APPENDIX E

INSTREAM FLOW RECOMMENDATIONS
SUSITNA AREA PLAN

Prepared by
Phyllis K. Weber, Habitat Biologist
Durand R. Cook, Habitat Biologist

Alaska Department of Fish and Game
Habitat Division
333 Raspberry Road
Anchorage, Alaska 99502

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INTRODUCTION

The 1980 Alaska State Legislature passed an amendment to the Water Use Act (AS 46.15.145) which allows reservation of water to protect fish and wildlife habitat, migration and propagation, for recreation and parks, for navigation and transportation, and for sanitary and water quality purposes. The Alaska Department of Fish and Game believes that the maintenance of fish and wildlife and their habitats are among the highest priority water uses in the Susitna basin.

The survival of anadromous and resident fish species within the Susitna basin depends not only upon identifying and protecting streams important for spawning and migration and managing fish populations wisely, but also upon insuring the availability of adequate seasonal water supplies within these streams. Seasonal water supplies, or instream flows, are a primary component of habitats used for spawning, incubation, rearing, overwintering, and passage of fish. The maintenance of instream flows assures that there will be enough water for fish to migrate to spawning areas, that eggs will not become desiccated and that rearing areas will remain wetted and accessible to juvenile fish seasonally. Winter water levels may be especially important to salmonid eggs and rearing fish. Seasonal flow regimes are also integral to determining the habitats of other aquatic and terrestrial biota.

The following discussion is presented to provide land-use planners with an understanding of the significant impacts associated with alterations of instream flows, and to recommend basic guidelines for maintaining the instream flows required by fish and wildlife.

This discussion is primarily limited to lotic (flowing water) environments and their relationship to fish. However, all hydrologic systems, including groundwater and precipitation, are interrelated. Changes in any component of the hydrologic cycle may affect other components directly and in subtle and indirect ways.

INSTREAM FLOW EFFECTS

Historical records of stream flows in the Susitna basin are generally nonexistent or of insufficient duration to predict long-term flow patterns. In addition, data on instream flow requirements of specific stocks of Alaskan fishes are also incomplete. Careful management of instream flows is essential for preserving, maintaining, or enhancing freshwater and anadromous fisheries, other aquatic and riparian wildlife, and instream flow uses such as navigation. If instream flow dependent resources in the Susitna basin are to be preserved, management decisions must consider seasonal fish and wildlife instream flow requirements, even if these requirements have not yet been specifically quantified.

Physical and biological parameters influenced by instream flows, and the consequences resulting from seasonal flow modifications are described below.

Effects of Instream Flows on Physical Parameters

Physical parameters which influence aquatic environments are: flow regime (volume, velocity, and temporal variation of flows), channel morphology (size, shape, gradient, and geologic material of channel), water quality (temperature, turbidity, dissolved gases and salts, etc.), and stream load (bed and suspended loads). Each of these factors is strongly controlled by the flow levels in a stream.

Because hydrologic systems maintain a state of dynamic equilibrium, change in any one of these factors will usually result in changes in the other parameters. For example, watershed alterations such as land clearing can increase erosion and consequently increase the amount of sediment entering a particular stream. If there is too much material entering the channel to remain suspended, sediments begin to deposit. Over time, this deposition results in changes to the channel slope and stream velocity. Eventually channel slope will decrease until the streamflow velocity is just high enough to transport the amount of material entering the stream, and an equilibrium will be reached.

Alterations in instream flows resulting from impoundments, diversions, channelizations or withdrawals also cause changes in stream equilibrium. There may be substantial changes in flow regime, channel shape, wetted area, substrate characteristics or water quality as the stream moves toward equilibrium. Moreover, these changes may affect areas far downstream from the original disturbance. Disturbances such as channelizations and impoundments may also cause stream readjustments upstream and downstream from the disturbance.

