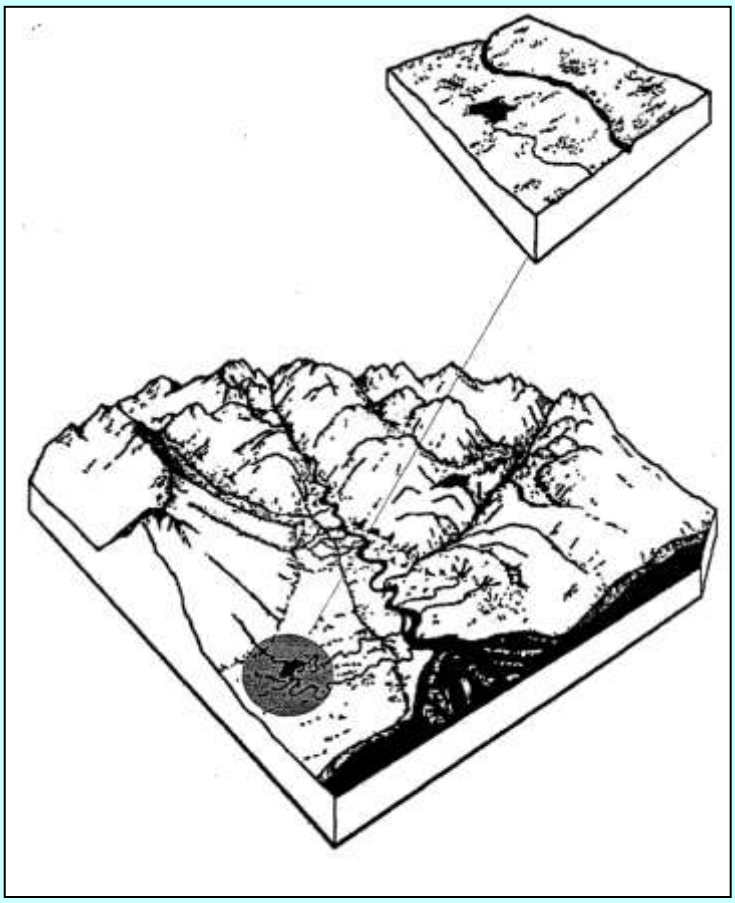
Palustrine Process Group



Channels within this process group are very low gradient (< 1 %) and associated with low relief landforms and wetlands. Water movement is slow and sediment transport is low. These channels trap and store fine organic and inorganic sediments. Channel banks are generally stable and flood plain depositional features such as gravel bars are infrequent. Riparian area size is highly variable and may encompass very large wetlands. Palustrine wetlands as described by the National Wetland Inventory are associated with this process group. These wetlands include bogs, fens, marshes and forested wetland swamps, and are dominated by persistent plants, mosses, shrubs, lichens and trees.

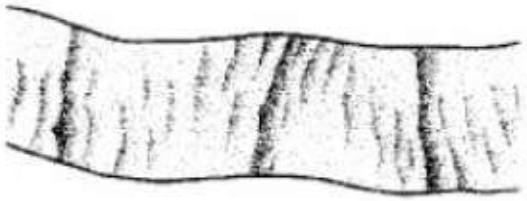
Stream gradient: less than 1 %
Sediment function: Storage
Stream class: I or II

Channel Types:

PAO – Micro Palustrine Channel
PAS – Small Palustrine Channel
PAM – Medium Palustrine Channel
PAL – Large Palustrine Channel
PAH – Groundwater Fed Slough
PAG - Glacial Backwater Slough
PAB – Beaver Dam/Pond Channel

NWI wetland Types associated with PA channels:

- **PSS – shrub swamp**
- **PEM – emergent marsh, fen or wet meadow**
- **PFO – forested or wooded swamp**
- **PML – moss or lichen wetland**
- **PUB - Pond**



Micro Palustrine Channel
Map Symbol: PAO

The PAO, is a narrow low gradient, placid flow, bog or fen channel, often adjacent to flood plain channels. When in proximity to FP channels provides rearing habitat to salmonids and refuge during high flow events.

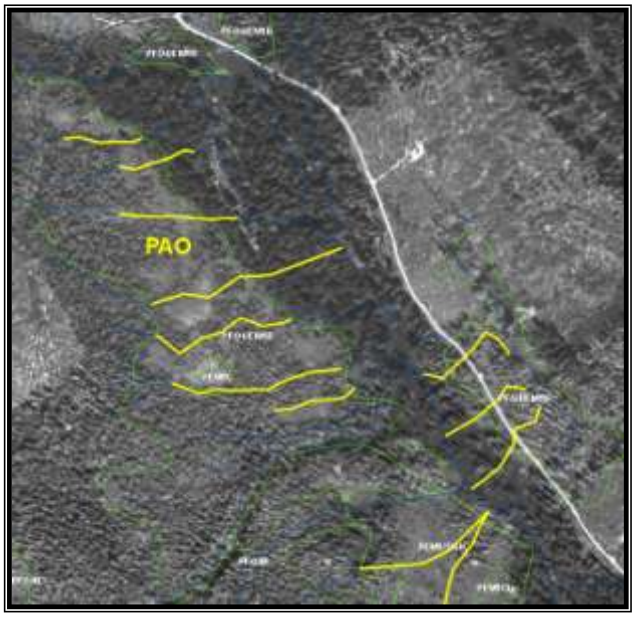


Figure 1. Typcial PAO landscape position, between footslope and valley bottom flood plain, associated with PFO and PEM wetlands.

