HATZIC PRAIRIE RIPARIAN PLANTING AND SEDIMENT CONTROL PROJECT

SECOND PHASE – SEDIMENT REMOVAL ALONG SAND REACH FROM DALE ROAD TO HATZIC LAKE

Prepared for:

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SUMMARY

The first phase of flood level lowering by sediment removal along Lagace Creek was completed in September, 2001, with the excavation of three pits just upstream from the Farms Road bridge. These three pits will trap sand and gravel thereby reducing the rate of bed level rise further down the creek. There is, however, a need to lower flood levels down the system and the 2nd phase of this project could involve excavating a portion of the sand bed downstream from the Dale Road bridge. The recommended technique is to excavate three pits about 800 m apart and to monitor the rate of filling of these pits. Planning of fish habitat compensation is necessary and some compensation may be achieved by excavation of old, silted oxbow channels adjacent to Lagace Creek.

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1. INTRODUCTION

1.1 Review of Sediment Deposition along the Pattison/Lagace Creeks

In a previous brief report by Northwest Hydraulic Consultants (nhc 2001) several alternative sites were recommended for sediment removal in order to lower flood levels along the Pattison/Lagace Creek systems (see Figure 1.1 for location). The main site selected for a gravel trap was upstream of the Farms Road Bridge and this site was excavated during the month of September, 2001. The excavation involved the creation of three separate basins as shown in Figure 1.2 and Photo 1.1. This gravel trap, however, is only one component of a wider-scope flood and bed lowering plan.

Several other sites previously identified were located as follows:

i) upstream from Pattison-Lagace confluence;
ii) Dale Road Bridge; and
iii) the Hatzic Lake inlet.

From field trips and overflights during the summer of 2001, it was noted that a rather long reach of Lagace Creek is filled with sand (Photo 1.2). Water levels through this reach, from the Dale Road Bridge to Hatzic Lake, are kept relatively high during low flows and farmers are experiencing high groundwater tables. As noted in Photo 1.3, the sand deposition upstream from the Dale Road Bridge is blocking drainage from Hereford Creek to the east and the bed downstream is rather high for a long distance. This long deposition zone is predominantly sand and its excavation over a continuous long reach may pose some problems. This topic will be discussed more in the next section.

Another deposition reach has been identified as being upstream from the Pattison-Lagace confluence – see Photo 1.4. This reach is filled with coarse gravel and cobbles and, if excavated, could serve as a gravel trap for this coarse material. However, most of the sands entering this reach will continue to move downstream with a portion dropping out

in the Farms Road trap. Because this Pattison-Lagace trap will not lower flood levels in the lower reaches, it should not be part of the next phase.

The most downstream deposition site is the delta at the inlet to Hatzic Lake (Photo 1.5). This delta backs up the water levels along the upstream part of creek, but removal of this material may not change water levels because they are primarily controlled by the lake level. Also, the excavation of sediment from the lake can be a large project and requires a feasibility study to identify methods for sediment removal, storage of sediment and costs. Therefore, this delta reach should not be part of the next phase.

As pointed out by nhc (1985), Lagace Creek changed from a single channel to a braided channel after the January 1935 landslide and has developed as an alluvial fan on top of historical lacustrine (lake) deposits (see Figure 1.3). The lateral extent of the fan is shown in Figure 1.1 and the downstream edge was located just downstream from Farms Road Bridge. However, the creation of a confined floodway channel has transformed the fan-shaped deposition to a long channel deposition which extends as far as the lake. This creation of the floodway has accelerated the rate of bed rise in the creek, thus requiring frequent sediment removal to maintain the flood conveyance capacity of the system. Therefore, removal of sediment downstream from the alluvial fan is a necessity.

2. PROPOSED SEDIMENT REMOVAL FROM DALE ROAD BRIDGE TO HATZIC LAKE

2.1 Alternatives for Sediment Removal.

After the November 1990 flood, deposition occurred along the Pattison-Lagace system and during the next year much of the deposition was removed by excavators and trucks. In the vicinity of the Dale Road Bridge, the excavated material was placed along the creek bank and some was later removed by local landowners.

Since 1990, sand and gravel have continued to cause the bed of the Lagace Creek to rise and more excavation is required to lower future flood levels.
From assessment of the system the sand deposits can be removed in several ways:
Alternative 1 - entire sand reach bed lowering;
Alternative 2 - short reach lowering at three locations; and
Alternative 3 - frequent short reach lowering at one location.

2.2 Entire Sand Reach Bed Lowering

This alternative assumes that a 2m excavation of a 20m wide channel will be undertaken for a 3000m length, starting several hundred meters upstream from the Dale Road Bridge. The volume of sand to be excavated would be 120,000m^3 and the sand will probably be trucked to nearby farms since many locals have requested creek sand to be used as local fill. This long-reach excavation would result in problems such as destruction of shrubs along one bank of the creek (see Photo 1.2). It may, however, be possible to build a sand berm within the active channel to serve as a platform for the trucks and excavator which would reduce damage to riparian shrubs and vegetation. The cost of this alternative could be $360,000 based on a unit price of $3/$m^3$ which would allow for the construction of a loading berm. A table showing a comparison of the salient features of each alternative is presented as Table 2.1.

