The greater natural abundance of broadleaf deciduous trees on the fan than on adjacent slopes (refer to Plate 4.3.2-5) is supportive of one of the goals for management in the Upper Nechako Canyon Resource Management Zone – which is to encourage the broadleaf deciduous component in the valley.

Viewed southwards (upstream) from the 'Neck' area, Cheslatta Fan shown in Plate 4.3.2-5 has an area with a diverse mixture of tree species. Although the relatively young surface of the fan is still sparsely revegetated with shrub and herbaceous cover, the entire fan surface is ecologically amenable to a variety of assisted revegetation techniques using species adapted to relatively dry, well-drained parent material.

The entire area from Scour Hole Lake to the confluence of the Cheslatta and Nechako rivers is logistically amenable to a variety of assisted revegetation techniques. Unlike Nechako Canyon, the Cheslatta Fan area has ready vehicle access if assisted revegetation with cottonwoods or other species is desired along the margins of a self-forming natural channel. It is premature to suggest specific revegetation options until there is a clearer definition of location, upper elevation limits, and expected stability of any future self-forming natural channel. Future revegetation options will also be determined by recreational and other land use alternatives for the area between Scour Hole Lake and Cheslatta Falls.

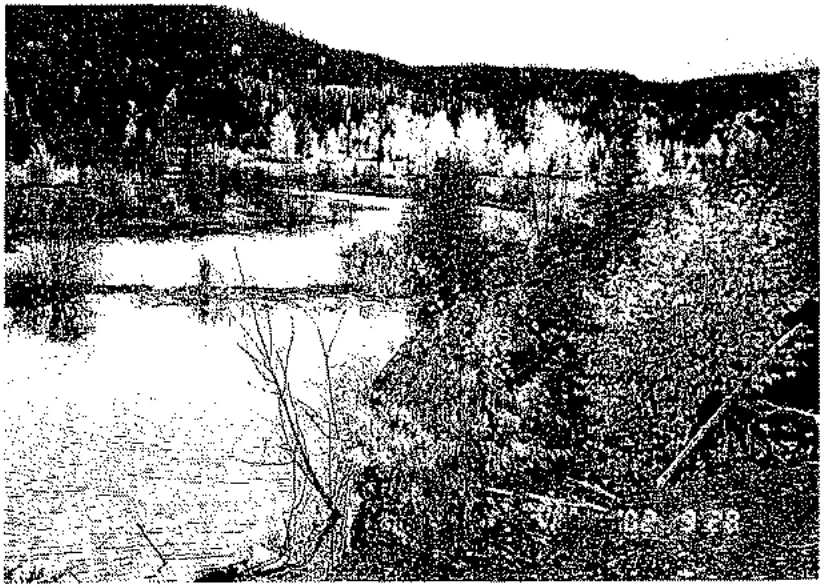


Plate 4.3.2-5 Present vegetation on the Cheslatta Fan.

While vegetation on the fan is sparse in herbaceous and shrub cover, there is a diverse mixture of tree species. The fan contains a higher proportion of broadleaf deciduous tree species (cottonwood, birch, and aspen) than adjacent forested slopes, a feature highlighted in recommended management strategies for the Upper Nechako Canyon Resource Management Zone. Location: view southward over Cheslatta Fan from rock outcrop on northwestern edge of 'neck' area shown in Plate 4.3.2-3, approximately 8.3 km downstream from Kenney Dam.

4.3.3 Fisheries

A qualitative assessment of fish habitat was conducted during the September 2002 field visit to the Cheslatta Fan. The remnant channel was approximately 30 m wide and water depths ranged from approximately 30 cm deep at the riffle at outlet of Scour Hole Lake to over one meter in some of the beaver ponds at the downstream end of the fan. The bed material was predominantly sands and fines, with small quantities of cobble and boulder material. There were a number of beaver dams present during the September 2002 survey that may impede fish passage at low water (i.e., late summer). The beaver dams present in the vicinity of the Cheslatta Fan create several large pools for fish to rear in. Without the beaver dams, the water levels in the late summer and late winter would be very low and useable fish habitat would most likely be limited. The sand and cobble riffle at the outlet of Scour Hole Lake may provide a possible spawning area for salmonids. The bed material in the remainder of the channel was generally too fine (i.e., silts and fine sand) for salmonids to use for spawning.

Scour Hole Lake provides year-round rearing and feeding habitat for all life stages of salmonids. The outlet of the lake would provide spawning habitat for rainbow trout, although there was a fairly high concentration of sands and fines in the streambed. The aquatic and overhanging vegetation would provide cover for juvenile fish. Fish species known to be present in Scour Hole Lake include rainbow trout, lake trout (*Salvelinus namaycush*), and residualized chinook salmon (i.e., chinook that did not migrate to the ocean; Cadden pers. comm.).

During the site assessment juvenile rainbow trout were observed in the upper end of the remnant river channel, immediately below the outlet of Scour Hole Lake. Large fish, presumably rainbow trout, were observed to be feeding at the surface throughout Scour Hole Lake. The remnant channel of the Nechako River provides a connection between Scour Hole Lake and the Nechako River. It is not clear if fish readily move from the Nechako River to Scour Hole Lake, although there is some anecdotal information that suggests that juvenile chinook salmon may rear in the Cheslatta Fan outflow channel (Rescan 1999).

Re-establishing flows through the Cheslatta Fan will likely result in the alteration of stream habitat from the current beaver controlled stream to a functioning river channel. It is anticipated that over time the channel will develop riffle-pool morphology, bed material will become more coarse and a functional riparian area will develop. In order to facilitate the development of the channel, riparian enhancement should be done once the channel has developed its maximum width. In addition, as the development of the riffle-pool will take time, it might be advantageous to construct habitat structures in order to provide some complexity to the channel. The changes to the existing channel around the Cheslatta Fan are considered to be beneficial as they would re-establish processes and habitat types that occurred prior to the construction of the Kenney Dam.

4.3.4 Wildlife Habitats

A qualitative assessment of wildlife habitat was conducted during the September 2002 field visit to the Cheslatta Fan. Signs of ungulate use were evident throughout the fan and some waterfowl were present on Scour Hole Lake. It is not known at this time to what extent the trees on the fan are used for nesting.

The conditions within the remnant channel are ideal for beavers. Low gradient and slow water velocities are ideal for construction of beaver dams. There were also abundant materials available for dam construction and food sources. Consequently, there were a large number of beaver dams between Scour Hole Lake and the Cheslatta River confluence.

Beavers will likely be the wildlife species most affected by increased flows from the CWRF. The velocities will be such that the existing dams will be broken apart and will prevent the beavers from rebuilding them.

The impacts on wildlife are not considered to be significant as much of the fan will remain undisturbed and there is available habitat downstream of the fan. In addition, the renewed flows and creation of a regime channel at the fan would result in conditions similar to those that existed prior to the construction of the dam.

4.4 Alternatives for Moving Water Across Cheslatta Fan

4.4.1 Concepts Considered

The NEEFMC report prepared by Hayco (2000) identified 14 options to convey water across the Cheslatta Fan. Descriptions of each are contained in the Hayco report, and will not be repeated here, with the exception of Options 12 and 13, which warrant more discussion than the others in this report.

The options considered by Hayco (2000) included:

• Option 1	Concrete Flume
• Option 2	Concrete Flume and Side Channel
• Option 3	Armoured Channel
• Option 4	Armoured Channel and Side Channel
• Option 5	Compound Armoured Channel
• Option 6	Compound Armoured Channel and Side Channel
• Option 7	Weir and Fish Ladder at Neck
• Option 7A	Rockfill Dam and Fish Ladder at Neck
• Option 8	Weir and Fish Ladder at Neck with Downstream Channel
• Option 9	Weir and Fish Ladder Downstream of Falls
• Option 10	Weir and Fish Ladder at Neck and Downstream of Falls
• Option 11	Excavate Sediment
• Option 12	Meandering Pilot Channel
• Option 13	River-cut Channel

Hayco (2000) identified the Meandering Pilot Channel (Option 12) as the preferred option following a primary screening of the options using an evaluation matrix. This concept featured the excavation of a small meandering channel through the central part of the fan. The excavated channel would be constructed with an 8 or 9 m bottom width and 3:1 (H:V) side slopes, and would be expected to self-enlarge once substantial discharges from the CWRF begin to flow through it. A wing dyke was also proposed to prevent flow from entering the existing side channel and to encourage flow to enter the pilot channel. The location of the wing dyke was not described, nor was it shown on the referenced figure.