Channel Characteristics:
Bankfull Width: 0.3 to 1.5 m
Bankfull Depth: 0.5 m
Width/Depth Ratio: 3/1
Dominant Substrate: Organic muck/silt to fine gravel
Stream Bank Composition: Organic material
Sideslope Length/Angle: n/a
Associated Landform: 61, 62, 40s,
Riparian Vegetation: Non-forested -Alder, sedge

Fish Habitat provides some anadromous rearing habitat and is consists of:
Pool -62%, Glide-35 %, Riffle -3 %
Stream Class: I or II
Large Wood is not significant.

Small Palustrine Channel
Map symbol: **PAS** (formerly PA1)

A low gradient, placid flow, sinuous, lowland or wetland channel. NWI wetlands types PEM, PFO, and PSS are commonly associated.

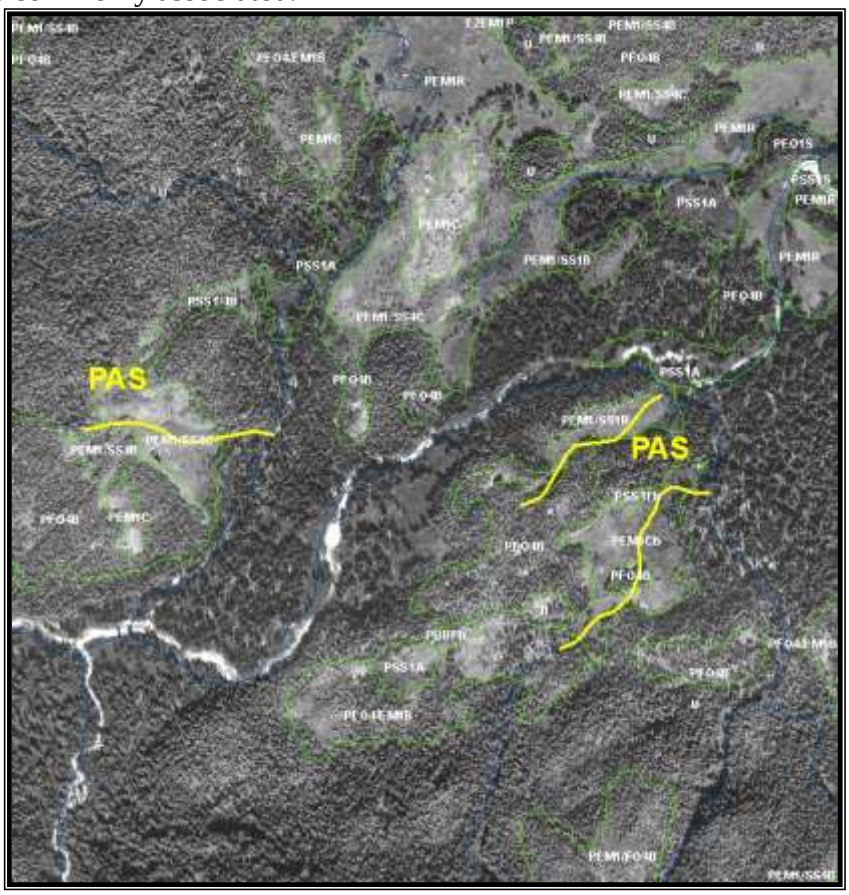
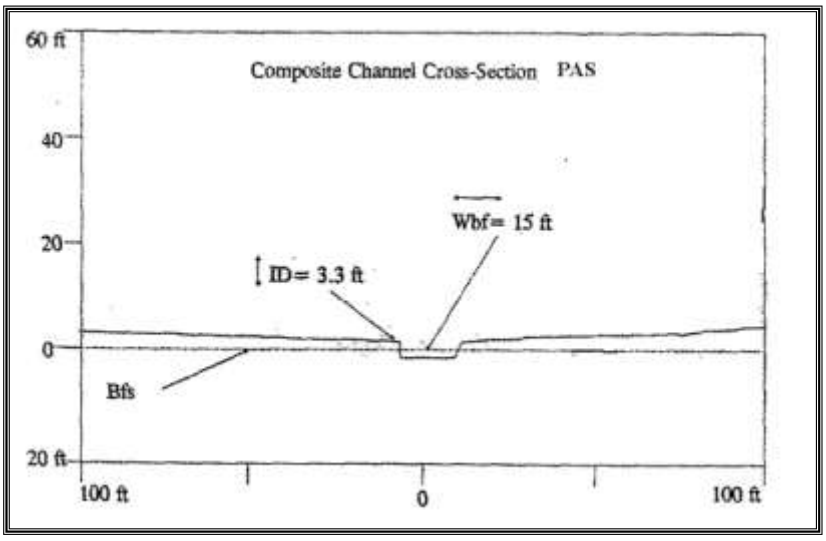


Figure 2. Typical landscape position of PAS channels is in valley bottom or lowlands. PSS, PEM and PFO wetland types are associated. (Orthophoto of Goose Ck, Chichagof Island-Gamma Tenakee Inlet Frontage.)