2.3 Short Reach Lowering at Three Locations

This alternative reduces the length of excavations and results in less encroachment into the creek. It was assumed that three locations could be excavated, each being 200m in length. This results in a removal of 12,000m^3 and implies a frequent operation, probably once per year. The cost for this alternative would be approximately $36,000 using a unit cost of $3/$m^3$. A basic assumption regarding this alternative is that the local lowering will induce bed levels downstream from each excavation (trap) to scour thereby causing water levels to lower. From previous reports (nhc 2001), one can make a rough estimate of sand load assuming that it is about twice the gravel load; this results in a sand load of 15,000m^3/year. Eventually, over about one year, the traps should fill with sediment. Studies by Snishchenka and Meserlians (1994) in the hydraulic laboratory and by Western Canada Hydraulics Lab. (1974) using computations indicated that the upper portion of a sand trap will slowly fill while the downstream face will erode. This results in the trap slowly migrating downstream as filling progresses. The water surface will drop, but only after a longer length of channel is lowered by erosion downstream from each trap. Also, studies by Western Canada Hydraulics Lab (1974) show that the length of downstream bed lowering might be up to three (3) times the length of the sand trap prior to the filling of the trap – therefore there may be a total lowering of about 2400m. Setting the traps at a spacing of approximately 800m appears to be reasonable.

The water surface lowering throughout a year is difficult to compute because of the rapid fluctuations in stream flows following intense rains in the upper watershed. This is discussed in the Hydrology section of the Associated Engineering report of 1992. Basically, at intermediate flows the upper part of a sediment trap will erode in a head cutting process, but during higher flows this eroded volume will be re-filled with sands coming from upstream – the process is highly dynamic and would require extensive numerical-computer modelling in order to estimate rates of filling and erosion. It may

prove more worthwhile to monitor the filling process in the field and, thereafter, to design the excavation program based on field data.

2.4 Single Location Excavation

This alternative involves the continuous removal of sand at a site near the Dale Road Bridge. This site could have excavation dimensions of about 10m by 10m and with a 2m cut would involve an excavation of about 200m^3. Using an annual sand load of 15,000 m^3/yr results in the site being excavated about 75 times. In practical terms, this site could be lengthened to about 100m utilizing a side-berm for movement of the excavator and trucks. This would then increase the trap to 2000 m^3 and the frequency of excavating could be about eight (8) times per year, probably during the winter freshets of November to January. However, this method would not lower water levels for any significant length of the creek – only about 400m. Therefore t his alternative is not attractive from a flood control perspective.

2.5 Recommendation

After reviewing sediment processes along Lagace Creek, it is recommended that Alternative 2 involving excavation of three (3) sediment traps be undertaken along the creek. This would allow for trapping of the entire sand load prior to the sand reaching the lake. The excavation of these traps would probably be required on an annual basis and could be undertaken with an excavator and trucks. The schedule and costs are presented in the next section.

3.0 SCHEDULE AND COSTS

3.1 Schedule and Methodology

The sediment traps may be excavated using large excavators moving along a low berm constructed within the active channel and located along one of the banks. There would be three (3) berms constructed along the system and the excavated material could be moved by truck to local fields or properties or to stockpiles.

The schedule for excavation (instream work) could be during the fish window of August first to mid-September and this should be adequate time to excavate the three traps and to implement the required fish habitat compensation works. The frequency of re-excavation would depend upon the rate of filling, but an approximate estimate is for annual re-excavation. Also, habitat compensation, such as excavation of former oxbow channels, needs to be discussed further with fisheries officers and more comments are presented in the next section.

3.2 Costs

The costs for the various alternatives are listed in Table 2.1 and these vary from an annual cost of $32,000 to $45,000. Alternative #l would incur a one-time cost of $360,000. However, assuming that the entire reach is excavated every 8 years results in a lower annual cost of $45,000/yr. The recommended alternative #2 costs about $36,000/yr, but this cost may be substantially reduced if locals were interested in paying for the trucking of sand , then the total cost could be about $25,000 in the first year and progressively less in following years as engineering and environmental costs are reduced. The estimates in the table are somewhat conservative and assumes extra costs such as

trucking of sand. However, the above estimates do not include environmental monitoring and engineering costs.

4.0 ENVIRONMENTAL ASPECTS

4.1 Habitat Compensation

There are several sites for habitat compensation along Lagace Creek and two sites are identified on Photo 1.2. These potential compensation sites involve excavation and complexing of old, filled-in oxbow channels which are well treed and no longer convey flows. The extent and method of excavation will be discussed with the biological consultant and fisheries agency staff in order to evaluate the length and type of compensation that might be appropriate to offset the proposed excavation from the active flow channel. The provision of flows and complexing would provide 1500m^2 of off-channel rearing habitat in the lower creek system. These habitats are typically utilized by coho salmon and trout, as well as over-winter habitat for older coho.

A habitat compensation plan needs to be developed for this proposed excavation of oxbow channels and a planting program could be part of this compensation.

4.2 Habitat Reassessment for the Farms Road Pit

The recently excavated Farms Road pit should be re-assessed for the existing condition of fish habitat and for possible enhancement. Recent overflights, see Photo 4.1 on November 7, 2001, show that the upstream two pits have partially filled with sand and gravel and several cross-berms have been eroded. Also, consideration should be given to establishing permanent cross-sections for monitoring of filling rates and co-operation from the landowner will need to be arranged. The Cascade Creek flood plan has already established cross-sections for monitoring and a maintenance manual has also been prepared for this creek.

REFERENCES:

Northwest Hydraulic Consultants (nhc, 1985) -

"Investigation of Sedimentation and Flood Control on Lagace Creek"

Report to B.C. Ministry of Environment.

Northwest Hydraulic Consultants (nhc, 2001, July) –

"Review of Information on Flooding and Sediment Loads along Pattison-Lagace Creeks"

Report to Fraser Valley Regional District, Chilliwack, BC.