We identified a potential weakness in this concept. The topography of the fan is such that, even with a wing dyke at the entrance of the pilot channel, the future river across the fan would tend to divert itself back into the existing channel course along the right valley wall upstream of the Neck when discharges exceeded the limited capacity of the pilot channel. This avulsion would be difficult to prevent during high discharges unless large intrusive works, such as continuous armoured dyking separating the pilot channel from the existing channel, were to be constructed.

The concept named River-cut Channel (Option 13) in the Hayco (2000) report calls for re-watering the fan without any prior physical preparations. The channel would primarily follow the course of the existing channel along the right margin of the valley upstream of the Neck, and self-enlarge as discharges increase. Hayco (2000) identified several disadvantages with the River-cut Channel option:

- destruction of the existing channel and its fish habitat;
- generation of large volumes of fine sediment that could cause damage downstream; and
- development of a braided, as opposed to a single thread, channel across the fan.

We see some inconsistencies between the predicted morphological outcomes for the Meandering Pilot Channel and the River-cut Channel concepts outlined by Hayco and we differ in the assessment of the degree of the negative consequences that would result from the River-cut Channel option. This is discussed in greater detail in Section 4.4.7. As a result of these considerations, a new concept was developed by our study team that was, in essence, a modification of the River-cut Channel option. This was named Option A, Reactivated Natural Channel, and is described in greater detail in the next section of this report.

A sub-option of this concept was also identified. It includes a short pilot side channel at the upstream end and two berms to deter erosion in two areas. This sub-option was named Option B, Reactivated Natural Channel with Side Channel.

We identified another concept that was very similar to Hayco Option 9 Weir and Fish Ladder Downstream of Falls, which uses a partial dam to limit the erosion of sediment upstream. The difference is that our option features a vertical slot though the centre of the dam instead of a full weir across the channel. The intent behind this concept, named Option C Downstream Slot, is to allow a natural channel to evolve at low flows, but to prevent erosion at high flows by means of the dam and slot constriction that would flood the fan. The dam and slot would be situated at the same location where a natural bedrock constriction occurs downstream of the Cheslatta Falls. This option is described in greater detail in Section 4.4.4.

4.4.2 Option A - Reactivated Natural Channel

This concept entails rewatering the Cheslatta Fan without the prior construction of a continuous channel across the fan. This option would utilize commissioning flows released at the Kenney Dam to perform the entire channel enlargement by eroding the bed and banks of the existing channel in a way that is closer to natural channel evolution.

The existing topography of the Cheslatta Fan naturally favours a channel route along the right valley wall upstream of the "Neck," because this is where the land surface is the lowest and the sediment tends to be finer than at locations closer to the apex of the fan. For a channel across the fan to be maintained in any other location would require considerable human intervention and ongoing maintenance, involving either a large excavated channel and/or a large dyke to prevent the river from diverting itself into this natural low corridor when large flows are released at Kenney Dam.

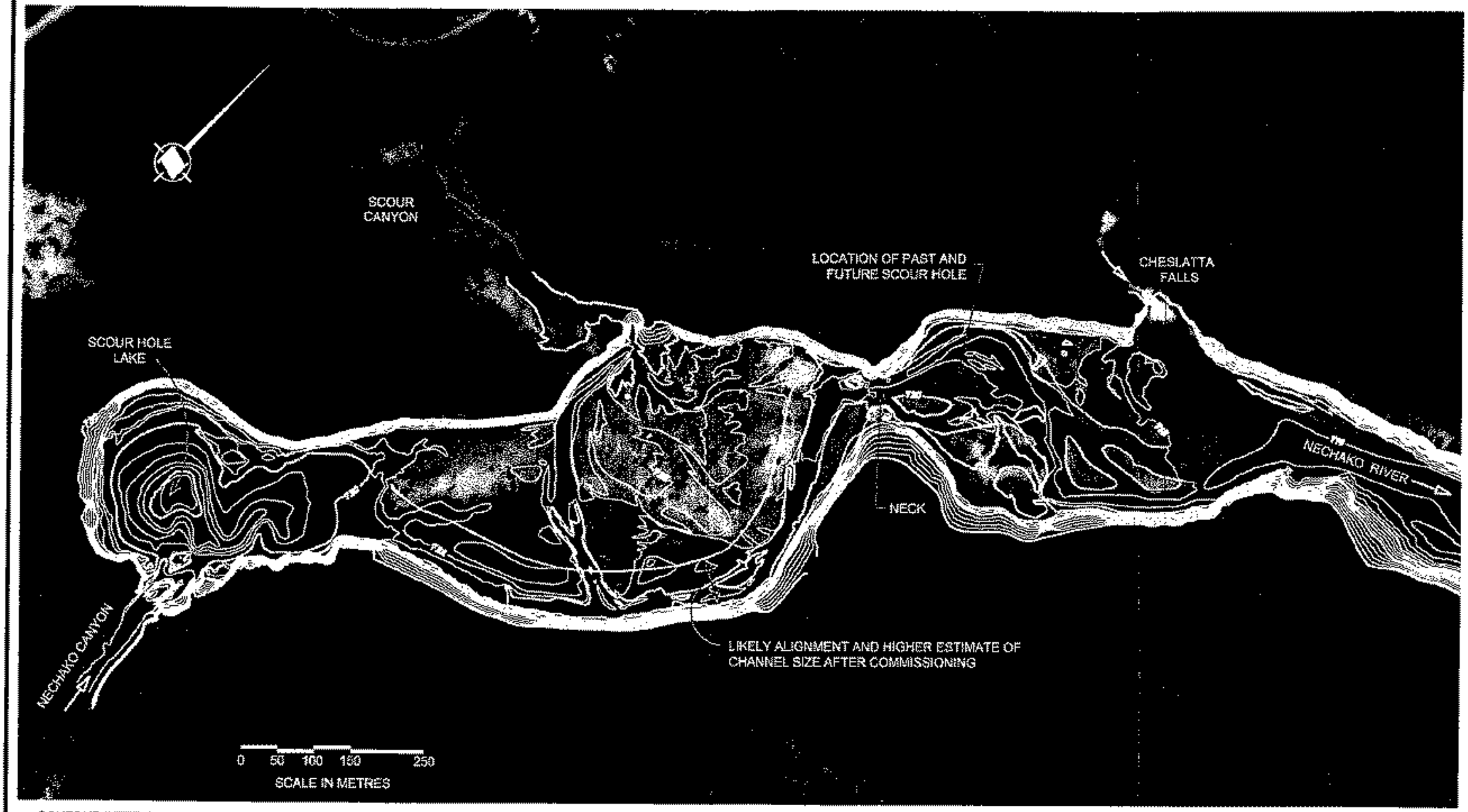
In essence, this concept is very similar to the River-cut Option identified by Hayco (2000). The major difference is that the Reactivated Natural Channel would be carefully commissioned to avoid the negative downstream consequences of elevated sediment loads described in the Hayco (2000) report.

Figure 4.4.2-1 shows how a future channel created under this concept might appear from the air. It is expected that the future self-formed channel will follow the general alignment shown in this figure. From its upstream end at Scour Hole Lake the channel will follow the existing channel along the right valley wall to the Neck. Immediately downstream of the Neck, a new scour hole will form, although its ultimate size will likely not match that of the scour hole that was there before Kenney Dam was built because the future peak discharges will be substantially smaller than the pre-dam peak flows. Below the future scour hole, the channel may take a different path from that shown on the drawing, because the large amount of bed material that will be transported through this area makes it impossible to predict the future shape of the channel. In any case, it will not migrate very close to the falls because of the large boulders deposited there by the force of the water from the falls.

