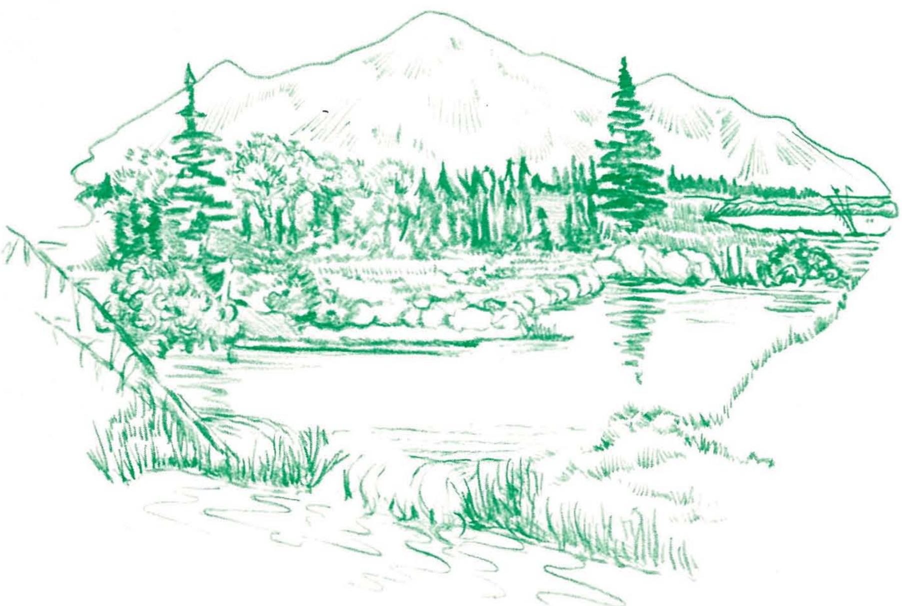
Restoration and Enhancement of Aquatic Habitats in Alaska: Case Study Reports, Policy Guidance, and Recommendations

By
Betsy L. Parry and Glenn A. Seaman

Technical Report No. 94-3



Alaska Department of Fish and Game
Habitat and Restoration Division

Copies of this publication may be obtained from the Habitat and Restoration Division, Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, AK, 99518-1599.

Sample Citation:
Parry, B. L. and G. A. Seaman. 1994. Restoration and Enhancement of Aquatic Habitats in Alaska: Case Study Reports, Policy Guidance, and Recommendations. Technical Report No. 94-3. Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage.

This project was funded by a grant provided by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration. The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies.

The Alaska Department of Fish and Game, Habitat and Restoration Division, has published this document to promote wise management of Alaska's coastal resources. This document was printed in Anchorage, Alaska, with Section 309 Enhancement Grant Funds from the National Oceanic and Atmospheric Administration at a cost of $16.30 per copy.

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July 1994

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LIST OF ACRONYMS COMMONLY USED IN THIS REPORT

ACMP	Alaska Coastal Management Program
ADF&G	Alaska Department of Fish & Game
ADOT/PF	Alaska Department of Transportation and Public Facilities
AEA	Alaska Energy Authority (now a sub-agency within AIDEA, the Alaska Industrial Development and Export Authority)
AWWU	Anchorage Water and Wastewater Facility
COE	U.S. Army Corps of Engineers
CBJ	City and Borough of Juneau
CRSA	Coastal Resources Service Area
CZMA	Coastal Zone Management Act
DEC	Alaska Department of Environmental Conservation
DGC	Division of Governmental Coordination, Office of the Governor, State of Alaska
DNR	Alaska Department of Natural Resources
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FWS	U.S. Fish and Wildlife Service
MOA	Commonly used for "Memorandum of Agreement" but in Alaska, MOA also refers to the "Municipality of Anchorage"
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration
NSRAA	Northern Southeast Regional Aquaculture Association (based in Sitka, AK)
OHW	Ordinary High Water

LIST OF ACRONYMS (Continued)

PMC	Plant Materials Center, a research facility within the Division of Agriculture, Alaska Department of Natural Resources
SAMP	Special Areas Management Plan
USFS	U.S. Forest Service
WMP	Wetlands Management Plan

ACKNOWLEDGEMENTS

This study was financed through the Alaska Coastal Management Program (ACMP) which is funded by the State of Alaska and the Office of Oceans and Coastal Resource Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. Specific federal funding for this project was disbursed to the State of Alaska under Section 309 of the federal Coastal Zone Management Act (CZMA).

During the second (and final) year of this project many interagency contacts assisted with case study site visits and background investigations. These contacts arranged for and accompanied project staff on field visits to the site, provided background details, and reviewed the accuracy and thoroughness of the draft case history reports. Representatives from the following agencies participated in the review of the case study descriptions: the National Marine Fisheries Service, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Environmental Protection Agency, Alaska Department of Fish and Game (three divisions), Alaska Department of Transportation and Public Facilities, the Alaska Energy Authority, the Alaska Department of Natural Resources Plant Materials Center, the Municipality of Anchorage (three divisions—Parks, Planning, and Public Works), the Northern Southeast Regional Aquaculture Association, HDR Engineering (a private consulting firm), and one independent contractor. Additional information such as maps, photos, etc., were obtained from office files of agencies such as the U.S. Army Corps of Engineers. Special thanks to Duane Peterson, Kevin Brownlee, Ron Josephson, Steve Reifenstuhl, Phil Brna, Don McKay, Mark Wenger, and Ken Hodges for extra assistance with case study investigations.

Our restoration guidance materials and project recommendations were developed in conjunction with a series of feedback workshops in which various state, local, and federal agency representatives and coastal management staff participated (see Appendix G). Additional perspectives on Alaskan policy or procedures were obtained by contacting government representatives directly, including Don McKay, Dennis Gnath, Carol Sanner, Van Sundberg, K Koski, Kerry Howard, Fay Heitz, Jan Caulfield, Linda Freed, and Sam Dunaway. Late in the project, important topical materials were also provided by Ken Bierly, Michael Scuderi, and Steve Gordon from the states of Oregon and Washington.

Staff from within ADF&G's Habitat and Restoration Division also assisted in various phases of the project. Mark Fink and Betsy McCracken participated in visits to case study locations. Betsy McCracken also searched archived files for materials relevant to the case study projects. For the production of this final report, Celia Rozen assisted with the two reference lists, Frances Inoue and Carol Barnhill helped with figures and photo plates, and Susan Peyer re-formatted the individual case study reports in Chapter 2.

EXECUTIVE SUMMARY

The protection, restoration, and enhancement of our nation's coastal habitat resources is a national objective of the Section 309 Enhancement Grant Program developed under the Coastal Zone Management Act (CZMA). For the past two years, the Habitat and Restoration Division of the Alaska Department of Fish and Game (ADF&G) has received funding to 1) assess the extent and status of aquatic habitat restoration and enhancement work in Alaska, and 2) develop guidelines and policy recommendations which will assure more effective and efficient restoration and enhancement activities in the future. These activities are a policy issue because the mitigation sequence adopted by EPA, other regulatory agencies, and Alaskan coastal districts may at times require such actions to permit the discharge of fill into wetlands.

This technical report presents the results of the second and final year of the two-year grant study. Our primary aim is to inform the local coastal district planners throughout the state about the strengths and limitations of restoration and enhancement techniques in Alaska and the related policy issues. In this report the term "coastal districts" refers to local governments recognized under the Alaska Coastal Management Program (ACMP), which includes coastal cities, boroughs, or designations known as Coastal Resource Service Areas in the absence of other recognized jurisdictions. In addition to coastal district planners, this report will also benefit those directly involved in restoration and enhancement projects in Alaska (e.g., regulatory agency staff, related industries, researchers and other practitioners of restoration and enhancement techniques) by presenting a synthesis of the information known on the topic in Alaska at this time.

The first year of the grant project involved the systematic compilation of all available information on aquatic habitat restoration and enhancement attempts within the state. This research produced a database inventorying and describing all known projects in Alaska, sorted by activity types and geographic areas (technical report no. 93-8). During the second year, a select number of these restoration and enhancement projects were further developed as case histories. The purpose was to provide a closer look at the types of projects of high current and future interest for the state, evaluate their effectiveness, and record the lessons learned from these attempts. Twenty-three case study projects were documented and analyzed using historical records, personal interviews, and site visits. The resulting case history reports (presented in this document) portray the track record of different types of restoration and enhancement work in the state.

Based on the Alaskan case study experiences and the points emphasized by professionals during project meetings, different types of restoration and enhancement activities were summarized into practical reference categories as requested by coastal district representatives. Project types were categorized according to their level of risk (in terms of potential for project success), the amount of required maintenance, and relative levels of expense.

Numerous recurring themes surfaced during our case study investigations which were not specific to any one type of restoration or enhancement project. These themes (e.g., common pitfalls, recommendations for more effective approaches) echoed the frustrations commonly expressed in other parts of the U.S. concerning aquatic habitat restoration and compensatory mitigation projects. These themes are summarized in this document, including: insufficient pre-project assessment, improper installation (e.g., problems with contractor understanding and following specifications), lack of site protection during the establishment period, lack of maintenance and monitoring, and the disappointing rate of compliance with approved mitigation agreements.

In keeping with our project objectives, several planning and implementation approaches are recommended at the coastal district level to promote successful restoration and enhancement projects. Some of these planning efforts may result in new enforceable policies in district plans. However, since most Alaska coastal districts have very little information available on the aquatic habitat resources within their district, several research steps are prerequisite to drafting district-specific aquatic habitat management and restoration policies. We recommend that districts: 1) inventory the aquatic habitat resources within the district, so as to assign the highest level of protection to the most valuable areas; 2) develop enforceable mitigation policies which reflect district resources and priorities; 3) identify mitigation opportunities within the district (i.e., potential restoration projects and/or lands for priority acquisition and preservation); and 4) establish district requirements for mitigation proposals, maintenance and monitoring provisions, and safeguards for compliance with mitigation agreements. As much as possible, these steps are illustrated with current materials from other U.S. state and local efforts at wetland planning and regulation.

Certain general guidelines can be used in developing policy for aquatic habitat restoration or enhancement projects. For example, due to the risks involved in such projects (and the uncertainty of results), the "avoid and minimize" parts of the standard mitigation sequence should continue to be emphasized first and foremost in all policy wording. Furthermore, since little is known about restoration science as a whole, and the appropriate conditions for each project are very site-specific, it is not possible to provide specific "how-to" technical criteria or standard conditions for restoration or enhancement projects in policy wording. These "cook book" approaches to aquatic habitat restoration and enhancement requirements have not yielded consistently favorable results. Although "cook book" prescriptions of rigid design criteria are not desirable, it is possible to suggest a range of conditions conducive to success. Requirements that incorporate good general guidelines—combined with incentives for completion of the mitigation project and enough flexibility to allow for experimentation—offer an increased probability of success and will contribute to the information base for designing future projects. The approaches recommended in this document are aimed at achieving these goals.

As prompted by coastal district representatives, this report also investigates several process-oriented issues that regularly hamper the success of restoration and enhancement projects within the state. District representatives felt that technical advice on conducting restoration and enhancement projects would not be effective unless efforts were also made to resolve the related procedural problems. Therefore, a section of this final report gives individual attention to these broader issues, which include: interagency communication problems; mitigation compliance and state/coastal district authority; transferring more responsibility to the permit applicant; establishing mitigation standards that are fair to both big and small operators; and the need for completion and monitoring reports to develop the science. One point emphasized in these discussions is that for mitigation negotiations and project agreements to yield fruitful results on location, there needs to be a much higher priority placed on follow-through and compliance on the part of the agencies (i.e., a commitment of staff and funding), and on communicating the information learned from each project and its relative success.

Although possible directions for improvement are discussed in this report, the overlying procedural problems would best be addressed by an interagency group composed of state and federal agency and coastal district representatives. We recommend that such a joint agency/coastal district working group be convened to explore possible solutions to the communication and administrative difficulties which currently limit the effectiveness of restoration and mitigation projects in Alaska. Many of these procedural problems are beyond the jurisdiction of local governments to resolve. Several of the identified concerns may also extend outside the bounds of the current coastal management program in Alaska. If the current policy efforts in other states are any indication, effective solutions may require new direction or clarification of authority from state regulations or statutes.

Presently, the emphasis in Alaskan coastal districts has been to simply protect existing resources. Many districts expressed that they have not had the time or capability to address the particular issues of aquatic habitat management in their planning efforts. In fact, some districts have rarely, if ever, dealt with negotiating restoration and enhancement actions for mitigating development in their areas. However, the current policy efforts in other states, along with those emerging in local governments in Alaska, provide evidence that the need to address all of these issues in a planning context (i.e., wise management of aquatic habitat resources, restoration and enhancement activities, and the attendant procedural and administrative problems) will become more prevalent in Alaska over time.

CHAPTER 1

Introduction

CHAPTER 1: INTRODUCTION

This technical report presents the results of the second and final year of a two-year grant study. In 1992 the Habitat and Restoration Division of the Alaska Department of Fish and Game (ADF&G) received federal funding to undertake an evaluation of aquatic habitat restoration and enhancement efforts in Alaska. This funding was provided by the Section 309 Enhancement Grant Program under the Coastal Zone Management Act (CZMA). Wetlands protection, restoration, and enhancement is listed as a national objective in Section 309, and as a priority in Alaska's Section 309 strategy. Impacts to coastal habitats are a key issue in Alaska because the state's communities are centered along the rivers and coastline where few upland alternatives exist for development. Wetlands in these areas serve important functions such as flood control, water purification, and habitat for fish and waterfowl.

Restoration and enhancement options are considered during the review of proposed developments in wetlands as part of the requirements of local coastal management plans, the National Environmental Policy Act, and other state or federal permits. However, little information has been available on the extent and success of such efforts undertaken to date in Alaska. The state felt that there was a need to evaluate restoration and enhancement projects in Alaska in order to develop guidelines and enforceable policies that could be applied by local coastal districts, agencies, and permit applicants. This Section 309 grant was awarded to ADF&G to address these issues.

The project's scope includes all aquatic habitats in Alaska, including wetlands, estuaries, streams, lakes, wet tundra and coastal marine waters. The overall project objectives are to: 1) identify and evaluate the success of restoration and enhancement in aquatic habitats in Alaska; 2) develop guidelines for aquatic habitat restoration and enhancement projects in Alaska; 3) formulate "model" enforceable policies for coastal districts[1] within the state; and 4) suggest other improvements to Alaska's coastal management program to assure effective and efficient restoration and enhancement requirements.

The first year of this project was devoted to surveying the extent and success of restoration and enhancement efforts undertaken in Alaska. The first grant products (contained in technical report #93-8) included: an inventory of aquatic habitat restoration and enhancement projects in Alaska, the selection of projects to be developed as case histories during the second year, and a bibliography of pertinent literature.

The second year of the grant project was devoted to conducting the case studies and developing guidelines and policy recommendations for more effective restoration and enhancement projects. The products of these efforts are contained in this final report for the project.

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[1] Coastal districts are local governments recognized under the Alaska Coastal Management Program, which usually take the form of a coastal city, borough, or a designation known as a Coastal Resource Service Area in the absence of other recognized jurisdictions.

Chapter 2 comprises the case history portion of the project. The purpose was to provide a closer look at the types of aquatic habitat restoration and/or enhancement projects of high current and future interest for the state, evaluate their effectiveness, and record the lessons learned from these attempts. The chapter details the methods used to select and develop case histories for two dozen such projects. An interagency advisory group assisted in determining the types of activities to represent, provided case examples, and helped refine the format used to evaluate the case study projects. These projects were documented and analyzed using historical records, personal interviews, and site visits.

Individual projects were selected to illustrate a category of restoration or enhancement work, regardless of its status as a demonstration project for enhancement techniques, or as a required action for a wetland fill permit. Controversies surrounding the soundness or validity of a mitigation project (when compared to the habitat lost by the permitted activity) were not figured within the scope of this investigation. Instead, projects were evaluated solely against the objectives stated for the restoration/enhancement site alone, regardless of other permitted actions.

Chapter 2 summarizes the results of our case study investigations by identifying the types of activities that are most promising, those that have proven more difficult, and the common setbacks to project success. The individual case study reports and accompanying photo plates are found in sections C and D of this chapter. The case study reports detail each project's objectives, implementation methods, current level of effectiveness, and the lessons learned from the effort.

The twenty-three case history reports presented in this document effectively portray the track record of different types of restoration and enhancement work in the state. Numerous recurring themes (common pitfalls, recommendations for more effective approaches, problems to be avoided) are highlighted in the discussion of these specific projects. This compilation of the results of various restoration and enhancement techniques employed in the state should prove to be a valuable reference for land use managers, local planners, private industry, and regulatory agency staff.

Chapter 3 presents numerous guidelines and policy suggestions for coastal districts, agencies, and permit applicants. Coastal districts are most likely to formulate policies concerning aquatic habitat restoration and enhancement from the perspective of mitigation for development projects. This chapter therefore begins with a review of policies currently being developed to address compensatory mitigation in other regions, particularly at the state-wide level. The chapter then proceeds to discuss ways that aquatic habitat restoration and mitigation issues could be addressed within the enforceable policies of Alaskan coastal district plans. The chapter also discusses further planning approaches available to districts (e.g., local wetland management plans), includes checklists for mitigation proposals, lists policy examples from Alaskan coastal district plans, and suggests directions for districts to pursue in the future.

Chapter 4 discusses several process-related issues raised by agency and coastal district staff during the course of our study. These procedural problems currently hinder the sound development and execution of restoration and enhancement efforts undertaken for project mitigation purposes in the state. Coastal district representatives felt that technical advice for conducting restoration and enhancement projects would not be effective unless efforts were also made to resolve the overlying procedural problems. Many of these concerns lie outside of local coastal district authority or even the authority of the current Alaska Coastal Management Program (ACMP) to resolve. These issues and possible solution approaches are profiled in Chapter 4.

The appendices are an integral part of this report, containing useful examples and other auxiliary information. Some of these materials were originally produced for this study; others are summaries or excerpts from other current U.S. state and local efforts at wetland planning and regulation. As much as possible, the steps recommended for Alaskan coastal districts to pursue (in chapters 3 and 4) are illustrated with materials currently being developed in other parts of the country.

This grant project has benefitted greatly from the participation of state and federal agencies, local governments, and organizations involved in aquatic habitat enhancement or restoration efforts. At different points in the project, an interagency advisory group included representatives from several coastal districts and agencies, such as: the City and Borough of Juneau (CBJ), the Kodiak Island Borough, Aleutians West Coastal Resources Service Area, the Alaska Department of Fish and Game (ADF&G), National Marine Fisheries Service (NMFS), U.S. Forest Service (USFS), Army Corps of Engineers (COE), University of Alaska, U.S. Fish and Wildlife Service (FWS), U.S. Soil Conservation Service (SCS), and the Alaska Department of Natural Resources Plant Materials Center (PMC). During the second year of this grant project, Alaskan group members provided guidance on the selection of case study projects, assisted during their investigation, and provided comments on draft products. From outside the state, materials concerning new planning and policy approaches were contributed by the Lane County Council of Governments (Eugene, OR), the Oregon Division of State Lands, and the Portland and Seattle districts of the U.S. Army Corps of Engineers.

Additional copies of this publication may be obtained from the Habitat and Restoration Division, Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, AK 99518-1599.

CHAPTER 2

Case Studies

CHAPTER 2. CASE STUDIES

A. INTRODUCTION AND METHODS

The first year of this project produced an inventory and database that effectively portrayed the range of aquatic habitat restoration or enhancement work conducted in the state. However, in order to take direction for future efforts based on previous experience, several issues needed to be addressed in more detail, such as: the amount of "return" or desired result realized for the investment of time, labor, and materials; the feasibility of restoring different types of aquatic habitat, including hidden costs or other difficulties; and identifying features that are often overlooked.

To address these remaining aspects, during the second year several of the previously identified aquatic restoration and enhancement projects were investigated in greater depth and developed into case histories. The case histories were intended to provide a closer look at the types of projects of most interest in Alaska, the constraints involved, and the lessons learned.

Selecting Case Study Projects

The first step was to determine which categories of restoration and enhancement activities should be prioritized for case study preparation. Consideration was given to the types of aquatic habitats impacted most often in Alaska and anticipated trends for the future. A review of the contents of original database revealed several categories of common project types. Members of the interagency advisory group for this study—composed of permit reviewers, researchers, and local land use planners—also suggested several categories of particular interest to them. Certain types of restoration or enhancement activities that had been extensively discussed in other works were given a lower priority for this study. For example, gravel pit reclamation in northern Alaska is the topic of several other ADF&G reports (Winters 1990, Roach 1993, McLean 1993).

The resulting list of categories represents project types that are either commonly encountered in the state, of particular interest for the future, or those that address identified information needs. These categories steered the selection of potential case study projects.

- Rehabilitating gravel or placer mined areas for fish habitat
- Correcting fish access through perched culverts on streams
- Adding cover (generally to improve the quality of rearing habitat)
- Increasing the amount of fish rearing and overwintering areas either by excavating new areas or by reconnecting access to isolated side waterways
- Construction of fish spawning channels
- Stream realignments, streambank and riparian habitat restorations
- Airport expansion into wetlands (mitigation examples)
- Impounding water in new areas for waterfowl (and fish) use
- Intertidal restorations
- General fill mitigation: i.e., habitat trade-offs or other optimization of remaining habitat when wetland fills are approved

Once the category priorities were defined, individual case study projects were selected to represent those categories based on the following criteria: accessibility, amount of time passed since the project was implemented, relative level of success, and the availability of supporting documentation. Time and travel funds dictated our decision to visit only a few different communities, while at the same time trying to survey projects which represent the informational needs of coastal communities across the state. Examples of both "failures" and "successes" were included in the case studies because a project that "almost worked" often reveals the elements most critical for success. Preference was given to projects that had been in place for a few years, since it is only after a few seasons of development (or deterioration) that a project's relative merits can be evaluated. In some cases, newer projects were included because of the specific techniques they illustrated. Other potential case studies were eliminated later on due to absence of sufficient information or simple time constraints. More information on the selection process may be found in the first year's report (Parry et al. 1993).

The selection criteria and investigative attempts eventually yielded 23 case history reports. Figure 1 (page 2-6) displays their geographic distribution. The final set of case study projects, the categories they represent, and other considerations are listed in Table 1 (beginning page 2-7).

Case Study Research Methods

A standard work sheet/data form was developed to compile the relevant information from each case study project, and to structure their evaluation. The project's interagency advisory group helped determine the key facts to include.

All of the case study sites were visited first-hand in the summer and fall of 1993, in most cases with the accompaniment of an agency representative or other contact person familiar with the project. Most site visits were completed in one day, though when possible, certain sites were revisited to examine remaining questions. Project locations included Fairbanks, Trapper Creek, Anchorage, the Kenai Peninsula, Cordova, Haines and Juneau (Figure 1). Project types ranged from construction or enhancement of fish spawning and rearing habitat, stream structures to correct perched culverts, re-routing and restoring stream segments due to highway/airport realignments, rehabilitation of gravel and placer mined areas, bank stabilization, riparian habitat restoration, construction of waterfowl ponds and nesting areas, intertidal wetland restoration, and general wetland mitigation projects. While onsite, the contact individual present relayed a history and overview of the project. Key features were photographed and recorded. In some instances (where relevant), fry traps were used to determine juvenile fish use of the restored or enhanced waterbody.

The information thus obtained for each case study project was recorded on the work sheets which slowly developed into the project descriptions. During the fall and winter of 1993, the projects were further researched by consulting agency files, historic photographs, other contact individuals, etc., for additional information necessary for the case history descriptions. Representatives from the following agencies were involved in development of the case histories, either by participating in the site visits, providing supporting information and/or reviewing draft case study reports: the National Marine Fisheries Service, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Environmental Protection Agency, Alaska Department of Fish and

Game (three divisions), Alaska Department of Transportation and Public Facilities, the Alaska Energy Authority, the Alaska Department of Natural Resources Plant Materials Center, the Municipality of Anchorage (three divisions—Parks, Planning, and Public Works), the Northern Southeast Regional Aquaculture Association, HDR Engineering (a private consulting firm), and one independent contractor.

Permitting files from within ADF&G (Habitat & Restoration Division) and the U.S. Army Corps of Engineers were consulted, sometimes yielding useful information such as maps, permit stipulations, memos, and project completion reports (the latter only rarely available). ADF&G had historical photos of several project sites on file. Miscellaneous supporting information was also researched for each case study report (specific location coordinates, anadromous stream numbers, permit numbers, etc.). Draft reports were composed from the information obtained onsite, any historical records, and from discussion with key individuals.

During the course of the field observations and interviews with local contact people, the case study descriptions were structured to evaluate the project's current level of effectiveness based on its original objectives. Since written reports were scarce, the objectives were usually defined through consultation with the individuals involved. Other existing information was utilized on a case-by-case basis to evaluate project effectiveness (e.g., pre-project information or photographs, historical record of fish runs in those areas, etc.). The exact means used to evaluate each project is explained in the individual case history descriptions.

Throughout the fall and winter of 1993, the completed draft descriptions were disseminated to appropriate contact individuals (i.e., those with local project knowledge and involvement) for review of their thoroughness and accuracy. The number of reviewers varied from 1-4 per project, totalling over 50 sets of comments received for the 23 draft case study reports. Additional project information was often supplied with the reviewer's comments.

<u>Final Case Study Reports</u>

The final version of the case history reports (found in Section C of this Chapter) include the following components (originally derived from an example in Kusler and Kentula 1989). For these reports, particular emphasis was placed on the lessons learned and relevance to future applications.

- Project name & short description
- Responsible organization, year work began/ended, current status
- Location/site characteristics (e.g., name of waterbody, nearest town, location description, size of project, aquatic habitat type)
- Goals & specific objectives of project
- Implementation methods
- Estimated costs (if available)
- Judgement of success (based on the stated objectives, including what they were or were not able to achieve, what problems were encountered, other impediments to success).

- Lessons learned (including what participants feel should have been done differently)
- Significance of the project (e.g., novel approach or specific goals, whether it is part of a long term research project, applicability to future projects, etc.)
- Further information sources (i.e., listing contact persons, any available written reports, and documentation used to develop this case study report)

Scope of Analysis/Study Limitations

The primary purpose of these case history descriptions was to educate Alaskan coastal district staff and others involved in planning and land use decisions as to what the possibilities might be for aquatic restoration/enhancement in their area, the common problems, and the most promising techniques. The slide show developed for similar use at workshops and presentations involving coastal district staff (see Appendix A) was favorably received at each presentation, partly because it gave life to the somewhat abstract concepts of aquatic habitat restoration, enhancement, and mitigation, and presented several concrete examples. The case histories should also prove beneficial to regulatory agency staff, research biologists, and other practitioners of restoration techniques.

The project inventory (completed during the first year) listed aquatic habitat restoration or enhancement work whether or not the work was conducted for mitigation purposes (i.e., to mitigate habitat losses from new development projects, as regulated by state and federal permitting authorities). Likewise for the case studies, the project motivation was not a primary consideration for their inclusion. Projects were selected simply to illustrate a category of interest, discuss its effectiveness, and what was learned. Although the background circumstances of each project are mentioned in the case history reports, any controversy surrounding the legitimacy of a mitigation effort considering the habitat lost by the permitted activity was not figured within the scope of this investigation. Instead, projects were evaluated solely against the objectives stated for the restoration/enhancement site alone, regardless of other permitted actions.

When defining the scope of work for the case history portion of this study, it was decided that it would be more advantageous to our target audience to investigate a greater number of sites (e.g., 20-25) at a medium-level of detail rather than conduct meticulous technical investigations at a few select locations. The greater number of sites would better illustrate the types of situations relevant to coastal planners and permitters on a state-wide basis. Hence, the resulting case study reports average four to five pages of text, and maps or technical diagrams were included only when readily available from another source. Photographs, on the other hand, were included for every project. Coastal district staff specifically requested photographs to better render a realistic understanding of project concepts and results.

There are obvious limitations to evaluating a project site based on a one-day site visit during only one season—a single visit could not possibly paint a thorough representation of the project functioning as a whole. For this reason, various opinions were solicited from people with local knowledge during the drafting and revision of the case study reports. This particular study was not intended to conduct multi-year scientific investigations of various project parameters, but to compile the information available on specific project types of interest for the benefit of coastal district planners and others. When available, more detailed data from other years and seasons were utilized in the case study evaluations. Approximately two-fifths of the case study projects included some form of post-project monitoring (indicated in the "Other Comments" column of Table 1).

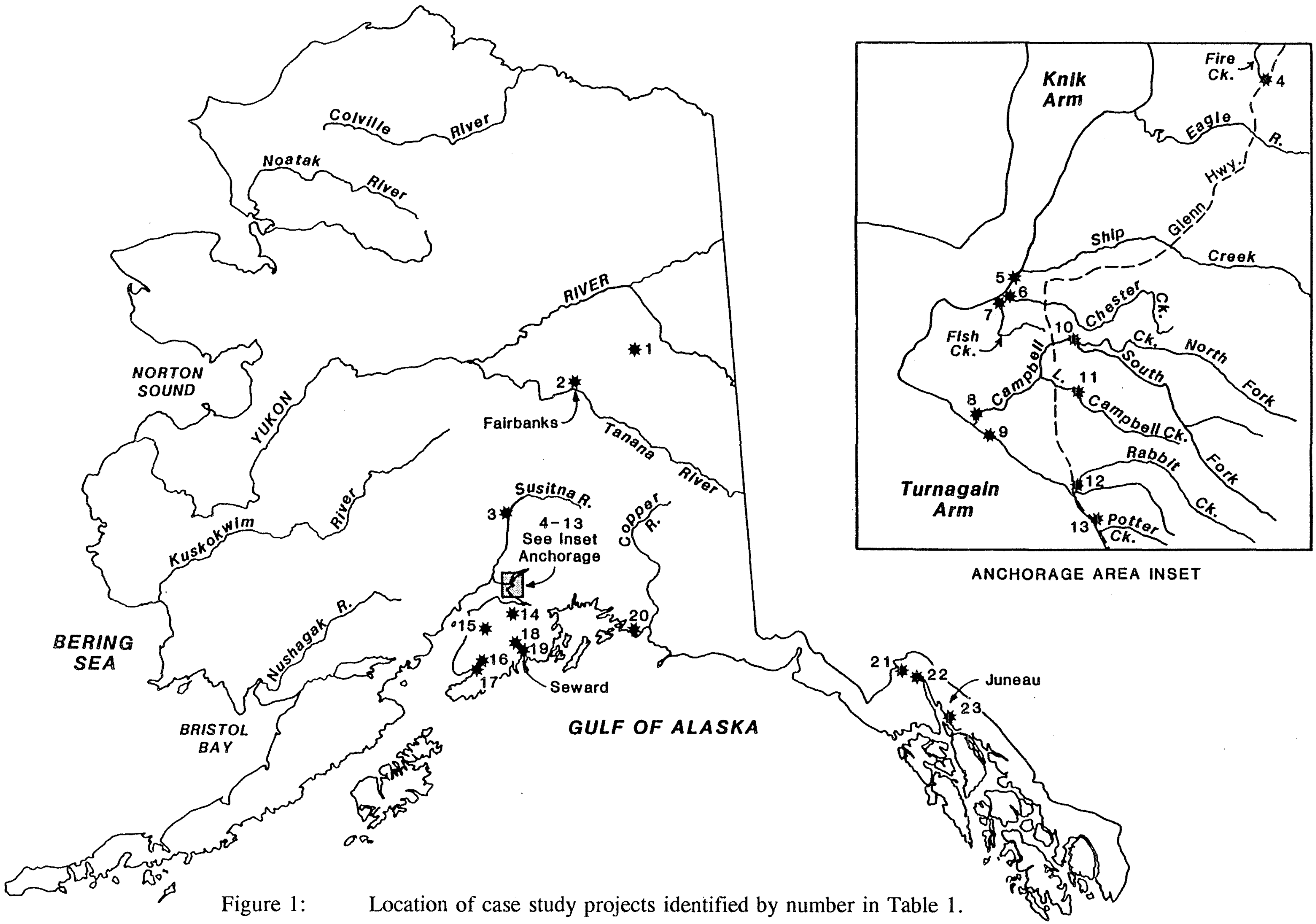


Figure 1: Location of case study projects identified by number in Table 1.

TABLE 1. CASE STUDY PROJECTS
(Listed North to South, as Indicated on Figure 1)

PRJ #	PROJECT NAME (and description)	REGION	PROJECT TYPE/ CATEGORY	NEAREST TOWN	YEAR BEGAN	OTHER COMMENTS
1	**Independence Creek Revegetation.** Riparian planting for stabilization following placer mining	Interior	RIPARIAN HABITAT, BANK RESTORATION, PLACER MINING	Circle/ Fairbanks	1989	Used willow sprigs and bundles. Good baseline maps and 2 yrs of monitoring data. A success, but there was an unusually high content of fine soil elements in tailings.
2	**Creamer's Field Waterfowl Enhancement.** Attempt to create a series of waterfowl ponds with nesting islands, connected by a small stream.	Interior	WATERFOWL PONDS/ IMPOUNDMENTS	Fairbanks	1987-present	Cooperative project between Ducks Unlimited and ADF&G. Continuous monitoring. Learned lessons about working with water level gradients & spillways in permafrost areas.
3	**Trapper Creek Step Pools.** Perched culvert corrections along Parks Hwy using weirs to form step pools.	Interior	PERCHED CULVERT CORRECTION	Trapper Crk	1990	Only example of this approach to perched culverts that ADOT/PF has done to date. Step pools built on 4 creeks using log and rock weirs.
4	**North Eagle River Interchange.** Varied bird & fish habitat as mitigation for highway fill interrupting stream alignments	Anchorage Area	GENERAL FILL MITIGATION, REARING/OW AREAS, WATERFOWL PONDS/ IMPOUNDMENTS, RIPARIAN HABITAT	Eagle River	1991	Good photo records & observations. Includes mitigation pond and two realigned creeks with structures for fish passage. However, juvenile fish may not be successfully going upstream.
5	**Coastal Trail Mitigation Project.** Attempt to impound storm-water to create brackish intertidal waterfowl pond.	Anchorage Area	WATERFOWL PONDS/ IMPOUNDMENTS, GENERAL FILL MITIGATION, COASTAL MARSH	Anchorage	finished 1991	Birds use site as a resting or loafing area, not for nesting. Revegetation difficult. Unique idea with potential application elsewhere.

Table 1 (continued). Case Study Projects

PRJ #	PROJECT NAME (and description)	REGION	PROJECT TYPE/ CATEGORY	NEAREST TOWN	YEAR BEGAN	OTHER COMMENTS
6	**Westchester Lagoon Offsite Mitigation.** (Fish Creek 6) Small wetland created on uplands adjacent to a larger wetland complex.	Anchorage Area	GENERAL FILL MITIGATION, WATERFOWL, COASTAL MARSH	Anchorage	1985-86	First example of offsite mitigation for wetland fills in Anchorage. Sloped gradation of different wetland habitat types (varying water depths). Limited bird use, however.
7	**Fish Creek Coastal Wetland Restoration.** Intertidal restoration after disturbance for sewer line installation.	Anchorage Area	INTERTIDAL, COASTAL MARSH, RIPARIAN HABITAT, WATERFOWL PONDS/ IMPOUNDMENTS	Anchorage	1986, 1990	Original duck pond design failed. Later, tried successive experiments with revegetation techniques. Lessons have been learned. Good monitoring/ research program.
8	**Campbell Lake Sedge Wetlands.** Intertidal restoration of large disturbed site.	Anchorage Area	GENERAL FILL MITIGATION, INTERTIDAL, COASTAL MARSH	Anchorage	1989-90	Area disturbed by sewer line installation. Contractor improperly installed riparian trees along stream; partial success at intertidal revegetation. No monitoring.
9	**Bayshore Ponds & Berms.** Attempt to create freshwater nesting ponds along the tideflats.	Anchorage Area	WATERFOWL PONDS/ IMPOUNDMENTS, COASTAL MARSH	Anchorage	1972-73	An experiment to berm up & impound freshwater on tideflats to create nesting habitat. No nesting on ponds, but it has provided brood rearing habitat which increased waterfowl productivity in immediate area. Illustrates the amount of natural regrowth after 20 years.
10	**Folker Street Small Tree Revetments.** (Campbell Creek) Small conifer tree revetment for bank stabilization and fish habitat enhancement.	Anchorage Area	BANK STABILIZATION, COVER	Anchorage	1990 & 1992	ADF&G (FRED Division) installed tree revetments on eroding bend of stream. Intended to arrest erosion and provide cover for young fish. Easy to implement, good results. New tree layers will be added every 2 years till goal achieved.

Table 1 (continued). Case Study Projects

PRJ #	PROJECT NAME (and description)	REGION	PROJECT TYPE/ CATEGORY	NEAREST TOWN	YEAR BEGAN	OTHER COMMENTS
11	**Abbott Loop School Creek Realignment.** (South Fork Little Campbell Creek). Community creek realignment project.	Anchorage Area	RIPARIAN HABITAT, REALIGNMENTS	Anchorage	1987-88	Big community and interdisciplinary effort to correct a poorly realigned stream. A great success story, but also much better funded than most projects. Not much recent data.
12	**Rabbit Creek Fish Pass.** Step pools to correct perched culvert; riparian revegetation.	Anchorage Area	PERCHED CULVERT CORRECTION, RIPARIAN HABITAT	Anchorage	1988	Technique to redress a perched culvert. Mostly a success, would have done it differently now. Revegetation had setbacks due to grazing.
13	**Potter Marsh Road Removal.** Removed access road to abandoned weigh station as COE enforcement action.	Anchorage Area	COASTAL MARSH	Anchorage	1984	Removed former road fill from Potter Marsh. Alders & seeding of new banks looks natural now. Not much aquatic plant regrowth on formerly filled areas—substrate problem.
14	**Resurrection Creek Habitat Restoration.** Forest Service project to study & restore a placer-mined river system.	Kenai Penin\ P.W.Sound	COVER, REARING/OW AREAS, MANY STRUCTURES, PLACER MINING	Hope	1992-still imple-menting	Very ambitious project. Good baseline & monitoring data. To date, 36 structures have been installed, (such as logs, boulders, rootwads) to increase pools and rearing areas within the main stem.
15	**Kenai Wilderness Lodge Bank Stabilization.** Kenai River (Owner-Dennis Dunham). Bio-engineering solution to continuing problems with river eroding the outside bend of the large river, threatening property.	Kenai Penin\ P.W.Sound	BANKS STABILIZATION, RIPARIAN HABITAT	Soldotna	1988-93	Originally tried wooden bulkhead solution (not good from a habitat perspective); it failed; then tried riprap to stabilize (1988). Continued problems with riprap maintenance. Finally, in '93, installed native vegetation and brush mattressing. Site looks good now, and has withstood high fall flows and spring ice. Very steep bank, high water velocity.

Table 1 (continued). Case Study Projects

PRJ #	PROJECT NAME (and description)	REGION	PROJECT TYPE/ CATEGORY	NEAREST TOWN	YEAR BEGAN	OTHER COMMENTS
16	**Bradley Lake Waterfowl Mitigation Area.** Attempt to create nesting habitat in impoundment created by road alignment across tidal area.	Kenai Penin\ P.W.Sound	WATERFOWL PONDS/ IMPOUNDMENTS	Homer	1991	Includes monitoring. Some problems encountered with revegetation (slow) and water levels (insufficient source to flood).
17	**Martin River Delta Fish Ponds.** Converting gravel pits into rearing ponds & spawning channel.	Kenai Penin\ P.W.Sound	GRAVEL MINING REHAB, REARING/OW AREAS, SPAWNING CHANNEL	Homer/ Kachemak Bay	1991	Work was conducted for site rehabilitation, not as part of required mitigation, so no monitoring was required. Intended to promote salmon rearing and spawning into Kachemak Bay.
18	**Box Canyon Creek Rearing Ponds.** Creation of rearing ponds & spawning riffles for offsite mitigation.	Kenai Penin\ P.W.Sound	SPAWNING CHANNEL, REARING/OW AREAS	Seward	1986	Tried to create rearing ponds; ended up with some spawning use as well. Still good rearing potential, but needs better cover & monitoring. No monitoring in mitigation agreement.
19	**Fourth of July Creek Spawning Channel.** Mitigation for habitat loss from Seward Marine Industrial Facility.	Kenai Penin\ P.W.Sound	SPAWNING CHANNEL	Seward	1981	Successful for spawning chum salmon at first, then waves created berm closing off fish access. Not good site selection.
20	**Mile 25 Spawning Channel.** Cordova area. Forest Service enhancement project for coho salmon.	Kenai Penin\ P.W.Sound	SPAWNING CHANNEL	Cordova	1984-1987	Successful at first, then the gravels silted in—currently attempting different remedies (fire pump, silt traps, manual removal). Monitoring includes number of spawners, emerging fry, and a coded-wire tagging study.

Table 1 (continued). Case Study Projects

PRJ #	PROJECT NAME (and description)	REGION	PROJECT TYPE/ CATEGORY	NEAREST TOWN	YEAR BEGAN	OTHER COMMENTS
21	**Herman Creek Spawning Channel.** Chum salmon enhancement project built by the local aquaculture association.	Southeast	SPAWNING CHANNEL	Haines	1989	One of the few clear Alaskan successes in creation of spawning channel—unusually high flow of groundwater so no siltation problems. Monitoring number of spawners and emerging fry.
22	**Haines Airport Mitigation.** Created a complex of wetlands & fish habitat using boulders, large organic debris, riparian & wetland vegetation on margins.	Southeast	RIPARIAN HABITAT, COVER, REARING/OW AREAS, AIRPORT EXPANSION	Haines	1990	ADOT/PF has an extensive monitoring plan. Represents a category of interest, in that similar airport expansions in wetlands are anticipated in other parts of the state.
23	**Juneau Airport Taxiway.** (Gastineau Channel 341.) Several activities, including: replacing a perched with an arched culvert, enhancing rearing habitat, constructing an intertidal slough, and an interpretive trail.	Southeast	PERCHED CULVERT CORRECTION, COVER, AIRPORT EXPANSION, INTERTIDAL	Juneau	1991-92	Perched culvert replaced with arched culvert on Jordan Crk; added boulders and large woody debris above. On Temsco property, experimental replacement of intertidal slough area.

B. SUMMARY OF FINDINGS ON RESTORATION/ENHANCEMENT IN ALASKA

This section summarizes the information gained from the case study examinations of various Alaskan aquatic habitat restoration and enhancement projects. In the chapters that follow, these results and policy implications will be discussed in a larger context.

The case study investigations covered a variety of restoration and enhancement activities in Alaska, which serve to illustrate the track record of different types of restoration and enhancement work, their relative effectiveness, and the common problems encountered. Relying on the Alaskan-specific experience compiled from the case history reports (e.g., the "lessons learned" and "project significance" sections), as well as the points emphasized by professionals during project meetings, we began to summarize the relative effectiveness of the various activity types in Alaska. Coastal district representatives suggested we shape our project findings into project categories useful to them, for instance: "high risk" versus "low risk" project types (in terms of potential for project success), the amount of required maintenance, and relative levels of expense. These categories are presented as a list of summary questions below. To find more information on the merits and problems related to one type of project, consult the "lessons learned" and "project significance" sections of the case study reports that address that specific type of work. Case study projects are identified by activity type in Table 1.

The following summary points are necessarily general, but should offer some insight into the strengths and limitations of different types of restoration and enhancement endeavors. Each question is followed by a list of applicable activity types and any associated explanations. When scanning these lists, it is important to keep in mind that most restoration and enhancement projects attempted result in some combination of partial success and partial failure.

1. **Which types of aquatic habitat restoration/enhancement show the most promise in Alaska, that is, which are most likely to succeed in improving habitat to meet the objectives?**

   - **Adding cover to channelized streams or sterile ponds.**

     This usually entails adding large woody debris to ponds or streams, and/or adding vegetation to the banks, which improves fish habitat. Re-establishing vegetational cover and/or woody debris is also commonly conducted after a construction project bordering a waterbody is completed, to correct the disturbed habitat conditions. The presence of organic cover elements stimulates the growth of various food chain organisms, and provides hiding refuges for juvenile fish such as rearing coho salmon.

   - **Reconnecting waterbodies that have been isolated.**

     Examples include restoring fish access to off-channel habitat, restoring tidal flushing to blocked areas, or re-uniting isolated habitat pockets. This technique is the easiest way to increase the amount of productive aquatic habitat for fish or bird use.

- **Correcting perched culverts (to restore fish access to upstream habitat areas).**

  Perched culverts are those that exhibit a short "waterfall" as water exits a culvert on the downstream side of a road crossing. This perching prevents fish from being able to move up the stream beyond the culvert, which may block access to important spawning and rearing habitat, and reduce the size of the fish population. Substituting arched culverts or bridges for standard culverted stream crossings (whether existing or planned, perched or non-perched) will restore or preserve desirable fish habitat characteristics as well.

- **Bio-engineered bank stabilization and riparian revegetation efforts.**

  New bio-engineering techniques, which feature the use of native plant materials, tree revetments, and/or rootwads, for example, are currently a subject of intense interest in the state. Often these techniques are combined in some fashion with more traditional stabilization materials (e.g., riprap or crib walls). Besides the examples profiled in the case studies, several other demonstration projects for bio-engineered bank restoration techniques are being launched in Alaska. In a few years these experiments should provide valuable direction for future bank and riparian work.

- **Removing gravel or accidental fill from tundra or wetlands if done immediately (within the same growing season).**

  At times there may be a need to restore tundra on which gravel was accidentally deposited, or wetlands that received fill without authorization. Alaskan experts emphasize that good results may be obtained, and less habitat damaged, if the fill is removed quickly.

- **Rehabilitating gravel pits into fish habitat.**

  This type of work has been particularly successful if the excavation plan is originally designed with later fish habitat needs in mind, and if enough fine sediments are present in the substrate to promote vegetation growth.

- **Willow trimming operations to mitigate loss of moose browse.**

  Although not always an example of "aquatic habitat" restoration, agency staff report that such trimming operations have successfully replaced lost browse areas as mitigation for a number of highway projects.

- **Alternative mitigation option: acquiring and preserving parcels of high value habitat.**

  Although though not an example of restoration/enhancement techniques, it is important to keep in mind that for mitigation purposes, another option with high potential for success (and low risk since habitat values are already known) involves the acquisition of high-value aquatic habitat areas and their placement in protected status.

It is important to note that in addition to the selection of a promising type of project, several process-related factors directly contribute to the success of a restoration or enhancement project. These include:

- **Involving different types of professional expertise in the project design and implementation.**

  The potential for long-term success of an aquatic habitat restoration or enhancement project increases greatly if people with different expertise are consulted (e.g., a hydrologist, engineer, fish biologist, etc.). Although initially time consuming, a multidisciplinary, flexible approach usually yields the best and most long-lived solutions.

- **Garnering support from neighbors or the local community.**

  In a developed area, obtaining the support of the community is essential for project success (to allow vegetation to establish, cut down on vandalism, respect the site, etc.).

2. Which types of restoration/enhancement have proven difficult and are therefore risky to undertake?

Basically, <u>creating</u> a new tract of aquatic habitat, with its requisite hydraulic characteristics and other functions, is more difficult than <u>restoring</u> degraded habitat or <u>enhancing</u> the potential of existing habitat areas. Some types of projects that have had recurring difficulties in achieving success in Alaska include:

- **Spawning channel construction.**

  Constructed spawning channels have often been plagued by chronic situational or hydrological problems, even if initially they appear successful (e.g., for the first few years).

- **Creating waterfowl nesting habitat.**

  Although a few case study projects document successful waterfowl enhancement efforts, these have usually resulted in increased loafing or brood-rearing areas, not actively used nest sites. One reason is that nesting birds require ample plant cover to hide in. Multiple layers of vegetational cover (e.g., ground surface, tall grasses, or shrubs) may take many years to develop on a disturbed site, depending on the level of disturbance and the condition of the soil/substrate.

- **Revegetating tidal substrates in general.**

  Tidal silts (common in the glacially-influenced coastal regions of Alaska) often dry out after grading, contain little organic matter, and are easily compacted by foot traffic or heavy equipment. These traits combine to yield a harsh environment for plant establishment.

- **Creating new wetland areas in former uplands.**

  Experience shows it is easier to restore degraded wetlands than to create new ones, because the requisite hydrological characteristics may already be in place.

- **Restoring whole placer-mined watersheds.**

  Often, restoring reaches of river that have been placer-mined is tantamount to "starting from scratch." One must re-create the appropriate contours, the stream and floodplain morphology, invertebrate populations, substrate texture, vegetation, etc. Numerous physical, biological, and chemical parameters may be involved, therefore a watershed restoration can be a very complex and very expensive undertaking. Several demonstration projects are now underway in the interior portion of the state which should provide a better understanding of what techniques are worthwhile.

3. **Which types of restoration/enhancement carry high maintenance requirements in order to function properly?**

- **Any project involving instream structures (i.e., weirs, barbs, culverts) or water control structures (e.g., head gates).**

  If not regularly inspected and maintained, no man-made project within a stream column (or active waterway) can be expected to perform forever. The slopes around the head gates may wash out, access to spawning channels may become blocked by rocks or collected debris, a culvert may fail, etc. If neglected, these instream structures may (and have) become obstacles to fish passage, ultimately defeating their own purpose.

- **A revegetation project (or bio-engineering project utilizing plants) must be shepherded through the establishment period.**

  A replanted site (e.g., an intertidal or bank restoration project) must be protected from trampling and other disturbances during the plant establishment period. Continued applications of water, fertilizer, or other amendments may also be necessary during the first few years.

- **Certain types of bank restoration require adjustments or additions over time.**

  For example, small tree revetments on a medium-sized creek may involve periodic addition of another layer of trees over the old one (e.g., every two years) until the sediment accretion has built the bank up enough to be replanted (such as case study #10, the Folker Street small tree revetment).

  Despite the care required during project establishment, eventually a bio-engineered solution to a bank stabilization problem should prove to be the lowest maintenance solution over the long term if native plant materials are used to hold the slope. Rocks or gabions will be damaged or shifted by ice scour or floods, but once established, planted slopes are largely self-repairing. The latter approach also provides maximum fish habitat benefits.

4. **Which types of restoration/enhancement activities tend to be the most expensive?**

- **Stream realignments**

  Permanently routing an entire section of stream into a new alignment can be very costly and involved, depending on the size of stream and length of realignment. Sometimes these actions are conducted to improve the stream itself, for example returning a stream that has already been severely re-routed or disturbed to its original channel or the best available substitute (cf. case study #11, the Abbott Loop School creek realignment). Often, however, creek re-routing is not done for restoration or enhancement purposes, but to accommodate development (such as re-routing a section of creek around the end of a new runway, as in case study #22, Haines Airport mitigation). At the same time, the new section of stream is likely to lack essential habitat characteristics, and requires initial enhancement measures in order to be productive.

- **Restoring a highly-disturbed stream system, such as a long section of a placer-mined river.**

  The complexity and expense involved in these activities are explained above under Question #2.

- **Removing and replacing perched culverts with either properly-installed culverts, arched culverts or bridges, to restore fish passage to upstream habitat areas.**

  These activities tend to be expensive because they involve digging up and replacing an entire section of road at the stream crossing. However, a properly-sized and installed culvert (or bridge) is the best long-term solution to a perched culvert problem.

- **Acquisition and placement of existing high-value land areas in protected status.**

  Although though not an example of restoration/enhancement actions, the acquisition of high-value aquatic habitat areas and their placement in permanently protected status is mentioned here because it is another viable mitigation option. The cost, of course, would be extremely variable from one location to another, but land purchase could be costly in more developed areas. Preservation is accomplished either by then donating the land to the public with stipulations, or via permanent easements or deed restrictions.

For complicated and/or high-profile projects involving stream dynamics, the amount of expertise consulted in the design and planning of the project (e.g., hydrologist, engineer, fish biologist, etc.) also increases project costs. Although this thorough approach can appear costly and/or time consuming, it may be most cost-effective considering that the resulting solution is likely to be the best and most long-lived, rather than a "band-aid" that must be fixed again.

5. **Which activities tend to yield good results for a relatively low cost?**
(Many of these activities were previously listed and explained above.)

- **Adding cover (e.g. logs, branches, or planted banks) for enhanced fish habitat.**

- **Reconnecting isolated waterbodies.**

- **Rehabilitating gravel pits into fish habitat.**

- **Locally-supported bank stabilization or riparian revegetation efforts.**

  If volunteer or low-cost labor can be arranged for a few days to collect, store, and install plant materials, these projects can often be implemented at low cost. A good example is a small tree revetment for bank restoration (cf. case study #10, Folker Street small tree revetment).

- **Willow trimming operations to replace lost moose browse.**

  Examples of these operations have been successfully implemented as mitigation for large highway projects at a relatively low cost (e.g., <$2,000).

Recognizing that this study's findings on restoration/enhancement activities would be used to assist coastal district staff in implementing the mitigation sequence, we felt it was important to also provide background on the track record of such projects when used for mitigation purposes. It is important that decision-makers understand the risks inherent in any trade-offs affecting aquatic resources. For this reason, information from publications outside of Alaska was summarized on the relative success of mitigation projects and on the frustrations common to the compensatory mitigation system. These are included in Appendix B of this report.

During our case study investigations, Alaskan experts voiced many similar frustrations, which are briefly summarized under the questions below. These issues are addressed further in Chapters 3 and 4.

6. What are the common problems and frustrations of people having worked on mitigation (and restoration) issues in Alaska and elsewhere?

- **Perceptions.**

  Compensatory mitigation never provides an equivalent replacement of lost habitat values; studies show it <u>almost always results in net loss of aquatic habitat area & loss of functions and values</u> (Kunz et al. 1988, emphasis added). For this reason, Alaskan agency staff continue to emphasize the importance of avoiding or minimizing development impacts on aquatic habitat before resorting to the risky proposition of compensatory mitigation.

- **In-kind versus out-of-kind mitigation.**

  A recurring debate centers on how important it is to replace the aquatic habitat that was lost with the <u>exact same type</u> of habitat ("in-kind") or whether it is appropriate to instead concentrate on what efforts will achieve the most net gain, based upon the available land and resources (including "out-of-kind" compensation). In other parts of the country, critics point out that compensatory mitigation has often led to many diverse wetland types being replaced by rudimentary "duck ponds". (See discussion in Chapter 3.)

- **Difficulty in trying to tailor a viable/worthwhile mitigation action on a small amount of property on a case-by-case basis.**

  Each time a permit proposal is submitted involving fill into acres of aquatic habitat, the permit reviewer is put on-the-spot to come up with mitigation ideas that could potentially "improve" habitat characteristics in some fashion within a limited area (theoretically to offset habitat loss). The resulting small, isolated mitigation projects often yield disappointing results for the effort.

- **Insufficient pre-project assessment regularly results in failure of restoration and enhancement projects due to: substrate, sediment load, hydrology, elevations/water levels, etc.**

  Examples abound of failed projects due to inadequate site conditions. For instance, the final substrate may not be suitable for plant establishment, sediments may wash in, there may be insufficient water flow or depth, the final elevation may not be correct in relation to the local water table for the desired aquatic species, etc.

- **Inaccurate or improper installation commonly reduces project effectiveness.**

  Language barriers often exist between the permit-approving agency and the onsite contractor. Although the agency staff may understand the project plans to say one thing, a contractor may interpret them to mean another. Mitigation project plans are often not specific enough to provide clear direction for the contractor. Without understanding the reasons behind certain details (in terms of habitat enhancement), the contractor may not realize their importance, and continue to do the job in his/her conventional manner. **Pre-construction meetings and on-site supervision are essential to a successful project.**

- **Projects regularly fail due to lack of maintenance & monitoring.**

  Problems often develop after installation, for example with clogged or eroding water-control structures, beaver activity, setbacks to revegetation efforts, etc.

- **Projects fail due to inadequate site protection and traffic control.**

  Anticipating impacts from the public or surrounding activities (e.g., trampling of new plantings by people and animals, grazing damage, vandalism, removal of trees placed in water for cover, sedimentation from disturbance upstream) are not often given enough consideration in project plans, but these issues can be pivotal to project success.

- **Difficulty in achieving compliance.**

  Unfortunately, the enforcement of mitigation agreements does not receive the highest priority from budget-strapped regulatory agencies. Consequently, a surprisingly large percentage of mitigation projects are never completed as approved (discussed extensively in Chapter 4).

Despite all these difficulties, some of the longest running man-made projects demonstrate the amount of habitat enhancement and development that is possible, given enough time.

Alaskan examples include the creation of Potter Marsh in Anchorage, another freshwater marsh created by the Juneau Airport dike, waterfowl ponds constructed below Bayshore in Anchorage (case study #9 in this report), and various rehabilitated gravel materials sites in the northern part of the state (e.g., Goose Green Gulch, as documented in Winters, 1990). All of these projects are more than 20 years old, and display desireable habitat characteristics and fish and wildlife use.

7. What is too often neglected in negotiating a mitigation agreement?

- **Stated goals, objectives and plan specifics**
- **Clear monitoring and reporting responsibilities (e.g., the timely submission of as-built reports to all agencies or other parties concerned)**
- **Provisions for mid-course corrections (e.g., adjusting water levels, replanting using a different technique if first results are unsatisfactory, etc.)**
- **Compliance incentives (accomplished through the timing of permit release, requiring performance bonds, etc.)**

These final issues will be specifically addressed in Chapters 3 and 4.

CASE STUDY REPORTS

C. INDIVIDUAL CASE STUDY REPORTS

1. Independence Creek Revegetation

SHORT DESCRIPTION: Slope stabilization on placer mine tailings using dormant willows.

Responsible Organization: Bureau of Land Management (BLM)
Organization Based In: Fairbanks
Agency Permit #: No ADF&G permit needed; unable to identify COE permit.
Year Work Began: 1989 - Year Ended: 1991
Status: Completed, with 2 years monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Independence Creek
Nearest Town: Central
Topographic Map Quad: Circle
Anadromous Stream #: Not anadromous
Location Description: Take turnoff at 114 Mile Steese highway, then go south for 4 miles on a gravel road.
Site Impressions of Habitat Type: Rocky slope at edge of Independence Creek floodplain.
Project Size: 500' by 35' of planted bank
Map: A detailed map included in Barb Masinton's article.

OVERALL GOAL(S) OF PROJECT:

To determine whether planting dormant willows can rapidly stabilize steep slopes in disturbed river floodplains.

OBJECTIVES:

1. Attempt to use willow bundles to stabilize the most erodible areas where expanding vertical gullies were already evident.

2. Use willow cuttings to stabilize the face of 10-45° slopes.

3. Reduce erosion, facilitate overall site restoration.

4. Research techniques which could be applied to reclamation of streambanks in placer-mined creeks.

IMPLEMENTATION INVOLVED:

1. Site selection—This site was chosen for a willow revegetation project due to the steep slopes of the overburden stockpiles with potential for surface erosion (Plate 1), and the strong possibility the claim would not be mined again in the near future.

2. Planting methods followed the guidelines for streambank revegetation (ADF&G 1986). Stem & branch cuttings were collected from dormant feltleaf willow (*Salix alaxensis*) in April 1989. The stem cuttings were cut to size (8"-10" long, 0.25-0.75" diameter stems). Other branches were tied into bundles (4"-6" bundle diameter), but cut to length at the time of planting (3'-4' lengths). All material was wrapped in plastic bags and stored in refrigeration (36° - 40° F) for one month.

3. Once the ground thawed in May, the cuttings were planted along the face of a 500' long slope. A "dibble" was used to make 6" deep vertical holes, the cutting was dropped in (with only 25% exposed above

ground), then the hole was closed by foot (Figure 2). These cuttings were planted in clusters of five within two foot diameter circles. The slope angle varied from 10-45 degrees.

4. The willow bundles were planted in a different section where on-going surface erosion & expanding vertical gullies were evident. The bundles were placed randomly throughout one gully, in shallow trenches, secured in place with willow stakes, & partially covered with surrounding soils.

5. Monitoring included: survival rate of cuttings and bundles; annual growth of planted material (e.g., length and diameter of stems, roots, etc.); natural recolonization of the slope; and wildlife occurrence/use of the site.

ESTIMATED COST:

No mention of expenses was made, but it would have been minimal, accounting for just the labor of cutting and preparing the willow materials, installation and a few monitoring trips. Manpower was supplied by the BLM Steese/White Mountains District minerals and resources group, Fairbanks.

JUDGEMENT OF SUCCESS:

1. Dormant willow cuttings. Installation of the 550 cuttings was intentionally conducted in a rough and/or inexact manner in order to see how well this technique would work in widespread application. Within 2 weeks, 95% of all material had leafed-out, and growth appeared vigorous. Then a month after installation (June), heavy rains flooded the area drainages. As a result of excessive runoff, the existing gullies deepened & all the bundle material was lost. The stem cuttings (placed on the slope, but not in gullies) survived this high water event. The cuttings averaged 12-18" growth the first season. Total vegetative cover in fall 1989 was 30%, composed of 10% planted willows and 20% local colonizing species (mostly *Calamagrostis* sp. & *Polygonum alaskanum*). By 1990, cover increased to 70-80%, composed of 20% planted willow cuttings and 50-60% local species. 515 of the original 550 cuttings had survived as of 1991.

   In September, 1993, data was again taken on the growth of the willow cuttings at the control points staked by Barb Masinton. The new stem growth of the year averaged two feet at these locations. Total willow height at the four control points were 10 ft, 7 ft, 9 ft, and 6 ft, respectively (Plate 2). Ten feet of growth after five growing seasons (1989-93) is very impressive. Growth rates at these control points may have been influenced by a variety of factors, including moisture differences in the soil. Insect damage was evident on the newest growth.

   The areas around the planted willow clumps appear to support more natural plant colonization than the surrounding areas. Prevalent indigenous species include wild rhubarb and bluejoint grass, as were documented the first season (see above), along with as yarrow, horsetails, a few alders, wild rose, *Artemisia* sp., and an unidentified composite (probably *Senecio* sp. or *Saussurea* sp.).

2. Willow bundles. As stated above, the willow bundles were placed in the most erodible areas (gullies) and were unfortunately subjected to a heavy flood event only one month after planting. All bundle material was washed out. The value of the bundle method on slopes cannot be adequately evaluated from such an application. The bundles may have performed very well if not placed directly into the gullies, such as in a similar location to the cuttings. They also might have stabilized the gully areas if given a bit more time to establish before a heavy flood event. Not much can be determined from this experiment; the technique needs further trials.

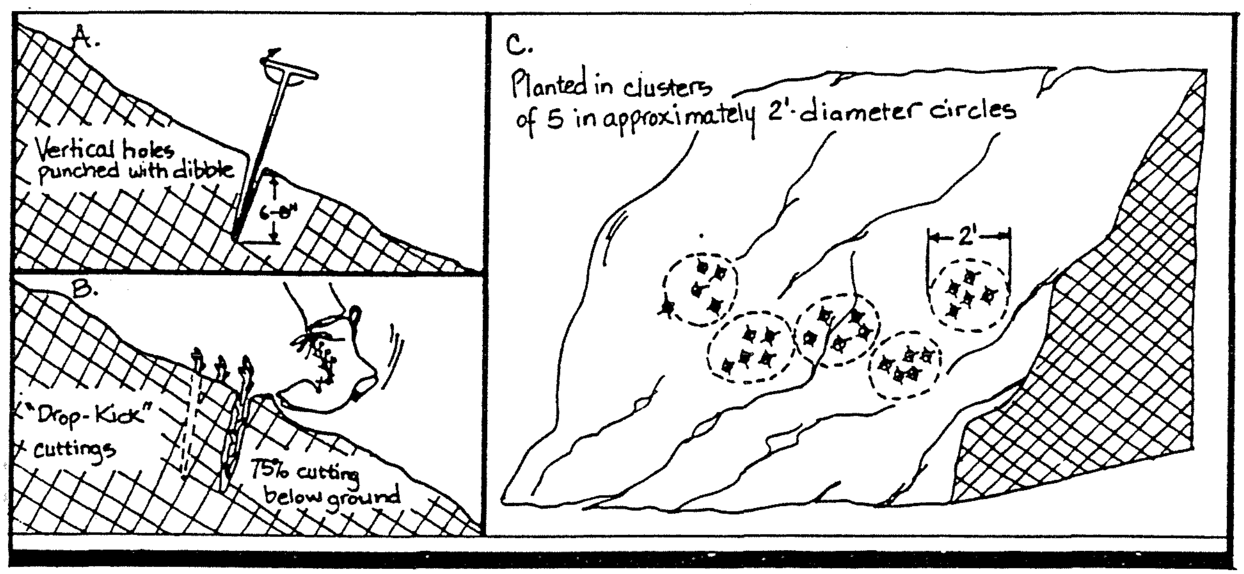


Figure 2. Planting method for dormant willow cuttings, Independence Creek project, 1989. Source: Barbara Masinton, BLM.

3. <u>Overall erosion</u>. Erosion on the sloped bank was reduced satisfactorily as a result of this project. Although the bundles in the most erodible area were inadequately secured to withstand the sudden onset of flood waters, the success of the stem cuttings on overall slope stabilization was evident following the flood. Surface water carved small gullies and rills around cuttings but did not dislodge them. Since then, normal seasonal runoff from snowmelt, rainshowers, and groundwater seepage continued to deepen the gullies, but the presence of the willows avoided further gully widening. The cuttings may have also increased water holding capacity of the slope, providing microclimates for seed germination and establishment of local species. This was important due to the distance of this slope above Independence Creek (Plate 1).

LESSONS LEARNED:

Material transplanted into highly erodible areas need <u>good</u> anchors. Perhaps ways could be devised to protect or buffer newly planted materials from flood waters in high risk areas during the establishment period.

The techniques used in planting the dormant material, particularly the cuttings, were those which might be used in an effort to rapidly "get the job done" with little to no attention paid to depth of holes, spacing, and firming the soil. At times the dibble was not able to fully permeate to optimum depth due to rocky and/or partially frozen substrate so that more material was exposed above ground the guidelines called for; and some holes were deeper than cutting lengths so that they were planted completely below ground level. With only minor losses, the rapid and intentionally haphazard planting methods had no appreciable effect on the overall survival of the dormant cuttings.

The cuttings successfully curtailed erosion on the sloped banks. The cuttings may also have increased water holding capacity of the slope, enabling establishment of local species. Overall, this proved to be a very successful project, leading to continued soil stabilization & plant succession.

The high amount of fine materials in the substrate of this bank (> 60% fines) may have had a great deal to due with the impressive results. The vegetation, topsoil, and overburden had been stripped on both previously mined and undisturbed ground at this location. The bank was then formed by pushing these combined materials into 30-45° stockpiles on the east-facing slope of the valley (Plate 1). In contrast, many placer mining operations leave behind piles of gravel that are devoid of fine soil materials. Such a bank would probably not be as readily receptive to the dormant willow technique.

SIGNIFICANCE OF PROJECT:

This project is a great demonstration of the success of dormant willow cuttings when stored and handled in a timely manner. This project was also unique due to superior documentation, such as detailed explanations of the techniques as applied, diagrams of materials used, photos and maps of planted areas, and permanent stakes identifying control points where monitoring data was taken.

BLM is currently involved in researching many other techniques for reclaiming placer mined areas. The dormant willow technique used at Independence Creek has widespread applications in various settings (e.g., bank stabilizations in general), but its success may depend on the amount of fine material in the substrate to be stabilized.

FOR FURTHER INFORMATION:

Report(s):

Authors: Masinton, Barbara
Publication Date: June 1991
Title: Stabilizing Steep Slopes Using Dormant Willows

Contact Persons: Barb Masinton, then at BLM, Steese/White Mountain District, Fairbanks, but now at BLM in New Mexico (since 1991/92). Her address there: New Mexico State Office (NM-931), 1474 Rodeo Road, Santa Fe, NM, 87502-7115, (505) 438-7445. Also Susan Will, BLM Kobuk District, 474-2330, and Shelly Jones, BLM Steese/White Mountain District, 474-2356, both stationed in Fairbanks.

Other Information Sources: After Barb Masinton's departure, Susan Will at the BLM Steese White Mountain district conducted some follow-up visits and photographed the area over time. Although since transferring to the Kobuk District of BLM (also stationed in Fairbanks), Susan still has considerable interest in the project, and would like to see the historical and recent data, photos, and other information compiled for comparison. She and Shelly Jones (BLM, Steese White Mtn district) surveyed the site in June 1993. For this case study description, Shelly Jones and Betsy Parry (ADF&G) visited the site on 9/9/93 and collected data at the staked control points in the manner established by Barb Masinton. Much of the background information in this narrative came directly from the above referenced article by Barb Masinton.

Ms. Masinton's report (and the case study description above) refers to a 1986 pamphlet on streambank revegetation by ADF&G and the Alaska Department of Natural Resources - Plant Materials Center. Although a new version is under development, the citation is: Alaska Department of Fish and Game, Habitat Division. 1986, June 19. *Streambank revegetation: field guide to streambank revegetation.* [Palmer, Alaska]: [Alaska Department of Natural Resources, Plant Materials Center]. Pamphlet. 17p.

2. Creamer's Field Waterfowl Enhancement

SHORT DESCRIPTION: Attempt to create a series of waterfowl ponds with nesting islands, connected by a small stream.

Responsible Organization: ADF&G and Ducks Unlimited
Organization Based In: Fairbanks
Agency Permit #: FG 87-III-001; COE Noyes Slough #17
Year Work Began: 1987 - Year Ended: 1987 (construction); continuing maintenance & repair work
Status: Monitoring/continued changes

LOCATION/SITE CHARACTERISTICS:

Waterbody: New ponds near Isabella Creek
Nearest Town: Fairbanks
Topographic Map Quad: Fairbanks D-2
Anadromous Stream #: Not anadromous
Location Description: Northeastern portion of the Creamer's Field Migratory Waterfowl Refuge in Fairbanks
Site Impressions of Habitat Type: Several acres of slightly undulating terrain. Tussock low-shrub bog is the predominant habitat type, interspersed with herbaceous bog and tall shrubs.
Project Size: 80 acres (1/2 mi. x 1/4 mile) encompasses the project area.
Map: An as-built diagram in the 1988 ADF&G annual waterfowl report listed at the end.

OVERALL GOAL(S) OF PROJECT:

To increase nesting habitat for waterfowl endemic to interior Alaska, test the use of waterfowl enhancement methodologies in the interior, and increase wildlife viewing, hunting, and education opportunities.

OBJECTIVES:

1. Construct six ponds with nesting islands in an area with little open water. One man-made pond had been created a few years earlier and had proven beneficial to waterfowl, launching the idea for this multiple pond project.

2. Impound spring runoff water in the ponds to depths favorable for waterfowl usage.

3. Revegetate approximately 15-16 acres of area disturbed by pond excavation (berms around ponds and islands). The resulting vegetation should stabilize the spoils and provide waterfowl with food and nesting cover.

4. Increase use of the site by various waterfowl species.

IMPLEMENTATION INVOLVED:

1. In spring 1987 (March-April), two bulldozers with ripper bars and U-blades were used to construct the ponds, while a backhoe excavated the level ditches connecting them (Figure 3). The bulldozers operated 24 hours/day for most of the construction period. The six ponds were sloped to a maximum depth of four feet in places, with the majority of the area from 12-24" deep. The ponds ranged in size from 1.5 to 3.4 acres. Two to four islands were left in each pond, totalling 21 islands of 0.04 to 1.0 acres in size. Where necessary, spoil material was added to islands to increase their elevation from 1 to 2 feet above water levels.

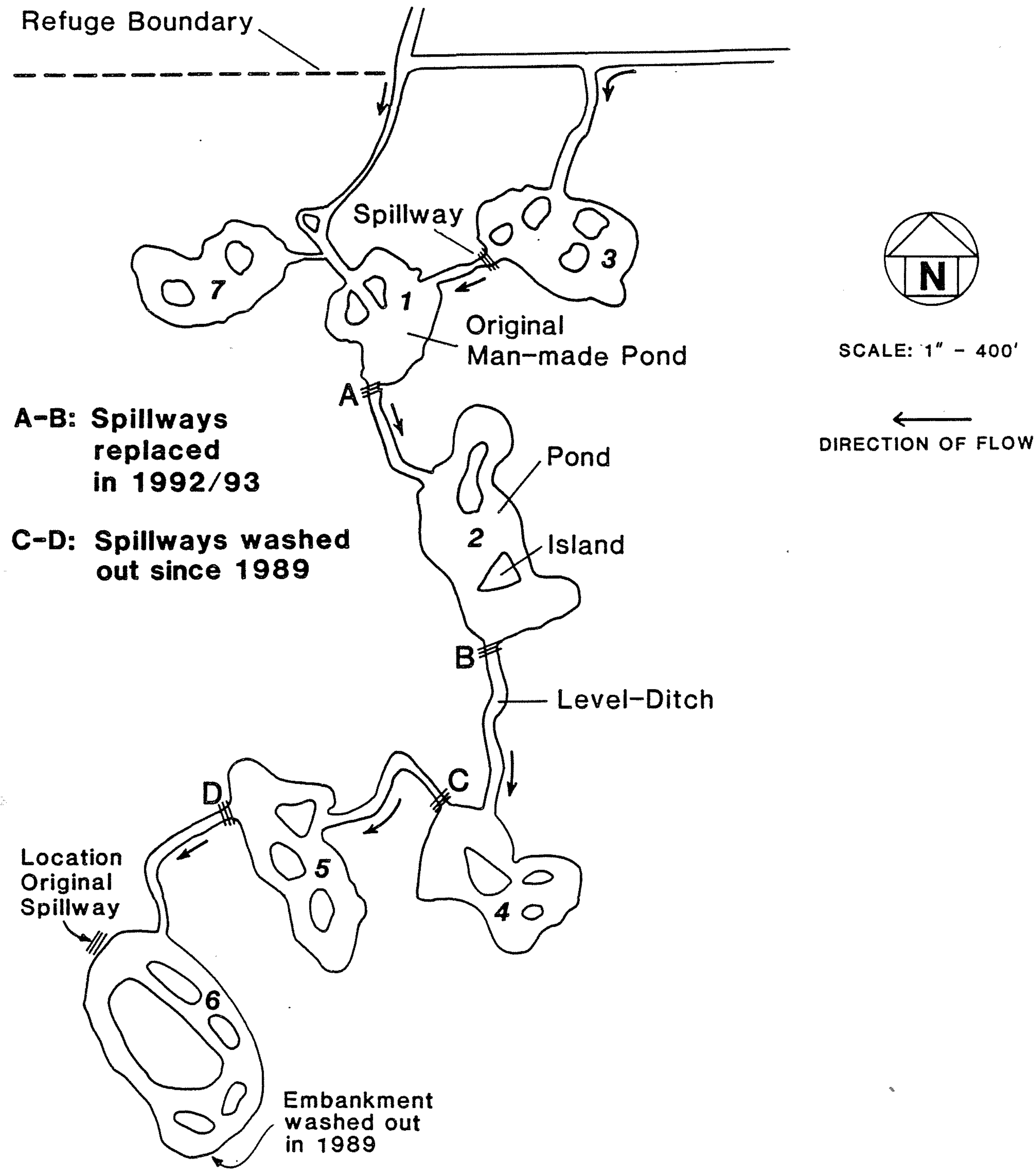


Figure 3. Creamer's Field waterfowl enhancement project showing ponds, islands, level-ditches, and spillways as of 1993. Source: Dan Rosenberg, ADF&G.

