Cumming Cockburn Limited

Consulting Engineers, Planners
and Environmental Scientists

November 16, 1994

R-1994

File: 3475-E

Ministry of Natural Resources
10 Findlay Avenue
Carleton Place, Ontario
K7C 3Z6

NOV
1994

Attention: Mr. Ken Harris

Dear Sir:

Re: Kanata Lakes, Beaver Pond,
Urban Stormwater Quality Control

We are pleased to submit herewith for your review and approval the results of our analysis and recommendations which address issues related to the urban stormwater quality control for the Kanata Lakes Community development.

As you are aware, Cumming Cockburn Limited has been retained by Genstar Development Company to undertake the design of several phases of the Kanata Lakes Community development. As a result we have been meeting with yourself and our client over the past number of years in order to understand your requirements with respect to the urban stormwater quality control measures as the development has progressed. As required prior to provision of M.N.R.'s Draft Conditions of Approval for the incoming development we have prepared this concept which addresses urban stormwater quality control issues. You will note, that this concept promotes the utilization of the existing Beaver Pond in consent with the provision of sediment forebays at each sewer outlet for stormwater quality treatment. Thus, this concept remains consistent with the original approved Master Drainage Plan and addresses the recent concerns about urban stormwater quality.

The Kanata Lakes community is a complex development serviced by a comprehensive stormwater management system. This system utilizes a dual drainage concept including a series of stormwater management facilities. The Master Drainage/Stormwater Management Plan for the development was prepared by Cumming Cockburn Limited in 1984. This study analyzed the engineering and environmental components of the proposed development and the potential impacts on the existing drainage conditions as well as providing direction for the design of drainage works. The detailed design of the stormwater management system for the proposed development was studied by Oliver Mangione McCalla in 1985. The stormwater management system has been gradually revised by various consultants as the development plans became finalized. The system includes the utilization of distributed upstream ponds used for attenuation of minor and/or major flows and utilization of the Beaver Pond in Kizell Drain as a flood control facility.

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The above mentioned studies detailed quantity control measures where the main objective was reduction of the post development peak flows to the pre-development levels. The quality control of the urban runoff was not required to be analyzed at that time. However, environmental aspects, aesthetic appearance and water quality within the Beaver Pond itself was addressed in the previous Master Drainage Plan (CCL 1984). Although the pond was receiving rural runoff the overall water quality was found to be very poor at that time.

The existing pond was characterized as a shallow eutrophic water body being clogged with many varieties of macrophytes and having a high degree of turbidity. Fluctuating water conditions present at that time created anoxic conditions, low oxygen levels and increased nutrient levels in the water because of decomposing aquatic vegetation. The pond had a generally low potential for water associated wild life because of the shortage of vegetative cover along the edges and fluctuating water levels. The above noted factors also contributed to a low aesthetic and recreational value of the pond.

In order to improve the water quality within the pond the previous study proposed dredging of the existing Beaver Pond and the stabilization of the water levels. Approximately one third of the proposed dredging works was implemented in the late 1980's (see Figure 3 enclosed in the Appendix). The total volume of the created permanent pool is approximately 50,000 m^3 at water surface elevation of 90.55 m.

Even though development has progressed over time, and the pond has received increased amounts of urban runoff the overall quality of the pond has improved. The results of the monitoring program (summarized in the following table) recently conducted by the Regional Municipality of Ottawa-Carleton (Surface Water Quality Branch) indicate that the TSS concentration downstream of the outlet of the pond is at normal or below the normal levels. The good quality of the water can be attributed to the implementation of the above mentioned measures. The increasing depth within the dredged portion of the pond has also encouraged quiescent settling of suspended solids and minimized water surface fluctuation.

Extract from the monitoring program conducted by the Regional Municipality of Ottawa-Carleton, Surface Water Quality Branch (Location # CK 06-008).

Report	Sample	Sample Time	Conditions	SS mg/L
930337	06/22/93	12:30	Wet	9.6
930552	07/13/93	13:35	Dry	24.0
930475	08/03/93	12:42	Intermediate	<0.5
930946	08/23/93	11:45	Dry	<0.5

Presently the urbanized portion of the watershed is about 220 ha which represents approximately 30% of the total tributary area to the Beaver Pond. It is anticipated that the urban area will increase in the future to about 420 ha. (Refer to Figure 1 and 2 attached in the Appendix). The community is being developed with a mixture of housing forms including single family on various sized lots, semi-detached and multiple housing, together with the associated commercial, institutional and recreational parcels (e.g. golf course) required to serve the residential development.