The ultimate size of the channel cannot be exactly determined, although it will be smaller than the pre-dam channel was because the future channel forming discharges will be lower than those that occurred before the dam was built and because the pre-dam gravel supply from areas above the dam is eliminated. River regime formulae were used to provide an approximate range within which the channel width will likely occur, assuming a channel forming discharge of 250 m^3/s at the end of the commissioning period. Figure 4.4.2-1 indicates a channel width of approximately 70 m, which is on the large side of the regime predictions, and Figure 4.4.2-2 shows a 50 m wide channel, which is on the small side. There is some uncertainty in these size predictions and the actual width may fall outside of this range. The actual size will depend partly on the gradations of the sediment present along the channel route, the magnitude and duration of the flows that will be released, and the amount of time it will take to stabilize the banks for trees. During the early commissioning phase, these flows would be prescribed and closely controlled. It is understood that larger flood flows with unpredictable magnitudes up to 450 m^3/s will eventually occur after the channel is commissioned, and these flows might cause additional channel enlargement.

The main advantages of this option are:

- a fully natural and sustainable channel at the end of the commissioning period;
- no maintenance requirements;
- enhanced spawning and rearing habitat for migratory and resident fish;
- no fish migration barriers;
- aesthetically pleasing; and
- economical.



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DATE: FEBRUARY 26, 2003

OPTION A
REACTIVATED NATURAL CHANNEL
ASSUMED 70 m WIDTH
FIGURE 4.4.2-1

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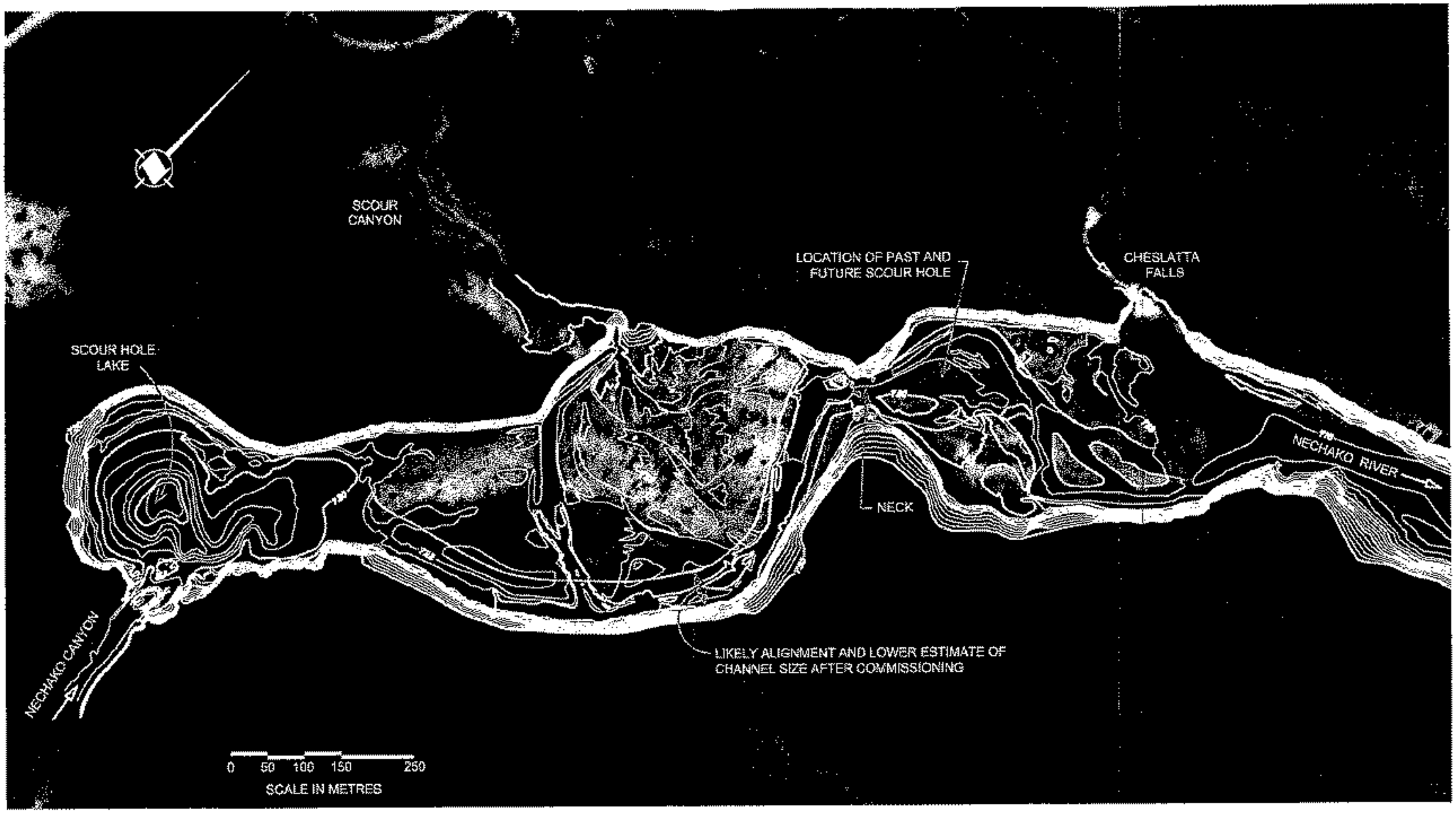

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OPTION A
REACTIVATED NATURAL CHANNEL
ASSUMED 50 m WIDTH
FIGURE 4.4.2-2

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The primary disadvantages of this concept are:

- an ill defined risk of downstream sediment impacts;
- potential for increased erosion along the left bank undermining the island of old-growth trees at the upstream end of the existing channel; and
- a longer commissioning period.

The risk of negative downstream impacts caused by sediment generation can be substantially mitigated by a cautious flow release strategy for commissioning the channel, involving rigorous monitoring and an adaptive management approach. This is described in greater detail in Section 5. Although this option would require a longer commissioning period than some of the other options, it should be understood that there would be some ability to release low flows through the CWRF for operational purposes immediately after the first flush, and the limit to the magnitude of these would increase with every subsequent flush.

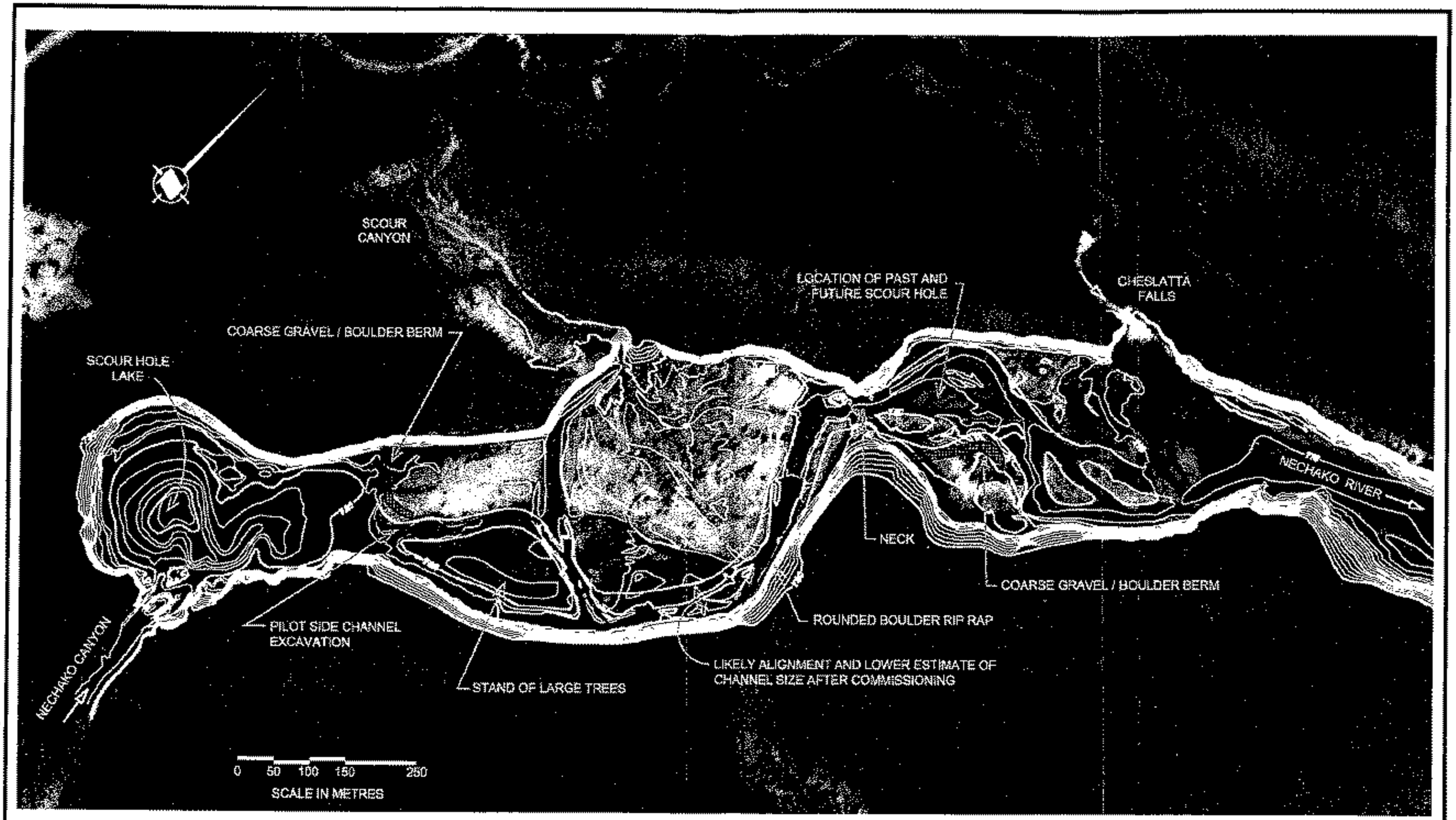
4.4.3 Option B – Reactivated Natural Channel with Side Channel