2. Excavated material was distributed around pond perimeters and along level ditches and acted as a dike at the lowest end of the ponds. Excavated material covered 15.3 acres.

3. The six new ponds were linked to an existing 1.25 acre pond by approximately 2,150 feet of meandering level ditches. The level ditches are 20 feet wide and contain from two to three feet of water.

4. In June, 1987, 16 acres covered by excavated material were revegetated with approximately 6,700 lbs of fertilizer (20-20-10) and 600 lbs of grass seed. The seed mix consisted of 15% tundra bluegrass (*Poa glauca*), 32% "arctared" red fescue (*Festuca rubra*) and 53% "norcoast" Bering hairgrass (*Deschampsia beringensis*). About 50 lbs of *Beckmannia syzigachne* was hand broadcast around pond margins and in spillways. Islands in the two southernmost ponds received the following mix: 50% *Beckmannia syzigachne*, 10% polar grass (*Arctagrostis latifolia*), 2% bluejoint (*Calamagrostis canadensis*), 20% "norcoast" Bering hairgrass, 8% tundra bluegrass, and 10% "arctared" red fescue.

ESTIMATED COST:

Project costs in 1987 totaled $53,800. Costs were split equally between the Alaska Conservation Stamp (duck stamp) program and matching funds from Ducks Unlimited, Inc. (DU). The costs broke down into: a) construction, $47,250; b) subsurface soil investigations prior to construction, $650; c) grass seed and fertilizer, $5,540; d) use of tractor for revegetation, $240; e) sand bags for erosion control during initial pond filling, $135; and f) berm and spillway maintenance (the first winter, 1987-88), $1,710. Since then, continuing maintenance on spillways, etc., has accrued additional costs (unknown).

JUDGEMENT OF SUCCESS:

1. <u>Pond Construction</u>. The physical arrangement of pond banks and island elevations are all according to specifications. The construction resulted in a satisfactory amount of open water (11.1 acres, totalled from six ponds) and 21 nesting islands.

2. <u>Maintaining Water Levels</u>. Winter construction caused frozen chunks of organic matter to be included within the berms. Uneven melting and settling led to a leakage problem called "piping". The first spring, leakage and low snow pack prevented all the ponds from filling.

   The combination of permafrost construction and a 12.2 ft. elevation gradient across the project area (north to south) necessitated the use of spillways at the outlet of each pond in order to retain the water. In November 1987 the upper two spillways (constructed of excavated spoils) were reinforced by lining them with a liner and riprap (approximately 6-inch rock) to retard erosion. A flood event in 1989 washed out the three lower spillways, which dewatered Ponds #4, 5, and 6. An attempt to replace the spillway at Pond 5 in 1990 was unsuccessful.

   In winter 1992/93, the two uppermost spillways were completely redesigned using more sophisticated engineering techniques. All the soft earth material was removed and set aside, then replaced with rock riprap. The following May the exposed rock spillways were then re-covered with the stockpiled topsoil, fertilized, and seeded. The newly reconstructed spillways accommodate a drop of 4-6 feet between the level of the pond above and the level ditch that leads to the next pond in the chain (Plate 3). Only two spillways were rebuilt in this manner due to limited funding and the desire to test out the technique before reconstructing all of the spillways. The new spillways have not yet weathered a full cycle of seasons so their effectiveness is still uncertain, although they appeared to be doing well during the site visit in early September, 1993. The two ponds above the redesigned spillways were filled to desired depths, with the islands exposed (Plate 4). A beaver was observed to maintain one spillway between ponds quite well in 1992. Future plans could include introducing other beavers for this purpose.

Ponds 4, 5, and 6 are currently not functioning as ponds at all because the spillways/dams at their outlets are no longer in place to impound the water. Currently, these areas look like well-vegetated depressions with a channel of water running through them, and a few high "bluffs" in the center (the intended islands, Plate 5). If the reconstructed spillways at the upper ponds hold up well over the seasons, the spillways on the lower ponds may be similarly redone. Up until that point, only three of the six newly constructed ponds will contain water.

3. Revegetation. The revegetation aspect of this project has been very successful, with close to 100% cover exhibited around the ponds and islands. During construction, the equipment operators deliberately avoided the island areas in order to prevent damage to existing vegetation. This allowed scattered trees to remain growing on a couple of the islands, including sizable spruce, birch, and willow. In other cases the island height had to be raised by placing spoils on top of existing vegetation. Often, the damaged woody vegetation resprouted after construction.

   Herbaceous growth on the excavated material along the pond banks has also been impressive. Bluejoint grass (*Calamagrostis canadensis*) is the most visually apparent cover. Willows are also sprouting on the banks, some already reaching 4-5 feet tall. Duckweed and other aquatic vegetation is evident along the pond margins and in backwater recesses.

   The recently reconstructed spillways, recovered with topsoil and seeded with grass, show a reasonable amount of herbaceous cover after the first season (Plate 3). Some natural recolonization by other species is also evident. The riprap layer was still exposed on half of the uppermost spillway because the stockpiled topsoil was insufficient to cover all the rocks.

   The ability for this area to recolonize naturally is well demonstrated by the pond bottoms in the dewatered lower ponds (Plate 5). Although seed and fertilizer was spread on the banks, the bottoms of the ponds were left alone. Nevertheless, after six years the herbaceous vegetation on the bottom is quite dense.

4. Increase waterfowl use and viewing opportunities. Twenty species of birds were identified the first season following construction, including Canada geese, northern pintails, sandhill cranes, shovelers, mallards, green-winged teal and American wigeon. In the years since, many broods have been observed (including mallards, green-winged teal, northern shovelers, northern pintails, common goldeneyes, American wigeon, horned grebes and other shorebirds), but only a few nests. Dan Rosenberg speculates that the low nest count could be because the seeded grasses came in so dense that it was unattractive for nesting. Although waterfowl require a certain amount of cover for nesting, too dense a vegetation can make adults apprehensive if they cannot see approaching danger. The birds are probably nesting in adjacent undisturbed areas, where the vegetation is not as thick with grasses, and using the ponds for feeding and brood rearing. Without proximity to open water, the surrounding areas had not previously been suitable for nesting. Thus the creation of the ponds has increased the amount of nesting and rearing habitat available for a wide variety of waterbirds.

LESSONS LEARNED:

The combination of permafrost construction and the elevational gradient between ponds led to numerous problems with water impoundment. These problems could be avoided if future permafrost projects are designed so that the ponds fill from surface and subsurface drainage rather than from outflow channels on a gradient. Significantly less maintenance would be required.

Dan Rosenberg feels they should have given more consideration to the elevation differences to begin with, because the pond spillways have been a continuous source of problems. Although recurring impoundment problems have prevented complete success of the project, the ponds that are now functioning as planned have been an unequivocal success in terms of enhanced waterfowl habitat.

The two newly reconstructed spillways remain untested until next spring's runoff. Without sufficient vegetation (willows, etc.), the soil could wash out again and expose the rocks. Dan Rosenberg feels that in these soils, fertilizer application without grass seeding may be sufficient to restore cover. The refuge staff is investigating the use of organic alternatives to chemical fertilizers, especially for use in a spillway or waterway location.

The pond project had been successful at testing wetland enhancement techniques in northern latitudes, increasing waterfowl productivity in the area, and providing recreational and educational opportunities. Its success is not complete because only the uppermost ponds contain water throughout the season, while the lower three ponds remain dry. However, the "unenhanced" state would have been no open water at this site at all, preventing ducks from raising broods there.

SIGNIFICANCE OF PROJECT:

Currently only three of the six new ponds contain water, so the overall success falls short of 100%. However, the project has accomplished several objectives. Waterfowl habitat enhancement techniques have been tested and refined in a permafrost area, and the inherent problems have been identified (e.g., leaking water via "piping"). The techniques used to revegetate the area have worked very well. Originally, the intent was to create habitat suitable for nesting immediately adjacent to the constructed ponds. Although the pond borders have not received nesting use, project staff came to realize that that is not a critical element to success because ample nest sites are available in the many acres of undisturbed natural vegetation immediately adjacent to the ponds. A wide variety of waterbirds have been observed to use the enhanced project area, and the success of the entire project may still be regained if all pond spillways are corrected and maintained to contain the runoff. Overall, the project has been very worthwhile. The careful documentation of the project also makes it valuable to others interested in waterfowl habitat enhancement in interior Alaska.

This aquatic habitat enhancement project is also significant in that it represents a voluntary partnership of public and private resources. The Ducks Unlimited funds were provided through their Matching Aid to Restore State's Habitat (MARSH) program. This is the first cooperative MARSH project between the ADF&G and DU.

FOR FURTHER INFORMATION:

Report(s):

Authors: Campbell, Bruce H.; Rosenberg, Daniel H.; Rothe, Thomas C.
Publication Date: July 1988
Title: Creamer's Field Waterfowl Nesting Project. (A chapter in the Federal Aid in Wildlife Restoration, Annual Report of Survey-Inventory Activities for Waterfowl, published annually by ADF&G).

Contact Persons: Dan Rosenberg, ADF&G Division of Wildlife Conservation, Anchorage, 267-2453. Herb Melchior and Audrey Magoun, ADF&G Division of Wildlife Conservation, Fairbanks, 456-5156. Robert McLean, ADF&G Habitat and Restoration Division, Fairbanks, 451-6192.

Other Information Sources: Dan Rosenberg, ADF&G, Div. of Wildlife Conservation, has files, slides, and video records of the project. The ADF&G staff in Fairbanks have numerous observations over the years. The site was surveyed for this case study on 9/10/93 by Herb Melchior and Betsy Parry, ADF&G. Much of the narrative comes from the above referenced ADF&G report (1988).

3. Trapper Creek Step Pools

SHORT DESCRIPTION: Step pools for fish passage through culverts on 4 streams along Parks Hwy.

Responsible Organization: ADOT/PF
Organization Based In: Anchorage
Agency Permit #: FG 89-II-0514, 89-II-0515, 89-II-0516, 89-II-0517 (+renewals 90-II-0367 & -0368)
Year Work Began: 1990 - Year Ended: 1990
Status: Completed/Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Trapper Creek & 3 unnamed creeks
Nearest Town: Trapper Creek
Topographic Map Quad: Talkeetna B-1 & C-1
Anadromous Stream #: 247-41-10200-2341 (Trapper Creek) & unnamed streams #247-41-10200-2381-3007-4017 (MP120), -4029 (MP121), &-10200-2381-3060 (MP126).
Location Description: 4 crossings between Mile 116 and Mile 126 on the George Parks Highway.
Site Impressions of Habitat Type: First and second order mountain streams
Project Size: Approx. 250 ft of each creek
Map: Diagrams available from ADOT/PF

OVERALL GOAL(S) OF PROJECT:

To allow fish passage through perched culverts on 4 streams by building weir step pools below the culverts.

OBJECTIVES:

1. On Trapper Creek itself, to provide fish passage for adult chinook and coho salmon.

2. At the other three unnamed streams, to provide passage for upmigrating coho fry.

3. To provide stream gradient structures that could withstand high water flows and function satisfactorily for 5-10 years.

IMPLEMENTATION INVOLVED:

1. All creeks were flumed during installation.

2. Some excavation was conducted for geotextile placement and fish channel contours.

3. Geotextile fabric was laid down, with a layer of Class II rip rap placed on top.

4. At Trapper Creek itself, larger riprap (Class III) was used to form three rock weirs below the culvert, separated by 10 foot wide pools. The elevation drop between weirs was 0.8 feet. The rock placed on the upstream side formed a 1.5-to-1 slope on the approach to the weir. A fabric lining was used to prevent scour around the weirs.

5. At the other sites, 2-3 cottonwood logs were placed all the way across the streams horizontal to the flow to form weirs at 10 ft. intervals (Figure 4). The logs were embedded into the stream banks approximately 10 feet into either side. The logs were notched in a staggered fashion so that the spill zone for each log was not in a direct line with the one above or below it. A geotextile lining and rip rap was placed on the upstream side of each log, to prevent the flowing water from undermining the logs. The geotextile fabric was attached to the front of the log surface with wooden battens. The elevation drop between log weirs was 0.8 feet, the same as for the rock weirs.

ESTIMATED COST:

To ADOT/PF, the culvert retrofits (estimated at $50,000) was much more attractive than $1,000,000 to replace all the culverts.

JUDGEMENT OF SUCCESS:

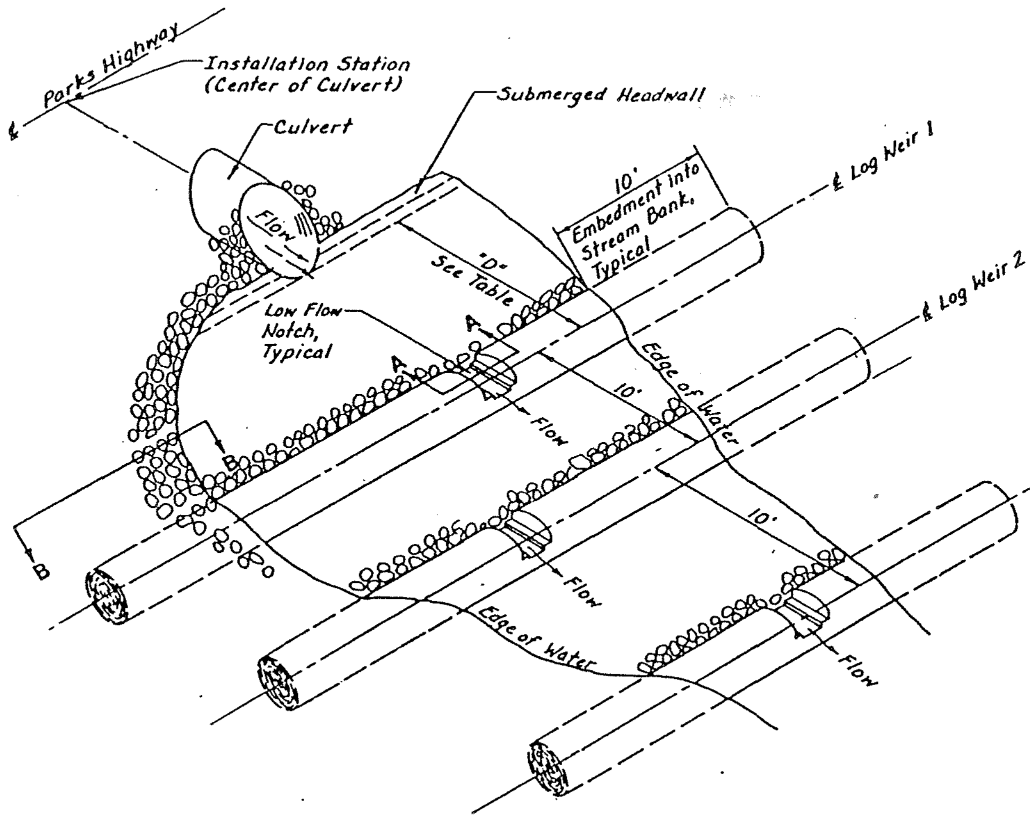
1. Trapper Creek—Adult Passage (Chinook & Coho). Water velocity appeared too high for fry movement upstream but passable for adults. The culvert outlet is still a bit perched (less than one foot), when observed at medium-high flows on Sept. 22, 1993. Good coho rearing habitat was noted upstream of the highway crossing (beaver ponds, etc.). Robert "Mac" McLean observed this project at low flow (9/19/91). The average vertical drop between step pools was approximately 3 to 4 inches, which is clearly passable to fish. His only concern was that at even lower flow levels, there may be an insufficient amount of water backed up to the perched culvert, but this does not appear to have been a problem so far. He observed two adult chums at one spawning redd just upstream of the culvert at Trapper Creek.

2. Other Creeks—Passage for Coho Fry. Only two out of three of these log structures were observed in Sept. 1993 (at Mile 120 and 121). These were much slower moving, smaller creeks than Trapper Creek, with nice pools between the weirs (Plate 6). The culvert outlets are bedded much lower in the stream than at Trapper Creek—ADOT/PF reports there is no perching there even at low flows. The staggering of the position of notch openings in the logs helps to decrease the velocity of the water (Plate 7).

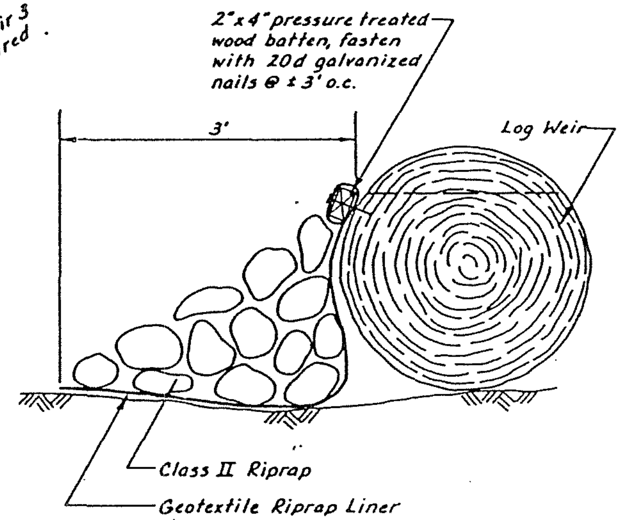
   At high flows (e.g., in spring), passage would not be a problem; fry may move along the rocky edges of the creek around the weirs. However, the final weir drops may pose a problem during lower flows at two of the locations. On 9/19/91 (low flow), Mac McLean observed the following vertical drops in water levels between log weirs (top to bottom): at MP 120 (Sta. 1157+65), 8 inches, 5 inches, and 1 foot 4 inches (Plate 8); at MP 121 (Sta. 1198+00), 6 inches and 1 foot 3 inches; at MP 126 (Sta. 1461+73): 1 foot, 6 inches, and 7 inches. The elevation drop (over a foot) at the final weir at both MP 120 and 121 is considered excessive for the passage of juvenile coho. Optimally, another weir or riprap backwater structure should have been included to provide approximately 6 to 8 inches of additional backwater below the lowest weir at both those locations. However, fry are able to travel upstream much of the time.

   Three adult coho salmon were observed in the step pools (MP 121) in late Sept., 1993. Mac McLean reported seeing 10 adult chum salmon in the northernmost of these crossings (MP 126) on 9/19/91. He also observed one smaller fish (100-120mm) which may have been a juvenile coho salmon ascending through the lowest log weir notch at that location.

3. Ability of Structures to Hold Up Over Time. At the Trapper Creek crossing, the water has breached a side bank just below the weirs, exposing some riprap and geotextile fabric, and forming a side slough below. One of the other creeks contained a beaver debris blockage at the culvert inlet—no fry passage is possible there at present. Some grasses are starting to fill in and grow up between rocks along the stream banks, but there is not much regrowth of willows, alders or other woody stemmed vegetation as of yet. The highway embankment has also been slow to revegetate. However, regrowth has begun and will increase over time.



OBLIQUE VIEW OF TYPICAL LOG WEIR STEP POOL



RIPRAP LINER DETAIL

LOG WEIR NOTES:

1. Log weirs are to be constructed from 2 foot diameter (minimum) limbed cottonwood logs.
2. Logs for weirs shall be embedded 10 foot horizontally into the stream bank for anchorage.
3. Logs shall be installed perpendicular to the direction of flow of the stream, which does not necessarily have the same bearing as the centerline of the culvert.
4. Riprap shown at Section B-B begins at the culvert headwall, on each side of the stream, and ends 5 feet downstream of the last log weir.

Figure 4. Construction diagrams of the log weir step pool structures installed by ADOT/PF on three unnamed creeks between Mile 118 and Mile 122 of the Parks Highway. Source: ADOT/PF

In 1992, Mac noticed lateral erosion around the log weirs (particularly at the Mile 126 structure). What generally happens in these structures is that a certain amount of bedload will drop out of the stream as it moves through the slower flowing pools, making the pools shallower. The width-to-depth ratio then increases, causing water to scour laterally around the ends of the logs, eventually washing out the weirs. Mac estimates these log structures may have to be replaced every 5-6 years, while ADOT/PF was expecting once every 5-10 years.

LESSONS LEARNED:

As of this point in time, these perched culvert retrofits have worked very well. Opinions differ about how this type of project should be approached in the future. Because of continued concerns about lateral scour possibly undermining the logs, Mac McLean would recommend considering vortex rock weirs with armored sides rather than logs. Vortex rock weirs have the advantage of allowing the bedload to pass freely, but still function as a gradient control structure and backwater the culvert outlet. Few of these structures have been installed in Alaska for this purpose to date. However, ADOT/PF feels that such structures would not work for all types of flow and floodplain configurations at culvert outlets. They also believe that lining the project with a separation geotextile (as was done here) should prevent undermining the logs.

In all applications, routine maintenance of instream structures is critical to success. In the case of the current log weirs, periodically removing some of the deposited bedload from the step pools might prove satisfactory.

SIGNIFICANCE OF PROJECT:

The Parks Highway project is the only example of this method of retrofitting culverts for fish passage that ADOT/PF has done to date. Although these are not permanent structures, and the logs will have to be maintained or periodically replaced, they are still a more economical solution than complete highway excavation and culvert replacement. The techniques used here were derived from USFS methods that have been used successfully in Oregon and Washington.

FOR FURTHER INFORMATION:

Report(s): None at present. Mac McLean has been compiling data on several methods of perched culvert retrofits that have been employed in Alaska. Someday he hopes to turn that information into an ADF&G technical report, but no date has been set.

Contact Persons: Carol Sanner, ADOT/PF, Anchorage, 266-1509. (Frank Lombardo, ADOT/PF, did the technical design). Robert "Mac" McLean (ADF&G, Fairbanks) has conducted preliminary measurements regarding fish passage ability through the culverts and step pools.

Other Information Sources: Carol Sanner, ADOT/PF, Anchorage, provided diagrams and background information. She has photo files. Mac McLean (ADF&G, Fairbanks) and Dennis Gnath (ADF&G, Anchorage) provided additional observations. Site was visited for this report on 9/22/93 with Betsy Parry, Betsy McCracken, and Dennis Gnath (all ADF&G) in attendance. ADF&G photo logs: P703, P706, P912.

4. North Eagle River Interchange

SHORT DESCRIPTION: Involved new channels and pond for coho and grayling at Carrol and Fire Creeks.

Responsible Organization: ADOT/PF
Organization Based In: Anchorage
Agency Permit #: FG 90-II-0089 and FG 88-II-0267
Year Work Began: 1991 - Year Ended: 1992
Status: Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Fire Creek and Carrol Creek
Nearest Town: Eagle River
Topographic Map Quad: Anchorage B-7
Anadromous Stream #: 247-50-10150 (& -2024)
Location Description: At the interchange of the Glenn Highway and the North Eagle River exit.
Site Impressions of Habitat Type: Post-construction, two small creeks in neatly confined channels without much overhanging debris, except in the natural channel of Carrol Creek just above the pond; very long culverted creek sections under portions of the interchange; and a 1/3 acre silt-bottomed pond with shallow edges, a deeper center, and three deadfalls extending from the shore into the pond (Figure 5).
Project Size: A total of 3 acres
Maps: From ADOT/PF permit files, diagrams & specifications

OVERALL GOAL(S) OF PROJECT:

To ensure fish passage on 2 creeks affected by the new highway interchange (Figure 5).

OBJECTIVES:

1. Ensuring fish passage on both creeks by using small V-notch rock weirs and random boulder placement to accommodate the gradient change between culverts, rendering the drop into smaller, "passable" increments.

2. Stabilizing the channel banks and road embankments with grass & wildflower seed mixes and/or willow sprigs.

3. Converting the sediment pond on Carrol Creek (created during construction), into viable fish and waterfowl habitat in the aftermath of the project. The pond design incorporated contouring elements appropriate for fish habitat and for later plant establishment. The objective was to provide summer and overwintering fish habitat in the pond.

IMPLEMENTATION INVOLVED:

1. Rock weirs were installed in stretches of open stream between culverts. Geotextile fabric was placed under rocks to prevent water from scouring and undermining them. The largest gradient drop occurs on Fire Creek between culverts on the north side of the project. At this location, the stream route was expanded into a loop to accommodate the gradient drop within the space available, using six or more rock weirs in succession. Stream channel banks were stabilized with seeded grasses and occasional rock. Willow sprigs were planted in certain streambank locations.

2. The pond was constructed with 6:1 sloped sides at the edges progressing to a 2:1 slope at bottom center (dredged material was used to contour banks); the deepest part in center is 10 feet deep.

3. The plans indicate that willow sprigs were planted in the 25 feet cleared zone above the pond perimeter (also with 6:1 sloped bank). Both dormant and rooted willow cuttings were used, spaced approximately 4 feet apart. Willow cuttings (8-10" long, 1/4 - 3/4" diameter) were installed with 3/4 of the cutting below the surface. Willow was intended to serve as moose browse as well as pond cover. Willows were planted in fall of 1990, then again in spring 1991.

4. Three fallen spruce trees (8-12" diameter) were placed extending into pond. Their root wads were placed on the shoreline, with branches extending into water, to serve as large woody cover for fish.

5. The entire pond perimeter area was hand-seeded with mixture of grasses, clover and various wildflowers (Arctic poppies, Nemophila, daisies, etc.), and fertilized.

ESTIMATED COST:

ADOT/PF could not provide figures that would reflect only the habitat components of this highway construction project.

JUDGEMENT OF SUCCESS:

1. Fish Passage. The realigned reaches of Carrol Creek between the culverted sections look very well done. These open stretches of creek have cobble/gravel bottoms, natural meanders, and rock weirs placed at intervals to accommodate the gradient drop. This design looks appropriate for fish passage.

   However, there is a concern with fish passage on Fire Creek, both due to the extremely long culverted section (approximately 479 ft. in one stretch) and the "loop" configuration in the short spanse between the northern culverts (i.e., between the highway and the frontage road). The series of rock drop structures in the loop may be too close together, without sufficient resting space between them to allow passage, particularly of juvenile coho (Plate 9). Fish trapping conducted two years post-construction (in late September, 1993) above the project on Fire Creek revealed only two-year old coho and chinook salmon—no adults, no young-of-the-year, and no one-year olds (based on ADF&G age-length data). It is possible that all the salmon found above the project in 1993 could be remaining there from before construction, which does not demonstrate the ability of fish to pass in the newly constructed channels. Nothing can be concluded from this 1993 trapping alone. If there is a blockage to fish ascending Fire Creek through the interchange, repeated trappings in successive years would show the disappearance of young coho and chinook in the upstream rearing habitat. Additional trapping and/or electroshocking in the spring and fall next year (1994) is recommended to determine the extent of fish passage.

2. Stabilization/Revegetation techniques. The stabilization techniques used on the steep interpass embankments and creek borders appears to have been very successful at holding down the soil, establishing a vegetative cover, and preventing erosion. Grass and wildflower seed mixes were very successful. There is some confusion as to how closely the woody material installation followed the plans (see table of information on Figure 5). Apparently many of the willow cuttings around the pond died, possibly due to poor timing of cutting or planting (the first round was planted in fall instead of spring), placement with roots too far above water table, moose browsing, or competition with the quick-growing grasses seeded there. Only a handful of willows were observed around the pond, although the plans indicated 655 cuttings would be installed there. ADOT/PF reports that moose heavily browsed the planted willows in this area. Quite a few willow cuttings (20-30) were observed to be doing well on a portion of Carrol Creek (between the "A2" ramp and the highway, Plate 10). The hundreds of other tree seedlings indicated on the specification diagrams (spruce, larch, birch and pine) were not observed on location. Additional plantings and growth of overhanging vegetation would provide necessary cover to pools and resting areas. Specifically, the pool

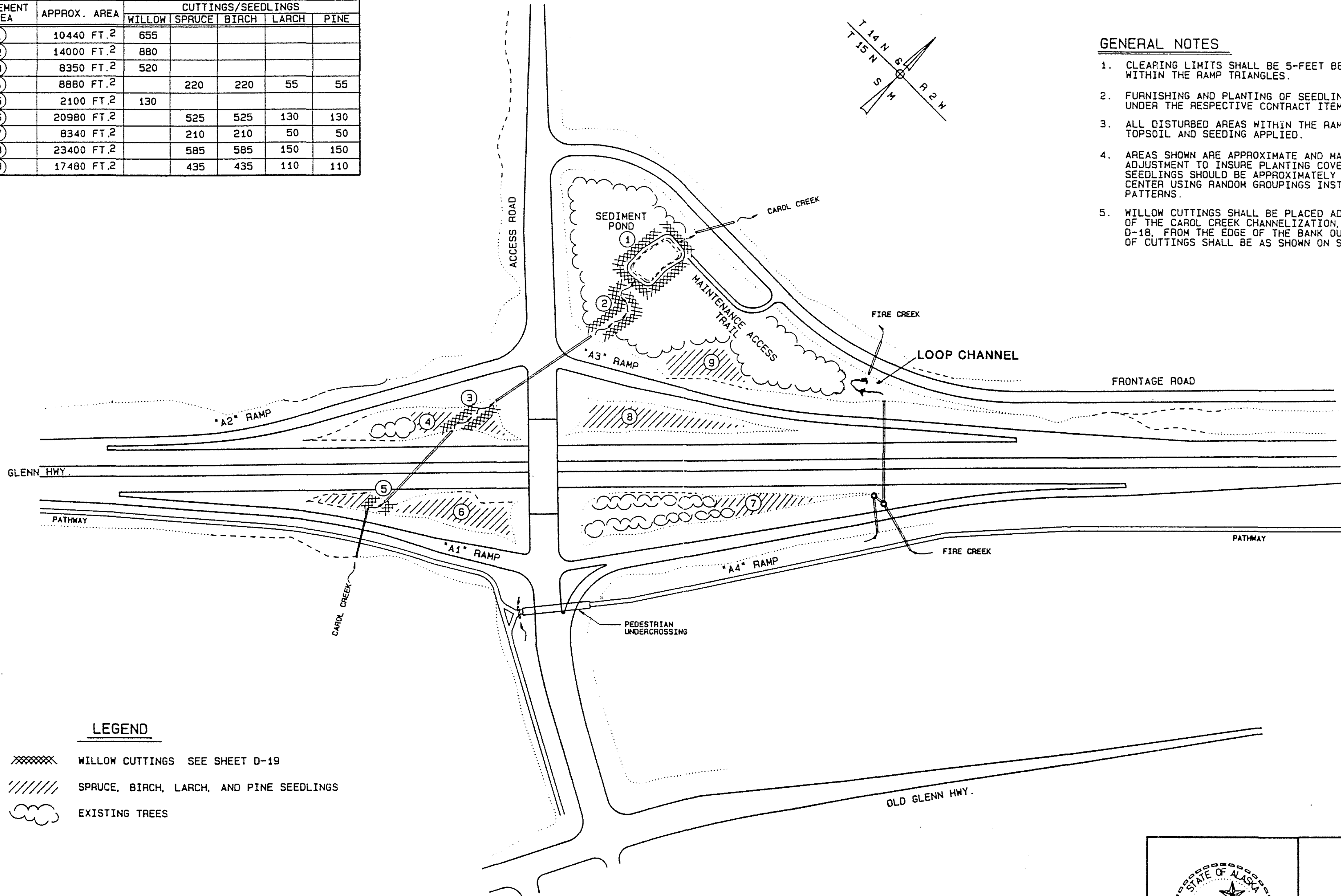
REVISIONS			STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
No.	DATE	DESCRIPTION	ALASKA	I-F-0A1-6 (4)	1990	D-25	129

SUMMARY

PLACEMENT AREA	APPROX. AREA	CUTTINGS/SEEDLINGS				
		WILLOW	SPRUCE	BIRCH	LARCH	PINE
1	10440 FT.^{2}	655				
2	14000 FT.^{2}	880				
3	8350 FT.^{2}	520				
4	8880 FT.^{2}		220	220	55	55
5	2100 FT.^{2}	130				
6	20980 FT.^{2}		525	525	130	130
7	8340 FT.^{2}		210	210	50	50
8	23400 FT.^{2}		585	585	150	150
9	17480 FT.^{2}		435	435	110	110

GENERAL NOTES

1. CLEARING LIMITS SHALL BE 5-FEET BEYOND THE SLOPE STAKES WITHIN THE RAMP TRIANGLES.
2. FURNISHING AND PLANTING OF SEEDLINGS SHALL BE PAID FOR UNDER THE RESPECTIVE CONTRACT ITEMS FOR EACH SEEDLING.
3. ALL DISTURBED AREAS WITHIN THE RAMP TRIANGLES SHALL HAVE TOPSOIL AND SEEDING APPLIED.
4. AREAS SHOWN ARE APPROXIMATE AND MAY REQUIRE FIELD ADJUSTMENT TO INSURE PLANTING COVERAGE. SPACING OF SEEDLINGS SHOULD BE APPROXIMATELY 4-FEET CENTER TO CENTER USING RANDOM GROUPINGS INSTEAD OF EVEN GEOMETRIC PATTERNS.
5. WILLOW CUTTINGS SHALL BE PLACED ADJACENT TO THE BANKS OF THE CAROL CREEK CHANNELIZATION, SHOWN ON SHEET D-17 & D-18, FROM THE EDGE OF THE BANK OUT 25-FEET. PLACEMENT OF CUTTINGS SHALL BE AS SHOWN ON SHEET D-19.



STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

NORTH EAGLE RIVER INTERCHANGE

SEEDLING PLAN

Figure 5. North Eagle River highway interchange, showing the realigned routes of Carol Creek and Fire Creek. Diagram adapted from ADOT/PF's preliminary seedling plan, included here to depict overall project.

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above "the Loop" on Fire Creek, Carrol Creek between "A1" ramp and the Glenn Hwy and Carrol Creek between "A2" ramp and the Glenn Hwy would benefit from more cover.

3. Sediment Pond as Fish Habitat. The slopes above the pond have revegetated very well with the seed mixtures (Plate 11). Grass & clover are well established with daisies and rose bushes noted as well. The shallow water at the pond margins and the silty bottom should promote good growth of aquatic emergent vegetation and efficient nutrient distribution, leading to greater food availability for fish. Due to the pond's shallow contour and water transparency additional trees and woody plants around the perimeter would enhance the cover, increase the food supply and help minimize extreme summer water temperatures. Several fish species are already using the pond in summer and fall (juvenile coho and chinook salmon, resident Dolly Varden, and the grayling and rainbow trout stocked higher in the watershed at Fire Lake). Fish were more prevalent in the areas where large woody cover had been introduced (i.e., the downed spruce trees). The pond's success as overwintering habitat for fish is still unknown. ADOT/PF intends to take some measurements at the pond this winter (dissolved oxygen, etc.) to determine its overwintering potential. Overall, the pond design appears to have been very successful.

4. Recreational Use. The area around the replanted sedimentation pond has been a big success aesthetically (Plate 11). Although not originally conceived as a recreational site, the location has proven to be very attractive and accessible for people to stop and picnic, camp or fish. In spring and fall, geese and ducks stop to feed at the pond. People fish at the pond, probably for the grayling and rainbow trout that are stocked at Fire Lake and migrate down the watershed.

LESSONS LEARNED:

From this experience, ADOT/PF feels that the installation of willow sprigs was expensive for the minimal return, and should not be regularly used. However, it has not been established what exactly went wrong in this case. Willow cuttings have been used very successfully in other locations. ADOT/PF feels grass alone accomplished erosion control, but in the future they may try willow bundles instead of cuttings.

The sediment pond design appears successful. It was a good decision to route the creek through existing "natural" channel leading to the pond rather than to construct a new channel as was in the original plan—the natural channel contains much overhanging vegetation, and can hardly be seen.

It is unfortunate that space limitations restricted the ability to include resting pools or side pockets in the Fire Creek "loop" section, because that may have compromised the ultimate goal of fish passage.

More attention needs to be paid to woody revegetation plans. The tree seedling plans, for instance, need to be more realistic to begin with, and adhered to at the site. The hundreds of five species of seedings listed in the plans (on Figure 5) seems very ambitious for the site, and does not appear to have been followed.

SIGNIFICANCE OF PROJECT:

The small rock weirs represent a novel approach for ADOT/PF, and were based on designs from Bill Hauser of ADF&G's Commercial Fisheries Management & Rehabilitation Division. The pond design was also approached with careful thought towards fish habitat features (contouring, woody debris). ADOT/PF is pleased that it is one of the most aesthetically successful projects they have done. The project was very successful in other ways as well, unless future samplings demonstrate that Fire Creek is still not passable to fish going upstream.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Carol Sanner, ADOT/PF, Anchorage, 266-1509. (Al Brooks was the designer at ADOT/PF).

Other Information Sources: Carol Sanner (ADOT/PF, Anchorage) has photo records and design plans. Site was visited September 23, 27, and 28 by Betsy McCracken and Betsy Parry (both ADF&G). Ed Weiss (ADF&G) assisted with fry trap evaluations on 9/28/93.

5. Coastal Trail Mitigation Project

SHORT DESCRIPTION: Water impounded to create intertidal waterfowl pond as mitigation for wetland fill for Coastal Trail construction near Nulbay Park.

Responsible Organization: Municipality of Anchorage (MOA)
Organization Based In: Anchorage
Agency Permit #: COE 840121 - Cook Inlet 317; also some discussion in Knik Arm 60.
Year Work Began: 1988 - Year Ended: 1991
Status: Completed

LOCATION

Waterbody: Cook Inlet Tide Flats
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: Not Applicable (not fresh water)
Location Description: Western (inlet) side of Tony Knowles Coastal Trail. Mitigation pond is south of Elderberry Park and west of Nulbay Park.
Site Impressions of Habitat Type: Mostly bare dirt berm impounding water on upper tidal mudflats.
Project Size: 500' long oblong area, below Coastal Trail & Railroad
Maps: In Army Corps Permit Application.

OVERALL GOAL(S) OF PROJECT:

To create an intertidal wetland (brackish water area) for waterbird use as mitigation for fill in a nearby intertidal wetland during construction of Anchorage's Coastal Trail. It was recognized that this would be an experimental application of the method used.

OBJECTIVES:

1. Construct a mitigation pond by building a berm on the tideflats that would trap and retain fresh water from an existing storm drain culvert which ran down the coastal bluff from a city snow dump (near Nulbay Park), and allow salt water penetration as well.

2. Armor and protect the berm and impoundment against damage from tides and ice scour.

3. Revegetate the new berm areas.

4. Ultimately, increase waterfowl use and productivity of the area.

IMPLEMENTATION INVOLVED:

The following lays out the implementation steps, as put forward in the 1987 mitigation proposal:

1. <u>Berm</u>: The earth berm was intended to create ponded areas for bird habitat between the Anchorage Coastal Trail and Cook Inlet. The berm was constructed of Type II fill, covered with a minimum of 18" of onsite mud. The banks of the berm were sloped 4:1. The seaward slope was to be armored with riprap. The top of the berm was set high enough in elevation to prevent overtopping by all but the highest tides. The bottom of the pond was set 2.5- 3.5 feet below the berm height. The berm was irregularly shaped, to form an oblong pond of approximately 1 acre.

2. Water Inflow: The water source was an existing stormwater culvert running down the coastal bluff. A concrete weir was proposed to control freshwater inflow into the pond, so that at high flows some of the water would be diverted over the mudflats instead of all going into the pond. The concrete weir was also intended to function as a sediment trap.

3. Outflow: The pond's outlet culvert was designed to allow some salt water intrusion into the pond area for tides above 12.5 ft. elevation (MOA datum). The berm would prevent total inundation by salt water unless the tide was high enough to overtop the berm, at 14.5 ft elevation. Water in the pond would be maintained at a minimum depth of 6" and a maximum of 18".

4. Revegetation: The berm was to be seeded with Bering hair grass and red fescue grass. Rooted willow cuttings and plugs of beach wild rye grass would be planted to stabilize the mud soil on the berms.

However, most of these actions were not accomplished as planned in 1987. In a September 28, 1990, letter from the U.S. Fish and Wildlife Service, it was brought to the attention of the Army Corps of Engineers that the mitigation project had never been completed or maintained. The berm had not been vegetated nor adequately riprapped. Consequently, the berm had eroded and the outlet culverts had washed out and were lying on top of the mudflats. Also, the connection to the freshwater supply from the existing stormwater culvert (east of the coastal trail) had never been completed, so freshwater had never been discharged into the pond as planned.

Since this mitigation project below Nulbay Park was required as part of a Corps permit (Cook Inlet 317), the Corps required the Municipality to correct the deficiencies. The following needs were identified in order to finish the original plan and/or rectify problems that had arisen[1]):

- The berm had to be rebuilt where eroded. Riprap was necessary on all unprotected slopes to retard ice scour and wave erosion.

- The hookup from the stormwater culvert to the weir structure had to be completed to direct freshwater into the impoundment area.

- The outlet culvert from the pond needed a flap gate mechanism to impede the entrance of silt-laden tidal waters.

- All areas of the impoundment berm not protected by riprap were required to be revegetated with salt-tolerant species (to be determined in consultation with the Alaska Plant Materials Center in Palmer).

- The entire berm and side slopes would be fertilized with 20-20-10 fertilizer at seeding time to promote establishment of the vegetation.

The Corps of Engineers required the Municipality of Anchorage to complete these deficient work items. Consequently, in 1991 the stormwater hook up was completed, the culvert that had served as the pond's outlet was replaced by a riprapped ditch (a low spot in the berm) to allow proper intrusion/discharge of salt water, and the remainder of the berm was armored against ice scour with riprap.

In 1992, the Alaska Plant Materials Center (PMC) staff made an unsuccessful attempt at replanting the berm. Approximately 850 sprigs of beach wild rye were planted in June, 1992, and the entire area was

[1]These needs were listed in a January 24, 1989 letter from DGC to the Port of Anchorage as mitigation possibilities in conjunction with the Corps permit that was under discussion at that time, Knik Arm 60. However, another mitigation option was ultimately pursued (at Business Park wetlands) for Knik Arm 60.

fertilized and seeded with hairgrass and sloughgrass (*Beckmannia syzigache*). A few of the transplanted sprigs of beach wild rye grass survived, but very few of the grass seeds came up. At the behest of the MOA Parks and Recreation Dept., another attempt was made in 1993, using additional fertilizer, more sprigs of beach wild rye, and two-year old seedlings of a salt tolerant plantain (*Plantago* sp.) supplied by the PMC. The plantain seedlings were concentrated in the softer, moister portions of the berm along the waterline and in among the edges of riprap.

Estimated Cost, if available: $90,000 includes all excavation, piping, riprap, plant materials, and supervision.

JUDGEMENT OF SUCCESS:

1. Wetland Impoundment. During a site visit in August, 1993, the water impoundment appeared to be functioning as planned (Plate 12). The pond was filled with brackish water, the primary source being the stormwater culvert from 7th Avenue. However, the pond was deeper than planned. Instead of the 6" to 18" target depth, the water appeared approximately 2 to 5 feet deep. The reasons for this difference may include improper excavation of the pond or the performance of the new type of outflow feature (a reinforced "low point in the berm" substituting for the original outlet culvert, which had previously washed out). The depth of the water greatly affects the value of the pond for waterfowl use. Also, the slopes of the pond appeared steeper than ideal for dabbling ducks. A more gradual bank slope would allow emergent vegetation to take hold. Almost no emergent or aquatic vegetation was observed.

2. Structural soundness. The berm and armoring appear to be holding up against tides and ice. However, the uppermost, unarmored portions of the berm are not protected by vegetation; it is mostly exposed mud/dirt. These areas are subject to erosion damage by tides every time the berm is overtopped by a high tide, which happens perhaps four times a year. By 1992, this erosion had caused a breach in the north end of the berm. Much more vegetation (fireweed, beach wild rye) is present on the embankment on the Coastal Trail side of the impoundment than on the exterior berm (Plate 12).

3. Revegetation. Both revegetation efforts have not been very successful. Factors may include: the poor quality and fertility of the substrate, the grazing of the ducks on the planted grass seeds and seedlings, or even the impact of a great concentration of duck droppings on the young plants at certain times of the year. Probably the greatest detriment to the revegetation efforts, however, has been the compacted condition of the berm soil. People have been observed to walk out on the berm, sun themselves, have picnics, set off fireworks, etc. This unanticipated foot traffic, along with the possible deposition of heavy chunks of ice by tidal action, has greatly compacted the silty/clayey soil on the berm surface. Beach wild rye and plantain do not thrive in compacted soils.

   In August 1993, sparsely scattered tufts of beach wild rye grass were observed on the sides of the berm, but the unarmored upper portions of the berm remain largely bare mud/dirt. The few mature plants of beach wild rye will probably continue to grow, but their lateral expansion by rhizomes may be hampered by the compaction of the surrounding soils. Not many plantain seedlings have survived, perhaps persisting only along the waterline. The Municipality has installed signs and snow fencing to try to discourage foot traffic from straying off the Coastal Trail in this area.

   A bit of scattered rush (*Scirpus* sp.) appears at the pond's water line but the bank drops off quickly, limiting the amount of littoral zone and preventing much emergent or submergent vegetation from establishing.

   If the area was intended to be used as a nesting area for waterfowl, a great deal of vegetational cover would be required. Ducks currently use the area primarily for "loafing", for which open views are preferred (rather than thick vegetation).

4. Bird Use. The project area regularly receives a certain amount of bird use, and serves as a high ground refuge during high tide. However, during a site visit at low tide in late August, over 300 ducks were sunning themselves on the relatively bare berm (Plate 12). Bird species observed were predominantly mallards, with up to 25% American wigeons and a few teal and northern pintails. Green-winged teal were more numerous out on the mudflats beyond the project site. A few pieces of driftwood have washed in at high tide and are now floating in the pond. These logs are popular resting spots for ducks.

As loafing habitat, the mitigation project area is an unqualified success. Ducks are attracted because they feed on the nearby mudflats, mostly while the tide is receding. Between tides the ducks wait or "loaf" on the pond berms, biding their time resting or preening. Only occasionally do the birds enter the pond water; most remain up on the berm or on the logs extending out of the water. Waterfowl biologists report that for loafing areas, ducks prefer dryer locations (such as a slightly higher point of ground), without much vegetation to obstruct the view of their surroundings. The berm above the mudflats at the Coastal Trail mitigation site easily meets these requirements. This piece of higher ground (providing loafing habitat) is relatively rare along this portion of the coastline, other than the highly trafficked and paved Coastal Trail. The pond and berm receive peak use during migration, as when observed in late August.

Observers report that shorebirds also use the area as loafing habitat during their peak migration period in June. Shorebirds also feed at the pond's outlet, which may resemble a mini-estuary.

As nesting habitat, the area has not been successful. However, nesting use was not specifically listed as the project's intent. If nesting had been the desired outcome, the amount of vegetational cover would have been the major concern. For nesting use, it would have been better to include more littoral zone at the pond edge (to encourage emergent and aquatic vegetation), and to explore other options for promoting vegetational growth on the berms (e.g., rectifying the soil compaction, and/or adding more topsoil to make the substrate more conducive to plant growth.). Also the amount of human and pet disturbance from the adjacent coastal trail made this an unlikely location to be successfully utilized as nesting habitat. Waterfowl are more tolerant of disturbance in resting or loafing areas than in nesting areas.

LESSONS LEARNED:

This project illustrates a common problem with mitigation work—it does not always get completed in a timely manner. Often it requires several years and additional motivation from the Corps of Engineers, and sometimes the mitigation package is never completed at all. If the property ownership changes hands without fulfilling the mitigation requirements, the problem becomes more complicated to resolve. In recent years, the Corps of Engineers has tried to avoid this problem by requiring that any mitigation work take place either beforehand or concurrently with the work authorized by the Corps permit. Still, better provisions are needed to follow through with promised mitigation work.

This project would have been improved by enlarging the area involved. As it was, the result was a small amount (approximately one acre) of brackish water habitat, in a setting totally isolated from anything like it. Proximity to the Coastal Trail has good and bad aspects; it is probably not ideal from the point of view of the waterfowl, but the Municipality may have regarded this as an asset because of the wildlife viewing opportunities created for users of the Coastal Trail.

Since completion, the physical design has been somewhat successful in withstanding ice, tides, etc., but biologically and aesthetically the project has been disappointing. When elevated and dried out, the clay/silt soils of Cook Inlet are very poor for supporting good vegetational cover. Eventually, this area could develop more diverse habitat values as suitable invertebrates and cover establish themselves. Many human observers presently find the mitigation site lacking on an aesthetic basis, appearing as a rather incongruous lump of exposed mud and rock on the vast expanses of tidelands.

Because the area previously contained relatively low habitat values for waterfowl, the brackish water impoundment has at least increased the habitat potential of the area. In its current state, the project is regularly used as a loafing area, receiving significant use at migration times.

SIGNIFICANCE OF PROJECT:

The idea of this project—that is, capturing and retaining stormwater runoff in tidelands to create brackish wetland areas—has potential application to other projects and locations. However, this is one of several projects that demonstrates the difficulty of obtaining significant plant growth on elevated tideflat muds. The concept of using stormwater runoff and wetland areas to complement one another (e.g., integrating the two to achieve EPA stormwater management requirements while augmenting wetland areas) has been explored in other urban situations in the Pacific Northwest states, and is worthy of further consideration.

The problem with enforcement of the mitigation agreement during this project underscores a common frustration with mitigation in general—exactly whose responsibility is it to see that the work is completed as proposed? In this case, several years passed before sufficient pressure was applied on the permit holder to meet their obligations. Following permit requirements through to completion requires a commitment of staff time and funding on the part of the regulatory agencies, which is generally not supported during times of limited financial resources. Perhaps the direction of the Corps in requiring mitigation to be performed before or during the permitted work is a step in the right direction, but this arrangement is not always practical.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Thede Tobish, Planning Dept, Municipality of Anchorage, 343-4222. Stoney Wright and Nancy Moore, Alaska Plant Materials Center, Palmer, 745-4469. Lori Eddie Schanche, Municipality of Anchorage Dept. of Cultural and Recreation Services, Parks and Recreation Division, 343-4335. Jack Ferrise, Army Corps of Engineers, Anchorage, 753-2716.

Other Information Sources: Discussions with Thede Tobish, Stoney Wright, Nancy Moore, and Lori Eddie Schanche, all listed above. Some information derived from the Corps of Engineers and ADF&G files. The actions remaining to be done at the Nulbay site as of January 24, 1989, were listed in DGC's Conclusive Consistency Finding for Knik Arm 60 (as possible mitigation alternatives). The U.S. Fish and Wildlife Service expressed their concerns for the mitigation project in a letter dated September 28, 1990 to the Corps of Engineers. Rick Sinnott (ADF&G, Division of Wildlife Conservation), and Betsy Parry (ADF&G, Habitat and Restoration Division) visited and photographed the site on 8/27/93.

6. Westchester Lagoon Offsite Mitigation

SHORT DESCRIPTION: Fish Creek 6 project (fill in wetlands for a strip mall) led to wetland construction as offsite mitigation.

Responsible Organization: Olympic, Inc. (owned by Zamarello)
Organization Based In: Anchorage
Agency Permit #: Fish Creek 6 (mitigation for)
Year Work Began: 1984 - Year Ended: 1985
Status: Competed

LOCATION/SITE CHARACTERISTICS:

Waterbody: Westchester Lagoon
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-50-10050 Chester Creek
Location Description: The northwest end of Westchester Lagoon, near 13th & U Streets.
Site Impressions of Habitat Type: Lower third of site is primarily emergent wetlands; uplands above.
Project Size: The entire property measures approximately 1/2 acre; the created wetland area covers the lower third (approximately 6,000 sq. ft.) of the site.
Maps: An as-built diagram sketched over blue line aerial photo. No scale, and somewhat hard to read.

OVERALL GOAL(S) OF PROJECT:

To create a wetland suitable for waterfowl use on a disturbed upland site near Westchester Lagoon. This created wetland served as the offsite mitigation component for a permit to fill several acres of emergent wetland in the Fish Creek wetlands near the intersection of Lake Otis & Tudor Road.

OBJECTIVES:

1. To create 20,000 square feet of wetland habitat suitable for waterfowl (of variable depths including open water, cattails, and emergents), and enhance adjacent upland habitat.

2. Encourage waterfowl nesting by creating nesting islands surrounded by open water and emergent wetlands.

3. Hydrologically connect the created wetland with ones nearby via a culvert or breach.

4. Screen the wetland from disturbance (and attract passerine birds) by landscaping the adjacent uplands and berms. Also, construct barriers or berms to isolate the created habitat from vehicular traffic .

Note: The mitigation for Fish Creek 6 also involved on-site mitigation requirements, but this case study is limited to the off-site wetland project at the Westchester Lagoon location only.

IMPLEMENTATION INVOLVED:

1. The previously disturbed area contained a parking area, a dirt road and an Anchorage Water and Wastewater Utility (AWWU) lift station. The first step was to remove all structures and excavate the remaining material to create a continuous gentle slope across the length of the site (approximately 6:1). The lowest end of the property (nearest the lagoon) was excavated and some light filling occurred at the opposite (uphill) end of the property in order to achieve the grade. This shallow slope was intended to allow water levels to vary over different seasons.

2. Nesting islands consisted of areas of minimal excavation left above water level. Areas designed to encourage growth of emergents were intended to have at least six inches of standing water, and the open water areas targeted a depth of at least two feet.

3. A 24" level culvert under the old maintenance road was used to connect the open water areas to an already existing series of ponds and outlets to Westchester Lagoon.

4. Permit stipulations called for a five foot berm to be constructed at the uphill end of the project to block traffic from the residential cul-de-sac (end of W. 13th Avenue). A barricade consisting of boulders 3 to 4 feet in diameter was also supposed to be constructed near the coastal trail at the lower west end of the project. These structures were intended to block vehicular traffic from the new wetland area.

5. Aquatic vegetation (e.g., sedges) was not planted, but was expected to colonize from adjacent areas. All berms were to be shaped and scarified to encourage revegetation. Landscaping plans called for seeding on the berms, and planting of white spruce, birch and willow trees on the berms and upland areas. These trees were never installed.

6. As part of their mitigation package, Olympic, Inc. agreed to prepare an engineered master plan for another potential off-site mitigation site west of Westchester Lagoon. This master plan would describe methods by which future developers could construct off-site wetland mitigation activities in the vicinity. Olympic was to include a detailed design with plan and cross sectional views, elevations and culvert locations in the plan. These mitigation components were negotiated with the Municipality and resource agencies, who had responded to the Corps notice of a fill permit application for the Fish Creek wetlands.

7. The Corps stipulated in the permit that Olympic, Inc. would be required to post a $20,000 bond to insure that the off-site mitigation plan would be carried out in accordance with specifications.

ESTIMATED COST:

Although originally estimated at $20,000, the mitigation wound up costing 2-3 times that amount (approx. $50,000) due to difficulties in removing the structures and transporting out materials.

JUDGEMENT OF SUCCESS:

1. Physical Parameters. The original applicant had proposed to create a wetland area of 20,000 sq. ft. (approx. 1/2 acre), but that appears to be the size of the entire property unit, not the portion that was excavated as wetland (Plate 13). When inspected, the amount of wetland area was paced off to be approximately 200' long (running uphill) by 30' wide, totalling 6,000 sq. ft., which amounts to 1/3 of the wetland area promised. The exact area of wetland on the site was difficult to determine from a one-time visit, because the original intention had been to create wetlands of variable depths over the season, and the site was inspected at the end of a particularly dry summer (8/27/93). Nevertheless, the amount of wetland area and the water depths appeared much less than intended. Depths varied from 3-4 inches to 12 inches in the deepest spot. The depth directly affects the distribution of water plants and the area's attractiveness to water birds. Two or three islands were observed, which contained more mature, undisturbed vegetation.

   The developer encountered many difficulties in removing and transporting the old structures, which may have been partly responsible for their delays in meeting scheduled tasks. In a letter written to the Corps on July 29, 1985 (the first season), the Municipality of Anchorage states that the berm over the old pump station showed signs of considerable subsidence and exposed rebar, and would require additional stabilization prior to revegetation. (The rebar was subsequently removed.)

   The Municipality also stated they had received numerous complaints about the unrestricted access to the new wetland area. Despite the inclusion of barricaded or bermed access routes in the mitigation stipulations, these barriers had not been installed by the permittee during the first season. The barricade that was to have been installed across the old entrance road became no longer necessary once the Municipality constructed a bridge for the new coastal trail in that area (Plate 14). The Municipality, not the permittee, was also later responsible for blocking access to the site from the residential cul-de-sac above with large rocks.

The water connection to adjacent areas was completed using a level 24" culvert under the old maintenance road, which seems to have achieved the desired result of hydrologically connecting the mitigation wetland with neighboring ponds and outlets to the lagoon.

2. Revegetation. Only minor revegetation efforts were made at the time. The upper berm was hydroseeded with an Alaskan mix, while adjacent areas were hydroseeded with perennial rye grass. Although the plans called for birch, white spruce, and willow trees to be planted alongside the berms, it does not appear these were ever installed. The Municipality of Anchorage specifically complained to the Corps about the lack of revegetation efforts on the disturbed slopes and berms, but it does not appear that Olympic, Inc., contributed any more to the revegetation efforts beyond the grass seeding. None of the proposed trees were observed on site in 1993, only grass. However, in 1988 the Municipality donated some left-over willow bundles and water lilies, which were introduced to the site. The willows have established on one side of the excavated area (the side nearest the coastal trail tunnel), and the tallest trees now reach 10 feet (Plates 13 and 14). In 1993, no surviving water lilies were observed.

Because the site is so close to Westchester Lagoon, natural plant colonization (for emergents, etc.) appears to have succeeded fairly well at revegetating the site after eight years. The lowest end (nearest the coastal trail bridge) contains a stand of cattails, although it is difficult to tell exactly where the boundary for the project area lies (Plate 13). Older "natural" cattail stands in the vicinity contain a great deal of pondweed growing on the water surface, which is a good duck food plant. Although eight mallards were observed at a neighboring cattail pond, the mitigation project's cattails contained no pondweed and no waterfowl.

The lower area of project excavation contained mostly shallow water with some emergent sedges and bullrush (*Scirpus* sp.), interspersed with deeper pockets (observed at one foot depth) of open water (Plate 14). The upper half of the project site possesses fewer wetland characteristics. The central section was intended to be flooded and exposed seasonally, based on the shallow grade of the slope. However, the vegetation on much of the upper half is more typical of uplands—clover, bluejoint grass (*Calamagrostis* sp.), and a number of young cottonwood trees. Therefore, this area does not appear to receive the anticipated amount of inundation.

Two or three islands in the open water contained mature (pre-existing) vegetation, including birch trees. These were left in place during project excavation, as planned.

3. Bird Use. During the site visit in late August, 1993, no ducks or fish were observed to be using the project area, only small wood frogs. However, hundreds of dabbling ducks were present in the adjacent Westchester Lagoon, and eight were observed in another small cattail pond. A wildlife biologist present for the site visit suggested that the project area contains little for the ducks to eat except a few sedges, and the site appeared too small and shallow overall to attract them (at least in the dry 1993 season). The area is probably not used for waterfowl nesting for the same reasons, especially when more attractive nesting habitat is close by. Bird use of the area has been observed during migration. Mallard broods have been observed to use the site, although they likely nested nearby.

4. Timeliness. The original completion date for the offsite mitigation was listed as June 1, 1985 in the permit. The Municipality of Anchorage wrote a letter to the Corps complaining that the offsite mitigation at Westchester Lagoon was either inadequate or completely lacking as of July 29, 1985. At that time, the access barricades had not been constructed, and revegetation efforts on the disturbed slopes and berms were not apparent. The landscaping plans never were implemented, beyond hydroseeding the berms. Hence,

only approximately 90% of this project was completed. The "as-built" diagrams, required in a Corps stipulation, were not submitted until September, 1987 (over two years late), after prodding from the Corps.

Olympic, Inc.'s environmental consultants (Environmental Services, Ltd.) did not recall posting of a $20,000 bond. One of their employees thought that the intent of that stipulation was to ensure that Olympic would do the off-site mitigation, which they felt they had, so they never posted the bond.

5. Master Plan Component. The "master plan" for at least one mitigation site in the vicinity was prepared on time, but not quite as anticipated. A hand-drawn blue-line map (dated May, 1985), was submitted to the Municipality and the Corps which superficially satisfies the stipulation, but apparently no written description was attached. Their consultants had promised (on 12/1/84) to include a detailed design with plan and cross sectional views, elevations and culvert locations as part of the master plan. The single blue-line sheet contains an overall plan view of the vicinity with proposed landscaping and culvert notations, but no elevations or cross sectional views.

LESSONS LEARNED:

The bond requirement did not perform as planned for this project. The bond was stipulated in the permit language, but it was never posted, nor mentioned again. Although most of the mitigation actions at this off-site location were eventually completed (though late), much more was required of the developer as on-site mitigation at the Fish Creek location. These actions have not been completed to this day. This project once again points out the problem of enforcement responsibilities, and the appropriate timing of requirements. Perhaps the Corps would be well advised to require bonds to be posted before the permits are delivered to the applicant.

After eight years, natural revegetation appears to have worked well at establishing wetland emergent vegetation (sedges, rushes, etc.). However, it must be kept in mind that this site contained favorable soils and abundant seed sources nearby. The soils were primarily upland topsoil, composed of a variety of particle sizes and organic matter. In contrast, numerous difficulties have been encountered attempting to establish emergents on poor quality substrates, such as the silty clays of Cook Inlet, which compact easily and are lacking in organic matter.

The idea of the shallow slope creating diverse habitat zones within a given area has merit. At this site, the slope provided some shallow and some deeper permanent water, and although the 1993 season left water levels lower than normal, it logically would result in a zone that is flooded and exposed seasonally. This juxtaposition of water levels and habitat types was intended to provide some attraction for ducks (the deeper water) and shorebirds (the upper wetland margin). However, the relatively small size of each habitat type may have impaired the overall project success. The site was basically too small for what the design could offer. This former upland site has had some success in simulating wetlands (in terms of vegetation and hydrology) probably only because it is continuous with large adjacent wetlands.

Mark Dalton (a Municipality representative during this project) feels the primary problem with this project was that insufficient attention was given to the hydrology of the area, particularly the amount of inflow from the storm drain culvert that comes from the road east of the mitigation site. The correct hydrology is the controlling function when it comes to wetland success (in creation or restoration efforts). In this case, the amount of water and water depths fell short of expectations. Mark Dalton feels that additional water input was needed to make the concept work. Rick Sinnott (the wildlife biologist who visited the site), also suggests that they might have had better success if the final elevations for much of the excavated areas were lowered, to accommodate low rainfall seasons. The neighboring ponds along Westchester Lagoon contain deeper water, and the cattails and pondweed continue to prosper there. The dry 1993 season made the wetlands on the project site appear particularly shallow, and ineffectual in terms of waterfowl habitat.

SIGNIFICANCE OF PROJECT:

This was the first example of off-site mitigation in Anchorage. As such, the Municipality of Anchorage was concerned that this project go smoothly because of the effect it might have on the palatability of future off-site mitigation efforts. As they stated in their 7/29/85 letter to the Corps, "The importance of this proto-typical (for Anchorage) off-site mitigation plan must be underscored. Every effort should be made to assure that it is satisfactorily completed as quickly as possible so that we may proceed with present and future mitigation efforts unimpaired." Although most of the off-site mitigation requirements were tardily completed, many components were not met in their entirety (landscaping, bond, barriers, brief master plan). Moreover, the on-site components of the mitigation package were never completed, and continuing compliance discussions have been muddied by the changing ownership of the property at the Fish Creek location. This experience once again emphasizes the need for mitigation requirements to be completed before or concurrently with the permitted wetland fill.

The idea of including the planning of other mitigation projects (the "master plan") as a component of a negotiated wetland fill mitigation agreement was novel for Anchorage, and has a great deal of merit for potential future situations, but clearly there is a need to better stipulate the scope of the delivered plan. In this case, one schematic diagram was submitted to just barely satisfy the requirement.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Thede Tobish, Municipality of Anchorage Planning Dept., 343-4222. Jack Ferrise, Army Corps of Engineers, Anchorage, 753-2716. Mark Dalton and Anne Leggett, HDR Engineers, Inc., Anchorage, 274-2000, who inspected the site in 1990 while on contract to the Corps of Engineers.

Other Information Sources: Jack Ferrise of the Army Corps of Engineers provided information from COE files, including an inspection report completed by Anne Leggett of HDR Engineers, Inc., on contract to the Corps. Rick Sinnott (ADF&G, Division of Wildlife Conservation) and Betsy Parry (ADF&G, Habitat and Restoration Division) visited the site on August 27, 1993. Much of the above commentary is derived from the opinions of Thede Tobish, Rick Sinnott, Mark Dalton, and the inspection report by Anne Leggett.

7. Fish Creek Coastal Wetland Restoration

SHORT DESCRIPTION: Intertidal restoration after disturbance for sewer line installation. One of few attempts in Alaska to restore disturbed coastal wetlands to date.

Responsible Organization: AWWU and DNR-PMC
Organization Based In: Palmer
Agency Permit #: No ADF&G permit needed; COE permit # unknown
Year Work Began: 1990 - Year Ended: 1994
Status: Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Fish Creek
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-50-10046
Location Description: Mouth of Fish Creek, Anchorage.
Site Impressions of Habitat Type: High intertidal emergent coastal marsh (sedge, some salt tolerant species). A few open water ponds (4).
Project Size: 3 1/2 to 4 acres at creek mouth
Maps: None yet available, but will probably be produced as part of report due in 1994-95.

OVERALL GOAL(S) OF PROJECT:

To revegetate the coastal estuarine area following large disturbance left by heavy equipment during sewer line construction in 1986-87. Initial restoration attempts (1987) by the Anchorage Water and Wastewater Utility (AWWU) were unsuccessful. Due to revegetation requirements in the Corps of Engineers permit, AWWU then contacted the DNR Plant Materials Center staff for assistance. Their efforts (beginning in 1990) constitute this case study.

OBJECTIVES:

1. Establish vegetation on entire area of disturbance using seeds and plugs of appropriate estuarine/ intertidal vegetation.

2. Match elevations of high, middle, and low marsh vegetation.

3. (Original 1987 objective) Create a series of pools for use by staging and nesting waterfowl.

IMPLEMENTATION INVOLVED:

1. (Originally) Regrading/ excavating for ponds in disturbed sediments with dikes to impound water.

2. In 1990, a demonstration planting of A) beach wildrye sprigs (*Elymus arenarius, E. mollis*, grown at the Plant Materials Center) onto higher elevations of site, and B) indigenous sedges (*Carex* sp.), arrowgrass (*Triglochin maritimum*), & rushes (*Scirpus* sp.) were transplanted onto the disturbed site from adjacent donor communities.

3. In 1991, a larger scale planting took place. Once again, dikes and the higher elevations of the site were planted with beach rye sprigs from the PMC and seeded with Norcoast Bering hairgrass (*Deschampsia beringensis*). Lower areas received sedge, rush, plantain (*Plantago* sp.), etc., transplanted from adjacent communities.

4. In 1992, some areas required additional work. Areas flooded during very high tides were planted with greenhouse-grown sedges, plantain and arrowgrass. One dike was rototilled to reduce compaction from heavy equipment & foot traffic; it was then sprigged with beach wildrye & seeded with hairgrass.

5. Fertilizer application varied from 450 to 1350 pounds per acre.

ESTIMATED COST: $11,000

JUDGEMENT OF SUCCESS:

By 1993, the vast majority of the area has adequately revegetated due to the combination of seeding, transplanting from adjacent communities, fertilizing, and natural recolonization (Plate 15). The site is complex in that the soil types and elevations are highly variable.

The ponds originally built for waterfowl (in 1987) have not proven so successful (Plate 15). The ponds are perched higher in elevation than the creek, and lack surface connections to the creek. They differ from natural ponds in their appearance (less cover around edges, fairly distinct sloped boundaries). Only one pond (with the island) appears to receive any duck use, whereas ducks are in abundance in the adjacent free-flowing Fish Creek itself. One pond dike serves as a loafing area; revegetation at this site proved difficult because ducks consumed the seeds and transplants.

Overall, this project's results are promising because the patches of vegetation that have established reflect the diversity of the site. Originally (1987) the entire area was seeded and fertilized at one uniform rate (by AWWU). But a combination of elevational differences leading to different salt and water conditions, along with fertilization and natural reinvasion, has led to a variegated cover of emergent vegetation across most of the site (Plates 15, 16).

LESSONS LEARNED:

The plant species and elevations could have been more carefully matched for better results. Planting times could also have been better correlated with high tides. As it was, the plugs were transplanted into the high intertidal zone just after a high tide, so that the plugs were subjected to the maximum dry period before the next tidal inundation (approximately one month). The PMC staff believe they may have lost some plugs due to this lack of moisture immediately after transplanting. Transplanting plugs before a high tide would be preferable. Seeding, on the other hand, requires a different technique in tidal areas. Since broadcasted seeds may be redistributed by the tide, it may be necessary to either lightly pack them down into the soil when planting, or to roughen the surface of the seedbed (with a harrow or some other implement) prior to seeding.

The amount and impact of human foot traffic in this area was underestimated—this clayey soil "sets up" like concrete when compacted (Plate 17). Some species cannot take trampling at all (e.g. beach rye grass); others have higher tolerance (e.g., hairgrass). Many of the higher elevated areas receive the brunt of foot traffic. Where less traffic is present (e.g., side banks of the dikes), species such as bluejoint (*Calamagrostis canadensis*), beach wildrye, hairgrass, marsh fivefinger and a salt-tolerant chenopode are doing well. Sloughgrass (*Beckmannia syzigachne*) was planted throughout the area but did not perform well, probably due to salt levels (it is a freshwater species).

Fertilization caused marked improvement in the establishment of both transplants and the natural reinvasion of species (e.g., salt-tolerant chenopodes, pickleweed (*Salicornia* sp.), marestail (*Hipparus* sp.)). The ideal amount of fertilizer for this kind of silt/clay intertidal site is being further researched.

Transplants from adjacent areas generally fared better than the greenhouse-grown transplants of sedges. Of the seeded species, hairgrass seemed to perform the best.

SIGNIFICANCE OF PROJECT:

This project is important since few coastal wetland rehabilitation projects have been attempted in Alaska. Results from this project will greatly enhance our knowledge regarding revegetation of estuarine wetlands.

Monitoring and data collection will continue through 1994. PMC staff plan to experiment with varying levels of fertilizer application rates in 1994. The motivation for this experiment stems from an observation of lush growth in an area where fertilizer was accidentally spilled during an earlier planting. The spilled fertilizer would have been expected to be so concentrated as to "burn" vegetation in that area, but instead the vegetation was more vigorous than elsewhere. This observation led PMC staff to believe that perhaps these soil types (salty Cook Inlet clays) require higher than usual rates of fertilizer to aid establishment. In 1994, they will apply different fertilizer rates in experimental bands on bare spots in the project area.

FOR FURTHER INFORMATION:

Report(s):

Authors: Wright, Stoney
Publication Date: 1992
Title: Fish Creek Wetlands Restoration Project, pp. 21-2 in PMC 1992 Annual Report

Contact Persons: Stoney Wright and Nancy Moore, DNR-PMC, Palmer, 745-4469.

Other Information Sources: Stoney Wright and Nancy Moore expect to put together a report some time in 1994 or 1995. They hope to include original AWWU photos of the site, to show the change due both to natural reinvasion, seeding, and transplants. The site visit for this case study was conducted on 8/11/93, with Stoney Wright (PMC), Mark Fink (ADF&G) and Betsy Parry (ADF&G) in attendance.

8. Campbell Lake Sedge Wetlands

SHORT DESCRIPTION: Rehabilitation of a sedge wetland (extreme high intertidal) following large disturbance for sewer line project.

Responsible Organization: MOA
Organization Based In: Anchorage
Agency Permit #: FG 89-II-0435 and FG 89-II-0569
Year Work Began: 1989 - Year Ended: 1990
Status: Completed, no monitoring.

LOCATION/SITE CHARACTERISTICS:

Waterbody: Outlet of Campbell Lake
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-60-10340-0010
Location Description: Outlet of Campbell Creek at west end of Campbell lake, on road to MOA pump station.
Site Impressions of Habitat Type: A hummocky high intertidal landscape with patches thick with sedges in some of the lower swales, and bare open patches higher in the areas receiving the most foot traffic.
Project Size: Approximately 3 1/2 acres
Maps: Map from the "Restoration Plan" submitted in files.

OVERALL GOAL(S) OF PROJECT:

To control the erosion occurring at the sewer line crossing site and rehabilitate approximately 3 acres of sedge wetland.

OBJECTIVES:

1. Stabilize the creek bank at the sewer line crossing site.

2. Revegetate the damaged sedge wetland and adjacent uplands.

IMPLEMENTATION INVOLVED:

1. Placing rock riprap on the south bank of Campbell Creek, at sewer line crossing to control the erosion of fine sediments.

2. Plant sedge plugs (2 ft. spacing) in the lower areas of the damaged site. Plugs were obtained from adjacent thickets of sedge.

3. Hydro-seed and fertilize the upper areas with a grass mix.

4. Plant willow and birch trees (6 ft. spacing) where tree vegetation was removed along the roadside and creek bank (north side).

ESTIMATED COST: $50,000

JUDGEMENT OF SUCCESS:

Based on photographs of the construction activities and review of the required revegetation plan prepared by AWWU, this rehabilitation project was successful. The area had been completely denuded by heavy equipment (Plate 18). On the east side of the creek, approximately 60,000 sq. ft. had been denuded. The planting of approximately 30,000 sq. ft. of sedge plugs, along with natural recolonization has resulted in almost complete revegetation (Plate 19).