Current provincial policies require that all new development must include, as an integral part of their design, acceptable stormwater management techniques which not only satisfy the engineering aspects of flood control but also address environmental implications. This generally translates into quality control of stormwater runoff (i.e. the "first flush").

The Ministry of Natural Resources has prepared "General Guidelines for Development" revised August 7, 1992), which ensure that stormwater runoff from new developments cannot be discharged into a waterbody without first being treated. A primary focus of these guidelines is the reduction of TSS concentration to 80 mg/l. Since the highest suspended solids concentrations are generally encountered within the "first flush", the guidelines require the attenuation of the first 10 mm of runoff from paved areas over 72 hours. This is generally sufficient to achieve removal of the required suspended solids.

Since the Beaver Pond has already been functioning as a stormwater quality control facility the following analysis was focused to investigate the accommodation of the remaining portion of the development within the pond as well.

Based on the above discussed landuse the estimated imperviousness ratios within the development is about 40% thus, the volume of the first 10 mm of runoff resulting from the paved areas can be calculated as follows:

$V = A \times 10{,}000 \times IMP/100 \times h/1{,}000$
$V = 420 \times 10{,}000 \times 40/100 + 10/1{,}000$
$V = 16{,}800\ m^3$ (approximately $17{,}000\ m^3$)

$v = 17{,}000/420 = 40\ m^3/ha$

where:

A	-	Total Urban Area (ha)
IMP	-	Imperviousness Ratio (%)
h	-	10 mm of runoff
V	-	Extended Detention Volume "first flush" (m^3)
v	-	Volume per unit area (m^3/ha)

The stage storage curve developed for the Beaver Pond presented on Figure 4 (enclosed in the Appendix) indicates that this volume can be accommodated at elevation of 90.85 m, which is 0.30 m above the normal water level. This normal water level is maintained by a 600 mm diameter opening placed within a weir structure which is located in the outlet manhole (See

Figure 4 enclosed in the Appendix). Hydraulic performance of the 600 mm diameter opening (from elevation 90.47 m to 91.07 m) is characterized by a free flow regime thus, during the treatment the opening would operate as a circular weir. Capacity of this weir is very low. The calculations presented in the Appendix shows that the first flush volume of 17,000 m^3 will be released approximately over a 130 hour time period. It should be noted that the majority of the "first flush" will be released over a shorter time period of approximately 75 hours.

In addition to the above calculated extended detension volume the permanent pool created from the dredging will significantly increase the efficiency of the treatment since the influent loading will be diluted in this pool. Based on the new "Stormwater Management Practices Planning and Design Manual, MOEE 1994", the above noted permanent pool volume of 50,000 m^3 will provide an excessive protection (better than "Level 1 protection"). The MOEE manual suggests that in order to provide Level 1 protection it is required to create approximately a permanent volume of 90 m^3/ha (see MOEE manual Table 4.1). In this particular case the required permanent pool volume would be equal to only 90 m^3/ha x 420 = 37,800 m^3. This suggests that no further dredging of the Beaver pond is required and therefore it is not recommended.

The stormwater runoff resulting from future urban areas will enter into the Beaver Pond via several storm sewer outlets. The storm sewer outlets will be located adjacent to the free water surface of the pond. The approximate location of the proposed sewer outlets are shown in Figure 2 enclosed in the Appendix. In order to provide better efficiency of the proposed system each sewer outlet will be provided with a sediment forebay and energy dissipator. The conceptual design of the sewer outlet is shown on Figures 5 and 6 enclosed in the Appendix. The major purpose of the sediment forebay is to concentrate the majority of incoming sediments in this area, to facilitate cleaning and to reduce the amount of sediments and hence frequency of maintenance in the Beaver Pond. This will minimize future impact on existing plant life within the pond. The settling of the suspended solids in the forebay will be promoted by the abrupt change in flow velocity as the storm drainage leaves the inlet pipe and enters the forebay area. The sediment forebay will be separated from the Beaver Pond by a permeable berm.