This concept is similar to Option A, except that a side channel would be developed at the upstream end by excavating a 230 m long pilot channel prior to commissioning. The reason for proposing this side channel is that a stand of the largest trees on the fan (refer to Section 4.3.2) would be prone to undermining and erosion by Option A, because there is insufficient width between the right valley wall and this stand of trees in which a single channel could fit. Providing a second channel would greatly decrease the natural tendency of the existing channel to widen as much or as quickly as it would as a single channel. The proposed alignment of the channels in this option is illustrated in Figure 4.4.3-1.

The intention is not to preserve this stand of trees from the threat of erosion indefinitely. Instead, the objective is to at least protect it from the rapid erosion expected during the commissioning phase. After commissioning, the natural processes of erosion, undermining and collapse of trees, which will provide large woody debris to the channel, are expected to continue as they would in any other natural setting.

The configuration of the upstream end of the Reactivated Channel, immediately downstream of Scour Hole Lake, is unique in that no significant quantities of bed material are expected to be transported into the upstream end of this reach for many decades, perhaps centuries. The larger-sized bed material fractions would be deposited in Scour Hole Lake, and the finer fractions would be transported through this reach in suspension. As a result, the initial alignment of the upstream end of the Reactivated Channel will likely be preserved for a long time, because a shortage of bed material typically results in a laterally stable channel.

A preliminary concept for the cross sectional shape of the pilot channel is shown in Figure 4.4.3-2. The lower part of the channel is intended to provide deeper flow at low discharges that would ensure fish would not be isolated. This channel is expected to enlarge itself at the same time the parallel existing channel also self-erodes. It is not possible to predict the relative degree of growth in the two channels.



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- PHOTO IMAGE FROM PROVINCE OF B.C. AIR PHOTO ROLL 15BCC00020 No.59, TAKEN 22 SEPT. 2000

DATE: FEBRUARY 26, 2003

OPTION B
REACTIVATED NATURAL CHANNEL
WITH PILOT SIDE CHANNEL AND BERMS
FIGURE 4.4.3-1

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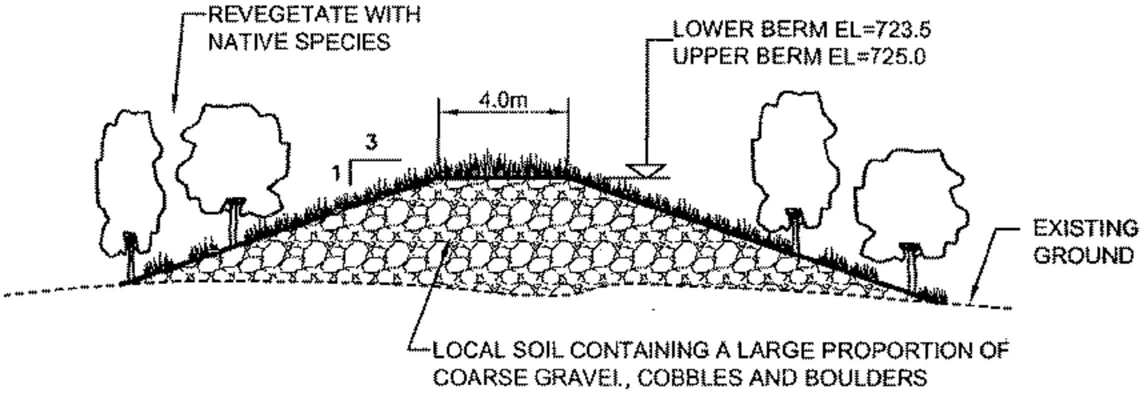
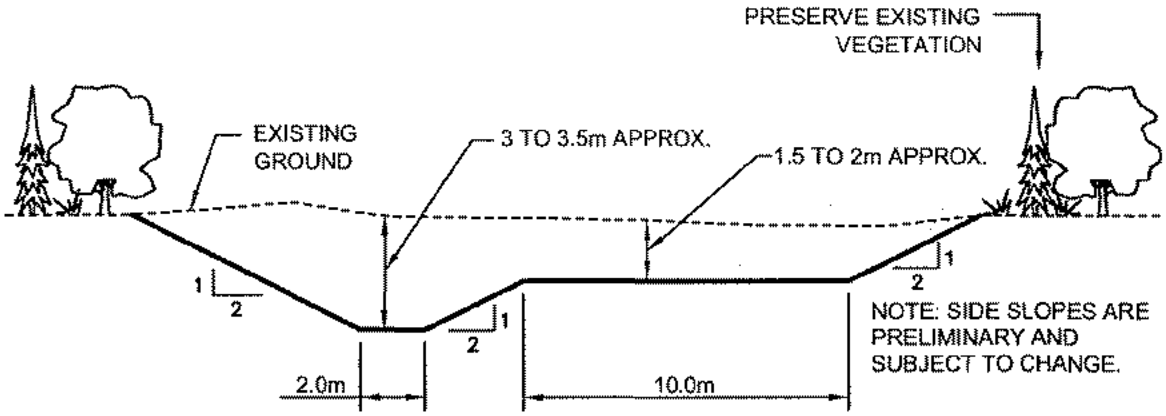


TYPICAL BERM CROSS SECTION



PILOT SIDE CHANNEL EXCAVATION (LOOKING DOWNSTREAM)

OPTION B
REACTIVATED NATURAL CHANNEL
TYPICAL BERM AND PILOT CHANNEL SECTIONS
FIGURE 4.4.3-2

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Two embankments are proposed as part of this concept, as shown on Figures 4.4.3-1. They are not essential to the concept, but their intent is to prevent the erosion of large sand deposits during commissioning and the early part of the post-commissioning period. These berms are not intended to be permanent features, instead they could be undermined in the distant future, and the river could eventually access and mobilize the sand deposits behind them, but by then the river would have become naturalized, having developed a stable long-term gradient. The sand would then primarily be mobilized by bank erosion as the channel shifts laterally. This erosion would be gradual, and no different from the erosion that occurs naturally in other parts of the river at high flows.

These berms would stand approximately 3 to 4 m high, and would have 3:1 (H:V) side slopes. Typical cross sections are shown in Figure 4.4.2-2. They would be constructed of soil (unconsolidated sediment) containing a large proportion of coarse gravel, cobbles and boulders that could be obtained locally from the area near the apex of the fan or from the Scour Canyon. They would also be planted with natural species after construction to blend in with the surrounding vegetation.

