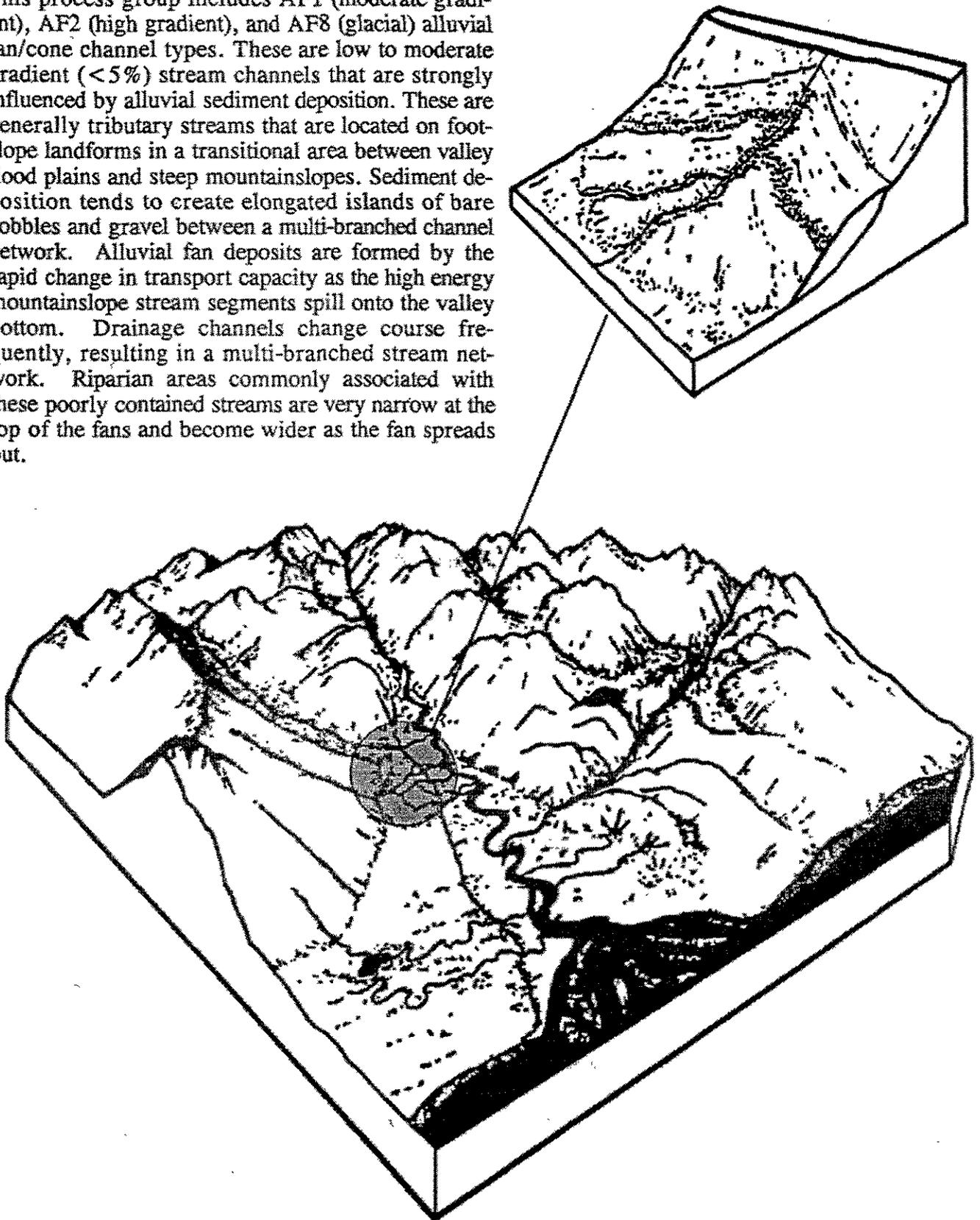


ALLUVIAL FAN PROCESS GROUP

This process group includes AF1 (moderate gradient), AF2 (high gradient), and AF8 (glacial) alluvial fan/cone channel types. These are low to moderate gradient (<5%) stream channels that are strongly influenced by alluvial sediment deposition. These are generally tributary streams that are located on foot-slope landforms in a transitional area between valley flood plains and steep mountainslopes. Sediment deposition tends to create elongated islands of bare cobbles and gravel between a multi-branched channel network. Alluvial fan deposits are formed by the rapid change in transport capacity as the high energy mountainslope stream segments spill onto the valley bottom. Drainage channels change course frequently, resulting in a multi-branched stream network. Riparian areas commonly associated with these poorly contained streams are very narrow at the top of the fans and become wider as the fan spreads out.