Snishchenko, B.F. and Meserlians, G.G. (1994) –

"Hydraulic Structure of the Flow and Sediment Transport in River Pits", Proc. Symp. in River Engineering Methods, St. Petersburg, Russia.

Western Canada Hydraulic Lab. (1974) –

"The Influence of Dredging Large Quantities of Material From the Fraser River on the Behaviour of the Riverbed",

TABLE 2.1

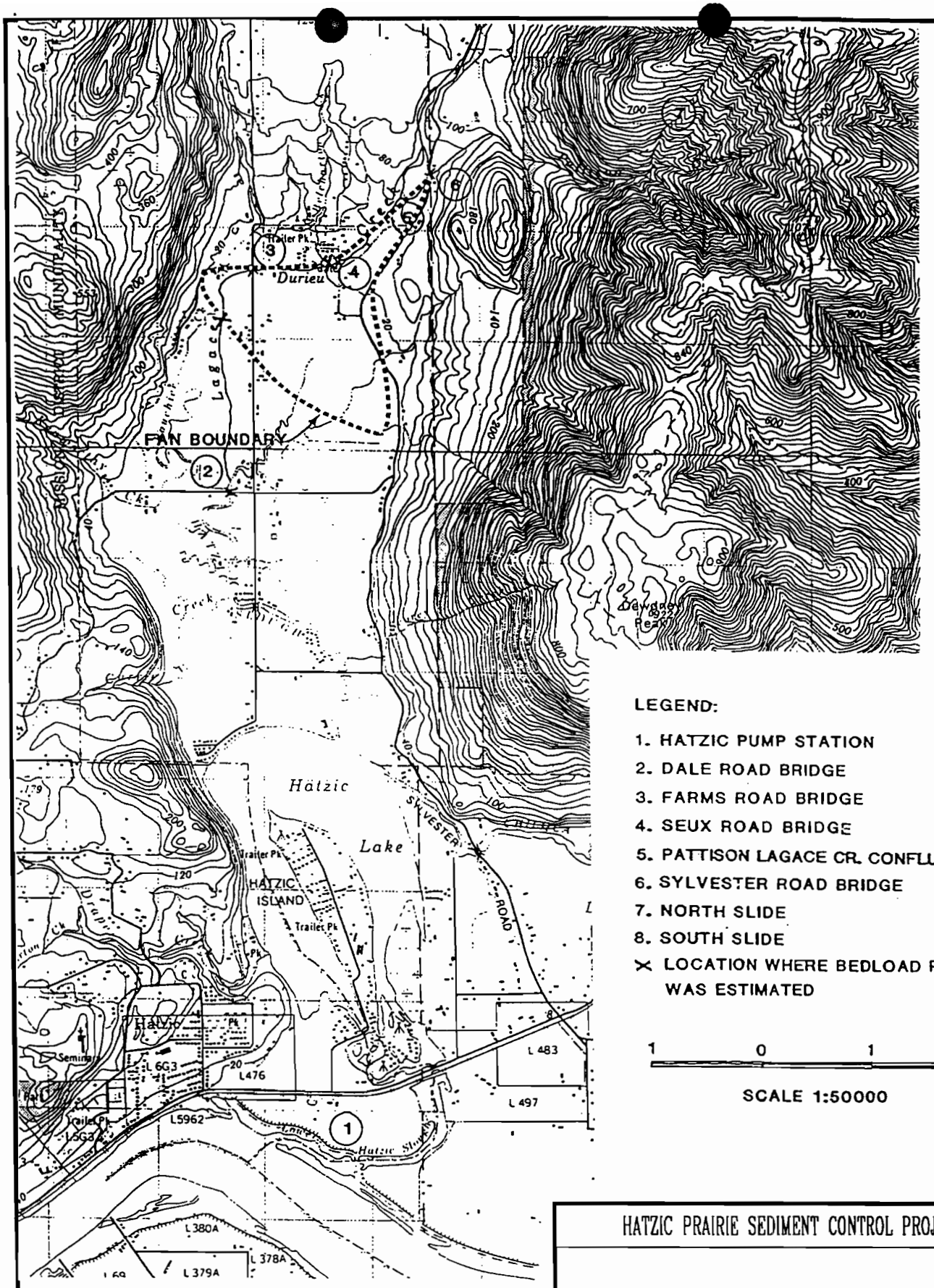
LAGACE CREEK

ALTERNATIVES FOR BED LOWERING FROM DALE ROAD BRIDGE TO HATZIC LAKE

Method of Excavation	Exc. Width (m)	Volume (m^3)	Unit Cost ($/$m^3$)	Total Cost ($)	Annual Cost ($/yr)	Comments
Alternative 1-Long Reach	20	120,000	3	360,000	45,000	Damage to shrubs
Alternative 2-Three Locations	10	12,000	3	36,000	36,000	-
Alternative 3-One Location	10	2,000	2	32,000	32,000	Least interference

Extra Costs:

i) excavation of oxbow channel compensation = $5,000
ii) improving fish habitat at Farms Road gravel pit = $2,000
iii) development of planting program = $3,000
iv) environmental monitoring during excavation and meetings = $5,000



LEGEND:

1. HATZIC PUMP STATION
2. DALE ROAD BRIDGE
3. FARMS ROAD BRIDGE
4. SEUX ROAD BRIDGE
5. PATTISON LAGACE CR. CONFLUENCE
6. SYLVESTER ROAD BRIDGE
7. NORTH SLIDE
8. SOUTH SLIDE
- ✕ LOCATION WHERE BEDLOAD RATE WAS ESTIMATED