In addition to the berms, a revetment of rounded boulders is proposed for the outside of the bend upstream of the Neck, as shown in the Figures 4.4.3-1. The purpose of this revetment is to address the concern that this area would become a long-term erosion site, with a very large potential sediment source, mostly sand, stored in the high terrace at the bend. The boulders, which could be taken from the Scour Canyon, would act to deter toe scour along this high bank. They would be placed around the existing trees, which would not be removed, with the intent that the tree roots and the rocks retain the bank.

The design of these berms and revetment are different from conventional designs in that they are not intended to be absolutely fail-safe for a long period of time. They are only intended to last at least through the commissioning period and the early part of the post-commissioning period. If the structures should become undermined after that time, there would not be serious consequences to the environment. Taking this approach, which acknowledges eventual possible removal by erosion, allows designs that are more aesthetically pleasing and harmonious with the natural surroundings.

The advantages and the disadvantages are the same for both Option A and B, except that Option B would have the following additional advantages:

- slightly increased quantity and variety of fish habitat;
- reduced erosion threat to the oldest and largest trees on the fan; and
- reduced quantity of sand released during and after the commissioning period.

The disadvantages of Option B as compared to Option A, is that it will cost more and the berms may be less aesthetically pleasing than the existing landscape.

4.4.4 Option C – Downstream Slot

Downstream of Scour Hole Lake, there are two natural bedrock constrictions that affect the hydraulics of flow and morphology on the fan. One is at the "Neck", and the other is located approximately 800 m downstream of Cheslatta Falls. The hydraulic modeling analysis (discussed in Section 4.4.5) indicated that these two constrictions create a substantial backwater effect over portions of the fan at high discharges. This backwater effect causes the flow to become deeper and slower upstream of the constriction, resulting in a reduction in energy available to erode material from the fan.

The Downstream Slot concept would involve increasing the degree of flow constriction at the lower location by building concrete 'shoulders' on the bedrock banks at this site, thus forming a dam with an open vertical slot through the centre of it. The goal would be to flood the fan and prevent erosion at high discharges, but retain the existing natural flow regime at the low discharges. The slot width tested in the model was set at 20 m, since this width corresponded to the width of the top of the narrow bedrock gorge, and would avoid any portion of the dam overhanging the channel below, although this was not an absolute constraint.

At low flows, the water would self-erode a channel through the fan, but it would be smaller than the channels in Options A or B described above. No fishway would be required, since there would be no migration barriers at low and average flows; however, during high flows the discharge through the slot would form a velocity barrier to fish migrating upstream.

Option C has the following advantages:

- unobstructed channel throughout;
- good fish migration at low flows;
- reduced volume of sediment generation compared to Options A and B;
- a fully natural and sustainable channel at the end of the commissioning period;
- enhanced spawning and rearing habitat for migratory and resident fish; and
- no fish migration barriers

However, the primary disadvantages of this concept are:

- considerably more expensive that either Option A or B;
- aesthetically inconsistent with the natural surroundings (and management goals);
- some remaining risk of downstream sediment impacts;
- long commissioning period, but less than Options A or B;
- maintenance required to periodically clear debris from slot; and
- fish migration barrier at high flows.

4.4.5 Hydraulic Analysis

In order to determine the hydraulic parameters for a regime channel through the fan, and to assess the ability of the proposed flows through the Cheslatta Fan to mobilize different sizes of sediment, steady-state water surface profiles were simulated over the range of expected future discharges. This was accomplished by applying the same HEC-RAS computer modeling software (USACE 1998) used to simulate the hydraulic conditions in the canyon. The model for the canyon was extended downstream across the fan and for several kilometres downstream.

The physical dimensions of the Cheslatta Fan are described in the model by a total of 11 cross sections that were taken from a 1 m contour map prepared by McElhanney Geosurveys Ltd. in 1989. A 4.5 km long reach of the Nechako River channel downstream of the fan was defined by 31 cross sections obtained from the 1998 NFCP report entitled Numerical Model of Nechako River (Triton 1998). The model used in the present analysis was part of a larger model that also included the canyon (described in Section 3.4) and covered a total length of 14 km.

Three scenarios of channel evolution over the fan were simulated with the model, as follows:
- the existing channel configuration before enlargement;
- a 70 m wide channel at the end of the commissioning period; and
- a 50 m wide channel at the end of the commissioning period.

Results from the model simulations for the first scenario are presented graphically in Figure 4.4.5-1 for discharges of 20 m^3/s, 200 m^3/s and 490 m^3/s. Simulated water surface profiles and the minimum bed elevation profile are shown in Figure 4.4.5-1a. These profiles indicate that the water surface would drop approximately 4 m through the 1.3 km long channel distance over the fan. The initial slope at low discharge would be relatively constant throughout this length.

The variation of flow velocities averaged across each cross section on the fan is presented in Figure 4.4.5-1b. This graph shows that the channel between Scour Hole Lake and the "Neck" would generally flow with a higher velocity than the short channel segment downstream of the "Neck." Simulated average depths at each cross section are presented in Figure 4.4.5-1c, and channel shear stress values are plotted in Figure 4.4.5-1d.

The set of 4 graphs presenting the same 4 parameters at the same 3 discharges for the second scenario are presented in Figures 4.4.5-2. The set of 4 graphs for the third scenario are numbered 4.4.5-3.

A comparison of the latter two sets of graphs with the first reflects the hydraulic changes associated with the incising and enlarging of a channel across the fan. A comparison of the water surface profile plots shows that the channel slopes would be reduced and the water level in Scour Hole Lake would be about one metre lower after channel commissioning for all discharges. The velocities would not change very much, except at the Neck, where the higher velocities would cause scour that would deepen the channel considerably and create a scour hole downstream. After channel enlargement, the velocities would generally be lower.

A comparison of the three average water depth graphs (not to be confused with channel depths) show the depth to be slightly increased after commissioning everywhere except at the Neck and lower scour hole, where large increases are indicated. This should not be interpreted as a model prediction since these are simply reflections of the assumptions used to create the assumed regime channels and scour holes in the models for the 50 and 70 m wide channels.

The shear stress figures indicate that the channel shear stress would generally decrease after commissioning except at the Neck, where the inerodible bedrock would create a localized water level drop and higher shear zone.