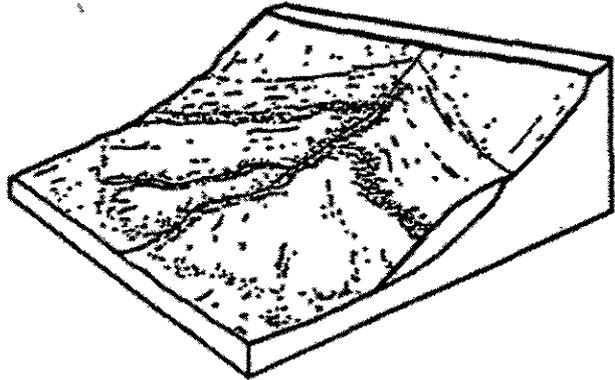


MODERATE GRADIENT ALLUVIAL FAN CHANNEL

Channel Mapping Symbol: AF1 (Formerly B5)

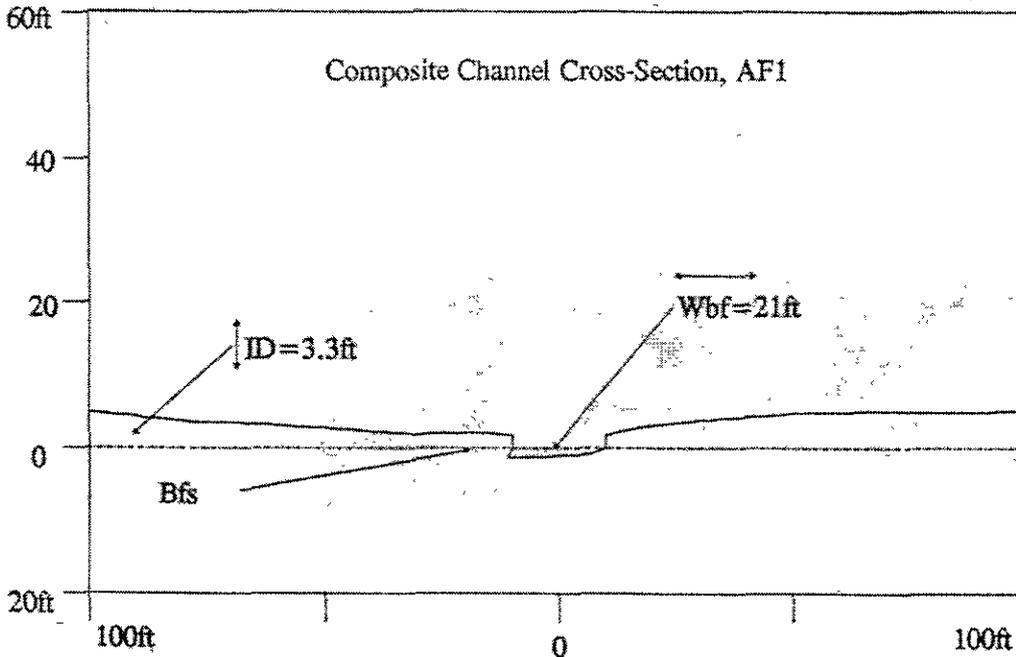
PHYSICAL CHARACTERISTICS

Geographic Setting: The AF1 channel type is exclusively associated with the alluvial fan landform. Normally, this landform is positioned between steep mountainslopes or hillslopes and flat valley bottoms or lowlands. In many valleys, AF1 streams lie adjacent to and merge with low gradient flood plain streams