Typical PAS cross-section, bankfull width, flat lowland location.

Figure 3. PAS channel in sedge wetland. Note smooth surface, deep trough bed form.

Channel Characteristics:
Bankfull Width: 1.5 to to 10 m (5-33 ft)
Dominant Substrate: Organic silt to very fine gravel
Stream Bank Composition: Alluvium and/or organic mat
Sideslope Length and Angle: Not significant
Associated Landforms: 61, 62, 40s
Plant Association: Nonforested - sedge, sphagnum, and sweet gale
Phases: PASv, forested wetland dominates riparian area.

Riparian Vegetation: The riparian plant communities are dominated by nonforested sedgem, sphagnum, and sweet gale bog plant communities. The western hemlock series, mountain hemlock/blueberry series , and shore pine series share dominance in th PASv pahse with nonforested plant communities being of some significance.

Plant Association Series	% cover	
	PAS	PASV
Non forest	72%	16%
Shore Pine	9%	24%
Western Hemlock	7%	22%
Sitka Spruce	6%	12%
Mountain Hemlock/Blueberry	---	23%

Channel Type Phases:
PASv- Scrub Forest Phase: Riparian vegetation interspersed with patches of muskeg or shrub (Sitka alder and shore pine) plant communities.

Management Considerations

Hydrologic Function: PAS channels are sediment storage reaches. Stream energy is low, therefore, organic silt, sand and very fine gravel size sediments are retained. Streamflow and chemistry is influenced by runoff from extensive peat bogs. Dark tea coloration and high tannic acid concentration is characteristic of palustrine streams.

Aquatic Habitat Capability

Large wood…….< 500 ft^3 per 1000 linear feet

Available spawning area (ASA)…….. insufficient data

Availabel rearing area (ARA)…….. insufficient data

Indicator Species Ratings

MIS	ASA	ARA
Coho	Low	High
Pink	Negligible	Negligible
Chum	Negligible	Negligible
Sockeye	Low	Moderate
Chinook	Negligible	Negligible
Dolly Varden	Low	High
Steelhead	Negligible	Negligible

These channels are moderately accessible to anadromous fish. ASA is low because of the extremely fine substrate (7% fine gravel, 24% sand and 69% silt and organic muck). Coho slamon and Dolly Varden char will spawn in patches of gravel and sand. Sockeye slamon will spawn in sand and muck where upwelling groundwater provides adequate supply of dissloved oxygen to the redds. Coho salmon and Dolly Varden char frequently, and sockeye occasionally, rear in these channels. Lare amountsof deep pooled water (mean depth = 0.7meter{2.3ft}, 51% of active water), in conjunction with cover from overhanging stream bank vegetation, provide high ARA. Thes echanels probably provide little overwintering habitat unless flowing from a lake source or a spring fed tributaty.

Riparian Management Considerations

Management Concern :	
Large Wood	**Low**
Sediment Retention	**High**
Stream Bank Sensitivity	**Low**
Sideslope Stability	**N/A**
Flood Plain Protection Needed	**Moderate**
Culvert-Fish Passage	**Moderate**

Sediment retention is very high in palustrine channels. However, lack of spawning habitat generally make these channels less sensitve to sedimentation impacts than flood plain channels.

Stream banks are composed of dense organic root mats that are resistant to erosion. However, bank degradation can coour from heavyfoot traffic (BMP 16.1).

Fish access is fothen a concern in PAS channel segments. Culverts laid at streamgrade should not be barriers to juvenile fish passage (BMP 14.17).

Management prescriptions should emphasize wetland protection and contorl of potential erosion sources (BMPs 12.5,13.16).

These are classified as Stream Class I streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991).

