**Special Publication No. 10-17**

# ADF&G Fish Passage Program: Summary of Existing Inventory and Assessment Data and Gap Analysis, September 2009.

**by**

**Gillian O'Doherty**

**December 2010**

**Alaska Department of Fish and Game** **Divisions of Sport Fish and Commercial Fisheries**

## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

**Weights and measures (metric)**

| | |
|---|---|
| centimeter | cm |
| deciliter | dL |
| gram | g |
| hectare | ha |
| kilogram | kg |
| kilometer | km |
| liter | L |
| meter | m |
| milliliter | mL |
| millimeter | mm |

**Weights and measures (English)**

| | |
|---|---|
| cubic feet per second | $ft^3/s$ |
| foot | ft |
| gallon | gal |
| inch | in |
| mile | mi |
| nautical mile | nmi |
| ounce | oz |
| pound | lb |
| quart | qt |
| yard | yd |

**Time and temperature**

| | |
|---|---|
| day | d |
| degrees Celsius | °C |
| degrees Fahrenheit | °F |
| degrees kelvin | K |
| hour | h |
| minute | min |
| second | s |

**Physics and chemistry**

| | |
|---|---|
| all atomic symbols | |
| alternating current | AC |
| ampere | A |
| calorie | cal |
| direct current | DC |
| hertz | Hz |
| horsepower | hp |
| hydrogen ion activity (negative log of) | pH |
| parts per million | ppm |
| parts per thousand | ppt, ‰ |
| volts | V |
| watts | W |

**General**

| | |
|---|---|
| Alaska Administrative Code | AAC |
| all commonly accepted abbreviations | e.g., Mr., Mrs., AM, PM, etc. |
| all commonly accepted professional titles | e.g., Dr., Ph.D., R.N., etc. |
| at | @ |
| compass directions: | |
| east | E |
| north | N |
| south | S |
| west | W |
| copyright | © |
| corporate suffixes: | |
| Company | Co. |
| Corporation | Corp. |
| Incorporated | Inc. |
| Limited | Ltd. |
| District of Columbia | D.C. |
| et alii (and others) | et al. |
| et cetera (and so forth) | etc. |
| exempli gratia (for example) | e.g. |
| Federal Information Code | FIC |
| id est (that is) | i.e. |
| latitude or longitude | lat. or long. |
| monetary symbols (U.S.) | $, ¢ |
| months (tables and figures): first three letters | Jan,...,Dec |
| registered trademark | ® |
| trademark | ™ |
| United States (adjective) | U.S. |
| United States of America (noun) | USA |
| U.S.C. | United States Code |
| U.S. state | use two-letter abbreviations (e.g., AK, WA) |

**Mathematics, statistics**

| | |
|---|---|
| *all standard mathematical signs, symbols and abbreviations* | |
| alternate hypothesis | $H_A$ |
| base of natural logarithm | *e* |
| catch per unit effort | CPUE |
| coefficient of variation | CV |
| common test statistics | (F, t, $\chi^2$, etc.) |
| confidence interval | CI |
| correlation coefficient (multiple) | R |
| correlation coefficient (simple) | r |
| covariance | cov |
| degree (angular ) | ° |
| degrees of freedom | df |
| expected value | *E* |
| greater than | > |
| greater than or equal to | ≥ |
| harvest per unit effort | HPUE |
| less than | < |
| less than or equal to | ≤ |
| logarithm (natural) | ln |
| logarithm (base 10) | log |
| logarithm (specify base) | $\log_2$, etc. |
| minute (angular) | ' |
| not significant | NS |
| null hypothesis | $H_O$ |
| percent | % |
| probability | P |
| probability of a type I error (rejection of the null hypothesis when true) | α |
| probability of a type II error (acceptance of the null hypothesis when false) | β |
| second (angular) | " |
| standard deviation | SD |
| standard error | SE |
| variance | |
| population | Var |
| sample | var |

*SPECIAL PUBLICATION NO. 10-17*

# ADF&G FISH PASSAGE PROGRAM: SUMMARY OF EXISTING INVENTORY AND ASSESSMENT DATA AND GAP ANALYSIS, SEPTEMBER 2009

by
Gillian O'Doherty

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Rd, Anchorage

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

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The Special Publication series was established by the Division of Sport Fish in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library, Alaska Resources Library and Information Services (ARLIS) and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm. This publication has undergone editorial and peer review.

*Gillian O'Doherty*
*Alaska Department of Fish and Game, Division of Sport Fish, Region V,*
*333 Raspberry Rd, Anchorage AK 99518-1599, USA*

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# ABSTRACT

The Division of Sport Fish performance target for fish passage assessments states that 100% of state-owned roadway mileage will have a fish passage assessment of culverts conducted within the last 10 years with program success measured as a percentage of state-owned roadway mileage. This gap analysis summarizes the history of the assessment program; quantifies the length of the road system surveyed to date; and prioritizes future projects. Between 2000 and 2009 ADF&G carried out 14 inventory and assessment projects and evaluated fish passage at 1,591 culverted stream crossings representing 65.6% of state owned roads. In addition to state owned roads ADF&G inventories and assesses culverts on borough, municipality, private and federal roads and the Alaska Railroad as time and funds allow. The gap analysis showed that the highest priorities for 2010 through 2012 inventory and assessment projects are the combined Southeast road networks and the Dalton/Elliott/Steese Highways which include the majority of the un-surveyed state road miles. The lowest priority roads are small, remote networks in Port Heiden, McGrath, Kwethluk and Kotzebue as they represent a very small number of state-owned road miles and will be costly to survey. Other road networks are intermediate in priority: Dillingham, North Slope, McCarthy Rd & Copper Highway Spur, King Salmon, Bethel, Fairbanks North star Borough owned roads and Copper Basin locally owned roads. In addition to prioritizing and carrying out the remaining un-inventoried road networks as described above, there is an ongoing need to update existing data as culverts are replaced.

Key words: Fish Passage; Culverts; Assessment; Gap Analysis;

# INTRODUCTION AND PURPOSE

If designed properly, bridges and culverts can have little or no adverse effect on the movement of fish and other aquatic organisms but many existing culverts are too small, too steep or too high above the stream grade to allow unimpeded movement. In order to assess the effect of culverts on the availability of habitat the ADF&G Fish Passage Improvement Program assesses existing culverted crossings throughout the state for their degree of passability to juvenile salmonids. The data are used to identify high priority fish passage restoration projects. Replacement projects are also surveyed to ensure they have been correctly installed. Between 1999 and 2009 ADF&G biologists assessed over 1500 road stream crossings for fish passage.

This document is intended for use as a planning tool and to inform the division and department of the status of the program and of the options for future projects. The goals of the document are:

- quantify the length of the road system surveyed to date and the number of culverts assessed and classified with respect to fish passage;
- summarize the history of the assessment program and provide information on when and where assessment projects have been carried out;
- quantify the extent of road system that has not been surveyed and the estimated number of unassessed culverts;
- prioritize future projects.

## STATE OF ALASKA OFFICE OF MANAGEMENT AND BUDGET PERFORMANCE TARGET

The Division of Sport Fish, in conjunction of the Office of Management and Budget (OMB) has established a performance target for fish passage assessments:

- 100% of state-owned roadway mileage will have a fish passage assessment of culverts conducted within the last 10 years.

The program success will be tracked by the following performance measure:

- Percentage of state-owned roadway mileage that have had a fish passage assessment of culverts conducted within the last 10 years.