Similar Channel Types: AF2, FP3, MM1, HC2

Channel Structure

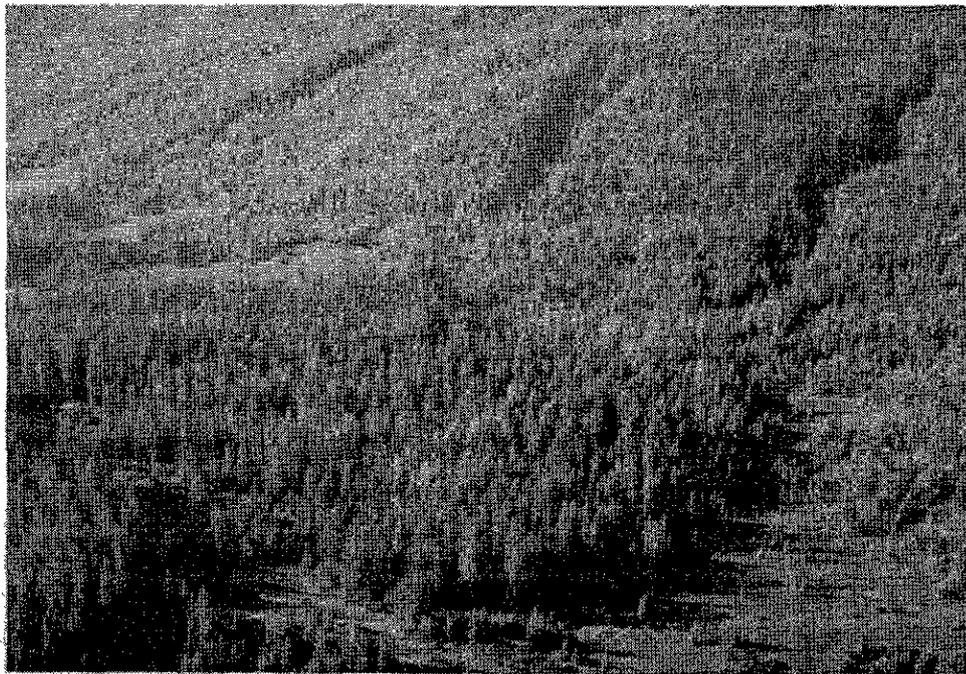


- Stream Gradient:1-6%, mean = 4%
- Incision Depth: < 2 m (6.5 ft), mean = 1 m (3.3 ft)
- Bankfull Width:..... < 20 m (66 ft), mean = 6 m (21 ft)
- Dominant Substrate:Fine gravel to large cobble
- Stream Bank Composition:Alluvium
- Sideslope Length:Not significant, concave landform associated
- Sideslope Angle:Not significant
- Channel Pattern:.....Single to multiple, channels spread across alluvial fan deposits
- Drainage Basin Area:..... < 5.2 km² (< 2 mi²)

INCHANNEL PHOTO: AF1



LANDSCAPE PHOTO: AF1 (foreground)



Riparian Vegetation: The dominant riparian plant community is the Sitka spruce series, with Sitka spruce/blueberry and Sitka spruce/blueberry-devil's club being the most common plant associations. Salmonberry and red alder shrubs dominate the nonforest riparian plant communities.

Plant Association Series	% Cover
Sitka Spruce.....	68%
Western Hemlock.....	15%
Nonforest.....	8%
Western Hemlock-Red Cedar.....	6%
Mixed Conifer.....	2%

Channel Type Phases:

- AF2s - SHRUB PHASE consists primarily of brush riparian vegetation.

MANAGEMENT CONSIDERATIONS

Hydrologic Function: AF1 channels are transitional streams from high gradient mountainslope to low gradient, valley bottom streams. This complex stream network exhibits a wide range of sediment erosion, transport, and deposition processes. Bank erosion, outwash sediment deposition, and lateral channels are common dynamic processes. Sediment transport occurs in the high and moderate gradient reaches of alluvial fan channels, leaving a substrate composed of larger cobble size materials. Extensive, fine gravel deposits are common on the lower reaches of the AF1 streams adjacent to the valley bottom flood plain channels.

Aquatic Habitat Capability

Large Woody Debris.....	12,000 ft ³ /1000 linear ft
Available Spawning Area (ASA).....	Avg = 7% for 14 sites
Available Rearing Area (ARA).....	Avg = 15% for 14 sites

Indicator Species Ratings

MIS	ASA	ARA
Coho.....	MOD	MOD
Pink.....	MOD	NEG
Chum.....	MOD	NEG
Sockeye.....	MOD	NEG
Chinook.....	NEG	NEG
Dolly Varden.....	MOD	MOD
Steelhead.....	LOW	LOW

AF1 channels are frequently accessible to anadromous species. The available rearing habitat is good, especially where they join mainstem channels in the lower reaches of a watershed. Coho and Dolly Varden use the pools (17% of active water, mean depth of 0.27 meters [0.9 feet]) commonly associated with large woody debris accumulations. Overwintering habitat is provided in these pools and along low gradient channel segments near the base of the alluvial fan where upwelling groundwater moderates water temperature and inhibits ice formation. Spawning areas located in the lower gradient, downstream portions of AF1 channels are moderately used by most species of anadromous salmon and Dolly Varden. When located next to accessible lakes, these channels provide good spawning habitat for sockeye salmon.