1 0 1 2km

SCALE 1:50000

NHCV

HATZIC PRAIRIE SEDIMENT CONTROL PROJECT

Location Map

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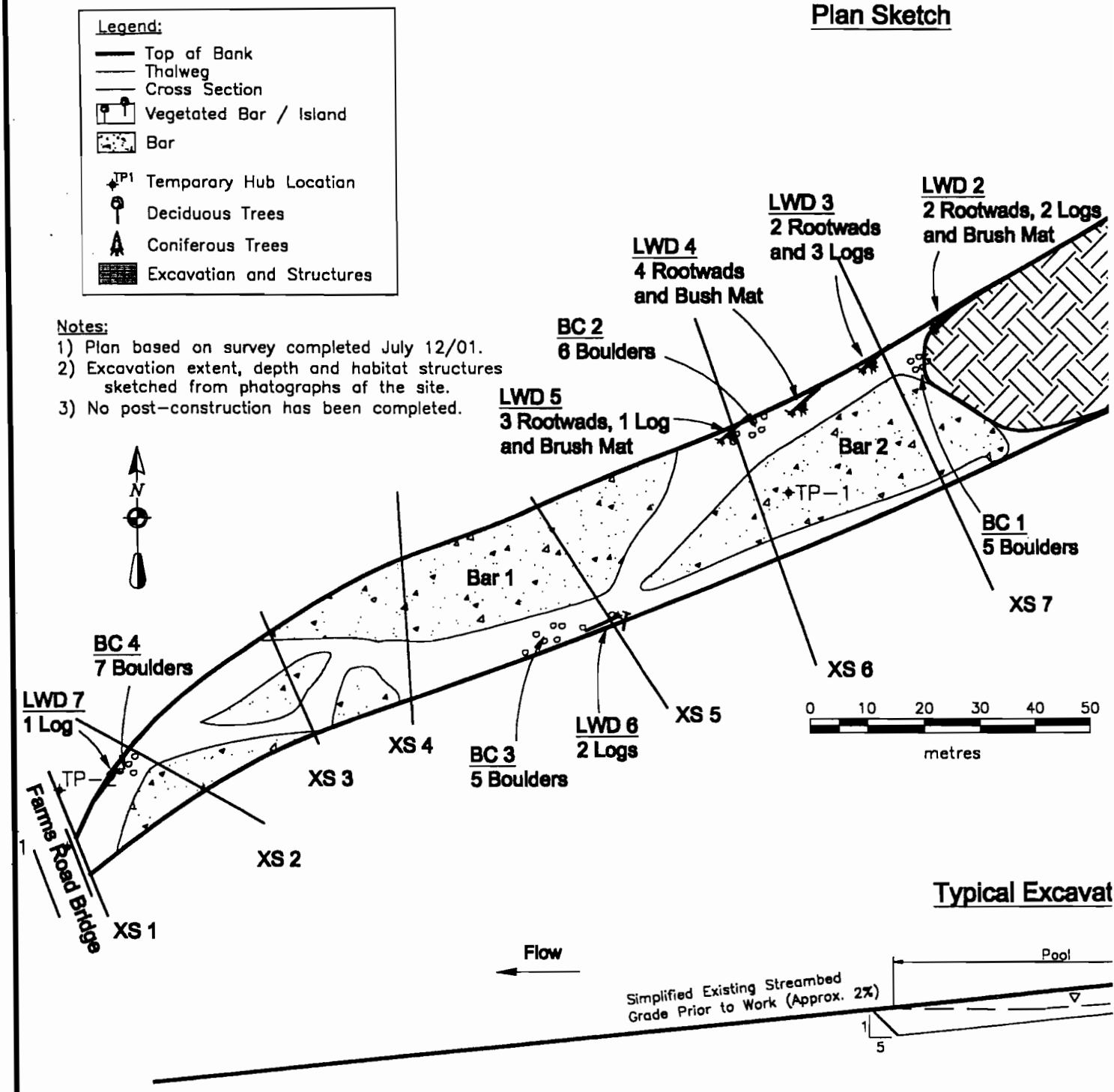
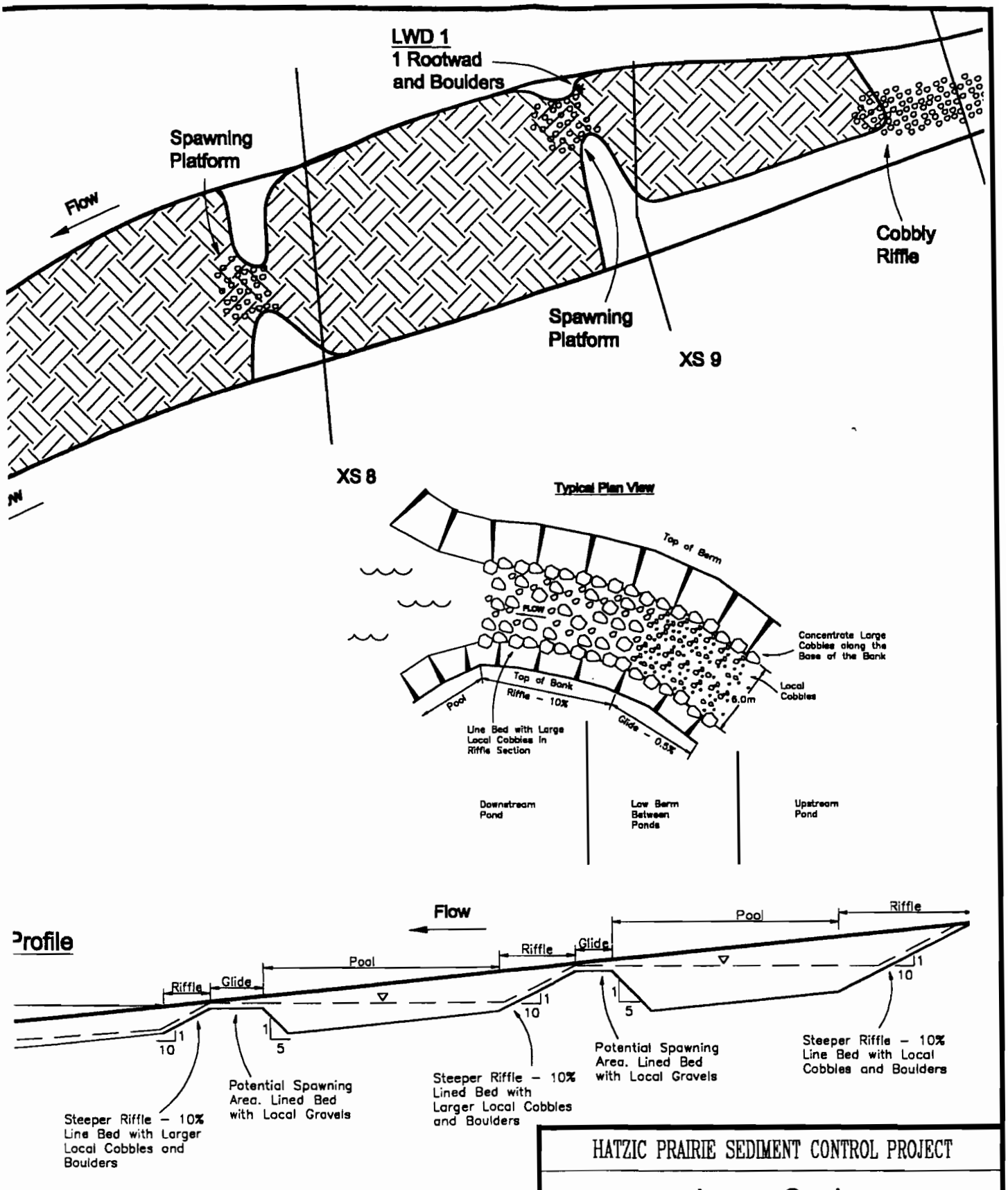
FIGURE 1.1