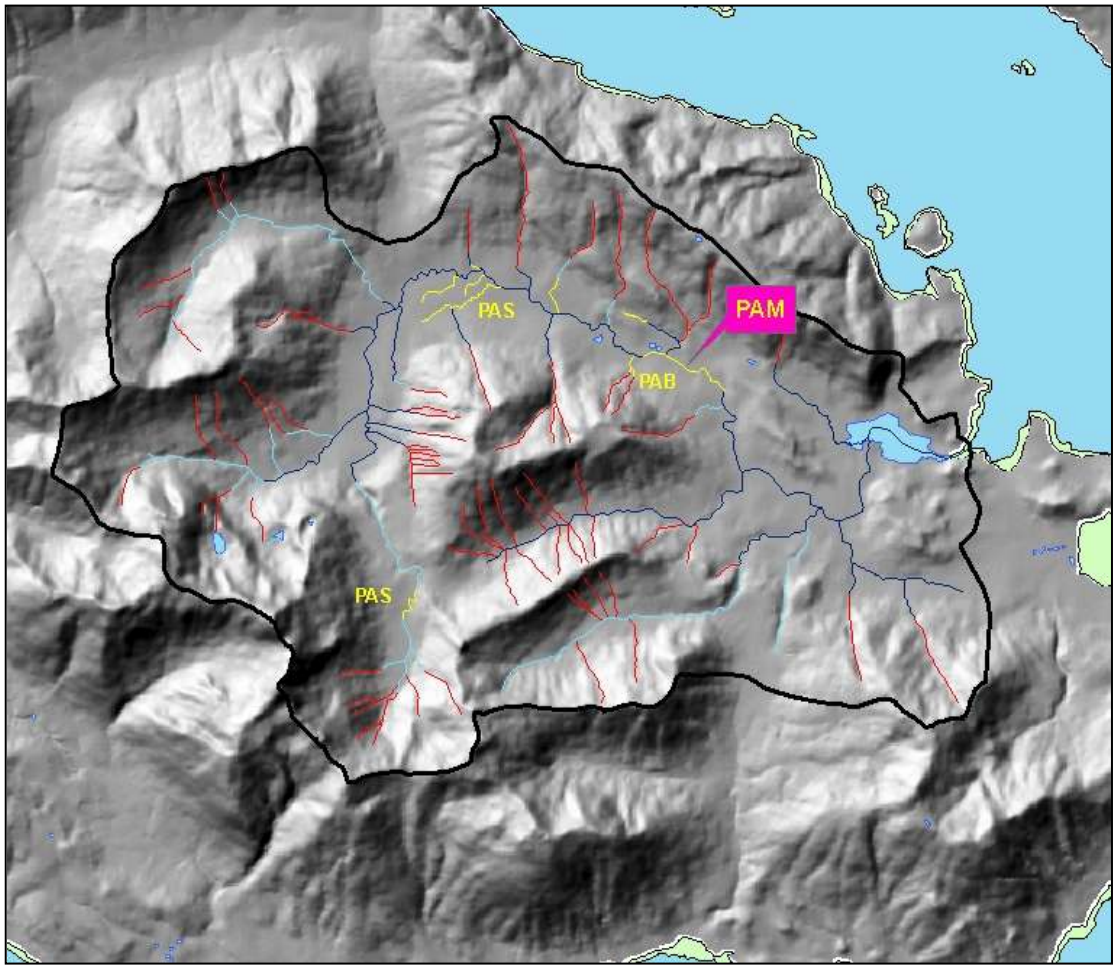
Control of inchannel operations is an important riparian management concern for these streams (BMP 14.14).

Riparian Management Opportunities
Sport Fish Potential……Moderate
Enhancement Opportunities….. Beaver Introduction

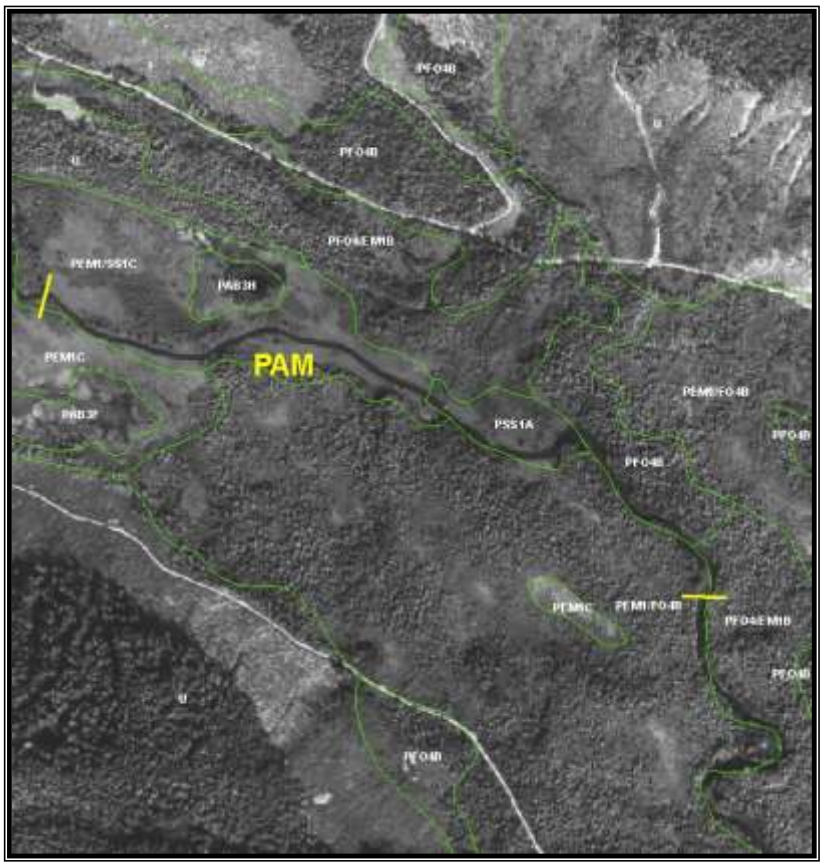
Some resident sport fish opportunities exist in may PAS segments. Species of interest include Dolly Varden and cutthroat trout. Streams adjacent to lakes and large beaver poonds may hav every good angling.
Beaver colonization could expand rearing habitat capability in these channels.