This will serve as an energy dissipator for the incoming water so it has minimal impact on the existing vegetation. In addition the berm will also prevent re-suspension and "flushing" of the accumulated sediment out of the forebay into the Beaver Pond.

It is intended that the forebay will be bed rock, however, should this rock not be stable, the bottom will be lined with armour stone. Ultimately, this facility will become the property of the City of Kanata and will be maintained and operated by them. Currently, the City has accepted and is maintaining the existing stormwater management facility. New additions to this facility, storm sewer outlets and sediment forebays, will be the responsibility of the developer until such time as final acceptance by the City of Kanata. Maintenance of this stormwater management facility will consist of regular cleaning of the sediment forebays to ensure sediment buildup does not impair flow in the storm sewer or cause undue resuspension of solids within the facility. A service road adjacent to the forebay would facilitate a rubber tired loader and dump truck to access to the forebay for cleaning accumulated sediment. Maintenance of the pond area will be minimal due to the construction of sediment forebays

and will be identified by site visits. Maintenance of the existing habitat which is to be retained as part of this stormwater management facility will be minimized to avoid any further destruction of the existing habitat.

The developer will be responsible for inlet and outlet sampling of both the Beaver Pond and first-constructed sediment forebay. Five wet weather events will be sampled during the open water season for a two-year period following the installation of the first sediment forebay. This sampling will include testing for total suspended solids, dissolved oxygen, nitrogen, phosphorus, temperature and heavy metals. Monitoring locations will be provided in the detailed design to the satisfaction of the Ministry of Natural Resources.

In summary the above discussed analysis indicates that the Beaver Pond with a combination of the existing outlet structure and sediment forebays proposed at each sewer outlet would meet the MNR's general guidelines for the treatment of the urban runoff and the proposed system would ultimately accommodate approximately 420 ha of the development.

It should be noted that during the implementation of the past development program, "On-site Best Management Practices" have routinely been utilized. This mainly included discharging of roof leaders onto grassed areas, the provision of split drainage for rear yards and providing storage in parks (mainly golf courses). It is intended that the implementation of the On-site BMP's will continue and this will also contribute to the overall good efficiency of the proposed stormwater management concept.

We trust that the analysis presented in this document is satisfactory and sufficient for M.N.R. approval. Should you have any questions, please do not hesitate to contact us.

We look forward to your early response to this matter. Our client is anxious to proceed with the next phase of this ongoing development.

Yours truly,

CUMMING COCKBURN LIMITED

Peter Spal, P.Eng.,
Senior Water Resources Engineer

c.c. Mr. Doug Smeathers, C.E.T. - Genstar Development Company
Mr. R.L. Phillips, C.E.T. - City of Kanata
Mr. F. Petti, P.Eng., - RMOC