The complexity of the physical interactions is compounded by natural fluctuation in flows with season and climate. As a result, changes produced by alterations in lotic systems stem from both the amount of modification (e.g., volume of flow withdrawal or alteration) and from the timing of the modification in relation to normal seasonal flow fluctuations. For example, certain periodic high flows (e.g., bankfull discharge) are responsible for maintaining channel morphology by flushing sediments or transporting bed load. Reduction, elimination, or rescheduling of regular high flows (e.g., during flood control) can have serious consequences on channel characteristics. On the other hand, during some high flows it is possible to withdraw water for human consumption, storage or industrial use with only minor effects to the stream system. During low flows, withdrawals represent a larger proportion of available instream flow and are more difficult to manage without inducing adverse changes to the stream environment. The complexity of these possible interactions, and effects of modifying them, must be considered on both a seasonal and cumulative basis for specific waterways.

Effects of Instream Flows on Biological Parameters

Although this discussion emphasizes effects on fisheries, instream flows also affect other aquatic organisms and the riparian and terrestrial wildlife associated with the lotic environment. For example, flow regimes influence the succession of riparian vegetation, access of predators to waterfowl nesting on islands, and the availability of food and cover for furbearers such as beaver, river otter and muskrat.

Modifications of instream flows, and the associated change to the physical environment, may have very significant effects to the fisheries resources. Specifically, streamflow modifications may cause changes to spawning, incubation, rearing, overwintering, and passage habitats. For example, decreased flows may prevent upstream or downstream passage of fish and may reduce the quantity or extent of spawning and rearing habitats. Reduced flows may also lead to silt deposition and reduced oxygen levels in spawning gravels, and therefore, cause suffocation of incubating eggs, pre-emergent fry and other aquatic organisms. Increased flows may wash away spawning gravel or destroy sheltering areas. Both decreases and increases in flows may alter stream productivity and thus modify food availability in rearing and overwintering habitats.

Alterations in flow regimes may also affect the seasonal behavior of fish species. Hynes[1] presents the following examples of the important interrelationships among seasonal flow regimes, fish movements, and human alterations of the lotic environment:

> Most fish are stimulated to move by rising water, and when the movement is to be upstream this enables them to pass over riffles with greater safety, because the increased width at such points spreads out the discharge and provides zones of slower water which are nevertheless deep enough to swim through.
>
> Descending fish, such as smolts..., are also stimulated to move by rising water... Under normal circumstances, descending fish readily overcome obstacles, and the cushioning of the water prevents damage at falls, or at any rate at falls which are small enough for them or their parents to have ascended... This presents no problems in a natural stream, but where man has erected dams the habit leads them not over the fall, but to the bottom of the upper edge of the dam, where they tend to become held up.

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[1] Hynes H.B.N. 1970. The Ecology of Running Waters. University of Toronto Press. 555p.

The complex interrelationships between instream flows and seasonal fish behavior are compounded by the seasonal flow requirements of a particular species. For example, returning salmon may need 30-50 percent of the mean annual flow to ascend the lower and middle reaches of a river system, and even more flow to ascend the headwaters (Hynes[2]). The preservation of fisheries resources requires that certain volumes of instream flow be maintained and that specific flows be available at particular times of the year. Tennant[3] provides a valuable discussion of the "instantaneous flow" percentages of average annual streamflow required to maintain particular levels of aquatic resources. He suggests that stream degradation begins with the first reduction in flow, and not after an arbitrary minimum flow level has been reached. Orsborn and Estes[4] discuss the limitations of and procedures for applying non-field methodologies such as the Montana Method to streams in Alaska and other states. Ott and Tarbox[5] provide a general literature review of methods to assess instream flows in Alaska.

INSTREAM FLOW RECOMMENDATIONS

Protection of fisheries resources and other aquatic resources in the Susitna basin requires that seasonal resource-maintenance flows be defined, established, and legally reserved.