Plan Sketch



Typical Excavat



HATZIC PRAIRIE SEDIMENT CONTROL PROJECT

Lagace Creek
Post Construction Layout
and Fisheries Mitigation

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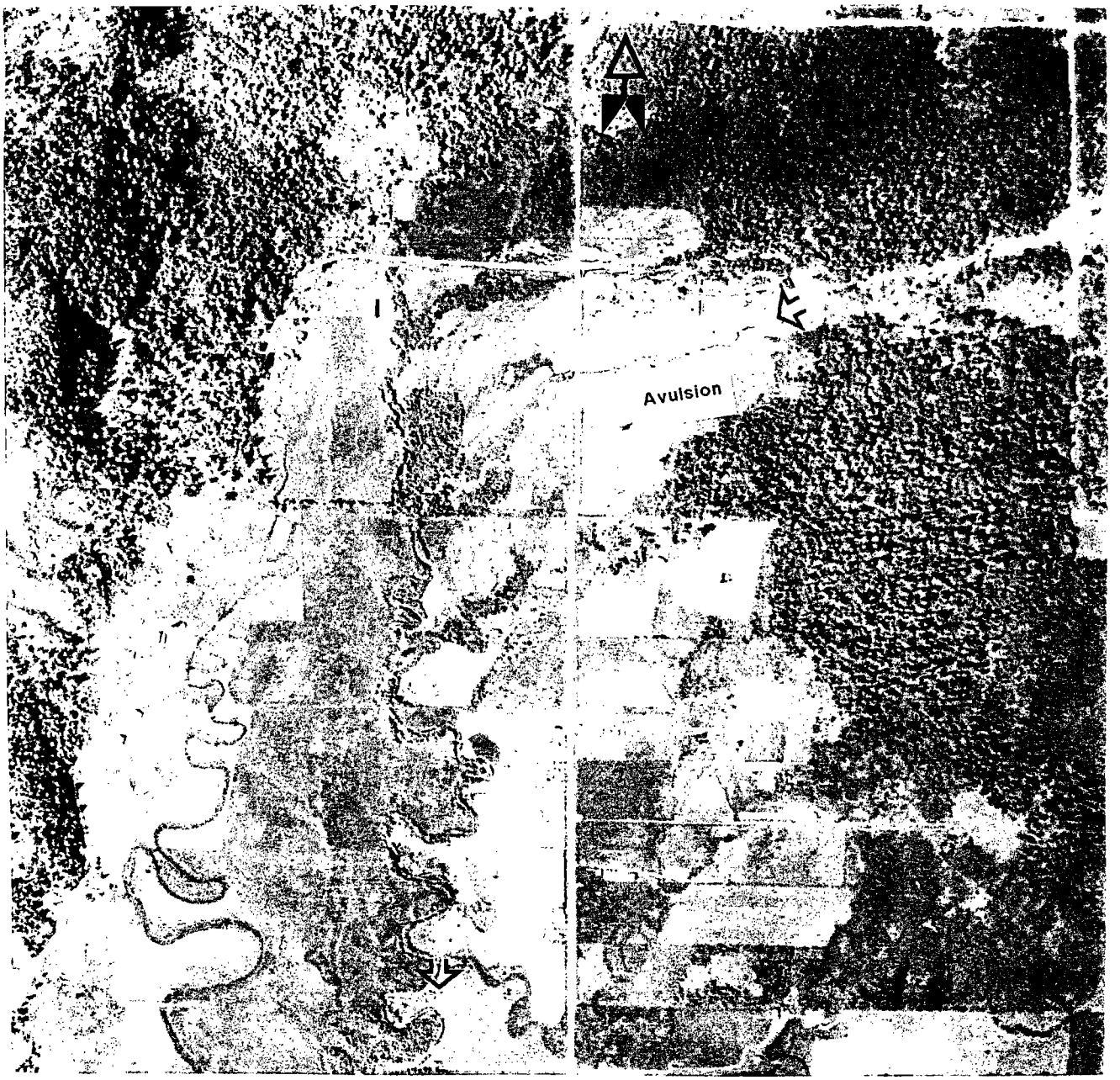
FIGURE 1.2