However, on the west side of the creek, revegetation was only partially complete. Approximately 50,000 sq. ft. was plugged with sedges or hydro-seeded. Sedges had re-established in the lower elevation areas (i.e., swales on northeast end, approximately 15% of west side), but the higher areas contained only patchy vegetation (some grasses, clover, *Potentilla* sp., which account for another 15% of the west side of the project). The northern portion contained patchy stands of grasses (20% of west side) on hummocky, uneven ground. The remaining or central portion (50% of west side) was hardpacked and nearly devoid of vegetation (Plate 20). A few sedge plugs (2-5 m spacing) were evident.

Approximately 17,500 sq. ft. of woody vegetation along the south stream bank had been cleared during construction activities. Re-establishment of the tree buffer occurred on only one-third (5000 sq. ft.) of the impacted area (appearing at extreme left in Plate 20). It is not known why trees were not planted along the remaining two-thirds of the impacted tree buffer (which would have continued along creek at least as far as riprapped area in Plate 20). The tree mixture called for in the revegetation plan (spruce, willow, and birch) also was apparently altered during installation. Of the 10 spruce trees indicated in the plan, only 5 trees were found. Other apparent changes included the presence of several mountain ash and aspen trees along with the stated birch and willow. The spacing between trees generally appeared too close (4 foot centers rather than the 6 foot spacing identified in the plan), but overall, the planted section (5000 sq. ft.) of the impacted tree buffer appeared to be functioning. Some natural invasion of willows was beginning on the far west end of the impacted stream bank (end of bank nearest riprap on Plate 20).

The riprap placed along Campbell Creek at the point of the sewer line crossing appeared to be functioning to protect against erosion. However, immediately downstream of the sewer line crossing, erosion was evident around the culverted access crossing (which had been installed during the dam and sewer line reconstruction).

LESSONS LEARNED:

During the sewer line installation procedures, the construction inspectors and agency personnel did not maintain control over the contractor. Consequently, more habitat acreage was disturbed than was planned or necessary. Unfortunately, this mistake is often repeated, as agency staff cannot be on the job site at all times. Pre-construction meetings with the contractor and equipment operators can help to avert such misunderstandings.

Sedges grew well in lower areas with adequate organic material and moisture. This clay substrate is sensitive to compaction from construction and continued foot traffic. Compaction of the substrate most likely inhibited revegetation in certain areas. Rototilling of the disturbed areas prior to plugging and hydro-seeding should be considered, along with continued control of foot traffic to enable plant cover to establish in these clay substrates.

Contractors apparently did not understand the instructions for replanting the tree buffer along the roadside and streambank. The problem may have stemmed from misinterpretation of one notation on the revegetation map, and lack of on-site supervision. Certain tree species were substituted for others in the plan, only a small section of the impacted tree buffer was actually replanted, and the trees were planted too close together. Communication between revegetation plan writers and the sub-contractors should be improved.

SIGNIFICANCE OF PROJECT (e.g., novel approach or specific goals, part of long-term research, etc.)

The Campbell Lake/Campbell Creek outlet is one of the few examples of attempted coastal wetland rehabilitation. Plugging with sedges taken from adjacent areas appeared to be a successful technique for revegetation in areas with adequate moisture (frequent tidal influence) and less severe compaction.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Don McKay, ADF&G, Anchorage, 267-2279, and Phil Brna, ADF&G, now at State Pipeline Coordinators Office, Anchorage, 278-8594.

Other Information Sources: Don McKay, Mark Fink, and Betsy Parry (all ADF&G) visited the site on 8/9/93 for this case study report. Other information exists in ADF&G files, including photo records.

9. Bayshore Ponds & Berms

SHORT DESCRIPTION: Attempt to create brackish water nesting ponds along the tideflats.

Responsible Organization: ADF&G
Organization Based In: Anchorage
Agency Permit #: Too old for filing system
Year Work Began: Winter 1972-73 - Year Ended: 1977
Status: Completed, no monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Cook Inlet Tide Flats
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-60 (Turnagain Arm)
Location Description: Ponds arranged along 2/3 mile at base of bluff below Bayshore subdivision, immediately south of the mouth of Campbell Creek (outlet below Campbell Lake).
Site Impressions of Habitat Type: High intertidal sedge wetland
Project Size: 9 ponds along 1.3 mile stretch
Maps: Best diagrammed on Municipality map of proposed coastal trail extension along this area.

OVERALL GOAL(S) OF PROJECT:

To take advantage of an opportunity to experiment with creating waterfowl nesting habitat by excavating ponds to trap freshwater in a high intertidal area. A broader motivation was to replace some of the Cook Inlet nesting habitat lost in the 1964 earthquake.

OBJECTIVES:

1. Excavate ponds and islands in disturbed intertidal sedge wetland.

2. Construct berms to trap freshwater runoff in the ponds (snow melt, etc.) from the adjacent bluffs.

3. Encourage the growth of vegetation for nesting cover.

This project was undertaken on an experimental basis. The project designer/implementer (Dimitri Bader of ADF&G) listed the following as the questions addressed by the experiment:

A. Can waterfowl utilization of low use coastal marsh habitat be increased through habitat manipulation?

B. Is better soil (imported top/mineral soil) required for the berms and islands to allow the establishment and growth of vegetation?

C. Is soil fertilization and seeding required to establish vegetation?

D. Will the berms withstand the erosion forces of the monthly high inlet tides and seasonal rains and winds?

IMPLEMENTATION INVOLVED:

1. Heavy equipment (from the then Greater Anchorage Area Borough) was already on site to install a new sewer line under the tideflats along the base of the bluff. Several ponds (9-12) were excavated on either

side of the sewer line as it was installed. These ponds were laid out linearly along the route of the sewer line. Pond sizes range from 150' to 800' long, and from 100' to 200' wide. The pond designs were more or less "guess work" at that time. They are irregularly shaped (many are rectangular), and some contain islands. Backhoes and bucket scoops were used to excavate the pond areas to the specified depth (probably 12-18", though not noted in records). The dredged material was mounded to form islands and berms around the ponds.

2. As part of the experimental layout of the project, certain areas were fertilized, others were not. Certain areas (berms, islands) received imported mineral soils, others did not. Certain areas were actively revegetated, others were not.

3. A variety of species were planted in the revegetated areas. These include sedges, marestail, arrowgrass (*Triglochin maritimum*), goosetongue, etc. Both sprigging and seeding methods were used.

ESTIMATED COST: $118,470 in 1972/73.

JUDGEMENT OF SUCCESS:

1. <u>Short Term Results</u>. In 1977, Dimitri Bader summarized the success of the project based on the questions he originally posed (listed above):

   A. **Increased waterfowl utilization.** Dimitri found waterfowl utilization of the pond area had increased for feeding and brood rearing. Nesting on the berms had not been documented, but significant increases in numbers of ducklings and broods had been observed. He felt this may have related to providing better interspersion of habitat suitable for brood rearing rather than nesting. He felt the ducks were depending on the adjacent upland bluff for nesting with the new ponds and berms enhancing their production and survival. Prior to the project, he noticed little waterfowl production in this area. In August 1977 (four seasons after), Dimitri observed 84 flightless ducklings and approximately 50 flying adults.

   B. **Imported Topsoil.** New vegetation grew on marsh silt and peaty soils in addition to imported mineral soils. Those islands that were built with imported gravel did not support much revegetation. Only a few small berms/islands showed either no primary recolonization or a decline of planted species.

   C. **Fertilization.** Dimitri felt fertilization provided rapid in-season revegetation. Non-fertilized soils were also observed to revegetate within three years. In low mud/silt areas exposed to tidal waters, stands of arrowgrass (*Triglochin maritimum*), which is a good food plant for waterfowl, had naturally recolonized.

   D. **Durability of structures**. During the negotiation period with the Anchorage Borough, their head engineer predicted total erosion of the berms within two years. Nevertheless, they had all weathered five years up to the time Dimitri wrote the 1977 report. Except for the islands/berms constructed from imported soils, all berms/islands built with onsite material included chunks of ice. During the first two years obvious slumping, fissuring, and cratering was evident from settling. Despite this, all of the berms built according to design stood firm till 1977. However, during construction the contractor had surplus soil material and constructed some berm piles on his own. A few of these were located directly exposed to tidal action with no thought given to protection; these eroded within three years. Portions of the main berms overlying the sewer line began settling more than other areas, and allowed tidal waters to flow over them. Dimitri noticed the first signs of soil erosion in these low spots in 1977.

2. Long Term Results. In 1993, Dave Harkness and Bruce Campbell of the Division of Wildlife Conservation summarized the progress of the project after twenty years:

A. **Increased waterfowl utilization**. These ponds and berms are still in place after 20 years (Plates 21-23), and ducks use them for feeding and loafing, but not nesting. During the August site visit, approximately half a dozen birds were flushed at each pond complex, including yellowlegs, teal, spotted sandpipers, mallards, goldeneye, and a merlin. Concentrations of teal, mallards and pintails have been observed in late July. The area of intersection of the sedge margin, mudflat, and ponds receives the most bird use.

Reasons for the limited nesting success include the exposed location of the ponds, very little available cover and upland edge for nesting, and salt water intrusion. The biggest deterrent to nesting is that, even after 20 years, there is still not enough vegetational cover—exposed rocks and clay remain. Although tall sedges may be growing through the silt, waterfowl are not attracted for nesting if there is no layer of organic matter directly on the ground surface (dead vegetation, etc.). As Dimitri suspected in 1977, the birds observed are probably still nesting nearby and coming to the pond complexes to raise their broods.

B. **Durability of structures**. The design of this project—separated small ponds, rectangular in shape—would probably be modified today into a series of interconnecting shallow swales. Twenty years of weather and tides has naturally pushed the pond project in that direction (Plate 23). At present, some ponds persist, although in different shapes than originally contoured. Some still appear unnaturally rectangular in outline, especially from the air (Plate 21). Some ponds have drained (e.g., the first pond complex near the pump station entrance). The tidal influence has breached some of the berms, draining some ponds, and causing others to be subjected to tidal action more often than designed. The settling and weathering of the berms has given rise to a series of pond and swale complexes, rather than individual ponds with distinct outlines. Increased tidal influence in the project area has probably increased the salinity of the water above original target levels as well, though the salinity was not measured.

Some ponds appear quite deep, greater than three feet. However, most of the waterfowl observed are dabblers, indicating that the majority of the pond and marsh complex is shallower (e.g., 6"-18"). Many of the pond's original steep banks have sloughed down to a shallower grade over time. The resulting well-developed sedge wetland contains more varied microhabitats than either the pre-existing tideflats or the discrete ponds as designed.

C. **Revegetation**. After 20 years, it is impossible to distinguish transplanted material from natural reinvasion. Arrowgrass has recolonized much of the area, particular the tidal sloughs. Natural reinvasion has successfully revegetated the majority of the area, though perhaps not thickly enough to support waterfowl nesting.

On the rocks and islands, beach wild rye, fireweed, and marsh five finger (*Potentilla palustris*) were evident. A couple islands had been mounded much higher than the surrounding wetland areas and did not revegetate well, probably due to dryness (Plate 23). Elsewhere, the prevalent vegetation included sedges (*Carex ramenski*), arrowgrass (*Triglochin maritimum*), rush (*Scirpus* sp.), goosetongue, and marestail.

LESSONS LEARNED:

In the future, a waterfowl pond project of this nature would not include ponds with rectangular outlines or such steep sides. The islands would not be constructed quite so high (and dry). A more likely design would include interconnected swales, with some shallower, some deeper spots, some tidal areas and some ponds more protected from salt water influence (which is the direction this project has taken over time anyway). Except for a few of the higher gravelly berms and islands, the whole area has revegetated well in 20 years, largely by natural reinvasion.

Bruce Campbell, an ADF&G waterfowl biologist, suggests that the most important factor in these situations is to focus attention on the substrate—if you can incorporate some organic matter into the soil, natural reinvasion will take off. The Bayshore situation is not unlike that at the Copper River Delta near Cordova after the 1964 earthquake—just plain clay was uplifted and exposed, and after 30 years some shrubs and sweetgale are just now advancing out onto the uplifted "new marsh". Once the pioneering plants began to function as sediment traps, the intertidal system along the Copper River Delta began to advance more quickly and diversify.

There are many similar intertidal waterfowl sites—Palmer Hay Flat intertidal zone, Redoubt Bay, Trading Bay—which do not receive much nesting use because the tide washes out the organic matter, and constantly deposits a new silt layer on top. The common denominator in all these locations is the exposed surface layer. Despite some tall sedges growing through the silt, the surface layer itself is bare. In Cordova, they have had some success in spurring on the development of vegetational cover by laying down a mat of peat to act as a plant substrate on the mudflats.

Bruce Campbell also commented that current belief is turning against the construction of new nesting "islands" in the intertidal zone. Even if built above high tide lines, the islands are often not big enough to develop a good layer of upland vegetation which would deposit sufficient organic matter on the surface (unless they are very big). Despite the lack of nest sites on the created ponds and islands in this project, it successfully increased local waterfowl production by diversifying the topological relief of the mudflats and therefore the types of habitat available. Waterfowl production on the adjacent hillside has increased, and these birds are utilizing the project site as feeding, loafing, and brood rearing habitat.

SIGNIFICANCE OF PROJECT:

The major importance of this project is its age—it illustrates how well a sedge wetland can recover in twenty years. At the same time, the development of different layers (surface layer, canopy layer, etc.) of cover vegetation can take even longer in tidal clay substrates. The experimental project has been successful in increasing the local productivity by providing waterfowl with feeding, loafing, and brood rearing habitat, but nesting does not occur to any great extent within the enhancement project area.

Many of the problems encountered with revegetating uplifted tidal silts are consistent with other trouble-ridden attempts to create or enhance intertidal waterfowl habitat. Several of these are profiled in other case studies (e.g., Bradley Lake waterfowl mitigation, Fish Creek wetlands, Campbell Lake sedge wetlands, Coastal Trail mitigation).

FOR FURTHER INFORMATION:

Report(s):

Authors: Bader, Dimitri
Publication Date: August 10, 1977
Title: Field Trip through experimental pond and berm area south of Campbell Creek
Reference Type: Memorandum Report to Regional Supervisor

Contact Persons: Dimitri Bader, then of ADF&G, now retired, worked on this project. Current contacts include Bruce Campbell & Dave Harkness, Wildlife Conservation Division, ADF&G, Anchorage, 267-2179.

Other Information Sources: Talked with Dave Harkness, Bruce Campbell, and Rick Sinnott of ADF&G's Wildlife Conservation Division, and Thede Tobish of the Municipality of Anchorage. Dimitri Bader wrote a memo describing the in 1977, as referenced above. Rick Sinnott and Betsy Parry (both ADF&G) visited the site on 8/17/93.

10. Folker Street Small Tree Revetments (Campbell Creek)

SHORT DESCRIPTION: Small conifer tree revetment of eroding bank.

Responsible Organization: ADF&G — former FRED Division
Organization Based In: Anchorage
Agency Permit #: No information in permit files.
Year Work Began: 1990 - Year Ended: Not yet finished
Status: Monitoring (& Continued Implementation)

LOCATION/SITE CHARACTERISTICS:

Waterbody: Campbell Creek
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-60-10340
Location Description: Campbell Creek between Folker St. and Lake Otis Parkway in the vicinity of Campbell Creek Park.
Site Impressions of Habitat Type: Riverine bank, gravel bottom.
Project Size: Approximately 100 ft of creek bank
Maps: Schematic ADF&G diagram attached (Figure 6)

OVERALL GOAL(S) OF PROJECT:

Stop erosion of creek bank on outside of bend.

OBJECTIVES:

1. Arrest erosion and bank loss on this outside "cutting" bend of medium-sized urban creek.

2. Trap fine sediments to begin rebuilding the bank.

3. Provide cover and slower water refuges for rearing juvenile salmon.

IMPLEMENTATION INVOLVED:

1. In 1990, native spruce trees were anchored to the eroding bank using earth anchors to act as a revetment or soft armoring. Two cables per tree or three cables per two trees were used.

2. In 1992, Over 200 Christmas trees (non-native) were anchored to the eroding bank over the existing revetment (Plate 24). These trees had not been sold during the Christmas season, and had not been treated with flame retardant. Trees were anchored to the bank by a cable strung through the base of the trees.

3. In 1994, a third layer of Christmas trees was added along the base of the bank. In addition, trees were placed along the upper section of bank to reduce foot traffic and continued degradation.

ESTIMATED COST:

Since labor was volunteered, project costs involved primarily hardware such as cable and earth anchors, which in the original installation totalled $400. In the subsequent placement of layers, costs included approximately $25 of cable. Of course, the project involved some ADF&G staff time to coordinate and monitor as well.

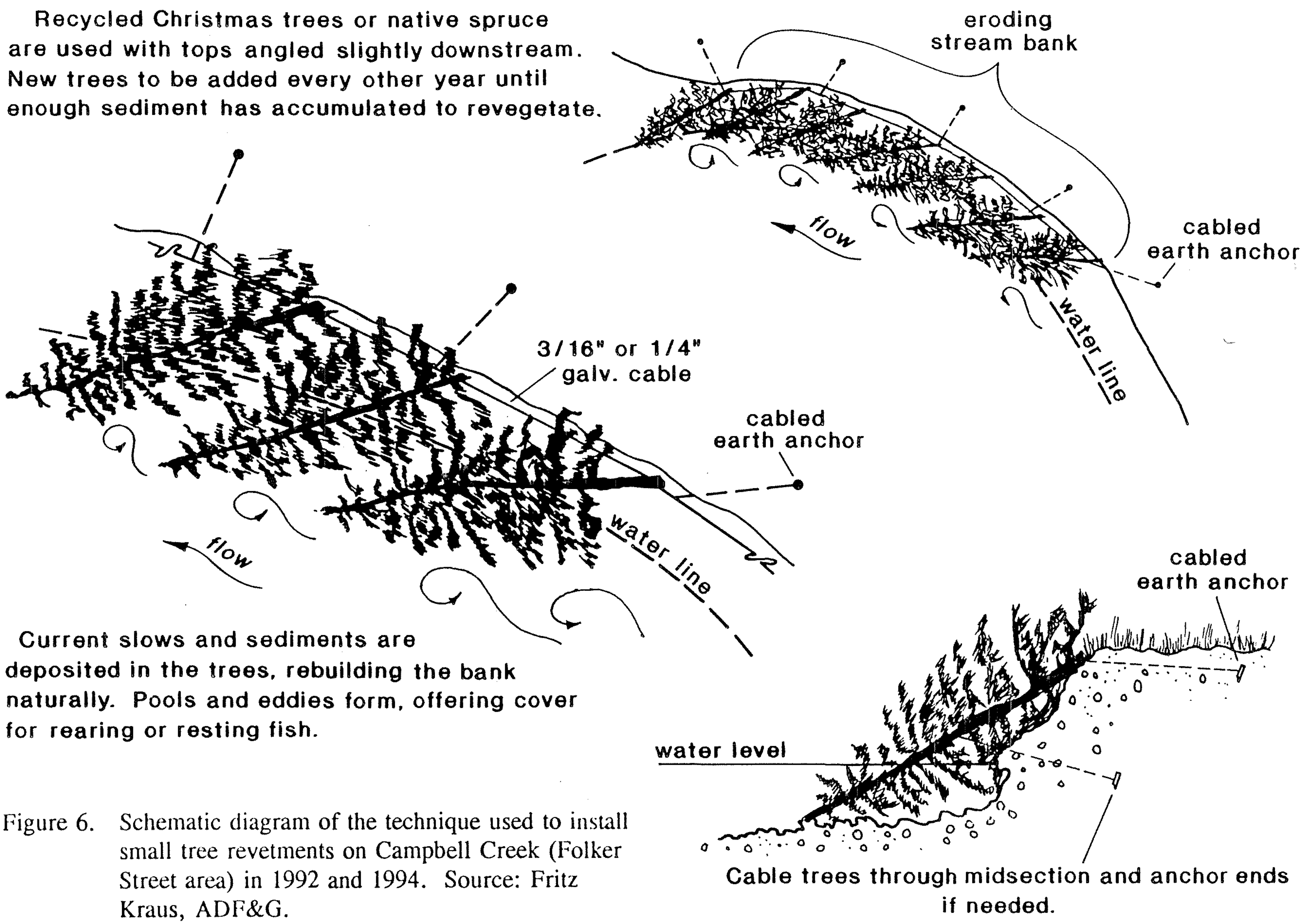

Figure 6. Schematic diagram of the technique used to install small tree revetments on Campbell Creek (Folker Street area) in 1992 and 1994. Source: Fritz Kraus, ADF&G.

JUDGEMENT OF SUCCESS:

The project has been successful in stabilizing the eroding bank (Plate 25). Sediments have begun to accumulate on the tree revetment, but several more years of sediment accumulation will be needed to completely rebuild the bank, at which time vegetation (willows) will be planted for stabilization (Plate 26). The project has been quite successful at improving fish habitat characteristics in the vicinity. Juvenile fry are using the tree revetment and associated slow water areas for rearing (Plate 25). Young fish are visible among the three branches.

LESSONS LEARNED:

Evergreen tree revetments require high maintenance due to sediment build-up and loss of needles and branches. New trees should be cabled in over the top of the previous ones every two years. "Bushy" trees (i.e., those with more branches and needles) are desirable because they are most effective at slowing current and causing silt to deposit. For this reason, non-native Christmas trees tend to be more effective than native spruce trees because they are bushier. Fewer Christmas trees are required to provide the same amount of bank protection as numerous native spruces. The Christmas trees used in 1992 were easier to install and more fully shaped than the native spruces used in 1990. The amount of cabling needed to construct the tree revetment depends on the hydrology of the location. The amount used in 1990—two cables per tree or three cables per two trees—may have been too much anchoring for this location. However, stringing one cable through the base of a series of trees (as in 1992) was probably not enough anchoring. When stabilizing a steep bank or a section of stream with a strong current, trees should be cabled in at both ends (i.e., the tree top should be anchored as well as the butt end) to prohibit the revetment from floating. If located in developed areas, tree revetments may tend to collect unsightly garbage and debris from the current.

SIGNIFICANCE OF PROJECT:

This project was one of the first Alaskan applications for this method of bank stabilization. Once a streambank has eroded to the point of being "vertical" (as it was in this case), it is very difficult to stabilize and erosion will continue. However, the tree revetment method or "soft armoring" proved to be a very successful technique. The objectives of controlling erosion and enhancing fish rearing habitat were accomplished at minimal costs. Trees were either collected locally (i.e., native trees in 1990) or donated (Christmas trees in 1992), and volunteers built the revetment. The community was actively involved. A greater amount of sediment has accumulated than expected, which will build up the eroded bank. Eventually, the layers of trees and accumulated silt along the bank will become high enough that it can be planted with willow or other woody species. This is the ultimate goal because plant root systems are the key to long-term bank stability.

This project is also significant because it illustrates techniques that can be implemented on a low budget that still yield good results. Although the small tree revetment worked well for a medium-sized creek, the technique could be utilized in a larger river setting, with adaptations (for example, obtaining trees larger than Christmas trees). This project represents one of several experiments in stream rehabilitation technology that were supported in part by a grant from the Alaska Science and Technology Foundation.

FOR FURTHER INFORMATION:

Report(s):

Authors: Kraus, Frederic and William J. Hauser
Publication Date: February, 1994
Title: Stream rehabilitation technology development. (Specifically, the chapter on small tree revetment.) Special report to the Alaska Science and Technology Foundation for project #90-3-156. ADF&G, Division of Commercial Fisheries Management and Development.
Reference Type: Grant Report

Contact Persons: Fritz Kraus, Aquatic Education Specialist & Stream Rehabilitation Biologist, and Bill Hauser, both of ADF&G, 333 Raspberry Road, Anchorage, 267-2159.

Other Information Sources: Information was obtained from Fritz Kraus and Bill Hauser, ADF&G. The site was visited on 9/3/93 with Betsy Parry, Fritz Kraus, Bill Hauser, and Mark Fink (all ADF&G) in attendance. Their 1994 report to the Alaska Science and Technology Foundation contains more detailed information.

11. Abbott Loop School Creek Realignment

SHORT DESCRIPTION: Municipality of Anchorage realignment of South Fork Little Campbell Creek at Abbott Loop School.

Responsible Organization: MOA
Organization Based In: Anchorage
Agency Permit #: FG 87-II-0308 and FG 88-II-0190
Year Work Began: 1987 - Year Ended: 1988
Status: Completed

LOCATION/SITE CHARACTERISTICS:

Waterbody: South Fork Little Campbell Creek
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-60-10340-2018
Location Description: South Fork Little Campbell Creek near corner of East 88th and Lake Otis, behind Abbott Loop School.
Site Impressions of Habitat Type: Small neighborhood creek, with obvious pool and riffle segments. Area of realignment still fairly open in terms of overhead tree cover.
Project Size: Restored reach totals 725 feet
Maps: Overall sketch in Bacon & Sandler article, plus construction diagrams from Dept. of Public Works, Municipality of Anchorage.

OVERALL GOAL(S) OF PROJECT:

This project constituted Anchorage's first effort at a multidisciplinary approach to rehabilitating an urban stream. Up until the 1950's, Anchorage's streams meandered naturally through rural forested areas. Since then major sections of streams have been moved out of their natural alignments to provide space for development, resulting in numerous problems such as loss of salmon habitat, increase in erosion and water pollution, increases in flooding and icing problems, and loss of aesthetic values. What was originally a civil engineering problem at this particular site became a multidisciplinary project sponsored by the MOA and its Water Quality Council.

OBJECTIVES:

1. To permanently resolve the hydrological conditions that led to stream icing and subsequent flooding of the adjacent areas, including the school yard.

2. To improve stream habitat characteristics. The existing flat-bottomed ditch lacked riparian vegetation and the bottom had been graded to increase hydraulic efficiency, thereby eliminating all stream bottom habitat. Objectives included enhancing stream bottom habitat, and adding bank vegetation and buffer zones.

3. To reduce health risks to the school children and neighborhood residents posed by the creek flooding and water quality issues.

4. To find a solution acceptable to the neighborhood residents, the school, and the regulatory agencies in a timely manner. The residents were originally hostile towards the Municipality and its ability to solve the problem.

5. When completed, the restored creek area was intended to serve recreational purposes as a neighborhood park.

IMPLEMENTATION INVOLVED:

1. The Anchorage Department of Public Works and the selected private engineering firm (Ott Water Engineers) formed a project team, with the consultants providing information on civil engineering, hydrology, fisheries biology, permitting and public participation techniques, and the Municipal project manager ensuring that the design remained on schedule, within the project budget, and met Municipal goals and policies.

2. Recognizing that the success of the project depended on public and interagency support, the project team initiated an extensive public involvement program which included a citizen review committee, neighborhood participation and education, and early meetings with federal and state review agencies. The citizen review committee had the full responsibility to select project design elements, within budget and permit agency requirements.

3. After many meetings with the citizen committee and the project team, and additional funding from the Municipal Department of Parks and Recreation, an alternative was selected that involved buying some privately-owned property adjacent to the creek (trailer court lots) and re-routing the creek alignment through the property (Figure 7).

4. An intern at the Department of Public Works developed an educational program for the 700 children attending Abbott Loop Elementary School. Using a story about a stream resident ("Sally Salmon)", the instruction informed the students about the differences between a stream which is good habitat and the existing condition of the South Fork Little Campbell Creek. The program also emphasized the children's roles in not destroying vegetation and in keeping the creek banks free of litter.

5. The municipal contractor removed all structures, septic tanks, etc., from the purchased and vacated trailer lots. The creek channel was realigned through the property in a gentle bend, a much more natural configuration than the previous two 90 degree turns, which were filled in. Eliminating the sharp turns would alleviate the icing/flooding cycle previously experienced in winter. As much of the existing older vegetation (willow clumps, etc.), was salvaged as possible and moved to the new creek banks. The new channel banks were sloped at a 2:1 angle, with one or more benches for flood conveyance and stability. Pools and riffles were created throughout the restored stream channel, to increase stream habitat values for fish (Plate 27). The restored stream channel was also lined with cobbles and gravels.

6. The following year, a variety of vegetation was planted (Plate 28). The revegetation efforts at this site were unusually diverse and extensive, partly because the area was to become a neighborhood park. The plans designed by a landscape architectural firm (Land Design North) included trees (poplars, birch, white spruce), shrubs (willows, raspberries, dogwood, currants, roses), several other perennial and annual wildflowers, and grass seed mixes. A specific section adjacent to the realigned creek was set aside to allow the children and their parents to participate by planting trees and bushes for the project. The PTA-sponsored "neighborhood planting day" got the children with the greatest creek contact directly involved in the process, which may have helped maintain project benefits after construction.

7. To inaugurate the creek restoration project, between two and three hundred rainbow trout were released into the creek in a big community and media event, involving the school children, the mayor, and various project participants. These were large, "catchable-sized" fish, generally 6"-10" long, and the children were catching them right away.

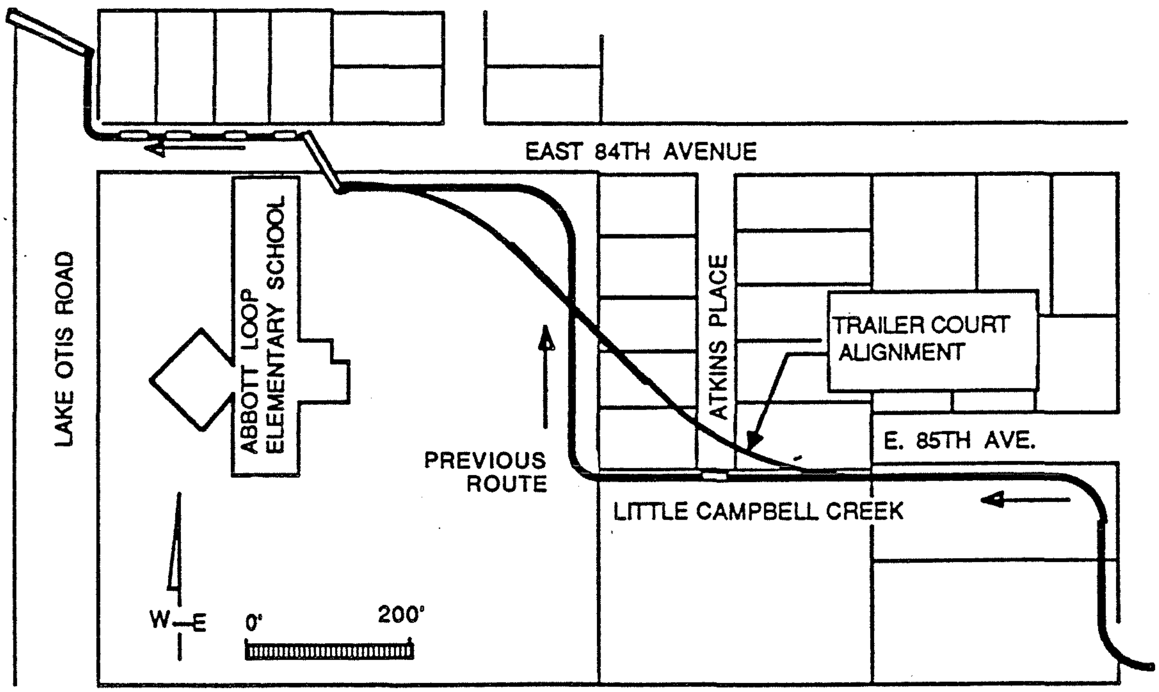

Figure 7. Previous and realigned routes of Little Campbell Creek near Abbott Loop School. Source: Bacon and Sandler, 1987.

ESTIMATED COST:

The budget was carefully monitored. Pooling of resources from more than municipal department was accomplished. Committee advocacy led to a neighborhood-supported solution, which prompted the Department of Parks and Recreation's decision to provide the additional land acquisition funds that made the route through the former trailer court a viable option.

In the end over a million dollars were expended, including consulting fees, community involvement and land acquisition. As Tom Bacon (Dept. of Public Works) admits, they'll probably never again have the time and money available to try a solution on this scale, however it was great for the Municipality to have had that opportunity, as a learning experience for future reference.

JUDGEMENT OF SUCCESS:

1. <u>Icing/flooding</u>. This aspect of the project was 100% successful. Considering that determining the best alignment was as much art as science, its hydrological performance over time has exceeded all expectations. The icing & flooding have ceased—the water may now rise & fall without impacting the community. The stream provides adequate channel flood protection for a one hundred year flood event. The project has successfully withstood several high rainfall storms. Previously, erosion was a problem during floods, but the re-sloped banks, the more gentle curve of the water route, and the increased riparian vegetation has alleviated these problems.

   One hydrological problem was encountered and resolved during construction. When the steam was first directed into the new channel, the flow went sub-surface through the added gravels. The contractor ended up re-excavating the whole channel and placing bentonite (a clay liner) in the bottom, then replacing the rock cover. This step added quite a bit to the cost of the construction. The stream then flowed above surface, as planned.

2. <u>Stream Habitat</u>. This was a truly creative design for stream bottom habitat in an urban setting. The interspersed pools and riffles continue to function as such (Plate 30). The gently sloped banks offer stability, flood protection, and promote successful revegetation.

   The revegetation efforts appear to have been very successful as well (Plates 29 & 30). Groundcover (grasses, etc.) has established in all areas. A few larger trees and bushes are present (15-20 ft. tall, possibly those salvaged from the old creek banks). Much of the realigned creek is still more open in terms of overhead tree cover than older, more established stream segments (which often exhibit thick, impenetrable vegetation). The city is restricted from deliberately planting large trees within the 100-year flood plain of an urban stream. City staff agree that they could have used more willows along the bank, but over time the area appears to be growing in on its own. Although thick overhanging vegetation on the banks would increase cover for fish in the stream, that must be weighed against the creek's other current role as the focal point of a neighborhood park, for which a certain amount of open access to the creek is desirable (Plate 30).

   Despite the overall success, a few problems were observed:

   A. **Size of rock introduced to line streambed**. The rocks used in the streams were of uniform size and quite coarse—4 to 5 inches in diameter, which is a bit larger than is optimum for fish use in spawning. This large size may also have contributed to the problems with sub-surface flow when the stream was first diverted. It may be that the stream accretes these smaller gravels naturally over time.

   B. **Siltation**. However, what the stream appears to be accreting is fine silts. Siltation appears greatest in the uppermost part of the project area (above the culvert at Atkins Place). Deposition of sediments over the stones in this area has led to the encroachment of vegetation into the stream channel, in some cases a difference of several feet from the original bank. Gravels in much of this area are no longer visible. Source of this sedimentation is unknown, originating upstream of the project.

C. **Human Impacts**. The proximity of the project to the school children has led to problems as well. Riprap was used to stabilize the culvert crossing at Atkins Place (Plate 31). A local resident reports that kids have repeatedly rolled the large stones (1-2 feet diameter) from their original locations into the creek, blocking the culvert openings. By the time of our site visit in 1993, the two side culvert pipes were completely blocked on both ends of the crossing (vegetation is establishing in front of them) and the center largest culvert pipe was partially blocked (Plate 32). This problem severely impacts the ability of the stream for flood conveyance, and hinders fish movement. Any rock that could be rolled or dug out is too great a temptation for resident children. On the next project of this sort, agency staff recommended using large, angular rock (rather than more rollable round rocks), and tamping them down with a backhoe during installation. This method appeared to thwart such temptations at the later project. Another problem with so much human use is that garbage collects in the boulder features of the stream.

D. **Fish Use**. Historic records (1985) reported the presence of juvenile cohos and resident Dolly Varden trout in this stream. Although not carefully surveyed, current fish use appears to be much less than anticipated for such a design incorporating habitat features. This is most likely due to blockages of fish passage in other parts of the creek's watershed, however.

3. Health Hazards. These concerns appear to have subsided with the halting of the flooding cycle. During the flood of February, 1986, high fecal coliform counts indicated a possible health hazard. No specific source of the contamination was identified, but the water quality situation has improved along with the flooding.

4. Cooperative Planning Effort. This project represents a great effort on the part of the community and local government, a learning experience, and an example of a win-win solution to urban stream problems. (See below under "Lessons Learned").

5. Recreational Use. The aesthetic improvement of the area was another very successful component of the project. Several years later, the area is still very attractive with interspersed open and vegetated areas and several types of wildflowers. The project area now functions as a neighborhood park (Plate 30). Local children play there, producing some level of activity almost all the time, at least in summer. One problem rests in the fact that the school children who are there now are not the same ones that took part in the project and the stream educational program, and without that sense of ownership, they are more likely to cause problems with the stream and design elements (e.g., blocking culverts by rolling riprap into creek, etc.).

LESSONS LEARNED:

Community involvement ultimately led to a more successful solution, particularly since the residents had voiced a lack of confidence in a "government-imposed" solution. The process allowed incorporation of social concerns into the design process while addressing the identified technical problems. The extensive public involvement resulted in open acceptance of project goals and in amiable land acquisition arrangements.

However, community involvement and support continues to play a role after the project is implemented. This concern is often stated as a conclusion in examinations of restoration projects anywhere. Without continued support of those who know and use the area, it will deteriorate. In this case, the children that are currently using the site are not the same as those that invested in the project, and therefore cause problems. A bit of continuing education of the school children (regarding riprap, etc.) may help the area to remain attractive and functional. In addition, this project illustrates that it is important to avoid placing obvious temptations in an area open to children and the public. In this case, using more angular rock that had been tamped into place by machine might have deterred the vandals.

The problem with sub-surface flow illustrates the importance of utilizing the correct substrate size in the stream channel. Phil Brna (ADF&G) feels that the expensive re-lining of the stream bottom with bentonite might have been avoided if the initial cobble size was smaller. It can be difficult to predict the correct cobble or gravel size to avoid sub-surface flow. Perhaps it should be recommended to err on the size of smaller-sized gravel when in doubt. Tom Bacon (Municipality of Anchorage) felt that they should have thought through the possibility of sub-surface flow beforehand, evaluating its likelihood, and perhaps lining the stream bottom with bentonite during the first installation.

Currently, sedimentation in the extreme upstream end of the project has eliminated the spawning potential in this area, and could reduce rearing ability as well if the pools continue to fill up. The source of this sedimentation is above the project. Fish are scarce in the project area, most likely due to blockages downstream. These problems serve to illustrate that the success of any stream project is contingent on other conditions throughout the stream and watershed system.

Participants from the Municipality emerged from this project with the belief that the best solutions unfold when experts of various fields (engineers, hydrologists, biologists, etc.) are able to sit down and work together rather than in isolation. A common language must be developed for this purpose to ensure effective exchange of ideas rather than mutually-unintelligible technical jargon. The criteria which emerged from this project's group design process later became part of a Department of Public Works Design Manual. Although initially appearing time-consuming, a multidisciplinary (and flexible) approach is most likely to lead to the best and most long-lived solutions.

SIGNIFICANCE OF PROJECT:

The Little Campbell Creek stream rehabilitation project was the Municipality of Anchorage's first major undertaking to improve the quality of its urban streams. This section of Little Campbell Creek was chosen because of its history of icing and subsequent overflow, its proximity to Abbott Loop Elementary School, and the need for landscaping and habitat improvements along its channel. Working closely with a citizen committee appointed by the Mayor, the project team (consisting of the Department of Public Works and Ott Water Engineers, Inc.) completed a hydrologic analysis of the stream; proposed six design alternatives; met with the public, affected landowners, other Municipal Departments, and federal and state regulatory agencies; and facilitated committee decision making. The end product of the mediation efforts was an effective solution which resulted in nine tenants willingly moving from their homes so that the creek could be rehabilitated.

FOR FURTHER INFORMATION:

Report(s):

Authors: Bacon, Thomas and Marideth Sandler
Publication Date: 1987
Title: Mediating water quality: turning a ditch back into a creek—the Anchorage experience (Proceedings of "Water Quality in the Great Land, Alaska's Challenge." R. G. Huntsinger, editor. Report IWR-109, Institute of Northern Engineering, Univ. of Alaska, Fairbanks)
Reference Type: Conference Proceedings

Contact Persons: Phil Brna, Habitat Biologist, ADF&G, now at the State Pipeline Coordinator's Office, 278-8594. Tom Bacon (MOA Public Works, 786-8187) and Mark Dalton (then MOA Planning Office, now at HDR/Ott Consultants, 562-2514) were involved from the Municipality. Marideth Sandler (then at Ott Engineering, now at SW Alaska Municipal Conference, 562-7380) was involved in the design/planning, and coordinated all community meetings, etc.

Other Information Sources: Interviewed Phil Brna (ADF&G), Tom Bacon (MOA, Public Works) and Marideth Sandler (now at SW Cities Conference) in May 1993. A substantial amount of text description was taken directly from the article referenced above. Several pages describing the original problem and proposed actions are in the permit application materials at ADF&G.

12. Rabbit Creek Fish Pass

SHORT DESCRIPTION: Step pools to correct perched culvert and riparian revegetation.

Responsible Organization: ADOT/PF
Organization Based In: Anchorage
Agency Permit #: FG 87-II-0232
Year Work Began: 1988 - Year Ended: 1989
Status: Completed

LOCATION/SITE CHARACTERISTICS:

Waterbody: Rabbit Creek
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-60-10320
Location Description: Rabbit Creek, immediately downstream of Rabbit Creek Road and Old Seward Hwy.
Site Impressions of Habitat Type: Mid-sized stone-lined creek & riparian vegetation.
Project Size: Roughly 150' of stream length
Maps: Layout of project including gabion diagrams and revegetation plans in files from ADOT/PF.

OVERALL GOAL(S) OF PROJECT:

To provide fish passage through a perched culvert to upstream spawning sites.

OBJECTIVES:

1. Enable fish passage for adult chinook and coho salmon to upstream spawning locations.

2. Provide a structure sufficient to withstand high flows.

3. Revegetate the stream banks and areas disturbed by construction equipment and diversion channel.

IMPLEMENTATION INVOLVED:

1. Silt fencing was installed. A diversion channel was constructed around the west side of the stream and lined with both visqueen and filter fabric to cut down on water quality problems. The stream was then diverted.

2. The dewatered channel of Rabbit Creek was excavated, lined with geotextile fabric, and a layer of Class II riprap to prepare it for the gabions. Ten notched gabion weirs were then installed at 10 ft intervals below the culvert opening. The drop in elevation between each notched weir opening was one foot per weir (Plate 33).

3. The silt fencing was moved, and the water was diverted back into Rabbit Creek.

4. The diversion channel was filled in and restored as a streambank.

5. The disturbed areas were revegetated with willow cuttings, small trees (4-6 ft.), and seeded with grasses and other species.

ESTIMATED COST:

ADOT/PF was not able to provide cost estimates for the fish pass, but the construction techniques were relatively expensive (see Plate 33).

JUDGEMENT OF SUCCESS:

1. <u>Fish Passage</u>. The fish pass was designed by ADOT/PF with help from George Cunningham, then with ADF&G, FRED Division. The fish populations in Rabbit Creek before construction were well documented by the Sport Fish Division of ADF&G. These included resident Dolly Varden, small numbers of rainbow trout and Arctic grayling, and annual runs of chinook, coho, and pink salmon. The size of the annual salmon runs were estimated at: 25 to 100 chinook, 50-250 coho salmon, and from several hundred to a few thousand pink salmon returning in even-numbered years, while few pinks returned in odd-numbered years. In 1991, post-construction of the project, a fairly good run of chinook was reported (64 actually observed, about half above and below the fish pass). In 1993, however, it is difficult to assess the continuing use of the fish pass because very few fish were observed to return to Rabbit Creek this year. The chinook survey reported no fish observed from Potter Marsh to 140th street, and only one coho salmon was observed upstream of the fish pass in three September visits. In 1993 a concern has been voiced from the neighborhood residents that a massive beaver dam (or series of beaver dams) in the Potter Marsh area below the fish pass may be blocking adult passage. ADF&G staff confirmed the existence of at least one very large beaver dam, and observed two dozen adult coho below the dam and 10 fish above the dam on October 6, 1993. There may be some validity to the residents' concerns of the beaver dam at/l/ast delaying the fish in ascending the creek. However, this problem has no reflection on the effectiveness of the Rabbit Creek fish pass itself.

2. <u>Stable Structure</u>. Construction was difficult because of the size of the gabions and poor substrate for foundations. Several problems were encountered with the gabions: they began sinking after construction; they were deformed by logs that washed down; the gabion weirs did not impound enough water—the openings were not set properly. Later in the summer of 1988, large rocks were added to the openings to impound more water and slow the velocity. It appears that many of the boulders placed in weir notches may have washed out over time. So far, the structure has not failed and the fish pass should still be providing access to upstream habitat (Plate 34). However, due to the problems encountered, the ADF&G staff person on the project (Phil Brna) would recommend using big boulders in the future rather than gabions.

   The slope leading down from the road embankment above experienced continuing stability and erosion problems. ADOT/PF later returned to conduct maintenance on this slope, which appears to have been effective.

3. <u>Revegetation</u>. The revegetation plan submitted included 80 rooted cuttings of Pacific willow (*Salix lasiandra*) planted in 3-5 foot intervals, and 20 small willow trees 4-6 ft high planted further back from the stream bank (Plate 35). The adjacent area was hydroseeded with grass mixtures. The vegetation (grasses, willows) is growing in on rip-rapped banks. Hay bales are still noticeable in places. The 4-6 ft willow trees on both the east and west banks have taken well (Plate 36). However, the willow root cuttings are not flourishing, especially on the east bank and the north end of the west bank (by the headwall). It was in the latter section that the adjacent property owner reportedly had horses grazing at the revegetation site the year after planting. Once aware of the problem, ADOT/PF made the owner correct his fence. In the meantime the grazing and trampling undoubtedly set back the growth of many rooted willow cuttings. Hydroseeding of grasses was successful around the entire project. Shrubs that were originally at the top of bank above the headwall apparently did not survive.

LESSONS LEARNED:

Overall, the project has performed satisfactorily. The gabions did present some problems with installation and durability, and Phil Brna would consider boulder weirs rather than gabions in the future.

The willows and grasses sustained damage from horse grazing and trampling the year following planting. A successful revegetation project requires that such potential impacts (from the public, school children, resident animals, etc.) be anticipated and prevented through barriers, fencing and/or signage.

SIGNIFICANCE OF PROJECT:

The grade of the stream and the perched culverts which existed prior to construction of the fish pass made the upstream migration of fish very difficult, particularly at high flows. This fish pass represents quite a large effort to correct a relatively common problem. The fish pass seems to have worked relatively well, despite the setbacks with the gabions and grazing damage. Hopefully the fish will be able to negotiate around the current beaver dam barriers to be able to continue using the fish pass and the upstream spawning habitat of Rabbit Creek; otherwise these salmon runs may be jeopardized.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Don McKay, ADF&G, Anchorage, 267-2279, and Phil Brna, ADF&G, now at State Pipeline Coordinators Office, Anchorage, 278-8594.

Other Information Sources: Don McKay, Phil Brna (both ADF&G), and Carol Sanner (ADOT/PF) were consulted for this report. Other information was obtained from ADF&G permit files and local stream surveys (in Sport Fish Division). Site visits for this case study report were conducted several days in September and October, 1993, and included Stewart Seaberg, Betsy Parry, Betsy McCracken, Dave Harkness, and Paul Cyr (all of ADF&G).

13. Potter Marsh Road Removal

SHORT DESCRIPTION: Removal of road fill to abandoned weigh station as enforcement action for other COE permit violation.

Responsible Organization: Viewpoint Ventures (assisted by COE and ADF&G)
Organization Based In: Anchorage
Agency Permit #: Unable to identify.
Year Work Began: 1984 - Year Ended: 1984
Status: Completed

LOCATION/SITE CHARACTERISTICS:

Waterbody: Potter Marsh
Nearest Town: Anchorage
Topographic Map Quad: Anchorage A-8
Anadromous Stream #: 247-60-10320
Location Description: South end of Potter Marsh, near intersection of the Old and New Seward Highways. The fill had formed an access road to the old weigh station. The access road stretched diagonally on the west side (across the end of the marsh) from the New Seward Highway to the old station. A parking turnout on the old highway now marks the site of the old weigh station.
Site Impressions of Habitat Type: Site is located near the end of a large, mostly freshwater marsh.
Project Size: Approximately 1 acre of fill removed; banks revegetated.
Maps: None available, due to lack of files, but good photo records exist.

OVERALL GOAL(S) OF PROJECT:

To remove a road bed traversing a portion of the south end of Potter Marsh and re-establish a contiguous marsh community.

OBJECTIVES:

1. To remove road bed and fill material (Plate 37).

2. Vary contours in the excavated area to promote natural revegetation of both submergent and emergent plant species.

3. Leave "hummocks" on edges of former road to naturally revegetate as waterfowl cover habitat.

4. Revegetate the disturbed marsh banks at either end of the removed road.

5. Provide for water transfer between the excavated area and the rest of Potter Marsh.

IMPLEMENTATION INVOLVED:

1. Excavate to a 12-20 inch water depth to promote natural revegetation of both submergent and emergent species.

2. Provide some higher hummocks along the edges of the former road alignment to revegetate for waterfowl use.

3. Use willow bundles to revegetate the disturbed bank of the remaining turn out area adjacent to the Old Seward Highway.

4. No monitoring was required.

ESTIMATED COST: Staff estimates the work was relatively inexpensive.

JUDGEMENT OF SUCCESS:

The project appeared partially successful based on the amount of revegetation that has occurred (Plate 38). Within the excavated area (approximately 27m X 72m) water depth did vary between a few inches to 1.5 ft. At the time of observation, however, the water depth was generally shallower than the intended 12-20 inches (Plate 39). The low rainfall this summer (1993) may have contributed to lower than average water levels. Overall, little emergent vegetation was observed outside of a few patches of bullrushes and sedges, and the former road bed (rectangle) was quite evident. Submergent vegetation was patchy, consisting primarily of mare's tail. Water depth of less than 6 inches was mostly devoid of vegetation. Much of the NW end of the project area contained scattered large rocks, with water to 2 inches deep (Plate 39). Sticklebacks were observed in the deeper parts.

The higher "hummocks" on either side of the former road bed were approximately 1 ft above the water level and contained abundant vegetation (sweetgale, grasses, alder) (Plates 38 & 39). No waterbird use was observed in the rehabilitated area. Willow, black cottonwood, birch, alder, clover, grasses, sweetgale, and sedges were observed on the embankment at both ends of the former road bed. Black cottonwood (2 inches in diameter) was the largest species observed there.

Fill removal and bank revegetation was successful. However, the regrowth of emergent and submergent vegetation in the excavated area remains somewhat inhibited.

LESSONS LEARNED:

Why was natural regrowth of aquatic revegetation so minimal in the nine years since fill removal? It is likely that the remaining roadbed fill material is not the best substrate for aquatic plant establishment. If this project were to be done over again, agency staff said they would pay more attention to achieving the right substrate conditions, probably by excavating the fill to below the desired bottom depth, then backfilling with a mixture that includes organic fill, topsoil, and/or patches of adjacent marsh substrate. The resulting substrate would more closely resemble that the surrounding marsh, and should improve the natural regrowth of aquatic vegetation in graveled/disturbed areas.

SIGNIFICANCE OF PROJECT:

Reconnecting isolated portions of marshes, streams, ponds, and off-channel habitats remains one of the most effective types of habitat enhancement for the amount of effort and money expended. In this case, although the spanse of area that had been filled with gravel is still relatively clear of aquatic vegetation, the two productive portions of the marsh have been hydrologically re-united, which amplifies the size and habitat value of the entire coastal marsh area.

This restoration project also represents one of the first times the regulatory agencies (COE, ADF&G, etc.) collaborated to have a developer compensate for an illegal fill by conducting a mitigation action on a nearby area, off the project site. Many people have advocated developing a list of such "mitigation possibilities" for a given area, so that when a permit violation or other discussion involving mitigation comes up, a set of viable options are ready to be discussed, rather than having to invent something on a case-by-case basis.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Phil Brna, Habitat Biologist, ADF&G, now at the State Pipeline Coordinator's Office in downtown Anchorage, 278-8594.

Other Information Sources: The site was investigated for this case study report on 8/10/93 by Betsy Parry and Mark Fink, both of ADF&G. Phil Brna, the original ADF&G staff person on the project, contributed to this report. Although no ADF&G permit records were found from 10 years previous, photo records remain in the files. More information may be present in COE files.

14. Resurrection Creek Habitat Restoration

SHORT DESCRIPTION: Forest Service attempt to restore placer-mined reaches for juvenile coho using instream structures, revegetation, and rearing pond access.

Responsible Organization: USFS
Organization Based In: Seward
Agency Permit #: FG 93-II-0041 and FG 92-II-0152
Year Work Began: 1990 - Year Ended: Ongoing
Status: Implementation

LOCATION/SITE CHARACTERISTICS:

Waterbody: Resurrection Creek
Nearest Town: Hope
Topographic Map Quad: Seward D-8
Anadromous Stream #: 247-60-10150
Location Description: Project area stretches from 3 to 7 miles above the creek mouth (at Turnagain Arm).
Site Impressions of Habitat Type: Swift flowing river through mountain terrain, exposed gravel banks containing little vegetation.
Project Size: 3 miles
Maps: Not specific project site maps; low level aerial photos of lower 8 miles of Resurrection Creek taken in 9/92.

OVERALL GOAL(S) OF PROJECT:

Improve instream, off-channel, and riparian habitat features in the lower seven miles of the drainage affected by placer mining.

OBJECTIVES:

1. Increase the amount of pool habitat in the creek's main channel through placement of instream structures (large rocks and/or wood, to replace the large stream substrate removed by mining activity).

2. Increase access of juvenile salmon to isolated side channels and inactive settling ponds.

3. Incorporate fish habitat features in future mining operation stream diversions.

4. Revegetate disturbed streamside areas.

IMPLEMENTATION INVOLVED:

1. Background Study. From 1990 through 1992, the Chugach National Forest and the Cook Inlet Aquaculture Association conducted an anadromous fish study on Resurrection Creek. Stream habitat characteristics were inventoried using methods developed by Hankin and Reeves (1988). Results indicated that the amount of rearing habitat was the limiting factor for fish in all portions of Resurrection Creek. The study also determined salmon fry distribution within the creek, and quantified the number and size of outmigrating smolts. These surveys have served as tools to identify where, how, and what stream restoration measures should be applied.

2. Instream Structures. Numerous instream structures, including boulders, boulder clusters, "vortex" rock weirs, log barbs, and root wads, have been installed into the mined reaches of Resurrection Creek. Log, rootwad, and boulder structures have been installed using heavy equipment working during the creek's low

water conditions in early May (in 1992 and 1993). Specific aspects of the instream structures are discussed below.

A. **Boulders and Boulder Clusters.** Several boulders and boulder clusters were placed in the disturbed main channel of Resurrection Creek to increase the availability of pool habitat. Boulders were generally 3 to 5 feet in diameter, and were "keyed" (or embedded) into the channel bottom using an excavator so as to withstand scouring from the river. The boulders were placed low in the stream profile—the tops of the boulders were specified to reach no higher than 3/10 the depth of bankfull levels above the channel bottom. After placement of the boulders, pools form naturally on the downstream (spillover) side of the boulder. Placing the boulders low in the stream profile allows pool formation to occur even at low flow conditions.

B. **"Vortex" Rock Weirs.** Two vortex rock weirs were installed in the spring of 1992 (Plate 40). Vortex rock weirs are cross channel boulder structures in which spaces are left between individual boulders. Like boulders and boulder clusters, the weirs also produce downstream pool habitat. However, as a cross stream structure, the weirs produce a significantly greater amount of interconnected pool habitats both upstream and downstream of the structure. To form the weir, the boulders are aligned in a slight "V" formation with the point facing upstream in order to direct overspilling water into the center of the stream during higher flows. The boulders are spaced with at least half a boulder width left vacant between them to allow for sediment transport through the structure.

C. **Log Barbs.** Log barbs mimic certain natural woody debris jams. Seven log barbs were installed on Resurrection Creek by "keying" cottonwood logs into one side of the streambank (i.e., burying half their length into the bank), and orienting the immersed end upstream towards the oncoming flow (Plate 41). The barb's diagonal orientation (with respect to the channel) is intended to force overflowing water out into the stream and away from the bank. A downstream pool forms near the tip of the log. The log is placed low in the stream profile (0.3 of bankfull depth).

D. **Root Wad Placement/Cover.** Several tree root wads were installed into pools in the mined sections of the main channel to provide additional cover. Root wads were secured by cabling them to an adjacent boulder (Plate 42), or by attaching them to an earth anchor driven into the stream bottom. Root wads provide a diverse cover media within the pool.

E. **Tree Revetments.** Beetle-killed spruce trees adjacent to the stream were felled and attached along the streambank using earth anchors. Some cottonwoods were felled and anchored as well. The tree structures provide diverse cover along the margin of the stream. Even in relatively swift water, whole tree revetments can provide significant shelter for salmon fry. At Resurrection Creek, the objective of tree revetments was to provide cover and pool formation rather than for bank stabilization.

4. Revegetation. Denuded segments of the stream bank have been revegetated using a combination of willow and cottonwood cuttings and alder seedlings. Cuttings and seedlings have been planted as individual stems, or in some cases as brush bundles trenched into the ground horizontally. Revegetation efforts have been concentrated along the stream's edge in order to maximize rehabilitation of the immediate streambank, and to increase nearshore cover and woody debris. Specific experiments are detailed in the next section along with results.

ESTIMATED COST:

Costs estimates are available for equipment rental only. In 1992, for the installation of 17 structures, the expenses for a backhoe and cat excavator totalled $3850. In 1993, 19 structures were installed using solely a backhoe, totalling $4900. Work scheduled for 1994 will employ a cat excavator with hydraulic thumb at the rate of $75 per hour.

JUDGEMENT OF SUCCESS:

1. <u>Pool Habitat in the Main Channel</u>. To date, 36 instream habitat structures have been placed in the mainstem of placer-mined reaches of Resurrection Creek. Preliminary observations on the physical performance of the various structures include:

   A. **Boulders and Boulder Clusters.** Boulders and small boulder clusters have proven to be susceptible to being pushed around during high flow periods. They do not appear to be providing much rearing habitat—pool formation has been disappointing. They would probably cause more pool formation in a finer-textured stream bottom with greater scour potential. Placing boulder clusters (or rock barbs) in pairs at short intervals along the stream (e.g., 30 feet apart) increases the chances of creating pools between them.

   B. **"Vortex" Rock Weirs.** Two vortex rock weirs were installed. These structures are reputed to back up the flow, cut the stream gradient, create pools downstream of the structure, and allow the bedload to pass freely. In Resurrection Creek, the pool scouring effect downstream has not occurred as in smaller streams. The coarseness of the channel substrate (4-6" diameter) in Resurrection Creek may have impeded the scouring process. In contrast, gravel is actually being *deposited* in some spots downstream of the weir, which does nothing to augment the much-needed rearing areas. Boulders have washed out of the second vortex rock weir. Smaller boulders (approximately 3 ft. diameter) have shifted downstream slightly during high flows, emphasizing the need to use larger boulders in the future.

   C. **Log Barbs.** Of the seven log barbs installed, several appear to be working well. Others have not, either because they are not intercepting enough of the flow (possibly placed too high in the stream profile), or they have been scoured out underneath. A high stream bank is necessary to properly anchor these structures.

   D. **Root Wad Placement/Cover.** Rootwads are very cost-effective structures. Those that were anchored into the stream margins have stayed in place. Rootwads anchored mid-channel to boulders have moved downstream, but eventually anchor themselves at a new location.

   E. **Whole Tree Revetments.** Both spruce and cottonwood trees were used, but the majority of the larger ones (18" dbh) were cottonwood. The spruce trees cabled to the bank have been effective. Attempts at anchoring large whole cottonwoods mid-channel to boulders have been less stable, and the wood has migrated downstream.

   Habitat changes and fish rearing associated with structures will continue to be evaluated to determine the effectiveness of different structures for creating juvenile salmon rearing habitat. Fry trapping at 72 naturally-occurring pools and 29 structure pools in August, 1993, indicated that the enhanced pools created by logs, rootwads and whole trees yielded similar rearing densities to those of the natural pools. Enhanced pools created by boulders and boulder clusters were difficult to evaluate due to turbulent flows in the small pocket pools formed. Evaluation of salmon rearing densities at enhanced and natural pools will continue in 1994.

2. <u>Juvenile Salmon Access to Off-Channel Habitat</u>. The greatest potential to increase the amount of available fish rearing habitat lies in re-establishing access to ponds and side channels that were isolated from the creek during mining operations. Unfortunately, conflicts with the claimholders' mining plans have precluded efforts to provide access to off-channel habitat on the most disturbed reaches of the stream. Progress has been made only at a few isolated locations outside of the claimholders' future mining operations.

   In one example, the USFS hopes to provide access to two series of side channels and ponds on the St. Louis and Pearson mining claims over the next few years, creating over 10 acres of off-channel rearing habitat. At the tributary Rimrock Creek (Pearson claim), salmon fry are blocked from reaching a system of ponds by an abandoned beaver dam. The access plan calls for a series of six-inch "steps" to enable fry to reach the ponds. Habitat values within the ponds may also be improved by adding woody debris (cover), and in some cases deepening the ponds for better overwintering habitat. Other off-channel improvements will include excavating access channels into abandoned suction dredge ponds (which average 200 to 300 sq. ft. of surface area) for additional rearing habitat.

3. <u>Incorporation of Fish Habitat Features into Mining Stream Diversions</u>. Hope Mining Company is considering diverting a 1,000 foot segment of Resurrection Creek in order to mine the present channel. An opportunity exists to design and construct rearing habitat measures into the diversion channel before any water is diverted. Habitat measures could include: boulder and woody debris structures, side sloughs/ponds accessible from the creek, and good vegetative cover along the banks. Installation of such habitat measures of course depends on whether the creek diversion is undertaken at all.

4. <u>Revegetation Efforts</u>. The USFS has made several revegetation experiments over the years at Resurrection Creek. The first revegetation efforts in the 1970's consisted of seeding grass into substrates containing little fine-textured material. The mixture of several grass species yielded about 50% cover which has persisted. In recent years, grass seeding has been less commonly used due to concerns that by monopolizing the small amount of available moisture in gravel substrates, the grasses may hinder the natural reinvasion of woody species.

   In 1991, a three-year experimental project was begun by Dean Davidson (USFS) using cottonwood and two species of willow. The test plots were conducted along the banks of settling ponds that contained approximately 10% fine sediments. Topsoil was added to half of the plots. 108 woody cuttings and 36 bundles were planted at different levels above the pond water surface. The first year (1992), showed good growth on all planted cuttings. By the second year (1993), many willow cuttings had been lost due to moose browsing. The remaining willows exhibited a slower growth rate than in the first year. Overall, the cottonwood cuttings produced significantly more growth than did the willows, although their growth was also diminished during the second season. Growth on the bundle plantings was quite impressive the first year, reduced the second year. The bundles closer to the water level may be doing a bit better than those placed higher on the bank. In 1994 all plots will be resurveyed and root development will be examined. A report will analyze findings of the three-year project.

   In 1993, Mark Wenger (USFS) began a revegetation project in a area which is not ideal for plant growth (due to coarse gravel content), yet very representative of the placer-mined watershed. He collected approximately 1,000 dormant cuttings from cottonwoods in spring (March-April), stored them at the recommended temperature and moisture levels (ADF&G, 1986), and planted them in May. Only cottonwood cuttings were used because of the high amount of moose browsing pressure on willows in this area. The cottonwood cuttings were planted into the gravel of Resurrection Creek's streambank, which is low on fine sediment content due to placer mining. Only about a 10% survival rate was observed at the end of the 1993 growing season. Possible reasons for the low survivorship include: a) the substrate size could be too coarse even for cottonwoods to take root, and b) the placement of some of the cuttings below the high water line, which may have flooded them out. When planting into similar gravels in the future, Mark Wenger plans to spread a certain amount of fine soil over the gravel, and closely monitor the results.

Also in 1993, approximately 50 young (3 ft.) cottonwood trees were transplanted into the gravelly streambank, roots and all. Approximately a 50% survival rate was observed for the first season.

LESSONS LEARNED:

Substantial anchoring is required to secure any structures in Resurrection Creek. Boulders 3 to 5 feet in diameter have shifted during high flows or from the force of an ice dam breaking on an upstream tributary. Very large boulders (greater than 6 foot diameter) may perform better as anchors.

Re-establishing access to ponds and side channels that were isolated from Resurrection Creek during mining operations has a much better chance of increasing significant amounts of rearing habitat than does the installation of instream structures. Unfortunately, political problems make cooperation with the fish habitat access program unsavory to miners, because once salmon began to use a waterbody the miners would become subject to many more restrictions on the use of their claim, due to the state's anadromous fish habitat protection laws. The Forest Service is currently working with a major claimholder to explore acceptable means for opening access to several ponds on the claim.

The Forest Service plans to continue installing and monitoring stream and habitat rehabilitation measures on Resurrection Creek over the next several years. Restoring a placer-mined watershed can be a long process. Individual rehabilitation measures taken together work towards the overall goal of returning some of the pre-disturbance character to the Resurrection watershed, and improving the coho salmon fishery. Rehabilitation measures will work to improve habitat for chinook salmon as well, although they have not been targeted in this effort. Improved habitat values should serve to increase productivity of coho salmon on Resurrection Creek.

SIGNIFICANCE OF PROJECT:

This project is significant in that it addresses a good-sized stream system with a long history of disturbance (placer mining dating back to 1895). Modifications to instream and riparian habitats are typical for placer mining and have included: stream diversion, channelization, elimination or isolation of side channels, removal of instream boulders and streamside vegetation, and construction of settling ponds. The creek supports primarily pink, coho and chinook populations, with lesser amounts of chum salmon and an occasional stray sockeye salmon.

The project is also significant in that a thorough investigation of the river system was undertaken before the restoration plan was developed. The studies indicated that the system was limited in the amount of rearing habitat available to salmon fry, which led the direction of the restoration actions. Studies also compared the mined and unmined reaches of the stream in terms of fry distribution, size and number of outmigrating smolts, and the extent of different habitat and cover types present. These study findings were used to target measures best suited to restoring and enhancing habitat in the reaches disturbed by mining.

The U.S. Forest Service's long-term investigations at Resurrection Creek will yield much valuable data relevant to other system-wide stream restoration projects in Alaska, such as those affected by placer mining, gravel mining, and logging.

FOR FURTHER INFORMATION:

Report(s):

Authors: Blanchet, Dave and Mark Wenger, Chugach National Forest
Publication Date: 1993
Title: Fisheries Habitat Restoration in Placer Mined Reaches of Resurrection Creek (in *Papers of the Second EPA Placer Mine Reclamation Workshop*, Anchorage, Alaska, March 1993).
Reference Type: Conference Proceedings

Contact Persons: Mark Wenger, USFS, Seward Ranger District, P.O. Box 390, Seward, AK, 99664. Phone 224-3374. Also Dave Blanchet and Dean Davidson, Supervisor's Office, Chugach National Forest, Anchorage, AK. Phone 271-2500.

Other Information Sources: Mark Wenger, USFS Fish Biologist, Seward, provided a copy of the above report from which much of this background information was taken. A site visit was conducted on 8/30/93 by Betsy Parry (ADF&G) and Mark Wenger (USFS).

References cited in the above case study description also include:

Alaska Department of Fish and Game, Habitat Division. 1986, June 19. *Streambank revegetation: field guide to streambank revegetation.* [Palmer, Alaska]: [Alaska Department of Natural Resources, Plant Materials Center]. Pamphlet. 17p.

Hankin, D.G., and Reeves, G.H. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Can. J. Fish. Aquat. Sci. 45: 834-844.

15. Kenai Wilderness Lodge Bank Stabilization

SHORT DESCRIPTION: Combination of woody revegetation & riprap for bank stabilization on Kenai River.

Responsible Organization: Kenai Wilderness Lodge
Organization Based In: Soldotna
Agency Permit #: FG 93-II-0303, FG 91-II-0619, FG 90-II-0515, and FG 88-II-0578
Year Work Began: 1993 (current); before that, 1989 & 1970's (originally)
Status: Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Kenai River
Nearest Town: Soldotna
Topographic Map Quad: Seldovia D-3
Anadromous Stream #: 244-30-10010
Location Description: Kenai Wilderness Lodge (owned by Dennis Dunham) near end of Funny River Road; Tract A of Eagles Roost subdivision; Mile 43 3/4 of Kenai River. Section 35, Township 5 N, Range 8 W, Seward Meridian.
Site Impressions of Habitat Type: Outside bend of swift-moving river.
Project Size: Total of 180 linear feet of riverbank (bioengineering solution employed along 70 linear ft).
Maps: Some preliminary drawings in ADF&G file.

OVERALL GOAL(S) OF PROJECT:

To stabilize a section of Kenai River bank subject to erosion & sloughing, save the existing buildings closest to the river's edge, and improve fish habitat features.

OBJECTIVES:

1. Arrest erosion and overall bank failure which has been caused by various factors, including: the extremely high force of the river at this position on an outside bend, boat wakes, and foot traffic on the bank from lodge visitors.

2. Attempt to stabilize a 70 linear foot section of bank using live native plant materials (at or above the high water line), not just rock. The combined biological and engineering solution was intended to last longer and improve fish habitat.

3. Ultimately, the objective was to save the land nearest the river bank, including a building originally 40 feet or more from the edge, currently only 20 feet back.

IMPLEMENTATION INVOLVED:

The following is a history of work previously conducted at the site, from the late 1970's to 1992:

<u>Late 1970's</u>: A bulkhead was installed and backfilled when the river bank was still some 30-40 feet out from the nearest building.

<u>1980's - 1992</u>: Eventually, water worked its way behind the bulkhead and washed it out, leaving behind much debris. As requested by ADF&G, this mess and the remaining bulkhead was removed in 1989. In its place, the contractor needed another way to stabilize the bank. ADF&G suggested a solution that would provide more fish habitat than a straight bulkhead. In 1989, the contractor (Jerry Holly) tried backsloping the bank to a 2:1 slope, lined it with typar fabric, and installed riprap of no greater than 3 ft diameter at the toeline. Smaller rock (4") was

used to bed the boulders. This arrangement kept eroding and it soon became evident that much bigger rock would be necessary (Plate 43). The following year (1990) he tried to stabilize an adjacent upstream section of the shoreline by lining the bank with typar fabric, then placing huge riprap (including some "truck-sized" pieces) along the toeline and up the slope. A few of these large boulders failed in 1991. The contractor had expected to continue placing large boulders along the remaining shoreline, but ADF&G asked that he try a bioengineering approach (i.e., including revegetation techniques) for any further work at or above the high water line. (Live plant materials are not an option for use below the high water line.)

<u>In 1993</u>, a number of techniques were employed:

1. On the downstream (first) section of bank, large rock was installed at the base of the slope, but stopped just below the ordinary high water (OHW) line (Plate 44). Above this point, the existing rock, bedding material, and typar were removed from the riverbank, exposing the natural bank. Spruce trees were cabled along the toeline outside of the large rock as an additional revetment, placed parallel to the river flow. A horizontal 4" x 14" wooden timber was installed along the bank at the point where the rock left off. This timber served as a transition to the section of planted slope. The timber was intended to hold the bank soil above it, and to prevent the soil from the upper plantings from washing down through the rocks.

2. In one section, the natural bank was then covered with a brush mattress from the rock to the top of the bank. The brush mattress was formed of willow cuttings placed vertically against the bank with the butt ends pointing downslope. The 4 to 12 inch thick brush mattress was then anchored with earth anchors and/or wooden stakes, and covered with a natural fiber jute mesh, to stabilize the materials.

3. On another section of the bank, willow fascines were placed at the high water line, above the timber (Plate 45). These fascines were composed of six to eight foot cuttings, buried horizontally into the slope with only 1/3 of the length exposed. The exposed branches extended towards the water over the top row of riprap. Fascines were installed at the high water line along approximately 40 feet of shoreline. Soil (composed of topsoil from a nearby area mixed with the material excavated from the slope) was added to the bank above the fascines, which was then covered with the natural fiber mesh.

4. The banks were then planted with a combination of materials, both in the section of riverbank above the fascines, and in the section containing the brush mattress (Plates 45, 46). Planting materials included: 250 rooted willow cuttings, 75 live willow stakes (2" diameter), and 60 willow bundles. The bundles were approximately three feet long, planted with only the tops exposed. Rooted cuttings were planted on 2 foot centers below the ordinary high water level and on one foot centers above OHW.

5. The plant materials were watered during establishment in the dry early summer of 1993. The cuttings were also fertilized with small buckets of miracle grow solution.

6. Additional planting was also attempted in the upstream area where large riprap had been in place since 1989. In the breaks between boulders, a cut was made in the underlying fabric, where a bit of soil and rooted willow cuttings were added in 1993. Previously (1991), the caretakers had transplanted a bit of turf from nearby areas which they called "moss patches". These were placed between the large boulders.

ESTIMATED COST:

This is a difficult site, with very fast water, a steep drop off below the exposed river bank, and access problems. Using these techniques probably averaged around $200-$400 per linear foot in 1993 (as per Jerry Holly), which is perhaps more than would be required in a less extreme location.

JUDGEMENT OF SUCCESS (for 1993 work only):

1. Erosion Control. So far, the bank project has held up well. The large rock at the toeline has held against the force of the river. The timbers and jute helped hold the bank during boat wakes. Root growth of planted materials will increase the stability of the slope over time. Meanwhile, the foot traffic situation has improved. In the past, large rocks alone may have actually attracted foot traffic onto the banks. In 1993, with only a small vertical board separating the planted slope from the gravel path at the top, people surprisingly stayed off the bank. Perhaps the tangled matrix of jute and willow bundles looked uninviting; it does appear to provide a much less secure foothold than solid rock, which is important when venturing out on a steep bank above a strong current. The lodge caretakers may have made special efforts to keep people off the newly planted areas. A wooden observation platform may have helped relieve the foot pressure off the streambank as well.

   The only erosion during the first (1993) season was noted at the extreme downstream end. There, Jerry Holly was unsure as to how to terminate the rock/timber/planting interface as the bank makes a sharp inward turn to an area of previously riprapped bank. Apparently, the transition was not secure, because soil washed under the basal timber and some of the brush mattress began to slough in this area. Jerry Holly feels another technique could solve this problem with the structural transition.

   By spring 1994, large sections of ice had frozen to the toe rocks and cabled spruce trees. As the water level on the river changed, the ice fell in and took several toe rocks with it. Along this section of the river, the submerged slope is quite steep (and the river deep), making it very difficult to securely stabilize the boulders at the toeline.

2. Performance of Plant Materials. The spruce tree revetments are now below ordinary high water, in front of the large riprap (Plate 45). The first season the tree branches provided good cover and eddies for young fish. At their location below OHW, the tree revetments are subject to damage from spring ice movement and may have to be maintained/replaced periodically in order to continue serving as habitat features.