The Alaska Department of Fish and Game recommends that decisions to permit alterations of natural instream flows for a particular project must be based on review of the following information by both fish and wildlife biologists and an instream flow hydrologist:

1. physical effects of seasonal flow alterations;
2. biological effects of seasonal flow alterations;
3. seasonal variation in physical and biological effects;
4. loss of opportunities to realize alternative flow benefits (e.g., navigation, recreation, socioeconomics, aesthetics, etc.); and
5. ability to mitigate effects of altered flow regimes.

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[2] ibid

[3] Tennant, D.L.1975. Instream Flow Regimes for Fish, Wildlife, Recreation and Related Environmental Resources. U.S. Fish and Wildlife Service, Billings, Montana.

[4] Orsborn, J.F., C. Estes 1981. Alaska Department of Fish and Game. Unpublished Report.

[5] Ott, A.G., and K.E. Tarbox. 1977. "Instream Flow" Applicability of Existing Methodologies for Alaska Waters. Woodward-Clyde Consultants, Anchorage, Alaska, 70 pp.

When the above data are not available, it will be necessary to determine whether or not:

1. to apply non-field techniques (e.g., Tennant's Montana Method), to evaluate effects of flow alterations, or

2. to initiate habitat preference and instream flow field assessments.

Specific instream flows will not be recommended at this time because flow data within the Susitna basin are minimal or non-existent on most of the streams identified. Alaska Department of Fish and Game proposes the postponement of any water withdrawals which will cause loss of fish or wildlife habitat until studies have been conducted to determine the extent of habitat loss and to propose acceptable mitigation measures. This condition should apply except where water is being appropriated for municipal or domestic use. Investigations are needed to determine flow regimes and the effects of reduced flows on fish and wildlife habitat.

Criteria for Stream Recommendations and Instream Flow Considerations

Specific waterbodies in the Susitna basin were identified as being important for reservations of water to maintain the instream flow and aquatic habitat values.

These areas were considered and selected based on the following criteria: fisheries and wildlife values, unique habitat characteristics and their potential for recreational use. Streams were defined as important for fisheries if escapements were greater than 1,000 for sockeye, coho, pink and chum salmon combined or greater than 500 for chinook salmon (Table 1). Each identified waterbody significantly contributes to the returning salmon population used for commercial harvest, recreation and continued propagation of salmon. Table 2 lists sport fishing effort days for select streams within the Susitna Area Plan. Harvest information was obtained from the Statewide Harvest Study for 1979 and 1980, and from a Sport Fishing Location, Access, and Effort Map, Alaska Department of Fish and Game, Sport Fish Division 1983.

Proposed Guidelines to Protect Instream Flows

Except for domestic use, the maintenance of fish stocks is the highest priority water use in the study area. It is the Alaska Department of Fish and Game's goal to:

1. maintain the historic levels of productivity of fish and wildlife populations and the carrying capacity of their natural habitats and

2. provide for optimum commercial, recreational, and subsistence use of fish and wildlife populations through conservation and management.

The following recommendations are based upon general habitat and land management practices. These issues need to be addressed if the productivity

TABLE 1(a). Salmon Escapement/Harvest Data for Susitna Area Plan Systems Upper Cook Inlet West Side Systems

