Points	3
Habitat Quality	0.64 - Low	(2) Habitat Quality Points	1
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	6
Comments			
Survey Date: 7/21/2004; Survey Comments: Undersized; Rusting through; Adjacent to Culvert ID # 10018; November 29 2012 TAC Meeting: N/A			
Photographs			
Inlet		Outlet	
			

Culvert ID #	10018	Priority Ranking	Med
Location Information			
Watershed	Willamina	Township-Range-Section-1/4	4S 6W 29 NW of SW
Stream Name	La Tautena Mary Cr	UTM Easting/Northing	463912 / 5004442
Road Name	N/A	Owner Type	USDI-BLM
Culvert Information			
Barrel Shape	Circular	Length (ft)	47.00
Culvert Material	Annular CMP	Horizontal Width (in)	48.00
Slope (%)	4.00	Vertical Height (in)	48.00
Overall Culvert Condition	Fair	Outlet Drop(ft)	2.90
Channel Information			
Inlet Gradient (%)	21.00	Upstream Bankfull Width (ft)	13.00
Upstream Channel Gradient (%)	1.00	Downstream Bankfull Width (ft)	12.00
Bankfull Ratio	0.35		
Prioritization Analysis			
Habitat Length (miles)	2.02	(1) Habitat Length Points	3
Habitat Quality	0.64 - Low	(2) Habitat Quality Points	1
Fish Presence	Yes	(3) Fish Presence Points	2
Barrier Severity	Red	Total Prioritization Points	6
Comments			
Survey Date: 7/21/2004; Survey Comments: No water flowing through, Cracked inlet; Adjacent to Culvert ID # 1116; November 29 2012 TAC Meeting: N/A			
Photographs			
Inlet		Outlet	
			

18 - La Tautena Mary Creek



Next Steps

It is imperative that this Action Plan is put to use and not left to gather dust on partners' bookshelves. As such, the GYWC will lead the following efforts to ensure that the plan continues to be implemented.

1. GYWC will maintain and update the Plan, convene annual meetings, and manage efforts to keep the Plan moving forward.
2. This Plan will be posted on the GYWC's website and associated data will be made accessible to all watershed partners
3. As fish barriers are replaced, the upper extents of fish distributions should be re-evaluated.
4. Future studies regarding fish distribution, such as Rapid Bioassessments, would greatly benefit this Action Plan and further identify High priority culverts to replace for migratory fish passage.

References

(Burnett et. al, 2007) Kelly M. Burnett, Gordon H. Reeves, Daniel J. Miller, Sharon Clarke, Ken Vance-Borland and Kelly Christiansen. (2007) Distribution of Salmon-Habitat Potential Relative to Landscape Characteristics and Implications for Conservation. *Ecological Applications* Vol. 17, No. 1 pp.66-80, Ecological Society of America.

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(Reeves, 1998) Reeves, G. H., P. A. Bisson, and J. M. Dambacher. 1998. Fish communities. Pages 200–234 in R. J. Naiman and R. E. Bilby, editors. *River ecology and management: lessons from the Pacific coastal ecoregion*. Springer-Verlag, New York, New York, USA.

(TEP, 2006) Hoffman, Rachael. (May, 2006) Nestucca/Neskowin Watersheds Culvert Prioritization and Action Plan for Fish Passage. Prepared for the U.S. Bureau of Land Management, Tillamook Resource Area by the Tillamook Estuaries Partnership.

(WCLU, 2006) Oatney, Janet, and Cruise, Stephen. (December, 2006) Dairy-McKay Fish Passage Assessment and Prioritization, Washington County Oregon. Washington County Department of Land Use and Transportation, Operations and Maintenance Division.