Riparian Management Considerations

Concern for Management of:

- Large Woody Debris..... HIGH
- Sediment Retention..... HIGH
- Stream Bank Sensitivity HIGH
- Sideslope Sensitivity N/A
- Flood Plain Protection Need..... HIGH
- Culvert Fish Passage..... HIGH

Large woody debris accumulations play a significant role in the morphology and function of AF1 channels. These stream segments have high large woody debris volumes, due to productive spruce stands that are typically associated with alluvial fan landforms. This large woody debris functions as a trap for bedload sediments and often forms log steps that contribute significantly to the development of pools that provide rearing habitat for fish. Maintenance of large woody debris sources is an important riparian management need (BMP 12.6).

Stream banks are naturally unstable due to fine textured alluvial bank materials. Sediment retention is high in some stream segments. Active bedload deposition and channel aggradation result in the formation of numerous side channels. Two or more main flow channels with extensive braided outwash deposits are common on the more active alluvial fans. Erosion control and stream bank protection should be emphasized for these streams (BMPs 12.7, 13.11-13.13, 13.16).

The flood plain soils consist of shallow organic mats that are very sensitive to physical disturbance (BMP 13.8). Alder and salmonberry quickly colonize the sensitive alluvial soils, making conifer recolonization difficult.

Road crossings should be avoided at low gradient channel segments along the base of alluvial fan drainage systems (BMPs 14.2, 14.13). Culvert crossing in these areas may restrict upstream migration of juvenile salmonids (BMP 14.17). Culverts are also very susceptible to clogging by bedload sediment and woody debris. Control of inchannel operations is also an important riparian management concern for these streams (BMP 14.14). An accelerated maintenance schedule (BMP 14.20) and special measures to stabilize road drainage structures should be incorporated in road crossing structure design and in the development of road management objectives (BMP 14.1). Bridge crossing structures at the fan apex are generally the most suitable stream crossing option for AF1 channels.

These are classified as Value Class I streams. 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 PotentialLOW
- Enhancement Opportunities.....Large Wood Placement

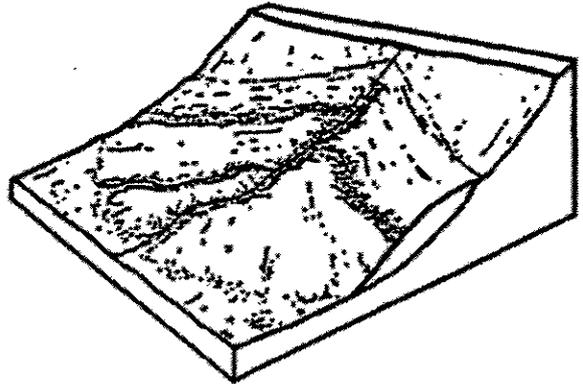
Large wood placement can be used effectively to increase availability of pool rearing habitat in stable AF1 stream reaches, however, given the general instability of these channels, consideration must be employed to avoid destabilization of channels when placing large woody debris structures.

HIGH GRADIENT ALLUVIAL CONE CHANNEL

Channel Mapping Symbol: AF2 (Formerly A3)