Area	Year	Chinook	Sockeye	Coho	Chum	Pink	Reference
Beluga River	1980			520(E)		1,500(E)	CIAA
Bishop Creek	1977	468(E)					CIAA
Coal Creek	1972		1,250(E)				CIAA
	1978	1,551(E)	2,313(E)				CIAA
Coal Creek Lake	1972		1,700(E)				CIAA
	1981		1,100(E)				CIAA
Drill Creek	1980	1,000(E)				5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Olson Creek	1977	1,229(E)					CIAA
Pretty Creek	1980					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Scarp Creek	*	1,000(E)					Per.Comm. 1983 Div. of SF/ADF&G
West Fork	*		1,000(E)				Per.Comm. 1983 Div. of SF/ADF&G
Chakachatna River	1982	1,300(E)	1,000(E)	1,000(E)	500(E)		Per.Comm. 1983 Div. of SF/ADF&G
Noaukta Slough	1981		5,000(E)				Per.Comm. 1983 Div. of SF/ADF&G
Straight Creek	1981		3,000(E)				WWC
	*					5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Tributary to Straight Creek	1982	1,300(E)	3,000(E)			5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Chuitna River	1976-79	1,130-1,984(E)					DE
	*			1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
BHW Creek	1982	285(E)		1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
Chuit Creek	1982	1,000(E)		1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
Lone Creek	*			5,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
	1982	548(E)					
Middle Creek	1982	150(E)		1,500(E)			Per.Comm. 1983 Div. of SF/ADF&G
Wolverine Fork	1982			1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
Lewis River	1978, 1979, 1981	546-560(E)					CIAA
	*			1,000(E)		5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Nikolai Creek	*			500(E)		10,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
	1982	500(E)					Per.Comm. 1983 Div. of SF/ADF&G
Theodore River	1976-79, 1981	512-2,263(E)					CIAA
	*			1,000(E)		5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Threemile Creek	*		1,000(E)	1,000(E)		5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G

Legend A
DOWL Engineers (DE)
Cook Inlet Aquaculture Association (CIAA)
Woodward-Clyde (WWC)
Personal Communication, Division of Sport Fish, Alaska Department of Fish and Game
Escapement data (E)
Harvest data (H)

NOTE: Escapement and harvest data do not necessarily estimate the total stream escapement.

*Escapement estimates from several years of observation

TABLE 1(b). Salmon Escapement/Harvest Data for Yentna River Drainage

Area	Year	Chinook	Sockeye	Coho	Chum	Pink	References
Bear Creek	*	100(E)				5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Cache Creek	1983	500(E)					Per.Comm. 1983 Div. of SF/ADF&G
Clearwater Creek	*	100(E)				5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Contact Creek	*	100(E)				1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Canyon Creek	1983	575(E)					Per.Comm. 1983 Div. of SF/ADF&G
Donkey Creek	*	100(E)	1,000(E)			5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Eightmile Creek	1982			1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
	1983	250(E)					Per.Comm. 1983 Div. of SF/ADF&G
Fish Creek	1982			1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
Happy River	1983	500(E)					Per.Comm. 1983 Div. of SF/ADF&G
Puntella Lake	1977		2,100(E)				Stream Survey Data ADF&G
	1978		1,105(E)				Stream Survey Data ADF&G
Hewitt Lake	1976, 1978, 1980		1,200-2,017(E)				Stream Survey Data ADF&G
Hewitt & Whiskey Lake	1981		9,850(E)				Stream Survey Data ADF&G
Huckleberry Creek	1980	1,750(E)					Stream Survey Data ADF&G
Hungryman Creek	*	100(E)	5,000(E)				Per.Comm. 1983 Div. of SF/ADF&G
Kichatna	*	1,000(E)	10,000(E)			10,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Nakochna River	*					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Lake Creek	1976-79	3,735-8,931(E)					Stream Survey Data ADF&G
		6,000(E)	5,000(E)	2,500(E)	15,000(E)	500,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Camp Creek	1983	1,000(E)					Per.Comm. 1983 Div. of SF/ADF&G
Chelatna Lake	1980		4,120(E)				Stream Survey Data ADF&G
	1981		14,900(E)				Stream Survey Data ADF&G
Home Creek	1982	500(E)					Per.Comm. 1983 Div. of SF/ADF&G
Sunflower	1983	1,000(E)					Per.Comm. 1983 Div. of SF/ADF&G
unnamed tributary	1980					500(E)	Per.Comm. 1983 Div. of SF/ADF&G
(T.25N., R.10W., SM)	1983	250(E)		250(E)			Per.Comm. 1983 Div. of SF/ADF&G
Yenlo Creek	1977	1,061(E)					Stream Survey Data ADF&G
	1982			500(E)		2,500(E)	Per.Comm. 1983 Div. of SF/ADF&G
Peters Creek	1976	1,489(E)					Stream Survey Data ADF&G
	*	4,000(E)		1,000(E)		10,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
	1982			500(E)		500(E)	Per.Comm. 1983 Div. of SF/ADF&G
Black Creek	1983	100(E)					Per.Comm. 1983 Div. of SF/ADF&G
	1982			500(E)		500(E)	Per.Comm. 1983 Div. of SF/ADF&G
Kenny Creek	1983	100(E)					Per.Comm. 1983 Div. of SF/ADF&G
Martin Creek	1976	791(E)					Stream Survey Data ADF&G
	1977	1,061(E)					Stream Survey Data ADF&G
Pickle Creek	*					5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Portage Creek	1980					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Quartz Creek	1981		1,210(E)				Stream Survey Data ADF&G
Quiggs Creek	1982			500(E)			Per.Comm. 1983 Div. of SF/ADF&G
	1983	250(E)	1,000(E)				Per.Comm. 1983 Div. of SF/ADF&G