In addition to state owned roads ADF&G inventories and assesses culverts on borough, municipality, private and federal roads as time and funds allow. Beginning in 2009 ADF&G has also started to assess culverts under the Alaska Railroad.

## ASSESSMENT OF FISH PASSAGE

Between 2000 and 2009 ADF&G carried out 14 inventory and assessment projects and evaluated fish passage at 1,591 culverted stream crossings throughout the state.

The majority of the assessments carried out are rapid assessments based on physical measurements of the culvert and the stream channel. These "Level 1" assessments focus on juvenile salmonid fish passage. ADF&G follows a standardized protocol, developed in part with other state and federal agencies specifically for use in Alaska. Culverts are surveyed for type, size, slope, outfall height and other physical parameters and then compared to a decision matrix; after which they are classified as *green*, *red* or *gray* (Figure 1; Appendix A1).

| | |
|---|---|
| Green: | conditions at the crossing are likely to be adequate for fish passage; of the structures ranked in the study, these have the greatest potential to pass juvenile fish |
| Red: | conditions at the crossing are assumed to be inadequate for fish passage |
| Gray: | conditions at the crossing may be inadequate for fish passage. |

Figure 1. Classification system for Alaska culverts.

The decision matrix (Appendix A1) uses the best available information to predict the ability of a juvenile coho (55mm) to pass through a variety of culvert types. A 55cm coho was chosen as the "model fish" because coho are believed to be the weakest swimming juvenile salmonid fish and 55 or 60cm is a size typically used in studies on juvenile fish swimming abilities. Therefore culverts that are passable by 55cm coho should be passable by other juvenile salmonids. In 2005 the matrix underwent some changes and earlier projects were retro-actively run through the revised matrix and fish passage classification changed to reflect the new status. This work was done automatically with mixed results due to wide variation in conditions from site to site. Currently pre-2005 projects are being manually reviewed using the original data sheets to take individual site considerations into account. This work is expected to significantly improve the accuracy of the classifications at these sites.

In addition to the Level 1 assessments, further assessments have been carried out during some projects. This includes culverts that the matrix classifies as Gray and/or for the purpose of evaluating passage of life-stages or species other than a juvenile coho. These assessments, referred to as "Level 2" assessments, use the software program *FishXing* (available from www.stream.fs.fed.us/fishxing/)[1] to further evaluate passage at select sites. These assessments do not add to the percentage of road miles surveyed or the number of sites assessed.

As crossings are surveyed the data are entered into the Fish Passage Inventory Database and made available on the web through an interactive map. At the time of publication data from 2001 through 2009 (Figure 2; Table 1) are available on the web. Accompanying reports are in draft form and have not been released to date.

[1] Product names used in this publication are included for completeness but do not constitute product endorsement.

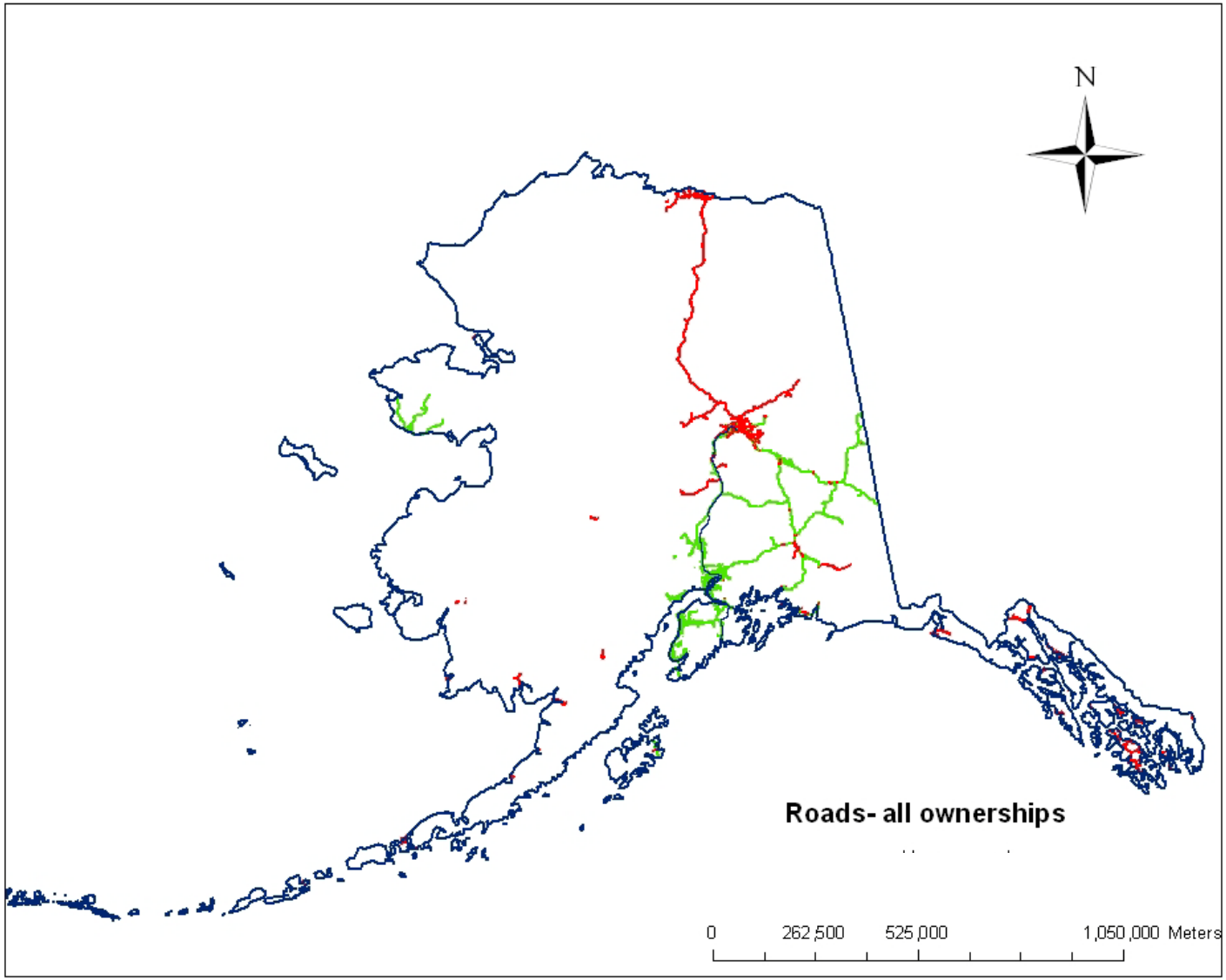


Figure 2.– Map of Alaska showing extent of ADF&G fish passage inventories carried out between 2001 and 2009 (green) and road systems that remain to be assessed (red). This map does not include inventories carried out by the US Forest Service on National Forest roads.