   This project utilized the following willow materials: 250 rooted cuttings, another 75 live stakes, 60 bundles, and fascine installations. Of these plant materials, the most successful were the rooted cuttings (90% successful), followed by the live stakes (20% successful) and the bundles (20% successful) (Plate 46). Jerry Holly had expected that the fascines and bundles would do well, but the results were the opposite. The fascines were very disappointing, with only a couple showing any leaves at all by the end of the season (Plates 44, 45). Jerry would like to try another fascine project, but would plant them above the high water line next time. A few alder cuttings were mixed into the bundles, but do not appear to have survived. The brush mattress was approximately 50% successful. The bank now also contains some small plants that originated from the topsoil (e.g., chickweed). The "moss patches" that were transplanted in between the large boulders in the upstream area (in 1991) are still alive and growing. The willow cuttings added to this upper area in 1993 (i.e., those installed through the fabric between boulders) generally showed good success. It must be kept in mind that in 1993 this area of the river experienced the highest water in 30 years. These cuttings were under water for about a month, so their performance is better than expected under the circumstances.

3. Threat to existing buildings. If the bioengineered bank continues to hold through flooding (as experienced in 1993) and icing then the buildings, now approximately 20 feet from the bank's edge, may be out of immediate danger. The performance of the project during the 1993 season was impressive, but it is still too soon to tell whether this approach will provide a long-term solution in a difficult site. Continued vigilance in maintenance (e.g., repairing the eroding end structure) and monitoring (e.g., keeping people off the banks) will contribute to its success.

LESSONS LEARNED:

Previous bulkhead and common riprap solutions at this site were not providing satisfactory long-term results. After several years of work, material was still being lost into the river. ADF&G advocated the use of plant materials along with large boulders, which alone do little to promote fish habitat. The current project, combining riprap, tree revetments, and several types of live plantings, will be a good test of alternative solutions.

Of the planted materials, rooted willow cuttings appear to be very successful when given attention during the establishment period. Fascines do not perform well at the high water line, but should be considered for uses higher on bank in the future. Willow bundles proved to be more susceptible to drying out than expected; they must be kept moist and covered.

The use of jute mesh and the retaining timber at the base of planted slope may have contributed much to the preservation of the soil and the planted materials during boat wakes and high water. As evidence, the one area where the timber was not as tightly installed (at its extreme downstream end), the slope failed.

This project again demonstrates that the most sound solutions evolve when engineers, contractors and fish biologists work together instead of at odds with each other.

SIGNIFICANCE OF PROJECT:

At this location, the owners have been battling the extreme high force of the river on an outside bend, boat wakes, foot traffic, and have tried to save buildings which were originally approximately 40 ft. from the river's edge. All previous attempts to stabilize the eroding bank (bulkhead, riprap of various sizes, etc.) have not achieved lasting results. If this bioengineered solution stands the test of time, it will be an important demonstration of the ability of natural materials to provide optimum results. The results are very encouraging at this time, since the materials withstood unusually high water conditions during the first season, and are still growing. One of the reasons for success is that such a variety of materials and planting techniques were employed at the site, a "shotgun" approach which yielded good results.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Jerry Holly, Specialty Excavating, Box 365, Soldotna, AK 99669, 262-5175. Jerry designed and installed the project. Gay Muhlberg, ADF&G, Anchorage, 267-2284, worked with him on the design. Phil Brna (ADF&G) was involved during earlier work at this site (through 1990).

Other Information Sources: Talked to Gay Muhlberg & Jerry Holly several times in September-October, 1993. Site was visited for this report by Betsy Parry and Jerry Holly on 10/21/93. Good descriptions are found in ADF&G files and the actual 1993 permit. Jerry Holly has extensive photo records of each step in the construction/installation process.

16. Bradley Lake Waterfowl Mitigation Area

SHORT DESCRIPTION: Tidal/freshwater waterfowl nesting area as mitigation for the access road for Alaska Energy Authority's (AEA) Bradley Lake hydropower plant.

Responsible Organization: AEA
Organization Based In: Anchorage
Agency Permit #: FG 86-II-0112 (Amended 12/26/90); more information in ADF&G file # 7-6.7-3.2-3.4-4
Year Work Began: 1991 - Year Ended: 1991
Status: Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Kachemak Bay tidal area
Nearest Town: Homer
Topographic Map Quad: Seldovia D-3
Anadromous Stream #: None
Location Description: Just west of the main hydroelectric facility, on south side of access road
Site Impressions of Habitat Type: Originally the area was a sedge meadow inundated only at high tides. After construction, it is a tidal area with raised linear islands that are still largely bare with patchy grass cover.
Project Size: 40 acres
Maps: In AEA's construction diagrams (Invitation to Bid No. AEA-91-R-001, Vol. 3)

OVERALL GOAL(S) OF PROJECT:

Create a waterfowl nesting area as mitigation for wetland fill to construct the hydroelectric plant's access road, which traverses the former tidal flats.

OBJECTIVES:

1. To impound freshwater runoff from the adjoining hillsides and combine it with tidal water to create a brackish water marsh, maintaining the desired water level in the nesting area.

2. To design islands suitable for waterfowl and shorebird nesting, including predator protection measures.

3. To foster the growth of vegetational cover, required for nesting habitat.

IMPLEMENTATION INVOLVED:

1. Stop-log water control structures were installed under the new access road to impound freshwater run-off, intended to create approximately 40 acres of marsh habitat. The water control structures allowed a small amount of tidal influence.

2. The islands (approximately nine) were laid out in long finger-like configurations to maximize the amount of nest sites for territorial birds and to facilitate construction (Plate 47).

3. Waste rock from the hydroelectric plant's tunnel construction (also called "tunnel muck") was used to form the core of the new nest islands. A backhoe then scooped up the adjacent tideflat mud and mounded it onto the islands, building them up until they were about two feet above the controlled water level.

4. Each island is encircled by deeper water (left by the backhoe). A minimum water depth of two feet depth was desired to act as predator deterrence.

5. A 6" layer of topsoil/overburden was placed on the islands, taken from the nearby alluvial fan which was being cleared for camp construction.

6. Several willows, shrubs, and small spruce were salvaged by a front end loader from the nearby camp construction site. These were transported and planted on the islands. The islands also received rooted sprigs of willow and alder (nursery-grown), and were fertilized and seeded with grasses more than once.

7. Monitoring was required as part of the project. The Alaska Energy Authority must submit a report on the mitigation feature to FERC after five years (i.e., 1996/97).

ESTIMATED COST: $675,000

JUDGEMENT OF SUCCESS:

1. Controlled Water Levels. The first season following installation (1992) turned out to be a very low rainfall year, so the amount of freshwater runoff was not enough to flood the area (Plate 47). The first response was to tighten the seal on the out-flow structures (i.e., the culvert covers under the road), so as to retain as much freshwater as possible. This measure still did not result in sufficient water in the marsh, so eventually the area was flooded with tidal water. The local tidal water still contains a fair amount of freshwater due to its proximity to the mouth of the Bradley River.

   In 1993, water depths varied between 6" and 20", which is considered ideal for dabbling ducks. A few areas had much deeper water. Maintenance crews have continued to work on repairing the leaks in the water control structures. AEA feels that after adjustments are made, they will be able to maintain a 18-24" water depth in the deeper, "predator deterrent" zone surrounding each island.

   Aquatic vegetation in 1993 consists primarily of pondweed, mare's tail and Lyngbye sedge. Lyngbye sedge is permanently flooded due to the impoundment and may not survive.

2. Adequate Nesting Cover. The following information is excerpted from Dan Rosenberg's written report of his May 19, 1993 evaluation of the waterfowl mitigation project (See "For Further Information").

   Vegetation cover on the islands is still sparse as of 1993. Plant cover consists primarily of the following species: bluejoint (*Calamagrostis* sp.), red fescue (*Festuca rubra*), beach rye (*Elymus arenarius*), Sitka spruce (*Picea sitchensis*), poppies (*Escholtzia* sp.), currant (*Ribes* sp.), alder (*Alnus* sp.), cottonwood (*Populus balsamifera*), elderberry (*Sambucus racemosa*), willow (*Salix* sp.), low bush cranberry (*Vaccinium vitus-idaea*), high bush cranberry (*Viburnum edule*), and sedges (*Carex* sp.).

   Overstory cover is less than 2% and ground cover varies from 0% to 40% cover in a few areas. The dominant ground cover is red fescue that was seeded in 1992. Other than red fescue, no species has more than 5% cover. Canopy height of ground cover is less than 10 cm. Overstory height is generally less than one meter. All overstory species were transplanted. Sedges grow along the side slopes near the waterline.

   Transplanted willows and alders are healthy but still small. If growing conditions are good they should provide significantly more canopy cover in a few years. Red fescue is expected to spread.

   Additional applications of fertilizer and seed should expedite plant colonization. Because these mud flat soils contain almost pure silt (with little organic matter), they do not hold moisture well. Watering any additional seeding or transplants will improve success rates if precipitation is below normal. If watering is not feasible, temporarily raising the water levels in the impoundment may aid plant establishment on the islands. For either application water salinity should be low.

3. Actual Waterfowl Use. The lack of plant cover to date precludes waterfowl nesting and no bird nests were found within the man-made portion of the project. A pair of American wigeon, a pair of mallards, two spotted sandpipers, a robin and a common raven were the only birds observed in the impounded area during a three hour visit in May, 1993. A later visit to the site (August 1993) yielded two yellowlegs and a small flock of American wigeon.

LESSONS LEARNED:

When tide flat silts are lifted above the waterline, they often dry out, harden, and do not support rapid plant colonization. To provide satisfactory results the nearly pure silt substrate requires either a great deal of soil amendments (to supply moisture-retaining organic matter, nutrients, etc.) or a great deal of time. The islands in the current project received topsoil, scoops of transplanted surface material, fertilizer, and were seeded more than once. The island vegetation is increasing over time, but it is still a slow process.

The water source for this type of project should be more heavily scrutinized in the planning stages. An ample, reliable water source is needed to flood an area this size, not an ephmeral stream. Regulating the water levels in this marsh was found to involve several variables (e.g., rainfall, evapotranspiration in dry years, and leakage through the control structures and gravel) and was more difficult to maintain than anticipated.

SIGNIFICANCE OF PROJECT:

Laying fill across a wetland for development is not an uncommon situation. Such an action usually results in loss of wetland acreage due to disruption of water circulation as well as the direct loss of the area filled. Often, fill bisecting a wetland will result in one side becoming drier and the other side wetter. When faced with such a fill proposal (such as for a road or highway), wetland permitters are interested in redeeming any possible benefits from the action. Waterfowl and fish are the most logical beneficiaries of water impoundments. In the Bradley Lake project, the road layout was incorporated into a design for enhanced waterfowl habitat (a configuration that was specifically intended to imitate the origins of Potter Marsh in Anchorage). This approach has many potential applications. If enough freshwater is present, the area might resemble Potter Marsh one day.

The project will also yield several years of monitoring and maintenance records, which will more clearly delineate the benefits and inherent problems in this type of waterfowl nesting project.

FOR FURTHER INFORMATION:

Report(s): Expected in 1997. (See below).

Contact Persons: Tom Arminski, Alaska Energy Authority, Anchorage, 261-7267. Dan Rosenberg, ADF&G, Anchorage, helped with design and has conducted surveys there.

Other Information Sources: Talked to Tom Arminski, AEA, and Dan Rosenberg, ADF&G. Some description on pages 5-35 to 5-38 of the Bradley Lake Hydroelectric Project Mitigation Plan, Nov. 1985. Much of the above information was taken from Dan Rosenberg's field report of his May 19, 1993 site evaluation. This field report was written as a memo dated October 7, 1993, to Lance Trasky of ADF&G's Habitat and Restoration Division. AEA must submit a more formal report of this mitigation project to FERC after 5 years (1996/97). Other observations came from a late summer field visit by Tom Arminski (AEA), Don McKay and Betsy Parry (both ADF&G) on August 18, 1993.

17. Martin River Delta Fish Ponds

SHORT DESCRIPTION: Former borrow pits for construction of the Bradley Lake hydroelectric plant were rehabilitated for fish spawning & rearing habitat.

Responsible Organization: AEA
Company Name, If Applicable:
Organization Based In: Anchorage
Agency Permit #: Unknown, but information contained in ADF&G file # 7-6.7-3.2-3.4-4
Year Work Began: 1991 - Year Ended: 1991
Status: Completed, no monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Martin River floodplain
Nearest Town: Homer
Topographic Map Quad: Seldovia D-3
Anadromous Stream #: 241-14-10600
Location Description: Eastern half of the Martin River delta area, 3.5 miles south on the access road from the main Bradley Lake plant headquarters on upper Kachemak Bay.
Site Impressions of Habitat Type: Still largely bare gravel berms and impounded water. A few emergents in select locations in the ponds. Some regrowth beginning on gravel slopes and dikes.
Project Size: 30 acres of ponds + 2800' long spawning channel
Maps: Specific portions of the work are diagramed in AEA's site rehabilitation construction contract (Invitation to Bid No. AEA-91-R-001, Vol. 3). Aerial photos also illustrate the site.

OVERALL GOAL(S) OF PROJECT:

Reclaim material site into suitable spawning and rearing habitat for coho salmon.

OBJECTIVES:

1. Convert former gravel pits into rearing and overwintering ponds for coho salmon. Provide cover for juvenile fish.

2. Convert former drainage channel into spawning channel for coho salmon.

3. Regulate water in spawning channel to retain adequate water levels in all reaches, and to provide fish access to all areas.

4. Scarify and fertilize the disturbed areas to encourage re-establishment of native vegetation.

IMPLEMENTATION INVOLVED:

1. Former pit areas were contoured to depths and slope grades indicated in original EIS and in consultation with ADF&G. The site was shaped with irregular sides and contained littoral areas as well as deep overwintering areas. The three pits, now ponds, are connected to the spawning channel that runs alongside them (Plate 48). The plans called for the system to empty into the main channel of the Martin River near its mouth.

2. The gravel extraction site was located on an inactive portion of the Martin River floodplain. An armored dike was built along the Martin River to assure long-term exclusion of the area from any active channel

(Plate 48). This dike previously protected the gravel mining operations, and now protects the rearing ponds from large fluctuations in flow.

3. Stumps and other large woody debris were placed on pond banks to provide cover (Plate 49).

4. Notched log weirs were placed at intervals along the spawning channel to maintain water depths in separate reaches of the channel (Plate 50). Riprap was used to stabilize spawning channel banks and to confine spawning to the center of the channel (to keep eggs immersed during periodic lower flow).

5. All exposed banks, dikes, and surrounding areas were scarified & fertilized to encourage plant growth.

ESTIMATED COST: $260,000

JUDGEMENT OF SUCCESS:

1. Rearing Ponds & Cover Establishment. Minnow trapping in 1993 confirmed that juvenile coho are using the former pits (as well as Dolly Varden and sticklebacks). Two age classes of juvenile coho were found—a good indication that utilization will continue and potentially increase as cover increases. There is not yet a great amount of vegetation regrowth, though it is only the second growing season; some alder and dwarf fireweed appear in the gravel. One corner of the second pond, nearest the spawning channel, showed the most growth with some emergent plants establishing (Plate 51). A few "islands" and a bit of existing vegetation were left in place in this area. Cover is not yet adequate for a truly productive rearing area, but it is increasing. ADF&G observers predicted that the area should have good brush cover in another 5 years. Areas of the gravel berm that contain topsoil are revegetating much more rapidly than areas containing coarser material. For example, Pit 1 (the furthest inland) is lined with coarse gravel and cobble and remains relatively barren.

2. Spawning Channel. Coho use of spawning channel is unknown; the site was visited too early in the 1993 field season to observe adults. However, coho have been observed to use the channel in previous years, even during project construction.

   The notched weirs appear to function well at maintaining water levels, but must be checked periodically. When inspected, several riprap rocks had washed down below the notch outlet at one weir, obstructing fish access to the upper reaches of the spawning channel and to the second rearing pond (Plate 50).

LESSONS LEARNED:

Indications are that the gravel pit/rearing pond conversions may work out well over time as the growth of aquatic vegetation and the invertebrate population increases. Because this was a gravel pit reclamation project, not a mitigation requirement, no monitoring was undertaken. This is unfortunate because follow-up surveys would have determined whether the effort expended was worthwhile—for example, how much fish use does the area receive, or how much of a contribution is it making to the fish population? Time and money was invested in the spawning channel and ponds, but the benefits are unknown.

Furthermore, to build the spawning channel weirs and not provide for periodic inspection (whether or not it is required), may fall just short of being an effective endeavor. As with any type of instream structure, the weirs require routine inspection and maintenance to assure function. If left alone, they may become obstacles to fish passage and defeat their own purpose, as observed in 1993 (Plate 50). Since the hydroelectric plant staff did reclaim the ditch as a spawning channel, and their permanent facility is located nearby, it seems that it would be within their interest to annually inspect the channel and remove any stray rocks that may block fish access.

SIGNIFICANCE OF PROJECT:

Unique aspects of this project include the scale of the gravel pit reclamation project (30 acres), and the substantial armored dike constructed between the Martin River and the project site, which was built to withstand a 100 year flood.

This project was not motivated by mitigation requirements. Instead, the pits and channel were constructed to supply the gravel needs of the new hydroelectric plant. The exploitative design was to excavate the pits, as needed, but at the same time to incorporate features that would allow future reclamation as fish rearing ponds. Measuring actual habitat benefits after reclamation was not the primary focus, although it would have been very useful to document the effectiveness of this design for future reference.

It must also be kept in mind that river deltas are dynamic. The rearing ponds and spawning channel occupy approximately one-third of the delta area. Bedload deposition will eventually fill the existing channel of the Martin River, diverting water through the protective dike and former gravel pits (which are lower in elevation than the present river channel), and ultimately complete the reclamation process. In the meantime, the gravel pit reclamation project may increase the amount of rearing habitat available for coho salmon.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Tom Arminski, Alaska Energy Authority, Anchorage, 261-7267. Don McKay & Gay Muhlberg were involved from ADF&G, Anchorage, 267-2284.

Other Information Sources: Interviewed Tom Arminski, AEA, and Don McKay, ADF&G. Both were present for the site visit on 8/18/93. Most of the project information exists in the form of correspondence between Tom Arminski and ADF&G. The description of the proposed fish rehabilitation efforts in the original EIS for the entire hydropower plant project fairly accurately describes what actually took place (Final Environmental Impact Statement, Sept. 27, 1985). A mitigation plan for construction of the hydroelectric plant was also developed: "Mitigation plan: Bradley Lake Hydroelectric Project, November 1985, Federal Energy Regulatory Commission Project No. 8221." This plan still contained reclamation measures at a conceptual level, however. The reclamation project was not designed in detail until 1991, when the contract went out to bid (diagrams in AEA's Site Rehabilitation Construction Contract, Invitation to Bid No. AEA-91-R-001, Vol. 3). Homer Electric Association now operates and maintains the project. Aerial photos are in the permitting files.

18. Box Canyon Creek Rearing Ponds

SHORT DESCRIPTION: Series of rearing ponds as mitigation for constructing the coal loading facility on wetlands.

Responsible Organization: ADOT/PF
Agency Permit #: FG 86-II-0287 & Amendment (more information in ADF&G waters files)
Organization Based In: Anchorage
Year Work Began: Design-1986, Construction-1987 - Year Ended: 1987
Status: Completed, no monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Box Canyon Creek
Nearest Town: Seward
Topographic Map Quad: Seward A-7
Anadromous Stream #: 231-30-10080-2040
Location Description: North side of Mile 2.7 Exit Glacier Road (also called Resurrection River Road).
Site Impressions of Habitat Type: Original Pond—small, (approx. 1/2 acre) quiet water pond with some overhanging vegetation. The newer ponds were rather sterile, gravel-sided ponds with fast-water riffles areas between them. A wide gravel bank lies between the ponds and Exit Glacier Road; cottonwoods grow behind the ponds on the back (north) side.
Project Size: 1,000 ft of stream
Maps: Maps of the proposal are in the Corps Public Notice, but changes were made before construction. The site is also on U.S. Forest Service air photos 86 & 92.

OVERALL GOAL(S) OF PROJECT:

Mitigation for loss of coho salmon spawning and rearing habitat (from the Seward Coal Loading Facility, 1983-4).

OBJECTIVES:

1. Construct a series of new ponds and riffles for spawning and rearing coho salmon in the outflow channel of an existing gravel pond near Box Canyon Creek (Plate 52).

2. Create a controlled inflow from Box Canyon Creek to the existing 1/2 acre pond in order to minimize winter ice scour, augment the amount of water available to the new rearing habitat complex in the pond outflow (approx. 500' of habitat) and enhance production of macrophytes, invertebrates, and juvenile coho salmon in the existing pond.

3. Deepen the existing pond (from 3 ft to 5 ft) and remove the fine sediment layer over the substrate (caused by erosion from Exit Glacier Road during flood stages). This resulting substrate would be more suitable for the growth of macrophytes and invertebrates. Also, a deeper pond is less likely to freeze to the bottom during the winter, thus providing overwintering habitat for juvenile fish. One section of the existing pond (nearest the outflow) was excavated much deeper (approximately 18 feet) to provide for overwintering habitat.

IMPLEMENTATION INVOLVED:

NOTE: In the following description, "Box Canyon Creek" refers to the groundwater-fed clear stream, not the neighboring glacial stream, prone to flooding, which is also called by the same name.

1. Extensive pre-project monitoring occurred while mitigation alternatives were being explored (1983-84). The monitoring objectives were to determine the use of the existing pond for coho salmon rearing and overwintering; to identify alternatives for augmenting the habitat in the pond and the effects of implementation of these alternatives on the existing stream habitat; and estimating the existing fish populations and extent of fish habitat. The final project configuration was conceived in 1985 by ADF&G and the U.S. Fish and Wildlife Service as suitable mitigation for habitat loss during construction of the Seward coal loading facility.

2. Construction began in May, 1987. J.G. Fisher & Associates did the field engineering and directed the project construction using ADOT/PF equipment and labor. The controlled inflow was accomplished by installing a headgate in the short channel between Box Canyon Creek and the existing gravel pond (Plate 53), and another headgate was installed at the outflow of the existing pond. This second headgate was an afterthought from the original design. It was intended to control the flow through the new pond complex below in cases where the old gravel pond was subjected to flooding (from the Resurrection River overtopping the main road). The new pond complex would then be protected from extreme flows.

3. The existing pond was deepened from 3 feet to 5 feet, with a much deeper hole (up to 18 ft) near the outflow channel.

4. The area for the new rearing ponds was cleared and contoured. Eight 6-foot deep ponds were excavated in a series, connected by shallow riffle areas (Plate 52). The designs called for the ponds to be 100 feet long (including transition areas at each end), and the seven connecting channels to be 25 feet long.

5. When the ponds were completed, 1,000 pounds of 16-16-16 fertilizer and 126 lbs of grass seed were spread on the approximately three acres of spoil and disturbed areas.

ESTIMATED COST:

ADOT/PF reports that the project was not to exceed $21,000. The contractor reported that the project was completed under budget, thanks to the financial contribution of $4,620 from the Seward Chamber of Commerce Fish Restoration Fund (which paid for the bulldozer work), and the 304 man-hours of inmate labor supplied by the Kenai Correctional Center.

JUDGEMENT OF SUCCESS:

1. Previously-existing gravel pond. This pond had already been identified as important overwintering habitat for coho salmon and Dolly Varden (ADF&G, 1984), but it was considered too sterile to provide much summer rearing opportunity (no cover). The pre-project report said that in spring both coho and Dolly Varden fry emigrated out of the pond into Box Canyon Creek to rear. Improvements to the pond, as well as the passage of time, appears to have increased the attractiveness of the pond as rearing habitat. Vegetation around the pond has accumulated. Minnow trapping in this pond (1993) revealed numbers of rearing Dolly Varden and coho salmon in various age classes. Although not recently examined in winter, overwintering potential has probably also increased with the deepening of the pond.

2. New Series of Rearing Ponds.

    A. **Overwintering**. The new ponds appeared to be deep enough (approx. 6 ft.) to provide adequate overwintering conditions. Actual winter use is unknown.

    B. **Rearing**. The series of newly-constructed (1987) ponds appear to support some salmonid rearing, but probably less than their potential. Minnow trapping in several of these ponds produced a total of a dozen juvenile coho salmon, five Dolly Varden, and two chinook salmon. The ponds are noticeably lacking in both in-water and shoreline cover types (Plate 54). This absence of sufficient cover (e.g., large woody debris) is the primary factor limiting the rearing potential of the constructed ponds. In contrast, a single trap in the outlet channel from the pond complex (where overhanging vegetation was retained) revealed large numbers of rearing Dolly Varden.

Another limitation on the ponds' rearing potential is the steepness of the banks. Steep sides do not provide much littoral zone for streamside vegetation and rearing (Plate 54). The bank slopes should have been sloped back to a more gradual incline.

C. **Spawning.** The project's biggest success has been its spawning use. Many species spawn in the riffle areas between ponds. Almost immediately after project completion, chinook salmon entered the pond system and were actively spawning. Fisheries technicians estimated that approximately 25 chinooks spawned in the riffle connections between ponds during the first season (1987). During a 1993 site inspection, spawned-out sockeye salmon were observed, along with actively spawning pink and chum salmon. Coho salmon are also using these spawning gravels in great numbers (375 observed during one-day escapement survey in October, 1993).

3. Revegetation. The grass seeding and fertilization was an immediate, short-term success; grass was observed to be 6 inches high by late July, 1987. The contractor advised planting additional vegetation such as sprigging with willow and transplanting native trees (e.g. willow, cottonwood) in his project completion report. He also recommended additional fertilization the following year. It does not appear that these suggestions were followed. Regrowth on the gravels has been slow. Grass cover in 1993 was sparse, though alders are colonizing the banks in patches (approx. 4-5 feet high, Plate 54).

LESSONS LEARNED:

The rearing potential of the newly-constructed ponds is limited by the steep pond banks, and the lack of in-water and shoreline cover. The pure gravel substrate of this clear water creek is favorable for spawning habitat but does not promote rapid revegetation. The easiest technique to improve the rearing potential would be to add large woody debris to the ponds. Adding root wads or perhaps felling a couple of the rear cottonwoods across the water would increase the amount of in-water cover. Additional measures would be to regrade or expand the pond margin into a more gentle grade (promoting growth of macrophytes and invertebrates) and to revegetate the banks with willows or other suitable shrubs. Vegetation growth in the gravels deposited on one side of the pond appears very slow due to lack of fine sediments. After seven years, alders are just now colonizing the banks in some areas. Perhaps this situation would improve with the addition of a limited amount of finer soil materials. Another concern with this area is the amount of use it receives as a recreational camping location. Provisions to minimize the amount of garbage and/or trampling on the banks would prove beneficial to the rearing fish.

The engineer/contractor (J.G. Fisher) wrote a two-page "Operations and Maintenance Guide" for the Box Canyon Creek rearing pond complex in 1987 (Appendix C). In this guide he detailed the type of problems that could be anticipated with the headgates, beavers, etc., and what to monitor. Unfortunately, no provision was made for monitoring responsibilities in the overall mitigation plan. This was the largest shortcoming of the project. As the engineer's guide states, "since this project is man-made, it cannot be expected to perform forever as designed without some maintenance inspection and action."

SIGNIFICANCE OF PROJECT:

The design of the mitigation ponds—a series of "beaded" ponds connected by swift water riffle areas—appears to have very high potential for providing rearing and spawning habitat in proximity. To date, the spawning use has been more successful than the rearing use, but that might easily improve with the addition of cover. This design may have wide application for use in other clear water creek locations, with modifications to create more littoral zone (promoting the growth of streamside vegetation).

As a mitigation project, the most significant problem was the lack of any provision for monitoring and maintenance of the new ponds and water-control structures (headgates). A commitment to these follow-up activities and possible mid-course corrections should be incorporated into mitigation agreements.

FOR FURTHER INFORMATION:

Report(s):

Authors: J.G. Fisher & Associates
Publication Date: September, 1987
Title: Construction Report, Seward Coal Facility Fish Mitigation, Project No. 57012, Box Canyon Creek

NOTE: The following report gives background (pre-project) data on the Box Creek Canyon system (original pond and creek) but it does not discuss the final configuration for the mitigation project.

Authors: ADF&G and FWS
Publication Date: May 1984
Title: Mitigation alternatives for Marine Industrial Center & Coal Loading Facility, Seward, AK
Reference Type: Report

Contact Persons: Don McKay and Stewart Seaberg, ADF&G Anchorage, 267-2284. Jerry Watkins was the design project manager at ADOT/PF, 266-1515. Mark Wenger of the U.S. Forest Service in Seward (224-3374) is involved in planning future enhancement actions at this location (see below).

Other Information Sources: Interview with Stewart Seaberg and Don McKay, ADF&G. A 8/23/93 site visit was conducted with Stewart Seaberg, Betsy Parry, Fritz Kraus and Diane Starkey (all ADF&G), and Mark Wenger (USFS) in attendance. The 1987 construction report by J.G. Fisher & Associates (listed above and included in Appendix C) gives a good account of the construction, field adjustments to the design, and includes 1987 photographs. Fisher also attached a two-page "Operations and Maintenance Guide" for the Box Canyon Creek rearing pond complex (see Appendix C), which detailed the type of problems that could be anticipated with the headgates, beavers, etc., and what to monitor. A copy of the construction reports exists in the ADF&G waters files. Jerry Watkins (ADOT/PF) provided the cost estimates for this case study description. The construction permit for the coal loading facility in Seward which led to this mitigation project is known as Resurrection Bay 79.

POSTSCRIPT:

ADOT/PF and the Federal Highways Administration are planning to realign Exit Glacier Road. Plans call for fill to be discharged into wetlands that are known to serve as coho rearing habitat. A portion of the mitigation plan calls for improvements to the nearby Box Creek Canyon rearing pond complex. As currently planned (in spring 1994), mitigation activities at the Box Creek Canyon site would include sloping back the rearing pond banks to provide for more littoral zone, and adding large woody debris (probably obtained from the road right-of-way clearance and/or the stand of cottonwoods behind the pond chain). Revegetation efforts on the pond banks (i.e., spreading overburden, planting cottonwood and willow cuttings & bundles) will be coordinated by Fritz Kraus (ADF&G, Anchorage) and the Alaska Plant Materials Center (Palmer), and will be conducted as a Seward Schools class project. These actions will probably begin in 1995. The proposed improvements at Box Canyon Creek are summarized in the following documents: "Pre-Monitoring Report and Mitigation Recommendations", a report to the Federal Highways Administration by Mike Kelly of the University of Alaska's Environment and Natural Resources Institute (ENRI), Anchorage, 257-2714; and "Exit Glacier Road Mitigation Plan," completed in December, 1993, by Mark Wenger of the U.S. Forest Service, Seward, 224-3374.

19. Fourth of July Creek Spawning Channel

SHORT DESCRIPTION: Spawning channel as mitigation for habitat loss from Seward Marine Industrial Center (in Spring Creek).

Responsible Organization: City of Seward (assisted by ADF&G and FWS)
Organization Based In: Seward
Agency Permit #: FG 81-II-0392; COE Resurrection Bay 58; information in ADF&G waters files.
Year Work Began: 1981 - Year Ended: 1982
Status: Completed, monitoring dropped.

LOCATION/SITE CHARACTERISTICS:

Waterbody: Fourth of July Creek
Nearest Town: Seward
Topographic Map Quad: Seward A-7
Anadromous Stream #: 231-30-10130
Location Description: Resurrection Bay at mouth of Fourth of July Creek
Site Impressions of Habitat Type: Upper end of channels have some alder & shrub cover; lower end (mouth) composed of shifting gravel bars—very unstable substrate.
Project Size: Two 600 ft. channels
Maps: Cannot find any relevant diagram for the project actually built in the large set of related ADF&G files.

OVERALL GOAL(S) OF PROJECT:

To create a groundwater-fed spawning channel for chum salmon as mitigation for the diversion and channelization of lower Fourth of July Creek and the loss of Spring Creek spawning habitat, as a result of construction of Seward Marine Industrial Center.

OBJECTIVES:

1. Excavate two channels that do not have direct surface connections to Fourth of July Creek, but are fed by groundwater upwelling through the floodplain gravel. (This was intended to decrease sedimentation into the spawning gravels.)

2. The channel should contain suitable spawning gravels, and have sufficient water flow for spawning and egg incubation year-round.

3. The result should provide "sufficient spawning habitat for 700 adult pink and chum salmon" (from FWS letter, 1981). The entrance to the channel should be assessable to adult chum salmon.

IMPLEMENTATION INVOLVED:

1. ADF&G and FWS staff consulted Canadian scientists who had worked on groundwater-fed channels. Groundwater levels were measured using pits during the winter of 1981 to determine whether there would be sufficient flow in the constructed channels. Design standards were then provided to the City of Seward (including spawning riffle depth, velocity, substrate particle size, etc). The design represented a combined effort of ADF&G, City of Seward, FWS, NMFS, contractors, etc.

2. Two 600-foot spawning channels (which join near the outlet to Resurrection Bay) were excavated. The uppermost end (the "feeder" end for groundwater) of each of the channel forks was composed of groundwater-intercept ditches, separated from the braided channels of Fourth of July Creek by a levee.

The two channels emptied into a lagoon near the mouth of Fourth of July Creek (Plate 55). The upper sections of the channels traversed shrubby zones. No revegetation was deemed necessary at the site.

3. Nearly 1000 pink and chum salmon were stocked in the spawning channels in late summer/fall of 1982.

4. The City of Seward agreed to monitor the mitigation site for four years. FWS and ADF&G were willing to participate in the monitoring. Among the monitoring parameters listed were: temperature, dissolved oxygen, flow, salinity, water quality, substrate samples, fry trapping, and egg-to-fry survival.

ESTIMATED COST: The City of Seward was unable to provide a cost estimate for these two channels alone.

JUDGEMENT OF SUCCESS:

1. Much of the lagoon area was washed out by floods during the first season, soon after the stocking of pink and chum salmon (late 1982).

2. The two channel branches remain to this day (Plate 55). The channels are fed by groundwater, but do not receive a high rate of flow. Algae has been observed to accumulate in the upper channels due to insufficient flushing. Water in the channels appears to contain silt, but is still considerably less silty than in Fourth of July Creek itself.

3. The channels appear to have satisfactory gravel substrate for spawning.

4. The mouth/entrance to the spawning channel is blocked off by beach berms caused by wave action in Resurrection Bay (Plate 56). The high amount of bedload that washes down Fourth of July Creek during periodic floods deposits near the mouth. This material shifts around, and most likely contributes to the formation of beach berms at the adjacent entrance to the spawning channel.

5. Chum salmon spawned in the channel for the first few years, then stopped (no access).

6. Because the mitigation site was severely compromised by floods the first year, the planned monitoring was abandoned. Meanwhile, the City of Seward still had not met its mitigation obligations for loss of habitat connected with the Seward Marine Industrial Center. Other mitigation efforts were then undertaken to improve spawning habitat in Spring Creek and Jap Creek (including construction of a spawning channel in the Jap Creek drainage). This work was implemented in 1985 and monitored for two years. Construction and monitoring of the latter projects was conducted by J.G. Fisher & Associates.

LESSONS LEARNED:

The Fourth of July Creek system is extremely unstable and prone to "flashy" high and low water, depending on rains and snow melt. For this reason, it is not a particularly good location for a spawning channel, which requires a moderate, even flow to incubate the eggs. Although groundwater measurements taken the winter before channel construction were favorable, it appears that frequently the amount of groundwater flow into the upper forks of the spawning channel is insufficient to keep it adequately flushed out, so algae accumulates. During floods, the water level is much higher, and the material carried downstream in nearby Fourth of July creek ends up in berms blocking the bay entrance to the spawning channel. Chum salmon used the spawning channel during the first few years after project completion—then the entrance became blocked off to saltwater by the berms. These processes are extremely difficult to control in such an unstable river system. One possibility may have been to build the channel further upstream, tying the outlet into the river itself, not the ocean. At that location the channel would require protection from the river (e.g., flood damage), but not from Resurrection Bay as well. However, there is no guarantee that continuing problems would not occur. The groundwater levels would still be fluctuating greatly in the channel, limiting the success of the spawning habitat.

The most important lesson from this project may be to avoid highly unstable riverine areas when choosing a location for a spawning channel project. A more stable creek system would be a better source of the consistent, even flow favorable for spawning habitat. If mitigation projects are to be located in unstable river floodplains, the responsible parties must commit to regular monitoring and maintenance to assure its success. The location selected at the mouth of Fourth of July Creek was and is a poor site for a permanent facility of any kind, and money was likely saved by abandoning this site and relocating the mitigation project to Jap Creek, in the Resurrection River drainage.

SIGNIFICANCE OF PROJECT:

A number of aspects of this project were significant. It was well researched to incorporate the latest in spawning channel design at the time (publications, direct consultation with Canadians with more experience in these techniques). It also included a well thought-out monitoring plan and performance standards as part of the agreement. Although parts of the project design were successful (i.e., the water is less silty in the channel, it does fill with groundwater from the Fourth of July Creek system, and chum salmon used the channel for spawning for a few seasons), the project was ultimately defeated by an unstable river system with uneven flows.

FOR FURTHER INFORMATION:

Report(s): None.

Contact Persons: Don McKay, ADF&G, Habitat, Anchorage, 267-2284, and Phil Brna, ADF&G, State Pipeline Office, Anchorage, 278-8594. Paul Deimer (now retired) was involved from the City of Seward; Marilyn Reynolds is the current contact at the City, 224-3331.

Other Information Sources: The following people were consulted: Don McKay and Stewart Seaberg, ADF&G; Phil Brna, ADF&G, now at State Pipeline Coordinator's Office; and Marilyn Reynolds, City of Seward. The Fourth of July Creek spawning channel site was visited for this case study report on 8/23/93, with Stewart Seaberg, Fritz Kraus, and Betsy Parry (all ADF&G) in attendance.

Many of the ideas for the initial spawning channel design were taken from a 1980 Canadian report, "Chum salmon survival and production at seven improved groundwater-fed spawning areas," by D.B. Lister, D.E. Marshall, and D.G. Hickey (Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 1595, Canada Dept. of Fisheries & Oceans, Vancouver, British Columbia).

The permitting files for this project present a tangled record due to various proposals and changes over time. A May 1984 report by ADF&G and FWS does not address the Fourth of July Creek spawning channels, but later (1984) efforts at remedial mitigation once some of the first mitigation features failed. This report was called: "Mitigation alternatives for the Seward Marine Industrial Center & Coal Loading Facility, Seward, AK." A final report also exists for the later mitigation work conducted at Jap and Spring creeks (a 1987 (?) report by J.G. Fisher, the engineer/contractor, contains monitoring results).

20. Mile 25 Spawning Channel, Cordova

SHORT DESCRIPTION: Forest Service coho salmon spawning channel in Copper River area.

Responsible Organization: USFS
Organization Based In: Cordova
Agency Permit #: COE 071-870133 & -134. No ADF&G permit on file.
Year Work Began: 1987 - Year Ended: On-going
Status: Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Tributary to Alaganik Slough
Nearest Town: Cordova
Topographic Map Quad: Cordova B-4,B-3
Anadromous Stream #: 212-20-10100 (Tributary to Alaganik Slough)
Location Description: Mile 25.25 of Copper River Highway, on the Copper River Delta.
Site Impressions of Habitat Type: Small meandering creek on flat delta terrain; shrubby vegetation.
Project Size: The Mile 25.25 channel is 22,500 sq.ft
Maps: Unknown if any are available.

OVERALL GOAL(S) OF PROJECT:

To increase the spawning area available for coho salmon in the Copper River Delta to benefit commercial fishing.

OBJECTIVES:

1. To construct a groundwater-fed channel lined with appropriate gravels and conditions conducive to coho salmon spawning.

2. To monitor the project's success with a five-year monitoring program.

3. To create a fish habitat enhancement project in an easily accessible roadside location for educational/ interpretive purposes.

4. Ultimately, to increase the production of coho fry in the vicinity to benefit commercial fishing.

IMPLEMENTATION INVOLVED:

1. A two-branched channel was excavated, which flows together at the downstream end. Large riprap was added to stabilize the channel banks, and also to serve as cover for the fish. Sorted gravels of uniform size were placed into the branched channel as spawning substrate.

2. A few wooden drop structures were placed along the length of the channels to control the water gradient (Plate 57).

3. Willow and alder were planted on all channel banks; some areas were also seeded. A few wooden platforms were installed at different spots along the channel bank to provide hiding cover, more or less simulating an undercut bank (Plate 57).

4. The monitoring program included coded wire tagging; weirs and live boxes to count the fry below each branch of the channel; and a thermograph to record water temperatures throughout the year.

ESTIMATED COST:

$22,000 for spawning channel construction alone. The monitoring costs were budgeted at $10,000/year for the wire tagging program, and expenditures in recent years have been approximately $1,000/year. If the channel had produced at its initial levels, the channel construction would have been cost-effective. The continuing amount of maintenance detracts from the cost effectiveness of the channel in terms of the number of fish produced versus its capital expenditures, however the effort will be profitable in terms of experimental results and further refining the techniques.

JUDGEMENT OF SUCCESS:

The spawning channel was highly productive for the first few years (1990 was the peak year at 50,000 fry produced), but the egg-to-fry survival rates have declined. It is thought that the sorted gravel introduced as the channel substrate allows silt to filter through and form a thick layer below the gravel, cutting off the upwelling groundwater and reducing intergravel flow. This has been reported as the reason for similar declines in egg-to-fry survival in chum salmon spawning channels in British Columbia.

Biologists in British Columbia now feel that the sorted gravel traps fine sediments more than the natural gravels which contain a variety of particle sizes. The Canadians have therefore experimented with replacing the sorted gravel with a natural, more varied substrate. Because this method is expensive, the Forest Service biologists in Cordova decided to try to flush out the accumulated sediment with a pump, as a means to improve the survival rates. Only one of the two branches of the channel was treated in this manner (Channel A), while Channel B was left alone to serve as a basis for comparison. In August 1992 and again in 1993, Channel A was cleaned using fire pumps. The sediment was forced downstream where it was removed with shovels. This method proved to be very labor-intensive and the results are not yet certain.

In the fall of 1992 approximately 68 coho spawned in Channel A and 38 in Channel B. In 1993, weirs and live boxes were set below each channel to determine fry production. Trapping between May 4 and June 9 yielded 27 young of the year (0+ age) in Channel B and 98 below Channel B. There were also 172 one-year old (1+ age) coho and 67 1+ coho captured below Channels A and B, respectively. No fry were seen in the quiet rearing areas in late June.

The number of fry produced in 1993 is too low to determine whether the cleaning had any effect, and it is not known why production was so low. The trapping period should have been appropriate, based on peak emergence measured in past years (usually in late May). The lack of fry in the rearing areas in late June 1993 also indicates that fry production was low.

The number of spawning adults does not appear to be a factor in 1993's low fry production. Surveys over the years estimated the following number of spawning adults in the channel: 1989 - 108 spawners, 1990 - 150, 1991 - 550, 1992 - 106, 1993 - 400. (The numbers obtained were approximate, based on a residency of two weeks in the channel.) Therefore, the source of the 1993 fry would have been the 106 spawners observed in 1992. Although this number is relatively low overall, it is still comparable to the spawning population in 1989 and 1990, which produced 50,000 and 2,000 fry respectively. Predation of the spawners should not have been higher than previous years, in fact three cover structures had been added in 1991 and 1992 to provide escape opportunities for spawning adults. There is no evidence that water temperatures have been substantially colder than in previous years, and temperature does not account for the trend of declining egg-to-fry survival rates over the history of the channel. Water temperatures in May, when fry emergence usually begins, have been consistently 3-5° C since 1990.

Silt traps were constructed in 1993 on the uppermost section of both spawning channel branches, designed to slow the water velocity sufficiently to allow silt to settle out above the main portion of the spawning channels. The effect of these silt traps is not yet known, but it appears that some sediments are being deposited above the trap, and less sediment is apparent in the lower stretch of Channel A.

Winter and summer temperatures will continue to be monitored. Fry production will again be monitored to determine whether there is a difference in production between the cleaned and uncleaned channels. If it is determined that siltation is the main problem with fry production, the decision will be made as to whether to flush the silt out of Channel B or whether the gravels should be replaced.

ADF&G has been monitoring the local commercial catch for evidence of the project's tagged fish. Fry emerging from the spawning channel were tagged with coded wire in 1988 and 1990. The number of tagged fish intercepted in the 1993 commercial catch indicated that the spawning channel currently contributes approximately 100 fish/year (or $1,000) to the commercial coho harvest.

It should also be noted that the commercial coho fishery shuts down in the first or second week of September, depending on weather, prices, etc. The run in the spawning channel appears to be a rather late run, with numbers peaking in late October or early November. In 1993, there were more than 100 fish in the channel in the first week of December. Thus, the commercial fishery may not harvest much of the run. It is also possible that if ADF&G does not sample the end of the catch, or assumes that spawning channel fish are equally present throughout the harvest, they could miss tags or underestimate the catch attributed to the spawning channel.

Regardless of its other successes or failures, the spawning channel project has been successfully used in interpretive programs of the Cordova District of the U.S. Forest Service.

LESSONS LEARNED:

The site was chosen for spawning channel construction due to the amount of groundwater upwelling, but apparently a thorough study of hydrologic and sedimentation factors was needed before embarking on this project. The cost effectiveness of this project in terms of producing adult coho salmon now looks unimpressive, but the monitoring program has made contributions to our understanding of the problems. In addition, although production has certainly been disappointing in some years (e.g., 1993), it is possible that in other years the channel has contributed more to the commercial fishery than has been estimated by the coded wire tagging system (which may have had flaws in the sampling effort to recover tags from harvested fish, and/or in later analysis.)

Weather may also be a key factor in this system, accounting for the highly variable escapement and production. Wet, warm winters may lead to higher egg-to-fry survival.

SIGNIFICANCE OF PROJECT:

Siltation in the gravels is a commonly encountered problem in constructed spawning channels. Although the Mile 25.25 site was selected because of its good groundwater upwelling characteristics, apparently the groundwater flow was not sufficient to keep the gravels flushed out, and/or the sedimentation load was unusually high. The practice of using uniformly sized sorted gravels has been more or less abandoned in recent years because of its potential to block off the groundwater flow (due to a sediment blanket).

The long-term nature of this project and monitoring data makes these efforts valuable to others considering spawning channel construction for coho salmon.

FOR FURTHER INFORMATION:

Report(s):

Authors: Samantha Greenwood
Publication Date: 1993
Title: Mile 25.25 Spawning Channel - 1993 Summary
Reference Type: 2 page draft report

Contact Persons: Dave Schmid, Ken Hodges, and Samantha Greenwood, Fisheries Biologists, US Forest Service, Cordova Ranger District, 424-7661.

Other Information Sources: Much of the description was taken from the above-referenced report, which is in a draft, memo-type format, two pages long. Ken Hodges (USFS, Cordova) sent in detailed comments on the draft version of this case study report. The project site was visited and photographed (by Betsy Parry, ADF&G) on 9/15/93, as part of a field trip for an AFS-sponsored fish habitat enhancement workshop. Cordova District Forest Service personnel and many other fish biologists were in attendance.

21. Herman Creek Spawning Channel

SHORT DESCRIPTION: Successful chum salmon spawning channel near Haines.

Responsible Organization: Northern Southeast Regional Aquaculture Association (NSRAA)
Organization Based In: Sitka
Year Work Began: 1989 - Year Ended: 1989
Status: Completed, monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Herman Creek
Nearest Town: Haines
Topographic Map Quad: Skagway B-6
Anadromous Stream #: 115-32-10250-2077-3061
Location Description: Herman Creek (tributary of Klehini River). Access via Porcupine Road.
Site Impressions of Habitat Type: Gravel-lined channel within a wooded floodplain.
Project Size: 1500' long x 20' wide
Maps: Through NSRAA

OVERALL GOAL(S) OF PROJECT:

To create a chum salmon spawning channel (to boost stock levels for commercial fishermen).

OBJECTIVES:

1. Expand chum spawning potential for the Klehini River chum runs.

2. Use local material and gravels to construct the channel (not imported sorted gravels).

3. Develop a flow rate of 3 to 7 cubic feet per second (cfs) from excavation at the outlet of the channel.

4. Create winter rearing habitat for coho salmon.

5. Blend the channel in with the surroundings.

6. Create a new local attraction (salmon viewing) for tourists and area residents.

IMPLEMENTATION INVOLVED:

1. In 1989, the 1500 foot long (by 20 ft wide) was excavated on a 1% grade with a bulldozer and front-end loader, allowing for a bit of bottom depth variation. The channel originates (its highest point) at a road dike which separates it from the Klehini River, thus intercepting only groundwater and no surface water flows. At its other end, the S-curved channel empties into Herman Creek which is a tributary of the Klehini River. Chums returning to spawn travel up Herman Creek to access the channel.

2. In order to blend the artificial channel into the wooded setting, less riprap was used on the sides of the channel than at a channel previously constructed by the same organization (24-mile spawning channel). At Herman Creek, as few trees were cut as possible, leaving a buffer zone of trees between the channel and the parallel road access.

3. All local gravels from the Klehini floodplain (specifically, the excavated channel) were used to line the spawning channel. These were not washed and screened, and were not of uniform size.

4. Dredge spoils were placed on the Porcupine Road base to raise the level of the road for viewing and to increase flood protection. Other excavated gravels formed a dike around the upland side of the channel.

ESTIMATED COST:

$50,000. The benefits were estimated (by projecting the number of adults produced that are actually caught in the fishery) at $16,000/year, while maintenance of the channel is estimated at $2,000/year, making the venture very cost-effective.

JUDGEMENT OF SUCCESS:

1. Spawning Use. The Herman Creek spawning channel has been an unequivocated success and continues to offer excellent spawning habitat for chum salmon returning to the Klehini River. The majority of fish choose to spawn in the upper 2/3 of the channel, where there is a greater amount of water upwelling through the gravel (Plate 58). An exceptionally strong return of chum in fall 1992 boosted the numbers of spawners to a new historical high for chums utilizing the Herman Creek spawning channel. As of 11 October 1992 a total of 3,308 spawners had used the channel and 2,159 chum were still spawning. It appears highly likely that up to 5,500 chum used the Herman Creek channel that year. In the future, NSRAA may limit use to 5,000 spawners a year.

   A small weir was used to trap and enumerate all chum fry leaving the spawning channel in spring 1990, 1991, and 1992. The weir was erected in early March and operated until early June for a total of 92 days. In 1992, 1,139,002 chum fry were counted which translates to an egg-to-fry survival of 23%. This survival is slightly higher than anticipated, and higher than the estimated 21% survival in 1991. This channel ranks second or third of all constructed chum spawning channels (behind one or two in Canada) in terms of producing the highest number of chum salmon per unit area.

   Project developers were hoping to achieve a flow rate of 3 to 7 cfs at the outlet of the channel into Herman Creek, in order to attract spawners into the channel. Their expectations were surpassed. The channel outlet exhibits a flow of 13 cfs, which is phenomenally high for these types of groundwater-fed excavations.

2. Materials. The combination of unusually high groundwater flow at this location (13 cfs) and the use of non-sorted gravels appears to have avoided the sedimentation problems often encountered in artificial spawning channels. When the spawning channel first opened, there was actually more fine material in the gravel than is apparent now. The spawning action of 5,000 fish may have whisked away much of this during the first couple years.

   In previous years, new spawning channels were often lined with sorted gravels (washed and screened) of optimal size for spawning use. However, experience indicates that a channel substrate made of introduced sorted gravel allows silt and fine organic matter to filter through and form a thick layer below the gravel, cutting off the upwelling groundwater and reducing intergravel flow. This has been reported as the reason for declines in egg-to-fry survival in chum salmon spawning channels in British Columbia. Canadian biologists now feel that the sorted gravel traps more fine silts than the natural gravels which contain a variety of particle sizes. In addition, it is also suspected that a certain amount of fine sand content (not silt) in the substrate may benefit salmon eggs by making them less obvious to predators (e.g., sculpin). For these reasons, the NSRAA staff purposefully chose to use unsorted local gravel to create a natural, more varied substrate. To date, the substrate at Herman Creek spawning channel has performed very well with no evidence of silting in, which may also be due in part to the exceptional flow rate at this location.

3. Overwintering use. The amount of groundwater flow through this channel prevents a solid freeze-up in winter, providing open water year-round. Therefore, deep holes are not necessary to provide ice-free zones for juvenile coho salmon in winter. In the previous spawning channel constructed by the same

organization (24-mile channel), wintering coho were observed in small eddies along the riprapped banks. Although not measured at Herman Creek, juvenile coho are presumed to be similarly using the open water channel in winter.

4. <u>Aesthetics</u>. The goal of creating a natural look to the artificial channel has been generally successful (more successful than at NSRAA's previous spawning channel). Vegetation on the channel banks is slowly growing back on its own. However, NSRAA staff said that if they were to build it again, they would lay out the Herman Creek channel with even more meanders. Not only would a meandering channel look more natural aesthetically, but it would provide more spawning area for the length of the channel. In addition, it would correct an unexpected problem with bear hunters (see below).

5. <u>Local Attraction</u>. The shallow channel provides easy observation of spawning fish which include chum and coho salmon, as well as Dolly Varden and cutthroat trout. Road access is good. The project has been visited by school groups and tourists. The concentration of spawning fish also attracts bears, creating bear viewing opportunities and increasing visitor interest in the channel. However, the fairly straight design of the channel has led to problems during fall bear hunting season. Because hunters can see bears along the channel from a good distance off (no obstructions), they tend to take shots from farther away than if they were in more varied terrain. This results in a higher percentage of merely wounded bears. Incorporating more meanders into the channel layout would help avoid this unanticipated problem.

LESSONS LEARNED:

The exceptional success of the Herman Creek spawning channel illustrates several points. First, choosing the right location for a spawning channel is critical—it must have an ample supply of clean, moving water to attract the spawners, aerate the eggs and flush out silt and algae. Without this steady flow, the channel will not function effectively for more than two to three years, and attempts to rectify the situation at that point may be futile. The Herman Creek spawning channel has this element in its favor, since the Klehini River valley boasts one of the highest rates of groundwater flow in Alaska. Second, the performance of this channel seems to support the idea that substrates composed of a natural mixture of gravel sizes may lessen the siltation problems encountered elsewhere. Third, the flow rate and grade of the channel was sufficient to prevent the backwatering and consequent siltation problems exhibited at NSRAA's previous spawning channel in the Haines area (24-mile channel, at the nearby Chilkat River).

The goals for aesthetics and educational viewing opportunities have been met. In the future, the only change that NSRAA staff member Lon Garrison said he would make would be to add more meanders to the channel design (see explanation above), and to incorporate more diversity of habitat to the length of the stream. This channel currently offers little opportunity for rearing fish (except in the interstices of the riprapped edge) because of the lack of cover and the fairly uniform velocity and channel depth (i.e, mostly riffle areas). Although the Herman Creek project was primarily intended to provide high-quality spawning habitat, Lon Garrison said for the next spawning channel built, he would investigate the cost and feasibility of incorporating some rearing habitat features as well (e.g., more cover, a few pools).

SIGNIFICANCE OF PROJECT:

The Herman Creek spawning channel is significant because, unlike the other spawning channels examined here as case study sites, this project illustrates how a spawning channel can work as planned, rather than what often goes wrong. Herman Creek is one of the most effective spawning channel projects in Alaska to date, and over three years of data are currently available. To a large extent this spawning channel succeeded where others failed because of the locational circumstances in its favor (intrinsic high rate of groundwater flow, good elevation grade, protection from flood damage, etc.). Site selection (for requisite stable hydraulic conditions and low sediment load) appears to be the singlemost determining factor for the success of a spawning channel. Attempts to correct the chronic problems encountered with placing a spawning channel in a less than ideal location (sporadic water levels, silting in the gravels, flood washouts, etc.) have not been fruitful.

This project also provides further evidence that a natural mixture of gravel sizes may perform better as a substrate over time than sorted spawning gravels (compare with the case study description of the Mile 25 spawning channel in Cordova, for instance). This channel's proximity to major rivers (and immediately adjacent to the Klehini River) may have contributed to its success by providing a great deal of pressure or head in the subsurface flow, forcing water through the dike into the spawning channel at an unusually high rate.

FOR FURTHER INFORMATION:

Report(s): Staff of the Northern Southeast Regional Aquaculture Association (NSRAA) prepare annual reports for the NSRAA board (including data tables). Contact information listed below.

Contact Persons: Lon Garrison, NSRAA, Haines, 766-3110. Steve Reifenstuhl, Field Projects Manager, NSRAA, 1308 Sawmill Creek Road, Sitka, AK 99835, Phone 747-6850.

Other Information Sources: Lon Garrison and Steve Reifenstuhl, NSRAA, provided information including a summary of their spawning channel activity taken from their autumn 1992 NSRAA board reports. Additional information was obtained during a site visit on October 6, 1993. Betsy Parry (ADF&G) was accompanied to the site by Lon Garrison (NSRAA), and Kevin Brownlee (ADF&G).

22. Haines Airport Mitigation

SHORT DESCRIPTION: Created fish rearing ponds and wetlands, monitoring required.

Responsible Organization: ADOT/PF
Organization Based In: Juneau
Agency Permit #: COE 860802 - Chilkat River 6
Year Work Began: 1990 - Year Ended: 1991 for construction
Status: Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Chilkat River 6
Nearest Town: Haines
Topographic Map Quad: Skagway A-2
Anadromous Stream #: 115-32-10250
Location Description: Haines Airport expansion along Chilkat River, including tributaries (Yindastuki Creek and Sawmill Slough).
Site Impressions of Habitat Type: Various types of floodplain habitat, described below.
Project Size: 19 acres (total for wetlands, ponds, and channels)
Maps: See Figure 8.

OVERALL GOAL(S) OF PROJECT:

To create habitat diversity in Yindastuki Creek and other waterways of the project area through a variety of stream channel, riparian, and wetland enhancement measures. This mitigation project was stimulated by the loss of a very productive rearing pond containing high densities of juvenile coho salmon. This pond (called West Pond, near the terminal) was filled to construct the new airport apron.

OBJECTIVES:

This mitigation project included the following components (Figure 8):

1. Created wetlands: Approximately 14 acres of emergent wetland were to be created between the old and new runways, and a 1.7 acre drainage slough running alongside it (and extending west of the runways).

2. Restored or re-created wetlands: Two areas which had been previously filled were to be returned to natural wetland conditions (totaling approximately 2.8 acres). The largest area was to mimic the nearby natural shrub/scrub wetlands, and a small second parcel was to become riparian habitat along Yindastuki Creek.

3. Yindastuki Creek: A new stream channel was to be constructed to realign this existing creek around the newly filled areas, accommodating continued fish access and meeting habitat needs.

4. Mitigation Ponds: Five new ponds were dug in the adjacent Sawmill Slough system to compensate for the productive coho rearing habitat that was filled at West Pond. These ponds were to serve as year-round rearing habitat.

IMPLEMENTATION INVOLVED:

1. Created wetlands. The 14 acres of new emergent wetlands located west of and between the old and new runways is displayed on Figure 8 (stipled area, labeled as "Upper," "Middle," and "Lower Block") and on Plate 59. The substrate in this area exhibited floodplain characteristics from the nearby glacial Chilkat River. This surface was graded down to the sandy bottom, and topsoil/overburden (that had been scraped

and stockpiled from the new runway construction area) was spread across it to facilitate natural revegetation. Sloughgrass was also seeded on the disturbed soil here. Although not native to this area, sloughgrass was intended to hold the soil in place as it began natural succession to native emergent scrub/shrub vegetation. A drainage slough was constructed, passing downriver (west to east) through the new wetland. An intake structure (called an "infiltration galley") was constructed at the upstream end of this slough (the west margin of the created wetland, extreme left in Plate 59), to allow the entry of relatively silt-free water into the wetland area.

2. Restored wetland areas. The two sites that involved removing old fill and restoring wetland were the easternmost 600+ feet of the old runway, and a small unauthorized parking lot fill behind the terminal building (both areas are shaded on Figure 8). The first site, the east end of the old runway, was to be restored to emergent scrub/shrub wetland (approximately 2 1/2 acres, Plate 60). The runway surface was excavated and removed. The ground surface after excavation was intended to be within a foot of the prevailing water table. Topsoil and overburden from the new runway site under construction was placed on the graded-down surface to expedite revegetation by indigenous species. The site was also seeded with sloughgrass (*Beckmannia syzigachne*) to minimize short-term erosion impacts.

   The second site of fill removal for wetland restoration is much smaller. Material was excavated from a former parking lot along the airport access road, adjacent to upper Yindastuki Creek (oblong shaded area just left of the words "Apron Reroute" on Figure 8). The site was fenced off from further traffic, and left to revegetate on its own.

3. Yindastuki Creek. New airport facilities necessitated the re-routing of Yindastuki Creek in two places. The first section (called the "Apron Reroute") was built to conduct the creek around the edge of the new fill for the expanded apron (near the airport terminal and access road), where it rejoins its former channel. The second section of new channel re-directs the creek around the east end of the new runway, where it empties into the Chilkat River several hundred feet downstream of its former mouth (called the "Mouth Reroute" on Figure 8). The latter channel was excavated in a series of short bends, resembling a zig-zag pattern (Plate 60). These channels were left to revegetate naturally, although woody materials (primarily cottonwood logs and branches) were added to bare, newly-constructed sections to increase fish cover.

4. Mitigation Rearing Ponds. Five rearing ponds were dug downstream (east) of the airport along various tributaries to Sawmill Slough, which enters the Chilkat River further east. Four of the five ponds were created oblong in shape, approximately 300 feet by 150 feet, with a maximum depth of 8 feet. The remaining pond (called the First Iron Pond because of the tributary on which it is located), was constructed to be a maze of interconnected channels and four 50 foot diameter pools, with a maximum depth of about 8 feet (Plate 60).

   Large organic debris (spruce and alder materials) were introduced into the ponds to enhance cover for juvenile fish. The ponds were designed to provide year-round rearing habitat for coho salmon and Dolly Varden. Depth profiles were intended to provide a shallow margin (vegetated by submerged and emergent plants) as well as deeper ice-free winter habitat but without a deep layer of anoxic un-mixed water in summer. The First Iron pond was also designed to increase groundwater flow into the surface waters of the Sawmill Slough system, increasing potential salmonid habitat.

5. Monitoring program. The monitoring program encompasses various parameters as appropriate at each of the component sites (e.g., fish use, water levels, and/or vegetation growth, discussed further below). ADOT/PF channeled funding to ADF&G staff to conduct this monitoring program for three years (through 1995).

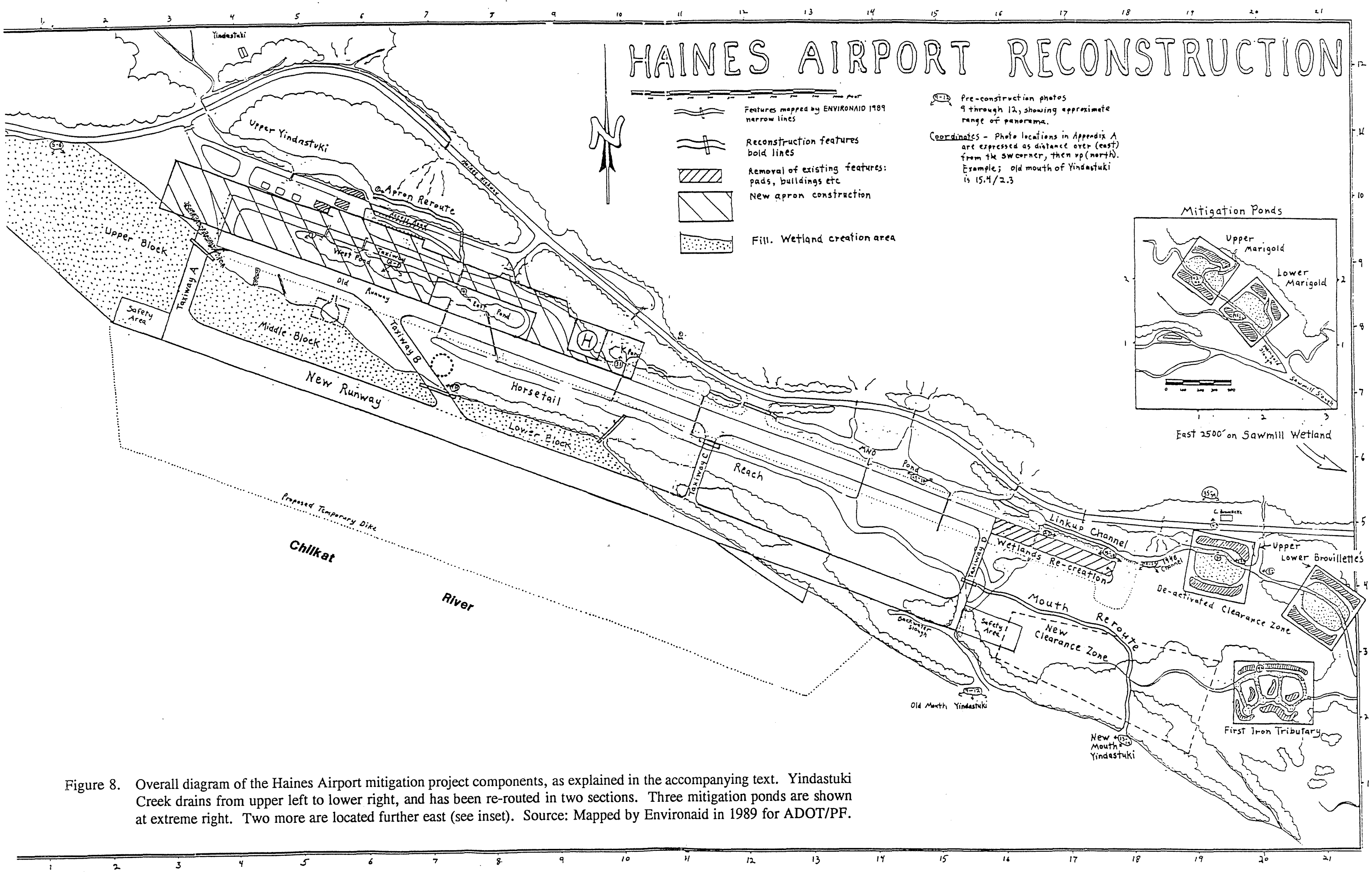

Figure 8. Overall diagram of the Haines Airport mitigation project components, as explained in the accompanying text. Yindastuki Creek drains from upper left to lower right, and has been re-routed in two sections. Three mitigation ponds are shown at extreme right. Two more are located further east (see inset). Source: Mapped by Environaid in 1989 for ADOT/PF.

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ESTIMATED COST:

ADOT/PF cannot easily extract the costs of constructing the mitigation components from the overall project construction costs. However, $100,000 was allocated for the three-year monitoring program.

JUDGEMENT OF SUCCESS:

1. Created wetlands. Natural revegetation of this large parcel is being monitored with vegetation quadrants and fixed photo points over time (Plates 61 and 62). Monitoring of this area also includes water levels and fish use of the created drainage slough. In the seasons subsequent to seeding sloughgrass (*Beckmannia syzigachne*), this species is still not prevalent in the area, and does not appear to have succeeded in the intended role of providing a cover crop as an erosion deterrent. Presently the new vegetation in this area is dominated by rushes (*Juncus* sp.) and various grasses, without much sedge. As the dead grasses/sedges build up over time, this area may become populated with meadow voles, which would attract birds of prey. The water table appears to be within one foot of the ground surface, which should provide the proper hydrological levels for the desired plant community (i.e., emergent wetlands).

   The slough's intake structure has worked well to conduct clear water through the wetland. The drainage slough has also become very productive coho rearing habitat in the summer.

2. Restored wetland areas. The seeded sloughgrass has not made much of an appearance in the restored former runway area either. However, the area has naturally revegetated. This section was intended to develop into a shrub/scrub community consisting of willows and sweet gale (*Myrica gale*), similar to many neighboring areas, but preliminary observations indicate that the emerging vegetation more resembles "upland-style" species. Only one sweet gale plant has invaded the site so far. The final elevation after runway excavation may not have been graded low enough in this portion of the project. The ground surface does not appear as wet as in the shrub/scrub areas they had hoped to duplicate. Monitoring of vegetation (e.g., permanent photo points) and groundwater levels will continue in this area, and will be presented in the 1995 ADF&G monitoring report (see "For Further Information," below).

   The other section of restored wetland, the former parking lot alongside upper Yindastuki Creek, appears to be doing very well. This area contains standing water and is already full of horsetails and other emergents.

3. Yindastuki Creek. The cottonwood pieces that were added to the new sections of creek channel to provide cover for fish appear to have been poorly installed. During the first period of high water, all woody pieces floated and were moved about. Later, crews attempted to rearrange the wood materials, but they were never anchored. It appears that ADOT/PF's contract with the subcontractor was too vague on this point, so the woody debris cover is not functioning as intended.

4. Mitigation Rearing Ponds. These ponds were meant to serve as deep-water year-round refuges for fish. (It was known that cutthroat trout and coho salmon spawn in a feeder creek to one of these ponds.) All ponds were dug in winter, making the dredged material a mixture of soil, snow and ice, which left the pond banks and margins quite lumpy. In addition, contractors ran into complications in excavating the ponds to the desired depth. These ponds were intended to serve as overwintering habitat for juvenile coho salmon, so the plans called for certain sections to be 8 feet deep. As the contractors excavated in the natural stream channel, a silty sand bottom was encountered, which continued to slough into the pit as they dug. Given this predicament, the contractors settled for a depth of approximately four feet, and left. However, this was not sufficient for overwintering habitat, so ADF&G notified ADOT/PF that the contractor had not met the project specifications. The contractors returned in winter 1991, and deepened the ponds as much as possible (7 ft. deepest). Part of the problem was that the contract specifications had been confusing—it was not clear which was the final depth from the original ground surface level vs. the resulting water depth.

Currently, fish do inhabit the ponds year-round (Plate 60), and include coho salmon, Dolly Varden, and cutthroat trout. The ponds may or may not continue to provide good rearing habitat over the long-term, depending on whether they silt in (or the sides cave in) over time.

First Iron Pond, which was designed to be a maze of interconnected channels and smaller pools, exhibits red water and a disagreeable odor due to the iron content, but fish are using this pond as well.

LESSONS LEARNED:

Contractor specifications were not clear enough to ensure proper construction of several project components (e.g., installation of woody cover in new sections of Yindastuki Creek, and the depth of ponds for overwintering habitat). Along with a clear set of project plans and stipulations, it is imperative that a contact person with good understanding of the mitigation project parameters be designated to serve as liaison with contractors and equipment operators during construction. These contractor communication problems have lead to the failure of many aquatic habitat restoration and enhancement projects. Pre-construction meetings between the construction crew and the mitigation project designers is a good way to avoid such unforeseen problems, but continued communication on-site is still key to building a successful project.

At the wetland restoration site on the east end of the former runway, regrowth of the desired vegetation type does not appear to be developing as intended. This area may not have been excavated down far enough to achieve the water level necessary to promote emergent and shrub/scrub wetland vegetation. Instead, initial regrowth on these sites includes many upland plant species, which may indicate that their roots are not "wet enough" for a true wetland plant community. These impressions are preliminary, and wetland species may still develop there over time. However, if monitoring does confirm that the graded surface is too far above the water table for the desired vegetation, either the contractor erred during excavation, or the level of the water table was miscalculated during project design. Achieving the correct hydrology is often the pivotal factor for a successful wetland project, and many different types of expertise should be consulted during project design.

Although it is possible that the disappointing showing of sloughgrass (*Beckmannia syzigachne*) in this case was due to problems with this particular application (e.g., with the specific materials or techniques), but these results may also indicate that sloughgrass is not a promising species for use as an erosion-preventing cover crop in the southeastern part of the state. Further test plantings are necessary to determine which variables govern its proper performance.

SIGNIFICANCE OF PROJECT:

Airport expansions are anticipated in the coming years for many coastal Alaskan communities. Many of these will involve fill in coastal wetland areas. Wetland mitigation opportunities for such projects are often limited because airports do not want to attract waterfowl to the immediate area. The Haines Airport mitigation project offers an example of a multi-faceted system of wetland creation, restoration, and enhancement which primarily benefits the local fish resources. Not much is known about wetland manipulations of this type in Alaska. The monitoring program was a prudent requirement of this COE permit, and ADOT/PF is meeting that responsibility. To avoid wasted efforts and repetition of mistakes in the future, monitoring requirements are needed components of COE permits for all complex restoration and enhancement projects.

This project is also unique because of the methodical, scientific approach used during development of the project design and the monitoring program. Dan Bishop, the local consultant who devised these plans for ADOT/PF, put a great deal of thought into all possible hydrological parameters involved. He also laid out specific questions to be addressed during the monitoring phase for each location. The results of the monitoring program will provide valuable guidance for future projects of this nature.

FOR FURTHER INFORMATION:

Report(s): A final monitoring report will be written by ADF&G staff (see below) and submitted to ADOT/PF in December, 1995.

Contact Persons: Art Dunn (initially) and Nate Johnson (currently) have been the contacts at ADOT/PF, Juneau, 465-4498. Other contacts include Steve Meyers at the Corps of Engineers (753-2712) and the consultants from Haines who helped write both the environmental assessment for the airport expansion, and monitoring plans for the mitigation work—Daniel & Gretchen Bishop and Richard Carstensen. ADOT/PF has arranged for three years of monitoring to be conducted by Kevin Brownlee, Ron Josephson and Scott Kelly (ADF&G, Douglas), 465-4233.

Other Information Sources: A great deal of information (objectives, implementation plans, preliminary monitoring inspections) exists in the COE files. ADOT/PF, Douglas (Nate Johnson), provided numerous preliminary documents by the consultants of Daniel and Gretchen Bishop and Richard Carstensen, including "A Report on Environmental Studies at Haines Airport, Second Phase", October 12, 1989; and "A Plan for the Monitoring of Environmental Protection and Mitigation, Haines Airport Reconstruction", Sept. 26, 1990. Much of the detail for the implementation section of this case study report was taken from the latter document. The site visit for this case study took place on October 6, 1993 by Betsy Parry, Kevin Brownlee, and Randy Ericksen. Kevin Brownlee and Ron Josephson provided information on the current status of the project, as well as photographs. Kevin Brownlee, Ron Josephson and Scott Kelly (ADF&G, Douglas) will continue to conduct the monitoring and write up reports for this ADOT/PF project.