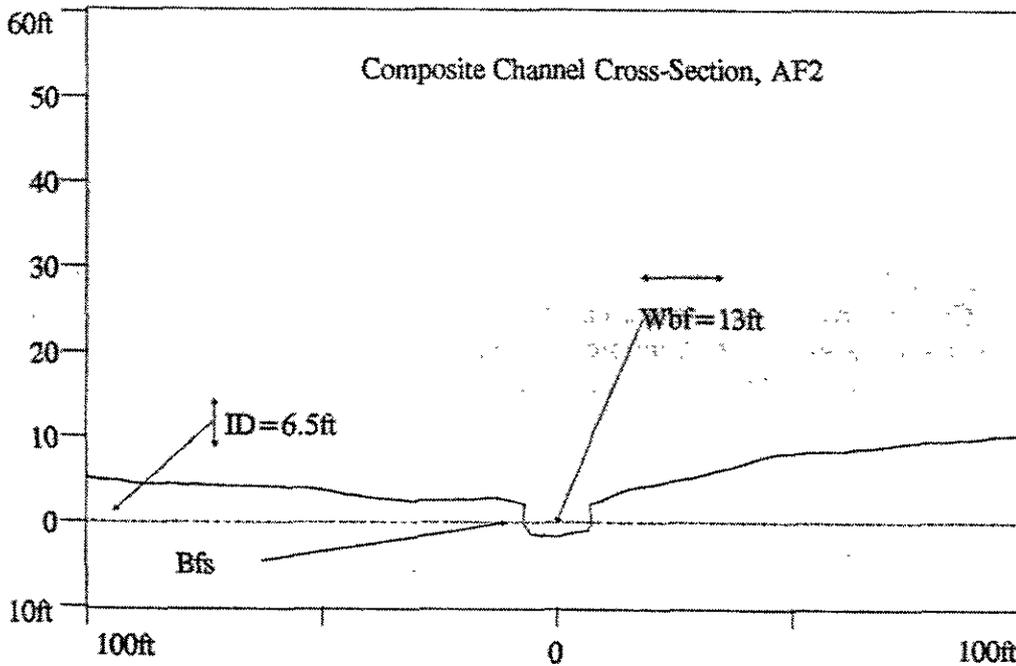
PHYSICAL CHARACTERISTICS

Geographic Setting: AF2 streams are typically situated on alluvial fan/cone landforms in steep sided, V-shaped valleys. These streams are located on transitional areas between mountain sideslopes and valley floors. AF2 channels are frequently located directly downstream from HC5 and HC6 channels. Less frequently, AF2 streams occur on sloping lowlands preceded by an HC3 stream. These channels have shallow incision, with poor flow containment. Channel pattern is single to multibranching.



Similar Channel Types: AF1, HC2

Channel Structure



- Stream Gradient: > 6% (at midpoint of alluvial cone), mean = 11%
- Incision Depth: < or = 4 m (13 ft), mean = 2 m (6.5 ft)
- Bankfull Width: Variable, mean = 4 m (13 ft)
- Dominant Substrate: Coarse gravel to small boulders
- Stream Bank Composition: Alluvium
- Sideslope Length: Not significant, alluvial cone landform is concave cross-section
- Sideslope Angle: Not significant
- Channel Pattern: Single to multibranching at lower end
- Drainage Basin Area: 5.2 km² (< 2 mi²)

LANDSCAPE PHOTO: AF2s

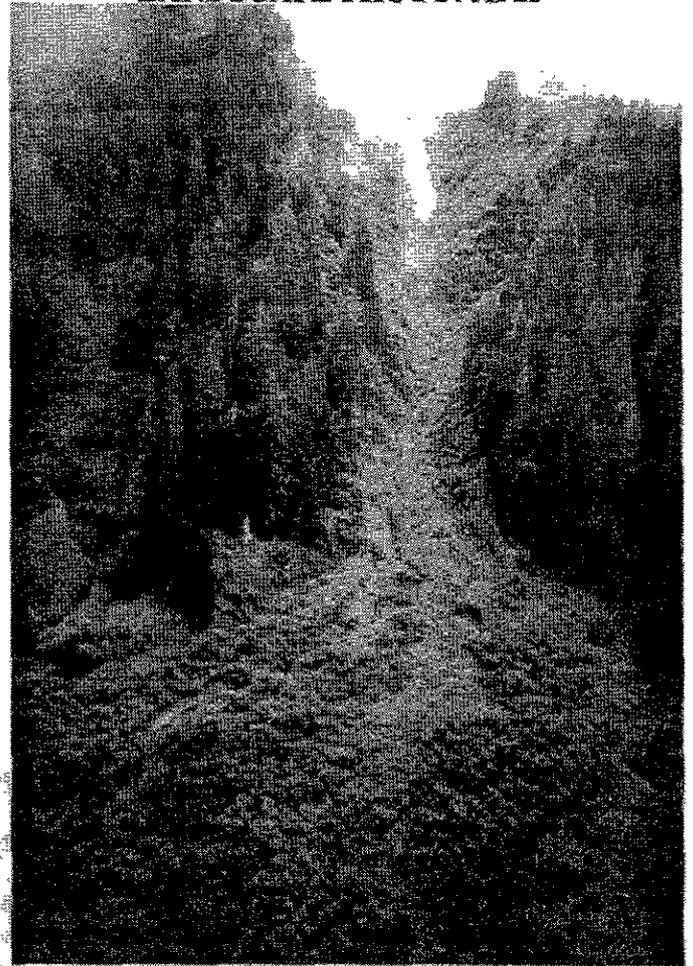
Riparian Vegetation: The riparian plant communities are dominantly Sitka spruce series, with western hemlock series and the nonforested communities also common. Red alder, salmonberry, and Sitka alder shrubs dominate the nonforest riparian plant communities.