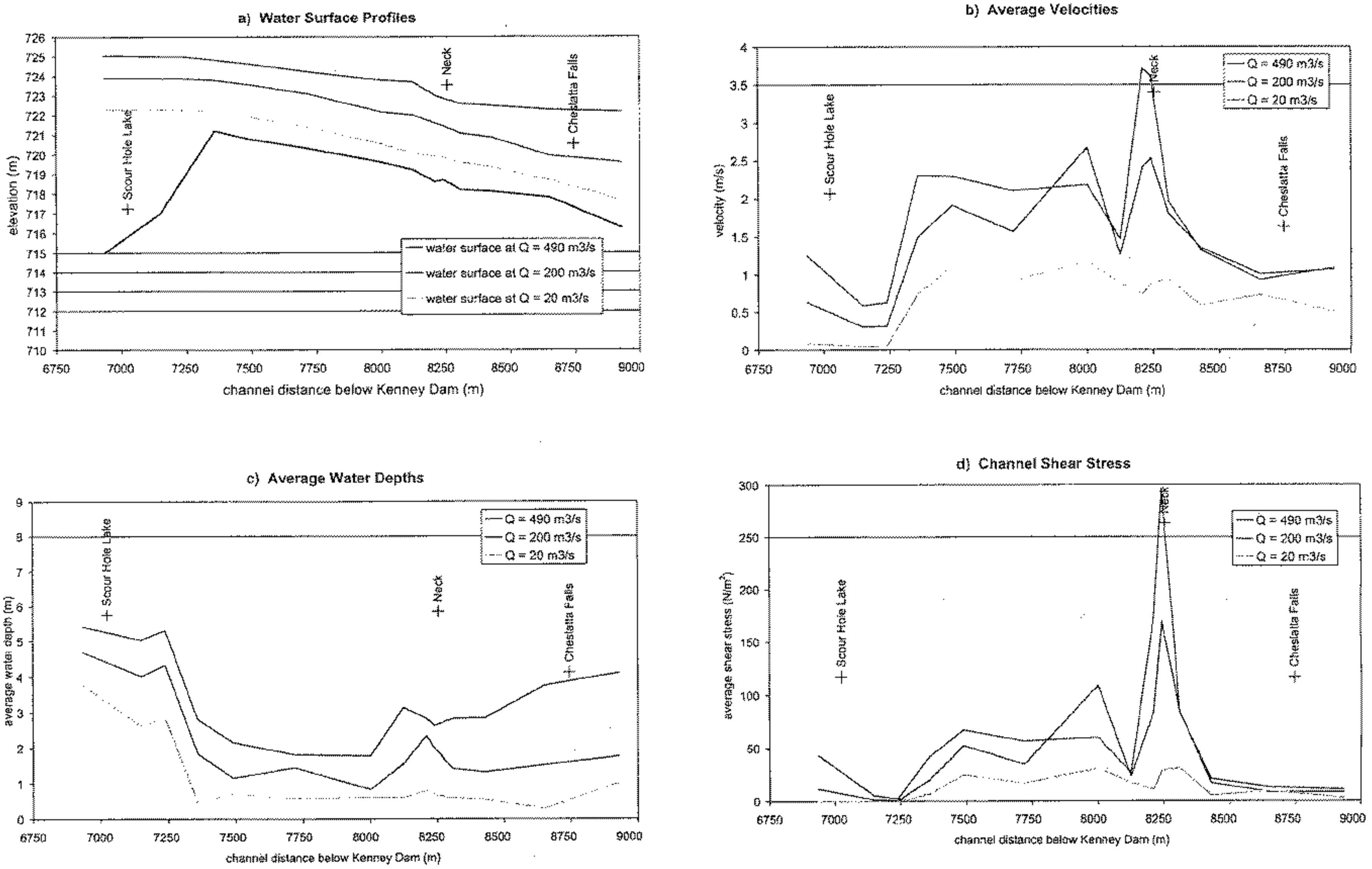
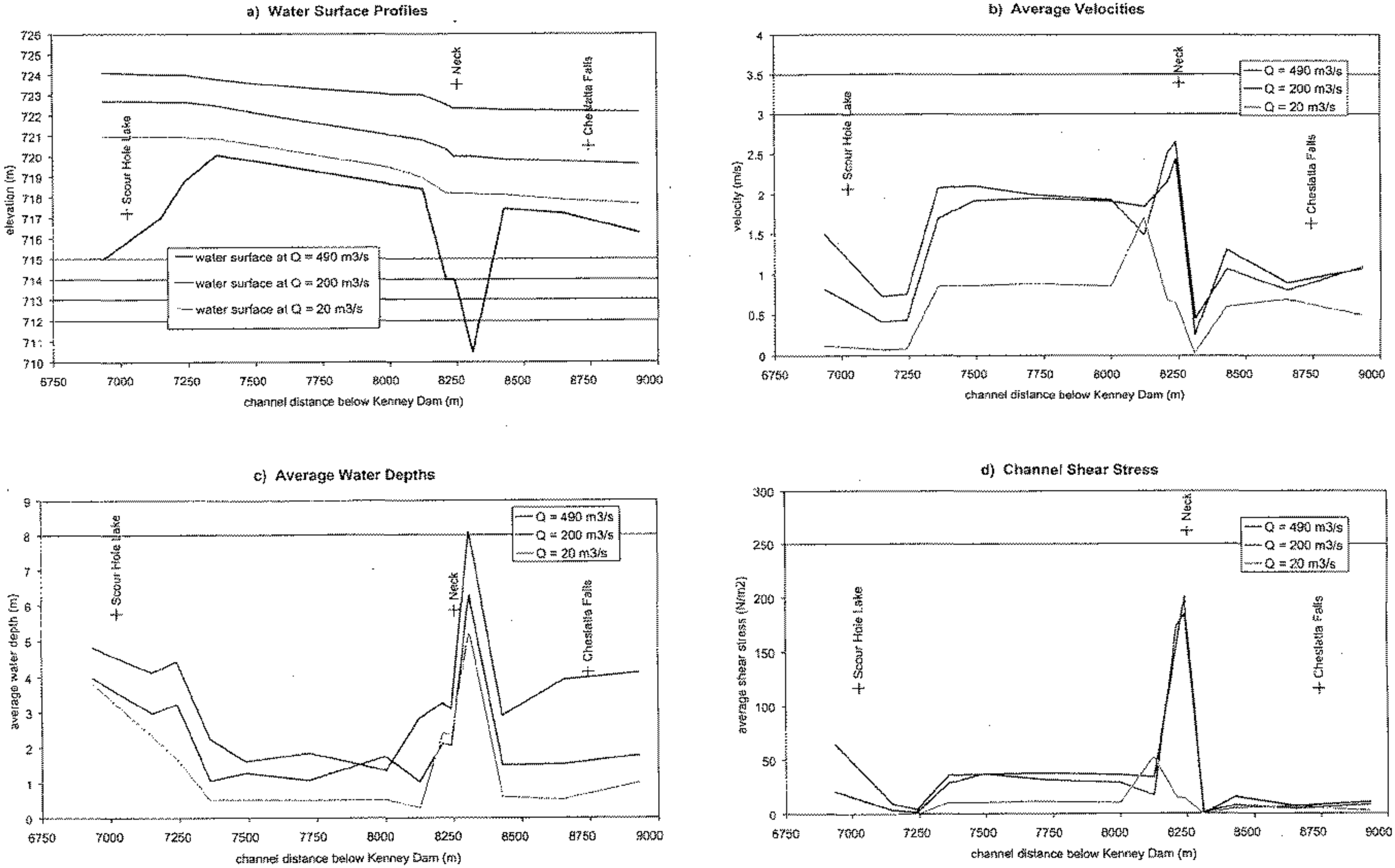


Figure 4.4.5-1 Simulated hydraulic parameters for existing channel on Cheslatta Fan