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APPENDIX

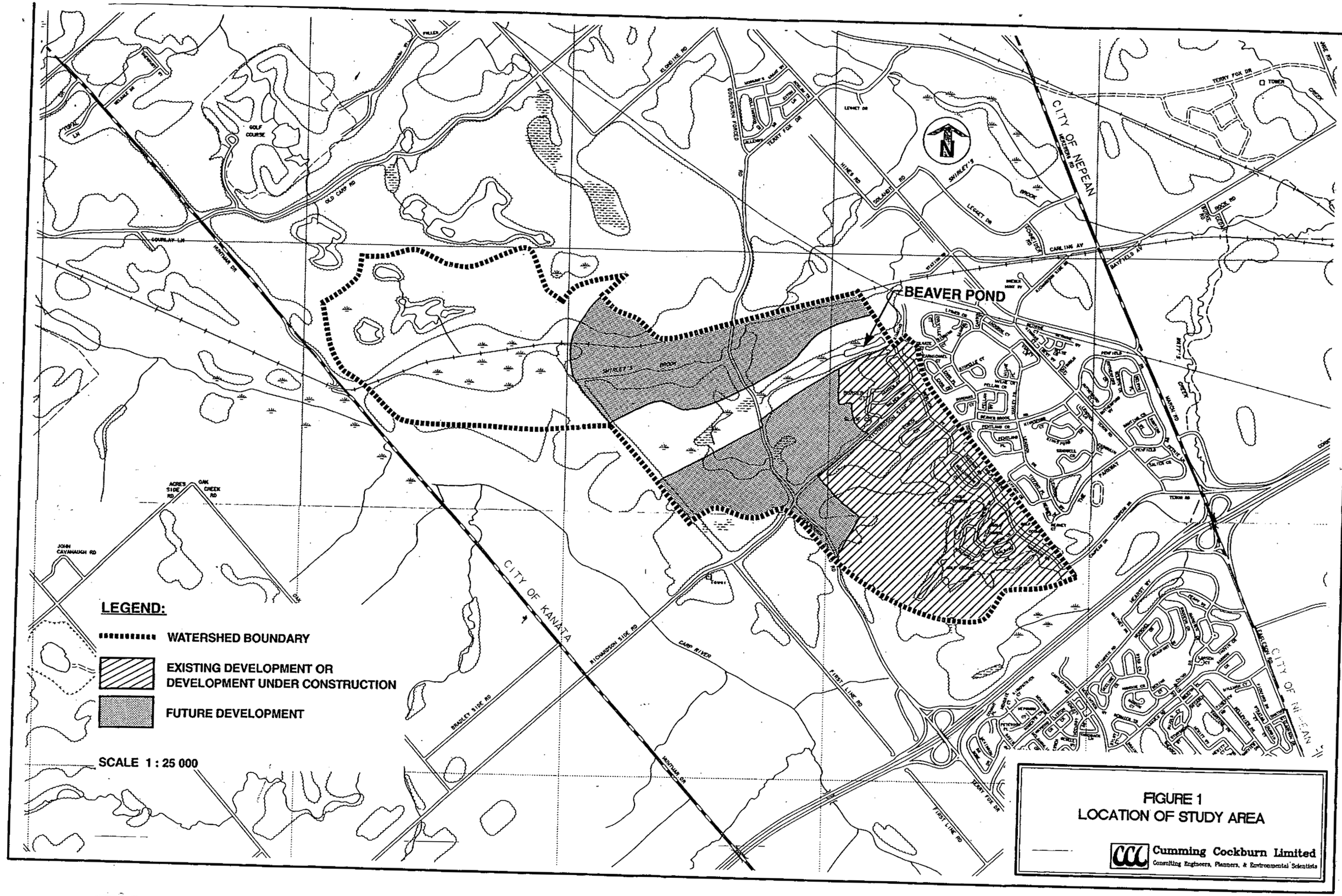

FIGURE 1