Plant Association Series	% Cover
Sitka Spruce	43%
Western Hemlock.....	24%
Nonforest.....	19%
Mountain Hemlock.....	4%
Western Hemlock-Alaska Cedar	4%
Mixed Conifer.....	4%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: AF2 channels function in a transitional capacity for the steep, sediment transport oriented channels upstream and the lower gradient, valley bottom channels downstream. These streams flow over and actively rework the deposited material that has formed the alluvial cone landform. AF2 channels act as rapid transport systems for material smaller than small cobbles. Small accumulations of fine sediment may be stored in pools associated with large boulders. Large woody debris plays a critical role in the stability of the banks and channels. Snow avalanche and debris flow processes also affect AF2 stream courses (See AF2s phase.)



Aquatic Habitat Capability

Large Wood Debris	5500 ft ³ /1000 linear ft
Available Spawning Area (ASA)	Insufficient data
Available Rearing Area (ARA)	Insufficient data

Indicator Species Ratings

MIS	ASA	ARA
Coho	LOW	LOW
Pink	NEG	NEG
Chum	NEG	NEG
Sockeye.....	LOW	NEG
Chinook	NEG	NEG
Dolly Varden.....	LOW	MOD
Steelhead	NEG	NEG

Due to high stream flow velocities, AF2 channels are only occasionally accessible to anadromous fish species. When accessible, it is at the downstream end, usually adjacent to FP4 and FP5 channels, where the gradient is low enough to allow AF2 habitat to be used. AF2 channels contain low amounts of spawning and rearing habitat. Being located at the sediment/water source areas of watersheds, AF2 channels typically influence downstream fish habitat productivity.

Riparian Management Considerations

Concern for Management of:

- Large Woody DebrisMOD
- Sediment RetentionMOD
- Stream Bank SensitivityHIGH
- Sideslope SensitivityN/A
- Flood Plain Protection NeedHIGH
- Culvert Fish Passage.....LOW

Large woody debris has moderate influence on many AF2 channel types. Except for segments located below snow avalanche tracts, which contain shrub cover and minor debris loading, the large woody debris is integral in retarding downstream sediment transport.

Sediment retention is moderate, consisting predominantly of coarse, cobble size, bedload sediments.

Protection of sensitive alluvial soils should be emphasized (BMP 13.8).

AF2 stream banks form on alluvium, therefore, they are naturally sensitive (BMPs 12.7, 13.16).

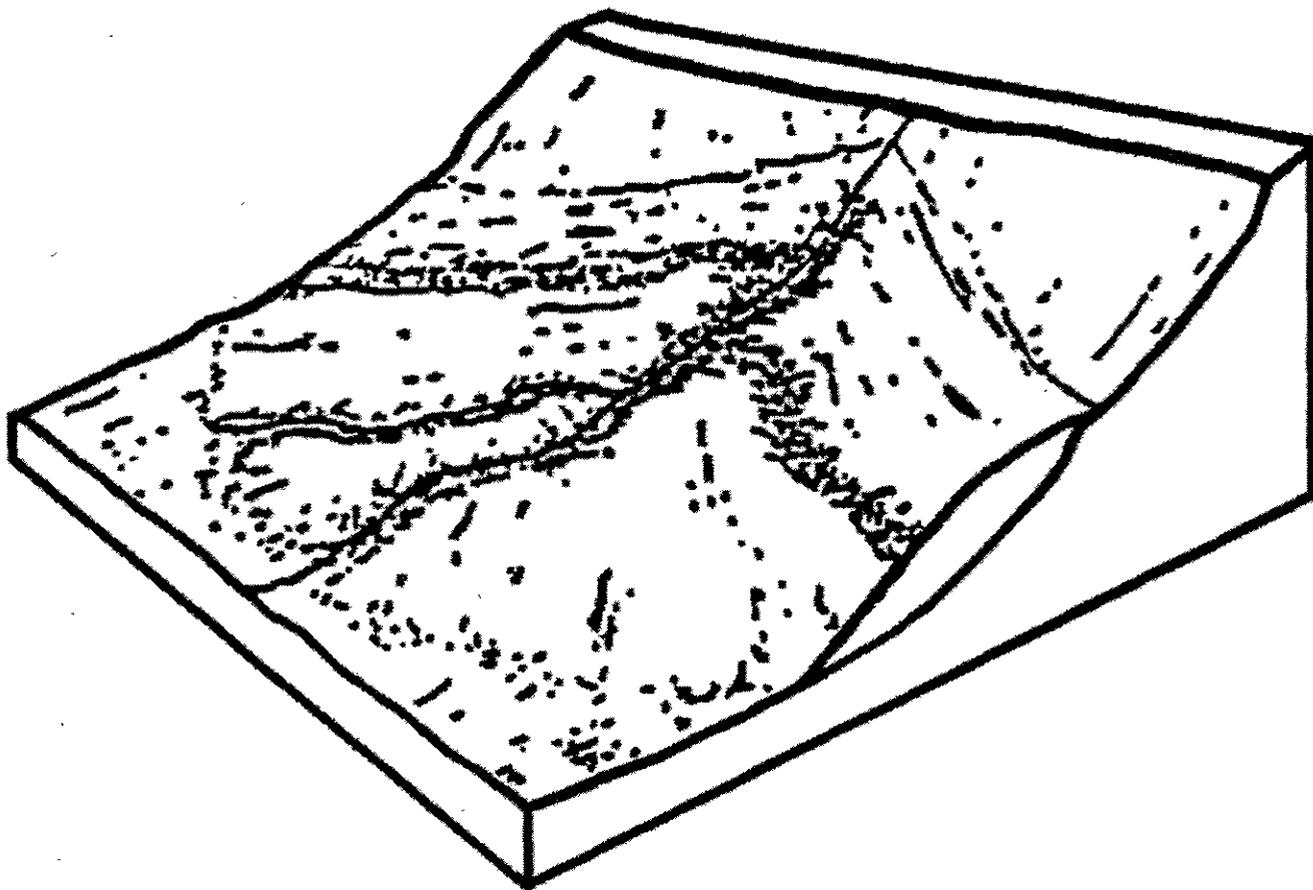
Channel shifts are easily precipitated by log jams, removal of riparian vegetation, debris deposits from upstream mass wasting, and snow avalanche activity. Multiple channels are common below the apex of alluvial cone landforms. Location and design of stream crossing structures are primary riparian management concerns for AF2 streams (BMPs 14.1, 14.2; 14.17). The most stable road crossing sites are generally located near the apex of the alluvial cone landform. Culvert structures have a high risk of being clogged by bedload and woody debris on AF2 channel segments. Road maintenance and measures to stabilize road drainage structures should be emphasized for these streams (BMP 14.20).