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Lagace Creek in 1940 - AVULSION

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NHCV

FIGURE 1.3

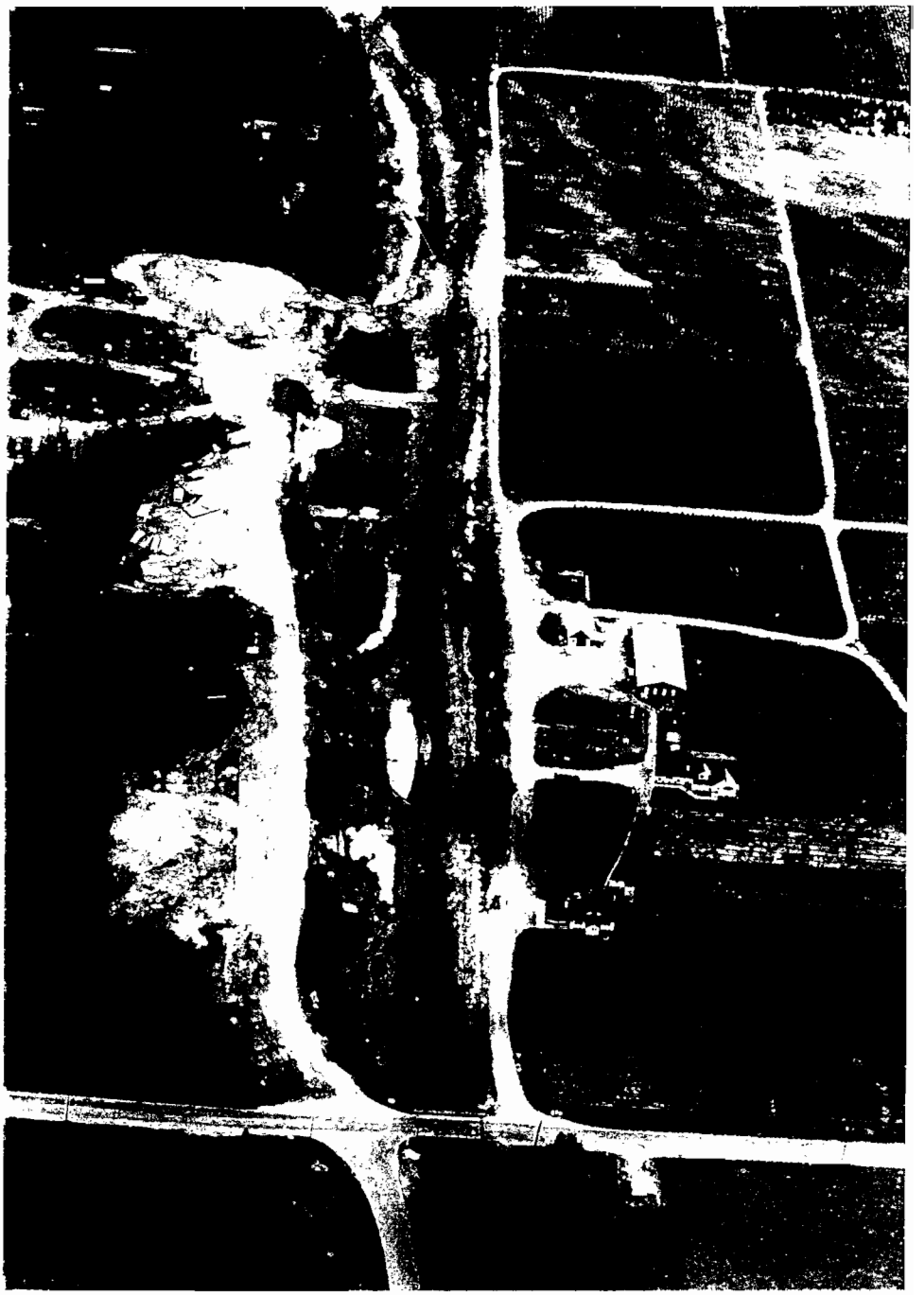

PHOTO NO. 1.1

LAGACE CREEK

Upstream view of three-basin
gravel trap excavated just
above the Farms Road Bridge.

(Oct. 6, 2001)
(Neg. No. 3-8)

Notes

1. Potential habitat compensation along A-A and B-B.

2. Excavation at Dale Road Bridge to start somewhere near habitat reach A-A.

3. Hereford Creek (slough) shown as C-C.

PHOTO NO. 1.2

LAGACE CREEK

Extensive deposition of sand downstream and upstream from the Dale Road Bridge. Flow is left to right.

(September 27, 2001)
(Neg. No. 2-12, 13, 14, 15, 16)

PHOTO NO. 1.3

LAGACE CREEK

Creek in the vicinity of Dale
Road Bridge. Hereford Creek
is to the left and is being blocked
by the sand deposit at the confluence.
Flow is left to right.