Table 1.–Past and ongoing fish passage inventory and assessment projects.

| Year | Project Code | Project Name | Scope | # Sites |
|---|---|---|---|---|
| 2000 | **MSB01** | Inventory and assessment for fish passage of crossing structures under Matanuska-Susitna Valley roads | Bodenberg Creek, Cottonwood Creek, and Wasilla Creek (including Spring Creek and Rabbit Slough) watersheds within the Matanuska-Susitna Borough | 104 |
| 2001 | **KPCS1** | Fish Passage at Culverts on the Kenai Peninsula, Alaska. | State road system on the Kenai Peninsula | 97 |
| 2001 | **ANCS2001** | Anchorage 2001 | Selected culverts in the Anchorage Bowl | 10 |
| 2002 | **CRB02** | Preliminary inventory and assessment for fish passage of culverts in the Copper River Basin. | The project extent included the entire lengths of the Copper River and Edgerton highways; the Richardson Highway between Valdez and Paxson; approximately 25 miles of the Denali Highway west of Paxson; the Glenn Highway east of Eureka Pass to Glennallen; the Tok Cutoff Highway from the Richardson Highway to the Nabesna Road intersection; the Nabesna Road and significant secondary roads (Power Creek, Whitshed, and Lake Louise roads) crossing fish streams. Additional surveys were carried out in the Matanuska River Valley and Anchorage-Girdwood-Portage area under this project. Jonesville Road, Knik River Road, Old Glenn Highway, Fishhook Road, Seward Highway, and the Alyeska area were surveyed as time allowed or at the request of DOT. | 326 |
| 2002 | **TYCS1** | Fish Passage Assessment of Culverts Near Tyonek, Alaska. | The project extent included: 1) roads within Trading Bay State Game Refuge 2) roads owned by the Tyonek Native Corporation, and 3) roads maintained by Chugach Electric in the vicinity of the Beluga electricity generating plant. | 24 |
| 2004 | **ANC04** | Anchorage 2004 | Culverts on State and locally owned roads within the Municipality of Anchorage that were not assessed in 2001 were included. | 241 |
| 2004 | **PRK04** | Parks Highway | George Parks Highway between milepost 0 and milepost 210 at Cantwell and the Denali Highway between milepost 133.8 at Cantwell and approximately milepost 125 at Lily Creek | 92 |
| 2004 | **MSB04** | Mat Su Borough '04 | Borough owned or maintained culverts in the Susitna River, Meadow Lakes & Fish Creek watersheds. Data collection was performed in 2004 by Bell and Associates under contract to the Matanuska-Susitna Borough | 130 |
| 2004-05 | **KOD05** | Kodiak Island | State owned or maintained roads on Kodiak Island | 97 |

-continued-

Table 1. Page 2 of 2.

| Year | Project Code | Project Name | Scope | # Sites |
|---|---|---|---|---|
| 2006 | **SEW06** | Seward Peninsula | The Nome-Teller Road, the Kougarok Road, and the Nome-Council Road and associated secondary roads including Woolley Lagoon Road, Pilgrim Hot Springs Road, Anvil Mountain Road, Dexter Bypass, Nome Bypass, Seppala Drive, Red Fox Road and Glacier Creek Road | 105 |
| 2006-07 | **CNT07** | Central -Interior | State-maintained primary and secondary roads from the Denali Highway north to Fairbanks and from Fairbanks east to the Canadian border | 200 |
| 2008 | **MOA08** | An Assessment of Fish Passage Conditions at Selected Stream Crossings in Anchorage, Alaska | Gray culverts in the Campbell, Ship and Chester Creek watersheds were re-assessed using an updated Level 1 methodology and/or Level II fish passage (*FishXing*). | n/a |
| 2009 | **PRK09** | Parks Highway 09 | Mat-Su Borough roads in the Parks Highway corridor from Willow to Trapper Creek, including Petersville Road and the Talkeetna Spur Road areas. | 71 |
| 2009-12 | **MSB09** | Mat-Su Borough fish Passage Inventory and Assessment | Previously un-surveyed culverts in the Matanuska-Susitna Borough including borough, private and state owned roads as well as the AK railroad. Previously surveyed culverts that have been replaced or altered will also be re-surveyed | '0 to date |

# METHODS

## DATA SOURCES

Data for this study were obtained from multiple sources.

### Road Data

The locations and lengths of state-owned road segments were obtained from DOT Alaska State Highway System Route Lists (available online at the DOT Highway Data Port (http://dataport.dot.state.ak.us/). This analysis was based on Highway Analysis System Data from 20 September 2007.

The Alaska State Highway System is comprised of those roads owned by DOT statewide (mileage does not include ramps, wyes, or proposed roads). These roads are categorized in three functional groups:

- The National Highway System (NHS) is an interconnected system of routes that serve important national functions (security, commerce, and travel). The NHS is comprised of Interstate and defense routes, other principal arterial routes, and routes connecting to inter-modal facilities such as airports, ports, and ferry terminals. With a few exceptions, all NHS routes in Alaska are owned by DOT&PF. Alaska has approximately 2113 centerline miles of NHS roads, of which 2,110 miles are owned by DOT&PF.
- The Alaska Highway System (AHS) was established by the Legislature in 2002. The AHS includes roads that have statewide significance but are not included in the NHS. These roads connect communities and link to recreational sites or areas of resource development. Statewide, there are approximately 1,508 centerline miles of AHS roads, of which 1,457 miles are owned by DOT&PF.
- Community Transportation Program (CTP) roads include all remaining roads owned by DOT&PF and include 2,058 centerline miles. These roads consist primarily of local roads owned by DOT&PF.

In addition to the information provided by DOT&PF, road maps or logs for non-state owned roads have been obtained from local borough or municipality governments, the Department of Natural Resources, Tongass and Chugach National Forests and other state, federal and local agencies. This information has been used by ADF&G to create an ArcGIS file that contains the majority of the roads in the state. Please see Appendix B for the metadata associated with this file.

### Stream Data

All stream data are from the USGS National Hydrography Dataset (NHD).

## CALCULATING THE PERCENTAGE OF STATE-OWNED ROADS INVENTORIED FOR FISH PASSAGE WITHIN THE PAST 10 YEARS

Only roads included in the State Highway System as defined by DOT&PF were included in this part of the analysis. These are the state-owned roads upon which the Fish Passage Management Target and Performance Measures are based.

First, the most recent route lists prepared by DOT&PF were obtained (September 2007). The route lists display the following information for each road segment in the state:

- **Route name (CDS Route Number)**
- **Route description (the posted or platted road name)**
- Beginning and ending mile points
- Beginning and ending termini locations

An Excel worksheet was prepared for each of the three functional groups in the State Highway System using the data from the Route Lists and inventoried road segments. We estimated the percentage of miles inventoried within each functional group and for state-owned roads as a whole by summing the lengths of all inventoried road segments and comparing this to the total road mileage for each functional group. This analysis includes work carried out through 2009 (ADF&G Division of Sport Fish, Region V, Biologist Steve Albert [retired]; unpublished data).

## IDENTIFYING PRIORITIES FOR FUTURE INVENTORIES

For this part of the gap analysis both state owned roads and non-state owned roads were included. Due to the cost of mobilizing a survey crew it will be more cost-effective to inventory all state and locally owned roads in an area at the same time in future projects.

Using road data provided by state, federal and local agencies a map of roads statewide was created that includes all roads connected to the state highway systems and marine highway systems and larger remote road networks. Additional small remote road networks will be added to the gap analysis when this information becomes available.

Road segments that were inventoried during completed projects or that are scheduled to be inventoried under ongoing projects were marked as surveyed and mapped (Figure 2). Road segments that remain un-inventoried were identified and then grouped geographically. Public roads connected to the major highway system formed three geographical groupings; roads on the North Slope formed one; roads connected to the Alaska Marine Highway System formed another and remote road systems throughout the rest of the state were considered individually. The geographic groupings are shown in Table 2.