Medium Width Palustrine Channel
Map Symbol: PAM

A moderately wide, deep, placid flow lowland or wetland channel. This channel can be associated with pond and lake outlets.

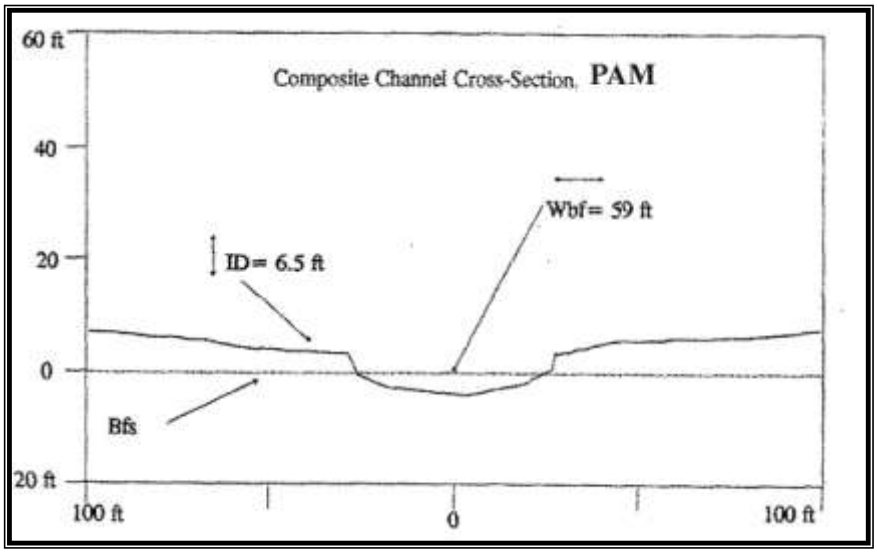


Typical watershed landscape position for PAM channels.



PAM channel associated with PEM and PSS wetlands.

Typical PAM cross-section profile.



Channel Characteristics
Bankfull Width: 10-20m (33-66 ft)
Dominant Substrate: Organic silt, sand, fine gravel
Stream Bank Composition: Alluvium/organic mat
Sideslope Length and Angle: Not significant
Associated Landforms: 60s, 53
Plant Association: Nonforested, Shore Pine/crowberry and Sitka Spruce

Riparian Vegetation

Plant Association Series	% Cover
Non-forest	40%
Shore Pine	24%
Sitka Spruce	20%
Western Hemlock-Red Cedar	13%

The riparian plant communities are dominated by non-forested sedge and sphagnum bog communities and the shore pine/crowberry plant association.

Management Considerations

Hydrologic Function: PAM channels are sediment storage sinks consisting of glide flow extensions from valley bottom lakes, or wide, low velocity glides associated with wetlands. Palustrine areas are normally associated with PAM channels, therefore, the substrate contains a large percentage of organic silt. Due to flat gradient, stream energy is very low. Little stream bank erosion occurs during high flow events due to the flow attenuation capacity of the associated lakes or wetlands.

Aquatic Habitat Capability

Large Wood…….2700 ft^3 per 1000 linear feet
Available Spawning Area (ASA)… no data
Available Rearing Area (ARA)..… no data

Indicator Species Rating

MIS	ASA	ARA
Coho salmon	Low	High
Pink salmon	Negligible	Negligible
Chum salmon	Negligible	Negligible
Sockeye salmon	Moderate	Moderate
Chinook salmon	Negligible	Negligible
Dolly Varden char	Low	High
Steelhead	Negligible	Negligible

These channels are frequently accessible to anadromous species. Available spawning area (ASA) is low due to placid flow and substrate that is predominately gravel, sand, and silt/muck. Coho and Dolly Varden will spawn in scattered pockets of gravel and sand. In addition, sockeye will spawn on a sand and muck bottom, however, most spawning takes place in areas of upwelling groundwater, which tends to offset the substrate deficiencies.

Riparian Management Considerations

Large woody debris sources are highly variable in PAM channels. Most large woody debris recruitment occurs from beaver activity or large wood that floats in from upstream reaches or lake shores. Retention time of large woody debris in these channels is high. Accumulations of large woody debris provide added cover and protection for rearing fish.

Management Concern for:	
Large Wood	**Moderate**
Sediment Retention	**High**
Stream Bank Stability	**Low**
Sideslope Sensitivity	**N/A**
Flood Plain Protection	**Moderate**
Culvert/Fish Passage	**Low**

Sediment retention is very high in these channels. Due to naturally high concentrations of fines in PAM channels, it is difficult to assess cumulative effects of sediment from upstream activities.

Stream banks are composed of organic soils held together by dense root mates that are resistant to erosion by the low velocity stream flows. Disturbances to stream bank vegetation (heavy foot traffic) may break down channel banks making them susceptible to sloughing (BMP 16.1).