23. Juneau Airport Taxiway/Gastineau Channel 341

SHORT DESCRIPTION: Various habitat restoration and enhancement actions as mitigation for several concurrent permits involving Jordan Creek.

Responsible Organization: CBJ (also ADOT/PF & private interests such as Temsco)
Organization Based In: Juneau
Agency Permit #: Gastineau Channel 341 and other concurrent permits.
Year Work Began: 1991 - Year Ended: 1992
Status: Monitoring

LOCATION/SITE CHARACTERISTICS:

Waterbody: Jordan Creek, Gastineau Channel
Nearest Town: Juneau
Topographic Map Quad: Juneau B-2
Anadromous Stream #: 111-50-10620
Location Description: NE side of airport property.
Site Impressions of Habitat Type: Various locations, see below.
Project Size: Many separate areas.
Maps: In Army Corps permit applications.

OVERALL GOAL(S) OF PROJECT:

In a rather unique move, the resources allocated towards mitigating several different wetland fill permits were pooled into a collective fund, and disbursed for several local habitat improvement activities. Although different applicants were involved, all permit actions were proposed on land owned by the City and Borough of Juneau in the airport vicinity.

OBJECTIVES:

1. To correct a perched culvert and enhance coho salmon rearing habitat upstream on Jordan Creek.

2. To experimentally replace an area of upper intertidal slough, in order to compensate for a section of similar habitat that was filled for the Temsco expansion (one of the collective permits).

3. To provide public interpretive/educational opportunities on adjacent, city-owned property and create a dedicated greenbelt along this section of Jordan Creek.

4. To test the feasibility of collective mitigation actions, which theoretically should result in greater habitat benefits than several isolated permit mitigation actions.

IMPLEMENTATION INVOLVED:

1. The developers involved in the localized wetland fill actions (ADOT/PF, CBJ, and a few private parties such as Temsco) set up a mitigation fund to cover a complex of habitat improvement activities. Contributions to the fund totaled $35,000. The regulatory agencies involved in the permit negotiations surveyed the area's possibilities for aquatic habitat restoration/enhancement, then set up priorities for the fund's use. This process resulted in the actions enumerated below.

2. Jordan Creek Fish Habitat Actions.

   A. In 1991-92, a perched culvert (where Crest St. crosses Jordan Creek) was replaced with a bottomless arched culvert, which would allow fish to pass upstream to good rearing habitat above (Plate 63). However, monitoring was required because there was concern that the bottomless culvert might lead to undesirable changes in stream morphology. For instance, the creek might cut down through the stream bottom upstream of the arched culvert. A year of monitoring revealed that the creek had indeed lowered the level of substrate at the culvert entrance (invert). To stabilize the level of the streambed, several boulders (3 to 4 ft. diameter) were then installed upstream of the culvert to slow the creek's flow.

   B. Airport construction work resulted in the removal of a few trees. Rather than disposing of the trees, the woody debris was used to enhance the coho rearing habitat approximately 300 yards upstream of the arched culvert. Two or three trees with limbs intact were laid across Jordan Creek just below Yandukin Drive to increase the amount of cover for rearing fish. These trees were not cabled in or anchored.

3. Intertidal Slough. On the east end of the airport (near Temsco building) are acres of high intertidal wetlands containing sand-bottomed sloughs. Several acres of these wetlands were impacted and/or filled for the new airport taxiway and Temsco expansion. As mitigation, several a new slough was excavated across the remaining wetlands in an attempt to replace some of the slough area lost (Plate 66). It was also hoped that the new sand-bottomed slough would attract sand lance, which are prey for chinook and coho salmon. In 1991, the new slough was excavated by backhoe. The sandy spoils were spread out very finely along the sides of the new channels. The wetland functions are being monitored by FWS and NMFS.

4. Interpretive Trail. Also as part of the mitigation fund, a 1/8 mile interpretive trail was constructed on city-owned property across the road (Yandukin Drive) from the airport in 1992. This area is a dedicated greenbelt. The trail was originally designed to be a boardwalk the entire length. Later, the surface material was altered to wood chips, but was eventually installed as a gravel path (i.e., gravel laid over geotextile fabric to prevent grass from growing up). This switch caused controversy (see discussion below). The trail includes three wooden foot bridges over Jordan Creek, passing alongside the creek and several ponds (rehabilitated borrow pits, now serving as fish rearing ponds) (Plate 65). Interpretive signage (describing the creek, components of the riparian habitat, the resident fish, etc.) remains to be developed and installed. Money still remains in the mitigation fund for this purpose.

ESTIMATED COST:

$35,000 in mitigation fund (of which $10,000 remains for the interpretive signage). However, replacement of the perched culvert with the arched culvert cost approximately $150,000. Although the culvert was part of the mitigation measures for these airport-related permits, it was paid for independently by the City and Borough of Juneau (CBJ).

JUDGEMENT OF SUCCESS:

1. Jordan Creek Fish Habitat Actions.

   A. Arched culvert area (Crest Street crossing). The arched culvert replacement has improved fish passage. The boulders placed upstream of the culvert have successfully stopped the stream course from unravelling anymore. The habitat boulders affect the stream flow by slowing the current, creating small pools, and promoting meander, all of which increase habitat diversity for fish. Downstream of the arched culvert, the stream has begun to cut its own path down through the substrate, transforming the previously straight path into a more natural meandering one (Plate 64). Plans still include adding shrubs to this downstream area to shade the creek.

B. Addition of tree cover. This portion of Jordan Creek (below Yandukin Drive) is currently functioning as good rearing habitat for juvenile fish. Of the trees installed for cover in 1991, one will be replaced because it is beginning to become a blockage to creek flow. The tree limbs are collecting garbage and other debris. This tree will be replaced with a larger log containing fewer fine branches. Another tree mysteriously disappeared since it was installed. Impacts of the public cannot be discounted in the functioning of stream projects in urban areas.

2. Intertidal Slough. After three years, the constructed slough appear stable and doing well (Plate 66), though the vegetation within the slough is not as dense as in similarly-sized natural sloughs. Sand lance are present, and geese have been observed feeding in the grasses.

3. Interpretive Trail. The trail begins across the road from the airport, and ends at the last bridge over Jordan Creek. The trail has received minimal use so far, but the addition of the interpretive signs may attract more public attention. Partway along the trail is a cutoff to the nearby Nugget Mall. The section between the airport and the mall cutoff is greatly used.

LESSONS LEARNED:

This project illustrates the idea of pooling money from more than one project to achieve a greater mitigation gain than several isolated projects. Although the mitigation fund was created up front, it is apparent that the joint agreement formally needs to be much clearer about which of the parties will implement which actions. Just because the money was dedicated towards mitigation activities does not mean all will be implemented in a timely fashion.

The bottomless arched culvert successfully corrects fish passage through a previously perched culvert, but it must be used with caution. The consequences of suddenly allowing the stream to cut down through the substrate must be carefully considered. In this case, the situation was corrected by adding a few boulders to slow the flow above the opening. Also, arched culverts may tend to fail more than regular round culverts, particularly if the appropriate amount of side support is not provided during installation. Of course, both culvert types also require regular inspection and maintenance.

Tree additions to streams (to increase fish cover) must be cabled into place so they will not shift during high water (possibly creating stream blockages), and to prevent tampering from the public.

Depending on the soil, the intertidal slough may widen or slough off. Placement of vegetative mats may be appropriate in some places.

The interpretive trail should probably have been built with more attention to needs of the prospective users—i.e., if not a loop trail, where should it lead? A trail to a dead end apparently does not invite much use. The new trail would also benefit from attractive signs or displays to get people to notice and appreciate it. The trail materials should also have been selected more sensitively—several staff people disputed the idea of putting a gravel path across a riparian wetland as compensation for placing gravel fill in a wetland elsewhere. Given the motivation for the trail, the initial boardwalk design would have been more appropriate.

SIGNIFICANCE OF PROJECT:

This project was very significant because the permitting agencies decided to treat coinciding Corps permit applications as one for mitigation purposes. This may have been the first cooperative mitigation agreement of this nature in Alaska. Such an approach (i.e., directing mitigation efforts from several smaller permits into the habitat activities that are deemed the most constructive for the given area) could potentially provide much greater habitat benefits than several isolated mitigation actions. However, as stated above, the parties to the agreement must clearly understand their individual responsibilities, and commit to a timeline.

This cooperative treatment for mitigation negotiations was only possible because several permit applications were received that coincided in time and place, which is not common. In addition, all proposed actions were on lands owned by the CBJ, which provided a central entity for coordinating the mitigation agreements and activities. The resource agencies (ADF&G, FWS, NMFS) recognized that the CBJ was the central player and insisted that they administer these permitting activities on their lands (even if some were to benefit and be built by a private party, such as Temsco), and coordinate the mitigation fund. Otherwise, the agencies feared that none of the mitigation work would be completed, which was probably a good move. It is worth noting that if the idea of the centralized mitigation fund (illustrated here) is taken one step further and extended to accommodate local projects over a longer time period, the result would be a mitigation bank.

Preservation of an area of known habitat value (e.g., in a dedicated greenbelt) has at times been used as one possible mitigation option for wetland fill. However, the practice has been disputed because there is no replacement of values lost from the filled wetland acres. At the same time, such a mitigation action can be viewed as good habitat for the investment (i.e., a good bet financially) when compared to funds expended towards habitat restoration actions with riskier or more marginal outcomes. In this case, the public received educational and recreational benefits as well through construction of an interpretive trail.

FOR FURTHER INFORMATION:

Report(s): None

Contact Persons: Janet Schempf (ADF&G, Douglas), Duane Petersen (FWS, Juneau), Ralph Thompson (COE, Juneau).

Other Information Sources: Originally, Rick Reed (ADF&G, now retired) and Duane Petersen (then with NMFS, now with FWS) were interviewed about the project. Much information is available in various agency files. The mitigation sites were visited for this case study report on 10/8/93, with Janet Schempf (ADF&G), Betsy Parry (ADF&G), Duane Petersen (FWS), and Paul Bowers (Airport Manager, City and Borough of Juneau) in attendance.

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PHOTO PLATES

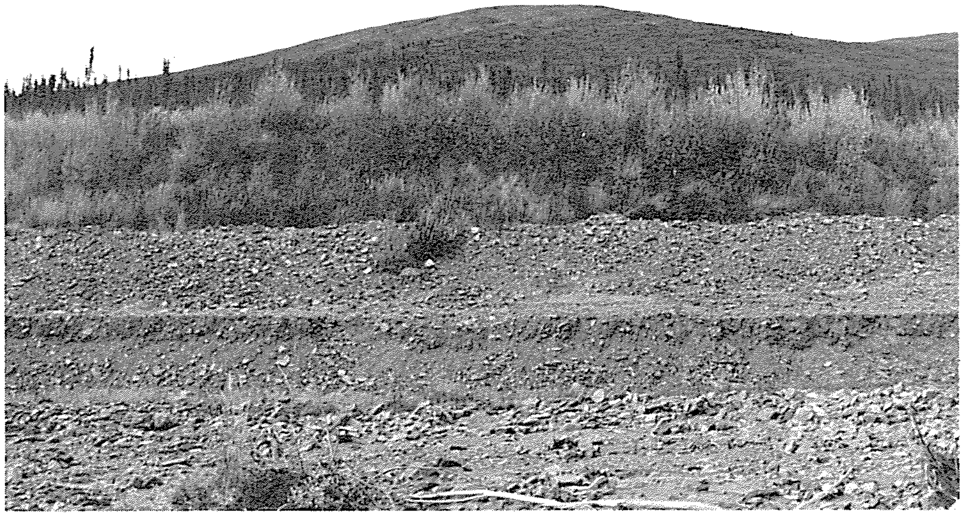

Plate 1. Independence Creek slope stabilization using dormant willows. Uppermost layer of overburden was planted four years earlier. Note high content of fine sediment in overburden stockpiles.

Plate 2. Independence Creek slope stabilization project. Ten-foot growth of planted dormant willow cuttings after 5 growing seasons (1989-93) at one of the marked control points.

Plate 3. Spillway between upper ponds at the Creamer's Field waterfowl enhancement project. This spillway was reconstructed in winter and spring of 1992/93 using rock riprap recovered with stockpiled topsoil, fertilized, and seeded. Photo from September 1993.

Plate 4. Pond 1 of Creamer's Field waterfowl enhancement project in 1993 after the spillway below was replaced, allowing the pond to refill. Note that existing vegetation was left standing on the "islands" during pond excavation.

Plate 5. Pond 4 of Creamer's Field waterfowl enhancement project, dewatered due to spillway washout below it in 1989. The intended island is center left. Only a channel of water currently runs through the excavated area.

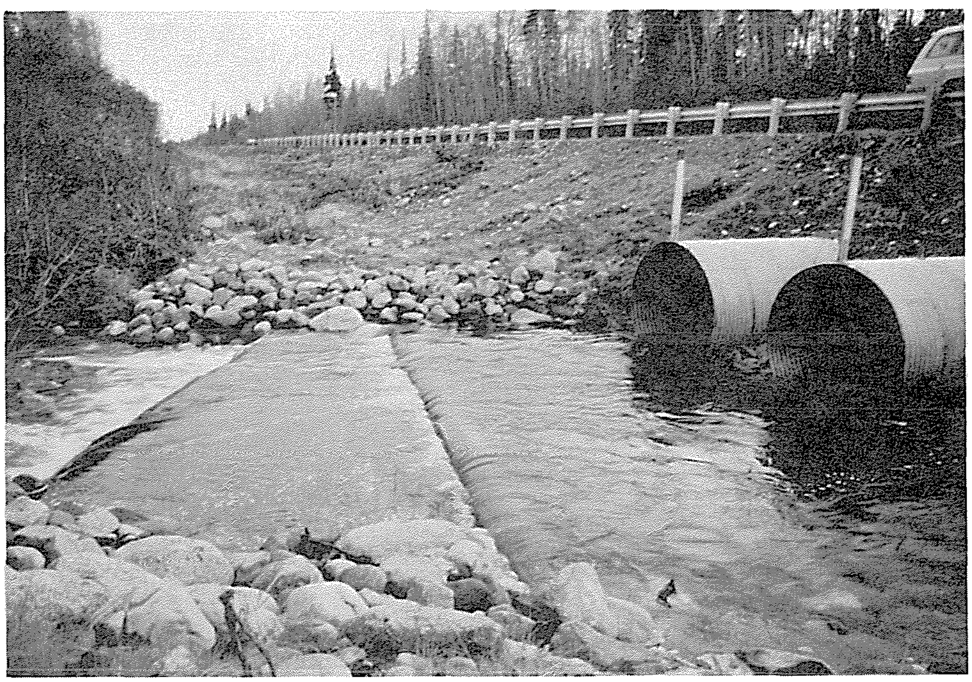

Plate 6. Log step pools constructed by ADOT/PF at a small, unnamed creek near Trapper Creek. Note low bedding of culvert outlet to eliminate "perch." 1991 ADF&G file photo.

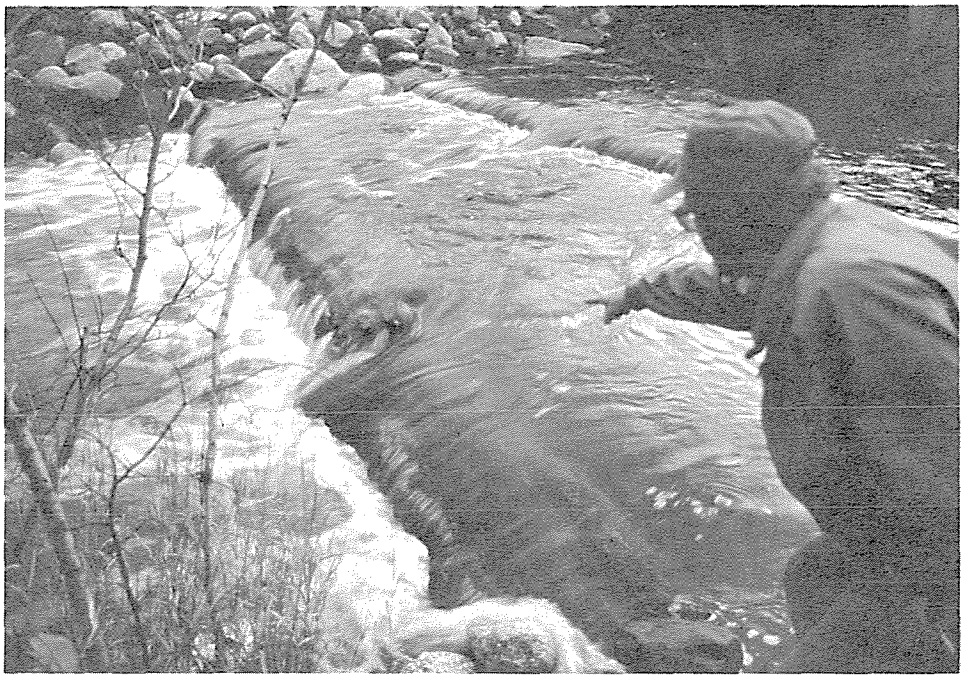

Plate 7. Log step pools near Trapper Creek during high flow. Photo shows staggered notch openings in the weirs. 1991 ADF&G file photo.

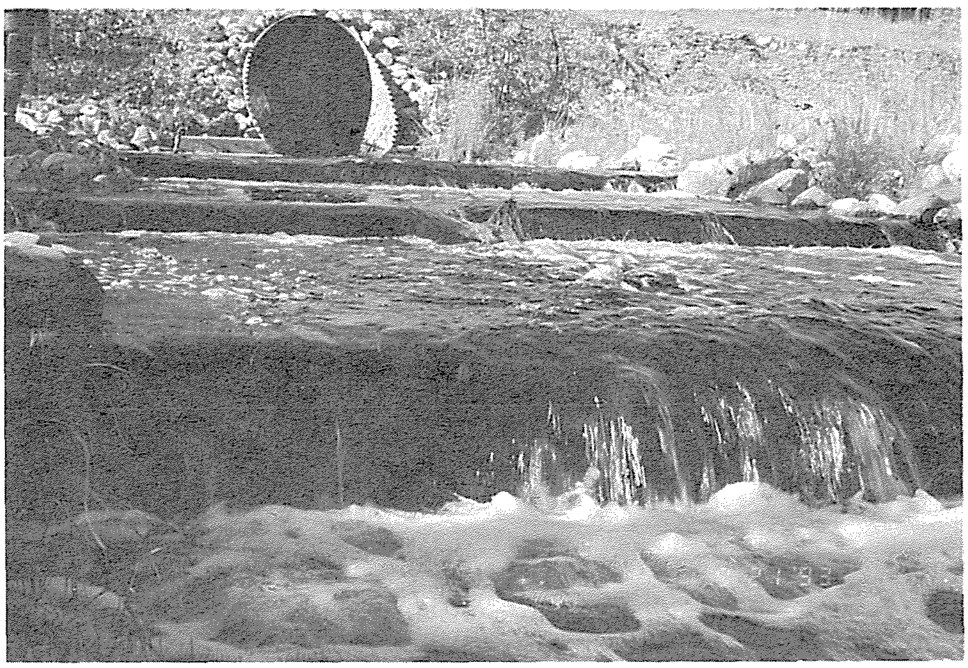

Plate 8. Log step pools at Milepost 120 of the Parks Highway during lower flow (Sept. 1993). The lowest weir was measured to have a 1 ft, 8 in. drop, which easily passes adults but may be excessive to pass juvenile salmon.

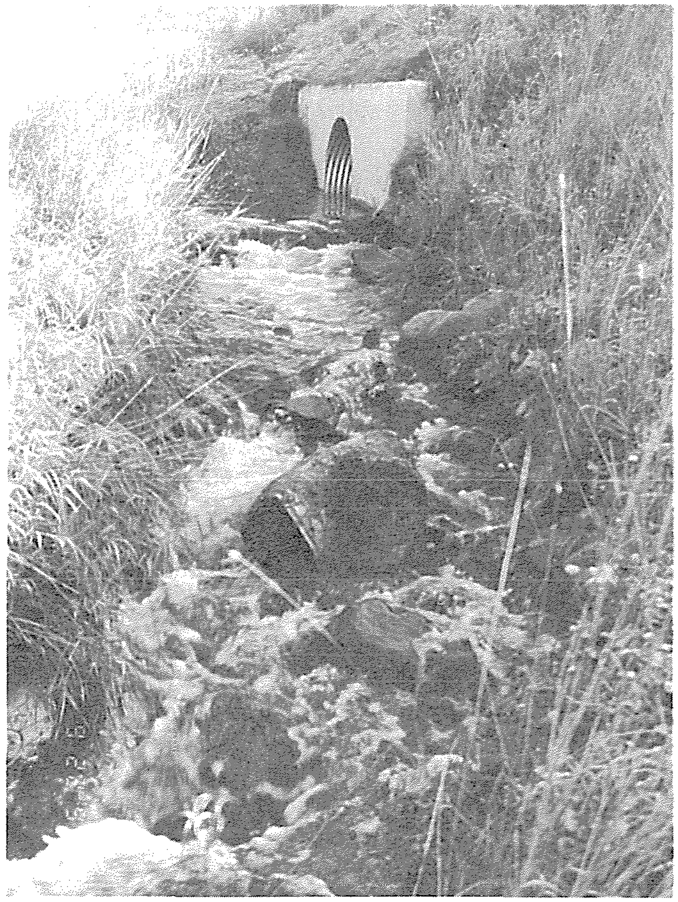

Plate 9. Rapids along the realigned loop section of Fire Creek as it exits the culvert north of the new highway interchange in North Eagle River (see Figure 5). The close succession of drop structures without resting space may be impeding fish passage through this section.

Plate 10. Realigned section of Carrol Creek at the North Eagle River highway interchange (between the "A2" ramp and the highway, see Figure 5). Willow cuttings are persisting in this area more than in the other sections of the project.

Plate 11. Looking north at the sedimentation/mitigation pond at the North Eagle River highway interchange. Skim of ice visible in shallower areas. Frontage road in rear.

Plate 12. Coastal Trail mitigation project, consisting of an excavated pond and berm on the tidal mud flats in Anchorage. The brackish water pond receives stormwater runoff. Ducks primarily use the site as "loafing habitat," congregating on the bare berm.

Plate 13. Westchester Lagoon offsite mitigation project. View looking uphill the length of the project; Westchester Lagoon located behind photographer. Cattails in foreground; transplanted willows halfway up site at center left.

Plate 14. Lower section of Westchester Lagoon offsite mitigation project, showing shallow standing water and coastal trail in rear. Transplanted willows on right bank near person.

Plate 15. Fish Creek estuarine wetland restoration project, showing revegetation on the varied terrain. Behind figures, an intended duck pond holds little water.

Plate 16. Fish Creek wetlands, showing sedge plugs in foreground (transplanted from edge of project site) and naturally reinvading salt-tolerant species such as pickleweed. Fertilization appears to speed natural regrowth in these salty clay soils.

Plate 17. Fish Creek wetlands. Human impact (foot and bike traffic) in this area was much higher than anticipated, hindering plant establishment in the easily compacted clay substrate.

Plate 18. Campbell Creek sedge wetlands in 1989, after sewer line installation and erosion denuded approximately 3 1/2 acres of high intertidal wetlands. ADF&G file photo.

Plate 19. Successful revegetation on east side of Campbell Creek wetlands. Photographed in 1993, four years after sedge plugs were transplanted.

Plate 20. Human impact at the Campbell Creek wetlands (demonstrated by foot traffic, vehicle and bike tire tracks) has prevented the establishment of planted vegetation in parts of the western section. In this region, only the lowest (and wettest) areas were successfully vegetated. Below the house on left lies the only section of tree buffer that was replanted. The creek bank at the sewer line crossing was reinforced with riprap after erosion, appearing in center right of photo.

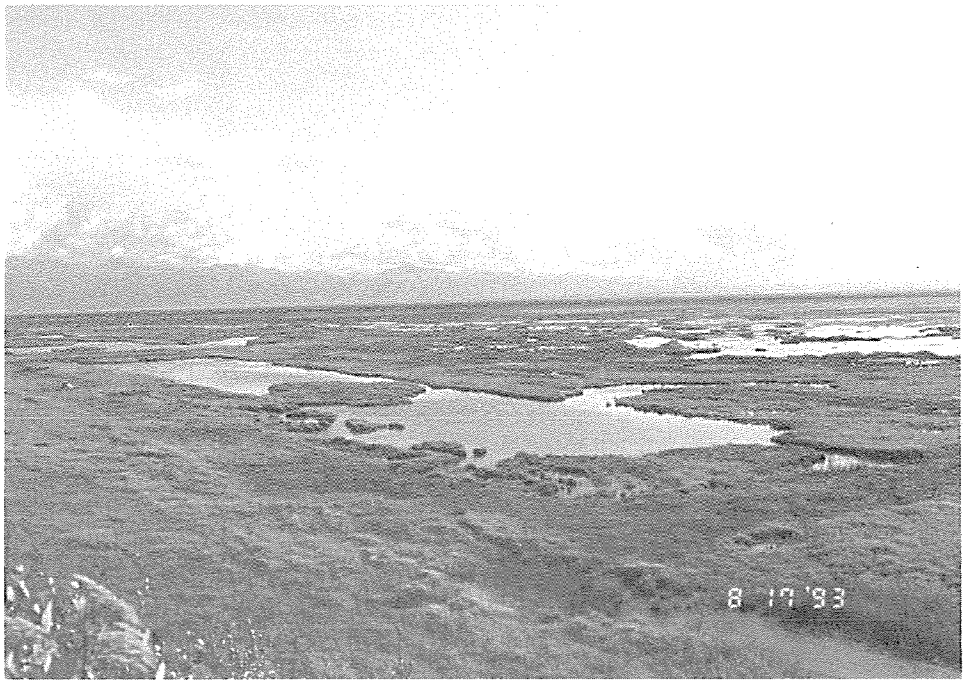

Plate 21. Two of the rectangular waterfowl nesting ponds, constructed at the base of the Bayshore bluff in Anchorage some twenty years earlier (in 1973).

Plate 22. Bayshore waterfowl ponds. Although perhaps not actively used for nesting, the constructed ponds do receive considerable waterfowl use, such as from these feeding greater yellowlegs.

Plate 23. 20 years of weather and tides have altered the waterfowl ponds below Bayshore, changing their original shape and drainage patterns. The nesting island was built too high to revegetate well.

Plate 24. Volunteers installing a layer of donated Christmas trees on the eroding bank of Campbell Creek in 1992. Trees were anchored with a cable strung through the bases. Source: Fritz Kraus, ADF&G.

Plate 25. The tree revetment installed the previous year (Plate 24) is stabilizing the eroding bank along Campbell Creek. In addition to slowing the current, the tree branches provide eddies and cover for juvenile fish.

Plate 26. The branches of the tree revetment cause water to slow and silt to drop out along the creek edge, rebuilding the eroding bank. Eventually, the accumulation of silty bank will be replanted with woody vegetation. Source: Fritz Kraus, ADF&G.

Plate 27. Realignment of Little Campbell Creek at Abbott Loop School. The new channel (700 feet long) included pool and riffle sequences to enhance fish habitat. 1988 ADF&G file photo.

Plate 28. The same view as above, taken the following year after replanting. 1989 ADF&G file photo.

Plate 29. The same view of the realigned section of creek at Abbott Loop School, five years after planting. The view from the top of the culvert is almost obscured by willow bushes.

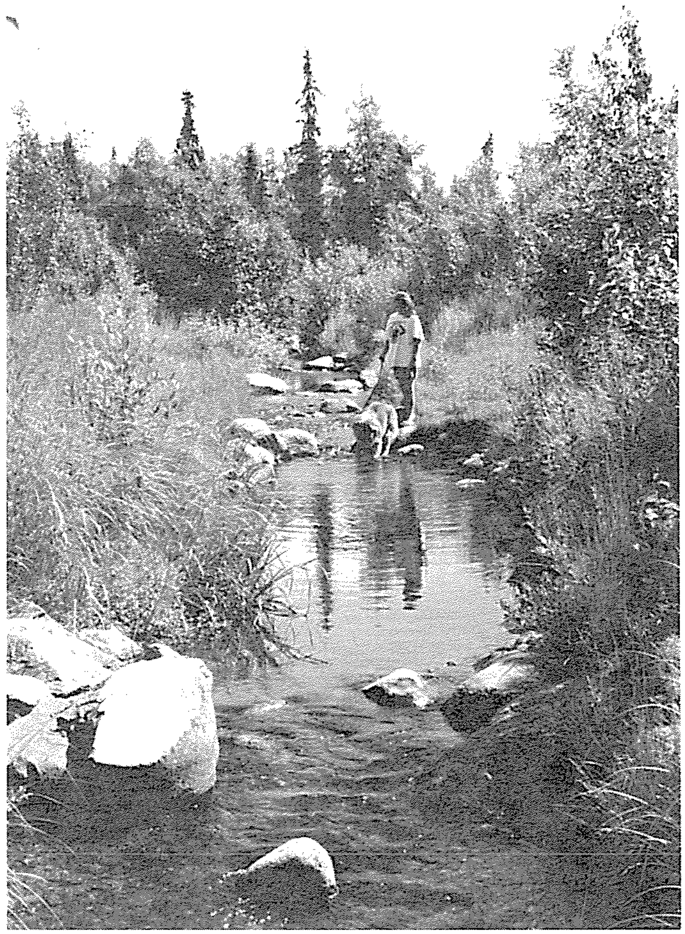

Plate 30. A realigned section of Little Campbell Creek near Abbott Loop School in 1993. The pool and riffle sequences continue to function as planned. The project area now serves as a neighborhood park.

Plate 31. The culvert under Atkins Place was reinforced with round stones when first installed over the realigned reach of Little Campbell Creek. 1988 ADF&G file photo.

Plate 32. The same culvert in 1993. The stones proved to be irresistible to neighborhood children. The opening on the left is completely obscured by fill (note wand marker above), and the other two culvert openings are substantially blocked, undermining the objectives of flood conveyance and fish movement through the project area.

Plate 33. Rabbit Creek fish pass during construction in 1988. The gabion weirs are intended to break the elevation change into smaller gradations, so that fish can negotiate their way upstream and through the culvert. ADF&G file photo.

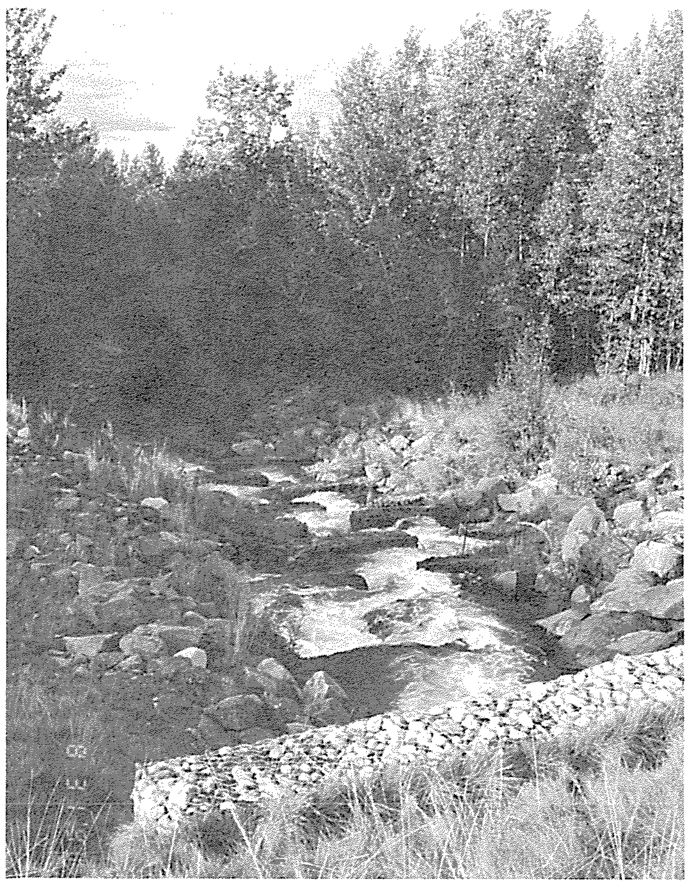

Plate 34. Rabbit Creek fish pass in 1993. The structure continues to function as intended, although no fish were observed there. Other obstacles downstream may be interfering with fish migration through this project area.

Plate 35. The west bank of Rabbit Creek just after replanting with riparian vegetation. Rooted willow cuttings are in the foreground; 4-6 ft. high transplanted willow trees in rear. 1988 ADF&G file photo.

Plate 36. The same view in 1993. Several shrubs in the foreground are new alders that have grown in, not the planted willows. Willow survival has been spotty (cf. Plate 35). Grazing damage the first season from a neighbor's horse could be partly responsible.

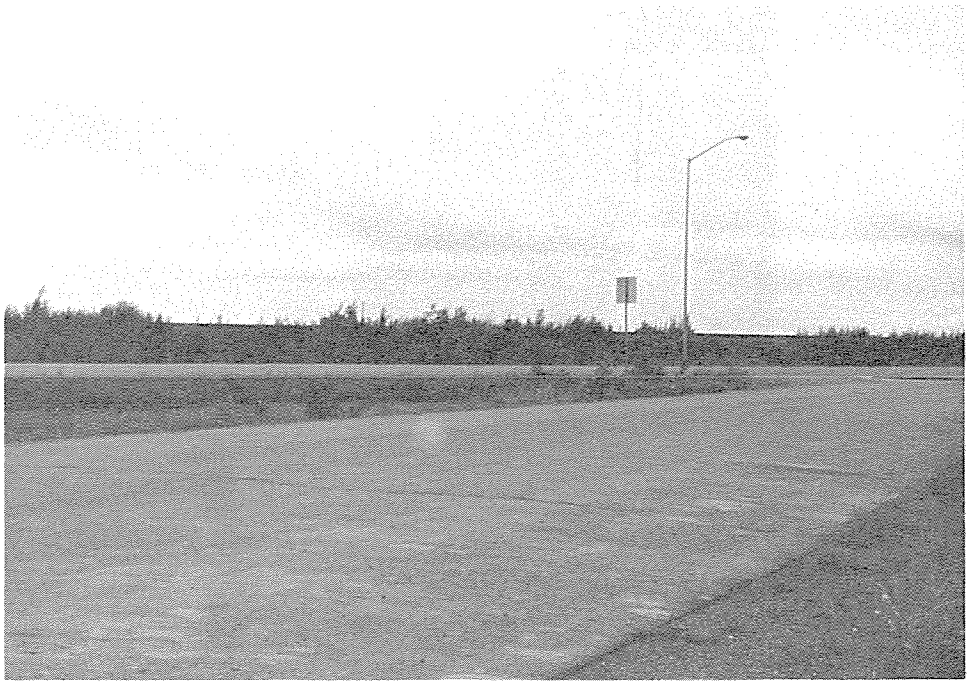

Plate 37. The removal of this access road across the south end of Potter Marsh served as mitigation for another unrelated fill permit. 1984 ADF&G file photo.

Plate 38. Same view as above in 1993, the new Seward Highway in rear of photo. The outside edges of the former road fill area have revegetated well, though the outline is still clearly visible.

Plate 39. View from northwest end of the former road fill area at Potter Marsh, as seen from the New Seward Highway. Foreground portion is very shallow (2" deep). Marestail visible in formerly filled area. Many woody species were planted on embankment at rear.

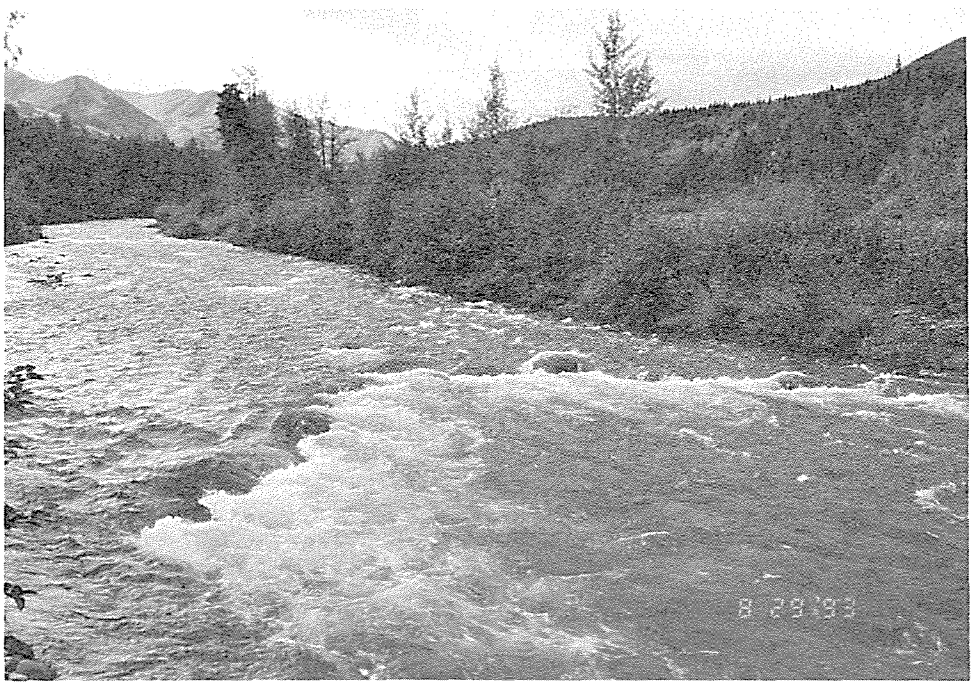

Plate 40. A vortex rock weir installed in Resurrection Creek in 1992. These structures are intended to produce interconnected pool habitats both upstream and downstream, while also permitting sediment transport through the structure. Some boulders have shifted position.

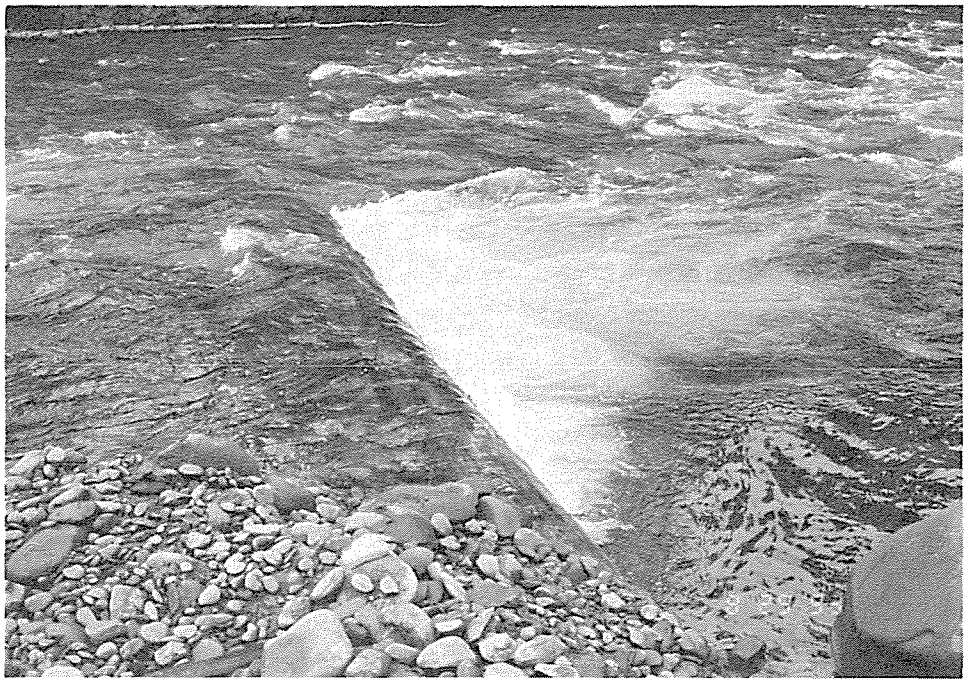

Plate 41. Log barb structure on Resurrection Creek, imbedded into the streambank for half its length. A downstream pool forms at the tip of the log.

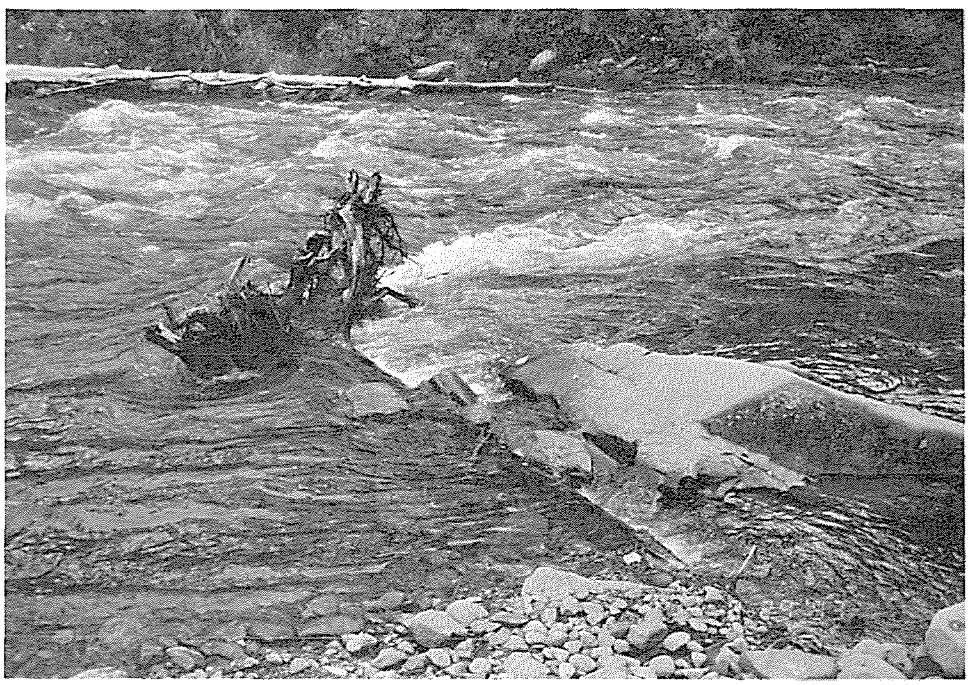

Plate 42. Tree root wad cabled to a boulder in Resurrection Creek. Root wads provide cover for fish, and help to vary the flow rate and channel depth.

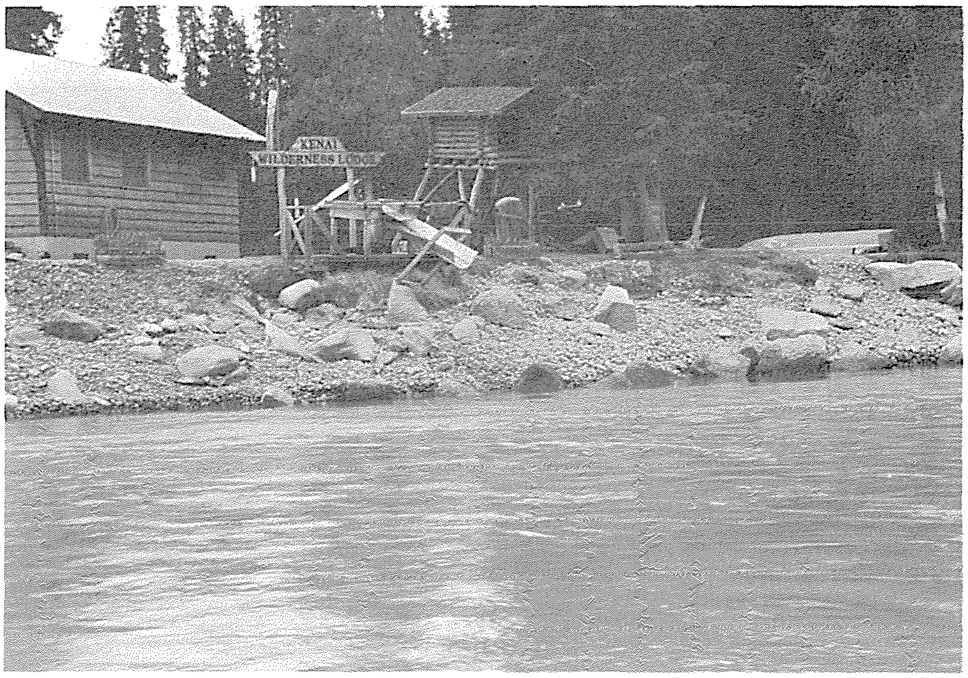

Plate 43. Bank in front of the Kenai Wilderness Lodge in spring 1993, before installation of the bioengineered bank restoration project. ADF&G file photo.

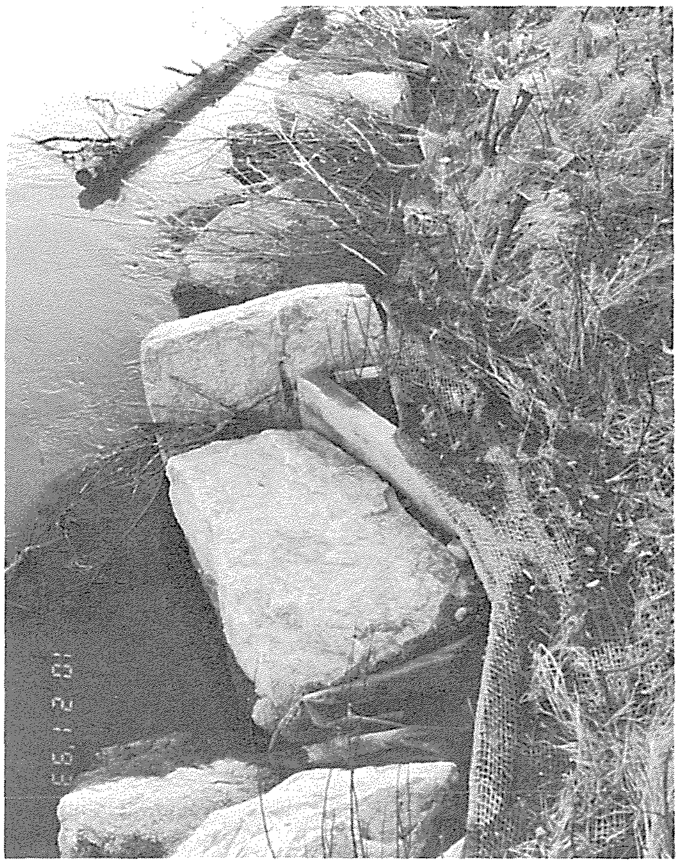

Plate 44. Bioengineered bank at Kenai Wilderness Lodge. A wooden timber was used to facilitate the transition between the rock at the toeline and the planted bank above. Willow fascines (over rocks), live stakes, and willow sprigs are visible on bank.

Plate 45. General view of the replanted bank at the Kenai Wilderness Lodge bioengineering project. The horizontally-installed fascines (which did not survive and resemble dead branches) and cabled-in spruce trees are at right.

Plate 46. Close-up of the various planted woody materials after high flood waters receded in the fall. Rooted willow cuttings appear to be the most successful after the first season.

Plate 47. Bradley Lake Hydroelectric Plant waterfowl mitigation area in 1992. The water impounded inside a road dike was designed to become a waterfowl nesting area, with islands laid out in finger-like configurations. Low water levels and slow revegetation has hampered the project. Source: Dan Rosenberg, ADF&G.

Plate 48. The Martin River delta at the conclusion of gravel mining operations. The armored dike on the left protected the mining operations (and later the fish ponds) from large fluctuations in flow. The spawning channel lies alongside and just to the right of the dike, and connects to each of the rearing ponds. Pit 1 is in the foreground, with Pits 2 and 3 behind, and Kachemak Bay in the distance. Source: Dan Rosenberg, ADF&G.

Plate 49. Former gravel pits at the Martin River delta in 1993. Woody debris was added along the margins of the sterile ponds to improve cover and fish habitat features.

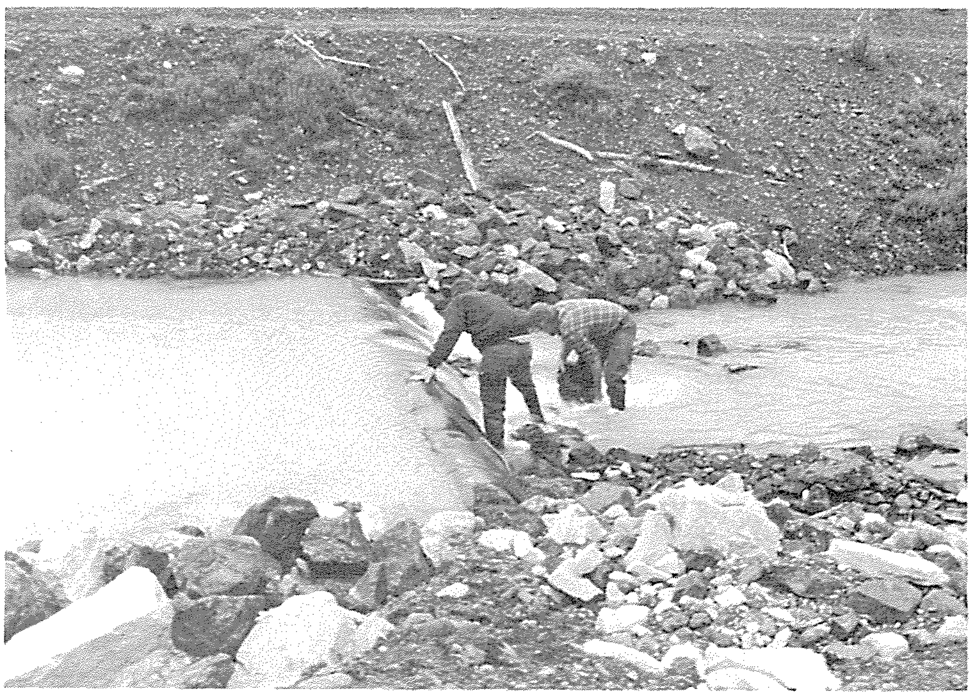

Plate 50. A notched log weir in the constructed spawning channel at the Martin River delta. When visited in 1993, several riprap rocks had washed below the notch, preventing fish from accessing the upper reaches of the spawning channel and other rearing areas. Regular inspection and maintenance is necessary for all instream structures.

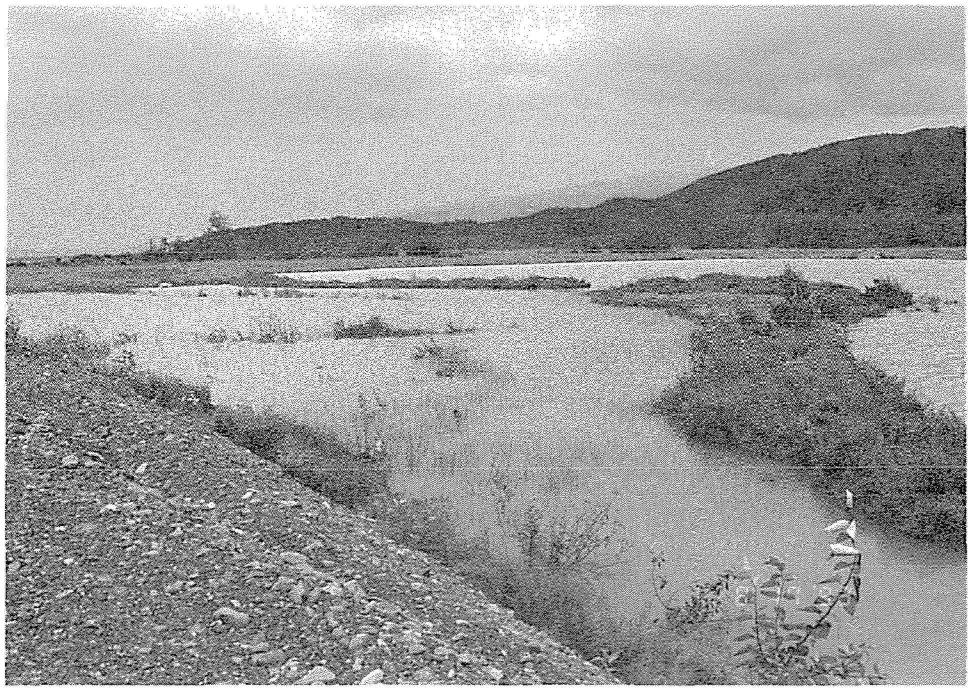

Plate 51. Regrowth at the Martin River fish ponds in 1993. Here, on one side of Pond 2 (cf. Plate 48), a few "islands" and some existing vegetation were left in place. This area contained the most regrowth observed, including some emergent vegetation. A higher amount of fine sediment in the local substrate may also have aided revegetation.

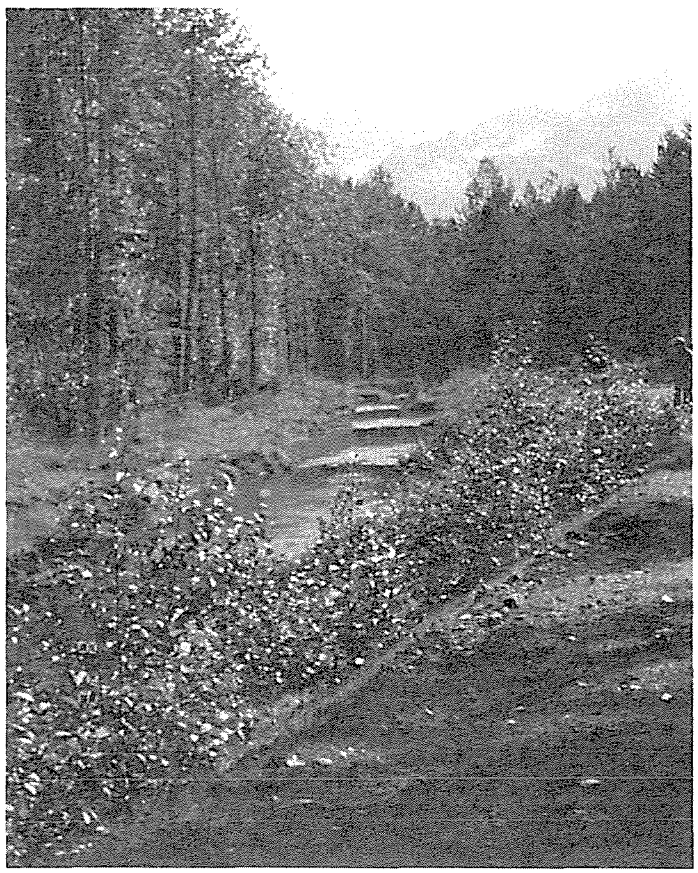

Plate 52. Box Canyon Creek rearing ponds near Seward, built as a series of small ponds separated by shallow riffle areas.

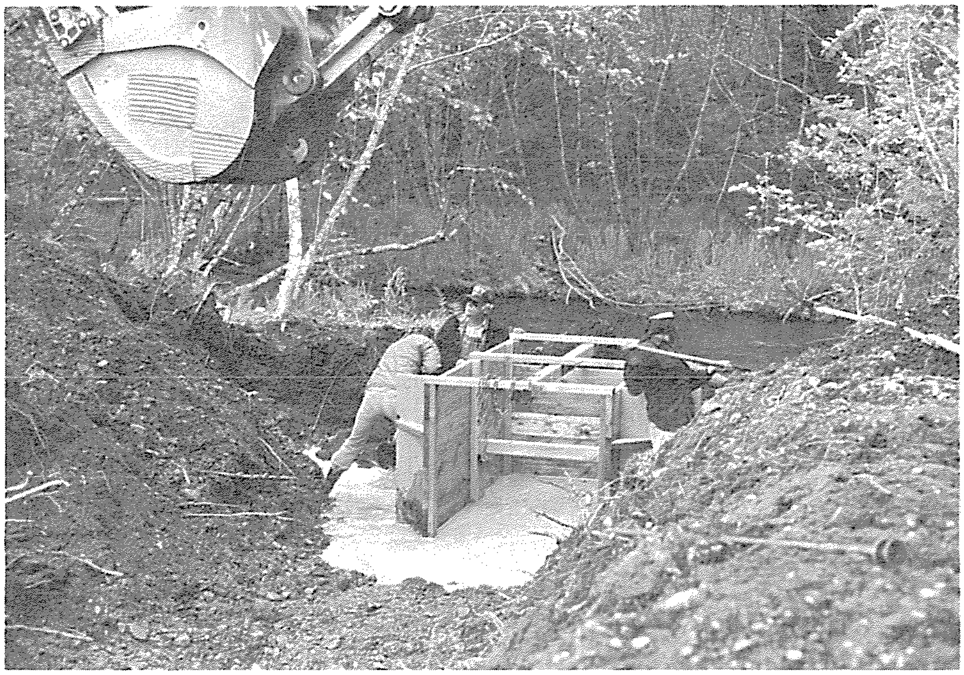

Plate 53. Headgate installed in the short channel between Box Canyon Creek and the existing gravel pond to control the flow through the mitigation area. 1987 ADF&G file photo.

Plate 54. View of Box Canyon Creek rearing ponds from the downstream end, showing a lack of instream and bank cover, and the steeply sloped banks.

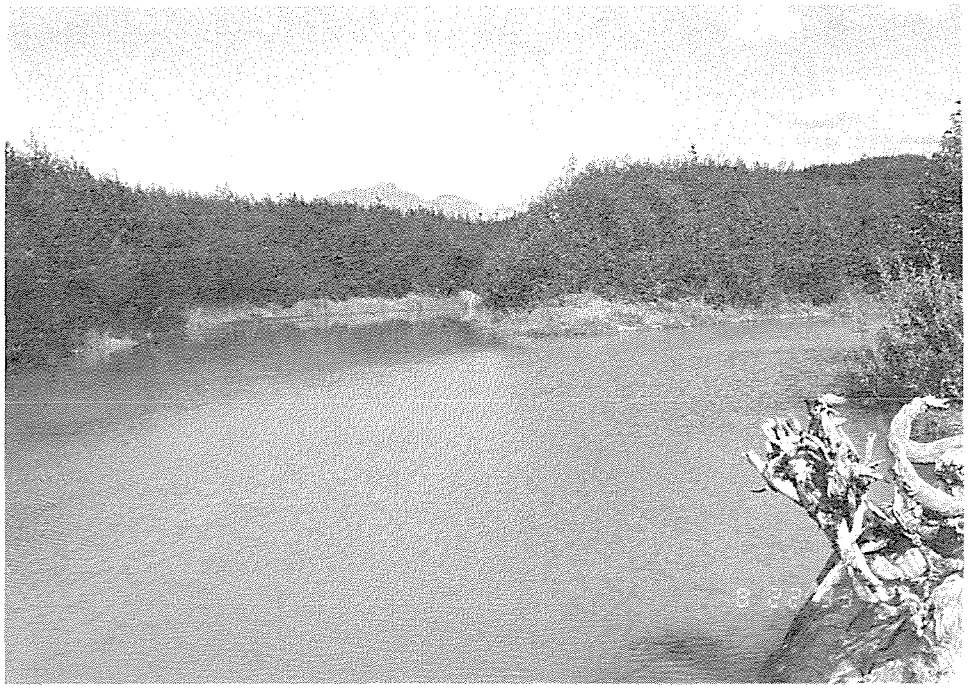

Plate 55. View upstream towards confluence of the two branches of the Fourth of July Creek spawning channel. Outlet to Resurrection Bay lies behind photographer.

Plate 56. The mouth/entrance to the spawning channel on Resurrection Bay is blocked by beach berms. The material deposited at the mouth of Fourth of July Creek (adjacent to spawning channel, just left of photograph) is formed into berms by wave action.

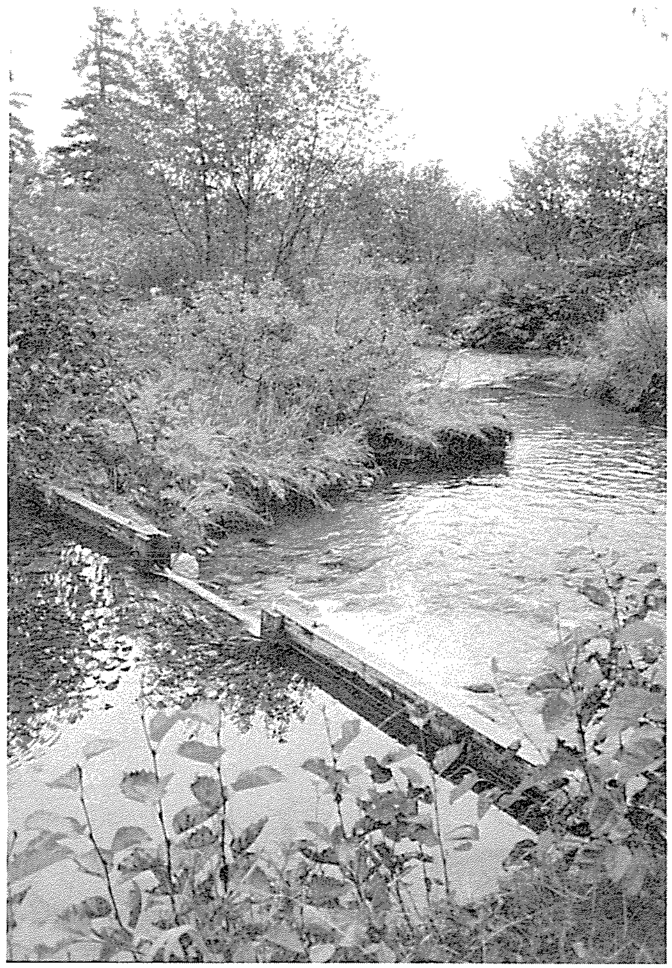

Plate 57. Confluence of forks A and B of the Mile 25 spawning channel, Copper River Delta. Photo shows a wooden drop structure in Channel A, and on the far bank, a grass-covered wooden platform that was intended to provide hiding cover for fish, simulating an undercut bank.

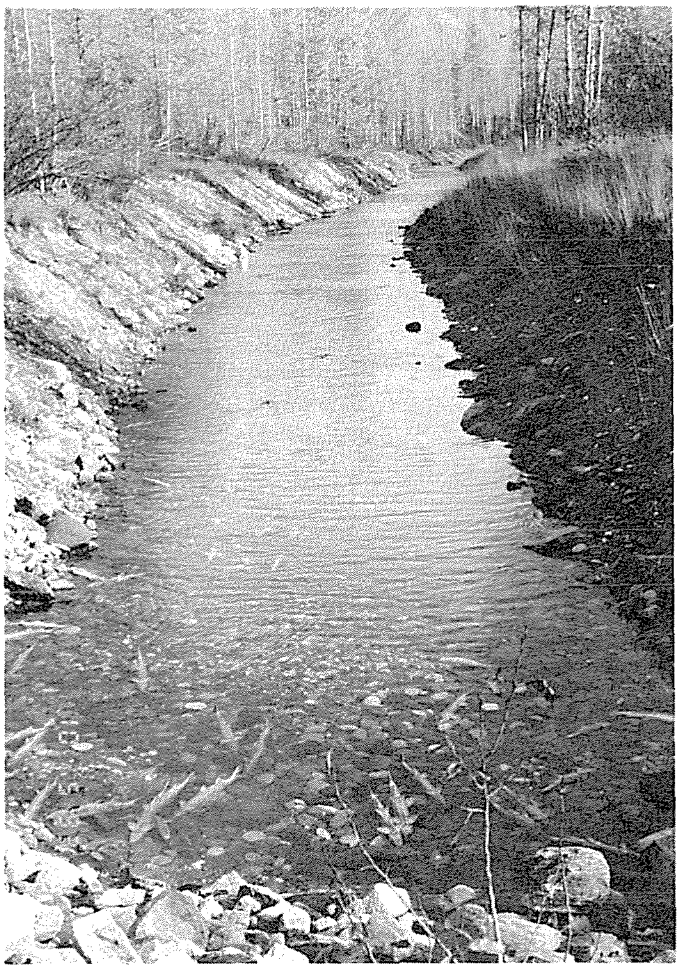

Plate 58. Herman Creek spawning channel at its origin. Groundwater flows from the Klehini River through a gravel road dike and into the constructed channel. Spawned-out salmon in foreground.

Plate 59. West end of Haines Airport project area in 1992, showing created emergent wetland west of and between the old and new runways. The new runway is along the Chilkat River, at bottom of photograph. The created drainage slough runs from an infiltration galley at far left, across the new wetland area to a taxiway at far right. Source: Ron Josephson, ADF&G.

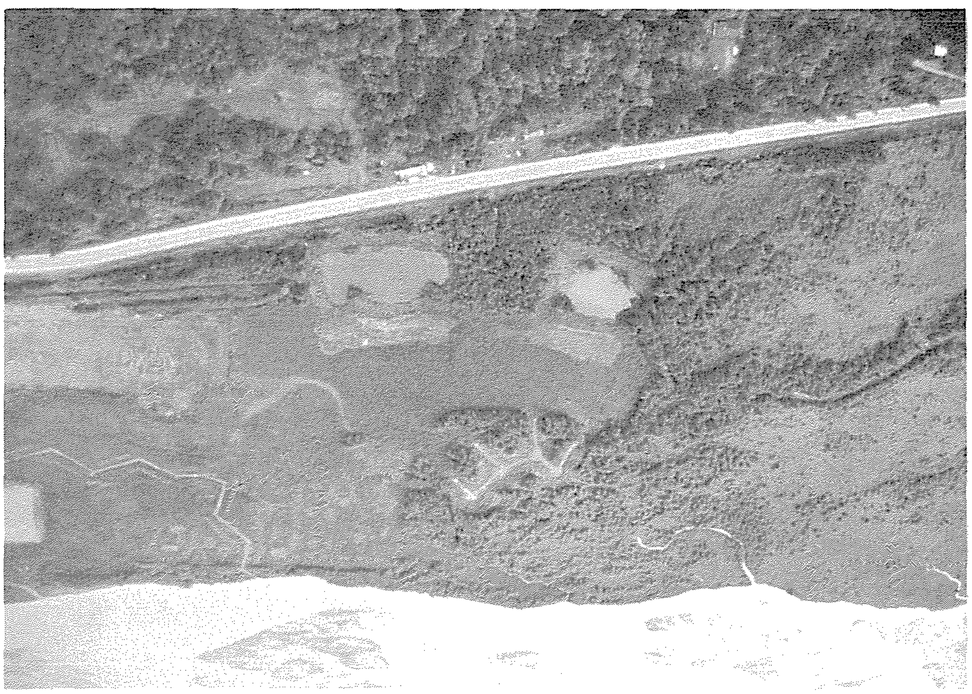

Plate 60. East end of Haines Airport expansion in 1992, showing the area of restored wetland (center left), the re-routing of Yindastuki Creek around the end of the new runway at bottom left (zigzag pattern), two of the created rearing ponds in center, as well as the First Iron Pond (actually several connected finger channels) at lower center (see also Figure 8). Source: Ron Josephson, ADF&G.

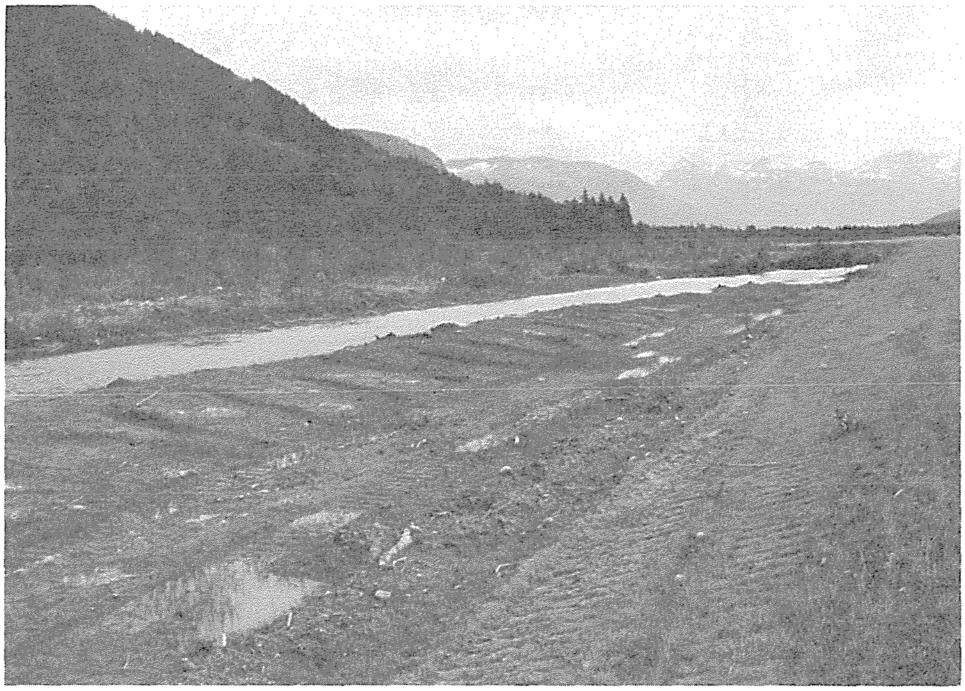

Plate 61. 1992 vegetation monitoring photo of the created emergent wetlands and drainage slough at west end of Haines Airport (cf. aerial shot, Plate 59). Source: Ron Josephson, ADF&G.

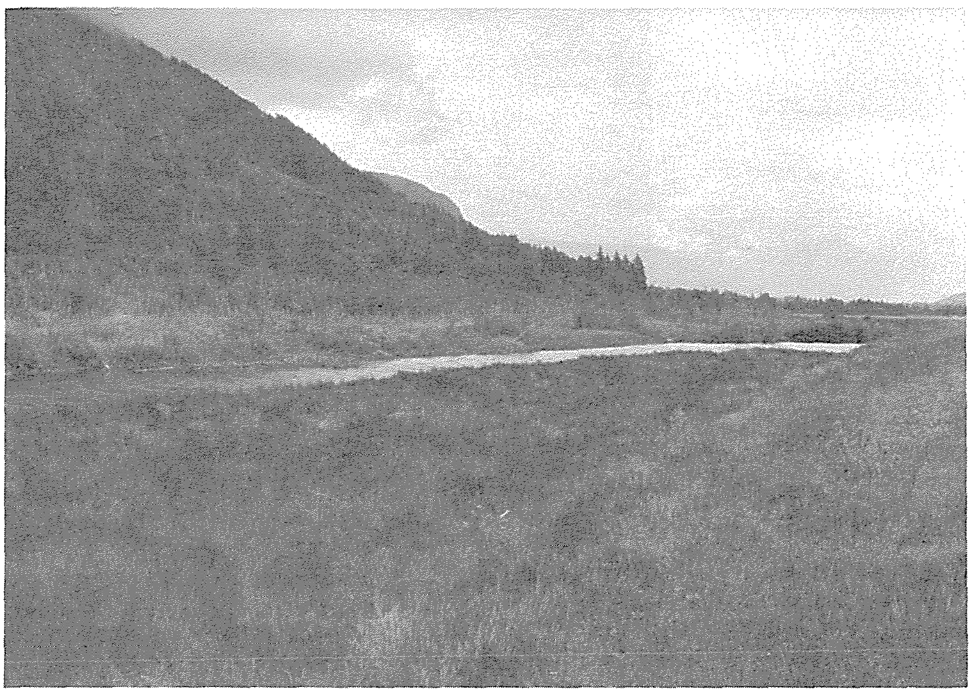

Plate 62. New vegetational cover on same site one year later in August 1993. The drainage slough has become productive coho rearing habitat. Source: Ron Josephson, ADF&G.

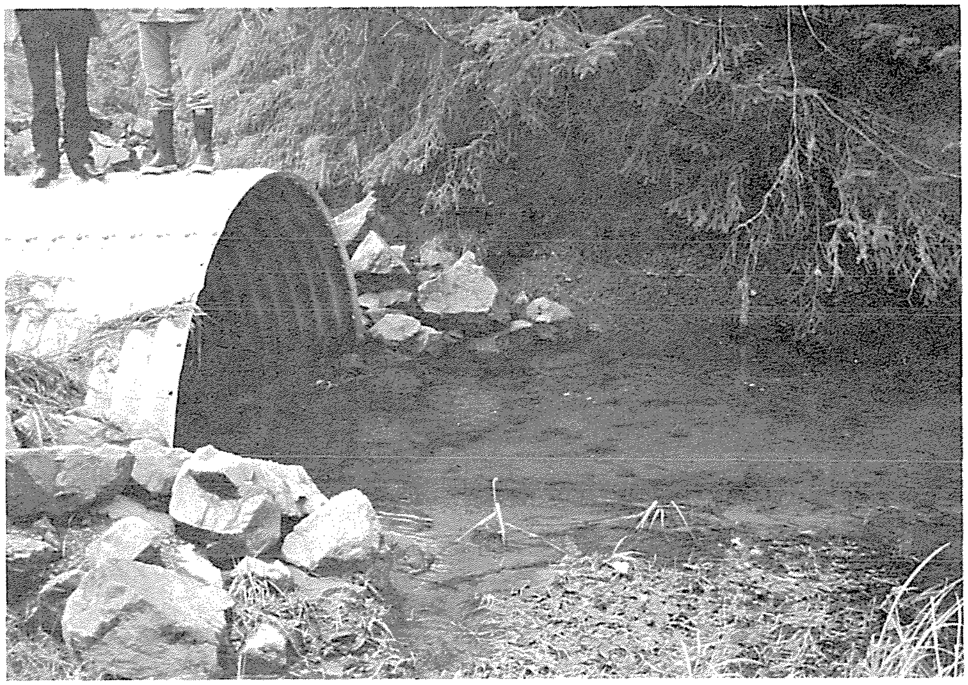

Plate 63. Arched culvert installed to replace perched culvert on Jordan Creek as part of the mitigation package for Juneau Airport expansion project.