TABLE 1(b). Salmon Escapement/Harvest Data for Yentna River Drainage

Area	Year	Chinook	Sockeye	Coho	Chum	Pink	References
Bear Creek	*	100(E)				5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Cache Creek	1983	500(E)					Per.Comm. 1983 Div. of SF/ADF&G
Clearwater Creek	*	100(E)				5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Contact Creek	*	100(E)				1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Canyon Creek	1983	575(E)					Per.Comm. 1983 Div. of SF/ADF&G
Donkey Creek	*	100(E)	1,000(E)			5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Eightmile Creek	1982			1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
	1983	250(E)					Per.Comm. 1983 Div. of SF/ADF&G
Fish Creek	1982			1,000(E)			Per.Comm. 1983 Div. of SF/ADF&G
Happy River	1983	500(E)					Per.Comm. 1983 Div. of SF/ADF&G
Puntella Lake	1977		2,100(E)				Stream Survey Data ADF&G
	1978		1,105(E)				Stream Survey Data ADF&G
Hewitt Lake	1976, 1978, 1980		1,200-2,017(E)				Stream Survey Data ADF&G
Hewitt & Whiskey Lake	1981		9,850(E)				Stream Survey Data ADF&G
Huckleberry Creek	1980	1,750(E)					Stream Survey Data ADF&G
Hungryman Creek	*	100(E)	5,000(E)				Per.Comm. 1983 Div. of SF/ADF&G
Kichatna	*	1,000(E)	10,000(E)			10,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Nakochna River	*					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Lake Creek	1976-79	3,735-8,931(E)					Stream Survey Data ADF&G
		6,000(E)	5,000(E)	2,500(E)	15,000(E)	500,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Camp Creek	1983	1,000(E)					Per.Comm. 1983 Div. of SF/ADF&G
Chelatna Lake	1980		4,120(E)				Stream Survey Data ADF&G
	1981		14,900(E)				Stream Survey Data ADF&G
Home Creek	1982	500(E)					Per.Comm. 1983 Div. of SF/ADF&G
Sunflower	1983	1,000(E)					Per.Comm. 1983 Div. of SF/ADF&G
unnamed tributary	1980					500(E)	Per.Comm. 1983 Div. of SF/ADF&G
(T.25N., R.10W., SM)	1983	250(E)		250(E)			Per.Comm. 1983 Div. of SF/ADF&G
Yenlo Creek	1977	1,061(E)					Stream Survey Data ADF&G
	1982			500(E)		2,500(E)	Per.Comm. 1983 Div. of SF/ADF&G
Peters Creek	1976	1,489(E)					Stream Survey Data ADF&G
	*	4,000(E)		1,000(E)		10,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
	1982			500(E)		500(E)	Per.Comm. 1983 Div. of SF/ADF&G
Black Creek	1983	100(E)					Per.Comm. 1983 Div. of SF/ADF&G
	1982			500(E)		500(E)	Per.Comm. 1983 Div. of SF/ADF&G
Kenny Creek	1983	100(E)					Per.Comm. 1983 Div. of SF/ADF&G
Martin Creek	1976	791(E)					Stream Survey Data ADF&G
	1977	1,061(E)					Stream Survey Data ADF&G
Pickle Creek	*					5,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Portage Creek	1980					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Quartz Creek	1981		1,210(E)				Stream Survey Data ADF&G
Quiggs Creek	1982			500(E)			Per.Comm. 1983 Div. of SF/ADF&G
	1983	250(E)	1,000(E)				Per.Comm. 1983 Div. of SF/ADF&G