(October 6, 2001)
(Neg. No. 3-24)

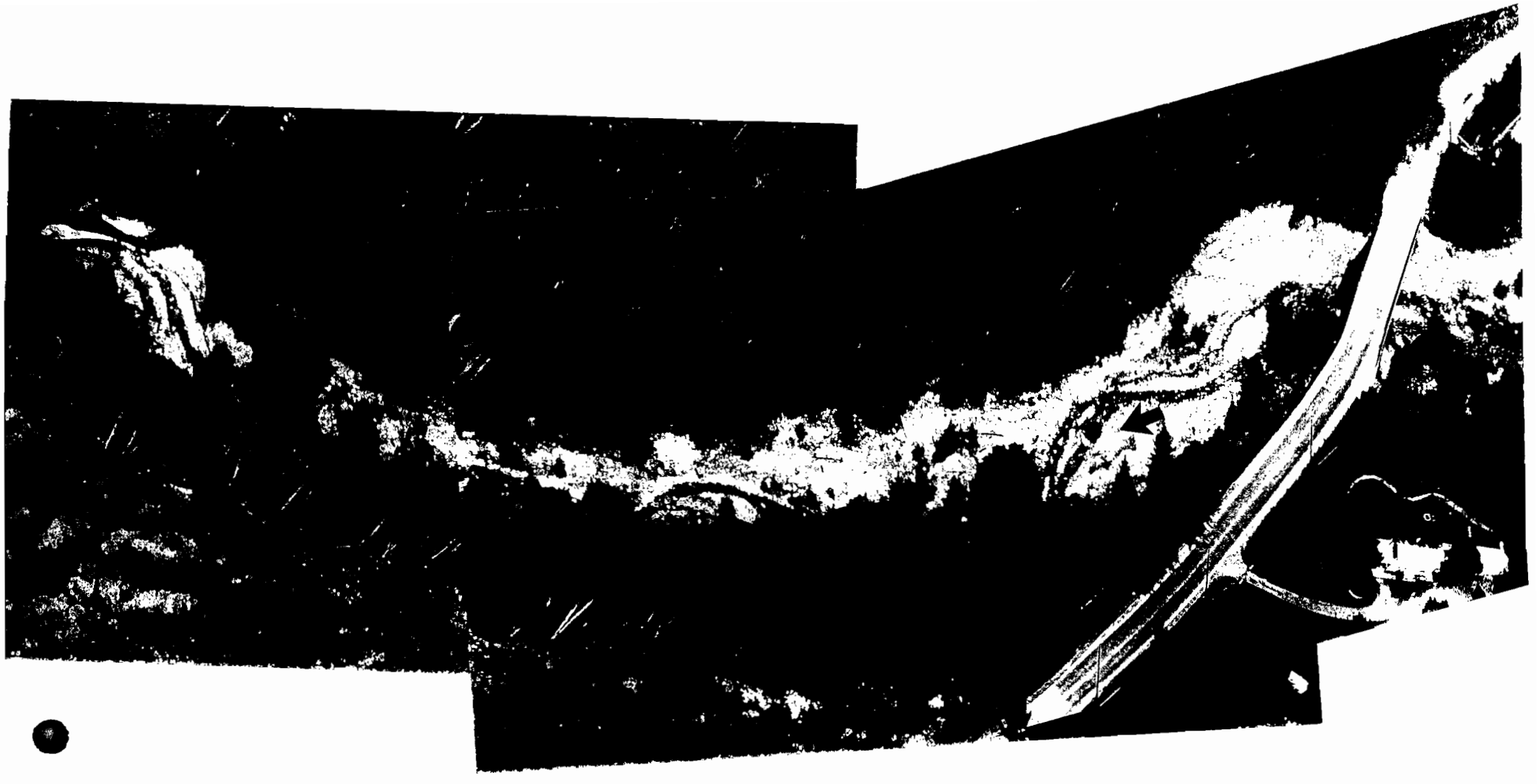

PHOTO NO. 1.4

PATTISON – LAGACE CREEKS

Confluence of the two creeks is at the left.
Sylvester Road Bridge is on the right side.
Flow is right to left.

(September 21, 2001)
(Neg. No. 1-16 to 19)