These are classified as Value Class II streams. A minimum 100 foot buffer is often required along both banks of these streams (Tongass Timber Reform Act, 1991).

Riparian Management Opportunities

- Sport Fish PotentialLOW
- Enhancement OpportunitiesN/A

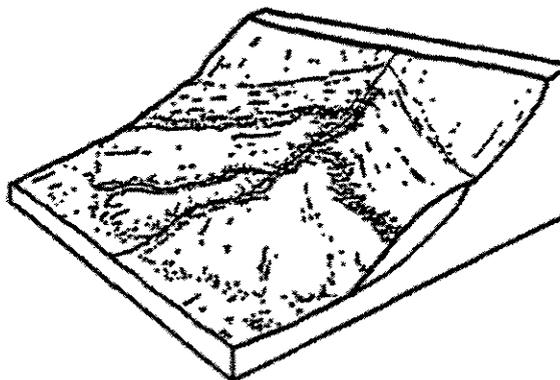
Alluvial Fan Process Group



GLACIAL ALLUVIAL CONE CHANNEL
Channel Mapping Symbol: AF8 (Formerly D6)

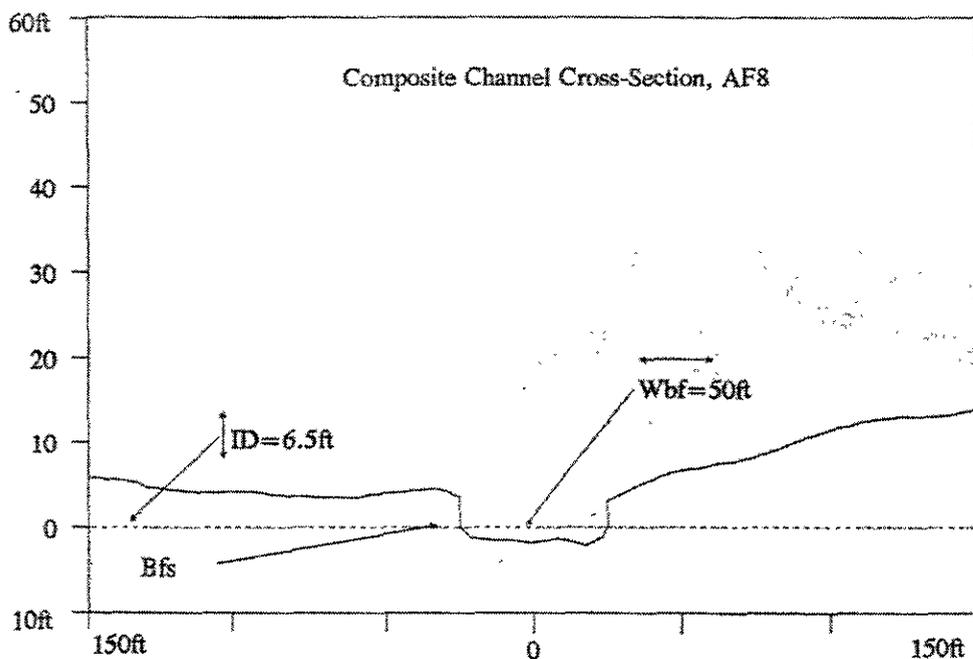
PHYSICAL CHARACTERISTICS

Geographic Setting: The AF8 occurs on alluvial cone landforms in glacial drainage basins. At least 15 percent of the drainage area must be covered by a glacier or permanent snowfield to qualify as a AF8 channel. Channel gradients are commonly greater than six percent. Channel pattern is variable, usually singular at the apex of the cone and branching at the terminus. Suspended glacial silt load is high in these channels.



Similar Channel Types: AF2, GO5

Channel Structure



- Stream Gradient:Variable, >6%; mean = 17%
- Incision Depth:< or = 2 m (6.5 ft)
- Bankfull Width:.....Variable, mean = 15 m (50 ft)
- Dominant Substrate:Coarse gravel to small boulder
- Stream Bank Composition:Alluvium
- Sideslope Length:Not significant
- Sideslope Angle:Not significant
- Channel Pattern:.....Single to multiple channel, normally single at the apex of the fan with channel branching at the terminus.
- Drainage Basin Area:.....2.6-13 km² (1-5 mi²)

INCHANNEL PHOTO: AF8



Riparian Vegetation: The riparian plant community is dominated by nonforested Sitka alder, willow, and salmonberry shrub communities.

Plant Association Series	% Cover
Nonforest.....	91%
Mountain Hemlock.....	3%
Sitka Spruce	3%
Western Hemlock.....	3%

Channel Type Phases:

- AF8s - SHRUB PHASE consists primarily of brush riparian vegetation.

MANAGEMENT CONSIDERATIONS

Hydrologic Function: AF8 channels have high rates of sediment transport and deposition. Sediment is delivered to these cone or fan channels from alpine glacier runoff, mountainslope avalanche, and mass wasting processes. Sediment outwash lobes are deposited across the surface of the alluvial cone by a network of multiple branched channels. Consequently, these are very dynamic landforms.