Table 2.–Un-inventoried road networks grouped by geographic region.

| Un-inventoried Road Networks | Ownership |
|---|---|
| McCarthy Rd & Copper R. Spur | State |
| Elliot/Dalton/Steese Highways | State |
| North Slope roads (not including Barrow) | Mostly Private |
| Interior & Copper Basin (local roads) | Local & Private |
| Southeast | All (State, Local, Private & Federal) |
| Dillingham | All (State, Local, Private & Federal) |
| King Salmon | All (State, Local, Private & Federal) |
| Newhalen | All (State, Local, Private & Federal) |
| Port Heiden | All (State, Local, Private & Federal) |
| McGrath | All (State, Local, Private & Federal) |
| Bethel | All (State, Local, Private & Federal) |
| Kotzebue | All (State, Local, Private & Federal) |
| Kwethluk | All (State, Local, Private & Federal) |

For each of these road networks the density of road-stream crossings was calculated using GIS by overlaying the road maps on the NHD. In addition the number and density of AWC stream-road crossings was calculated by overlaying the road map on the AWC layer. Available road layers are inaccurate or incomplete in terms of road ownership so this part of the gap analysis was not broken down into state-owned and non-state-owned road segments by mile.

Road-stream crossings were predicted based on the best available data from the NHD, AWC and local, state and federal government and are not expected to reflect the actual number of crossings in a given area. Instead they are used as a tool for planning to identify areas of relatively high road and stream density versus areas of relatively low density.

# RESULTS

## PERCENTAGE OF STATE-OWNED ROADS INVENTORIED FOR FISH PASSAGE BY ADF&G, 2009

Table 3 shows the percentage of the state-owned road system inventoried in the past 10 years by functional group and as a whole. The remaining miles are largely located in the Southeast and Northern parts of the state, with the Elliott, Dalton and Steese Highways making up 702 miles of the 1,132 un-inventoried NHS and AHS miles statewide. All state-owned roads in the Central region have been inventoried, with the exception of McCarthy Road.

Remote road systems make up the remaining un-inventoried state-owned roads. The only remote road systems inventoried to date are the large remote road network connected to Nome on the Seward Peninsula and the Tyonek road system. No roads have been inventoried in the Southeast region or on the smaller remote networks in Western Alaska. Smaller road systems with air access are more costly per mile to inventory than any other kind of road.

Table 3.–The percentage of state-owned road miles that have been inventoried for fish passage barriers by ADF&G, 2009.

| | | | | |
|---|---|---|---|---|
| **National Highway System (NHS) Centerline Miles** | | | | |
| Southeast Region | 111 | | | |
| Central Region | 578 | | | |
| Northern Region | 1,463 | | | |
| State-owned NHS Mileage | | Subtotal: | 2,152 | |
| Statewide NHS Mileage Inventoried: | | | 1,540 | |
| **Percent Inventoried:** | | | | **71.5%** |
| **Alaska Highway System (AHS) Centerline Miles** | | | | |
| Southeast Region | 178 | | | |
| Central Region | 237 | | | |
| Northern Region | 1,056 | | | |
| State-owned AHS Mileage | | Subtotal: | 1,471 | |
| Statewide AHS Mileage Inventoried: | | | 951 | |
| **Percent Inventoried:** | | | | **62.2%** |
| **Community Transportation Program (CTP) Centerline Miles** | | | | |
| Southeast Region | 213 | | | |
| Central Region | 883 | | | |
| Northern Region | 892 | | | |
| State-owned CTP Mileage | | Subtotal: | 1,988 | |
| State-owned CTP Mileage Inventoried: | | | 1,183 | |
| **Percent State-owned CTP Inventoried:** | | | | **59.5%** |
| **SUMMARY** | | | | |
| State-owned Mileage (NHS, AHS, and CTP): | | | 5,611 | |
| Grand Total State-owned Centerline Mileage Inventoried: | | | 3,674 | |
| **Percentage State-owned Centerline Mileage Inventoried**: | | | | **65.6%** |

Source: Alaska Department of Fish and Game, Region V Sport Fish Biologist Steve Albert (retired), 2009.

## PRIORITIZING FUTURE INVENTORIES

Comparing the number of projected road-stream crossings per mile using GIS does not yield a direct comparison of the number of crossings due to inaccuracies in the locations of roads and streams. It does give a relative measure of the density of both road and stream networks and has been used extensively in planning inventory projects since 2001. In this analysis we also look at the density of Anadromous Waters Catalog (AWC) stream-road crossings per mile. The density of AWC crossings per mile is affected by survey effort and cannot be compared across the state; however it does indicate areas where fish streams are known to be abundant.

The Southeast road networks have the highest density of estimated stream crossings per road mile at an estimated 0.99 NHD stream-road crossings/mile (Table 4). The Southeast region also

has the highest density of AWC stream-road crossings/mile at 0.38 AWC stream crossings/mile. The Elliott/Dalton/Steese road network has the next highest estimated density of road-stream crossings per mile at 0.60 NHD stream crossings/mile, but a very low number of those streams have been mapped for anadromous fish at only 0.04 AWC stream crossings/road mile.

The McCarthy Road and Copper Spur Rd, North Slope, Dillingham, New Halen and Kotzebue have comparable densities of road stream crossings per mile (0.35–0.46) while McGrath, Pt Heiden and Kwethluk all have an estimated <0.20 crossings per mile.

Table 4.–Stream-road crossing numbers and densities for all un-inventoried road networks.

| Un-inventoried Road Networks | Length (miles) | AWC XIngs | AWC Xing Density (xings/mile) | NHD Xings | NHD Xing Density (xings/mile) |
|---|---|---|---|---|---|
| Southeast (State and locally owned) | 1,265.78 | 481 | 0.38 | 1247 | 0.99 |
| Elliot/Dalton/Steese Hwys | 707.63 | 29 | 0.04 | 427 | 0.60 |
| Dillingham | 75.41 | 7 | 0.09 | 35 | 0.46 |
| Newhalen | 31.28 | 3 | 0.10 | 13 | 0.42 |
| North Slope (not including Barrow) | 360.38 | 16 | 0.04 | 150 | 0.42 |
| Kotzebue | 22.97 | 0 | 0.00 | 9 | 0.39 |
| McCarthy Rd & Copper R. Spur | 62.73 | 6 | 0.10 | 22 | 0.35 |
| King Salmon | 78.20 | 4 | 0.05 | 22 | 0.28 |
| Bethel | 40.05 | 2 | 0.05 | 11 | 0.27 |
| Interior & Copper Basin (local ownership) | 2378 | 25 | 0.01 | 550 | 0.23 |
| Kwethluk | 6.10 | 0 | 0.00 | 1 | 0.16 |
| McGrath | 24.56 | 0 | 0.00 | 4 | 0.16 |
| Port Heiden | 25.90 | 0 | 0.00 | 3 | 0.12 |

The combined Southeast road networks also have the overall highest estimated numbers of total NHD stream-road crossings at an estimated 1,247 crossings, followed by the Interior and Copper Basin local roads at an estimated 550 crossings, the Elliott/Dalton/Steese Highway grouping with 427 crossings and the North Slope with 150 crossings. The rest of the road networks have less than 100 estimated crossings; several of the smaller road networks have less than 10 estimated crossings. Previous experience has shown this kind of analysis to overestimate the number of crossings present in a given area by a factor of 1.5 to 2.0 (Table 4).

# DISCUSSION

The results of the Gap Analysis indicate that the highest priorities for 2010 through 2012 inventory and assessment projects are the combined Southeast road networks and the Dalton/Elliott/Steese Highways.

The combined Southeast road networks represent the greatest number of overall estimated road-stream crossings, the highest density of estimated NHD stream-road crossings per mile and the highest density of estimated AWC stream-road crossings per mile. ADF&G has not carried out any surveys in this part of the state and has not been engaged in culvert replacement projects to date. There is local interest in having inventories carried out as well as the potential to partner

with federal agencies to fund and carry out the surveys. The Sport Fish value of watersheds in the region is high.