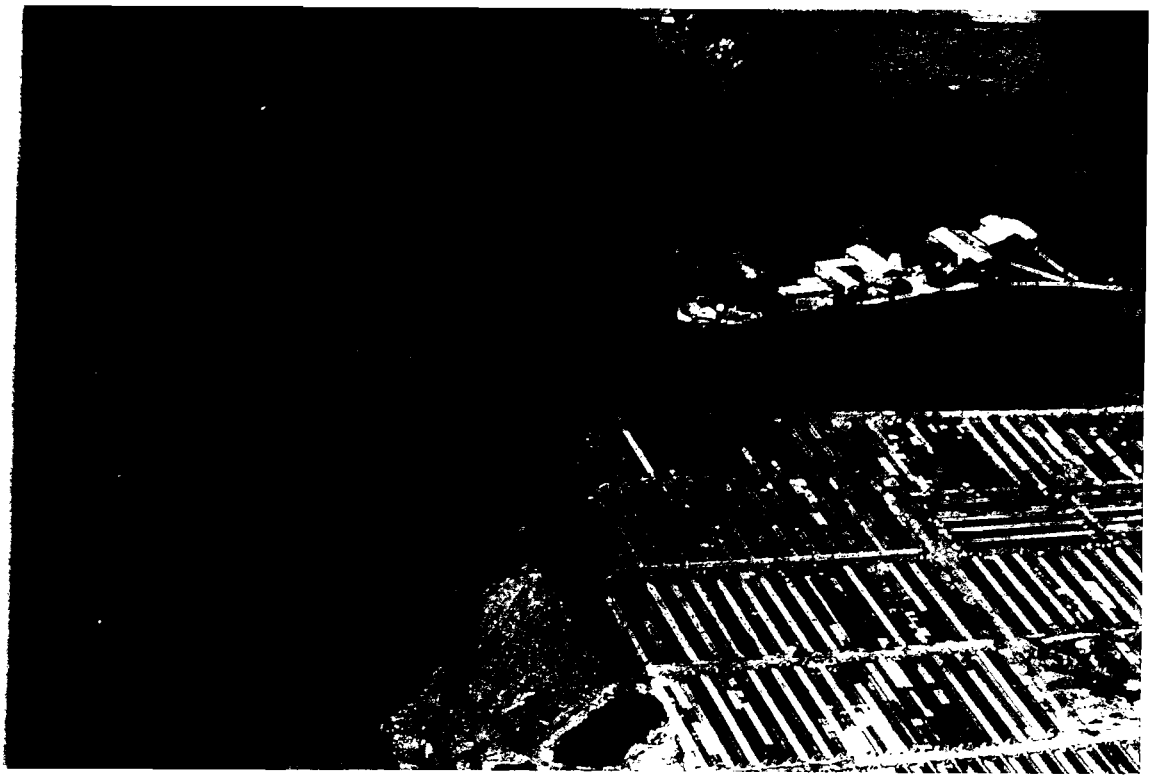

PHOTO NO. 1.5

LAGACE CREEK – HATZIC LAKE

Delta deposit at north end
of Hatzic Lake.

(September 21, 2001)
(Neg. No. 1-2)

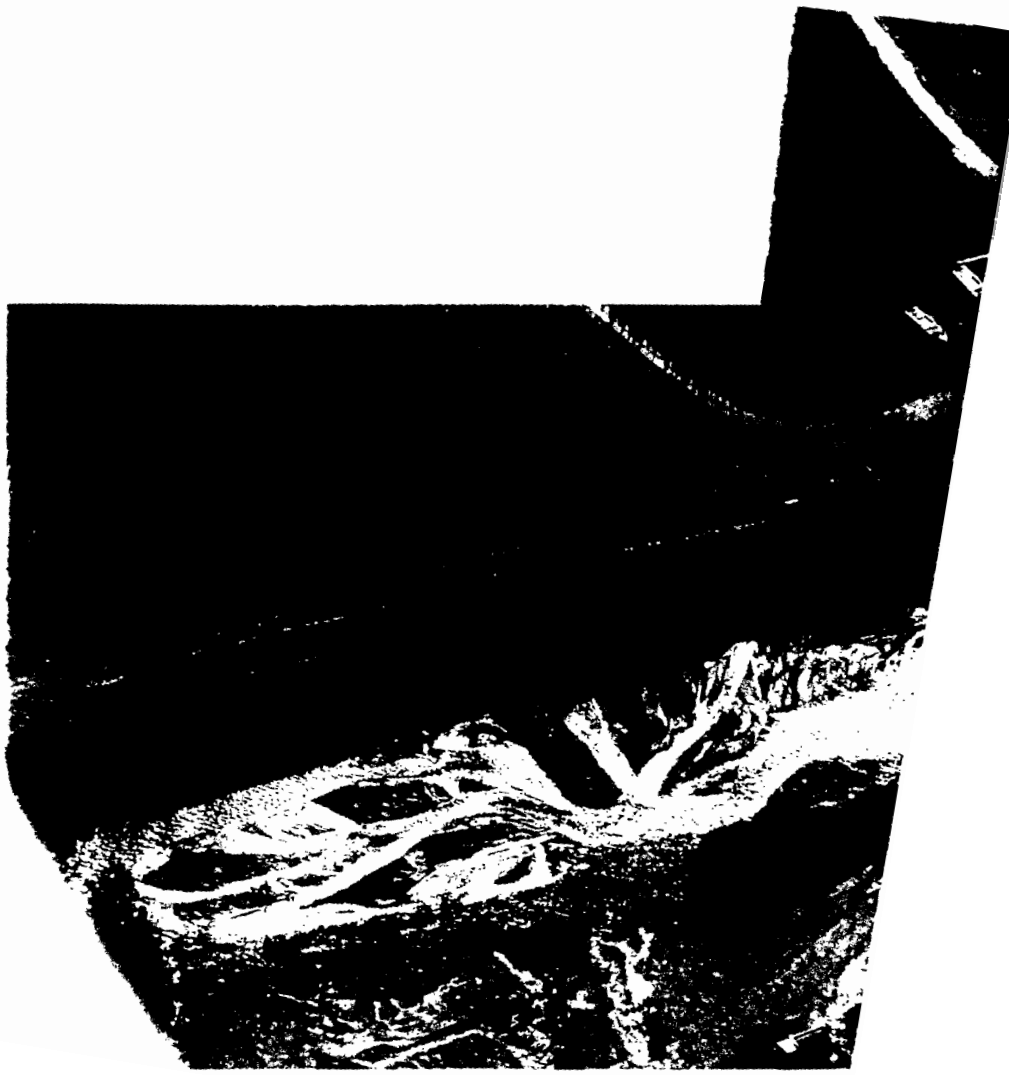

PHOTO NO. 4.1

LAGACE CREEK

Condition of Farms Road Gravel
Trap after several high flows.
Pits #1 and #2 have partially
refilled with sand and gravel.
Flow is left to right.

(November 7, 2001)
(Neg. No. 6-1, 2,3)