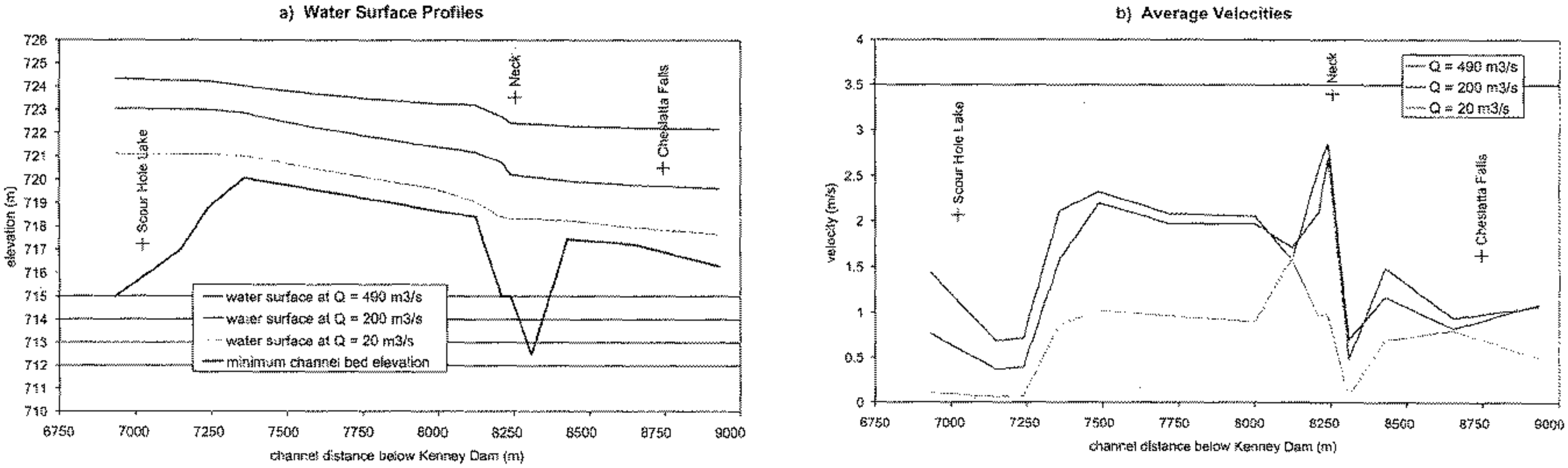
a) Water Surface Profiles

b) Average Velocities

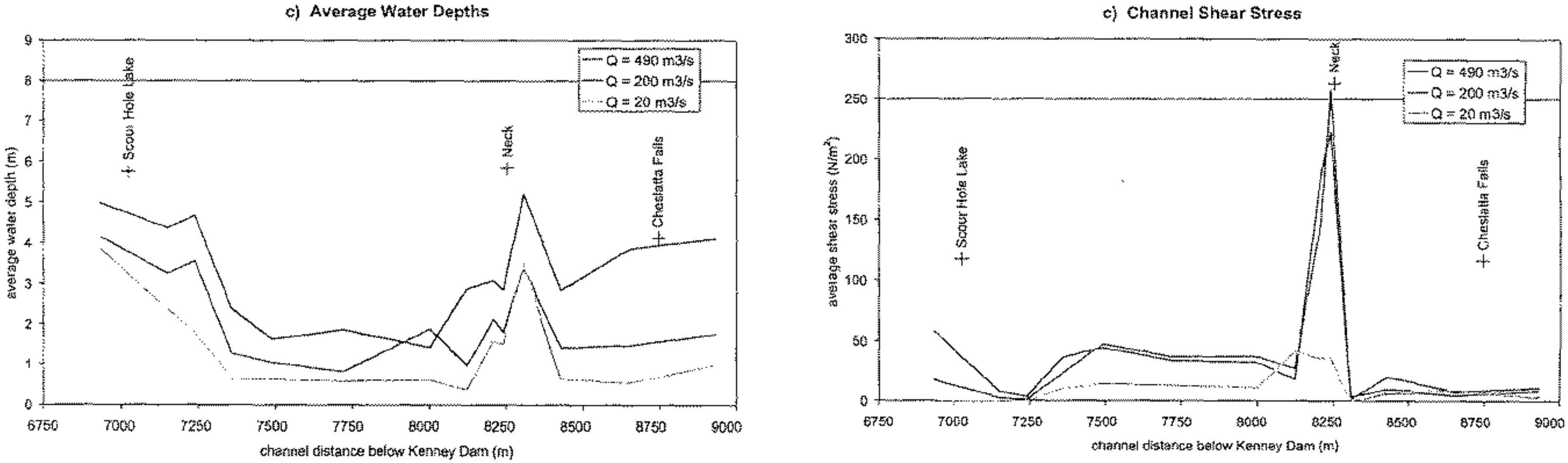
c) Average Water Depths

d) Channel Shear Stress

Figure 4.4.5-2 Simulated hydraulic parameters for 70 m wide channel on Cheslatta Fan


a) Water Surface Profiles

b) Average Velocities


c) Average Water Depths

c) Channel Shear Stress

Figure 4.4.5-3 Simulated hydraulic parameters for 50 m wide channel on Cheslatta Fan

A model was also set up to test the effectiveness of Option C, the Downstream Slot concept. The cross section representing the natural bedrock constriction 800 m downstream of the falls was modified to reflect a dam with a 20 m wide vertical slot. A series of discharges ranging from 20 to 490 m^3/s were simulated with the model. The results confirmed that flow velocities at very large discharges (490 m^3/s) were reduced by the slot, but smaller flood discharges were not effectively diminished. This meant that the slot would have to be made significantly narrower to be effective.

4.4.6 Sediment Transport

The potentially mobile sediment along the proposed Cheslatta Fan channel route can be calculated using the approximate methodology used in Nechako Canyon (Section 3.4.2). The results for the proposed 70 and 50 m wide channels are presented on Figures 4.4.6-1 and -2, respectively.

The analyses indicate that both the 70 and 50 m wide channels behave relatively similarly from a sediment transport perspective. The shear stress calculations predict that medium to coarse sand or larger sediments could be deposited in Scour Hole Lake during flows of 20 m^3/s. Any finer textured materials eroded from Nechako Canyon will, in large measure, be transported downstream. This small discharge is also sufficient to mobilize sand and fine to medium gravels in the proposed channel across the Cheslatta Fan.

Our calculations suggest that sand-sized materials will be conveyed through Scour Hole Lake at a flow of ≥ 200 m^3/s. Coarse to very coarse gravels will also be entrained from the channel around the Cheslatta Fan. This indicates that our assumed 50 or 70 m wide channels are reasonable outcomes of the process of channel incision during commissioning, provided there is enough gravel-cobble material in the fan deposits to form a armoured layer in the channel. Should the incision process fail to encounter sufficiently coarse material, it would proceed to somewhat lower levels (lowering water levels in Scour Hole Lake) until there is a balanced reached between the size of the channel armour material and the channel slope across the fan. The highest shear stresses occur just upstream of the "Neck" and, in this area, cobbles of up to 6 cm in diameter could be entrained. This is similar to the bed material size observed near the Cheslatta confluence described in Section 4.3.1 Minimum shear stresses under all flows occur immediately downstream of the "Neck". It is expected that an unconfined regime channel in this area would evolve rapidly in response to sediment deposition.

4.4.7 Review of the Hay & Company Concepts

The 14 concepts developed and evaluated by Hayco (2000), and Options A, B and C were reviewed by the our study team. It was recognized that the criteria selection for an evaluation matrix is subjective and that the rankings also require subjective judgment. Rather than developing an alternative evaluation matrix, the one used by Hayco was retained for this review. We agreed with Hayco's screening results to the extent that the first 12 options listed by them should be eliminated, leaving only Option 12, the Meandering Pilot Channel and Option 13, the River-cut Channel for further consideration.