The Elliott/Dalton/Steese highways represent the greatest length of state-owned roads that have not been inventoried to date as well as the second highest density of estimated NHD stream-road crossings per mile. This inventory project is the highest priority in terms of meeting the OMB Performance Target of surveying all state-owned roads. The low number of estimated AWC stream-road crossings per mile does raise some concern that the fishery value is not as high in this region as some of the other regions.

The lowest priority road networks are the small remote networks in Port Heiden, McGrath, Kwethluk and Kotzebue as they represent a very small number of state-owned road miles and road-stream crossings and will be costly to survey.

Other road networks are intermediate in priority: Dillingham, North Slope, McCarthy Rd & Copper Hwy. Spur, King Salmon, Bethel and Interior and Copper Basin local roads. Prioritizing these inventories should be done after considering other factors such as the age of existing inventories, access, availability of state, federal or local funds, pending road upgrades or and relative costs.

# RECOMMENDATIONS

In addition to prioritizing and carrying out the remaining un-inventoried road networks as described above, there is a need to update existing data. The OMB Performance Target for state-owned roadways is to have an inventory of fish passage barriers carried out within the last 10 years. The older inventory projects are nearing 10 years old and there is the need to update the data to reflect new construction and replacement. In many cases this does not mean re-surveying a large number of culverts but it does require seeking out records on replacements, coordinating with local agencies and re-surveying when necessary. This work will be carried out throughout the Mat-Su Borough as part of the ongoing MSB2012 project, which will comprehensively update the MSCS1, PRK04 and MSB04 projects. Work has also begun on updating the Kenai 2001 and 2004 inventories in the database but no funding is allocated for re-surveying replaced culverts at this time and re-surveys are being done on an ad hoc basis. In the interim replaced culverts are identified in the database as “Unclassified” with a notation that they have been replaced but not re-surveyed. In order to reduce the work associated with this task in the future it is recommended that the Fish Passage Improvement Program work with ADF&G Division of Habitat and the AKDOT&PF to track locations of culvert replacements on an ongoing basis.

Some specific additional recommendations are provided based on earlier inventories, personal observation or discussion with agency staff:

**Alaska Railroad:** the Alaska Railroad within the Mat-Su Borough is being inventoried as part of the ongoing MSB 2012 Inventory and Assessment and it is recommended that the Railroad be included in future surveys whenever possible, and that railroad crossings be surveyed on an as-needed basis when planning replacements on adjacent road-stream crossings. In order to survey the railroad ADFG staff must be accompanied by AKRR staff. To date this has been a major constraint on completing surveys on the railroad, particularly in areas that are only accessible by Hy-rail. Because of the ongoing difficulty of accessing the railroad AKRR surveys should happen opportunistically whenever there is staff time and/or funds available but should not be scheduled as the bulk of a field seasons work.

**Private Roads & Driveways**: where private road or driveway culverts are within the public road right of way they are surveyed and where they are not the address is noted in order to contact the landowner and gain access at a later date. Private roads and driveways often cross the same streams as public roads and the data are needed for accurate prioritization.

**Abandoned Roads:** When the Tok Cutoff was realigned the old road bed was abandoned and crossings were not decommissioned. At least one of these crossings is known to have collapsed and become a barrier to fish passage (located on the Little Tulsuna River at N 62.43436, W -144.95370). There may be other abandoned road beds and DOT should be consulted in an effort to locate and inventory them.

Many miles of roads within Trading Bay SGR were abandoned in the early 1980s when timber harvest operations on the Refuge ceased. Most are grown over and appear to receive little use except those that provide access to hunting and fish areas near the Chakachatna River and Nicolai Creek. Crossings are unmaintained and some are known to have failed (Rich *in prep* b).

**Trails**: Many paved and unpaved trails are connected to the road system and carry ATV, snow-machine, bicycle or pedestrian traffic, often parallel to the road or, in the case of urban trails, parallel to watercourses. Trail crossings should be assessed whenever possible at the same time as the adjacent road culverts. Trails that do not parallel the road system may require a separate inventory effort. These include urban trails that run along watercourses such as the Chester Creek trail in Anchorage and some ATV trails that access remote sub-divisions in the Mat-Su valley.

Recreational hiking, skiing and snowmachine trails have also been observed to be constructed with culverted stream crossings and are not accessible to survey crews on ATVs or in a truck. Efforts should be made to coordinate with the agencies responsible for maintaining these recreational trails in order to identify potential barriers.

# REFERENCES CITED


Albert, S.W. and E.W. Weiss. *In prep*. Inventory and assessment for fish passage of crossing structures under Matanuska-Susitna Valley roads. Alaska Department of Fish and Game, Anchorage.

Albert, S.W. and D. Beers. *In prep*. Preliminary inventory and assessment for fish passage of culverts in the Copper River Basin. Alaska Department of Fish and Game, Anchorage.

Rich, C.F. *In prep a.* Fish passage at culverts on the Kenai Peninsula, Alaska. Alaska Department of Fish and Game, Anchorage.

Rich, C.F. *In prep b.* Fish passage assessment of culverts near Tyonek, Alaska. Alaska Department of Fish and Game, Anchorage.

Ryland, D. *In prep*. An assessment of fish passage conditions at stream crossings associated with the state road system on the Seward Peninsula. Alaska Department of Fish and Game, Anchorage.

Zimmer, H. 2009. *In prep*. An assessment of fish passage conditions at selected stream crossings in Anchorage, Alaska. Department of Fish and Game, Fishery Data Series, Anchorage.

# APPENDIX A:
# LEVEL 1 ASSESSMENT/COARSE SCREEN MATRIX

Appendix A1.–ADF&G Level 1 Coarse Screen Matrix 2005-2010.

| | Structure Type | *Green*<br>*Conditions assumed adequate to pass fish* | *Grey*<br>*Conditions may not be adequate to pass fish, additional analysis required* | *Red*<br>*Conditions assumed not adequate to pass fish, additional analysis required* |
|---|---|---|---|---|
| 1 | Bottomless pipe arch, embedded pipe arch, CMP, box culvert or other embedded structure that functions in a similar fashion. | Installed at channel gradient (+/- 1% slope), AND culvert span to OHW width ratio greater than or equal to 0.75 OR fully backwatered | Structure not installed at channel gradient (+/- 1%), OR culvert span to OHW width ratio of 0.5 to 0.75 | Culvert span to OHW width ratio less than 0.5 |
| 2 | Culverts (all span widths) with 2 X 6 inch corrugations or greater, not embedded. | Culvert gradient less than 1.0%, AND outfall hgt.= 0, AND culvert span to OHW width ratio greater than 0.75 OR fully backwatered | Culvert gradient 1.0 to 2.0%, OR less than or equal to 4-inch outfall hgt., OR culvert span to OHW width ratio of 0.5 to 0.75 | Culvert gradient greater than 2.0%, OR outfall hgt. greater than 4 inches, OR span to OHW width ratio less than 0.5 |
| 3 | Pipe arch or circular CMP (span width greater than 4 feet), less than 2 X 6 inch corrugations, not embedded | Culvert gradient less than 0.5%, AND outfall hgt. = 0, AND culvert span to OHW width ratio greater than 0.75 OR fully backwatered | Culvert gradient 0.5 to 2.0%, OR less than or equal to 4-inch outfall hgt., OR culvert span to OHW width ratio of 0.5 to 0.75 | Culvert gradient greater than 2.0%, OR outfall hgt. greater than 4 inches, OR culvert span to OHW width ratio less than 0.5 |
| 4 | Pipe arch or circular CMP (span width less than or equal to 4 feet), less than 2 X 6 inch corrugations, not embedded | Culvert gradient less than 0.5%, AND outfall hgt.= 0, AND culvert span to OHW width ratio greater than 0.75 OR fully backwatered | Culvert gradient 0.5 to 1.0%, OR less than or equal to 4-inch outfall hgt., OR culvert span to OHW width ratio of 0.5 to 0.75 | Culvert gradient greater than 1.0%, OR outfall hgt. greater than 4 inches, OR span to OHW width ratio less than 0.5. |
| 5 | Non-embedded box culverts, culverts with non-standard configurations or materials, culverts with baffles or downstream weirs or step pools, fish ladders, bridges with aprons. | Fully backwatered as described below. | All others | Outfall height at downstream end of structure greater than 4 inches. |
| 6 | Multiple Structure Installations | Individual culverts all classified as Green as above | Individual culverts all classified as Gray or as some mix of Green, Gray or Red as above. | Individual culverts all classified as Red as above. |