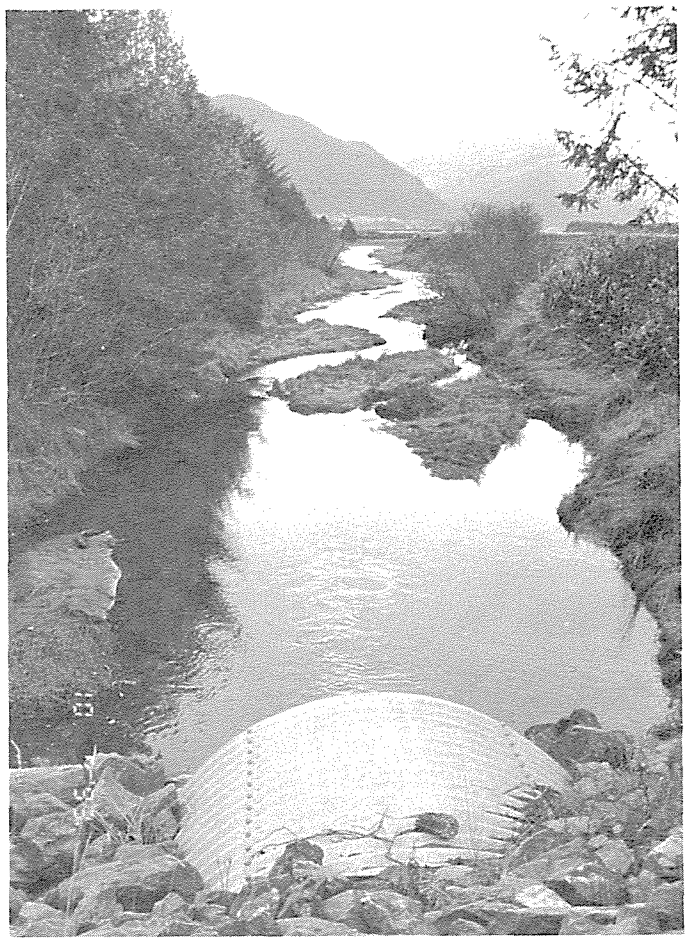

Plate 64. Besides correcting the perch, the arched culvert on Jordan Creek led to a more natural meandering channel downstream, by allowing the creek to cut its own path through the substrate (previously the channel was a straight run).

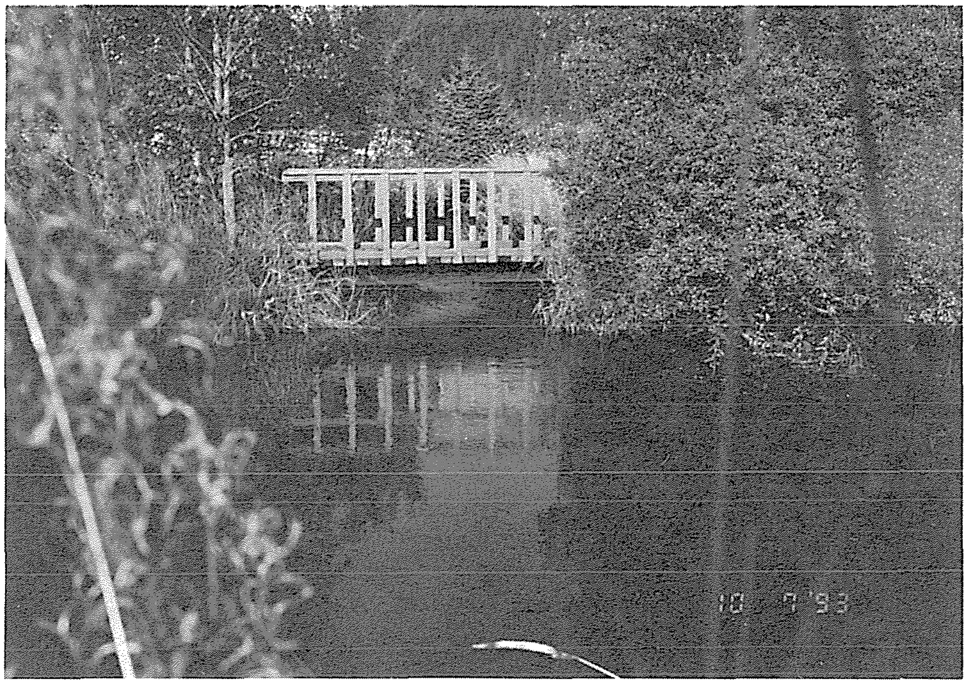

Plate 65. This wooden bridge over Jordan Creek was built for an interpretive trail, one of the activities funded by the Juneau Airport expansion mitigation fund. In the foreground is a former borrow pit, now rehabilitated as a rearing pond for fish.

Plate 66. One of the experimental sandy-bottomed sloughs constructed on high intertidal wetlands to compensate for acres of similar habitat filled during taxiway expansion. The sloughs were also intended to attract sand lance, a prey species for salmon.

CHAPTER 3

Policy Guidance

CHAPTER 3. POLICY GUIDANCE

The primary objectives of this project include the development of guidelines for aquatic habitat restoration and enhancement projects in Alaska; formulation of "model" enforceable policies for coastal districts within the state; and recommendations of other improvements to Alaska's coastal management program to promote effective and efficient restoration and enhancement requirements. Chapter 3 will present the recommended guidelines, policies, and planning approaches for coastal districts within the state. Related procedural issues are discussed in Chapter 4.

Coastal districts are most likely to formulate policies pertaining to aquatic habitat restoration and enhancement as it concerns mitigation for development projects in the state and federal regulatory process. This chapter therefore begins with a review of relevant federal regulations and current attempts by other states to address mitigation within state-wide policy. The chapter then proceeds to discuss ways that Alaskan coastal districts might address aquatic habitat restoration and enhancement within the district's enforceable policies, and the role that detailed local plans (e.g., local wetland management plans or mitigation plans) can play in facilitating successful aquatic restoration and enhancement efforts. The chapter also includes checklists for mitigation proposals, policy examples from ACMP-approved district plans, and a summary of recommendations for coastal districts.

A. STATUS OF COMPENSATORY MITIGATION POLICY

Many U.S. states and local governments have adopted or are considering adoption of policies (i.e., statutes or regulations) to guide habitat restoration, creation, or enhancement when employed as compensation for damage or destruction of a wetland associated with a development project. In many parts of the country, permit applications for developments involving substantial wetland alterations commonly include proposals to offset these losses by creating, restoring, or enhancing aquatic habitat. However, the practice of compensating for permitted habitat losses is controversial because of the high rates of failure of many compensatory mitigation projects to date, the lack of basic scientific knowledge, the lack of regulatory staff expertise to evaluate proposals, and the amount of staff time needed to evaluate and monitor proposals.

Current statutory and regulatory guidance for compensatory mitigation at the state-wide level typically address the following elements (from Kusler et al. 1994):

1) The conditions under which restoration, creation, or enhancement is to be considered as compensatory mitigation.
2) Whether the compensatory mitigation is to be on-site or off-site, in-kind or out-of-kind.
3) Mitigation ratios for particular types of aquatic habitat.
4) Overall suitability of the mitigation proposal.

These elements are discussed below.

Conditions under which restoration/enhancement is to be considered

The first question to be addressed when formulating these policies is determining when habitat restoration, enhancement or preservation should be considered as mitigation options. The federal Council of Environmental Quality defined "mitigation" (40 CFR 1508.20) as a sequence of steps to include: avoiding impacts, minimizing impacts, rectifying impacts over time, and compensating for impacts. EPA's Section 404(b)(1) guidelines present the overall framework used to evaluate proposals for COE wetland dredge and fill permits. Under these guidelines (clarified in a 1990 Memorandum of Agreement between EPA and the COE), an applicant's promise of compensatory mitigation cannot make a project with *avoidable* wetland impacts acceptable because it represents a less environmentally damaging alternative than the same project without compensation. Rather, once a determination has been made that potential impacts have been *avoided* to the maximum extent practicable (considering all alternatives), steps may then be taken to reduce the remaining unavoidable impacts to the extent appropriate and practicable. Such steps would include requiring measures to minimize impacts (e.g., best management practices) and, finally, to compensate for unavoidable losses of aquatic resource values (Kruczynski 1994).

Many state regulatory programs have elaborated on this basic framework, avowing that compensatory mitigation is not even to be considered unless certain conditions are met. For example, in North Carolina[1] a permit applicant for activities in tidal wetlands must demonstrate that:

1. There is no reasonable or prudent alternative design or location for the project that would avoid the losses to be mitigated;
2. The project is dependent upon being located within or in close proximity to public trust waters and coastal wetlands;
3. Benefits to the public interest will clearly outweigh the long range adverse effects to the environment. A private or commercial project may qualify if the applicant can show that it provides a clear benefit (i.e., necessary community service, essential economic development) to the state or region in which it is located; and
4. All reasonable means and measures to lessen the impacts of the project have been incorporated within the project design.

After avoidance and minimization have been exhausted, further options in the mitigation sequence can be used to compensate for any remaining impacts. The COE recognizes all of the following as compensatory mitigation options: restoration, creation, enhancement, preservation, and banking (Kruczynski 1994). States and local governments may delineate more specific directions or preferences among these options in their policies.

[1] 15 N.C. Administrative Code #07M.0702, as sited in Kusler et al. (1994).

Whether restoration or enhancement is to be in-kind or out-of-kind, on-site or off-site

As a matter of unwritten policy or explicit regulations, permit reviews in most states favor in-kind and on-site restoration. This preference stems from the goal of maintaining or replacing the ecological functions provided by the destroyed wetlands which may include wildlife habitat, water quality, flood storage, and water quantity functions. Off-site and out-of-kind mitigation approaches have been challenged because the benefits obtained do not necessarily counter the functions lost. The early years of compensatory mitigation displayed many such instances of "trading apples for oranges." Permit applicants often favor off-site mitigation where it is less expensive and time-consuming, although it may not adequately compensate for on-site losses of wetland function. As an example of out-of-kind/off-site mitigation, a permit applicant might propose to compensate for fill encroaching in an intertidal marsh by excavating freshwater ponds for waterfowl in an upland area. These simple "duck ponds," however, are a much less complex habitat type (and therefore easier to reproduce) than the habitat being destroyed, often resulting in a significant loss of net wetland function and value in that area.

The preference for on-site, in-kind compensatory mitigation is an attempt to avoid inappropriate tradeoffs of important habitat functions, but if rigidly applied, it may not lead to the most ecologically beneficial decision. For example, in some instances insisting on compensatory mitigation within the defined development area may result in a restoration project of decreased area, quality, or probability of success than another option at a nearby off-site location. Strict application of the on-site, in-kind standard could also bypass local opportunities for creative restoration or enhancement solutions, and may not reflect the habitat needs or limitations of the area (as could be determined in a local analysis or planning document—see Section B below).

Some state regulations incorporate options for mitigation within a slightly broader area. For example, New Jersey regulations[2] for the freshwater wetland program provide, in part:

> Location of Mitigation Sites
> (a) All mitigation projects shall be carried out on-site to the maximum extent practicable.
> (b) If on-site mitigation is found to be impracticable, the mitigation shall be carried out within the same watershed (subwatershed if possible) and as close to the disturbed wetland as possible.

The importance of maintaining a whole watershed view when regulating or managing aquatic habitat resources (rather than focussing on only one land parcel at a time) has been increasingly espoused by state and federal agencies in Alaska as elsewhere. This watershed perspective must also be integral to written mitigation guidelines, so that future mitigation efforts will be directed toward resolving the true source of any ecosystem problem, not just the symptoms. For instance, it would not make sense to approve a mitigation plan to remove excessive sedimentation downstream unless the mitigation/restoration opportunities upstream (at the source of the erosion problem) had not already received scrutiny, even if those opportunities fell on

[2] New Jersey Regulations 7:7 - 13.3, sited in Kusler et al. (1994)

public land or another owner's property. As another example, it would not be prudent to include innovative fish habitat features for a mitigation site unless an existing blockage to fish passage downstream in the watershed were not first corrected. Trouble spots in the watershed should be the first place to look when devising mitigation options for the area.

In summary, the replacement of the same type and functions of the aquatic habitat parcel being lost to development is of course the goal of compensatory mitigation; however, strict application of the on-site, in-kind preference has at times been known to result in small, isolated compensatory mitigation projects of low habitat value, which may not be the best use of the mitigation funds and efforts. When other guidance is available for a given area (e.g., an assessment of the region's aquatic habitat resources, goals, and prime restoration opportunities such as would be found in a local wetlands management plan), the same mitigation dollars could be better directed than if determined solely on the basis of an individual permit review process.

<u>Mitigation Ratios</u>

Mitigation ratios specify the amount of habitat area to be restored or enhanced for every acre of aquatic habitat destroyed. Many states or local governments have developed mitigation ratios which vary according to such factors as the type of habitat to be lost, the potential risk of failure of the mitigation project, the timing of mitigation efforts (whether the replacement area is created before or after the filling activity), and on-site versus off-site locations. Examples of mitigation ratios adopted in administrative regulations, statutes, or less formal policies include: Alabama (1.5 unit area replaced for every 1.0 unit area lost if replaced within the same watershed; a 2:1 ratio if outside the same watershed); Kentucky (2:1); Maine (1:1); and New Jersey (up to 7:1 for certain habitat types) (Kusler et al. 1994).

<u>Overall suitability of the mitigation proposal</u>

Many state regulations include a broad range of criteria to be considered when determining the acceptability of a mitigation proposal, such as (from Kusler et al. 1994):

- The size of the mitigation project
- Location of the mitigation site in relation to the proposed development
- Suitability of the monitoring program (e.g., ensuring an 85% survival rate of vegetation plantings for three years)
- Success of similar mitigation projects within the area
- Hydrology and proposed elevations; and
- Other criteria specific to the selected mitigation site.

<u>Oregon Draft Compensatory Wetland Mitigation Policies</u>

One manner of translating the above concerns into policy at the state-wide level is illustrated in the administrative rules that the State of Oregon is drafting for freshwater wetland compensatory mitigation (included as Appendix D). These regulations are being promulgated under a state law [ORS 196.800(10)], which sets forth one version of the standard mitigation sequence for reducing adverse impacts to wetlands or waterways (beginning with avoidance). The current rulemaking addresses the last element of the mitigation sequence—compensating for permitted wetland impacts through wetland restoration, enhancement, and/or creation. These rules currently encompass: relevant definitions; on-site vs. off-site priorities; intergovernmental coordination; compensatory mitigation ratios; protection or payment as means of compensation; minor projects; required elements of a mitigation plan; monitoring requirements; enforcement mechanisms; and application and review procedures.

Since the Oregon policies have not yet been finalized or enacted, there is no way to know what problems may arise with implementation. Nevertheless, the draft regulations represent current trends in compensatory mitigation policies, and offer a great deal of specific material for our consideration in Alaska. Please keep in mind when reviewing these policies that no explicit state regulatory statutes currently exist in Alaska (such as the Oregon law on which these wetland mitigation rules were based), and also that their proper implementation will demand a great deal of time and commitment from state agency staff. However, these efforts may pay off in sizable benefits, such as clarifying mitigation procedures and policies as applied to both large and small projects, and directing compensatory mitigation efforts toward activities that make good ecological sense (that is, those which have high potential for success and correspond with regional goals).

B. APPLICATIONS TO COASTAL DISTRICT POLICIES

Absent such specific regulations at the state-wide level in Alaska, many of the concepts discussed above could also be addressed at the local level through the policies of coastal management plans. The ACMP directs individual coastal districts around the state to develop a set of "enforceable policies." Alaskan coastal districts take the form of coastal cities, boroughs (similar to counties in the contiguous 48 states), or designations known as Coastal Resource Service Areas (CRSAs) in the absence of other recognized local jurisdictions. The district's enforceable policies are delineated in the district's coastal management plan. These policies specify the land and water uses and activities that are subject to the district program, and the process which will be used to determine whether specific proposed activities will be approved within the district boundary. District enforceable policies provide direction for such matters as: protecting coastal habitats; preserving air, land and water quality; prioritizing uses within the waterfront area; maintaining recreational and subsistence uses; avoiding development in geophysical hazard areas; identifying areas preferred for gravel mining or energy facilities, etc. Once a coastal district plan containing these policies is approved through the state ACMP process, the enforceable policies take on the authority of state law for areas within the district boundary. State agencies and coastal districts then evaluate proposals for land or water use against these mandatory rules, to determine whether the specified use is consistent with the goals and policies of the district and the state-wide coastal management program. If found inconsistent, the proposal will not receive coastal consistency approval, which is required before any state or federal permits may be issued.

Examples of existing Alaskan coastal district policies relating to aquatic habitat restoration and enhancement range from the generalized mitigation sequence, to highly specific policies tailored to a local region.

1. Standard Mitigation Sequencing Policy in Many District Plans

At present, approximately half of the coastal districts in Alaska have a mitigation sequencing policy within their approved coastal management plans. The sequence is modeled after that established by the Council on Environmental Quality for implementation of the National Environmental Policy Act (40 CFR §1508.20, see page 3-2). Districts should not only consider adopting a generic mitigation sequencing policy, but should also explore ways to tailor the mitigation policy to their particular priorities and concerns (outlined later in this chapter). The general mitigation sequence policy (for example, the second half of the policy cited below) may also be suitable for adoption as a state-wide ACMP standard.

The following example of a general mitigation sequencing policy is excerpted from the Aleutians East Borough Coastal Management Plan (Jon Isaacs & Assoc. et al. 1993):

> <u>Mitigation</u>
>
> All land and water use activities shall be conducted with appropriate planning, implementation, and monitoring/enforcement to mitigate potentially adverse

effects and/or cumulative impacts on the following resources of local, state, or national importance:

a) fish and wildlife populations and their habitats;
b) commercial fishing uses and activities;
c) subsistence and personal use resources and activities;
d) air and water quality;
e) cultural resources; and
f) recreational resources.

The cost of mitigation relative to the benefit to the coastal resource will be considered in the implementation of this policy. Mitigation shall include and be considered in the following order of preference:

a) avoid the loss altogether by not taking a certain action or parts of an action;
b) when the loss cannot be avoided, minimize the loss by limiting the degree or magnitude of the action and its implementation;
c) when the loss of resources and/or associated activities of local, state, or national importance cannot be minimized, restore or rehabilitate the resource to its pre-disturbance condition, to the extent feasible and prudent; and
d) where the loss of important habitat or activities of local, state, or national importance is substantial and irreversible and cannot be avoided, minimized or rectified, compensate for the loss by replacing, enhancing, or providing substitute resources or environments. Compensation may be in-kind or out-of-kind, and off-site or on-site. The preferred option is in-kind and on-site, to the extent feasible and prudent.

2. District-Specific Management of Aquatic Habitat Resources

Coastal district planning under the ACMP offers one avenue to institute direction for restoration and enhancement activities at the local level. Local planning initiatives also offer an advantage over state or federal regulations in that they provide the opportunity to develop guidance specific to the needs and resources of the local area. However, the development of detailed local plans requires considerable homework—a preliminary process of resource assessment and goal setting.

Many permit decisions are made without complete knowledge of the ecological system where the proposed activity will occur. This lack of first-hand knowledge is particularly pronounced in Alaska where permit reviewers are usually based in the urban centers (Juneau, Anchorage, or Fairbanks), often a great distance from proposed development sites. Ideally, regional management plans could provide a framework for making informed decisions regarding permits requirements and restoration or enhancement proposals. These plans could outline which factors are limiting the function of different habitat types in a given region, the steps necessary to restore or enhance those functions, and which habitat types are rarest or have experienced the most loss over time (Kruczynski 1994). In areas where such management plans are in place, permit decisions could support the stated goals for that watershed or region. For example, if cumulative losses of salmon spawning areas are limiting the function and productivity of a watershed, any additional loss of known spawning areas may be unacceptable. Mitigation requirements for permits could promote restoring or creating spawning areas in order to compensate for lost parcels of less critical components of the ecosystem (i.e., out-of-kind and off-site compensation). Absent explicit knowledge of the area and established goals for a watershed or region, permit regulators are apt to apply a more rigid preference for on-site, in-kind mitigation. However, strict adherence to any mitigation policy that does not consider local conditions, goals, and opportunities is not likely to result in the most ecologically beneficial restoration or enhancement project.

A variety of names have been given to special planning efforts designed to resolve development and protection conflicts in communities with significant wetland areas. In Alaska, the examples to date have been termed "Wetlands Management Plans." The COE's version of this type of planning is called "Special Area Management Plans" (SAMP), while others have been called "Wetland Conservation Plans" or "Comprehensive Wetland Management Plans." The ACMP allows for a similar type of detailed planning called "Areas Meriting Special Attention" (AMSA) plans. Regardless of title, any of these planning processes provide models applicable to studying a specific area or issue in more detail, such as to improve the management, protection, and restoration/enhancement of local aquatic habitat resources.

A wetlands management plan or SAMP is a comprehensive plan providing for a balance between economic growth and natural resource protection in a specific geographic area. The benefits of such a regional plan are numerous. Well-prepared plans can potentially: 1) increase consistency among permitting agencies; 2) streamline the permitting process (e.g., if a "general permit" or "letter of permission" is approved by the COE); 3) better protect local fish and wildlife resources and related industries; 4) provide greater certainty to landowners and developers (by identifying which areas will be protected and where development will be allowed); 5) contribute to improved flood control and water quality for local communities; and 6) facilitate analysis of both the individual and cumulative impacts of proposed development projects (e.g., fills) in the context of broad ecosystem needs.

Planning processes encompass the identification, study and evaluation of aquatic habitat values in light of community development needs and interests. The general steps outlined in the development of a wetlands-related SAMP are:

1) Assessing the aquatic habitat resources in the region or specified area (could be a watershed, coastal district, borough, etc.). This step usually includes mapping the region's existing resources and assessing their relative functions and values.
2) Establishing the goals and priority uses for the regional resources (i.e., the heart of the "management plan")
3) Developing policies and implementation mechanisms based on those plan components. (In the context of a wetlands management plan, these might cover required buffers, implementation responsibilities, and mitigation-related policies).

It is only after the initial steps of assessing the resource base and developing the management goals are accomplished that locally-specific enforceable policies can be formulated. These plans are best developed through a public involvement process in conjunction with a technical advisory committee of federal and state agency representatives. Additional information on developing a regional wetlands management plan and specific examples are included in Appendix E.

In Alaska, the coastal districts of Anchorage and Juneau have undertaken this type of special issue planning process, which resulted in the Anchorage Wetland Management Plan and Juneau Wetlands Management Plan. The policies of these plans are enforceable—they exert the force of state regulation—once approved under the ACMP as part of the local coastal district program. Anchorage and Juneau first examined the aquatic habitat resources in the given area and developed priorities and policies to steer the preservation and management of aquatic habitats (including restoration and mitigation policies) within their district.

3. Possible District Policies Regarding Aquatic Habitat Restoration and Enhancement

Once the assessment and management plan goals have been established for a given area, specific policies concerning mitigation and aquatic habitat restoration and enhancement may be considered.

For this grant project report, ADF&G endeavored to develop a list of pre-approved projects at the state-wide level (called "B-List" projects[3]), along with general guidance and "model policies" to assist individual coastal districts. We found, as have others, that it is not realistic to provide specific "how-to" technical criteria or standard conditions for restoration or enhancement projects in a planning document. Little is known about restoration science as a whole, and the appropriate conditions for each project are distinctly site-specific. For these reasons, "cook book" approaches to aquatic habitat restoration and enhancement projects—such as envisioned for a B-list project—are not likely to yield consistently favorable results (Kusler and Kentula 1989). Therefore, we did not pursue the designation of aquatic habitat restoration or enhancement project types on the state's B-list (with prescribed sets of standard conditions) at this time. However, as an alternative to "cook book" prescriptions of rigid design criteria, districts or agencies may develop requirements promoting conditions conducive to success. Requirements that incorporate good <u>general guidelines</u>, combined with <u>incentives for completion of the mitigation project</u> and enough <u>flexibility</u> to allow for experimentation, offer an increased probability of success and will <u>contribute to the information base</u> for designing future projects.

The following approaches, summarized from wetland management recommendations in other publications (primarily Kusler and Kentula 1989), are aimed at achieving the goals underlined in the paragraph above. Districts should consider similar treatment of these topics within their enforceable policies. Although a few of policies related to restoration could be included directly

[3] The ACMP consistency review procedures include a sliding scale for the level of agency review required based on the degree of potential impact on coastal resources (and the ability to mitigate these impacts with standard conditions). Within this classification scale, the "B-List" contains "cook book" type projects that can be categorically approved with standard conditions. If a proposed project meets the criteria of the B-listed activity, no further review under the ACMP is required.

in the district-wide coastal management plans (e.g., the general mitigation sequence policy mentioned in Section B-1 above), others would benefit from a more specialized local planning process (described in Section B-2) to better direct the management and restoration of aquatic habitat areas within the district. These specific policies may more appropriately be expounded in a special management plan document (such as the Juneau Wetlands Management Plan). The wording of the policies below may be further tailored to match a specific district's concerns and resource priorities, as identified in its special management plan.

1. **Due to relatively low restoration and enhancement project success, clearly emphasize the direction of permitting practices toward <u>avoiding wetlands</u> and <u>minimizing the effects</u> of permitted activities on wetlands.**

   Repeat this phraseology throughout the policy language of the special wetlands management plan, not just in the general mitigation sequencing policy at the level of the district-wide coastal management plan.

2. **Propose a district-tailored policy reflecting priorities for aquatic habitat restoration and enhancement projects.**

   When the opportunities for avoidance and minimization are exhausted and other mitigation measures are deemed appropriate, districts could provide priorities for preservation and restoration/enhancement mitigation actions for their district and, where possible, within specific watersheds. Coastal districts would have to establish such priorities through a public planning process, which could provide the foundation for policy development.

   As an example of a compensatory mitigation policy delineating priorities, the Florida Department of Environmental Regulation developed a sequencing scheme for mitigation projects based on: 1) the aquatic habitat issues of highest priority in their area (primarily the diking and filling of extensive wetland areas and the subsequent interruption of state-wide hydrological regimes), and 2) the relative success rates of different mitigation activities. Florida's priorities for mitigation proposals are (from Redmond 1992):

   A) Enhance degraded wetlands and/or restore historical wetlands

   B) Preserve existing wetlands in conjunction with other forms of mitigation

   C) (Last Resort) Create new wetland areas. The creation of wetlands should accepted only if a review of the proposal indicates that it include features that ensure its success. Because fluctuations in the water table at freshwater sites are more difficult to predict than in tidal areas, the creation of freshwater wetlands as mitigation should only be authorized when the applicant has substantiated the future range of the water table elevation at the creation site. Because of its importance to the vegetation, the soil substrate must also be considered carefully. A favorable location would be one that is in closer proximity to natural, contiguous wetlands.

D) If the proposed restoration or enhancement project does not provide reasonable assurance that the wetland losses can be offset, it should be denied.

For Alaskan coastal districts to develop a similar sequencing scheme that is truly useful, they would first need to examine the same underlying issues, that is: 1) determine their primary development concerns and aquatic habitat mitigation/preservation priorities (in Alaska, these priorities more often center on riverine and riparian zones than on the broad "wetlands" referenced in the above example); and 2) consider the relative success rates of different types of restoration and enhancement activities. The latter is important in order to steer mitigation proposals towards those activities that are most likely to deliver a "good return on the investment." As a starting point, Chapter 2 contains a summary of such findings based on the Alaskan case histories. Continued consultation with locally experienced biologists, hydrologists, agency staff, and engineers is also advised to determine the "best bet" opportunities within a specific district or watershed.

3. **Require clear, site-specific goals and objectives to be established for each project.**

For example, the restored area size and functions, type and density of vegetation, target fauna species, and intended management activities should be clearly stated. This requirement could be specified in the district's special management plan.

4. **Require in advance a relatively detailed plan concerning all phases of a the project.**

Suggested requirements are listed in the "Checklist of Minimum Plan Components for an Aquatic Habitat Mitigation Proposal," page 3-14. These requirements could be adopted in the special management plan.

5. **Establish a standard protocol for the development, approval, and implementation of a project plan, in order to obtain optimal results.**

This would include contacting all relevant parties early in negotiations, supervising installation, etc. The suggested protocol is outlined in the "Checklist of a Model Process to Ensure a Sound Aquatic Habitat Mitigation Project," page 3-16. A more specific version could be adopted in each district's special management plan.

6. **To minimize the number of compliance problems, districts and agencies should consider incorporating the following measures into any mitigation approvals** (to be adopted and specified in the special management plan):

- *Require that the mitigation is accomplished <u>prior to or concurrent with</u> the permitted activity.*

  Experience has shown that the mitigation responsibilities are otherwise neglected for years and/or may never reach compliance with the approved permit.

- *Require the posting of performance bonds to guarantee that the restoration or enhancement project will be satisfactorily completed.*

  If a bond posting program is adopted under local or state authorities, the system must be constructed such that evidence of having posting the bond must be required before the permits are released. Releasing a permit to the developer which lists a performance bond as a permit stipulation has not proven to be sufficient to see that the bond is actually posted. These compliance incentives must be satisfied before the permit is released to avoid lengthy enforcement battles.

- *Require pre-construction meetings with the contractors or equipment operators, and on-site supervision during project installation.*

- *Require that the mitigation project site be protected in perpetuity.*

  For example, establish a conservation easement or deed restriction so the mitigation site is not subsequently proposed for fill. Appendix F contains example wording of such deed restrictions.

- *Require the timely submittal of as-built plans to all the relevant parties.*

  All agencies consulted in planning and implementing the project should be notified that the project was completed and its final form. This measure ensures that every practical experience will add to the knowledge base of restoration and enhancement techniques in Alaska. In addition, an as-built plan submitted for one of the case study sites included a two-page "Operations and Maintenance Guide," which did an excellent job of detailing what to monitor, anticipating the types of problems that might arise (with the water control structures, etc.), and recommended what remedial actions would be appropriate (See Appendix C). This type of thought process should be required for final submission of all paperwork on a mitigation project. Permitting agencies often receive little or no documentation of required mitigation projects.

Further information on the above options are contained in Chapter 5.

7. **The inherent risks and probability of success for restoring or creating particular types and functions of aquatic habitat should be reflected in the standards and criteria for projects and project design.**

The stringency of design requirements should reflect the risks, such as greater replacement area ratios (1.5:1, 2:1) for filling more complex or valuable wetland types, as well as more demanding standards for mid-course corrections. These criteria would be established in the special management plan.

8. **Other policies in the special management plan should further delineate the responsibilities for implementing this plan.**

The following pages display two checklists that ADF&G developed to address some of these concerns (particularly numbers 4 and 5 above). "Checklist A" (pages 3-14 and 3-15) lists the suggested minimum plan components for an aquatic habitat mitigation proposal. "Checklist B" (pages 3-16 and 3-17) outlines a model process for developing and implementing a sound aquatic habitat mitigation project.

CHECKLIST A

MINIMUM PLAN COMPONENTS FOR AN AQUATIC HABITAT MITIGATION PROPOSAL

Many of the common problems of aquatic habitat restoration and enhancement projects could be avoided with a well-thought out plan. A relatively detailed plan concerning all phases of a mitigation project should be presented for approval in advance. The plan should include the following, at a minimum, and other information depending on the type of project and goals:

____ **Clear, site-specific project goals and objectives (e.g., stating the restored area size and functions, type and density of vegetation, target fauna species, intended management activities, etc.)**

____ **Boundary delineations of the resulting aquatic habitat area**

____ **Proposed elevations across the project area**

____ **Water sources and connections to existing wetlands, water bodies and uplands**

____ **Relevant hydrologic factors such as: water depths (maxima, minima, norms), velocity, hydroperiod, salinity, amount of bedload movement, levels of nutrients or toxics in the water, etc.**

____ **Proposed soil and substrate conditions (including proposals to alter those conditions when necessary in order to create a suitable substrate for that habitat type, such as by stockpiling and replacing the original topsoil layer, adding new topsoil or organic matter, or by reducing compaction)**

____ **Probable sedimentation characteristics of the project and vicinity**

____ **Best management practices, such as utilization of adequate erosion control measures and minimizing compaction of the project area soils**

____ **Proposed plant materials**

____ **The methods and time for plantings**

CHECKLIST A, Page 2

____ **Evaluation of need for buffers, barriers, or other protective measures (to minimize or eliminate human impact during plant establishment)**

____ **A monitoring program, which will detect the need for any mid-course corrections**

____ **Identification of possible problems and the appropriate mid-course corrections, and any other project management capability**

____ **Measures for determining success, and provisions for a follow-up evaluation based on the identified project objectives**

CHECKLIST B

MODEL PROCESS TO ENSURE A SOUND AQUATIC HABITAT MITIGATION PROJECT

Problems with communication, implementation and follow-through result in many mitigation projects not living up to their potential. Although the specifics of every project will be different (depending on intent and location), the proper procedures to go through to ensure good projects can be delineated. Following these procedures should optimize the results of a given mitigation project, and make sure that the knowledge obtained from each trial is added to scientific information base. Other useful recommendations are found in Kunz et al. 1988, Hruby and Brower 1994, and others listed in Appendix B.

A. CHECKLIST FOR THE MITIGATION PERMIT APPLICANT

____ **Discuss mitigation plans with all appropriate agencies and groups in the early stages of the process. Coordinate with state and federal agencies and local coastal district representatives. Make sure these individuals have the opportunity to review the same proposal at the same time.**

____ **The potential for long-term success increases greatly if people with different expertise are involved in the design and planning of the project (e.g., a hydrologist, engineer, fish biologist, etc.). Although initially time consuming, a multidisciplinary, flexible approach is most likely to yield the best and most long-lived solutions.**

____ **In a developed area, obtaining the support of the neighboring community is essential to project success (to allow vegetation to establish, cut down on vandalism, etc.).**

____ **Hold pre-construction meetings with the contractor and equipment operators to clearly establish the intent and purpose of the different construction measures and permit stipulations.**

____ **Ensure that all phases of project installation are supervised by someone familiar with the purpose and elements of project design.**

____ **If an "environmental commitment checklist" was established for the project[4], make sure that all items have been satisfactorily completed.**

[4] Discussed in Chapter 4, page 4-7.

____ After project installation is complete, file completion reports to all agencies involved in negotiations. Include an "Operations and Maintenance Guide" section which outlines what could go wrong with the project and what mid-course corrections would be appropriate.

____ After ___ years, evaluate project performance based on its stated objectives. Distribute this evaluation to all agencies and representatives involved in the plan negotiations, so that agency staff and other professionals may ascertain which measures to recommend in the future.

B. CHECKLIST FOR THE AGENCIES AND LOCAL DISTRICT STAFF

____ Assist in the development of mitigation plans, keeping in mind any mitigation priorities that may have been established for that coastal district. If the coastal district has established a list of mitigation ideas exists for that area, evaluate whether they are applicable to the immediate permit situation. Coordinate with all appropriate regulatory agencies and groups in the early stages of the negotiation process.

____ Keep all information, requirements and monitoring results pertaining to mitigation projects in at least one comprehensive filing system (such as within the Borough offices).

____ Attach a thoroughly complete mitigation plan to the development permit (e.g., the §404 permit). Reference the mitigation plan in the permit in such a way that the permit is revokable if the terms and conditions of the mitigation plan are not met.

____ Establish a structured review program which assigns responsibilities for inspecting completed mitigation sites, evaluates success, and reports to the agency responsible for enforcing the mitigation agreement.

____ Inspect and/or monitor the project to determine whether it was completed according to plan and whether all stipulations were met.

____ Once the evaluation of project performance vs. objectives is completed, assess which measures should be recommended in future projects, and which should be adjusted.

C. EXAMPLES FROM THE CITY AND BOROUGH OF JUNEAU PLANS

The following pages present existing enforceable policies within the ACMP-approved coastal district plan and wetlands management plan of the City and Borough of Juneau. Juneau is one example of an Alaskan coastal district which developed mitigation requirements beyond the general mitigation sequence. This specificity was possible because they first inventoried the aquatic habitat resources within their district and established preservation and restoration priorities. These provided a framework to devise specific mitigation policies for various impacts to aquatic habitats within their district, comprising the Juneau Wetlands Management Plan. The management plan clearly specifies what the mitigation requirements will be for impacts to a given type of aquatic habitat. Although in Juneau's case this was a long and costly planning exercise, tips to assist other coastal districts in accomplishing some meaningful mitigation planning with more limited time and funding will be discussed further in Section D of this chapter.

The following policies, excerpted from the Juneau Coastal Management Plan (CBJ 1986) and the Juneau Wetlands Management Plan (CBJ 1991), are presented here as examples of the framework which may achieve district-specified mitigation goals. As of the date of this report, Juneau is just beginning to implement the policies of its wetlands management plan (which was fully incorporated into the ACMP in November 1993) and has not yet established the wetlands mitigation bank referenced in the following policies.

JUNEAU COASTAL MANAGEMENT PLAN:

<u>49.70.950</u> <u>Habitat</u>

e) Each development which adjoins a river or stream which has been degraded by previous human activity shall, as part of its development plan, include provisions for rehabilitation of the stream or river, and shall be approved by the Alaska Department of Fish and Game. Such provisions shall be limited to removal of debris, removal of abandoned machinery and vehicles, grading and stabilization of banks and related clean up activities, and shall include preservation or restoration of riparian vegetation. Restoration shall not be required beyond that needed to return the area to natural appearance and function. Provided, the following are exceptions to this policy:

1) Construction of one single-family or duplex dwelling on a lot of record;

2) Construction of single-family or duplex dwellings on lots created by subdivisions of four or fewer lots.

Wetland Management Designations and Rules

7) 'A, B, C, D' and 'EP' wetlands will be managed according to the management guidelines described below:

   A) 'A' wetlands might be developed only is there is no net loss of individual functional values in the wetland unit. One environmental function could not be substituted for another.

   B) 'B' wetlands might be developed only if there is no net loss of aggregate functional values in the wetland unit. One environmental function could be substituted for another. However, to the extent feasible and prudent, individual environmental functions that are rated high or medium high in Appendix F[5] will be retained within the wetland unit.

   C) 'C' wetlands might be developed if there is no net loss of aggregate functional values in the roaded area. To the extent feasible and prudent, individual environmental functions that are rated high or medium high in Appendix F will be retained either within or outside the wetland unit.

   D) 'D' wetlands can be developed using best management practices. Project design and scheduling must minimize adverse impacts.

   E) Dedicated land refers to land that has special land use restrictions in addition to wetlands restrictions. They include city and state parks, state land, municipal rural reserves, Tongass National Forest, etc. These lands are not generally available for development because of public ownership and associated restrictions. They have not been evaluated by the plan because their management is already determined. The Mendenhall Wildlife Refuge and all estuaries are in this category. Dedicated land is not available for general development.

   F) Enhancement potential ('EP') wetlands are wetlands that have the highest potential for environmental enhancement. These are, in large part, wetlands that have been created or degraded by development. Enhancement could be only required if the wetland is publicly owned. Publicly owned 'EP' wetlands can only be used for enhancement projects.

[5] Appendix F, as quoted on this page and the next, refers to an appendix in the Juneau Wetlands Management Plan, not part of the present document.

Mitigation

11) For each wetland unit, individual functions which have potential for high values as presented in Appendix F will be considered during review of a project. Any new information regarding the value of individual wetland functions will be evaluated and considered during the review of a project. Individual wetland functions may either be demonstrated to be less, or more, important than the data in Appendix F indicate. As wetlands are developed, some functions may become scarce, increase in value, and require special consideration during a project review.

12) The following mitigation policies will apply to a development proposal that would be located in category 'A' or 'B' wetlands and that requires municipal, state, or federal permits.

    A) Avoid damage to the functional values by avoiding or relocating the development proposal.

    B) Where loss or damage to the functional values cannot be avoided, minimize loss or damage by limiting the degree or magnitude of the development and the actions associated with conducting the development.

    C) Where the loss of functional values cannot be minimized, restore or rehabilitate the wetland to its pre-disturbance condition, to the extent feasible and prudent.

    D) Where the loss of functional values at the development site is substantial and irreversible and cannot be avoided, minimized, or rectified, compensate for the loss as follows:

        (i) For 'A' wetlands, the compensation actions must be in-kind and must be on-site, located as close as possible to the development site(s).
        (ii) For 'B' wetlands, the compensation actions may be in-kind or out-of-kind, provided the net aggregate values of the wetland unit are maintained. Compensation actions must occur on-site, located as close as possible to the development site(s).

13) The following mitigation policies will apply to a development proposal that would be located in category 'C' or 'D' wetlands and that requires municipal, state, or federal permits:

    1) Based on the extensive analysis of land use alternatives conducted in the land use inventory for the JWMP, the CBJ will presume that there is no practicable alternative for developments proposed on category 'C' and 'D' wetlands. This presumption is rebuttable for individual projects, which means that the Wetlands Review Board can still conclude that there is a

practicable alternative based on its review of project-specific evidence during the permit review process.

2) Where the development proposal is otherwise lawful and entitled to a wetlands development permit, minimize the loss of functional values by limiting the degree or magnitude of the development and the actions associated with conducting the development.

3) Where the wetland loss cannot be reduced by minimizing the development, mitigate by restoring or rehabilitating the wetland to its pre-disturbance condition, to the extent feasible and prudent.

4) Where the loss cannot be reduced by minimization and restoration/rehabilitation, mitigate by compensating for the loss as follows:

(i) For 'C' wetlands, the form of compensation required will be selected on the basis of: (1) probability of success, (2) potential gain in functional values, (3) extent to which high and medium high functional values are retained, and (4) cost effectiveness. In general, the order of preference for compensation is:

— on-site and in-kind;
— on-site and out-of-kind;
— off-site and in-kind; and
— off-site and out-of-kind

For small-scale developments (five acres or less), the CBJ mitigation bank may be used to meet this requirement.

(ii) For 'D' wetlands, off-site compensatory mitigation is not required provided the minimization and restoration steps above in 13(B) and (C) are followed and best management practices are employed.

14. Some wetland units may receive a category 'B' designation for a portion of the unit and a category 'C' for the rest of the unit. If on-site mitigation is required as compensation for development within the category 'B' area of the wetland unit under policy 12(D)(ii), the mitigation project should occur with the "b" wetland area unless: (1) a suitable site or mitigation opportunity is not available within the 'B' wetland area, or (2) the same or greater environmental benefit could be gained with less expenditure by conducting a mitigation project with the category 'C' wetland area.

15. A mitigation bank will be established to provide bank credit to satisfy compensation requirements for certain developments in category 'C' wetlands. The Mitigation Bank will operate under the following conditions:

A) Credits are not available to a permit applicant until the bank completes the wetlands protection, enhancement or creation project and the Wetlands Review Board, in consultation with the agency working group, certifies that the wetlands functions and values have been or will be established.

B) Mitigation bank credits cannot be used for any permit action where the wetlands area to be adversely affected by a dredge or fill activity exceeds five acres. This requirement prevents bank credits from being exhausted by a single large development.

C) A permit applicant will be required to perform mitigation through individual actions rather than through the bank for fill activities that exceed five acres. The bank is designed to facilitate mitigation for small-scale developments that might otherwise cause cumulative incremental damage to overall wetlands values.

D) To the extent feasible and prudent, projects using least damaging technologies will be given priority in using mitigation bank credits.

E) The calculation of cost charged to a project applicant for each mitigation bank credit will be based on all costs and expenses incurred or expected to be incurred by the bank in establishing and maintaining the bank. This includes, but is not limited to, applicable land costs and project monitoring.

F) The mitigation bank should focus on proven mitigation techniques. Restoration and enhancement is preferred over wetlands creation. Protection of existing wetlands (such as through public purchase) is the lowest priority for the bank and should only be considered when development and the loss of wetlands functions and their values are imminent.

G) To the extent feasible and prudent, mitigation shall occur in the same watershed as the development for which it is compensating.

D. INCREMENTAL STEPS FOR DISTRICTS TO PURSUE

Research and planning efforts such as those performed by the City and Borough of Juneau require a high commitment of time, labor, and resources, which may not be available to other Alaskan coastal districts. Nevertheless, the road to better-balanced decision-making involving a district's coastal habitat resources lies in the same basic steps of inventorying resources; identifying the aquatic habitat areas of highest value (in advance of specific development proposals) so as to protect those areas and steer development towards areas of lesser wetland impact; and developing management goals for the watersheds in question. Lacking a comprehensive special planning process (and substantial funding), there are still many general steps that a coastal district may take towards wise planning and management of their aquatic habitat resources. In summary, districts should explore methods to:

1) Adopt a mitigation sequencing policy, if they have not already done so.

2) Inventory the aquatic habitat resources within the district, identifying which high value areas are the most important to preserve "as-is." It also would be helpful to define how these areas directly benefit the district's residents, such as their function in flood attenuation, improving water quality (drinking water or stormwater), providing fish habitat to support the area's subsistence or commercial fishing activities, or even supporting the local economy by drawing visitors to waterbird staging areas.

3) Explore methods to put these protections in writing, either in enforceable policies in a district coastal management plan, or in a special management plan (by designating "preservation wetland areas" or "high-value wetland areas"), or possibly pursuing other protections such as a state-legislated critical habitat area for areas of regional significance.

4) Develop a list of restoration and enhancement opportunities, potential restoration projects, and/or lands prioritized for acquisition/preservation within the coastal district. This list would greatly assist the regulatory agencies whenever situations involving mitigation negotiations arise.

5) Consider establishing minimum requirements for restoration and enhancement projects (e.g., such as the checklists included in this chapter), safeguards or incentives for compliance with mitigation agreements, and expectations for project maintenance/monitoring. Lacking a special wetlands management plan, many of these individual policy components could be addressed in the enforceable policies of the regular district-wide coastal management plan.

Existing resources may help districts begin assimilating the information necessary to improve management of their coastal habitats and resources. Possible sources are recounted below.

Inventory/Analysis

For the initial task of inventorying aquatic habitat resources, mapped information on wetland types and locations currently exists for a large proportion of coastal areas at the Alaskan office of the National Wetland Inventory project (located within the regional FWS office in Anchorage). ADF&G is another established source of mapped habitat information. For example, one could locate known salmon spawning and rearing locations in the "Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes" and its associated atlases, which are updated annually. Atlases in the "Alaska Habitat Management Guide" series show the known ranges and use areas for many types of Alaskan wildlife resources. The distribution of shellfish and water-dependent birds in these guides often indicate important regions of aquatic habitat. ADF&G can also provide information on dozens of state-designated wildlife refuges and critical habitat areas which may occur within or near a coastal district's boundary. The large-scale "Area Plans" produced by the state DNR include the mapping and description of what they identify as "crucial habitat areas." Districts within or bordering U.S. Forest Service lands should consult that agency for information sources. Many other locally knowledgeable resource people (including long-term residents, amateur bird-watchers, fishermen, etc., in addition to biologists and hydrologists from various agencies) should also be consulted to identify noteworthy aquatic habitat resources within a coastal district.

Geographic Information Systems (GIS) provide one of the best ways to store and manage spatial information from disparate sources. A GIS database can help identify potential future conflicts between development activities and protected areas, and allows great opportunity to view and analyze the effects of different potential planning designations in the area (since maps do not have to be painstakingly re-drawn to illustrate new alternatives). However, this high technology approach requires considerable start-up expense, time, and staff expertise. For these reasons only the state and federal agencies and the most populated coastal districts currently have access to GIS tools as planning aids. Other districts might consider applying for funding through a variety of means (see below). However, the lack of GIS capability should not prevent local districts from assembling useful information on the district's aquatic habitat resources. Hand drawn maps or sketches also effectively convey useful information to the public and to regulatory personnel.

Identifying Potential Restoration Projects

To begin the task of identifying good potential restoration sites within the coastal district, districts might consider calling a meeting of biologists with local knowledge, e.g., staff from agencies such as NMFS, FWS, ADF&G, as well as local F&G advisory committees. Even local highway maintenance crews could be a good source—they would know where too much sediment or roadside gravel gets deposited into streams, and where bad or perched culverts exist. Long-term residents can often identify areas that previously supported more fish or birds than they do now—the problems in these areas could be analyzed for possible restoration efforts.

Biological consultants are often hired to assemble this type of information. In an early example in this state, the Municipality of Anchorage hired private consultants to map and identify potential mitigation sites in the 1980's (Resource Analysts et al. 1988; Resource Analysts et al.

1989). Instead of hiring a private consultant, the City and Borough of Juneau took the route of directly funding an ADF&G habitat biologist to identify potential restoration sites within their borough. Specific project possibilities were analyzed and recommended by watershed throughout the district (Schempf 1993). These recommendations will serve as the framework for Juneau's future mitigation bank. As part of the comprehensive planning for the Juneau Wetlands Management Plan, this task was funded by ACMP money provided to the borough. For those districts not undertaking such massive planning efforts, the importance of simpler means to assemble information relevant to future aquatic habitat restoration or enhancement should not be discounted. A simple list obtained through consultation with the various resource people mentioned above could go far to direct future restoration efforts towards those projects with the most potential. State and federal regulatory agencies in Alaska have stated that they would welcome knowledge of restoration or enhancement projects that have local support and good potential.

Funding

Local special management planning efforts (e.g., wetlands management plans) are usually financed through a combination of local, state, and federal funding. The Juneau plan drew upon local (i.e., city and borough government), state (ACMP funds), and federal funding (EPA funding for the wetlands assessment); the Anchorage plan was funded through local and ACMP funding. Both the Area Meriting Special Attention (AMSA) and Section 309 funding possibilities may be available for these efforts under the ACMP. In other examples outside the state, regional or local governments (or an assemblage) have procured EPA, COE, or other federal funding to conduct wetland inventories and special planning efforts (see materials in Appendix E). Several federal programs and private foundations that fund wetland research, planning, acquisition, restoration/enhancement or management are listed in another recent ADF&G technical report (Schempf 1993). In the absence of a large wetlands management planning effort, a simpler investigation to identify potential aquatic habitat restoration and enhancement sites within a district could be funded by ACMP monies directly. For example, a district could apply for a Section 309 enhancement grant solely for this purpose.

CHAPTER 4

Process-Related Issues

CHAPTER 4. PROCESS-RELATED ISSUES

During the formulation of our final recommendations and products, a series of workshops were held with coastal district and agency representatives to gain a better understanding of district and agency needs (workshop information listed in Appendix G). These workshops brought to light concerns related more to process than substance. A number or procedural problems currently hinder the development and effectiveness of restoration and enhancement projects serving as mitigation in Alaska. Coastal districts and agencies felt that technical guidance on restoration and enhancement techniques would be of limited value without concurrent efforts to resolve procedural problems. Consequently, this section was added to describe and discuss these procedural problems.

The majority of these procedural problems stem from the interaction of various levels of local and regulatory authorities in Alaska. As such, they may be beyond the scope of an individual coastal district to resolve. New plans and enforceable policies at the district level are therefore not likely to yield a comprehensive remedy. Instead, a joint agency/coastal district working group may be the most effective forum to confront these issues. The purpose of this chapter is to highlight such problems and identify possible directions to improve the present conflicts. The following recommendations were derived through consultation with agency and district personnel, as well as a few publications from other states.

The process-related issues raised by workshop participants fell into the following categories. These issues affect the development and implementation of aquatic habitat restoration and enhancement projects undertaken for mitigation purposes in Alaska.

Issue 1)	Interagency communication problems
Issue 2)	Mitigation compliance and state/coastal district authority
Issue 3)	Transferring more responsibility to the permit applicant
Issue 4)	Establishing mitigation standards that are fair to both big and small operators
Issue 5)	Need for completion and monitoring reports to develop the science

Each issue is described below by category.

Issue 1: Interagency Communication Problems

Problem: Coastal districts stated that local governments need to be "in the loop" earlier when developments are being negotiated that may involve mitigation. As it is now, the COE often discusses mitigation options with a permit applicant alone, perhaps long before the districts and other state agencies are notified. This does not allow districts or other sources of local knowledge to contribute mitigation ideas for their specific area.

Coastal districts and regulatory agencies concurred that their overall communication needs substantial improvement. Phone and fax communication, as it is currently used, is leaving some players out of the loop too long. A system is needed to ensure that all players will be notified of what is going on in a quick and efficient manner. Some sort of electronic mail system might fill this void for agency and district coordination.

Coordination of the review schedule is another significant procedural problem. Currently, federal agency staff are often required to submit comments on a project (in response to a COE public notice) before the state agencies and coastal districts ever receive the project information from the state's Division of Governmental Coordination (DGC). The district, state, and federal reviewers often end up looking at different versions of the same project (some original, some with updated changes), which is very confusing and ineffective. Remedies must be sought to allow district, state, and federal agency staff to meet and discuss the same project version at the same time.

Districts reported that these poorly coordinated negotiations can result in compensatory mitigation actions which are simply not good projects, i.e., those that do not appear to be a worthy investment of time or resources. Advanced planning of potential restoration efforts could improve those odds. One expert in land use law suggests that the agency staff ask themselves whether they would spend the mitigation dollars accordingly if they themselves had the authority to invest the same amount in order to improve aquatic habitat in the subject area. A "no" answer could flag a project that has been negotiated to the point of being unsound (Moss 1994).

In Alaska, distance from the proposed site can further exacerbate the problem. For instance, a compensatory mitigation idea which may make sense on a desk top (e.g., in Anchorage) may not appear worthwhile to those that know the area better (e.g., on Unalaska Island). In our project workshops, Alaskan coastal district staff provided a few recent examples of poor or ineffective projects, which they termed "silly mitigation," and several agency representatives concurred with their appraisal. These type of mitigation projects benefit no one—they waste the applicant's time and money, they do not account for the loss of public resources impacted by the development, and they lend a bad name to the concept of compensatory mitigation.

Agency and district staff also reported that they need better coordination when dealing with "after-the-fact" permit applications. These situations arise when fills have already occurred, though never authorized through the permit process. District and agency staff then need to collaborate to derive remedial compliance orders and permit stipulations.

Solution Ideas:

Ideally, the way to improve this situation would be to achieve a working two-way communication among local, state, and federal agencies.

- *Local Staff* (e.g., districts) need education defining what constitutes restoration and enhancement, what the possibilities are, and the known dangers of mitigation trade-offs. The products of this 309 grant—this report and the slide show (see Appendix A)—can begin to serve this need.

- *Agency Staff* (state and federal) need to be made aware of district priorities, mitigation opportunities within specific areas, and should accommodate district input earlier in the process. This district input could greatly assist agency reviewers in alerting them to the highest value resources in the community, and providing sound ideas for local mitigation projects.

More specifically, recommendations to improve district and agency communications include:

- Correlating agency and local district input on restoration and enhancement projects in the early negotiation stages (see above). This may involve changes in DGC procedures, development of an electronic mail system, etc. DGC and the federal agencies should work this out together. Also, the reasons underlying the non-synchronization of state and federal agency review schedules need to be re-examined in order to make the system work more efficiently.

- Specific efforts that local districts could make to lessen the chances of unsound or nonsensical mitigation proposals and assist the regulatory agency staff were discussed in Chapter 3, Part D. Briefly, these steps would include:
  - inventorying the aquatic habitat resources in their district, so restoration efforts may be geared accordingly;
  - developing a list of "canned ideas" of restoration and enhancement opportunities that make sense for their given area, which the permitters could then use as a source of ideas during permit (and mitigation) negotiations.

Issue 2: Mitigation Compliance and State/Coastal District Authority

Problem: Mitigation project success is grossly hampered by compliance problems. For example, in a Florida study (Redmond 1992), 94% of the projects reviewed were not in compliance with permit conditions (ranging from failure to submit reports, to major deviations from the permitted design). No restoration and enhance projects were attempted in 34% of the projects reviewed, and only partly constructed in 14% of the cases. Most permitted projects had one or more major deviations from the permitted plans (which in some instances may have improved the project design). The same situation exists in Alaska. For example, ADF&G reports that 90% of bank stabilization projects on the Kenai River are out of compliance (usually due to improper revegetation or immediate trampling damage) (McKay, 1993).

Solution Ideas: To address this problem, many planners nationwide have advocated the incorporation of compliance incentives into mitigation programs. These incentives may include: requiring that mitigation be accomplished before or concurrent with permitted activity, posting performance bonds, not granting any further permits to an applicant unless they are in compliance with all previous ones, etc. However, several Alaskan coastal districts were unsure about their authority to require these measures through an enforceable district policy. Perhaps these questions are appropriate to refer to a district/agency working group for resolution, which would be composed of state agency and coastal district representatives. Establishing district authority to incorporate such compliance measures might require a new state standard from the legislature.

Of the compliance measures under consideration, state agency representatives felt that it would be very difficult to consider the applicant's past record while evaluating a new permit application under the provisions of the ACMP. The ACMP directs them to examine each project based on its own merits. Moreover, the effectiveness of this technique is not guaranteed—an applicant could always hire a consultant and use their name to apply for the next permit.

Requiring the completion of the mitigation project before the permitted activity begins should be advocated whenever possible, but such a sequence is not always viable. Some types of restoration and enhancement projects take several years to implement (e.g., for example, when revegetating the following spring). Developers normally resist efforts to complete mitigation projects beforehand (although mitigation banking offers promise in facilitating this approach). Concurrent mitigation presents the next best (and often more feasible) option.

Of the compliance alternatives, agency representatives in Alaska were very favorable to the concept of performance bonds. These bonds would be posted before the permit was issued, and released when all permit stipulations and restoration and enhancement obligations were met. This system is very attractive from an enforcement perspective, because it places the incentive directly on the applicant to finish the mitigation actions in a timely manner, in order to retrieve the bond. The bond system promises to be much more effective at getting the job done than relying on the regulatory agencies to "police" every tardy applicant. The amount of the bond would have to be enough to make it a true incentive to perform their obligations, so that applicants would not look upon it as just "buying a permit," with no true intention of following through. Bond amounts can be determined either as a proportion of the total project budget, or it can be based on a "worst-case" estimate of how much money would be required to repair the site if the developer walked away before project completion. Bankruptcy and/or sale of property before completion are not uncommon.

Similar approaches have been made in the mining industry, where the federal Surface Mining Control and Reclamation Act (PL 95-87) requires the posting of a reclamation bond. This system has worked fairly well nationwide to meet the desired objectives, most often implemented for coal mine reclamation. However, the bond system has not substantially eased the load of the regulatory agencies involved. Agencies must still commit staff and funding to track and inspect the permitted actions, but there arises an additional level of paperwork for setting up and releasing the bonds. Performance bond systems are not easy to administer: the agency's authority to require bonds must be established; willing bonding companies must be available to participate in this type of program (none are presently in Alaska); the bond amount must be safeguarded to fulfill the mitigation agreement in the event of applicant bankruptcy (some state legislatures have acted to distinguish the status of these bonds from other company assets); and disagreements over return of the bond can become contentious (Dunaway 1994). Additionally, it must be recognized that the bond system tends to favor large companies over small operators, who have a harder time qualifying for bonds. In sum, the performance bond system may be more effective at ensuring compliance of the applicant with the terms of the mitigation agreement, but it still requires considerable administrative effort.

The approach taken with the improvements to the Juneau Airport (case study #23) offers another option to consider. In this case, the applicants established a dedicated "mitigation fund" at the outset of a permitted activities, containing the funds earmarked for the mitigation efforts. This approach may be more flexible and practical than the bonding system, especially at the local level, but still requires agency vigilance to see that all mitigation activities are carried out. Additional experimentation with this approach should further demonstrate its strengths and weaknesses.

The following recommendations targeting compliance were made at the conclusion of another state's review of their mitigation program (in this case, Florida). These recommendations (adapted from Redmond 1992) reveal how seriously compliance problems can compromise the effectiveness of any mitigation program. Although not intended to be direct recommendations for Alaska, these possibilities should receive full consideration by a district/agency working group.

- Clarify authority for the state to assess compliance fees when permits are issued, and administrative fines for noncompliance (funds collected to go to the compliance program to fund staff). These fees were justified by the fact that all these actions affect public resources, such as fish, wildlife and collective wetland functions. Also, provide additional state staff positions for permit compliance, enforcement, and mitigation work.

- Permits with mitigation requirements should clearly state the applicant's responsibility for long-term mitigation success. In the wake of the high levels of noncompliance found in the state's study, they intended to place a greater emphasis on the applicant's track record. They recommended that the state Department of Environmental Regulation should consistently consider the mitigation compliance record of the applicant's previous permits in determining whether to issue the permit. If the permittee is not in compliance with an existing mitigation permit, further permits should not be issued. The study recommended an addition to state law to clarify the authorization for this procedure.

- The study found that the state regulatory agency had put a strong emphasis on timely processing of permits, and significantly fewer resources into permit compliance. (The same is true of most permitting agencies). They demonstrated the need for a much stronger emphasis on permit compliance and enforcement in order to improve the overall success rate of wetland mitigation programs.

Clearly, establishing requirements without concomitant enforcement is not effective at protecting the public's resources (including aquatic habitat functions). The ability of authorities to "close the loop" and make mitigation programs work depends on adequate funding for monitoring and compliance. Various methods, such as the use of application fees, performance bonds, and fines for noncompliance need to be explored for potential application in Alaska. Selected improvements may require authorization by the state legislature.

For a mitigation program to work, both the incentives for applicant compliance and provisions for enforcement must be in place (i.e., the "carrot" and the "stick"). Besides performance bonds, tax incentives can also be used to "reward" individuals, in terms of property tax savings, for adequate protection of aquatic habitat values on their property. A program of this nature is currently being developed by the state and the Kenai Peninsula Borough for property owners along the Kenai River.[1] Although tax incentive programs reduce revenue to the governing body, they can be an efficient method of preserving the public's resources because 1) they often cost less than expensive enforcement programs, and 2) their costs pale in comparison to that resulting from the loss of the resources themselves (which in the case of the Kenai Peninsula would jeopardize the region's premier fishing and tourism industry).

Issue 3: Transferring More Responsibility to the Permit Applicant

Problem: Agency staff made the point that they cannot be expected to review, consult with, re-design, inspect, and follow-up on every project proposed. Avenues must be explored to transfer more of these responsibilities to the applicant in Alaska. If not, the agencies require budgetary support for additional staff devoted to such needs (design assistance, compliance) in some fashion other than the way the system is presently constructed.

Large project developers routinely hire consultants to prepare their permit applications before ever approaching the agencies for a permit. Consultants may anticipate the agencies' requirements and concerns, and guide complicated projects through the permitting process. Such investment by the applicant is driven by fear of delays in obtaining the permit if insufficient information is provided from the start.

In Alaska, the permit applicant is often an individual or small company who is less aware of the permitting process. Agency staff must often coax applicants to provide complete project information, consider alternatives, etc., all of which requires substantial staff time, and can be frustrating for the applicant as well due to time delays. Permitters may review the application, offer suggestions for project revisions that are more likely to be approved, and even make site visits with the applicant. Despite this assistance, if the applicant's proposal is not approved (due to inconsistency with regulations), some applicants still expect agency staff to prepare the project design in a way that it will be approved. Regulatory agency personnel are not intended, qualified or sufficiently staffed to serve as project designers or engineers.

Solution Ideas: It may be possible to streamline the amount of agency time involved in the preliminary stages of the project review and consideration of mitigation options.

New educational materials might help the applicant to understand the regulatory agencies' perspective when discussing mitigation projects. One agency person suggested developing a color brochure to explain the concept of accounting for and/or replacing those **public** resources

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[1] The Alaska State Legislature passed legislation during the 1994 session allowing local governments along the Kenai River to establish a tax credit program. In such a program, tax credits would be offered to offset a portion of local property taxes (up to 50 percent due on land or interest in land) for riverside projects that aid in: 1) protecting the Kenai River or a tributary of the Kenai River from degradation of fish habitat due to public or private use, and 2) restoring riparian fish habitat along or in the Kenai River or a tributary of the Kenai River that has been damaged by land use practices. The Kenai Peninsula Borough is considering developing this type of tax incentive program and is currently working with ADF&G and DNR.

(e.g., fish populations, or wetland functions such as flood attenuation) that are lost or damaged by development fill. Other educational materials could be prepared to make applicants better aware of their initial responsibilities—to clearly think through project alternatives in advance, provide all relevant information, engage a consultant to provide design specifications if necessary, etc. The checklists of essential mitigation plan components and a sample procedure for developing mitigation proposals may be helpful (included in Chapter 3). The amount of relevant information would vary according to the size and complexity of the mitigation/restoration project. All the larger or more complicated projects should require consultation with a hydrologist (or other appropriate expert) to affirm the project assumptions.

Adequate field supervision during construction of restoration/mitigation projects is critical to its success. Permitters and regulatory officials often cannot spend several days at the site to make sure it is done as approved. Incentives should clearly make it in the interest of the developer to supervise installation and get it right the first time, rather than agencies pursuing enforcement once it has been improperly installed. Larger projects should assign one person at the job site to be responsible for permit compliance and agency contact.

Pre-construction meetings are important tools to clarify the purpose of specified measures with the contractors and the equipment operators. Making contact with the local foreman, not just the developer, is important. Without understanding the point of certain "unusual" specifications, the operators may proceed (e.g., conduct the grading) in the manner that seems most expedient to them at the time. This sort of "public relations" investment tends to pay off in results. Although some agency staff time will always need to be committed to post-construction inspections, a combination of pre-construction meetings and compliance incentives could greatly reduce the disappointing rate of mitigation failures as well as the need for enforcement actions.

To assist applicants with follow-through on their permit and mitigation agreements, one state agency representative suggested condensing what the permittee agreed to do down into an "environmental commitment list." The Alaska Department of Transportation and Public Facilities (ADOT/PF) has recently begun attaching these types of lists to their new projects. The list is intended to function as a quick checklist for the developer/contractor. Each item would be listed in brief, with references where necessary such as "see page __ for specifications." This itemized checklist might make it easier for the contractors to keep track of what they still need to do while they are on location. ADOT/PF provided an example called the "Conditions of Approval," which was placed at the front of the environmental assessment for the current Homer airport expansion. These lists could be attached to various documents for proposed mitigation/restoration projects, e.g., a Corps permit, state permit or consistency determination. State agencies and the COE should consider establishing a similar quick reference system.

Another idea is to establish relevant reference materials, and attach these to the permit (e.g., guidelines on culvert placement or riprap installation). This approach parallels the common process for obtaining building permits.

After the project approvals are given, the issue of transferring responsibility to the applicant merges with the discussion of general compliance problems (see above).

Issue 4: Establishing mitigation standards that are fair to both big and small operators

Problem: It becomes difficult to justify the full mitigation sequence (avoid, minimize, restore/enhance, compensate) for small projects. In many places, permitters have reacted to this problem by thoroughly following the mitigation sequence negotiations for larger projects (which have more financial backing), but since they cannot require exacting amounts of background information and mitigation proposals from smaller, more common projects (e.g., mom and pop operations), they often attach a set of "best management practices" and issue the permit. This approach hinges on the attitude that those most likely to cause the most environmental damage tend to be the larger developers which are usually also in a better position to fund restoration or enhancement projects. However, this same regulatory behavior pattern has led to complex problems of cumulative impacts in many parts of the nation, which have proven very difficult to assess and control.

Solution Ideas: Controlling adverse cumulative impacts on public resources is a difficult topic all to itself. However, regional planning efforts can provide policy guidance and permit guidelines that are fair to both large and small developers. Although "best management practices" need to be retained on all permit approvals, they do not usually address the issues of habitat restoration. If small projects are unable to adequately reduce impacts through avoidance and minimization according to the general mitigation sequence (see Chapter 3), the options are either to deny the permit or to negotiate further mitigation using restoration and enhancement. Perhaps this is another instance where a pooling of resources (akin to a mitigation bank) could yield better ecological returns for the smaller, more common projects than the current case-by-case permitting and mitigation process. In this way, a small developer could contribute to the region's mitigation bank (which theoretically has already identified local restoration activities having high potential for success) in proportion to the unavoidable loss.

Another planning method to administer protection measures fairly is demonstrated in the new wetlands management plan of the City and Borough of Juneau. In this plan, the rigorousness of the mitigation procedures was tied to the importance of the aquatic habitat being impacted by the project (see Juneau WMP, Chapter 3). The plan establishes a baseline of minimum mitigation required for projects impacting habitats of various value classifications. In theory, this approach should be fair to both big and small operators.

Issue 5: Need for Completion and Monitoring Reports to Develop the Science

Problem: The scientific information on which to base a restoration or enhancement plan for a particular type of aquatic habitat is often scarce. For aquatic habitat mitigation projects in Alaska, thorough project completion reports are a rarity (usually only completed by very large corporations such as the oil companies). Sometimes a type of project may work at one location, but not at another. The reasons for these different outcomes has not often been explored. This leaves the applicant and the permitter in a very difficult situation—that of trying to make do with spotty information. Without feedback from previous projects, the permitter does not know which permit stipulations are most important to include, and which do not tend to have much bearing on project outcomes.

Solution Ideas: The best way to maximize use of existing information is to consult a wide variety of expertise early in the planning process, and ensure good communications among reviewers (see "Checklist of a Model Process to Ensure a Sound Aquatic Habitat Mitigation Project," page 3-16). Alaskan agencies, major industries, and consultants are also starting to work toward better information sharing, as manifested in the first regional meeting on aquatic habitat restoration (September, 1994) and the interest in forming a state-wide working group for this issue. Such efforts may result in more available information in the future.

However, one of the easiest ways to expand the scientific information base for future restoration/enhancement projects is to make sure the developer submits completion reports to all parties involved in the permit negotiations (e.g., permitting agencies, coastal districts, etc.) following a mitigation project. A questionnaire could be developed to be submitted with the completion report that would review the same issues addressed in the pre-construction meetings, and ask the applicant (and/or consultant) to evaluate the effectiveness of the different techniques or stipulations in their particular project. Likewise, better efforts could be made to structure a "feedback loop" within the regulatory agencies themselves. For example, the COE has both permitters and compliance personnel, but their duties are distinct: permitters rarely get the opportunity to visit project sites later on to evaluate the effectiveness of different stipulated measures. It would be very beneficial if their compliance/enforcement staff, who do visit projects after completion, would regularly write up recommendations for future projects based on their observations.

The developer's completion report should also be required to include a section similar to the two-page "Operations and Maintenance Guide" that was submitted for the Box Canyon Creek mitigation ponds in Seward (See Appendix C). This brief discussion is extremely useful in that it outlines which aspects of the project to continue checking over the first couple years, what might go wrong, and what mid-course corrections would be appropriate in that case (e.g., re-seeding or fertilizing, adjusting water levels, reinforcing a water diversion structure, etc.).

Not only does there need to be more emphasis on the applicant's submittal of completion reports, but also on the continuing responsibility of the permit holder to conduct any needed mid-course corrections for a defined period of time (at least 2-3 years, depending on the project). Outside of Alaska, longer monitoring periods are often specified for mitigation projects. For example, the California Department of Transportation has made it a policy to monitor all mitigation projects for five years, with annual reporting required (Rieger 1994). If a period of monitoring, maintenance, and adjustments is not defined as part of the agreement, the "mitigation" project is not likely to function as approved, and design and installation efforts could be for naught. Examples of permit language specifying the permittee's responsibilities for monitoring and corrective measures are included in Appendix F. Again these stipulations must be backed by enforcement support in order to be effective. Performance bonds or other incentives could help encourage the developer to follow through on these aspects, but funding within the regulatory agencies also needs to be dedicated towards these compliance reviews.

CHAPTER 5

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CHAPTER 5. REFERENCES CITED

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APPENDICES

A

APPENDIX A: Alaskan Aquatic Habitat Restoration & Enhancement Slide Show: Narrative as Presented at Annual Coastal District Conference, Juneau, April 14, 1994

The purpose of the slide show was to summarize the breadth of Alaskan restoration/enhancement work to make the terms and concepts more meaningful for coastal district staff. Many coastal districts in Alaska have not had much exposure to these types of projects. Slides (mostly from the case study projects in this report) were used to illustrate the diversity of project types common in Alaska. Coastal district representatives requested that this presentation be made into a packet that could be borrowed by district staff, for instance to share with their board members. Such a lendable packet may still be developed, contingent on a small amount of additional funding.

For the presentation, restoration/enhancement activities were grouped into categories, starting with streams.

1. Streams:

A. Bank Stabilizations

The first slide illustrates why we need stream habitat protection **(slide—eroding bank after stream buffer mistakenly bulldozed)**. Bank stabilization projects are common but many continue to wash out **(slide—Porters site after bank project failed)**. A series of shots showing one project at the Kenai Wilderness Lodge **(slide spring, 1993)** in which the bank had been reinforced and repaired numerous times over the years, using various methods such as large riprap. For the latest effort, **(slide-after installation, Oct. 1993)** they utilized new bioengineering ideas by planting a variety of native shrubs, grasses, and jute erosion control techniques. Once they become established on the bank, these natural materials and shrubs are believed to work better than riprap to preserve the bank over the long term, and at the same time they create much better fish habitat along the stream margin. **(slide)** This project still included some boulders at the toeline—illustrating a combination of approaches. **(Slide)** Here is the project under high flood conditions the first year, and it has survived well. In a smaller stream situation, **(slide)** "tree revetments" were used to bolster the eroding banks. Labor was provided by volunteers. **(slide)** The tree branches slow the water, **(slide)** and cause silt to drop out, building up the banks. **(slide)** In the meantime, the cover of the branches and shallow eddy waters make good rearing habitat for juvenile salmon. The end goal here is to rebuild the banks to the point that **(slide)** they can be replanted with shrubs and trees. (The school kids replanting banks in this slide leads into the discussion of riparian habitat restoration.)

B. Riparian Habitat Restoration

Riparian habitat means the areas bordering a stream or lake, illustrated in this riparian revegetation project **(Rabbit Creek streamside area—slides before and after)**. Another example of riparian habitat restoration at a big urban stream realignment in Anchorage —**(slide)** near Abbott Loop School. **(click through 4 before and after slides while continuing)....** Unique situation where the city re-routed the stream to relieve some hydrological problems (glaciering and flooding in the winter). They re-routed the stream to a natural meander, but they also took great care with fish habitat requirements, revegetation, and aesthetics. In this particular example, a great community effort was involved. Although very costly to realign an entire section of stream in this manner, this project has yielded impressive results. A couple of continuing problems illustrate the important effects of the public and nearby activities on the success of a particular restoration project site—vandalism **(culvert slide before and after)**, and sedimentation from projects upstream **(slides before and after)**.

C. Instream Structures

(slide—log barb) The intention here is to create diversity of water depth and flow characteristics (pools and riffles), which are important for fish and other stream residents. **(Slide—weir)** These habitat characteristics need to be re-established in a stream that has been channelized or placer-mined, because they often then run at a uniform flow rate and depth, providing no refuges for juvenile fish to rest from the current. **(slide)** Some instream structures are large woody pieces which are anchored into place to create cover for young fish to hide in.

2. Fish Rearing Habitat—increasing both area and quality

(slide) For this mitigation project near Seward, a series of slow-water ponds was constructed for fish rearing habitat (Box Canyon Creek). **(slide)** They used a water control structure and channels to divert and control water flow through the area. These structures can give rise to problems later on because they must be serviced and maintained in order to function properly. In this case, they got a bonus **(slide)** because salmon and trout have been regularly observed spawning in the riffle areas between rearing ponds. At other locations, rearing area has been increased just by reconnecting side ponds to a stream by digging a new channel **(slide of footbridge over new channel in Juneau).** This reconnecting of isolated waterways is one of the easiest ways to increase fish habitat area. (It also usually benefits flood control and water quality goals too). Improving the quality of rearing habitat **(slide)** usually means increasing the amount of cover for juvenile fish, here attempted by adding large woody debris to a formerly sterile gravel pond.