Figure 4.4.6-1 Calculation of mobile bed material size through Cheslatta Fan

70 m channel width estimate

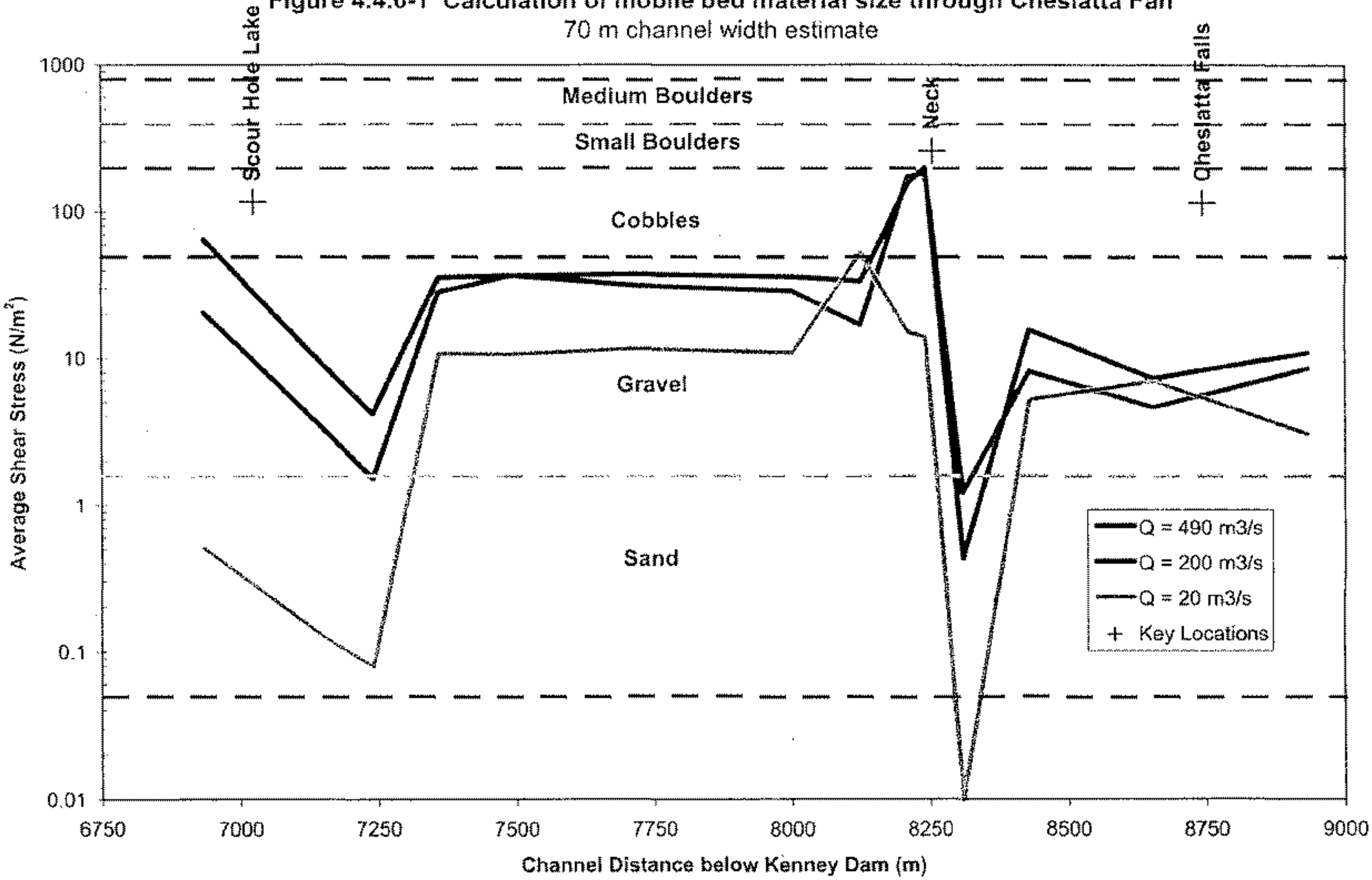
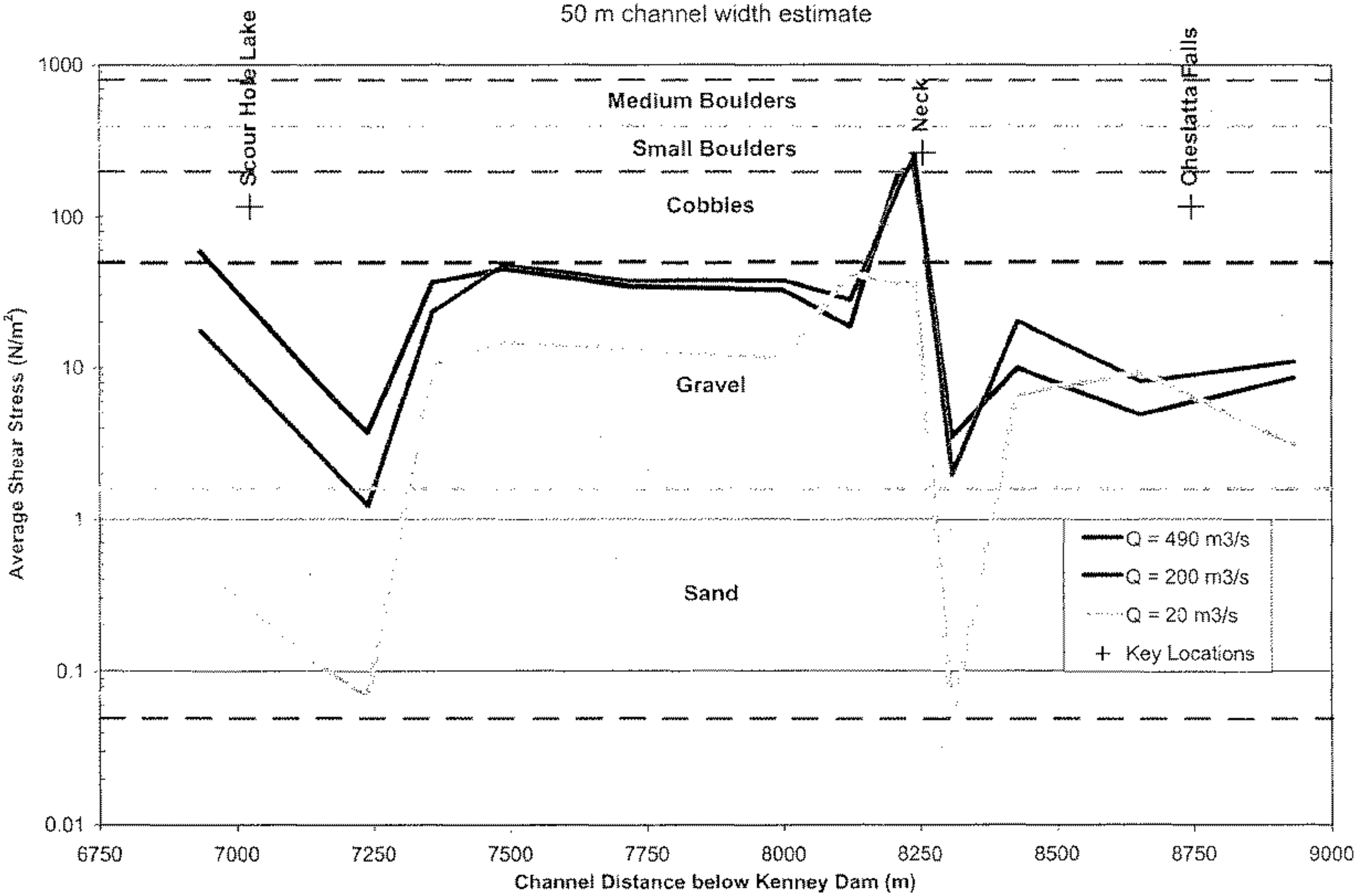


Figure 4.4.6-1 Calculation of mobile bed material size through Cheslatta Fan

50 m channel width estimate



We differed with Hayco's assessment of the River-cut Channel option, primarily because of inconsistencies in their evaluation of it with respect to the Meandering Pilot Channel concept. Hayco (2000) ranked the River-cut Channel option as being worse than the Meandering Pilot Channel for both short-term and long-term sediment mobilization, reliability, and impact of downstream spawning beds, yet both concepts require self-eroding channels through fine deposits on the fan. As there is no provision for a large continuous barrier to prevent the Meandering Pilot Channel to divert itself during a high flow event into the same route that the River-cut Channel would take, all the sediment mobilization consequences of the River-cut Channel should be applied to Meandering Pilot Channel concept as well. It could be argued that the Meandering Pilot Channel concept would generate more sediment downstream than the River–cut option would, since the Pilot Channel option has the potential to erode sediment from two routes across the fan. We believe that the sediment mobilization for these two options should be ranked at least equally, if not favouring the River-cut Channel option.

In the text of the Hayco report, the assertion that the River-cut Channel option would result in the immediate removal of the existing channel does not take into consideration the possibility of gradually enlarging the channel by careful application of the initial commissioning flows. Also, their comment regarding loss of the existing fish habitat of the existing channel is not balanced against the intention in the Meandering Pilot Channel option to cut off flows to the existing channel with a wing dyke and the impact that this would have on the fish habitat of the existing channel.

Another difference relates to the Hayco (2000) prediction that re-watering the fan in its present state would likely result in the development of a braided channel. It is our opinion that a single thread channel will initially develop across the fan from Scour Hole Lake to the lower scour hole that would develop below the Neck, because a braided channel requires a very high bed sediment load, which clearly would not exist for the upstream portion of the fan. It is possible that some bar development will occur immediately upstream of the Neck, due to deposition induced by the backwater effect from the Neck, but it would not likely be enough to warrant a braided classification. It is likely that for the short (300 m) reach between the future lower scour hole and Cheslatta Falls, a more braided channel pattern will develop, but this would occur for the Meandering Pilot Channel also in the very same fashion.

If both the River-cut and Meandering Pilot Channel options are given the same rankings in Hayco's evaluation matrix for the categories named sediment mobilization, reliability, and downstream spawning beds, then the River-cut Channel would clearly become the preferred option. In summary we do not expect a significant difference between the downstream sediment consequences of the two options, and certainly not enough to warrant eliminating the River-cut Channel from further consideration. As a result, we have retained this concept, and renamed it the Reactivated Natural Channel option.

The construction costs for the Meandering Pilot Channel as outlined by Hayco (2000) were re-estimated considering the information in the Klohn Leonoff (1991) report regarding potential weak foundation problems in certain locations. Due to the lack of data identifying the precise locations of the weak areas, several assumptions had to be made, especially related the nature of the foundation along the exact route of the channel, and the quantity of seepage flows expected. It was assumed that dewatering from local sumps along the channel would be necessary, but could be handled by two 340 L/s pumps. It was also assumed that well points would be needed only in the area of the "Neck" and the former scour hole to