LOCATION OF STUDY AREA

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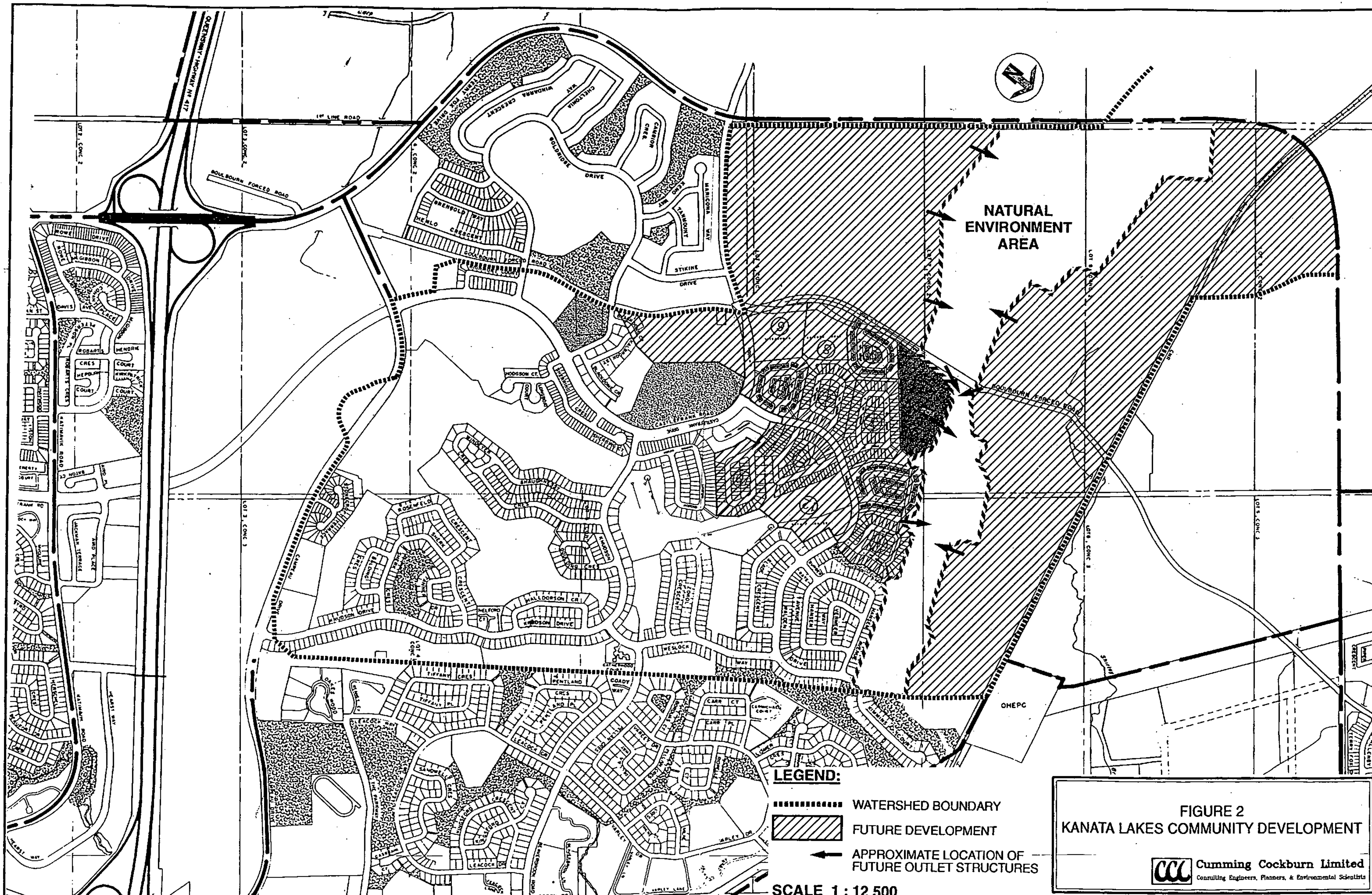