3. Gravel-Mined Areas

(slide) Aerial view of former gravel-mined pits, and **(slide)** more recent photo of Martin Rive delta area (gravel source for construction of Bradley Lake Hydroelectric Facility). An example from further north, **(slide)** shows how productive a former materials site can become after 20 years. However, this Alyeska materials site next to the Sag River was mined in a configuration of many shallow pits, later reconnected to the river, which facilitates natural succession to productive fish habitat (Goose Green Gulch, 1974). **(slide)** The resulting pond system contains ample Arctic grayling.

4. Placer-Mined Areas

In addition to the instream structures you've already seen, which were intended to increase **(slide)** the variety of water habitats within severely impacted streams like this, another big concern is re-establishing vegetation on the banks. This revegetation can be very difficult because usually there is only bare gravel in the banks—not much fine soil for plants to establish roots in. **(slide)** This slide shows a successful demonstration project with willows in a placer-mined stream near Fairbanks, where sufficient fine sediments were still present in the bank substrate. **(slide)** As logic would dictate, settling ponds often contain fine sediments, and are therefore easier to revegetate and rehabilitate. These 15 year-old abandoned settling ponds from the northern part of the state contain a variety of water depths and micro-habitat types. Arctic grayling overwinter there.

5. Spawning Channels
(slide) Although many spawning channels have been constructed in Alaska, only one of several examined for this project's case studies is an unequivocal success. **(slide)** Common problems include sediment filling in the clean gravel bottoms (choking off water flow through the gravels and therefore inadequate incubation conditions for the eggs), and insufficient water flow through the seasons. **(slide)** Continuing maintenance is also a high concern—here rocks had washed down through weir notches, blocking access for adult fish to even reach the spawning channel area.

6. Perched Culvert Retrofits
Perched culverts are those that exhibit a short "waterfall" as water exits a culvert on the downstream side of a road crossing. This perching prevents fish from being able to move up the stream, which may block access to important spawning and rearing habitat. This problem is corrected by either digging up the road and replacing the culvert at a different elevation or angle, or a newer approach **(slide of log weirs below culvert)** is to place weir structures in the creek downstream of the culvert to get the water to pool up below the culvert and approach the elevation of the culvert exit. **(another slide of Trapper Creek area weirs)** This allows fish to enter the culvert and continue upstream to their spawning grounds. The weirs form what are called "step pools" below the culvert.

7. Waterfowl Projects (ponds, impoundments)
(slide) This slide shows an aerial view of the Bradley Lake waterfowl nesting project. In this project, the road and airstrip were placed in a straight line across tidal flats, impounding water behind it. This impoundment was to be enhanced as waterfowl nesting habitat. The "finger-like" islands were constructed to maximize the amount of safe nesting sites. This project is still very new—not much regrowth yet. A much older waterfowl project demonstrates how much regrowth can occur at disturbed sites over 20 years. **(slide—Overview of Bayshore ponds)** This tidal area had been torn up by heavy equipment for sewer line installation, but now ducks and shorebirds use the ponds **(close up slide showing yellowlegs there)**.

8. Intertidal Projects
There have been a few attempts in Alaska to restore estuarine or intertidal areas that had been severely disturbed (for example, by heavy equipment for sewer line installation) **(slide of Fish Creek wetlands)**. Generally these attempts have been a limited success—vegetation is often still sparse after several years **(slide)**. Continued trampling and other impacts greatly hinder such efforts to revegetate disturbed intertidal areas **(slide)**. Historical photos demonstrate the degree of disturbance exerted by one sewer line project, and the progress of the sedge wetland intertidal restoration—**(several before and after shots of Campbell Creek outlet wetlands)**. Still sparse vegetation in some parts **(slide of measuring tape)**.

9. General Wetland Fill Mitigation

Mitigation for filling wetland areas has taken all forms in Alaska—ranging from creating new wetland areas adjacent to an existing wetland **(slide)**, attempting to impound water for waterfowl ponds **(slide—coastal trail mitigation pond)**, preserving a land parcel and creating an interpretive trail **(slide)**, correcting perched culverts, and any number of other things. In highly visible example, a developer that had illegally filled a certain wetland area was required (as a mitigation/enforcement action) to remove a road turnoff that was no longer needed. This removal served to rejoin two parts of Potter Marsh that had been separated by the access road, re-establishing water circulation, and increasing the size and quality of the marsh **(proceed through 5 "before and after" shots of Potter Marsh road removal).** In another case, mitigation for fill into a tidal marsh for airport expansion consisted of creating additional intertidal sloughs in the remaining marsh, which geese and sand lance now use **(last slide).**

[The presentation at the coastal district conference then moved onto a discussion of this project's findings regarding the effectiveness of different types of aquatic habitat restoration/enhancement in Alaska.]

B

APPENDIX B: BACKGROUND INFORMATION ON MITIGATION PROGRAMS

1) SUMMARY POINTS FROM LITERATURE

These summary points were compiled from publications evaluating the effectiveness of wetland mitigation programs in other parts of the country. These points are presented here in brief to provide Alaskan coastal planners and agency staff with a basic understanding of experts' experience in implementing compensatory mitigation projects using aquatic habitat restoration and enhancement. The literature underscores the limitations and common disappointments in compensatory mitigation projects. For further elaboration of the items below, consult the two primary references: Kusler and Kentula, 1989; and Eggers, 1992. These and other excellent references on these issues are listed as full citations in Section 2 of this Appendix.

ADEQUACY OF THE SCIENCE BASE

1. **Practical experience and the available science base is limited for most types of restoration and habitat creation and varies by region.**

2. **Most wetland restoration projects do not have specified "goals and objectives", complicating efforts to evaluate their "success."**

3. **Monitoring of wetland restoration or enhancement projects has been uncommon.**

SUCCESS OF PROJECTS

1. **Restoring or creating a wetland that "totally duplicates" a naturally-occurring wetland is impossible; however, some systems may be approximated and individual wetland functions may be restored or created.**

2. **Partial project failures (and partial successes) are the norm.**

3. **Success varies with the type of wetland and the target functions, including the requirements of any target species.**

4. **The ability to restore or re-create particular wetland functions varies by function.**

   For example, topography may be created with relative ease, leading to water ponding, while achieving a certain infiltration capacity is difficult.

5. **Long term success may be quite different from short term success.**

Long term success may be impacted by fluctuations in hydrology (drought or flood), pollution, erosion/wave action, impacts from foot or vehicular traffic, grazing, or increased sediment loads from elsewhere in the watershed.

6. **Long term success depends on the ability to assess, re-create, and manipulate hydrology.**

Wetland types and the species inhabiting them have specific hydrological tolerance levels. Of the wetland types, it is generally easiest to create the proper hydrology for marsh habitats that are connected to other water bodies (e.g., in estuarine or coastal locations). It becomes more difficult to create the correct hydrological conditions for isolated pockets of freshwater wetlands supplied, for example, by groundwater.

7. **Success often depends upon the long term ability to manage, protect, and manipulate the project wetlands and adjacent buffer areas.**

Restored or created wetlands are often in need of "mid-course corrections" and management over time. Common management needs include adjusting water levels, replanting or regrading, fencing off areas from traffic, pollution control, and establishing buffers. Few developers are willing to accept responsibility for *managing* these systems. Restored or created wetlands must therefore be designed as self-sustaining or self-managing systems unless a project sponsor (e.g., a wildlife agency or a duck club) clearly has the incentive and ability for long term management.

8. **Success depends upon expertise into project design and careful project installment and supervision.**

Hydrologic, biological, botanical and engineering expertise is needed in the design of many projects. Involving people with prior experience in aquatic habitat restoration is also highly desirable. Pre- and post-construction meetings should be conducted for all large or complex mitigation projects.

9. **"Cook book" approaches for wetland restoration will likely be only partly successful.**

Too little is known about the science, and the appropriate actions for each project are very site-specific. Although "cook book" prescriptions of rigid design criteria are not desirable, guidance documents suggesting ranges of conditions conducive to success are possible. Requirements that incorporate such general criteria, combined with incentives for completion and the flexibility to allow for experimentation, offer an increased probability of success along with contributing to the information base.

10. Factors which Influence Successful Restoration or Establishment of a Coastal Wetland: (Summarized from Briuer 1992.)

a) Elevation must be suitable for the plants under consideration, with special attention that the planted area will be neither too wet nor too dry.
b) Drainage must be correct and built into the site, through tidal connections and appropriate elevations, slopes, etc.
c) Erosion causing elements must be controlled. Plants rarely can successfully withstand wave, wind, and wake erosion. Low energy sites are the most successful.
d) Plant material selected for the site must be appropriate for the conditions, locations, etc.
e) Human impact must be minimized or eliminated.

RECOMMENDATIONS FOR WETLAND MANAGERS

1. **Wetland restoration proposals must be viewed with great care, particularly where promises are made to restore or re-create a natural system in exchange for a permit to destroy or degrade an existing more or less natural system.**

   It is important to keep in mind that there is no substitute for the "avoidance and minimization" steps in the mitigation policy sequence because at best compensatory mitigation (habitat restoration or creation) can present a simulation of <u>some aspects</u> of wetland functions. Purchasing and preserving high value habitat areas is another possible mitigation component with more secure results.

2. **Multidisciplinary expertise in planning and careful project supervision is needed at all project phases.**

3. **Clear, site-specific project goals and objectives should be established.**

   Project objectives should delineate restored area size, restored functions, type and density of vegetation, target fauna species, intended management activities, etc.

4. **A relatively detailed plan concerning all phases of a project should be prepared in advance to help the regulatory agency evaluate the probability of success for that type of wetland, at that site, meeting those specific goals.**

   Avoid authorizing wetland fill on the condition that a permittee will <u>later</u> submit mitigation plans. The plan should include the following, at a minimum, and other information depending on the type of project and goals:

   - Clear project goals and measures for determining success
   - Boundary delineations of the resulting aquatic habitat area
   - Proposed elevations across the project area

- Sources of water supply and connections to existing waters and uplands
- Proposed soil and substrate conditions, and probable sedimentation characteristics
- Proposed plant materials
- The methods and time for plantings
- A monitoring program
- Identification of possible problems and mid-course corrections, other project management capability.

5. **The original wetland system should be studied prior to destruction.**

   To provide guidance for restoration activities, and to offer a comparison for the determining the success of the restoration project.

6. **Careful attention to wetland hydrology is needed in design.**

   Hydrology is the key element, although not sufficient in itself. Relevant hydrologic factors include: water depths (maxima, minima, norms), velocity, hydroperiod, salinity, sedimentation rates, levels of nutrients or toxics, etc.

7. **Wetlands should, in general, be designed to be self-sustaining systems and "persistent" features in the landscape.**

8. **Wetland design should consider relationships of the wetland to other water sources and wetlands in the watershed, and to adjacent upland and deep water habitat.**

   In some cases, expected alterations in the watershed or adjacent lands may threaten the project area.

9. **Buffers, barriers, and other protective measures are often needed.**

   Such protective measures would include buffers, barriers, silt fences and sediment basins. These measures are often pivotal to project success.

10. **Restoration should be favored over creation.**

    The probability of success is greater for restoration efforts rather than for wetland "creation" projects, because the proper hydrologic factors once existed there.

11. **The capability for monitoring and mid-course corrections is a necessary element.**

    These possibilities should be reflected in the project design and proposal.

12. **For some types of aquatic systems or projects, there is a need for longer term management capability.**

    For example, to manipulate water levels, control invasive plant species or animal predators, periodically remove sediment, etc.

13. **The inherent risks and probability of success for restoring or creating particular wetland types and functions should be reflected in standards and criteria for the projects and project design.**

    The stringency of design requirements should reflect the risks, such as greater replacement area ratios (1:1.5, 1:2), and establishing standards for mid-course corrections.

14. **Permits should carry the following requirements:**

    - that mitigation is accomplished prior to or concurrent with the permitted activity.
    - that a suitable substrate will be created for establishment of the desired vegetation (e.g., require addition of topsoil, or actions to relieve compacted soil conditions if necessary).
    - that adequate erosion control measures and other best management practices are employed both in and adjacent to compensatory mitigation sites.
    - that performance bonds be posted to guarantee satisfactory completion of compensatory mitigation.
    - that mitigation sites be protected in perpetuity (e.g., with a deed restriction).

15. **Avoid compensatory mitigation that only exchanges one wetland type for another.** (e.g., filling an estuarine wetland while creating a freshwater "duck pond".)

16. **There are several side topics, integral to the mitigation issue, which are whole subjects unto themselves, such as:**

    - How to come up with a good project design
    - How to design an appropriate monitoring program
    - Compliance requirements and enforcement responsibilities
    - Options for pooling resources from several isolated permit actions into the most constructive efforts (e.g., mitigation banks or other collective actions that can be orchestrated for coinciding permitted activities located in proximity. The Juneau airport expansion mitigation fund described in the case studies, Chapter 2, provides an Alaskan example of the latter).

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C

APPENDIX C: Examples of Post-Construction Reports: the Box Canyon Creek Rearing Ponds

This Appendix contains:

1) Construction Report, and
2) Operations and Maintenance Guide.

Both reports were completed for the Box Canyon Creek rearing ponds project near Seward, Alaska. The project was designed and constructed under the supervision of J.G. Fisher & Associates, Anchorage, AK.

For most of the case study projects investigated in this study, no written reports were found that described what was conducted at the site. Usually the only written descriptions in the records (if any) explain the work that is *proposed* for the site, often in a very vague or preliminary stage, and not what actually took place on location. This construction report for the Box Canyon Creek rearing ponds was the best example of a clearly-written construction report encountered during this investigation. Although not overly intricate or elaborate, this report effectively documents how the project was installed, which is very valuable information for future reference. The Army Corps of Engineers often requires that construction reports be filed for mitigation projects contingent on §404 permits, but many are never completed or submitted in this type of useful fashion. This amount of follow-through is desperately needed to allow the science of restoration and enhancement techniques in Alaska to evolve from experience. Otherwise, many individuals and large sums of money are wasted while repeating the mistakes of others.

NOTE: The construction report contained an aerial photograph of the location, plus 14 photos documenting the work in progress at different site locations. These photos did not reproduce well enough for their inclusion in this appendix.

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CONSTRUCTION REPORT

Seward Coal Facility Fish Mitigation

Project No. 57012
Box Canyon Creek

Mile 2.7 Exit Glacier Road
Seward, Alaska

September 1987

This project was conceived in 1985 by the Alaska Department of Fish and Game and the U. S. Fish and Wildlife Service as suitable mitigation for loss of coho salmon habitat as a result of the construction of the coal-handling facility at Seward.

In late 1986 conceptual plans were prepared by Jack Fisher, P.E., utilizing aerial photos. No field work was done although the general area was well known to both the fisheries agencies and the designer. Much of the design was predicated on prior knowledge of water flows and the geologic conditions existing in the general area of the proposed project.

In May 1987 a professional services contract was awarded to J. G. Fisher & Associates to field engineer and direct the construction of the project utilizing DOTPF-furnished equipment and labor.

The original concept was for a series of nine ponds excavated to approximately 4 feet below water surface and connected by 8-foot-wide channels. The ponds were to be approximately 80 feet long and 30 feet wide at the water surface with the connecting channels to be approximately 8 feet wide and 20$\pm$ feet long. Since no topographic surveys were conducted prior to the award of the contract, it was necessary to first survey the site and then redesign the project to fit the field conditions if indeed the topographic data obtained in the surveys indicated the project was feasible.

On May 18, 1987, a survey of the area was made, and it was determined from the survey results that the project was feasible hydraulically, but that some modifications to the design would have to be made. First, the surveys showed that there was more slope in Box Canyon Creek than had been anticipated. The survey showed a total drop from the point of the diversion on the existing pond outlet ditch to the proposed confluence of the outlet ditch and Box Canyon Creek to be approximately 5.4 feet. It had been anticipated that this drop would be on the order of 2.0 feet. In order to maintain correct spawning velocities in the connection channels, the slope required was 0.25-0.30 percent. With this predetermined slope it became immediately apparent that the pond system would have to be shortened from the original design in order to provide the correct slope to assure correct transportation velocities in the ditch between the upstream pond and the point of diversion.

On May 19 clearing the base line for the ponds was started using chainsaws. The forest cover in the area was mostly cottonwood trees with some birch, aspen and alder. The majority of the cover was cottonwood ranging in size from seedlings to 14-inch-diameter trees about 80 feet in height.

By May 22, the D-3 dozer was on the project clearing the roadway and baseline.

The original intent for clearing was to fall the trees, then move them with the excavator used to excavate the ponds. Early on it became apparent that this would not only be very time-consuming but would not be efficient or cost-effective. Therefore, a D-8K bulldozer was hired to clear the area needed for both the ponds and spoil disposal. The entire three-acre project site was cleared and all logging debris piled in 10 hours. This was done on May 25. Meanwhile, chainsaw and hand clearing of the area near the lower diversion point and in the area of the upper diversion from Box Canyon Creek had been completed. The project was shut down on May 26 to await the arrival of the excavator for the ponds.

On June 1, work resumed with the prefabrication of the two wooden headgates for the project. It had been determined earlier by surveys that the planned diversion structure for Box Canyon Creek would not be required as there was enough drop in elevation between the upper diversion point and the old gravel pond to assure adequate transportation flows. This negated the need for a diversion structure as all that was needed was a ditch to provide transportation flow from the gravel pond to the creek, and this could be provided with a headgate structure.

On June 2 the excavator arrived on site. It was a Caterpillar 235 backhoe with a 2 c.y. bucket. As staked on the ground the project was to consist of eight ponds 100 feet long (including transition areas at each end) and seven connecting channels 25 feet long, with a channel from the upstream pond to the lower diversion point about 100 feet long on a 2½% grade and an outlet channel from the downstream pond to Box Canyon Creek. The gravels found in the excavation were clean river gravels ranging in size from 4 inches to sand. Silt inclusion was found as expected but flushed out during the excavation.

During the staking of the project it was found that the excavation for the pond using the backhoe alone would require moving the majority of the spoil twice or more due to large quantities and the limited reach of the backhoe. It was decided to remove all of the overburden down to the water table using the D-8K and to push the material onto the debris berm left from clearing. The dozer worked about 16 hours on this portion of the project and moved in excess of 50% of the total spoil.

On June 9 all excavation for the chain of ponds and connecting channels was completed as well as setting the headgate box on the lower diversion point. This headgate was an afterthought as far as the original design was concerned. There was some evidence that the old gravel pond had on occasion been subjected to high flows from both the Resurrection River overtopping the main road and also from the Resurrection River spilling into Box Canyon Creek above the project area. In order to be able to control the flow through the new pond complex, a headgate was installed so that stop-logs could be placed to divert the overflow waters from the gravel pond down the old high-water channel and not subject the new system to extreme flows. This headgate, in order to function properly, also required that the diversion dam located just downstream (from the headgate) in the old channel be constructed so that high water in the gravel pond and outlet would cause the dam to fail, thereby relieving the head on the pond complex.

On June 10, the connecting channel from the gravel pond to Box Canyon Creek was excavated, the headgate set in place and the south and east sides of the gravel pond were deepened.

On June 11 the cofferdam at the lower diversion was removed and the water was allowed to flow through the complex. This included not only spring seepage water in the new ponds but also included transportation flow from Box Canyon Creek and the seepage from the gravel pond.

Also on June 11, 1,000 pounds of 16-16-16 fertilizer and 126 pounds of grass seed were placed on the approximately three acres of spoil and disturbed areas.

On June 12 a general cleanup of the area was done, and the laborers and excavation equipment left the project.

On June 16 and 17 water measurements were taken at selected points on the project. Results are as follows:

Date	Location	Flow	Average Depth	Average Velocity
6/16/87	Hdgate-BC Cr.	6.60 cfs	1.20 feet	1.50 fps
6/16	Channel 3-4	16.30 cfs	0.80 feet	2.50 fps
6/16	Channel 6-7	14.00 cfs	0.65 feet	2.40 fps
6/16	OUTLET	15.30 cfs	0.80 feet	2.30 fps
6/17	Hdgate-BC Cr.	0.00	0.00	0.00
6/17	Channel 3-4	10.60 cfs	0.60 feet	2.00 fps
6/17	Channel 6-7	7.80 cfs	0.50 feet	1.90 fps
6/17	OUTLET	10.50 cfs	0.60 feet	2.10 fps

As evidenced from the above data it appears that the project "makes water" below the channel between ponds 6 and 7, and some of the additional flow provided by the Box Canyon Creek diversion is lost into the aquifer between the upper diversion headgate and pond 6. This is not abnormal since the upper end of the project (including the old gravel pond) is several feet higher than the lower ponds. Some of this lost flow is probably recovered in the downstream portions of the project, but some is lost into the floodplain aquifer. Also it is obvious from the above measurements that there is considerable ground water available in all of the ponds without the auxiliary flow from Box Canyon Creek and the gravel pond. The drainage from the gravel pond without the auxiliary flow was not measured, but was estimated to be less than 0.25 cfs. A permanent staff gage was installed on the stream side of the Box Canyon Creek headgate. The readings on this gage for the flows indicated were: 1.30 feet with stop-logs removed on June 16 and 1.45 feet with stop-logs in place on June 17 (resultant stream head drop of .15 feet (1-3/4 inches). This gage can be used as a rough measurement of flow through the headgate. Using the 1.30 feet gage reading as an indication of 6.6 cfs flow, then any deviation from 1.3 can be used to estimate flow. Figures to be used are 0.6 cfs per 0.1 foot rise in gage height and 0.5 cfs per 0.1 foot fall in gage height. These figures should be regarded as estimates only but will provide adequate information between gage heights of 0.8 feet and 1.8 feet.

On July 30 another stream measurement was made on the outlet stream. The flow was 19.2 cfs with a headgate gage reading of 1.40. It can be readily seen that a rise in stream flow at the upper gage and resultant increased flow through the headgate is not entirely responsible for the increase in flow in the entire system. Obviously the aquifer providing the majority of the flow in the system is also charged with a resultant increased in flow throughout the system. Another stream gage was installed at the transect point on the outlet ditch at the time of measurement. This gage read 0.80 feet at the time the above measurement was taken. Using the same rationale as was outlined in the use of the upstream gage as a tool to estimate flows, this gage should provide the same usable information.

Flows above 0.80 feet on the gage will average about 2.9 cfs per 0.1 foot, and flows below 0.80 will average about 2.7 cfs per 0.1 foot.

On September 2, 1987 the gages read as follows:

Upstream Gage	1.27 feet	Estimated flow	6.50 cfs
Downstream Gage	0.53 feet	Estimated flow	11.90 cfs

The inflow from the aquifer to the pond system shows definite influence from the weather.

Conclusions

The project was deemed a success almost immediately after completion when chinook salmon entered the system and were actively spawning. By the end of July, fisheries technicians estimated approximately 50 fish were in the ponds.

It was estimated that approximately 25 of the chinook actively spawned in the pond connection channels. Chinook were also observed in the old gravel pond indicating satisfactory fish passage from the project to the old pond. In August some pink salmon were also observed in the ponds, but none were observed spawning.

The only major changes from the original design were:

(1) Elimination of the Box Canyon Creek diversion structure;

(2) Addition of a headgate at the outlet from the gravel pond drain to the project ponds;

(3) Reduction of the size of the diversion dam at 2 above;

(4) Elimination of one pond due to hydraulic constraints.

The project was completed ahead of schedule and under budget. Under budget was in part possible due to financial participation in the project by the Seward Chamber of Commerce Fish Restoration Fund. This contribution paid for the D-8 dozer for a total of $4,620.00.

Also contributing to the cost savings was the labor contribution by the Department of Corrections, which furnished inmate labor from the Kenai Correctional Center for 304 man-hours of labor at a cost of $1.00 per hour. Added to this cost was cost of meals, but the total labor cost was still well under what it would have been had this labor pool not been used.

Safety was an important consideration from start to finish. No serious or lost-time accidents occurred on the project. Two separate chainsaw incidents occurred, resulting in torn clothing and scratches. Future projects of this nature where use of chainsaws is required should again stress safety in their use and in addition require the use of safety chaps by anyone using a chainsaw.

The revegetation of the area disturbed by construction is apparently a success as the grass was about 6 inches high in late July. Moose were using this area by the end of summer. Some other types of revegetation of the area would be advisable, weather and funds permitting. This might include but not be limited to: sprigging with willow, transplanting native trees, and planting alder. Refertilization is recommended in May of 1988.

Beaver activity in this drainage had been observed before construction, and it was anticipated that some additional activity would occur in the newly accessible waterways. Predictions in this regard were fulfilled, and much increased beaver activity is under way on the project. One dam has been removed, and another is scheduled for removal in early September.

An operations/maintenance program for this project is attached.

Acknowledgments

The writer wishes to thank those who helped make the project move along in a timely manner. Jerry Watkins of DOTPF was the design project manager, and his extra effort

from the beginning to completion was much appreciated. Bob Hibpshman from the DOC, Wildwood Correctional Center, coordinated all of the inmate labor and provided transportation for the workers between Kenai and Seward. His screening of the workers and cooperation in coordinating their schedules made the project progress much smoother than anticipated. Frank Dieckgraeff, president of Metco, Inc., was of great assistance in providing the D-8K bulldozer on short notice and on a holiday and for being the liaison between the project and the Seward Chamber of Commerce.

Submitted this 14th day of September, 1987.

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OPERATIONS AND MAINTENANCE GUIDE
BOX CANYON CREEK REARING POND COMPLEX

Since this project is man made, it cannot be expected to perform forever as designed without some O&M inspection and action.

During the first year of operation some earth movement on slopes can be expected; any intrusion on the connecting channels should be corrected by removal of any landslide materials.

There will likely be some subsidence of the fill around the two headgates, and this should be monitored closely. Any holes developing alongside the structures should be filled and close observation made to determine if any piping of fines is occurring along the structures. If leakage is discovered along the structures, the leaks should be sealed immediately to preclude failure of the structure.

Beaver activity is expected to increase in the areas and should be closely monitored, especially during the fall when dam building is usually at its peak. All dams in the new waterways and in the headgate areas should be removed as soon as they are discovered. Any dams in the new pond connecting ditches will not harm the project other than impeding both upstream and downstream fish movement.

Some refertilization should be done in the spring of 1988. This would also be an opportune time to revegetate with native trees and shrubs.

Flow in the complex should be closely monitored with gage readings taken and recorded at every opportunity to determine seasonal flows. Flows may be estimated using the following table.

Upper Gage (located on Box Canyon Creek headgate)

Gage Reading	Flow
1.30	6.6 cfs
Gage readings above 1.30 add	0.6 cfs per 1/10 foot
Gage readings below 1.30 subtract	0.5 cfs per 1/10 foot

Lower Gage (located in outlet ditch below downstream pond)

Gage Reading	Flow
0.80	19.2 cfs
Gage readings above 0.80 add	2.9 cfs per 1/10 foot
Gage readings below 0.80 subtract	2.7 cfs per 1/10 foot

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D

APPENDIX D: Oregon Draft Administrative Rules for Freshwater Wetland Compensatory Mitigation

OREGON DIVISION OF STATE LANDS

DRAFT ADMINISTRATIVE RULES

Freshwater Wetland Compensatory Mitigation

MAY 5, 1994

141-85-aaa Application

(1) These rules shall be used by the Division for determining compensatory mitigation requirements for the loss of freshwater wetlands due to the permitted removal or filling of material.

(2) These rules shall not apply to compensatory mitigation for estuarine wetlands covered by ORS 196.830 and OAR 141-85-240 through 141-85-264.

141-85-bbb Definitions

(1) **"Compensatory Mitigation"** means wetland resource replacement or, in limited circumstances, payment or protection in lieu of replacement for wetlands damaged or destroyed by a permitted activity.

(2) **"Compensatory Mitigation Plan"** means a document that describes in detail a proposed compensatory mitigation project.

(3) **"Compensatory Mitigation Project"** means a project to replace permitted wetland losses by the creation, restoration, or enhancement of a wetland according to a compensatory mitigation plan.

(4) **"Creation"** means to convert an area that has never been a wetland to wetland conditions.

(5) **"Degraded"** refers to a wetland with diminished functions or values resulting from alternative invasion of exotic species, hydrologic manipulation, or other actions or events.

(6) **"Enhancement"** means the alteration and/or active management of existing wetlands for improvement of particular functions and values.

(7) **"Functions and Values"** are those ecological characteristics or processes associated with a wetland site and the social value placed on them (see the Oregon Freshwater Wetland Assessment Methodology).

(8) **"Hydrologically Isolated Wetland"** is a wetland which has no surface hydrological connection to streams or other regulated waters.

(9) **"In-Kind"** means replacement of a wetland class, using the Cowardin classification system, with the same wetland class.

(10) **"Long-Term Protection"** means a legally enforceable action taken to ensure that compensatory mitigation site vegetation, structures, buffers, water quality, wetland jurisdictional status, and wetland functions and values are maintained indefinitely.

(11) **"Maintenance"** means the process of supporting or preserving the condition or functions of a wetland.

(12) **"Minor Project"** means a single project involving permitted impact to 0.5 acres or less of hydrologically isolated or degraded wetland.

(13) **"Mitigation"** means the reduction of adverse effects of a proposed project by considering in the following order:

- avoiding the effect altogether by not taking a certain action or parts of an action,
- minimizing effects by limiting the degree of magnitude of the action and its implementation,
- rectifying the effect by repairing, rehabilitating, or restoring the affected environment,
- reducing or eliminating the effect by preservation and maintenance operations during the life of the action; includes monitoring and appropriate corrective measures, and
- compensating for the impact by replacing or providing comparable substitute wetland or water resources (ORS 196.800 (10)).

(14) **"Practicable"** means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purpose.

(15) **"Reference Site"** means a site or sites that have the same characteristics as those proposed for compensatory mitigation.

(16) **"Removal-Fill Permit"** means a permit issued by the Director of the Division of State Lands under the authority of ORS 196.810.

(17) **"Restoration"** means to rehabilitate a dewatered hydric soil area by providing wetland hydrology or removal of fill material or other means of re-establishing freshwater wetland features.

(18) **"Standard"** is an established guideline or basis against which the condition of a wetland, or the success of a mitigation project can be compared.

(19) **"Watershed"** means the entire land area drained by a stream or system of connected streams such that all stream flow originating in the area is discharged through a single outlet.

141-85-ccc Compensatory Mitigation Policy

(1) The Division shall require applicants for Removal-Fill permits that propose impacts to freshwater wetlands to demonstrate why the wetlands can not practicably be avoided.

(2) Where wetlands cannot practicably be avoided, the Division shall require proposals to minimize encroachment into and impact to wetlands.

(3) The Division shall require applicants for Removal-Fill permits that impact freshwater wetlands to demonstrate that wetland functions and values lost will be compensated by restoration of historic wetlands, creation of new wetlands, or enhancement of existing wetlands or compensation by other means.

(4) The Division shall require replacement of wetland functions and values equal to or greater than those allowed to be impacted.

141-85-ddd Location and Type of Compensatory Mitigation Projects

(1) The applicant shall demonstrate the availability for on-site compensatory mitigation prior to consideration of off-site actions. To the extent practicable, the Division shall require that off-site compensatory mitigation replace lost functions and that replacement should occur within the same watershed. Compensatory mitigation shall replace habitat in-kind whenever practicable and environmentally advisable considering historic wetland losses or loss of wetland functions and values in the watershed. Off-site wetland habitat mitigation sites that are adjacent to or connected with other protected sites, will be preferred.

(2) Compensatory mitigation shall not be located in areas with high existing natural resource values, unless there are no other practicable compensatory mitigation alternatives. Out of watershed mitigation shall be considered only where creation, restoration, or enhancement of habitat is more appropriate in that location—for instance, where there is an opportunity to significantly improve or enlarge habitat for rare, threatened or endangered species, or geographically rare habitats.

(3) Linear projects that impact resources across watersheds may provide consolidated mitigation.

141-85-eee Intergovernmental Coordination and Cooperation

(1) The Division shall provide notice and opportunity for comment on compensatory mitigation plans with other state agencies, affected federal agencies and local governments, the applicant(s), affected property owners, and interested parties.

(2) The Division shall authorize wetland compensatory mitigation that is compatible with local government ordinances as determined by local officials.

(3) The Division shall utilize local wetland conservation plans and watershed plans as guidelines for locating compensatory mitigation projects when such plans are completed and address wetland resources.

(4) In the interest of protecting Oregon's water quality, the Division shall coordinate compensatory mitigation projects with the Oregon Department of Environmental Quality.

141-85-fff Selection of Compensatory Mitigation Approaches

(1) Whenever possible or practicable, the Division will require compensatory mitigation plans which result in restoration of historic wetland areas.

(2) If restoration of a wetland is not possible or practicable, the Division will consider plans which result in the creation or enhancement of wetland areas. Enhancement proposals must demonstrate the project will not result in adverse secondary impacts to the wetland and aquatic system.

(3) The Division shall require at a minimum the wetland functions and values proposed be impacted to be fully replaced. Those wetland functions and values that cannot be replaced on-site, such as flood storage, must be replaced in an alternative manner. Those wetland functions that are replaced off-site shall be within the same watershed except as provided in 141-85-ddd.

141-85-ggg Compensatory Mitigation Ratios

(1) The Division will require the following minimum ratios in determining the amount of wetland acreage which must be included in a compensatory mitigation plan:

(a)	restoration projects	1.0 acre for each one (1) acre of impacted wetland
(b)	creation projects	1.5 acres for each one (1) acre of impacted wetland
(c)	enhancement projects	3.0 acres for each one (1) acre of impacted wetland

(2) The Division may increase the ratio based on the following considerations:

(a) time delays from anticipated or applicant cause that result in delay between wetland impact and compensatory mitigation construction,
(b) difficulty of replacing the wetland resource proposed for impact,
(c) out of watershed mitigation,
(d) significance of wetland resources impacted,
(e) significance of the wetland resources proposed for compensatory mitigation, and
(f) other extenuating circumstances.

(3) Other ratios may be established where compensatory mitigation involves restoration of wetland functions historically lost, or is based on regional priorities as developed in watershed or wetland conservation plans.

(4) The Division will multiply the required ratio by two (2) if a fill, removal, or alteration activity impacts an already existing mitigation site to discourage impacting existing mitigation sites.

141-85-hhh Protection, or Payment In Lieu of Compensatory Mitigation

(1) The Division, at its discretion, may issue a permit to fill, remove, or alter wetlands at a single site if the applicant pays an amount determined by the Division to the Oregon Mitigation Bank Revolving Fund or other dedicated fund approved by the Division an amount set by the Division to compensate for the loss of that wetland.

(2) This provision may be applied where:

(a) the wetland fill site is one-half (1/2) acre or less, is hydrologically isolated, and is degraded, and/or

(b) the proposed project would involve less than one-half (1/2) acre of wetland and would not have significant adverse secondary impacts to remaining aquatic resources.

(c) the project would not affect a locally protected wetland resource

(3) Payment amounts shall be established in the permit and shall include the costs of:

(a) land acquisition, and
(b) wetland restoration, creation, or enhancement, and
(c) management and maintenance, or
(d) local mitigation bank costs.

(4) The applicant donates land or grants to the State of Oregon or an appropriate land trust, the title to land or a conservation easement to an area of at least five (5) times the size of the impacted wetland area where:

(a) The protected area shall be existing high value wetland and/or riparian habitat not protected by public ownership or land use designation. The recipient entity shall ensure long-term protection of the subject site, or

(b) [inadvertently missing from circulated draft regulations]

141-85-iii Conceptual Wetland Compensatory Mitigation Proposals

(1) The Division will consider a wetland mitigation proposal prior to the development of a complete compensatory mitigation plan. The proposal will be considered as a preapplication consultation.

(2) Proposals that utilize new techniques may be considered as experimental approaches under appropriate circumstances and, after consultation with the Division, may be developed as compensatory mitigation plans.

141-85-jjj Minor Project Compensatory Mitigation Plans

(1) A compensatory mitigation plan for minor projects which involve an impact area of one-half (1/2) acre or less in size, shall include:

(a) a map showing the compensatory mitigation site location,
(b) a plan map illustrating proposed wetland types to be restored, enhanced, or created and water source to support the wetland,
(c) a written description of the proposed creation, restoration, or enhancement actions to be taken, goals to be achieved that includes at a minimum a grading and planting plan and,
(d) a plan map showing photographic monitoring locations.

141-85-kkk Compensatory Mitigation Plans

(1) A compensatory mitigation plan shall be submitted by an applicant for a Removal-Fill Permit for projects that are not minor.

(2) A compensatory mitigation plan shall include at a minimum each of the following elements:

(a) Maps showing the project site location, compensatory mitigation site location and spatial relationship between the two.

(b) detailed project site plan (scale of 1"=200' or larger) indicating where specific wetland types (Cowardin class and hydrogeomorphic setting, and water source) are located within the proposed fill, removal, or alteration area.

(c) wetland functions and values expected to be lost or altered by the proposed fill, removal, or alteration activity.

(d) description of the proposed compensatory mitigation site that includes: wetland description (Cowardin class and hydrogeomorphic setting and water source); an evaluation of the natural resource functions proposed to be impacted at the compensatory mitigation site; and an evaluation of possible adverse impacts from existing and planned adjacent activities.

(e) description of compensatory mitigation design assumptions and wetland restoration, creation, and/or enhancement goals that includes: reference wetland site(s); a summary of expected wetland losses and proposed wetland gains in function(s); and target wetland goals by Cowardin class and hydrogeomorphic setting and water source.

(f) description of the methods to be used to implement the mitigation plan and the time lapse required to accomplish the compensatory mitigation goals.

(g) design details including construction limits, methods of construction, grading plan, planting plan, water control structure design and engineering analysis of soil structural stability for earth works, if necessary.

(h) the person(s) responsible for implementation maintenance and monitoring of the compensatory mitigation project.

(i) the proposed monitoring plan in conformance with OAR 141-85-lll (below).

(j) description of the method(s) proposed to ensure long-term protection of the compensatory mitigation project site (for example, donation to land trust, wetland conservation easement, performance bond, etc.).

(k) demonstration that water rights or registrations have been filed for or received.

(l) proposed contingency measures specifying steps to be taken to prevent failure.

(m) a summary of the plan on forms provided by the Division.

141-85-lll Compensatory Mitigation Monitoring Requirements

(1) The Division shall not issue a Removal-Fill Permit requiring a compensatory mitigation project until a monitoring program acceptable to the Division has been developed by the applicant. The purpose of the monitoring program is to:

(a) determine if the project is in compliance with conditions of the Removal-Fill Permit, and

(b) evaluate whether the compensatory mitigation project has been successful in meeting the goals of the compensatory mitigation plan, and

(c) provide data on the success of the permit program in meeting the policy goals and performance measures in state benchmarks, statutes, rules, and agency evaluation programs.

(2) Monitoring reports shall be prepared by an environmental professional.

(3) Monitoring reports shall include:

(a) a post construction report that demonstrates "as-built" conditions including grading, and a discussion of any variation from the approved plan, will be submitted, typically within 60 days of completion of grading, unless waived,

(b) annual written monitoring reports that include all data necessary to document compliance with mitigation conditions and success in meeting the compensatory mitigation goals. Measurable performance standards shall be specified in the permit. For example, photographs, topographic surveys, plant survival data, hydrologic data or other information shall be required for a period determined necessary to ensure compliance and initial success, typically for 5 years, on forms provided by the Division.

(4) If the Division does not respond to a written report within 90 days, the project evaluation will be accepted by the Division.

(5) At the end of the monitoring period, the Division shall determine if the project meets the compensatory mitigation goals. If the compensatory mitigation project does not, the Division may require modifications to the mitigation site and additional monitoring.

(6) The Division may require modifications at any time it becomes evident that the management measures are failing to meet the mitigation goals.

(7) When the mitigation project complies with the goals established as a condition of the Removal-Fill permit, the Division shall provide the applicant notice in writing of compliance with state requirements.

141-85-mmm Minor Project Compensatory Mitigation Monitoring Requirements

(1) The Division shall require applicants to provide annual monitoring reports. These reports shall be submitted on forms provided by the Division and shall have attached to them whatever supporting data (for example, photographs, surveys, or other appropriate information) is necessary to document the status of the mitigation project. Monitoring reports shall be evaluated by the Division for compliance with the Removal-Fill Permit, and project goals as presented in the minor project compensatory mitigation plan.

141-85-nnn Enforcement of Compensatory Mitigation Permit Conditions

(1) The Division shall seek voluntary cooperation with compensatory mitigation permit conditions. However, where necessary, the Division shall enforce the compensatory wetland mitigation permit conditions through the imposition of civil penalties, and/or other compliance actions.

(2) The Division shall require that persons undertaking a compensatory mitigation project obtain a bond or post a security instrument or secured account in an amount determined by the Division to be sufficient to ensure completion of the required compensatory mitigation, if the mitigation activity:

   (a) involves an area greater than one and one-half (1.5) acres, or

   (b) is determined by the Division to be an appropriate experimental approach, or other projects that present a significant risk of failure.

(3) The Division shall authorize release of the bond or other form of security at the end of the required monitoring period and upon concurrence with monitoring reports showing the project has met mitigation goals specified in the compensatory mitigation plan.

141-85-ooo Application and Review Procedure

(1) The Division shall use the following procedure when reviewing applications for a Removal-Fill Permit which require a compensatory wetland mitigation action:

(a) Whenever any person submits an application for a permit to fill or remove material within a wetland area, the Director shall advise the applicant that compensatory mitigation shall be required as a condition of any permit.

(b) The Director shall notify the applicant that the application for a Removal-Fill Permit is not complete until a compensatory mitigation plan or minor project compensatory mitigation plan has been received, and avoidance is shown to be not practicable. The Director shall also advise the applicant that the review period required by ORS 196.825 (7) will not begin until receipt of the written compensatory mitigation plan, or minor project compensatory mitigation plan.

(c) The Director shall review any application for a removal or fill permit in conjunction with a compensatory mitigation plan. The Director's review shall consider the statutory criteria set out in ORS 196.825 and OAR 141-85-005 through 141-85-090 to determine whether a permit shall be issued. If a permit is to be issued, the Director shall then consider the compensatory mitigation plan or minor project compensatory mitigation plan and determine its adequacy in accordance with law and these policies.

(d) The Director may accept, reject, or amend the compensatory mitigation plan or minor project compensatory project mitigation plan. A rejected plan may be modified and resubmitted by the applicant. If a modified compensatory mitigation plan is not received by the Director within 120 days of the date the prior mitigation proposal was rejected, the application shall be denied or returned as incomplete by the Director.

(2) If the Director accepts or amends the applicant's compensatory mitigation plan or minor project compensatory mitigation plan, the plan, as accepted or amended, shall be incorporated as a condition of the issued permit. If amended, the applicant shall be informed of the proposed change prior to issuing the permit.

(3) The Director shall require that the compensatory mitigation project be completed prior to or concurrent with the permitted wetland fill, removal or alteration activity and that the Removal-Fill Permit remains active until all conditions are met, including monitoring.

141-85-ppp Program Monitoring

(1) The Division shall develop and maintain a database of compensatory mitigation activities and impacts. This database shall be available to the public.

(2) The Division shall review and evaluate the effectiveness of this policy on a biennial basis. The review shall include a summary of actions taken, an analysis of trade-offs made, an identification of issues raised and/or problems identified, and recommendations for changes to make the program more effective.

E

APPENDIX E: INFORMATION ON DEVELOPING A LOCAL OR REGIONAL WETLANDS MANAGEMENT PLAN

This appendix contains the following materials:

- Hints on preparing a comprehensive wetland management plan. July, 1991. Lane County Council of Governments. 8 pgs.

- The West Eugene Wetlands Plan (summary of their plan's multiple objectives and benefits), Lane County Council of Governments. 4 pgs.

- Federal Register Excerpt from October 5, 1992, issue defining and explaining "Special Area Management Plans" (SAMPs) in regulatory guidance to the Army Corps of Engineers. 1 pg.

- Special area management plan for the Mill Creek basin. January, 1992. U.S. Army Corps of Engineers Information Paper, Seattle District. 5 pgs.

- Mill Creek drainage basin special area management plan: final plan of study. Army Corps of Engineers, Seattle District. 14 pgs.

- Summary pages of Mill Creek SAMP goals, process, time chart of tasks, and lessons learned. Army Corps of Engineers, Seattle District. 6 pgs.

- Example flowcharts of how an individual would obtain authorization to develop a wetland parcel under these sample local wetlands plans. Provided by Army Corps of Engineers, Seattle District. One page each:

  Newton Creek Letter of Permission Process
  Columbia South Shore Permit Process
  Mill Creek SAMP Permit Process

Hints on Preparing a Comprehensive Wetland Management Plan

July 1991

Lane Council of Governments
125 East Eighth Avenue
Eugene, Oregon 97401
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July 16, 1991

HINTS ON PREPARING
A COMPREHENSIVE WETLAND MANAGEMENT PLAN (CWMP*)

* (Also known as a Special Area Management Plan, SAMP, in U.S Army Corps of Engineers parlance or a Wetland Conservation Plan, WCP, in Oregon Division of State Lands parlance).

A CWMP is a plan dealing with development and protection conflicts where a pocket or cluster of wetlands affects a significant portion of a community. The plan encompasses the identification, study, and evaluation of wetland values in light of community development needs and investments.

While discovery, study and planning for wetlands is likely to be controversial and stir emotions, the CWMP process can lead to better understanding of relative values and can lead to solutions which add certainty within the community in keeping with state and federal laws. Wetlands can be viewed as part of a community's water resources. The CWMP can offer public and private benefits.

Based on the development of the West Eugene Wetlands Plan in Eugene, Oregon, here are some general and specific hints to consider if your community is faced with a wetlands question or issue.

GENERAL HINTS

1. Plan to work with affected people at the local, state and federal levels.

2. Use the best information available.

3. Develop a vision or overall direction for your plan early in the process.

4. Use our Oregon planning knowledge and principles to your advantage; for example, have a citizen involvement program, develop goals and policies, use maps and graphics to convey information, develop and evaluate alternatives, and use criteria for making final decisions.

5. Consider implementation and financing as part of your plan.

6. Treat wetlands as an asset and fit them into a multiple objective natural resources, public facilities, and public enjoyment framework.

SPECIFIC HINTS

Here are some specific hints that cover the above key points in more detail and add some other minor ideas.

1. *Consider the Scope and Nature of Your Wetlands*

   Conduct a reconnaissance survey. Useful tools include: the U.S. Fish & Wildlife Service National Wetland Inventory maps, U.S. Soil Conservation Service soil surveys for your county (you can ask for help in determining which soil types are classified as "hydric" or wetland type soils), floodplain maps, air photos, infrared photography, property ownership maps, comprehensive land use diagram or zoning maps, historical wetland maps (from old Government Land Surveys), drainageway maps, and topographic maps or U.S.G.S. quadrangle sheets. If you have vegetative mapping available, that can be useful (ask your federal or state agency representatives for assistance in determining "hydrophytic" or wetland type plants for your region).

   From this information and a preliminary off-site view of the potential wetlands, you can determine the extent and nature of wetlands in your community. If your wetlands are of small size or extent or affect only one or a few properties, you may chose to rely on the wetland permitting process(es) to deal with the disposition of those wetlands.

   If you determine that the wetlands are important, that they are in conflict with community development plans, or that they jeopardize sizable community investments in public facilities and services, you may consider developing a CWMP.

2. *CWMP Advantages Over the Permitting Process*

   Preparing a CWMP has the following advantages over the regular permitting process(es):

   a. It is easier to develop a reasoned, balanced approach through a comprehensive examination. The piecemeal nature of the permitting process does not allow for regional issues to be weighed.
   b. It is easier to determine relative values and attach significance to wetland resources. This is especially true in a regional planning approach which includes an assessment of wetland functions and values and an analysis of the regional development effects and options.
   c. It is easier to balance environmental and development interests. The permitting system is biased because property interests are not balanced with local environmental interests. Unless an enlightened developer involves the community when planning development, other interests must

be protected by regulators or through the public review or appeals processes. Too often in the permitting process, there is not an opportunity for dialogue and compromise between development and environmental interests.

d. It is easier to analyze cumulative impacts. Because the permitting process is incremental, there is no attempt to measure the impact of permits issued within a region over a long period of time. The comprehensive planning approach provides a framework for estimating and measuring cumulative impacts.

e. It is easier to develop community consensus. The permitting process invites confrontation. The comprehensive planning approach promotes active participation from a wide variety of community interests; it provides for a more collaborative approach to problem resolution.

f. It is easier to educate citizens about wetland issues. Once confrontation is introduced through a permit dispute, it is difficult to present facts and offer opinions in a constructive way. The comprehensive planning process allows education to take place in a variety of ways, including newsletters, workshops, field trips, presentations to organizations, and direct contact with interested citizens.

3. *Develop a Work Program and Budget*

There have been enough of these projects undertaken that you can seek examples and advice about the tasks required, optional tasks, and the sequence of events necessary to accomplish the study and prepare the plan. If the wetlands affect more than one jurisdiction, decide on the level of coordination needed (including consistent plan adoption and implementation). Because various departments and agencies are involved and because wetland issues tend to be complex, a project manager should be designated. You may want to consider assistance from a regional planning agency. Once tasks are identified, prepare an estimated budget and realistic schedule for completing the plan.

Most plans with which we are familiar have taken two or more years to complete. The cost of preparing the plan should be weighed against the magnitude of the problem. Seek advice from state and federal agencies about financial assistance, as well as in-kind and private contributions. See also #6 below regarding a citizen involvement program.

4. *Conduct the Best Inventory That You Can Afford*

Consider in advance what information is already available, what needs to be gathered, and how that information will be evaluated. Do you plan to use the Wetland Evaluation Technique (WET)? or the Habitat Evaluation Program (HEP)? Do you have ways to conduct soils or hydrology studies in-house? Can you enlist volunteers from the local plant club to inventory for rare plants? Do you have university or college interns who can conduct air photo interpretation for you? Seek assistance from state and federal agencies for a list of wetland consultants in your region.

In order to discuss implications with property owners, boundaries should be fairly specific so protection and development implications can be considered. Gather information about the functions and values of wetlands in order to determine relative significance. A wildlife habitat rating system was valuable in west Eugene. Having information on wetland types, acreages, and values allows for better decision-making in a regional context. Without that information, it is difficult to assess the impact of a fill on a single wetland. Balancing wetlands protection and development requires a good information base so the community and regulatory agencies can reach agreement on a plan for a regional wetland resource.

To the degree possible, tie your inventory into a Geographical Information System (GIS) and develop a data base for each wetland type or unit.

5. *Support of Elected and Planning Officials Is Vital*

While it easy to call attention to wetland values or to development conflicts with wetlands law in a crisis mode, a comprehensive wetland planning approach allows issues to be debated in a more rational manner. Unlike the permitting process, the comprehensive approach allows wetlands issues to be addressed in a positive, pro-active fashion. In addition to local elected officials, other decision-makers are important, including planning commissioners. Involving, educating, and communicating with your local elected representatives is important because of budget decisions and eventual adoption of the plan must involve them. find ways to keep them informed as you make progress over the life of your work program; use newsletters, meetings, copies of reports, field trips, and individual contacts to keep them informed. Invite them to any workshops you may conduct.

6. *Develop A Citizen Involvement Program*

This can be done in conjunction with the work program (see #3 above).

A citizen involvement program that includes property owners, environmental interests, the development community, educators, and other interested citizens and groups is essential to success. Educating the community and involving them in expression of preference allows them to provide suggestions for creative solutions. In the West Eugene project, we found widespread support for concepts such as mitigation banking, building wetlands in advance of need, greenways, a connected system, a balanced approach to protection and development, and a financial plan with Federal, State, local, private and non-profit group roles. The citizen involvement program is key to the success of a comprehensive planning effort.

Among the techniques used in the West Eugene project were developing, updating, and expanding an interested parties mailing list; conducting nine workshops (eight open to the public); developing handouts; leading field trips; speaking to civic and community organizations and special interest groups; developing a self-guided tour brochure; sending individual letters to property owners; placing posters around town; taking part in interviews leading to media exposure; talking to elementary, secondary, and college classes; having assigned staff to meet with owners and others at the City or at the COG to answer questions. Maps, posters, handouts, and direct personal contact were techniques used at the workshops to educate citizens. Surveys, maps, questionnaires, bean jars, and one to one contact were techniques used to solicit feed-back from the public at workshops. A description and summary results of every workshop were prepared after every workshop and sent to all planning commissioners and elected officials (Councilors and Commissioners) following each workshop.

7. *Involve Affected State and Federal Agencies*

Whether through a committee or by direct involvement in conducting inventories and managing plan preparation, or through other communications (telephone, field visits, review of draft materials, progress reports), involvement of State and Federal agencies is critical. The formation of a Technical Advisory Committee (TAC) worked well in the West Eugene project. We conducted meetings in Portland, Salem and Eugene to meet the time constraints of individual members. Some TAC members participated in every workshop. This involvement allowed them access to local citizens and gave them an opportunity to view the wetlands first hand.

8. *Develop Multi-disciplinary Local Expertise within Affected Departments*

Within your own jurisdiction(s) form a multi-disciplinary team from all affected departments. In the West Eugene study, we included planning, public works, parks and recreation, finance, business assistance, intergovernmental relations, legal counsel, and the permit and information center, as well as L-COG project management and technical assistance.

9. *Consider The Role of a Non-Profit Group*

Groups such as The Nature Conservancy, a public land trust, a wetland conservancy, or a "Friends" organization can be beneficial at the inventory, planning and implementation stages of the project. They can play an important role in property negotiations and purchase because of expertise and options they can offer to property owners for lands slated for purchase.

10. *Consider Involving Your State and Federal Representatives*

If the issue is of regional significance, it may be advisable to involve State and National elected representatives. They usually hear only bad things about wetlands--let them know that you are working on a positive approach to solving a regional issue. In the west Eugene project, the Oregon delegation has been helpful in obtaining study funding and in seeking funds to implement the plan (i.e., land acquisition funds). The City of Eugene also retains a professional lobbying firm in Washington, D.C. which has been invaluable in achieving the City's federal wetland lobbying agenda.

11. *Link the Wetlands Plan to Your Comprehensive Land Use Plan.*

Under the Oregon land use planning and City of Eugene planning systems, the West Eugene Wetland Plan is a refinement to the general plan. It contains goals, objectives, and maps and is backed by a technical report which deals with issues of need, alternatives, and environmental and economic evaluation. Wetlands are related to water resources, public facilities (many are part of the floodplain, the stormwater system, and stormwater non-point water quality), recreation and open space. Because they may impact planned industrial, commercial, residential or public (e.g., airport) uses, it makes sense to deal with them within the context of your local comprehensive plan. Wetlands are often related to waterways or bodies and your community's recreational plans; wetlands can be part of a livable community.

12. *Use a Systems Approach*

Consider the wetlands as part of a drainage system or watershed. They are often related to upstream and downstream events and uses. Most wetlands do not exist in isolation from uplands. Consider how upgradient uses may affect valuable wetlands, how wetlands to be protected can be buffered from adjacent incompatible uses, and what values the wetlands have for downstream users (e.g., flood storage and sediment trapping capacity).

13. *Think About Implementation Early in the Process*

How is your plan going to be implemented? Will you use existing development regulations and zoning ordinances to protect wetlands? If so, are your current codes adequate? Do you need new ordinances? If you propose to buy wetlands, acquire conservation easements, or manage a municipal wetland system, do you have an identified local funding mechanism in place (e.g., a storm water user fee or systems development charge)? Do you plan to obtain a regional wetlands permit from the Corps? What does it entail? How will you implement a local wetland permitting program? How will your inventory and plan be integrated into decisions at the local permit counter? Will you operate a mitigation bank? If so, will a manual be needed to guide financial transactions? Will public works maintenance practices associated with wetlands and streams need revision?

14. *Be Positive*

The CWMP allows you to be proactive. Think creatively and find solutions that benefit the pubic, solve problems for the majority of people, and still maintain the rights of owners of small land parcels.

15. *Think of Multiple Objective Approaches*

A CWMP that addresses only wetlands protection is likely to fail. When the inter-relationships among wetlands, urban development, public facilities, open space, wildlife habitat, streamside protection, recreation corridors, aesthetics, urban design, and water quality are taken into account in a balanced way, the CWMP can offer benefits for the environment and the entire community. While wetlands protection alone may be prohibitive in cost and may lack overall community support, when combined with many interests, the multi-objective approach can save total dollars and can generate broad public support.

16. *Evaluate the Economic Impacts of Your Wetlands Plan*

How will the plan affect individual properties? Will there be a reasonable economic return? If the wetlands are protected from adjacent upland development, how will the transition are between wetland and upland affect development? How will the present public investment in public facilities and services be taken into account? Can the remaining carrying capacity of those systems be used by allowing development on some lesser value wetlands? Lastly, what is the cumulative impact of your wetlands plan on the residential, commercial, and industrial buildable land inventory within your urban growth boundary? Do you need to make adjustments elsewhere in your plan to account for adding protection to wetlands which were not subtracted from your buildable land inventory previously? Answering these questions as part of the project will go a long way in explaining the impacts of wetlands decisions to the public and local officials.

17. *Develop a Vision*

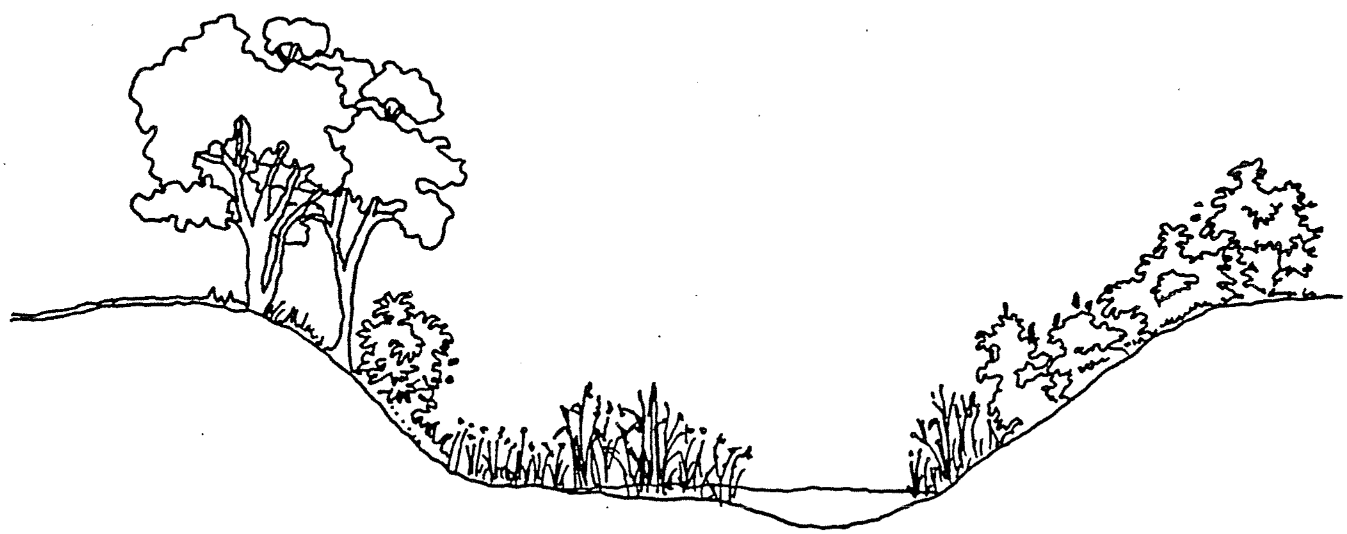
Through words and illustrations, show the community what the system will look like when fully implemented. Use maps, drawings, and narrative to show an integrated system with mature vegetation along streams, with forested wetlands and ponds alive with animals and birds. Illustrate a visitor center and a boardwalk leading school children through a marshy habitat. What would a tasteful new industrial building look like near a wetland with a buffered area serving to pretreat parking lot runoff before discharge into a wetland? These kinds of illustrations and vision statements can help the community understand the long-term goals of your CWMP.

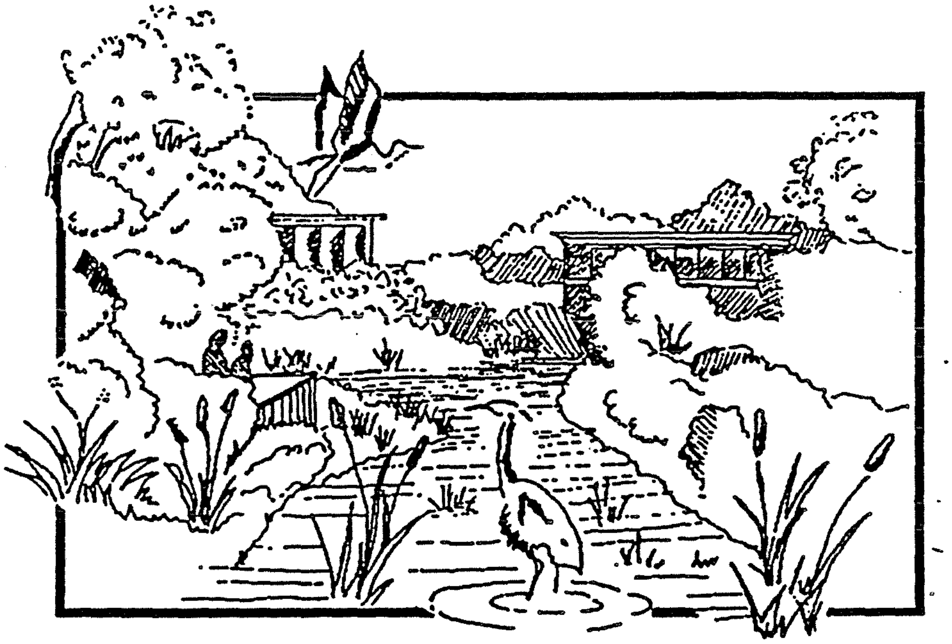
Allow the public to help shape the vision or to amend it during the process. The public should feel ownership in the vision, as should your planning commission and elected officials.

19. *Treat Wetlands as an Opportunity*

Rather than focus on wetlands as a community problem, realize that wetlands are valuable natural resources which can be an asset to your community. Through enhancement, protection, interconnection with other natural areas, wetlands can be opportunity areas for wildlife, recreation, rare plants, cleaner water, and nearby development. Wetlands are among the most productive ecosystems on earth. Loss of habitats is one of the major environmental problems facing humankind; protection of wetlands through "no net loss of wetlands functions and values" can help reverse our national trends.

The comprehensive wetland approach is an excellent way to address wetlands issues in a community or region where a pocket or system of wetlands requires more intensive study than that undertaken through the individual wetland permitting process. The comprehensive wetlands plan allows for the best available information to be integrated into a rational solution. The comprehensive planning approach should not be an excuse for developing wetland resources; it provides an opportunity to protect valuable wetlands through a systems approach rather than through the incremental permitting process. The resulting system of west Eugene wetlands will produce multiple environmental and social benefits for the enjoyment of present and future Lane County residents and visitors.





THE WEST EUGENE WETLANDS PLAN

This multiple objective, comprehensive study recommends protecting wetlands and streams as shown on the following conceptual plan map. The Plan was developed through an extensive public involvement process with oversight from federal and state agency representatives on a technical advisory committee. The Plan should be adopted locally in early 1992. Your assistance in obtaining EPA grants and Land and Water Conservation Funds for land acquisition helped us put this "win-win" Plan together; a Plan which can be a national model in urban wetlands planning.

The Plan provides a vision for the Amazon drainage basin and the West Eugene wetlands region. It addresses the following multiple use objectives:

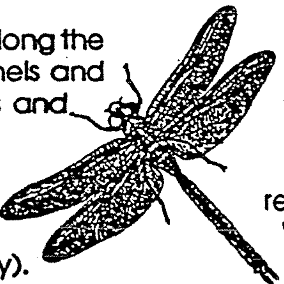
DEVELOPMENT VALUES:

- **CERTAINTY RETURNED** - Owners and developers know where wetlands will be protected and where fill and development will be allowed. Future permit decisions will be based on the Plan.
- **STREAMLINED PERMITTING PROCESS** - The City is seeking to assume federal and state wetland permitting for the area.
- **MITIGATION COST REDUCTION** - Through creation of a regional mitigation bank, we can pool federal, state, local and private funds to spread costs among various interests, thus saving costs to developers.
- **IMPROVED LAND VALUES** - Businesses will benefit by locating near a wetland setting. Property values adjacent to the wetlands and stream corridors are expected to increase in value.
- **FEDERAL LAND ACQUISITION** - BLM's program to acquire wetlands will assist private land owners. Wetlands will be acquired or protected through easements purchased with federal funds, thus providing compensation to owners of wetlands designated for protection.

THE WEST EUGENE WETLANDS PLAN

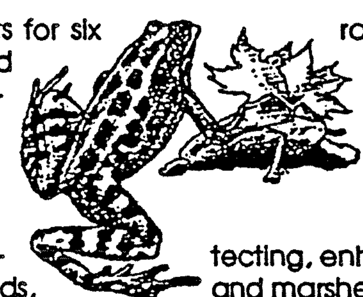
(CONTINUED)

ENVIRONMENTAL VALUES



- **CONNECTED WATERWAY SYSTEM** - Greenways will be created along the Amazon, "A", and A-3 Channels and Willow Creek. Improved channels and restoration of adjacent wetlands will connect important wetland areas and protect and improve urban streams.

- **PROTECT UNIQUE HABITATS** - Protection, enhancement and restoration of wetlands will benefit plant and animal habitats - including the Willamette Valley prairie grasslands (tufted hairgrass plant community). Among the wetland types to be protected and restored is the Willamette Vally wet prairie, home to a diverse array of native grasses and wild flowers. This plant community covered over 300,000 acres of the Willamette Valley when the first settlers arrived, but has been reduced to less than 1% of its original extent.



- **PROTECT RARE SPECIES** - Habitats for six rare plants and the rare Fender's Little Blue Butterfly will be protected and improved. Western Pond Turtles, a potential species for future listing, is found in several waterways in west Eugene. If habitats can be protected and plants propagated, populations could increase with federal "de-listing" as a future goal.

- **IMPROVE BIO-DIVERSITY** - By protecting, enhancing and restoring waterways, prairie grasslands, ash forests, ponds, and marshes, natural diversity can be improved. By providing different wetland types, plant species diversity will occur, thus providing cover, food, and nesting habitat for a variety of birds, mammals, amphibians, reptiles, fish, and insects.

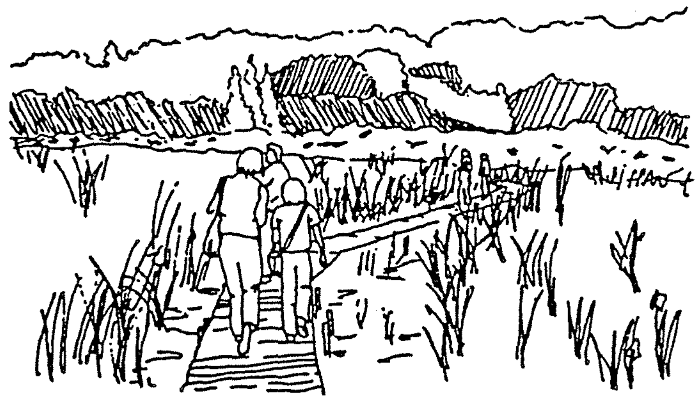
- **IMPROVE WATER QUALITY** - These public works efforts will improve the health of plants, animals and humans.

THE WEST EUGENE WETLANDS PLAN

(CONTINUED)

SOCIAL VALUES

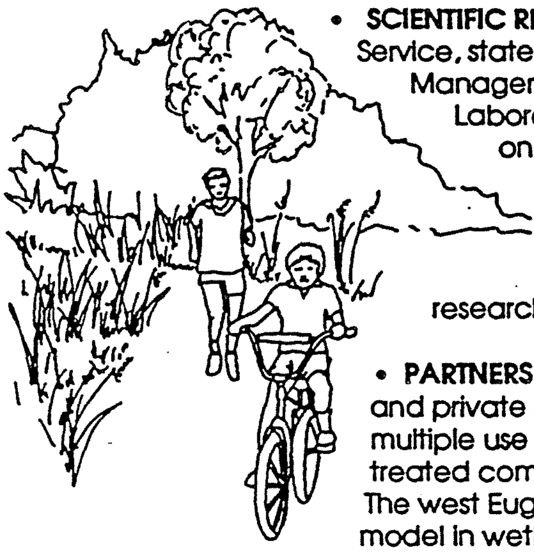
- **TRAILS** - Hiking trails and bicycle paths will provide access to nature and will connect neighborhoods along the waterways. A trail system along the Amazon Channel will connect the City with Fern Ridge Reservoir to the west. The system will include connections to nearby neighborhoods and provisions for handicapped access. The wetland system will provide benefits to a broad segment of our community.



- **PARKS** - The wetland greenway system will provide a large natural park setting in the Bethel and southwest Eugene neighborhoods.

- **RECREATION** - The wetlands and waterways will provide opportunities for hiking, fishing, canoeing, bird watching, plant study, nature study, and solitude.

- **EDUCATION** - West Eugene wetlands will provide opportunities for students and the general public to learn about the natural and cultural history of the area. This study can involve local schools, Oregon State University, the University of Oregon, Lane Community College, and local recreation programs. This effort could be coordinated with volunteers and non-profit groups.



- **SCIENTIFIC RESEARCH** - The Army Corps of Engineers, Soil Conservation Service, state and federal Fish & Wildlife agencies, Bureau of Land Management, the Environmental Protection Agency's Corvallis Laboratory, both Universities, and others can conduct research on wetland biology, restoration and mitigation, and water quality.

- **INTERPRETATION** - An interpretive center can be established to benefit the local community, students, researchers, and visitors.

- **PARTNERSHIPS** - Federal, state, local government, non-profits, schools, and private sector arrangements will be encouraged. By taking a multiple use approach to the wetlands problem, many issues can be treated comprehensively, thus involving a wide spectrum of interests. The west Eugene partnerships are likely to become another national model in wetlands protection based on the Eugene experience. Already, the cooperation among the City, County, Nature Conservancy, COG, and BLM are creating solutions and implementing the West Eugene Wetlands Plan.

THE WEST EUGENE WETLANDS PLAN
(CONTINUED)

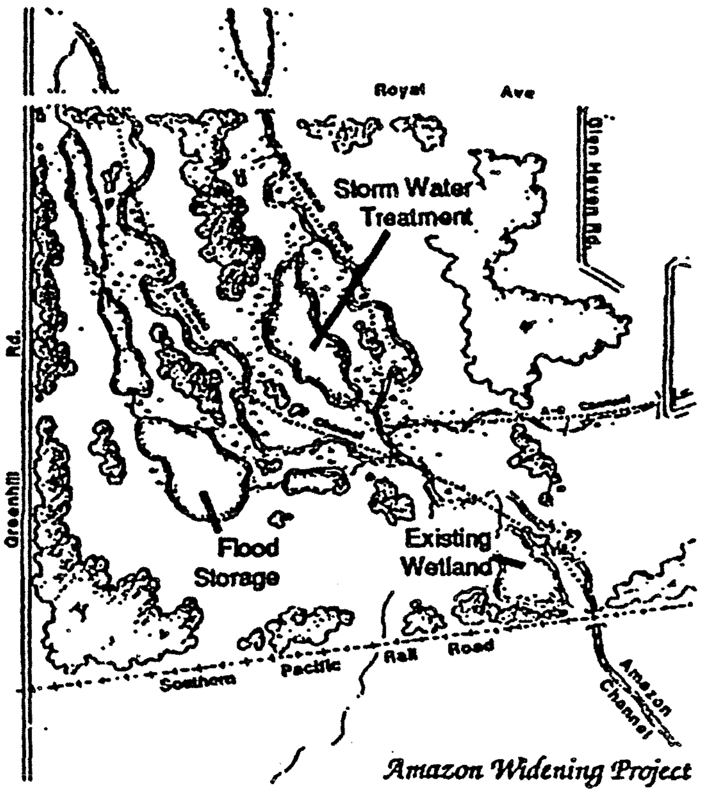
PUBLIC WORKS VALUES:

- **FLOOD CONTROL** - Widened channels, created ponds, and purchase of wetlands in the flood-plain will improve flood protection, saving long term public facility costs.

- **WATER QUALITY** - In-channel improvements, created ponds, and buffers adjacent to wetlands will improve storm water quality, saving long term public facility costs.

- **STORMWATER SYSTEM CONVEYANCE** - The in-channel and adjacent "soft engineering" approaches will handle storm runoff to meet both quantity and quality objectives in a more environmentally sensitive way. Not only will this save public facility capital costs, but it will change the image of Eugene's storm drainage management system - providing multiple community and environmental benefits.

- **ENVIRONMENTAL MANAGEMENT** - With new EPA stormwater quality regulations under the Clean Water Act, the Eugene Public Works Department is developing a comprehensive stormwater management plan. The Public Works Department will assume a greater role in environmental mangement during this decade, and wetlands management is recommended to be part of this Department's role in managing the City's infrastructure systems.



Road, Vicksburg, Mississippi 39180-6199.

Kenneth L. Denton,

Army Federal Register, Liaison Officer.

[FR Doc. 92-24023 Filed 10-2-92; 8:45 am]

BILLING CODE 3710-06-M

Regulatory Guidance Letters Issued by the Corps of Engineers

AGENCY: U.S. Army Corps of Engineers, DOD.

ACTION: Notice.

SUMMARY: The purpose of this notice is to provide a copy of the latest Regulatory Guidance Letter (RGL) to all known interested parties. RGL's are used by the Corps of Engineers as a means to transmit guidance on the permit program (33 CFR Parts 320-330) to its division and district engineers. The Corps of Engineers publishes RGL's in the Federal Register upon issuance as a means of informing the public of Corps guidance.

FOR FURTHER INFORMATION CONTACT: Mr. Sam Collinson, Regulatory Branch, Office of the Chief of Engineers at (202) 272-1782.

SUPPLEMENTARY INFORMATION:

RGL 92-03, Subject: Special Area Management Plans (SAMPs), issued on August 19, 1992, is hereby published as follows:

CECW-OR

Subject: Extension of Regulatory Guidance Letter (RGL) 86-10, subject: "Special Area Management Plans (SAMPs)" is extended until 31 December 1997 unless sooner revised or rescinded.

For the Director of Civil Works.

/s/

John P. Elmore,

Chief, Operations, Construction and Readiness Division.