These channels are associated with important wetland/flood plain complexes that function to moderate runoff, store sediment, and bank nutrients. Protection of wetland functions and values is an important management consideration for these streams (BMP 12.4-12.6).

PAM channels are classified as Stream Class I streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of in-channel operations is an important riparian management concern for these streams (BMP 14.14)

Riparian Management Opportunities
Sport Fish Potential…….Moderate
Enhancement Opportunities…Beaver introduction, fry stocking, large wood placement

Sport fish opportunities are often good in PAM channels, with the best fishing generally being associated wit lake inlets and outlets. Species of primary interest are Dolly Varden, cutthroat, and sockeye. Small boat access, particularly from lakes, is usually good.

Encouragement of beaver colonization or the addition of large woody debris can significantly enhance rearing habitat associated with PAM channels.

Large Palustrine Channel
Map Symbol: PAL

Characteristics of this channel type are similar to the **Moderate Width Palustrine Channel**

Bankfull width is greater than **20m** (66 ft).

Approximately 10% of the PAS and PAM channel type verification sites in the CTV database will be reclassified as PAL.

Groundwater Fed Slough - Map Symbol: **PAH** (formerly PA3)
Glacial Backwater Slough – Map Symbol: **PAG** (formerly PA4)

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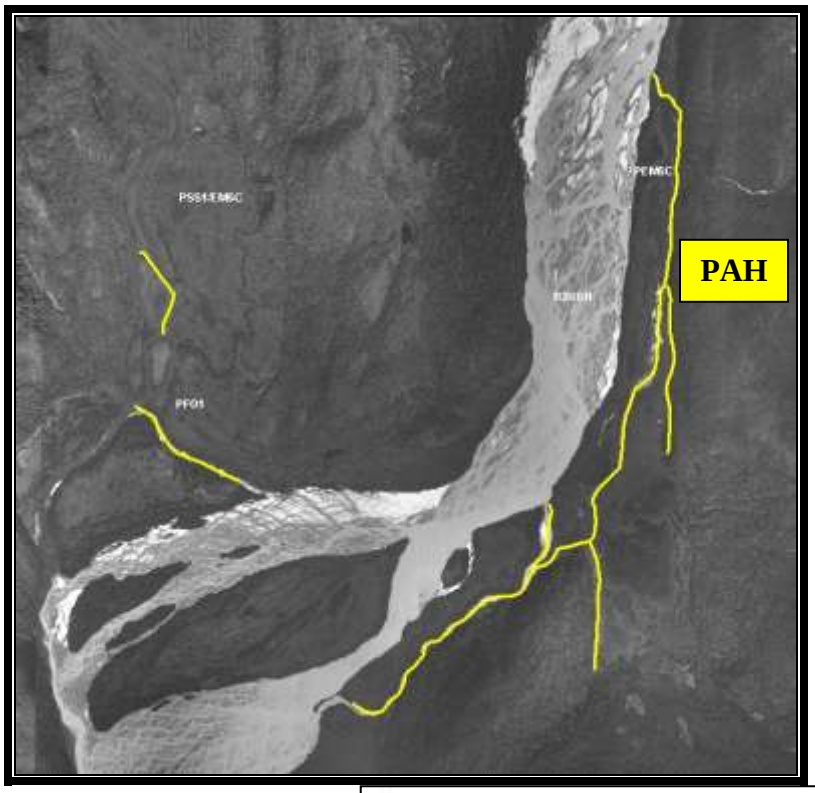
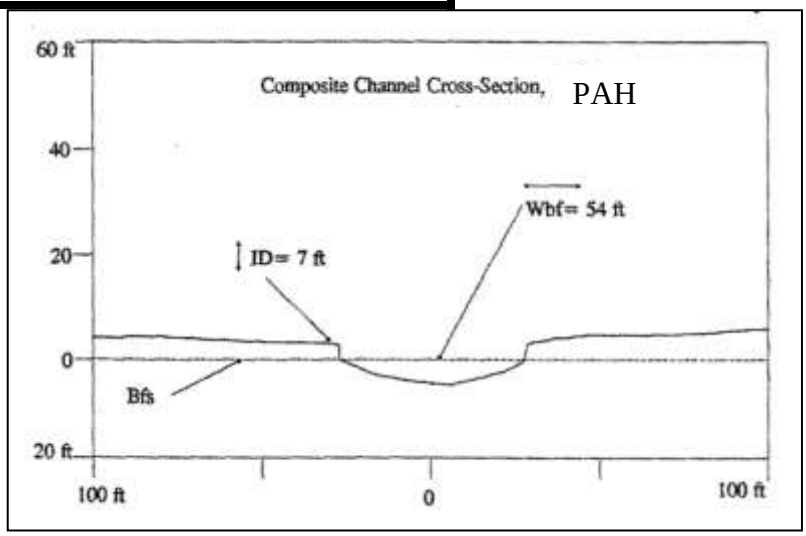
Geographic Setting: Mainland glacial outwash flood plains. These channel types may be active side channels or occupy relic braided channels. If the channel is recharged by clear groundwater it is labeled a PAH, if not and glacial silt turbidity is evident then it is labeled a PAG. These channels are often associated with PEM, PSS and EM wetland types.