TABLE 1(b). [continued]   Salmon Escapement/Harvest Data for Yentna River Drainage

Area	Year	Chinook	Sockeye	Coho	Chum	Pink	References
Red Creek	1977	1,511(E)					Stream Survey Data ADF&G
	1981	749(E)					Stream Survey Data ADF&G
	*					5,100(E)	Per.Comm. 1983 Div. of SF/ADF&G
Johnson Creek	*					5,100(E)	Per.Comm. 1983 Div. of SF/ADF&G
Red Salmon Lake	1980		1,100(E)				Stream Survey Data ADF&G
Shell Creek	1979		1,000(E)				Stream Survey Data ADF&G
	1981		5,100(E)				Stream Survey Data ADF&G
Shell Lake	1980		5,500(H)				Sport Fish Harvest ADF&G
	1981		6,050(H)				Sport Fish Harvest ADF&G
Talachulitna R. System	1976-81	1,319-2,025(E)	9,295-25,935(E)			30,000-500,000(E)	Stream Survey Data ADF&G
	*			2,000(E)	10,000(E)	500,000(E)	Per.Comm. 1983 Div. of SF/ADF&G
Friday Creek	1983	950(E)					Per.Comm. 1983 Div. of SF/ADF&G
Judd Lake	1973-75		4,720-10,364(E)				Stream Survey Data ADF&G
Saturday Creek	1983	600(E)					Per.Comm. 1983 Div. of SF/ADF&G
Talachulitna Creek	1973		1,350(E)				Stream Survey Data ADF&G
Talachulitna River	1976, 77, 79	1,319-1,856(E)	2,699-29,935(E)			30,000(E)	Stream Survey Data ADF&G
Twentymile Creek	1983		2,000(E)			1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G

Legend B Stream Survey Data courtesy of Alaska Department of Fish and Game, Division of Commercial Fisheries, Division of Sport Fish and Fisheries Rehabilitation, Enhancement and Development Division, and Cook Inlet Aquaculture Association
Sport Fish Harvest - State Harvest Study 1980 Data, Alaska Department of Fish and Game, Division of Sport Fish
Personal Communication, Division of Sport Fish, Alaska Department of Fish and Game
Escapement data (E)
Harvest data (H)
NOTE: Escapement and harvest data do not necessarily estimate the total stream escapement.
*Escapement estimates from several years of observation