Directorate of Civil Works

RGL 86-10

Special Area Management Plans (SAMPs) Issued 10/2/86. Expired 12/31/88.

1. The 1980 Amendments to the Coastal Zone Management Act define the SAMP process as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies, standards and criteria to guide public and private users of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone." This process of collaborative interagency planning within a geographic area of special sensitivity is just as applicable in non-coastal areas.

2. A good SAMP reduces the problems associated with the traditional case-by-case review. Developmental interests can plan with predictability and environmental interests are assured that individual and cumulative impacts are analyzed in the context of broad ecosystem needs.

3. Because SAMPs are very labor intensive, the following ingredients should usually exist before a district engineer becomes involved in a SAMP:

a. The area should be environmentally sensitive and under strong developmental pressure.

b. There should be a sponsoring local agency to ensure that the plan fully reflects local needs and interests.

c. Ideally there should be full public involvement in the planning and development process.

d. All parties must express a willingness at the outset to conclude the SAMP process with a definitive regulatory product (see next paragraph).

4. An ideal SAMP would conclude with two products: (1) appropriate local/state approvals and a Corps general permit (GP) or abbreviated processing procedure (APP) for activities in specifically defined situations; and (2) a local/state restriction and/or an Environmental Protection Agency (EPA) 404(c) restriction (preferably both) for undesirable activities. An individual permit review may be conducted for activities that do not fall into either category above. However, it should represent a small number of the total cases addressed by the SAMP. We recognize that an ideal SAMP is difficult to achieve, and, therefore, it is intended to represent an upper limit rather than an absolute requirement.

5. Do no assume that an environmental impact statement is automatically required to develop a SAMP.

6. EPA's program for advance identification of disposal areas found at 40 CFR 230.80 can be integrated into a SAMP process.

7. In accordance with this guidance, district engineers are encouraged to participate in development of SAMPs. However, since development of a SAMP can require a considerable investment of time, resources, and money, the SAMP process should be entered only if it is likely to result in a definitive regulatory product as defined in paragraph 4 above.

8. This guidance expires 31 December 1988 unless sooner revised or rescinded.

For the Chief of Engineers.

/s/

Peter J. Offringa,

Brigadier General, USA, Deputy Director of Civil Works.

Kenneth L. Denton,

Army Federal Register Liaison Officer.

[FR Doc. 92-24024 Filed 10-2-92; 8:45 am]

BILLING CODE 3710-92-M

DEPARTMENT OF ENERGY

Notice of Intent to Prepare an Environnental Impact Statement; for Environmental Restoration and Waste Management Activities at the Idaho National Engineering Laboratory Department of Energy—Idaho Field Office Idaho Falls, ID

AGENCY: Department of Energy.

ACTION: Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for Environmental Restoration and Waste Management (ER&WM) activities at the Idaho National Engineering Laboratory (IN[illegible] in Idaho Falls, Idaho.

SUMMARY: The Department of Energ[illegible] (DOE), Idaho Field Office (DOE-ID), announces its intent to prepare an E[illegible] pursuant to the National Environmer[illegible] Policy Act of 1969 (NEPA) (42 U.S.C. 4321 *et seq.*), in accordance with the Council on Environmental Quality (CEQ) Regulations for Implementing Procedural Provisions of NEPA (40 C[illegible] Parts 1500-1508) and the DOE NEPA Implementing Procedures (57 FR 1512 April 24, 1992, to be codified at 10 CF[illegible] Part 1021), and to conduct a series of public scoping meetings. This EIS will address ER&WM activities at INEL. Such activities include decontamination and decommissioning (D&D) of existing facilities, environmental cleanup, waste and spent nuclear fuel (SNF) management and technology development, and infrastructure functions (e.g., roads, power, fire protection, security) in support of environmental restoration and waste management activities. The EIS will analyze the reasonably foreseeable environmental impacts of ongoing and proposed ER&WM activities and alternatives. Although some activities at the INEL are not ER&WM activities and therefore are not part of the proposed action, the cumulative effects of the proposed action and other past, present, and reasonably foreseeable future actions will be included in the EIS.

The EIS will cover the ER&WM activities at the INEL site, an 890-square mile reservation located approximately 35 miles west of Idaho Falls, and facilities located within the city limits of Idaho Falls (*e.g.*, the INEL Research Center). The EIS is intended to assure that the potential environmental impacts associated with the ER&WM activities at the INEL site are documented and factored into DOE decisionmaking, and

US Army Corps
of Engineers
Seattle District

Information Paper

Date: January 1, 1992

SPECIAL AREA MANAGEMENT PLAN FOR THE MILL CREEK BASIN

The Seattle District, U.S. Army Corps of Engineers (Corps), is participating with King County, the city of Kent, and the city of Auburn, as local sponsors, in the development of a Special Area Management Plan (SAMP) for the Mill Creek Drainage Basin, King County, Washington. Seattle District has taken the role as the lead coordinator for the two year effort. Through its responsibilities as the administrator of the Clean Water Act, the U.S. Environmental Agency (EPA) is working closely with the Corps. Other key players include the U.S. Fish and Wildlife Service, the State of Washington, the Indian tribes, and the local development community.

What is a SAMP? A SAMP is a comprehensive plan providing for reasonable economic growth and natural resource protection in a specific geographic area. The Mill Creek SAMP is focusing on wetland resources and its goal is to develop a wetlands management plan for the Mill Creek Drainage Basin which results in implementation of a Corps of Engineers regional permit within two years. Through our regulatory responsibilities under the Clean Water Act, the Corps has the authority to work with local governments in developing a SAMP.

What are the benefits of a SAMP? One result of the SAMP process will be a regional Corps permit (or permits) which would authorize wetland fill projects meeting certain criteria in designated areas. The result would be accelerated review and increased predictability in the Corps regulatory process for those activities or designated areas. The SAMP process would provide the basis for development of local land use plans and equivalent programmatic permits by local and state agencies. The SAMP would increase consistency among the various permitting agencies regulating developments in wetlands. Additionally, the SAMP would give environmental organizations certainty of wetlands protection in designated areas, would contribute to improved flood control and storage for the local communities, would assure that individual and cumulative impacts of wetland fill projects are analyzed in the context of broad ecosystem needs, and would contribute to consistency with the EPA Wetlands Priority Plan.

Why a SAMP and Regional Permit for the Mill Creek Basin? Mill Creek is the main westside tributary to the lower Green River (see attached maps), and

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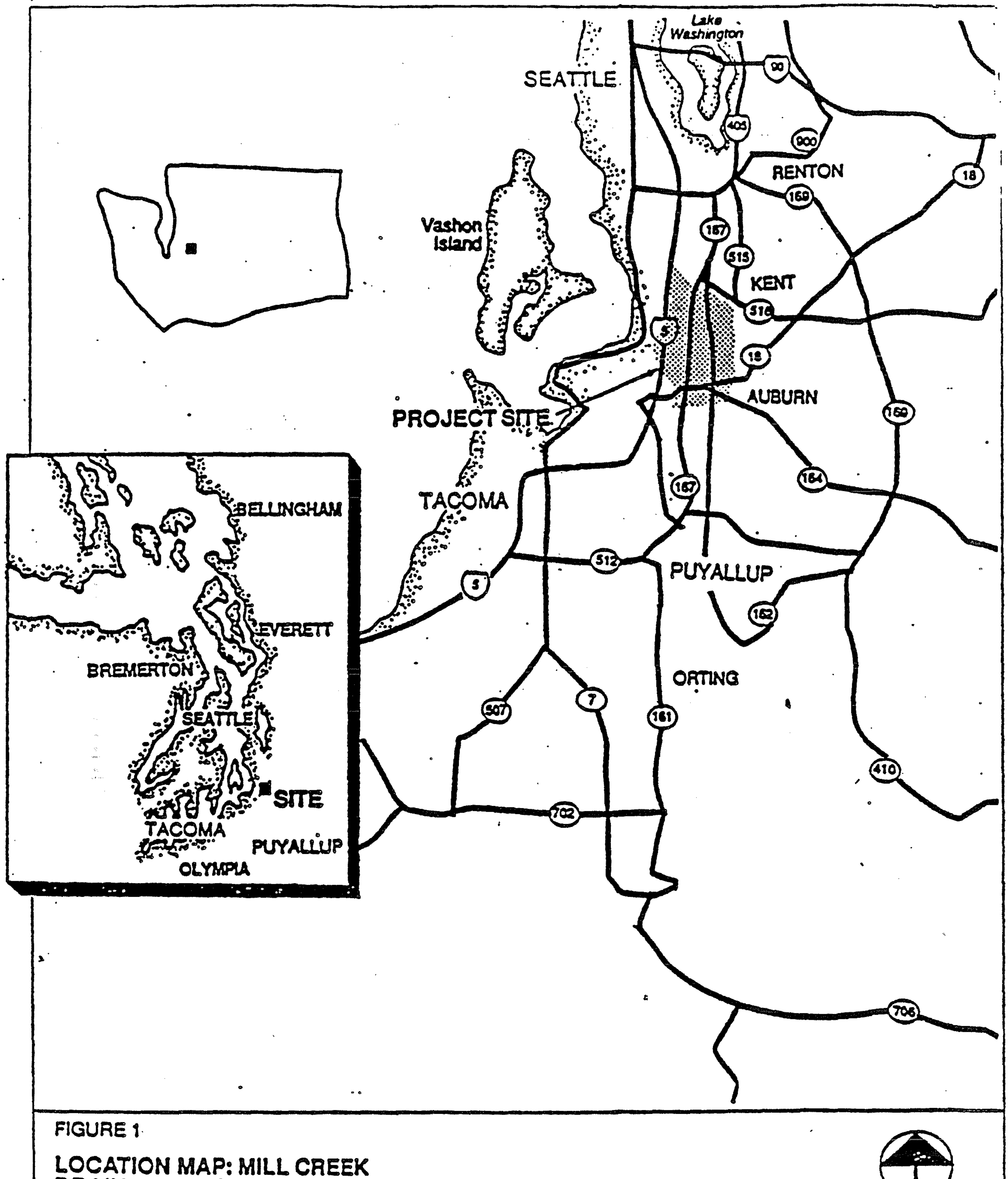


FIGURE 1

LOCATION MAP: MILL CREEK DRAINAGE BASIN STUDY AREA

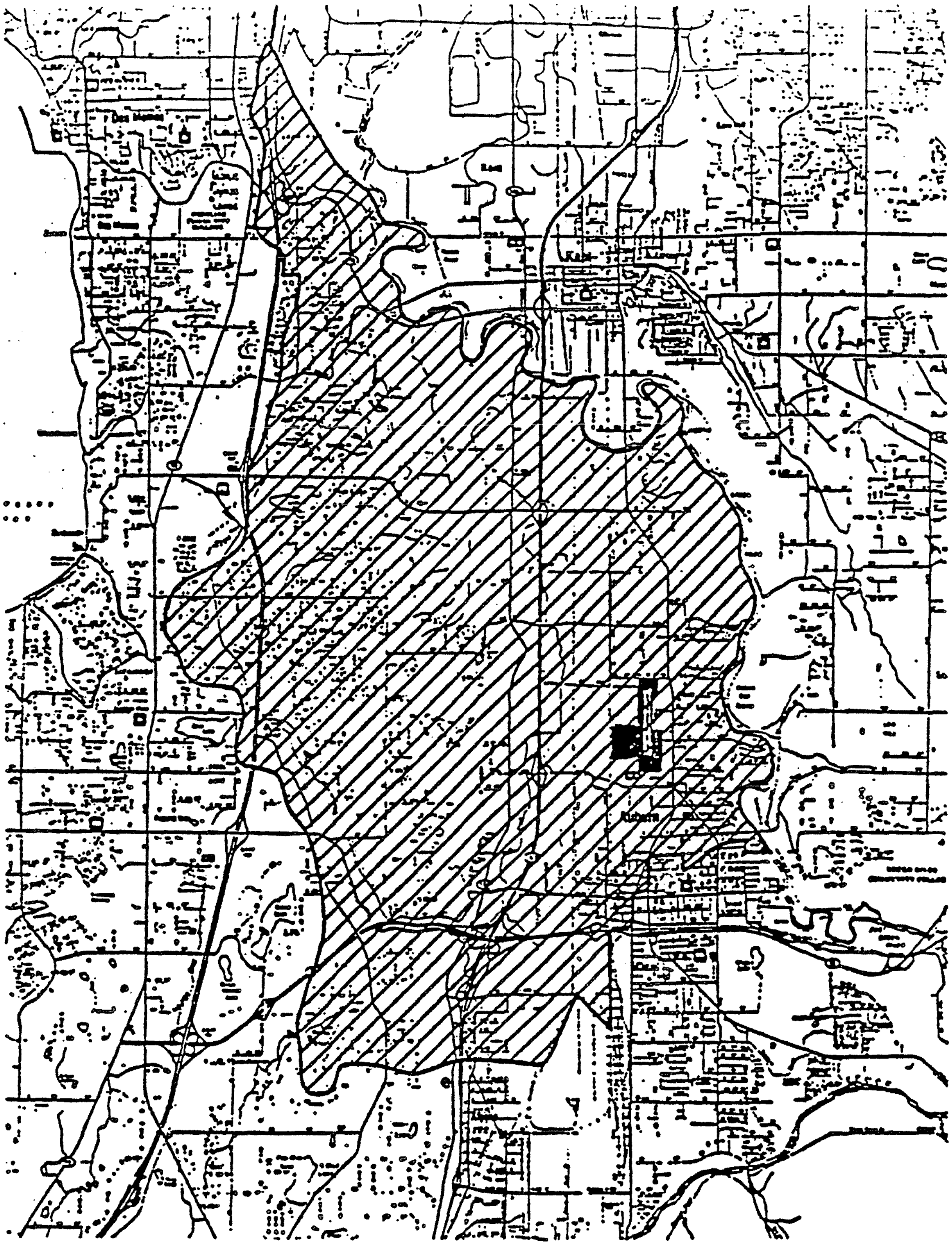


FIGURE 2

MILL CREEK DRAINAGE BASIN AS DEFINED BY THE SPECIAL AREA MANAGEMENT PLAN

0 1 MILE APPROX.

SHAPIRO & ASSOCIATES, INC.

encompasses approximately 20 square miles. It includes part of the cities of Auburn and Kent, and part of unincorporated King County. The Mill Creek basin is an environmentally sensitive area, with numerous quality wetland tracts remaining, and is under strong developmental pressure. Flooding in the lower Mill Creek basin occurs nearly every year. King County, Auburn, and Kent are in the process of studying the flooding issues with an objective of wetlands protection and enhancement. The Soil Conservation Service is also studying flooding problems in the Mill Creek area. These efforts and the SAMP are highly complimentary. The often confusing and conflicting regulatory requirements placed by federal, state and local levels of government on a development project in wetlands, the environmental concerns regarding the impacts of development in wetlands, and the flood control issues make the Mill Creek basin a good candidate for a SAMP.

<u>What are the major tasks necessary to accomplish the SAMP?</u>

TASK 1. Development of a Plan of Study (POS), cost estimates, schedule, and sources of funding. STATUS: A final POS, cost estimates, schedule, and identity of funding sources has been completed. The POS will be the vehicle which will constitute the local sponsors' agreement with the Corps. Total estimated cost for the SAMP is $536,473; study duration is estimated to be 2 years.

TASK 2. Procure funding. This is an ongoing effort. STATUS: To date, the Corps has funded approximately $210,000 through FY 91 toward the effort. The EPA has provided $47,000 in FY 89 and $50,000 in FY 91. The city of Auburn has conducted an updated wetland inventory of the Auburn area which is a contributed effort to the SAMP. Other sources of funding area being explored.

TASK 3. Resource/wetland mapping, using the Corps/EPA wetlands definition and the joint Federal methodology. STATUS: The Phase I report (identifying what areas in the study area remain to be inventoried and/or refined to meet the criteria of the Federal methodology) and Phase 2 report (conduct additional inventory work and mapping) have been completed.

TASK 4. Determine functions and values of identified wetlands. STATUS: This task was begun in September 1989 through the initiation of a literature search of the resources of the study area, their history, and current status. The literature search was completed in May 1990. Information gathered through the literature search and the wetland inventory will be used as a baseline for evaluating wetland functions and values. This task is scheduled for completion by the end of 2nd quarter FY 92. All field work has been completed.

(continued)

SPECIAL AREA MANAGEMENT PLAN FOR THE MILL CREEK BASIN (cont'd.)

TASK 5. Summarize and categorize projected development in intensity according to desired uses. STATUS: This task will be conducted by the local sponsors, and is also due for completion by the end of 2nd Qtr FY 92.

TASK 6. Develop criteria for areas to be developed, protected, enhanced, and for wetland mitigation/creation. STATUS: This task will overlap with tasks 4 and 5 and began in the 2st Quarter, FY 91. This task will culminate with the selection of areas to be designated.

TASK 7. Conduct alternatives analysis using criteria developed in TASK 6. Evaluate the impacts of the various wetland management alternatives developed. Select a preferred alternative. STATUS: This task began in the 4th Quarter, FY 91.

TASK 8. Institutionalize the SAMP through Corps regional permit(s) and equivalent local and state permits. Prepare appropriate environmental documentation. STATUS: This task is targeted to begin in the 1st Quarter, FY 92.

PUBLIC INVOLVEMENT TASKS: Public involvement is ongoing throughout the SAMP study. STATUS: To date, public involvement has included coordination with the local sponsors, the EPA, the State of Washington, the Muckleshoot Tribe, and the general public. Additionally, the concept of the SAMP has been discussed at meetings with the development community and the environmental community in the study area with positive response and with offers to assist. Public workshops for the SAMP were held in the 1st Quarter, FY 91, and in the 4th Quarter, FY 91.

18 June 1990

FINAL

MILL CREEK DRAINAGE BASIN SPECIAL AREA MANAGEMENT PLAN
PLAN OF STUDY

1. __Introduction__. The purpose of this Plan of Study is to present a description of tasks, costs, and schedule for accomplishment of a Special Area Management Plan for the Mill Creek Drainage Basin in southern King County, Washington. A Special Area Management Plan (SAMP), as described in the 1980 Amendments to the Coastal Zone Management Act, is a comprehensive plan providing for natural resource protection and reasonable economic growth in a specific geographic area. A SAMP will be developed for the purpose of improving coordination between the Corps of Engineers and local governments' permit programs and resource management planning in the Mill Creek Drainage Basin.

The Corps of Engineers regulates the placement of dredged or fill material into waters of the United States, including wetlands, pursuant to Section 404 of the Clean Water Act and regulations issued by the Environmental Protection Agency. The local governments regulate development through various permit requirements. King County and the cities of Auburn and Kent are jointly formulating a regional flood control plan for the Mill Creek Basin study area, as part of their ongoing Green River Basin Program efforts.

Development of the SAMP will involve: (1) an inventory of wetlands in the Mill Creek Basin, (2) an evaluation of their functions and values, (3) a summary of potential development plans within the basin, (4) development of alternative wetland management plans, and (5) selection of a preferred wetlands management plan. The SAMP process will conclude with development and implementation of a regional permit or permits by the Corps of Engineers. A regional permit, based on the results of the SAMP, will identify areas within the Mill Creek Basin in which development projects will be subject to an abbreviated Corps of Engineers permit process. The regional permit will specify the conditions which must be adhered to in order for a project to be authorized by the abbreviated review process.

Local governments will be able to incorporate the SAMP into their land use planning and/or permitting programs. This will improve the consistency between federal, state and local regulation of development projects in wetlands in the Mill Creek Basin. Regional flood control planning underway in the Mill Creek Basin will also be assured of consistent and reliable standards at both the local and federal levels, with project mitigation and enhancement needs coordinated throughout the project area. Development interests will be able to plan with more predictability, and environmental interests will be assured that resource management and regulation are being done in the broad ecosystem context of evaluating both individual and cumulative impacts.

2. **SAMP Goal and Objectives**: The goal of the Special Area Management Plan is to develop a wetlands management plan for the Mill Creek Drainage Basin which results in implementation of a Corps of Engineers regional permit within 2 years.

The objectives of the SAMP are:

a. The SAMP will provide detailed information for resource management and protection.

b. The SAMP will reflect the needs and interests of the federal, state and local regulatory and resource agencies and will contribute to consistency among federal, state and local efforts for wetlands protection and management.

c. The SAMP will ensure that wetland functions and values continue to be equal to or greater than are currently existing in the Mill Creek Drainage Basin.

d. The SAMP process will provide for a balance between wetlands protection and economic development in the Mill Creek Drainage Basin.

e. The SAMP will provide valuable watershed information for the assessment of cumulative impacts.

f. The SAMP will result in greater predictability for both developmental and environmental interests.

g. The SAMP will result in an abbreviated Corps of Engineers permit process for projects meeting certain conditions and located in appropriate areas of the Mill Creek Drainage Basin.

The SAMP for the Mill Creek Drainage Basin will result in three main products with associated benefits:

Product	Benefits
1. Corps of Engineers Regional Permit	Predictability for both developmental and environmental interests. Reduction in permit processing time for projects meeting specified conditions and in specified locations.
2. Wetlands Management Plan	Detailed guidance for use by planning and regulatory entities to assure conformance with local, state, and federal legislation. Assurance that wetlands resources will be maintained and improved. Protection of the health and welfare of local residents. Model planning effort in Washington state.

Product	Benefits
3. Data Base	Substantial information on functions and values for local wetlands resources. Critical information for the assessment of cumulative impacts in urbanized areas.

The SAMP process will result in intermediate products in the form of technical reports and maps.

3. **Study Area**. The Mill Creek Basin SAMP study area includes all areas tributary to the Mill Creek, Mullen Slough, Midway Creek, and Northeast Auburn drainage systems (see Figure 1). Mill Creek is the largest stream within this 22 square mile area, which includes both flat valley bottom and portions of the Federal Way plateau east of Interstate 5. The study area includes portions of unincorporated King County, and portions of the cities of Auburn and Kent.

4. **Need for a Special Area Management Plan for the Mill Creek Drainage Basin**. The Mill Creek Drainage Basin is an environmentally sensitive area under strong development pressure. Numerous quality wetland tracts remain among large vacant areas actively marketed for development. The Mill Creek basin is part of the larger Green River Valley which is rapidly being developed for industrial, commercial, and residential uses. As the area grows, more public improvement projects are also likely for provision of necessary infrastructure. Because of the controversial nature of projects involving filling wetlands, private and public developers may face lengthy permit processes and unpredictable outcomes of those processes. Inconsistencies between the local and Corps regulatory programs also contribute to frustrations for both land use developers and environmental interests. In addition, the ability of local communities to carry out effective growth management strategies has been impacted. Meanwhile, wetlands are being lost to piecemeal development. The SAMP would assure predictability in the Corps permit program within the Mill Creek area as well as ensure wetlands protection and enhancement in appropriate locations within the study area. The SAMP would also ensure that both individual and cumulative impacts of development projects in wetlands in the study area are analyzed. Regional permit development will involve the preparation of environmental impact documentation.

Flooding in the lower Mill Creek Basin occurs nearly every year. King County, Auburn, and Kent, as well as the Soil Conservation Service, are in the process of studying the flooding issues in the basin and recommending drainage facilities to correct the problems. One of the components of the SAMP effort will be wetlands protection and enhancement in appropriate areas. Wetlands protection and enhancement in strategic areas can have very positive effects on flooding problems and related critical functions such as erosion control, pollution control, and ground-water exchange. The local flood control planning efforts and the SAMP are mutually complimentary efforts.

5. **SAMP Criteria**. To have a successful conclusion to the SAMP process, the following criteria should exist: (1) the area to be studied should be environmentally sensitive and under strong developmental pressure; (2) there should be a sponsoring local agency to ensure that the plan fully reflects local needs and interests; (3) there should be full public involvement in the planning and development process; and, very importantly, (4) all parties must express a willingness at the outset to conclude the SAMP process with a definitive regulatory product.

These criteria are met for the Mill Creek SAMP effort. The study area is environmentally sensitive as it contains wetlands in a rapidly urbanizing environment. The portion of the study area within the lower Green River Valley is particularly subject to development pressure. The three local governments whose jurisdictions include the Mill Creek Drainage Basin have indicated their willingness to participate in the SAMP process (see Appendix A). The plan of study addresses a comprehensive public involvement program as described in Task 1. Interagency letters of agreement will be developed, as part of Task 3, to ensure a commitment to participate in development of a regional permit or permits at the conclusion of the SAMP process.

6. **SAMP Plan of Study**. The plan of study will be accomplished through a cooperative effort between the Corps of Engineers and other federal, state, and local agencies. The Corps of Engineers will be the lead federal agency for this effort. The plan of study addresses the following:

a. The work tasks and responsibility for their accomplishment.

b. The cost for the work tasks.

c. The schedule of performance.

Table 1 presents a summary of SAMP costs. Table 2 describes work tasks, ~~responsibility for accomplishment,~~ and the estimated cost of work items for the 24-month SAMP process. Costs listed for local entities are primarily reflective of services in kind. Cash contributions are not a requirement for study participation. Figure 2 illustrates the general schedule of performance required to conduct the SAMP process.

7. **SAMP Project Management Team Members**. The three local governments in whose jurisdiction Mill Creek flows are non-federal sponsors for the Mill Creek SAMP. These are King County and the cities of Kent and Auburn. The local governments will be represented on the SAMP project management team and will contribute funding and/or services to the SAMP effort. In addition to the Corps of Engineers and local sponsors, the U.S. Environmental Protection Agency and the Washington Department of Ecology will be represented on the SAMP project management team and will contribute funding and/or services to the SAMP effort. The agencies' contributions will be determined as part of Study Task 3. Figure 3 depicts the organization of the SAMP project management team.

8. Project Management Coordination. Project management is generally described under Study Task 2. The Corps of Engineers Project Manager (CEPM), from Operations Division, Regulatory Branch, will be responsible for day-to-day project management. The Regulatory Branch Environmental Analyst will provide technical assistance. The SAMP project management team (Figure 3) will consist of technical managers responsible for the technical studies described in the SAMP Plan of Study. There will be technical management teams for such tasks as wetlands, functions and values methodology, GIS coordination, development plans, and management alternatives generation and evaluation. The representatives of the Environmental Protection Agency and Washington Department of Ecology will be responsible for coordinating the participation and input of other federal and state resource agencies in the technical studies.

The CEPM will maintain close formal and informal coordination with the entire project management team to ensure timely implementation of the study and compliance with the plan of study. The CEPM will meet and confer with the appointed project management team on a regular basis throughout the study to discuss study progress. A written record of such discussions will be maintained by the CEPM.

Quarterly study progress reports for SAMP project management team member agencies will be prepared by the CEPM, with appropriate input from the project management team. The reports will identify progress of all work items during the period, as well as document unresolved conflicts or policy issues requiring resolution. The CEPM will be responsible for scheduling and conducting milestone meetings and decision briefings.

The CEPM will be responsible for coordinating reviews of study products. The project management team, under the direction of the CEPM, will monitor and review all work. Project management team review and acceptance of work items, including contracts, will be documented in the quarterly study progress reports.

9. Public Involvement. The SAMP process will include numerous public involvement opportunities, as described in Study Task 1. In addition to the SAMP project management team member agencies, participants will include representatives of other federal, state, and local agencies, the Muckleshoot Indian Tribe, landowners, the development community, environmental organizations, and interested citizens. Public information notices will be sent on a periodic basis to all interested individuals and organizations. Public and agency input will be solicited at public workshops and meetings to be held throughout the SAMP process.

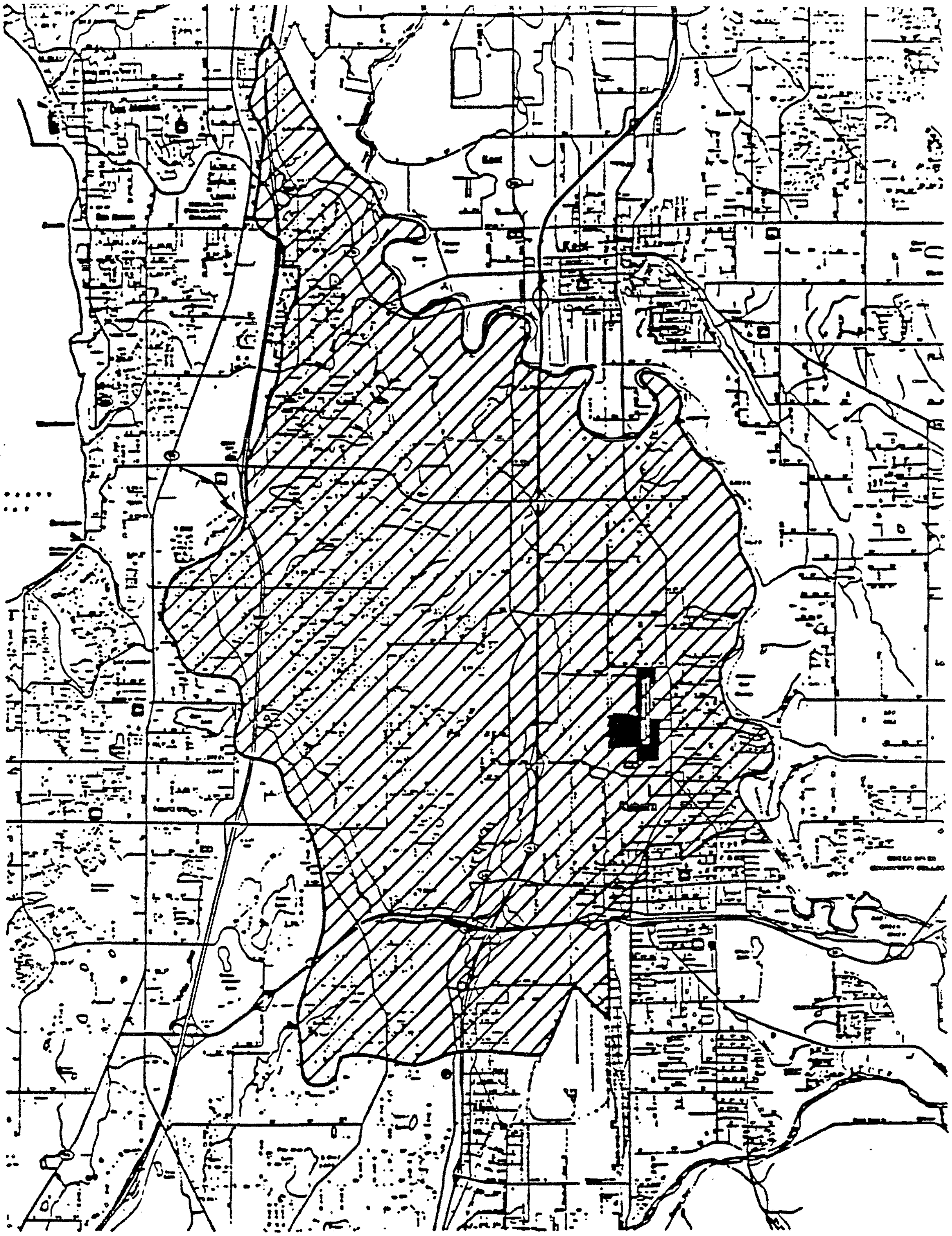


FIGURE 1

MILL CREEK DRAINAGE BASIN AS DEFINED BY THE SPECIAL AREA MANAGEMENT PLAN

0 1 MILE APPROX.

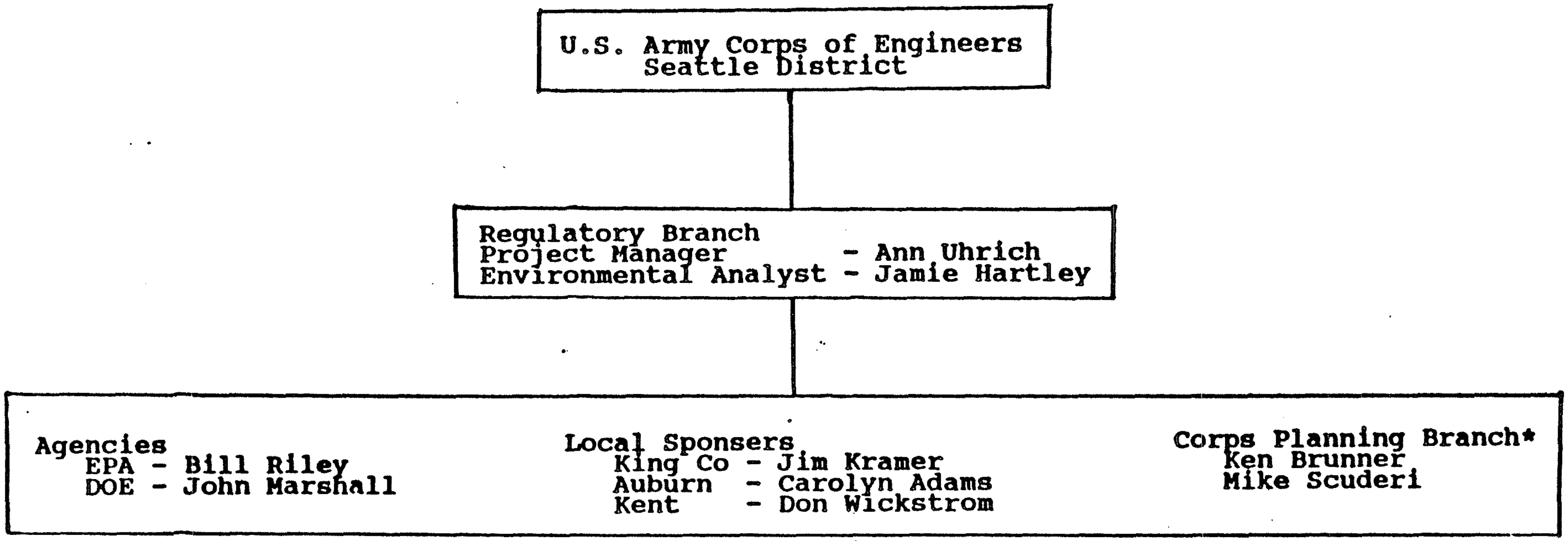
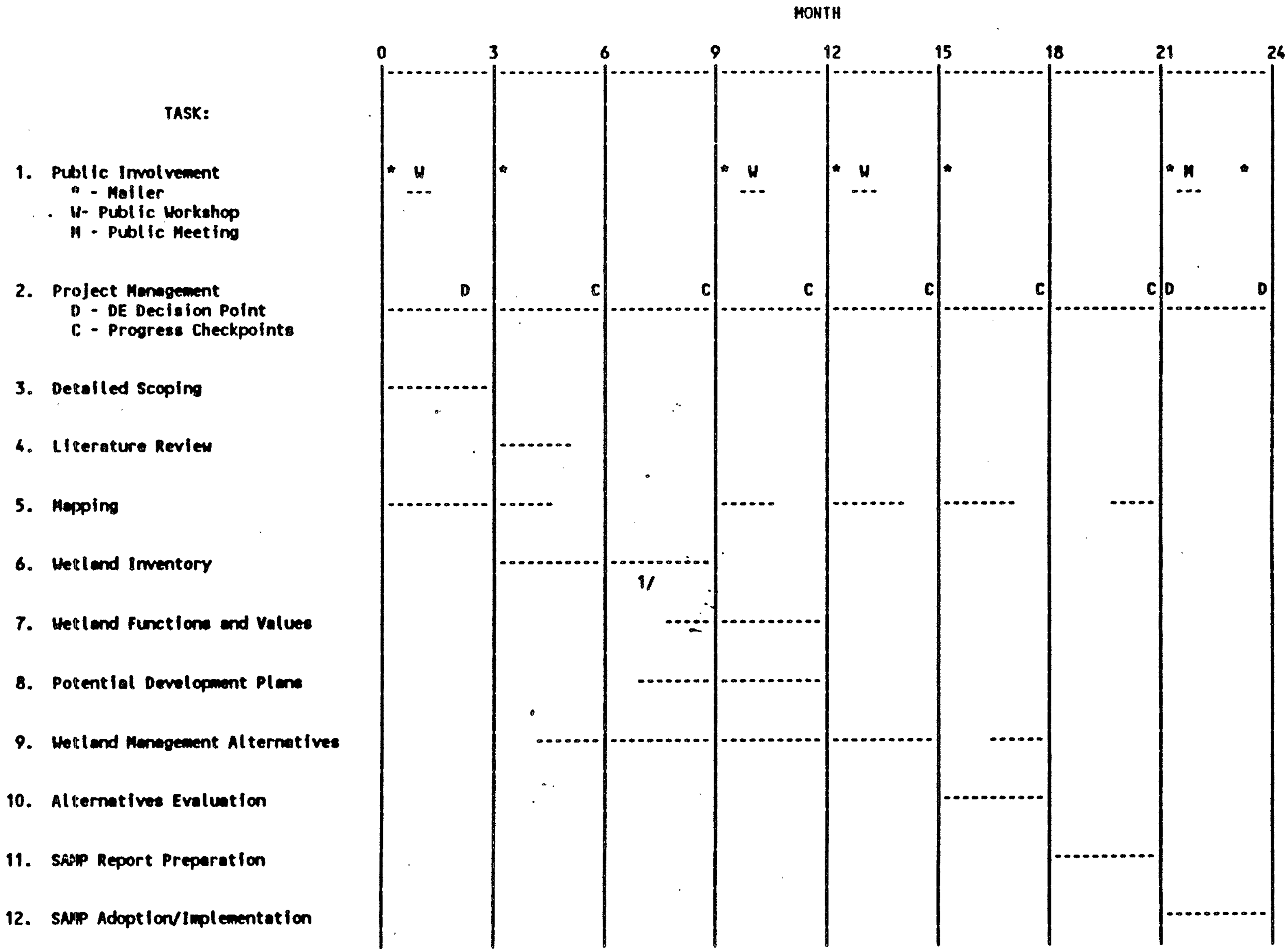


Figure 3. SAMP Concept Project Management Organization

* Tasking to Engineering Division, Planning Branch, will be accomplished in accordance with the Procedural Agreement between Operation and Engineering Divisions for Engineering Support to Civil Works O & M dated 11 April 1988.



1/ May require additional work to accomodate seasonality of vegetation and hydrology.

Figure 2. SAMP Schedule

TABLE 1
Summary Cost Estimate
Mill Creek Drainage Basin Special Area Management Plan

TASK	CORPS OF ENGINEERS	KING COUNTY	KENT	AUBURN	EPA	DOE	OTHER	TOTAL
1. Public Involvement	$5,350	$150	$150	$150				$5,800
2. Project Management	$55,000	$10,000	$10,000	$10,000	$10,000	$10,000		$105,000
3. Detailed Scoping	$5,000	$1,500	$1,500	$1,500	$2,000	$1,500		$13,000
4. Literature Review	$21,000	$1,000	$1,000	$1,000	$1,000	$1,000		$26,000
5. Mapping	$17,670	$2,500	$2,500	$2,500	$44,000	$2,500		$71,670
6. Wetland Inventory	$41,230	$3,500	$3,000	$3,000	$16,000	$11,500		$78,230
7. Wetland Functions and Values	$20,666	$4,666	$4,666	$4,666	$7,947	$6,666		$49,277
8. Potential Development Plans	$1,000	$12,332	$12,332	$12,332	$1,000	$1,000		$39,996
9. Wetland Management Alternatives	$16,000	$3,500	$3,500	$3,500	$8,500	$5,500		$40,500
10. Alternatives Evaluation	$14,500	$3,500	$3,500	$3,500	$6,000	$3,500		$34,500
11. SAMP Report Preparation	$28,000	$3,000	$3,000	$3,000	$10,000	$3,000		$50,000
12. SAMP Adoption/Implementation	$20,000	$500	$500	$500	$500	$500		$22,500
TOTAL	$245,416	$46,148	$45,648	$45,648	$106,947	$46,666	$0	$536,473

Special Area Management Plan
Mill Creek Drainage Basin

18 June 1990

TABLE 2

PLAN OF STUDY TASKS

1. PUBLIC INVOLVEMENT TASK

The public involvement task will be implemented in close coordination with Corps and other agency public affairs offices. The public involvement program will include three public workshops, one formal public meeting at the end of the study period, and seven public information notices to be distributed to agencies, interested organizations, and the general public. Costs shown exclude allowances for associated effort of study management personnel which are covered under Task 2.

a. Prepare and mail initial public information notice to introduce SAMP concept and solicit mailing list input.

b. Develop mailing list.

c. Three Public Workshops. (Subjects: 1. Plan of Study; 2. Assessment of Resource Functions and Values/Basin Development Potential; and 3. Development of Wetlands Management Alternatives.)

(1) Prepare, print, and mail public workshop notices (1 for each workshop), visual aids, handout materials, and coordinate preparation of workshop records.

(2) Arrange for audio-visual and other workshop support, including workshop rooms.

d. Prepare, print, and mail 2 interim public information notices.

e. Public Meeting

(1) Prepare, print, and mail public meeting notice. Public notice will include items listed at Task 12b. Prepare visual aids and handout materials, and coordinate preparation of meeting records.

(2) Arrange audio-visual and other meeting support including meeting room and recording, transcribing and editing of meeting record.

f. Prepare, print and mail final public information notice, advising of regional permit implementation.

2. PROJECT MANAGEMENT TASK

This task includes all activities related to management of the SAMP study. Activities include: assuring conformance with Corps regulatory program rules and policies and the Clean Water Act throughout the SAMP process, preparation of budget submittals, programming and managing study funds, scheduling work tasks within the Corps of Engineers, Seattle District office and between the Corps of Engineers and local government and agency project management team members, conducting coordination meetings, preparing and presenting management briefings and reports, and preparing correspondence pertaining to the study. Also, includes work by Corps of Engineers and sponsors in preparation for public workshops and meeting, developing public involvement materials, and coordinating with other agencies and the general public.

3. DETAILED SCOPING TASK

This task involves preparation of detailed scopes of work for the study tasks and detailed cost estimates, formation of the SAMP technical management teams, development of letters of agreement with local sponsors and agencies, and assignment of task implementation and/or funding responsibilities to participating team members.

4. LITERATURE REVIEW OF AVAILABLE RESOURCE INFORMATION

This task involves reviewing existing information on the natural resources of the Mill Creek Basin:

a. Review history of development and flood control, including land use and hydrologic changes that have occurred since construction of Howard Hanson Dam.

b. Review information on wetland functions and values that has been developed for the Mill Creek study area.

c. Review existing environmental resource information specific to the Mill Creek drainage basin, including hydrology, land use (zoning and regulations), ownerships, fish and wildlife use, endangered species, cultural resources, and other environmental data.

d. Prepare report of findings, including annotated bibliography. Includes typing and reproduction.

5. MAPPING TASK

This task involves developing base maps of the study area, with overlays of the wetland inventory, land use zoning, property ownership, ecological and economic ratings assigned to wetlands, and draft and final SAMP designations. Assume use of existing geographic information system (GIS) for mapping. Assume scale of 1" = 400'.

a. Review existing mapping systems and select methodology.

b. Prepare baseline maps of the study area (consider using King County maps).

c. Prepare overlays:

- wetland inventory
- wetland functions and values
- existing ownership
- existing land uses
- comprehensive plans
- existing zoning
- transportation and utility plans
- water quality plans
- flood control plans
- parks recreation plans
- resource plans
- soils and geology
- flood plains
- fish and wildlife habitat
- alternative management plans
- SAMP final plan

d. Graphics

e. Reproduction

6. WETLAND INVENTORY TASK

This task includes evaluating the applicability of existing and ongoing wetland inventories to Corps methodology, determining the need for new or updated wetland inventories, conducting needed inventory work, and compiling the results in a report.

a. Review wetland inventories that have been completed for areas within the Mill Creek Drainage Basin. Assess their applicability to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands. Determine the need for additional or updated inventories.

b. Obtain rights of entry to properties to be inventoried.

c. Conduct new or updated inventories, Document in report. Includes typing and repoduction.

d. Digitize data for input to GIS.

7. ASSESSMENT OF WETLAND FUNCTIONS AND VALUES TASK.

This task requires selection of an evaluation method that is agreeable to the agencies and local sponsors. The resulting scores from evaluation will be used to categorize wetlands based on their values in performing certain key functions.

a. Select an assessment method agreeable to study management team. Potential methods include one developed by King County and one developed by the COE, a modified version of one of these, or other methods.

b. Conduct assessment of Mill Creek wetlands, incorporating existing information, where applicable. Identify and digitize other pertinent environmental data, including:

(1) Existing and proposed water quality plans.

(2) Boundaries of the Base Flood, from Federal Flood Insurance Rate Maps.

(3) Soils and geology.

(4) "Prime" and "unique" agricultural land, per SCS definitions.

(5) Fish, waterfowl, and wildlife habitat.

(6) Endangered species (plant or animal).

c. Categorize wetlands according to priority beneficial functions, using a system agreeable to agencies and local sponsors.

d. Prepare summary report. Includes typing and reproduction.

8. SUMMARY OF POTENTIAL DEVELOPMENT PLANS TASK

This task includes all work necessary to identify and summarize development potential of all land in the study area.

a. Identify all areas for potential development, including wetlands and upland areas, per existing comprehensive plans and zoning designation of all local sponsors. Digitize for input to GIS.

b. Identify and digitize other pertinent development data, such as:

(1) Existing and proposed flood control plans (SCS, County).

(2) Existing land use.

(3) Flood plains (FEMA).

c. Categorize projected development intensity of areas according to desired use(s), both public and private.

d. Prepare report. Includes typing and reproduction.

9. DEVELOPMENT OF WETLAND MANAGEMENT ALTERNATIVES TASK

This task includes all work necessary to formulate wetland management alternatives for the study area that are ecologically sound.

a. Conduct literature review of wetland management approaches. Focus on literature relating to wetlands of the Pacific Northwest.

(1) Define terminology (e.g., wetland management strategy, mitigation).

(2) Review literature on wetlands management strategies.

(3) Prepare report, including an annotated bibliography. Includes typing and reproduction.

b. Evaluate success of wetland management strategies that have been or are being used. Focus on what has worked best for the type of wetlands found in the Mill Creek Area. Conduct site visits, case reviews, and interviews with experts, as appropriate.

c. Develop wetland management alternatives.

(1) Outline the ingredients of an ecologically sound wetland management strategy for use as a framework in development of alternatives.

(2) Summarize potential alternative strategies resulting from subtasks b., c., and d. These may consist of varying combinations of enhancement, creation, consolidation, relocation, mitigation of the wetland area itself, mitigation banking, wetland protection guidelines such as buffer zones, and monitoring and contingency plans.

d. Using GIS or other method, overlay results of Tasks 7 and 8 to identify areas of accord or conflict. Formulate wetland management alternatives for the Mill Creek study area, incorporating the results of Tasks 7, 8, and 9.

e. Prepare text documentation of the wetlands management alternatives and supporting graphics. Includes typing and reproduction.

f. Provide technical input to alternatives' modification as part of Task 10.

10. ALTERNATIVES EVALUATION TASK

This task includes all work necessary to perform the alternatives evaluation and select a preferred alternative(s).

a. Review existing guidelines for evaluation criteria, such as Sensitive Area Ordinances, Draft State Wetlands Guidelines, etc.

b. Formulate evaluation criteria (environmental, economic/developmental, cultural, social, engineering), drawing on the results of the previous tasks.

c. Compare the alternatives, including no action, to the criteria.

d. Document evaluation through the use of a matrix.

e. Make a preliminary evaluation of the impacts of each alternative for inclusion in the matrix.

f. Develop final array of alternatives. Repeat evaluation against criteria step until a preferred wetland management alternative is selected.

g. Document the alternatives analysis in report. Includes typing and reproduction.

11. SAMP REPORT PREPARATION TASK

This task includes assembling, writing, editing, drafting, reviewing, revising, reproducing and distributing study reports such as the draft and final Special Area Management Plan and other related documentation.

a. Prepare and draft Special Area Management Plan report and draft environmental assessment (EA). Includes typing, printing and reproduction.

b. Corps and Agency review.

c. Revise draft SAMP report and EA as needed. Includes typing, printing, and reproduction.

d. Public review of draft SAMP and EA.

e. Prepare final Special Area Management Plan and EA, incorporating public comments into final reports. Includes typing, printing and reproduction. Submit final reports to agency executives.

12. SAMP ADOPTION/REGIONAL PERMIT IMPLEMENTATION TASK

This task involves implementing the final SAMP and a regional permit.

a. Corps take discretionary authority over nationwide permit 26 for the Mill Creek Drainage Basin study area.

b. Develop regional permit for implementing the SAMP. Prepare draft regional permit, draft EA, and text of public notice. Public notice will include a summary of the SAMP, a notice of availability of the SAMP documentation, a notice that nationwide permit 26 will not apply within the SAMP study area, the draft regional permit, and an invitation to public meeting (see Task 1, item e).

c. Based on comments received, complete EA, prepare Finding of No Significant Impact and permit decision document (assume EIS not prepared). Includes typing and reproduction.

d. Issue regional permit (Public notice of regional permit implementation addressed in Task 1, item f).

MILL CREEK SAMP GOALS

1. Achieve a balance between Wetland Protection and Reasonable Economic Development in the Mill Creek watershed

2. Assure no net loss of wetland functions and values for the Mill Creek watershed.

3. Reestablish an interconnected system of wetlands and other habitats centered on the Mill Creek corridor.

4. Provide adequate flood storage in the watershed

5. Improve water quality in Mill Creek

6. Direct development to isolated and/or ecologically lower value wetlands in the watershed

MILL CREEK SAMP GOALS (Continued)

7. Provide predictability and consistency in the permitting process

8. Integrate wetland planning and management at the Federal, State and Local levels

9. Provide relief to wetland property owners

10. Increase public recreational (passive) and educational opportunities for watershed wetlands

11. Secure funding for outright acquisition of critical wetland tracts

12. Provide for long term maintenance and management of watershed wetlands

MILL CREEK SAMP PROCESS

WETLAND INVENTORY

ASSESS WETLAND FUNCTIONS AND VALUES

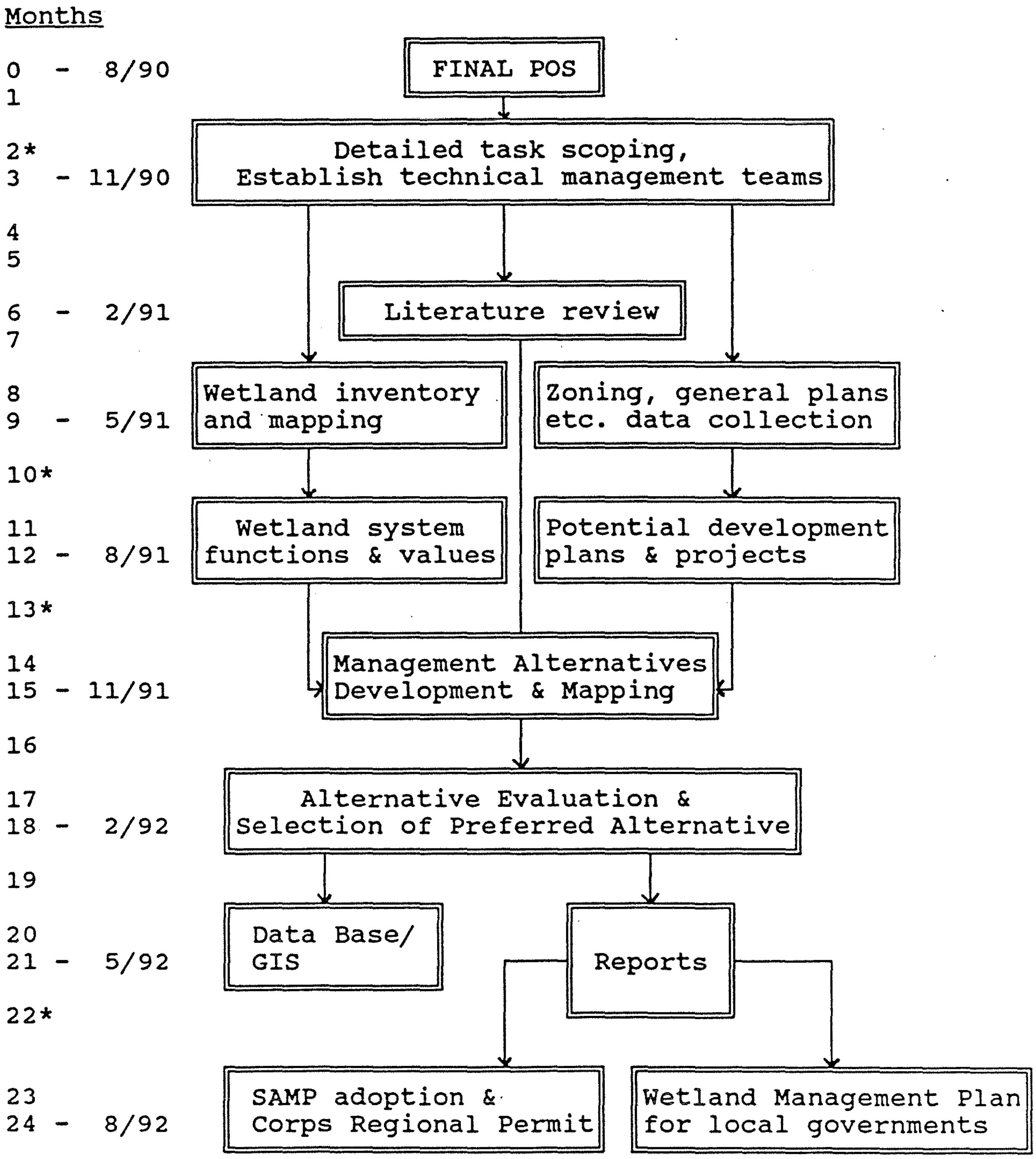
- WET
- WASHINGTON STATE ECOLOGY RATING SYSTEM
- IVA

ASSESS DEVELOPMENT POTENTIAL

PLAN DEVELOPMENT

- PARTICIPANTS
  - AGENCY ALTERNATIVES COMMITTEE
  - CITIZEN'S ADVISORY GROUP
- ACTIONS
  - PLAN DEVELOPMENT
  - POLICY DEVELOPMENT

MILL CREEK SAMP SUMMARY FLOW CHART



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* Public workshops/meetings

MILL CREEK SAMP
LESSONS LEARNED

Don't judge a wetland by its cover. (i.e. No wetland, no matter how bad it looks is necessarily "low value.")

Be prepared to compromise.

Corollary – Maintaining the status quo means wetlands lose

If you don't buy it, don't assume the existing regulations will protect it.

Wetlands and development can and have to coexist in an urban environment.

Given incentives, even developers can protect wetlands.

Prepare a restoration plan up front which agencies can use for permit decisions while a management plan is being prepared

Most likely you can't go back to what was there before

MILL CREEK SAMP
LESSONS LEARNED (Continued)

You can't please everyone. Listen to everyone and follow procedure

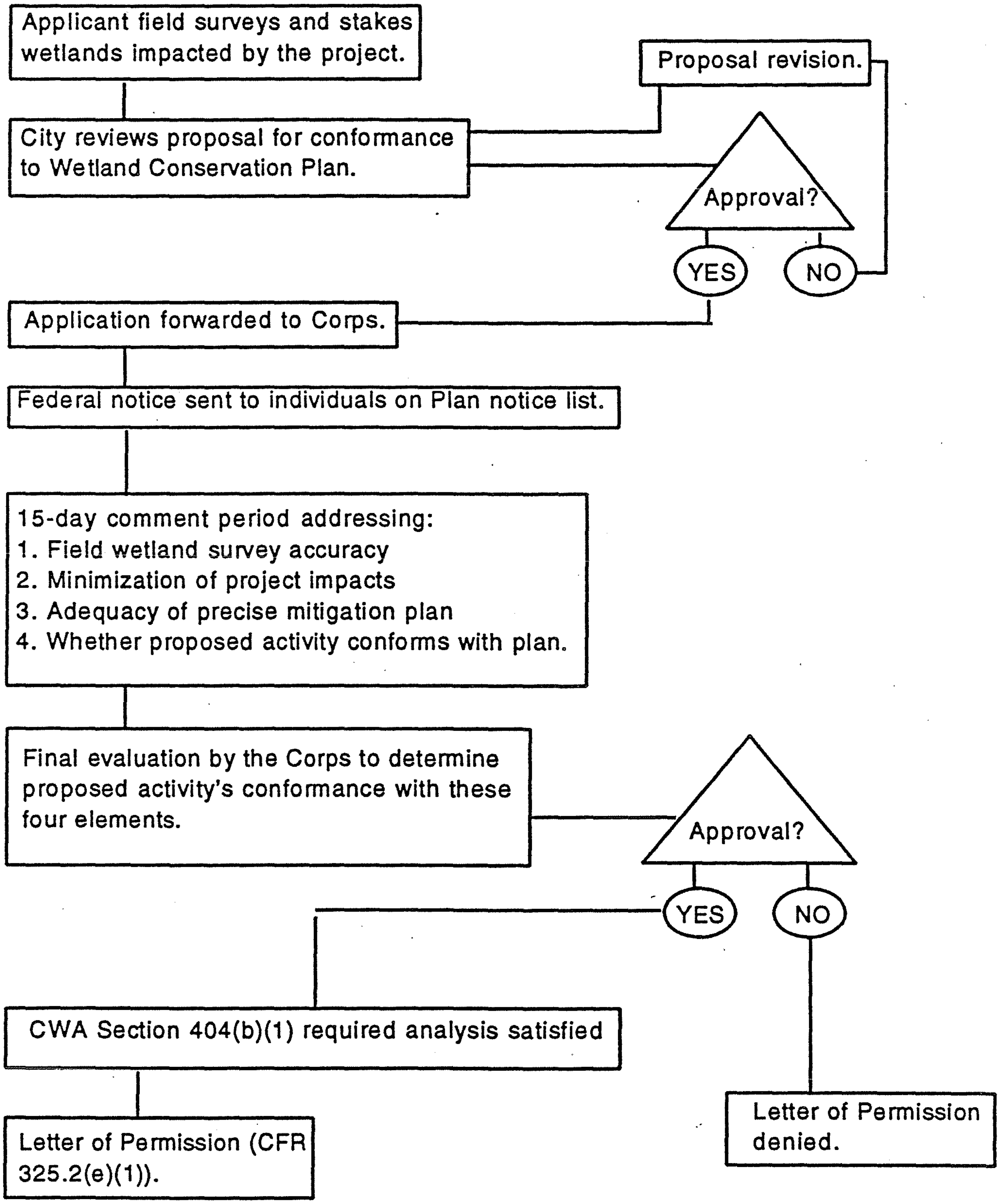
Emphasize citizen participation

Dedicate at least one full time person to work on the management plan

Secure long-term commitments and financing early

Get political officials involved early in the process

Newton Creek Letter of Permission Process



Columbia South Shore Permit Process

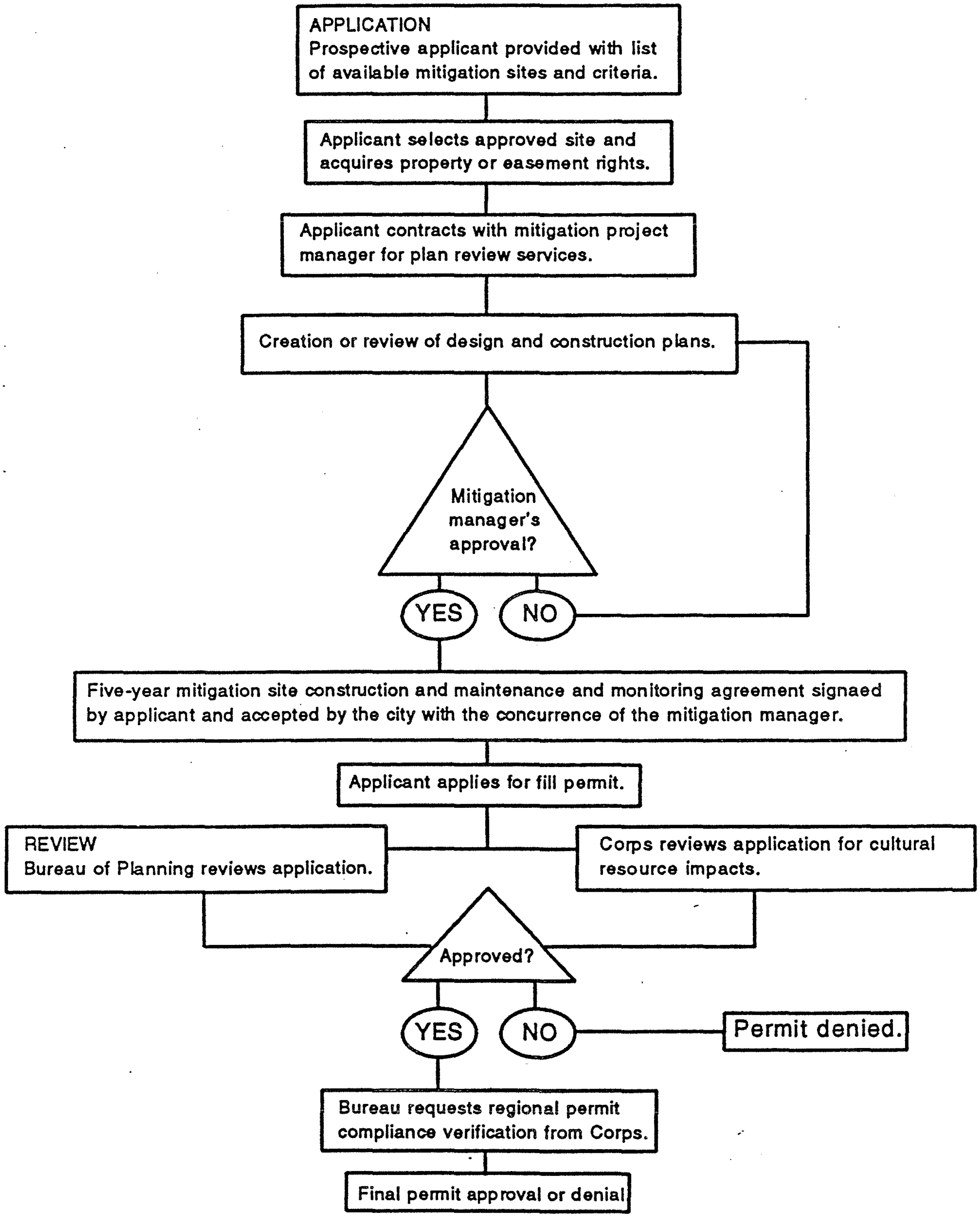
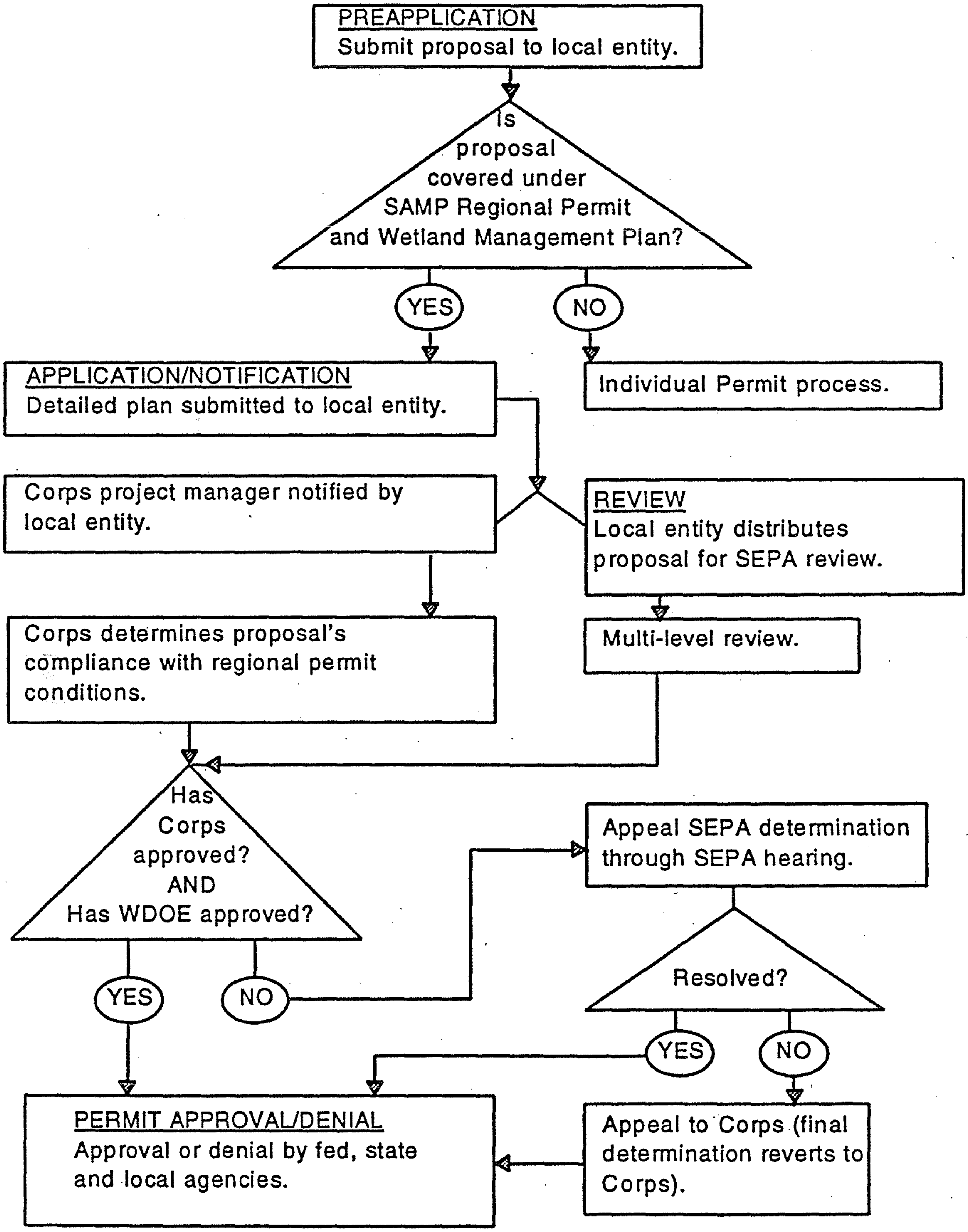


Figure...: Mill Creek SAMP Permit Process



F

APPENDIX F: Examples of Special Conditions from Corps of Engineers 404 Permits[1]

For engineering drawings:

- Engineering drawings consisting of a plan view at 1 inch equals 100 feet, with 1- or 2-foot contour intervals, coupled with representative cross sectional views, shall be submitted showing pre- and post-construction features of the ____(project)____.

For topdressing (to promote revegetation):

- The upper 12 inches of soil from the authorized fill area shall be scalped and stockpiled at an upland location for subsequent use as topdressing for the mitigation site.

- The mitigation site shall be excavated one foot below final grade elevation. Soil scalped and stockpiled as described above shall be spread as a 12-inch thick topdressing to bring the mitigation site to final grade.

- Final site preparation for seeding/planting shall consist of tilling using a chisel plow.

For corrective measures:

- The permittee shall assume all liability for accomplishing corrective work should the District Engineer determine that the compensatory mitigation has not been fully satisfactory. Remedial work may include regrading and/or replanting the mitigation site. This responsibility shall extend for a period of _____ years beginning upon completion of the mitigation work.

For deed restrictions:

- Perpetual deed restrictions shall be placed on the mitigation site to guarantee its preservation for wetland and wildlife resources. The required legal description shall be determined by a registered land surveyor. A certified copy of the deed restriction recorded by the Registrar of Deeds for _________ County shall be provided to the Corps by _____________.

For monitoring:

- The permittee shall submit _____ annual reports on the status of the mitigation site (NOTE: schedules other than annual reporting can be used). The first report is due on December 31st after the first growing season following completion of the mitigation work, and

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[1]Excerpted from: Eggers, Steve D. 1992, February. *Compensatory wetland mitigation: some problems and suggestions for corrective measures.* U.S. Army Corps of Engineers, St. Paul District.

subsequent reports shall be submitted on or before December 31st of the following ____ years. These reports shall include the following at a minimum:

a. All plant species, along with their estimated relative frequency and percent cover, shall be identified by using plots measuring 10 feet by 10 feet with at least one representative plot located in each of the habitat types within the mitigation site. The location of each plot shall be identified on the plan view engineering drawing.

b. Vegetation cover maps, at a scale of one inch equals 100 feet, or larger scale, shall be prepared for each growing season.

c. Photographs showing all representative areas of the mitigation site shall be taken at least once each year during the period between July 1 and September 30.

d. Surface water and groundwater elevations in representative areas shall be recorded twice a month during April through October of each year. The location of each monitoring well or gage shall be shown on the plan view engineering drawing.

e. The permittee shall define a reference wetland to be used for monitoring the success or failure of the mitigation plan. The reference wetland shall be approved by the District Engineer and shall not be subject to any alterations during the _____-year monitoring period. Baseline data concerning vegetation, water quality, wildlife use, soils, etc., shall be provided to the District Engineer. The proposed project is not authorized until the District Engineer determines that the baseline data submitted is satisfactory.

G

APPENDIX G: List of Feedback Workshops and Attendees

Feedback Workshops were held in Anchorage on January 28, 1994, and in Juneau on February 14, 1994. Participants included:

Anchorage (1/28/94)
Chuck Degnan, Bering Straits CRSA
Amelia Woods, NW Arctic Borough
Jim Glaspell, Consultant
Tina Anderson, Aleutians East Borough
Linda Freed, Kodiak Island Borough
Darcy Richards, Aleutians West CRSA
Thede Tobish, Municipality of Anchoarge
Lloyd Fanter, COE
Mary Lee Plumb-Mentjes, COE
Barbara Mahoney, NMFS
Laurie Fairchild, FWS
Glenn Seaman, ADF&G
Betsy Parry, ADF&G

Juneau (2/14/94)
Jan Caulfield, City and Borough of Juneau
Janet Schempf, ADF&G
Mary Bixby, DGC
K Koski, Auke Bay Lab, NMFS
John Thedinga, Auke Bay Lab, NMFS
Duane Peterson, NMFS Regional Office
Ed Grossman, FWS
Van Sundberg, ADOT/PF
Neil Babik, U.S. Forest Service
Drew Grant, DEC, Water Quality
Glenn Seaman, ADF&G
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In addition, approximately 25 representatives of ADF&G and U.S. Fish and Wildlife Service attended an in-house workshop at the Anchorage ADF&G office on February 10, 1994, and provided valuable feedback.

Additional input from coastal district representatives was obtained during open discussions at the Annual Alaska Coastal Management Program Conference held in Juneau, April 13-14, 1994.

Other consultations with coastal district and agency staff were held by teleconference or in person in smaller meetings. Several coastal district staff commented on draft copies of chapters 3 and 4 of this report.

H

APPENDIX H: Possible Required Permits for Aquatic Habitat Restoration or Enhancement Activities on Private, Municipal, or State-owned Property[1]

If a restoration or enhancement activity is to be conducted for the purpose of mitigation, and is located at the same location as the development activity, it is possible that many required authorizations could be granted at the same time as the original development permits. This does not often happen, however, because the applicant rarely has sufficient detail available for the mitigation project to enable the two activities to be reviewed and approved together. It is also possible that subsequent authorization of the mitigation activity could be approved as a modification of the original permit, rather than through an entirely separate permitting process. Separate permitting would be required for a project that is not undertaken for immediate mitigation purposes, but purely for the cause of habitat restoration or enhancement.

1. U.S. Army Corps of Engineers (COE) permit authorizations may include:

   a. A Section 404 permit for placement of fill in waters of the United States, including wetlands, or;
   b. A Section 10 permit if a restoration structure is proposed within a navigable waterway.
   c. Nationwide permit #27 (NW 27) provides for an optional approval process for non-tidal wetland restoration activities that may avoid the lengthy individual 404 permit review (i.e., #a above). NW 27 applies to wetland restoration or creation projects on private lands if conducted in accordance with the terms and conditions of a binding wetland restoration or creation agreement between the landowner and either the U.S. Fish and Wildlife Service (FWS) or the Soil Conservation Service (SCS). (NW 27 also applies to certain activities on federally-owned lands, which are not dealt with here.) Such activities may include: installing and maintaining water control structures or berms, removing existing drainage structures, constructing small nesting islands, etc. This nationwide permit applies to restoration projects that serve the purpose of restoring "natural" wetland hydrology, vegetation, and function to altered and degraded non-tidal wetlands and "natural" functions of riparian areas.

2. A state Coastal Consistency Review may be required if **both** of the following conditions are true:

   a. The property is located in the coastal zone (or may affect the coastal zone); **and**
   b. At least one federal permit or more than one state permit will be required for the proposal. If only one state permit is required, the applicant does not follow this coordinated review process but applies directly to that state agency (called a "single agency review").

[1]Special considerations of projects located on lands owned by the various federal agencies are not addressed here.

The Coastal Consistency Review process is conducted through the Alaska Division of Governmental Coordination (DGC). An applicant should first fill out a Coastal Project Questionnaire from DGC to determine whether a coordinated or single agency review is necessary. If the proposal is subject to a coordinated review, the next step may be a pre-application meeting to discuss the project with the commenting agencies before DGC's review period begins. This pre-application meeting may bring out the concerns of the commenting agencies, clarify project specifics, and avoid many delays during the consistency review. DGC's Coastal Consistency Reviews usually take from 30-50 days, but may be longer if one of the agencies must publish a public notice (depending on the particulars of the proposal) before the coordinated review may begin. Consistency reviews may contain permit authorizations from various state agencies and federal agencies, as well as comments and/or approvals from the area's coastal district (see #3 below).

DGC also has a list of authorizations (A, B, C List) for certain routine activities that have already been found consistent with the state's coastal management program. A full review may not be required for these listed activities.

3. Either as a part of a coordinated Coastal Consistency Review (discussed above), or on an individual basis (e.g., if a project is not in the state's coastal zone), an aquatic habitat restoration or enhancement project may possibly be subject to the following authorizations:

   a. Federal permit authorizations such as the Army Corps of Engineers (see #1 above), the Environmental Protection Agency, Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, etc.

   b. State permits such as:
      Alaska Department of Environmental Conservation (DEC) 401 Water Quality Certification
      DEC Wastewater Permit
      Alaska Department of Natural Resources (DNR) Water Rights Permit
      DNR Temporary Water Use Permit
      DNR Material Sales Permit
      DNR State Historical Preservation Office Review
      Alaska Department of Fish & Game (ADF&G) Fish Habitat Permit
      ADF&G Special Area Permit

   c. If applicable for the project area, local municipal or planning and zoning authorizations (e.g., flood plain permits), and/or approval from the local coastal district.