*Notes:*

1 These criteria are not design standards, but rather indicate whether the structure is likely to provide fish passage for juvenile salmonids based on a one-time evaluation.

2 Ordinary high water (OHW) is the mean stream width measured either upstream or downstream of the culvert beyond the hydraulic influence of the culvert.

3 An embedded culvert must have 100% bedload coverage. Circular and box culverts must be embedded at least 20% of their height. A pipe-arch must be embedded so that the mean bedload depth is greater than or equal to the vertical distance from the bottom of the pipe to the point of maximum horizontal dimension of the culvert (haunch height) or is 1 foot deep, whichever is greater.

4 A culvert is considered backwatered if one of the following conditions is met: 1) elevation of the tailwater control exceeds the elevation of the invert at both the outlet and inlet of the culvert and the invert of any aprons or other inlet or outlet structures 2) the culvert is located in a pond, slough or other area with slow moving or still water and the tallwater and headwaters surface are equivalent and water surface is continuous throughout the entire structure and at least 0.1 feet in depth at the shallowest point. Culvert gradient, span to OHW ratio, and outfall height criteria are not considered in the assessment of fish passage in backwatered culverts. A culvert is not backwatered if a hydraulic jump occurs within the barrel.

5 Outfall height is the difference between the water surface elevation at the outlet and in the outlet pool (or the equivalent tailwater surface).

# APPENDIX B
# PROJECT DETAILS

Appendix B1.–Details of projects, statewide, 2000–2012.

- **Matanuska Susitna Borough 2000 (MSB01):** 2000 inventory and Level 1 assessment of all culverts within the Bodenberg Creek, Cottonwood Creek, and Wasilla Creek (including Spring Creek and Rabbit Slough) watersheds within the Matanuska-Susitna Borough. 104 culvert crossing sites consisting of 130 culverts were evaluated (Albert & Weiss *in prep*).
- **Kenai Peninsula 2001 (KPCS1):** 2001 inventory and Level 1 and 2 assessments focused primarily on the State road system on the Kenai Peninsula. A small number of culverts on municipal, borough, and Federal roads were also inventoried and assessed. State logging roads previously surveyed in 1998 were excluded. Only culverts on fish-bearing streams were surveyed: fish bearing status was determined based upon a combination of existing AWC survey data (ADF&G 1998), minnow trapping at the time of survey, and visual inspection of habitat quality at each road-stream crossing. Fish passage evaluation of each culvert was two-tiered. The first approach, "Level 1" was meant to function as a coarse-filter, identifying culverts that were highly likely to be fish passage barriers or highly unlikely to be barriers. Culverts where fish passage was not readily estimated based on "Level 1" indicators (see below) were further analyzed using detailed hydraulic methods ("Level 2") (Rich *in prep a*). 97 road-stream crossings were evaluated for fish passage.
- **Anchorage 2001 (ANCS2001):** 2001 Level 1 assessment of selected culverts in the Anchorage Bowl. This small project was carried out after the completion of the Kenai Peninsula surveys in 2001. Sites were selected on known fish bearing waters. 10 crossings were evaluated.
- **Copper River Basin 2002 (CRB02)**: 2002 inventory and Level 1 assessment carried out on state and some secondary roads. The project extent included the entire lengths of the Copper River and Edgerton highways; the Richardson Highway between Valdez and Paxson; approximately 25 miles of the Denali Highway west of Paxson; the Glenn Highway east of Eureka Pass to Glennallen; the Tok Cutoff Highway from the Richardson Highway to the Nabesna Road intersection; the Nabesna Road and significant secondary roads (Power Creek, Whitshed, and Lake Louise roads) crossing fish streams. Culvert sites to be evaluated were selected based on their likelihood to have fish pass through the culvert at some point during the year or at one time had fish above the culvert inlet. Fish presence was confirmed as time allowed. 262 culvert installations with 305 culverts along 486.7 miles of state highways and secondary roads were evaluated for fish passage within the Copper River Basin (Albert and Beers *in prep*).

  Additional surveys were carried out in the Matanuska River Valley and Anchorage-Girdwood-Portage area under this project. Jonesville Road, Knik River Road, Old Glenn Highway, Fishhook Road, Seward Highway, and the Alyeska area were surveyed as time allowed or at the request of DOT. An additional 64 stream crossings with 73 culverts were evaluated outside of the Copper River Basin (Albert and Beers *in prep*).

-continued-

- **Tyonek 2002 (TYCS1):** 2002 inventory and Level 1 assessment conducted on all accessible roads on State and native corporation-owned lands in the vicinity of Tyonek (Figure 1). The project extent included: 1) roads within Trading Bay State Game Refuge 2) roads owned by the Tyonek Native Corporation, and 3) roads maintained by Chugach Electric in the vicinity of the Beluga electricity generating plant. The majority of the assessed crossings (24 crossings) were on private roads near the village of Tyonek, while a small number occurred either within the boundary of Trading Bay State Game Refuge (SGR; 2 crossings) or near the Beluga power plant and gas line (3 crossings). Only culverts on fish-bearing streams were assessed. If no fish were captured, and the stream did not appear capable of supporting fish the crossing was not surveyed. A total of 29 road-stream crossings were inventoried and assessed for fish passage. (Rich *in prep b*).
- **Municipality of Anchorage 2004 (ANC04):** Inventory and Level 1 assessment of barriers to fish passage on fish-bearing waters within the Municipality of Anchorage. Culverts on State and locally owned roads that were not assessed in 2001 were included. 241 crossings were evaluated for fish passage.
- **Lower Kenai 2004 (KPC04):** 2004 inventory and Level 1 assessment of fish passage conditions at road-stream crossings in fish-bearing waters in the Ninilchik River, Deep Creek, Stariski Creek, and Chakok River watersheds. 50 crossings were evaluated for fish passage.
- **Parks Highway 2004 (PRK04):** An inventory and Level 1 assessment of road stream crossing on the George Parks Highway between milepost 0 and milepost 210 at Cantwell and the Denali Highway between milepost 133.8 at Cantwell and approximately milepost 125 at Lily Creek. 92 crossings were evaluated for fish passage.
- **Kodiak Island 2005 (KOD05):** Inventory and Level 1 assessment of state owned or maintained roads on Kodiak Island carried out in 2004 and 2005. Approximately 97 surveys were evaluated for fish passage (ADF&G unpublished data).
- **Seward Peninsula 2006**: 2005 inventory and Level 1 assessment of culverts of fish bearing streams on regional highways. The project extent included the Nome-Teller Road, the Kougarok Road, and the Nome-Council Road and associated secondary roads including Woolley Lagoon Road, Pilgrim Hot Springs Road, Anvil Mountain Road, Dexter Bypass, Nome Bypass, Seppala Drive, Red Fox Road and Glacier Creek Road. Coarse Screen used. 105 crossings were evaluated for fish passage over approximately 270 miles of road. (ADF&G unpublished data)
- **Central-Interior 2007 (CNT07)**: 2006 and 2007 inventory and Level 1 assessment of fish passage on all state-maintained primary and secondary roads from the Denali Highway north to Fairbanks and from Fairbanks east to the Canadian border. All stream crossing structures, other than bridges, in fish-bearing waters along these public roads were located, surveyed and evaluated with respect to fish passage. For this project fish-bearing waters are those streams and water bodies that have been shown to support fish through direct sampling or observation, are known by local biologists to support fish or are a tributary to a known fish-bearing water body with no apparent obstruction between the two[2]. Approximately 200 crossings were evaluated for fish passage (ADF&G unpublished data).