Appendix

1. BLM Coarse Screen Filter Version 2.2

Appendix 1: BLM Coarse Screen Filter Version 2.2

BLM Coarse Screen Filter Version 2.2, Juvenile Salmonid Passage Evaluation Criteria				
	Structure	Green	Grey	Red
1	Bottomless pipe arch or countersunk pipe arch, substrate 100% coverage through pipe and invert depth greater than 20% of culvert rise.	Culvert installed at channel grade (+/- 1%), culvert span to bankfull width ratio greater than 0.9, no blockage.	Culvert installed at channel grade (+/- 1%), culvert span to bankfull width ratio greater than 0.5, less than or equal to 10% blockage.	Culvert not installed at channel grade (+/- 1%), culvert span to bankfull width ratio less than 0.5, greater than 10% blockage.
2	Pipe arches (1x3 corrugation and larger). Substrate less than 100% coverage through pipe or invert depth less than 20% of culvert rise.	Culvert gradient less than 0.5%, no perch, no blockage, culvert span to bankfull width ratio greater than 0.75.	Culvert gradient between 0.5 to 2.0%, less than 4" perch, less than or equal to 10% blockage, culvert span to bankfull width ratio greater than 0.5.	Culvert gradient greater than 2.0%, greater than 4" perch, greater than 10% blockage, culvert span to bankfull width ratio less than 0.5.
3	Circular CMP or ABS, 48 inch span and smaller, spiral or annular (CMP) corrugations, regardless of substrate coverage.	Culvert gradient less than 0.5%, no perch, no blockage, culvert span to bankfull width ratio greater than 0.75	Culvert gradient 0.5 to 1.0%, perch less than 4 inches, less than or equal to 10% blockage, culvert span to bankfull width ratio greater than 0.5.	Culvert gradient greater than 1.0%, perch greater than 4 inches, blockage greater than 10%, span to bankfull width ratio less than 0.5.
4	Circular CMPs with annular corrugations larger than 1x3 and 1x3 spiral corrugations (>48" span), substrate less than 100% coverage through pipe or invert depth less than 20% culvert rise.	Culvert gradient less than 0.5%, no perch, no blockage, culvert span to bankfull width ratio greater than 0.75.	Culvert gradient between 0.5 to 2.0%, less than 4" perch, less than or equal to 10% blockage, culvert span to bankfull width ratio greater than 0.5.	Culvert gradient greater than 2.0%, greater than 4" perch, greater than 10% blockage, culvert span to bankfull width ratio less than 0.5.
5	Circular CMPs with 1x3 or smaller annular corrugations (all spans) and 1x3 spiral corrugations (>48" span), 100% substrate coverage through pipe and invert depth greater than 20% of culvert rise.	Culvert gradient less than 1%, no perch, no blockage, culvert span to bankfull width ratio greater than 0.75	Culvert gradient 1.0 to 3.0%, perch less than 4 inches, less than or equal to 10% blockage, culvert span to bankfull width ratio greater than 0.5.	Culvert gradient greater than 3.0%, perch greater than 4 inches, blockage greater than 10%, culvert span to bankfull width ratio less than 0.5.
6	Circular CMPs with 2x6 annular corrugations (all spans), 100% substrate coverage through pipe and invert depth greater than 20% of culvert rise.	Culvert gradient less than 2.0%, no perch, no blockage, culvert span to bankfull width ratio greater than 0.75	Culvert gradient 2.0 to 4.0%, less than 4" perch, less than or equal to 10% blockage, culvert span to bankfull width ratio greater than 0.5.	Culvert gradient greater than 4.0%, greater than 4 inch perch, greater than 10% blockage, culvert span to bankfull width ratio less than 0.5.
7	Special items; log stringer or modular bridge,	No encroachment on bankfull width.	Encroachment on bankfull width (either streambank).	Structural collapse.
8	Baffled structure installations (all culvert sizes and configurations).	No perch, no blockage. Culvert span to bankfull width ratio greater than 0.75. 100% substrate in pipe but baffles protruding.	Outlet with less than 6 inch perch, less than or equal to 10% blockage, culvert span to bankfull width ratio greater than 0.5. Less than 100% substrate.	Perch greater than 6 inches, greater than 10% blockage, culvert span to bankfull width ratio less than 0.5. Less than 100% substrate.
9	Weir installations (all culvert sizes and configurations).	No perch, no blockage. Culvert span to bankfull width ratio greater than 0.75 Weirs provide 6 inch minimum pool depth and no jumps exceed 4 inches.	Outlet with less than 6 inch perch, less than or equal to 10% blockage, culvert span to bankfull width ratio greater than 0.5. Weirs with pool depths less than 6 inches. Jumps over weirs greater than 4 inches.	Perch greater than 6 inches, greater than 10% blockage, culvert span to bankfull width ratio less than 0.5. Weirs without pools, no resting areas. Weir Jumps > 4 inches
10	Concrete Box Culverts	Culvert backwatered or mostly backwatered w/100% substrate. Culvert span to bankfull width ratio greater than 0.75. No blockage.	Culvert gradient up to 2%. Outlet with less than 4 inch perch. 100% substrate in pipe. Culvert span to bankfull ratio greater than 0.5.	Perch greater than 4 inches. Culvert span to bankfull ratio less than 0.5. Laminar flow. Less than 100% substrate in pipe.
11	Circular concrete and smooth wall ABS culverts.	100% substrate in pipe. Slope less than .5%. No Perch	Less than 100% substrate in pipe. Slope .5-1%. Perch less than 4 inches	No substrate. Slope greater than 1% Perch greater than 4 inches.
Notes: 1) For culverts containing baffles but are entirely covered with substrate, evaluate using the criteria for structures 2-8, as appropriate; 2) If culvert does not fit well on this CSF run Fish-Xing; 3) This CSF works well for culverts on public lands, not always well for private landowner culverts due to large variations in construction materials and types of installations.				