FIGURE 2
KANATA LAKES COMMUNITY DEVELOPMENT

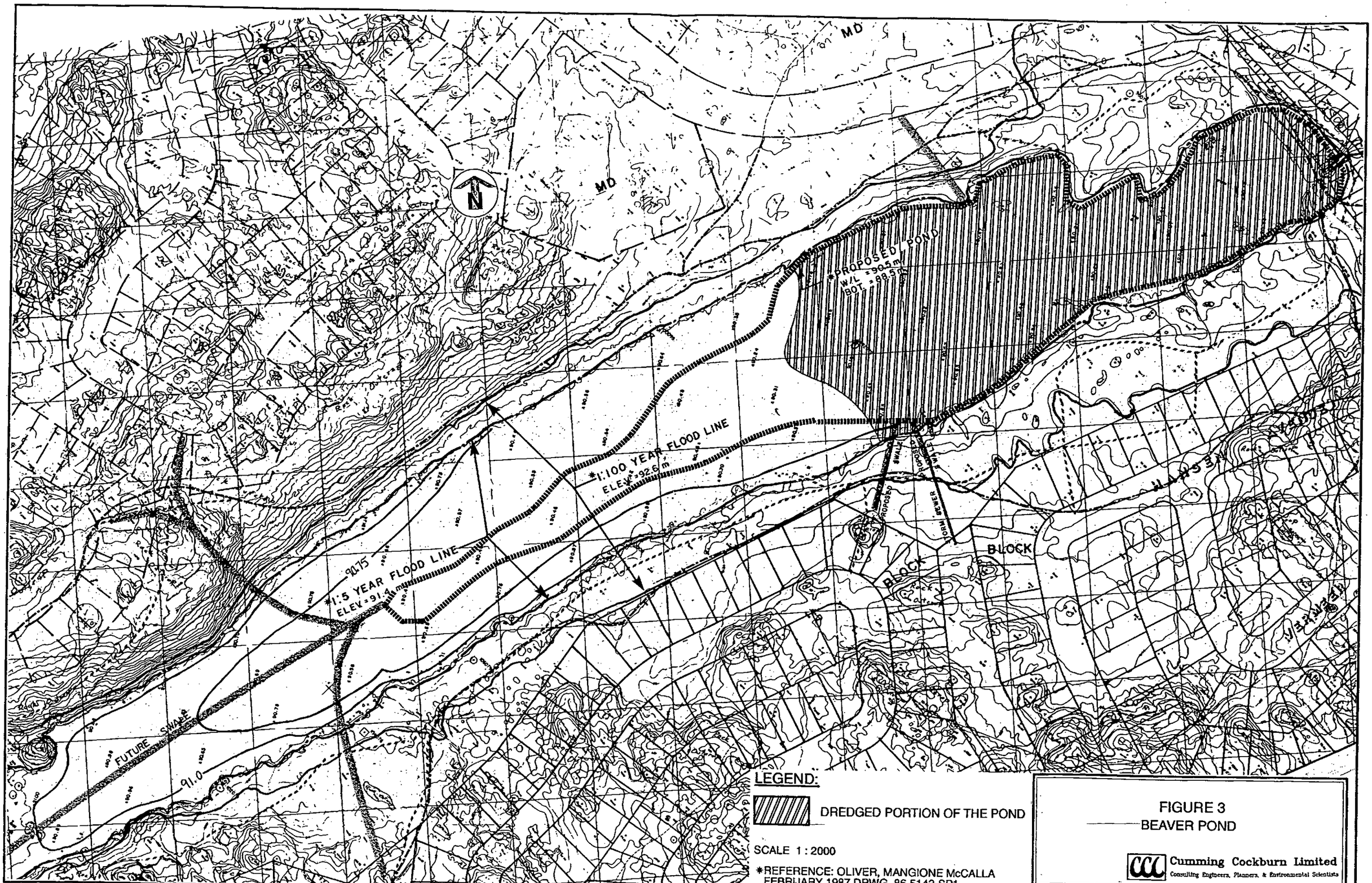

FIGURE 3
BEAVER POND

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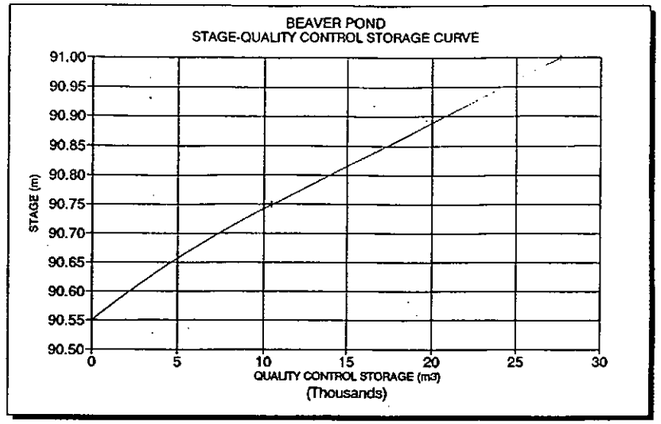