Berners River area on mainland, north of Juneau. PSS (shrub swamp), PEM (emergent marsh), PFO (forested wetland) and adjacent to braided GOL, (Riverine wetland).

Typical PAH or PAG cross-section.



In-channel views of PAH. Sitka Spruce riparian vegetation

PAG in-channel view. Willow dominates riparian area.

Channel Characteristics

Bankfull width: variable, range is 5 to 33 meters (17-107 ft)
Dominant Substrate: silt to fine gravel
Stream bank composition: alluvium and organic mat
Sideslope length and angle: not significant
Channel pattern: singular, low velocity flow
Drainage area: variable

Riparian vegetation

The riparian plant community is dominated by non-forest plant communities with the Sitka Spruce series also being significant. Non-forested plant communities are dominated by willow, Sitka alder, salmonberry, and Devil's Club shrub communities.

Plant Association Series	% Cover
Non-forest	80%
Sitka Spruce	16%
Sitka Spruce-Cottonwood	4%

Management Considerations

Hydrologic function: PAG and PAH channels store sediment. Flow velocity is very sluggish and is controlled by backwater from main river channels. Bed substrate is composed of fine silt.

Aquatic Habitat Capability
Large Woody Debris……. Less than 500 ft^3 per 1000 linear feet
Available Spawning Area…….. N/A
Available Rearing Area……. Average = 91% for 11 sites surveyed

Indicator Species Ratings

MIS	ASA	ARA
Coho	Low	High
Pink	Negligible	Negligible
Chum	Negligible	Negligible
Sockeye-PAG	Low	High
Sockeye-PAH	Mod	High
Chinook-PAG	Negligible	Low
Chinook-PAH	Low	Moderate
Dolly Varden	Low	Low
Steelhead	Negligible	Negligible

PAG and PAH channels are often accessible to anadromous species, but occasionally maybe physically isolated from the stream network. The combination of low velocity flow and fine substrate renders spawning capability insignificant, although coho, sockeye salmon, and Dolly Varden may have some success in isolated patches of gravel. Coho and sockeye salmon will frequently rear in these channels. Sockeye will spawn more frequently in the PAH as there is active groundwater upwelling. Chinook salmon may rear temporarily in these sloughs, if accessible from large mainstem channels. Over-wintering habitat can be significant if groundwater in-flow is present. Pool area is 66% of the channel with an average mean depth of 0.61 meters (2.0 feet).

Riparian Management Considerations

Management Concern for:	
Large wood- PAG	**Low**
Large wood – PAH	**Moderate**
Sediment retention	**High**
Stream bank stability	**Moderate**
Sideslope sensitivity	**N/A**
Flood plain protection	**High**
Culvert fish passage	**N/A**

Large wood sources are highly variable in these channels. However large wood retention is higher in the PAH channel. Large wood provides cover and protection for rearing fish. Sediment retention is high. These channels may also function as long term sediment sinks when cut off from the main flood plain side channels. Increased sedimentation will likely have minor effects on spawning capabilities, due to a lack of usable spawning gravels.
Stream banks are moderately sensitive to disturbance due to a high percentage of fine unconsolidated alluvium (BMP 12.6, 13.16, 14.17). Stream banks may be composed of organic soils held together by dense root mats that are resistant to erosion. Disturbances to the stream bank vegetation (heavy foot traffic) may break down channel banks making them susceptible to sloughing.

These channels are often associated with extensive floodplain/wetland complexes. The adjacent riparian areas function as sediment and nutrient sinks, and are important buffers against extreme flood flows. Protection of these values and functions should be a primary management emphasis (BMPs 12.4, 12.6)

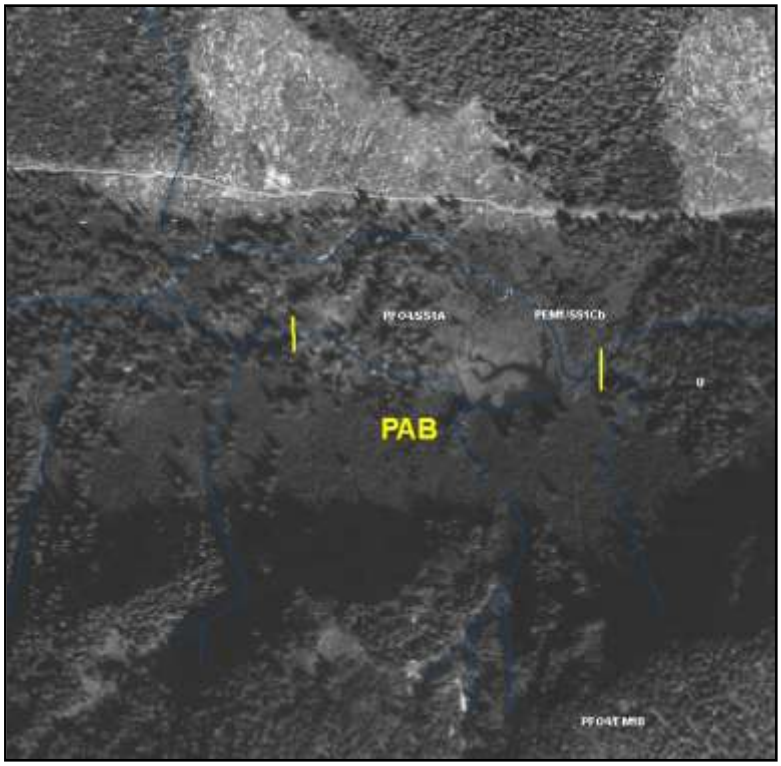
PAG and PAH channels are classified as Stream Class I. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of in-channel operations is an important riparian management concern for these streams (BMP 14.14)