Aquatic Habitat Capability

- Large Woody Debris..... N/A
- Available Spawning Area (ASA) Insufficient data
- Available Rearing Area (ARA) Insufficient data

Indicator Species Ratings

MIS	ASA	ARA
Coho.....	NEG	NEG
Pink.....	NEG	NEG
Chum.....	LOW	NEG
Sockeye.....	LOW	NEG
Chinook.....	NEG	NEG
Dolly Varden.....	LOW	LOW
Steelhead.....	NEG	NEG

AF8 channels are often accessible to anadromous fish, and are occasionally accessible to resident fish. The amount of ASA and ARA are insignificant. Substrate material is generally large, consisting of 22% gravel, 43% rubble, and 31% boulders and bedrock. Chum salmon and Dolly Varden char may spawn where finer substrate is found at the base of these alluvial cones near the junction with mainstem river channels. Shallow groundwater aquifers associated with alluvial cones can significantly improve spawning habitat in adjacent mainstem streams where groundwater upwelling occurs. Where these channels feed accessible lakes, spawning by sockeye salmon and resident species may occur.

Riparian Management Considerations

Concern for Management of:

Large Woody Debris	LOW
Sediment Retention	LOW
Stream Bank Sensitivity	HIGH
Sideslope Sensitivity	N/A
Flood Plain Protection Need	HIGH
Culvert Fish Passage.....	N/A

Stream banks are naturally unstable in AF8 channels, and riparian vegetation plays an important role in stabilizing these banks, therefore, maintaining riparian vegetation integrity is an important management concern (BMPs 12.6, 13.16). Large sediment loads from glacial meltwater and snow avalanches cause extensive channel aggradation and frequent channel shifting. Consequently, bridge and culvert design, and road maintenance are key riparian management concerns (BMPs 14.17, 14.20).

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

Riparian Management Opportunities

Sport Fish Potential	N/A
Enhancement Opportunities	Spawning Channels

Spawning channel sites can often be located in the vicinity of glacial alluvial cone channels where suitable gravel substrate and shallow groundwater aquifers often occur. Provisions for protecting spawning gravel installations from flooding and sediment deposition should be incorporated into project plans.