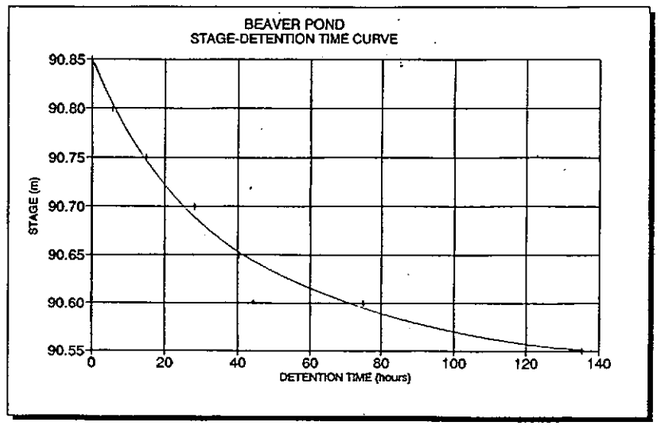

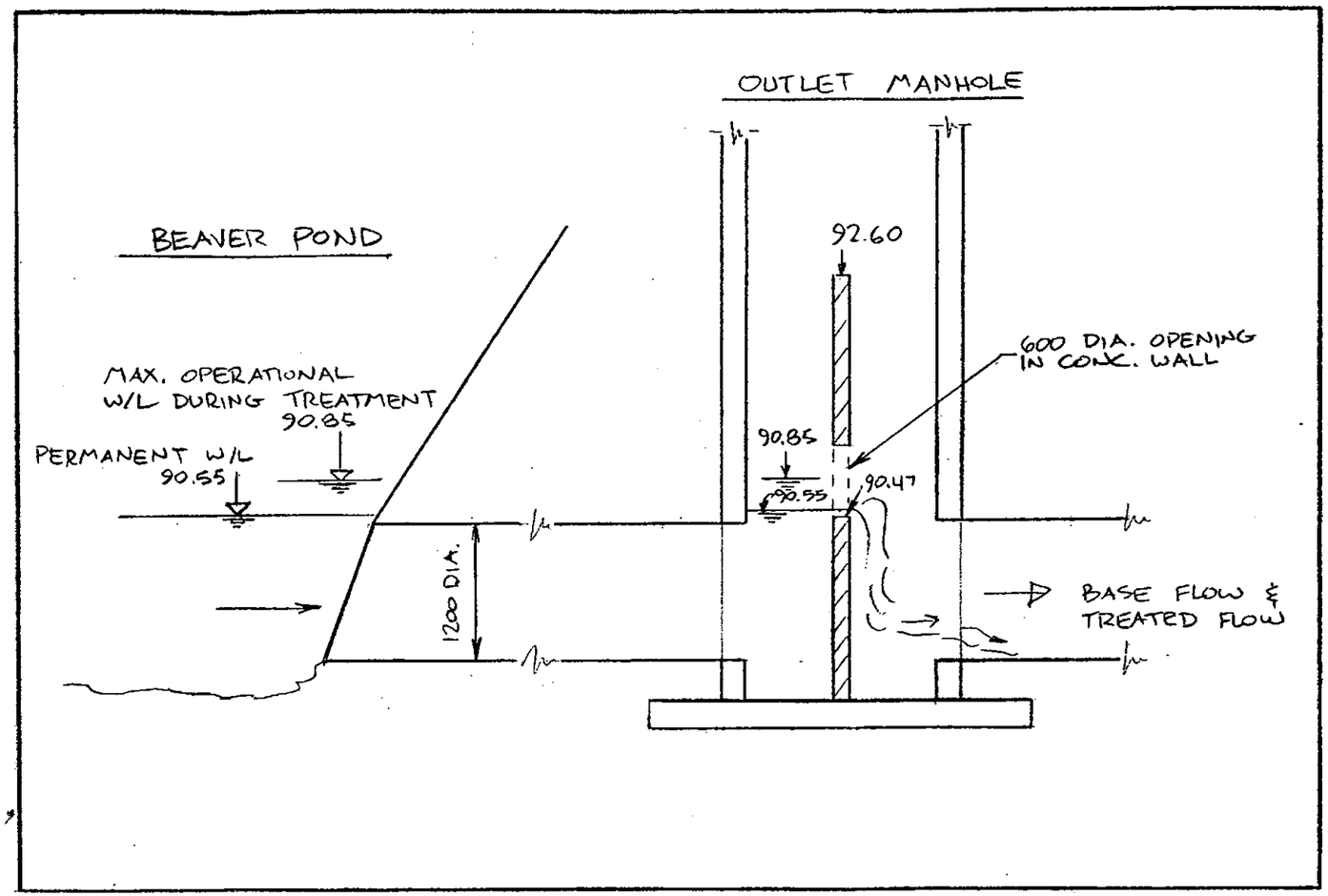

CALCULATION

BEAVER POND
STAGE - DETENTION TIME CURVE

DEPTH (m)	AVE.DEPTH (m)	Q (l/s)	V (cub.m)	TIME Hours	CUMUL.TIME Hours	ELEVATION (m)
0.300			17000		0	90.85
0.250	0.275	144.2	14000	5.8	6	90.8
0.200	0.225	106.2	10500	9.2	15	90.75
0.150	0.175	73.1	7000	13.3	28	90.7
0.100	0.125	45.5	5000	12.2	40	90.65
0.050	0.075	24.1	2000	34.6	75	90.6
0.000	0.025	9.2	0	60.4	135	90.55