TABLE 1(c). Salmon Escapement/Harvest Data for Susitna River Tributaries

Area	Year	Chinook	Sockeye	Coho	Chum	Pink	References
Alexander Creek	1976-79	5,412-13,385(E)					Stream Survey Data ADF&G
	1979			1,560(H)			Sport Fish Harvest ADF&G
	*		5,000(E)			250,000(E)	Per.Comm. 1983 Div. of SF/ADF&
Upper & Lower Sucker	1983	500(E)					Per.Comm. 1983 Div. of SF/ADF&
Wolverine	1983	500(E)					Per.Comm. 1983 Div. of SF/ADF&
Birch Creek	1972					3,051(E)	Stream Survey Data ADF&G
Fish Lakes	1980		2,100(E)				Stream Survey Data ADF&G
Sheep Creek	1980					10,000(E)	Per.Comm. 1983 Div. of SF/ADF&
Goose Creek	1983	500(E)					Per.Comm. 1983 Div. of SF/ADF&
Indian River	1976	537(E)					Stream Survey Data ADF&G
Kashwitna River-North Fork	1981	557(E)					Stream Survey Data ADF&G
Kroto Creek	1976-79	21,693-39,642(E) --	Entire Deshka System (EDS)		--		Stream Survey Data ADF&G (EDS)
	1979			2,290(H)			Sport Fish Harvest ADF&G
	*			10,000(E)		500,000(E)	Per.Comm. 1983 Div. of SF/ADF&
Trapper Creek	1983	300(E)	500(E)	250(E)			Per.Comm. 1983 Div. of SF/ADF&
Twentymile Creek	1983	200(E)		500(E)		500(E)	Per.Comm. 1983 Div. of SF/ADF&
Montana Creek	1976-79	881-1,445(E)					Stream Survey Data ADF&G
	1979	312(H)		1,735(H)		2,472(H)	Sport Fish Harvest ADF&G
	1980	559(H)		2,684(H)		8,230(H)	Sport Fish Harvest ADF&G
Portage Creek	1976	702(E)					Stream Survey Data ADF&G
	1981	659(E)					Stream Survey Data ADF&G
Question Creek	1980					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&
	1980					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&
Rabiduex Creek	1983	200(E)		200(E)			Per.Comm. 1983 Div. of SF/ADF&
Sheep Creek	1978, 79, 81	778-1,209(E)					Stream Survey Data ADF&G
	1979					2,412(H)	Sport Fish Harvest ADF&G
	1980					6,362(H)	Sport Fish Harvest ADF&G
Sunshine Creek	1980			1,534(H)		2,408(H)	
Trapper Creek	1980					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&

Legend C Stream Survey Data courtesy of Alaska Department of Fish and Game, Division of Commercial Fisheries, Division of Sport Fish Fisheries Enhanc Division, and Cook Inlet Aquaculture Association
Sport Fish Harvest - State Harvest Study, 1979 and 1980 Data, Alaska Department of Fish and Game, Division of Sport Fish
Personal Communication, Division of Sport Fish, Alaska Department of Fish and Game
Escapement data (E)
Harvest data (H)
NOTE: Escapement and harvest data do not necessarily estimate the total stream escapement.
*Escapement estimates from several years of observation

TABLE 1(d). Salmon Escapement/Harvest Data for Talkeetna River Subdrainage of the Susitna River

Area	Year	Chinook	Sockeye	Coho	Chum	Pink	References
Chunilna Creek	1974, 76, 77	769-1,237(E)					Stream Survey Data ADF&G
	1979			1,248(H)			Sport Fish Harvest ADF&G
Mama & Papa Bear Lakes	1976, 78, 80					7,700-20,250(E)	Stream Survey Data ADF&G
Larson Lake	1977, 81		2,500-5,500(E)				Stream Survey Data ADF&G
Prairie Creek	1976-78, 81	1,900-6,513(E)					Stream Survey Data ADF&G
Stephan Lake	1978		1,022(E)				Stream Survey Data ADF&G

Legend D Stream Survey Data courtesy of Alaska Department of Fish and Game, Division of Commercial Fisheries, Division of Sport Fish, Fisheries Rehabilitation and Enhancement Division, and Cook Inlet Aquaculture Association

Sport Fish Harvest - State Harvest Study 1979 Data, Alaska Department of Fish and Game, Division of Sport Fish

Escapement data (E)

Harvest data (H)

NOTE: Escapement and harvest data do not necessarily estimate the total stream escapement.