[2] Ryland, D. *Unpublished.* FY 2007-2008 OPERATIONAL PLAN: An inventory and assessment of culverts in fish-bearing waters in the lower Tanana management area and along the Denali Highway. Alaska Department of Fish and Game, Anchorage.

- **Municipality of Anchorage- Gray Culvert Assessment Project 2009 (MOA08):** Level 1 & 2 re-assessment of culverts identified as *Gray* during the 2001 and 2004 Anchorage inventories. All *Gray* culverts in the Campbell, Ship and Chester Creek watersheds were re-assessed using an updated Level 1 methodology and/or hydrologic analysis of fish passage (*FishXing*). No additional crossings were assessed during this project (Zimmer *in prep*).
- **Parks Hwy 2009:** 2009 inventory and Level 1 assessment of culverts on all Mat-Su Borough roads in the Parks Highway corridor from Willow to Trapper Creek, including Petersville Road and the Talkeetna Spur Road areas. For this project fish-bearing waters were those streams and water bodies that have been shown to support fish through direct sampling or observation, are known by local biologists to support fish, are a tributary to a known fish-bearing water body with no apparent obstruction between the two or that appear capable of supporting fish during a visual inspection at time of survey. A total of 71 sites were evaluated during this project (ADF&G unpublished data).
- **Matanuska-Susitna Borough 2012:** 2009-2012 inventory and Level 1 or Level 2 assessment of all previously un-surveyed culverts in the Matanuska-Susitna Borough including borough, private and state owned roads as well as the AK railroad. Previously surveyed culverts that have been replaced or altered will also be re-surveyed. For this project fish-bearing waters are those streams and water bodies that have been shown to support fish through direct sampling or observation, are known by local biologists to support fish, are a tributary to a known fish-bearing water body or that appear capable of supporting fish during a visual examination at time of survey. This project is ongoing, with approximately 100 sites evaluated for fish passage to date.

In addition the ADF&G database holds information collected by partners:

- Mat-Su Borough 2004 (MSB04): a survey of borough owned or maintained culverts in the Susitna River, Meadow Lakes & Fish Creek watersheds. Data collection was performed in 2004 by Bell and Associates under contract to the Matanuska-Susitna Borough. 130 sites were evaluated for fish passage.

# APPENDIX C
# ROADS METADATA

What does this data set describe?
How should this data set be cited?
What geographic area does the data set cover?
What does it look like?
Does the data set describe conditions during a particular time period?
What is the general form of this data set?
How does the data set represent geographic features?
How does the data set describe geographic features?
Who produced the data set?
Who are the originators of the data set?
Who also contributed to the data set?
To whom should users address questions about the data?
Why was the data set created?
How was the data set created?
From what previous works were the data drawn?
How were the data generated, processed, and modified?
What similar or related data should the user be aware of?
How reliable are the data; what problems remain in the data set?
How well have the observations been checked?
How accurate are the geographic locations?
How accurate are the heights or depths?
Where are the gaps in the data? What is missing?
How consistent are the relationships among the data, including topology?
How can someone get a copy of the data set?
Are there legal restrictions on access or use of the data?
Who distributes the data?
What's the catalog number I need to order this data set?
What legal disclaimers am I supposed to read?
How can I download or order the data?
Who wrote the metadata?

---

**What does this data set describe?**
*Title:* ConsolidatedRoads
*Abstract:*

Consolidated road coverage across the entire State of Alaska compiled from various data sets

1. **How should this data set be cited?**
   Alaska Dept. of Fish & Game, Unpublished Material, ConsolidatedRoads. Contact the Division of Sport Fish, Habitat Support, for link to the data.

-continued-

2. **What geographic area does the data set cover?**
   *West_Bounding_Coordinate:* -180.000000
   *East_Bounding_Coordinate:* 180.000000
   *North_Bounding_Coordinate:* 70.547615
   *South_Bounding_Coordinate:* 50.028185
3. **What does it look like?**
4. **Does the data set describe conditions during a particular time period?**
   Calendar_Date: 2010
   *Currentness_Reference:* publication date
5. **What is the general form of this data set?**
   *Geospatial_Data_Presentation_Form:* vector digital data
6. **How does the data set represent geographic features?**

a. **How are geographic features stored in the data set?**

This is a Vector data set. It contains the following vector data types (SDTS terminology):

- String (56935)

b. **What coordinate system is used to represent geographic features?**

The map projection used is Albers Conical Equal Area.
Projection parameters:
*Standard_Parallel:* 55.000000
*Standard_Parallel:* 65.000000
*Longitude_of_Central_Meridian:* -154.000000
*Latitude_of_Projection_Origin:* 50.000000
*False_Easting:* 0.000000
*False_Northing:* 0.000000

Planar coordinates are encoded using coordinate pair
Abscissae (x-coordinates) are specified to the nearest 0.000100
Ordinates (y-coordinates) are specified to the nearest 0.000100
Planar coordinates are specified in meters

The horizontal datum used is North American Datum of 1983.
The ellipsoid used is Geodetic Reference System 80.
The semi-major axis of the ellipsoid used is 6378137.000000.
The flattening of the ellipsoid used is 1/298.257222.

*Vertical_Coordinate_System_Definition:*

*Altitude_System_Definition:*
*Altitude_Resolution:* 0.000100
*Altitude_Encoding_Method:*

Explicit elevation coordinate included with horizontal coordinates

-continued-

## How does the data set describe geographic features?

**Consolidated Roads**
Collected roads coverages throughout the State of Alaska
**OBJECTID**
Internal feature number. (Source: ESRI)
*Sequential unique whole numbers that are automatically generated.*
**Shape**
Feature geometry. (Source: ESRI)
*Coordinates defining the features.*
**LENGTH**
Length of the road segment
**ST_TYPE**
Describes the type of street
**OWNER**
Designated the ownership of the road
**ROAD_NAME**
Known name of the road
**SOURCE**
Describes where the arcs came from
**SURFACE**
Describes the surface type
**MAINTAIN**
Designates who maintains the road
**CDS_NUMBER**
A DOT associated number
**CITY**
Associated or closest city
**Shape_Length**
Length of feature in internal units. (Source: ESRI)
*Positive real numbers that are automatically generated.*
**View**

---

**Who produced the data set?**

1. **Who are the originators of the data set?** (may include formal authors, digital compilers, and editors)
   - Alaska Dept. of Fish & Game
2. **Who also contributed to the data set?**
   - Alaska Dept. of Fish & Game
3. **To whom should users address questions about the data?**