Riparian Management Opportunities
PAG Sport fish potential……..Low
PAH Sport fish potential……..Moderate
PAG Enhancement opportunities….Spawning channels
PAH Enhancement opportunities…..Beaver introduction, fry stocking, large wood placement

Provided that the rearing habitat is not at its carrying capacity, construction of spawning channels adjacent to PAG channels may increase fish production. Floodplain gravels and near-surface groundwater are key features often associated with PAH channels, making them potentially suitable for spawning channel projects.
PAH channels offer good sport fishing opportunities, with the best fishing being associated with lake inlets and outlets. Species of primary interest are Dolly Varden, cutthroat and sockeye.
Encouragement of beaver colonization or the addition of large wood can significantly enhance rearing habitat in PAH channels.

Beaver Dam/Pond Palustrine Channel
Map Symbol: PAB (formerly PA5)

Geomorphic Setting: PAB channels are found on valley bottom floodplains and low relied landforms. Beaver impoundments are the most dominant feature.



PAB situated in valley bottom, PFO and PEM wetlands are adjacent.

Pond in a PAB, placid flow.

Dead tree zone, common in a PAB channel.

Channel characteristics
Bankfull width: variable, can be greater than 30 m (100 ft)
Domiant substrate: Organic silt to sand
Stream bank composition: Organic material
Sideslope length and angle: N/A
Channel pattern: ponded area, glide flow

Actively maintained beaver dam, creates pond in a flood plain channel.

Riparian Vegetation

Plant Association Series	% Cover
Non-forest	**31%**
Sitka Spruce	**20%**
Shore Pine	**17%**
Mixed Conifer	**13%**
Western Hemlock-Red Cedar	**8%**

The riparian area is dominated by non-forested plant communities, with the Sitka Spruce series and shore pine series also being significant. The non-forested plant communities are dominated by sedge and sphagnum bog communities.

Management Considerations

Hydrologic Function: The PAB channel is a sediment sink. Silt, sand and fine gravel are effectively trapped by these channel reaches. Typically the PAB channels occure when valley flood plain channels (FPS, FPM) or palustrine channels (PAS, PAM) are worked by beavers. Flood peaks tend to be attenuated by these streams. Substantial sediment loads may be delivered to downstream reaches in the wake of a beaver dam burst.

Indicator Species Ratings

These channels are moderately accessible to anadromous species. Spawning is limited by the sand, silt and organic muck substrate. Sockeye salmon do spawn near areas of groundwater upwelling. PAB channels provide good rearing habitat for coho, sockeye salmon, and Dolly Varden char. Good over-wintering habitat is provided in the deep pools (mean depth = 0.55 meters, 1.8 ft, and 78% of active water).

MIS	ASA	ARA
Coho	Negligible	High
Pink	Negligible	Negligible
Chum	Negligible	Negligible
Sockeye	Low	High
Chinook	Negligible	Negligible
Dolly Varden	Negligible	High
Steelhead	Negligible	Negligible

Riparian Management Considerations

Concern for Management for:	
Large Wood	**Low**
Sediment retention	**High**
Stream bank sensitivity	**Low**
Sideslope sensitivity	**N/A**
Flood plain protection	**Moderate**
Culvert fish passage	**N/A**

The woody debris associated with beaver dam complexes provides extensive areas of cover for juvenile fish. In addition, these beaver dam complexes greatly increase production of invertebrates, upon which the juvenile fish feed.

Sediment retention is very high in PAB channels. These channels can buffer downstream sediment transport. Sedimentation behind beaver ponds gradually reduces available rearing habitat in these channels.

These channels are associated with important wetland/flood plain complexes. The PAB channel stores sediment and nutrients, and buffers flows from extreme runoff events. Protection of wetlands functions and values is an important management consideration in PAB channel types (BMP 12.4-12.6).

PAB channels are classified as Stream Class I. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991).

Riparian Management Opportunities

Sport Fish Potential……..High
Enhancement Opportunities…….Beaver introduction, fry stocking

PAB channels provide good sport fishing opportunities especially when these channels are tributary to large flood plain rivers. Primary species of interest include Dolly Varden char and cutthroat trout.

Provided that they are not at carrying capacity, PAB channels can be stocked with fry to increase production. Beaver populations should be managed to maintain optimum fish rearing capability and sufficient food source for beaver.