TABLE 1(e). Salmon Escapement/Harvest Data for the Chulitna River Subdrainage of the Susitna River

Area	Year	Chinook	Sockeye	Coho	Chum	Pink	References
Byers Creek	1979		1,000(E)				CIAA
Chulitna River Middle Fork	1976-78	900-1,870(E)					Stream Survey Data ADF&G
Troublesome Creek	1980					1,000(E)	Per.Comm. 1983 Div. of SF/ADF&G

Legend E Cook Inlet Aquaculture Association (CIAA)
Stream Survey Data courtesy of Alaska Department of Fish and Game, Division of Commercial Fisheries, Division of Sport Fish, Fisheries Rehabilitation and Enhancement Division, and Cook Inlet Aquaculture Association
Personal Communication, Division of Sport Fish, Alaska Department of Fish and Game
Escapement data (E)
Harvest data (H)
NOTE: Escapement and harvest data do not necessarily estimate the total stream escapement.

TABLE 2. Susitna Area Plan Sport Fishing Effort Days/Year

10,000	5-10,000	1-5,000	1,000
Sheep Creek	Moose Creek	Chuitna River	Straight Creek
Deshka River	Chunilna Creek	Chuit River	Theodore River
Alexander Creek	Sunshine Creek	Talachulitna River	Olsen Creek
Montana Creek		Kashwitna River	Nikolai Creek
Lake Creek		Goose Creek	Lewis River
Caswell Creek		Peters Creek	Prairie Creek
		Beluga River	Portage Creek
		Skwentna River	Indian Creek
		Black Creek	Red Creek
		Martin Creek	Shell Creek
		Sucker Creek	

Ref: Sport Fishing Location, Access and Effort Map, Alaska Department of Fish and Game, Sport Fish Div., South Central Regional Staff 1983.

of populations and the carrying capacity of their habitats is to be maintained.

1. The Alaska Department of Natural Resources should not allow an appropriation of water from a river, lake or wetland to cause the flow or water level to fall below the amount determined necessary to protect fish, wildlife and waterfowl habitat and production, unless, under the procedures outlined in AS 46.15.080, the commissioner of ADNR makes a finding based on public review that the competing use of water is in the best public interest and no feasible and prudent alternative exists.

2. To minimize negative impacts on natural stream flows and water quality, the appropriate land management agency should retain a publicly-owned vegetated (if naturally occurring) strip of land or an easement as a buffer on lands adjacent to fish habitat. A buffer is preferred on streams and rivers important to the production of anadromous fish or with important public use values. The sizes of the river, lake, or wetland buffers should be decided on a case-by-case basis and may vary, depending on the nature of the activity proposed and the particular values of the river, lake, or wetland. Generally, public land disposals for rural homesites, recreational facilities, recreational land disposals, and similar low density, non-water dependent uses should have a minimum buffer of 200 feet landward of the ordinary high water mark(s)[6].

[6] Guidelines for Protection of Onshore and Nearshore Fish and Wildlife Areas, Habitat Division July 1983.

Where buffers are smaller than the minimum, soil erosion should, to the extent feasible and prudent, be minimized by restricting the removal of vegetation adjacent to fish-bearing waterbodies and by stabilizing disturbed soil as soon as possible. Adequate stabilization practices should be determined on a case-by-case basis. Private land owners are encouraged to maintain development setbacks equivalent to the buffers described here and to follow soil erosion mitigation practices.

3. Rivers, streams, or lakes that support important commercial, subsistence, or recreational fish species should not be dammed, diverted, or drawn down by hydroelectric projects unless the project will be designed or mitigated to provide adequate instream flows so as to cause no net loss to fish production.

4. Significant amounts of snow and ice cover should not be removed from shallow lakes, wetlands and rivers with low winter flows that are important to overwintering anadromous fish. Water withdrawal shall be limited as to not reduce limited overwintering fish habitat in ice-stressed (frozen) systems.