Alaska Dept. of Fish & Game
c/o Jason Graham
Cartographer I
333 Raspberry Rd
Anchorage, Alaska 99508 US

907 267 2326 (voice)
907 267 2464 (FAX)
jason.graham1@alaska.gov
*Hours_of_Service:* 0800-1630

---

**Why was the data set created?**
To consolidate all the roads in the state into one coverage

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-continued-

**How was the data set created?**

1. **From what previous works were the data drawn?**

**<http://www.asgdc.state.ak.us/>** (source 1 of 11)
Alaska Department of Transportation (DOT), 20070921, DOT centerline:,.
Online Links:
- <http://mapper.landrecords.info/SpatialUtility/SUC?cmd=md&layerid=452>

*Other_Citation_Details:*
Road centerline and roadway inventory feature data collected for the Alaska Department of Transportation (DOT), Division of Program Development, Highway Data and GIS/Mapping Sections through a contract with Navstar Mapping Corporation of Austin, Texas.
*Type_of_Source_Media:* Vector
*Source_Scale_Denominator:* Various

Anchorage Department of Public Works (DPW), 9/1997, MOA Roadnet. (source 2 of 11)
Online Links:
- <http://munimaps.muni.org/moagis/download.htm>

*Type_of_Source_Media:* Vector
*Source_Scale_Denominator:* 1" = 100'

Borough, Kemai Peninsula , December 17, 1999, Kenai Centerline Survey. (source 3 of 11)
Online Links:
- <http://www.borough.kenai.ak.us/gisdept/centerline.htm>

Borough, Matanuska Susitna , Oct. 24 2007, Matsu Borough Road Centerlines. (source 4 of 11)
Online Links:
- <http://www.matsugov.us/GIS2/gisdata.cfm>

*Type_of_Source_Media:* Vector
*Source_Scale_Denominator:* 1:6000 or 1 inch equals 500 feet

Gustavus, City of , 5/31/2005, City of Gustavus roads. (source 5 of 11)
Online Links:
- NA

Fairbanks North Star Borough, FSNB road centerlines. (source 6 of 11)
Online Links:
- <ftp://co.fairbanks.ak.us/GIS/>

State of Alaska - Department of Transportation and Public Facilities, 19991117, Alaska Highway GPS Centerline Data. (source 7 of 11)
Online Links:
- <http://www.dot.state.ak.us/mapping/dgps_centerline.html>

*Other_Citation_Details:*
The road centerline data was collected using a twelve channel Trimble Pro XR receiver with a Trimble TSC1 data logger running Trimble's Asset Surveyor software. Centerlines were captured as line features with a collection interval of one position per second. All rover files were differentially corrected with the best available base station data. Trimble specifies the Pro XR receiver as capable of delivering differentially corrected C/A code position accuracy to better than 50 centimeters (RMS) horizontal. The 50 centimeter level of horizontal accuracy is obtained only under optimal operating circumstances. The accuracy of each determined position may be greatly degraded by many factors. Factors that degrade accuracy may include but are not limited to atmospheric interference, satellite geometry, satellite clock errors, satellite orbit errors, topography, receiver noise, and multipathing errors. Since our road centerline data was collected in very dynamic driving conditions it is not possible to make a blanket statement of accuracy. However, Trimble's Pathfinder Office software does provide tools to predict the precision of both individual observations and entire features. Trimble's precision estimates are RMS based. Average horizontal 2dRMS values for our road centerline data range from four to eight feet. Precision estimates should be used as a gauge of quality and repeatability and not be misconstrued as a measurement to or from true feature location.
*Type_of_Source_Media:* Vector

-continued-

Juneau, City of , 2003, City of Juneau Roads. (source 8 of 11)
Online Links:
- <http://www.juneau.org/cddftp/maps/zonemap.php>

ADF&G, HUD. (source 9 of 11)
Online Links:
- none

*Other_Citation_Details:* Heads up digitization of roads from available imagery

Alaska Department of Natural Resources, 20070920, Alaska Infrastructure 1:63,360. (source 10 of 11)
Online Links:
- <http://mapper.landrecords.info/SpatialUtility/SUC?cmd=md&layerid=75>

*Other_Citation_Details:*
This data depicts infrastructure locations in Alaska as digitized primarily from 1:24,000, 1:63,360, and 1:250,000 USGS quadrangles.
*Source_Scale_Denominator:* 1:63,360

NAVTEQ, March 24, 2004, NAVSTREETS™ Streets Data Product Version 3.3.0 for ArcView® 3.2. (source 11 of 11)
Online Links:
- www.NAVTEQ.com

*Other_Citation_Details:* Some data was edited HUD due to odd projection issues.

2. **How were the data generated, processed, and modified?**
(process 1 of 1)
Dataset consolidated from the several layers
3. **What similar or related data should the user be aware of?**

---

**How reliable are the data; what problems remain in the data set?**

1. **How well have the observations been checked?**
2. **How accurate are the geographic locations?**
3. **How accurate are the heights or depths?**
4. **Where are the gaps in the data? What is missing?**
5. **How consistent are the relationships among the observations, including topology?**

---

**How can someone get a copy of the data set?**

**Are there legal restrictions on access or use of the data?**
*Access_Constraints:* none
*Use_Constraints:*
* Although extensive effort has been made to produce error free and complete data, all geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. * You should consult available data documentation (metadata) for these particular data to determine their limitations and the precision to which they depict distance, direction, location or other geographic characteristics. * These data may be subject to periodic change without prior notification. * No Warranty: These data are provided as is, without any warranty whatsoever, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose. * Liability: the user assumes the entire risk as to the results of the use of these data. * The Department of Fish and Game is not responsible for any interpretation or conclusions based on these data made by those who acquire or use it. * The Alaska Department of Fish and Game shall not be liable for any direct, indirect, special, incidental, compensatory or consequential damages or third party claims resulting from the use of these data, even if the Alaska Department of Fish and Game has been advised of the possibility of such potential loss or damage.

1. **Who distributes the data set?**[Distributor contact information not provided.]
2. **What's the catalog number I need to order this data set?**
Vector Data

-continued-

3. **What legal disclaimers am I supposed to read?**
   The State of Alaska makes no express or implied warranties (including warranties of merchantability and fitness) with respect to the character, function, or capabilities of the electronic services or products or their appropriateness for any users purposes. In no event will the State of Alaska be liable for any incidental, indirect, special, consequential or other damages suffered by the user or any other person or entity whether from the use of the electronic services or products, any failure thereof or otherwise, and in no event will the State of Alaska s liability to the requestor or anyone else exceed the fee paid for the electronic service or product.
4. **How can I download or order the data?**
   - **Availability in digital form:**

     **Data format:** Size: 20.172
   - **Cost to order the data:**
     See State of Alaska Standard Operating Procedures for charges that apply for data distribution.

---

**Who wrote the metadata?**

Dates:
Last modified: 04-Mar-2010
Metadata author:
ADF&G
c/o Jason Graham
Cartographer
333 Raspberry rd
Anchorage, Alaska 99518US

907-267-2326 (voice)
907-267-2464 (FAX)
jason.graham1@alaska.gov
*Hours_of_Service:* 0800-1630
Metadata standard:
FGDC Content Standards for Digital Geospatial Metadata (FGDC-STD-001-1998)
Metadata extensions used:
- <http://www.esri.com/metadata/esriprof80.html>

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Generated by mp version 2.9.6 on Thu Mar 04 15:49:23 2010