FIGURE 4
HYDRAULIC PERFORMANCE OF BEAVER POND DURING THE TREATMENT

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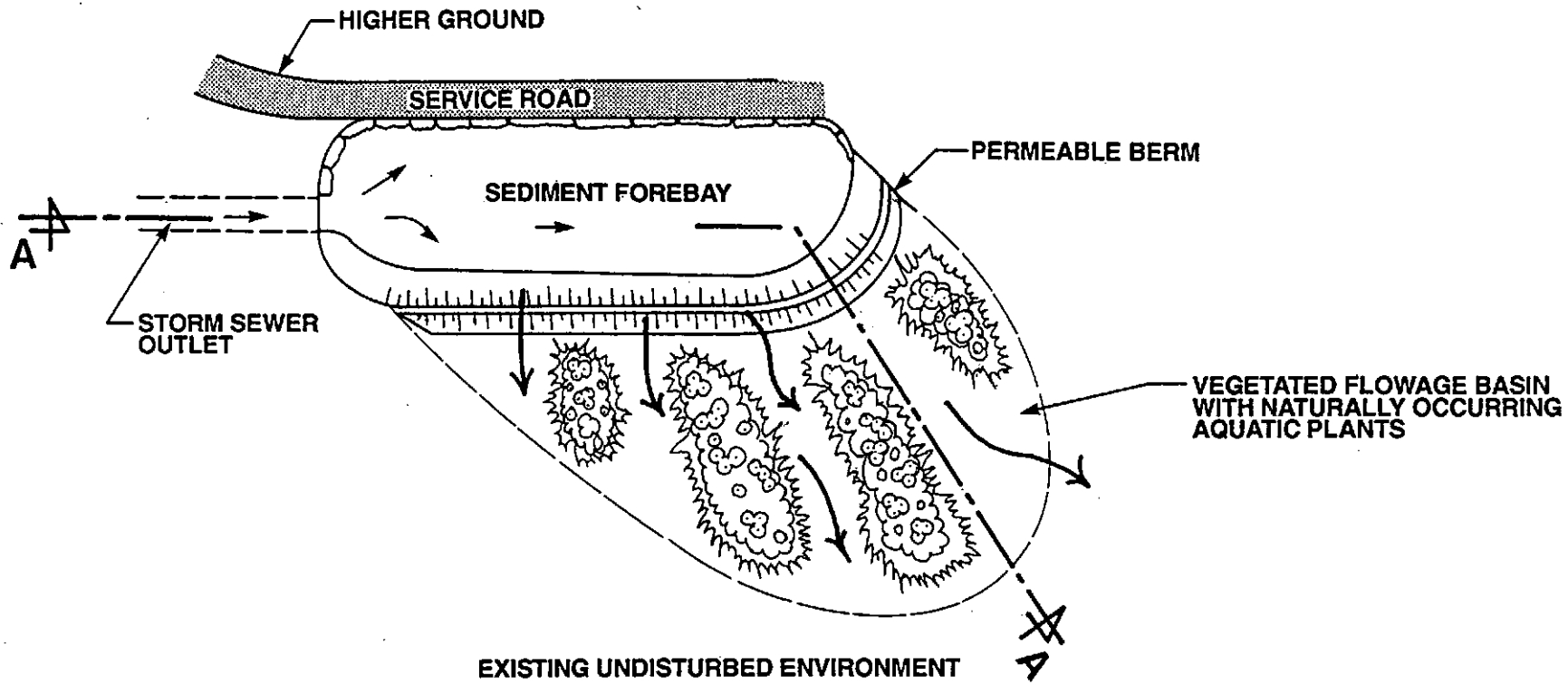

CONCEPTUAL DESIGN OF THE SEWER OUTLET - PLAN VIEW
FIGURE 5

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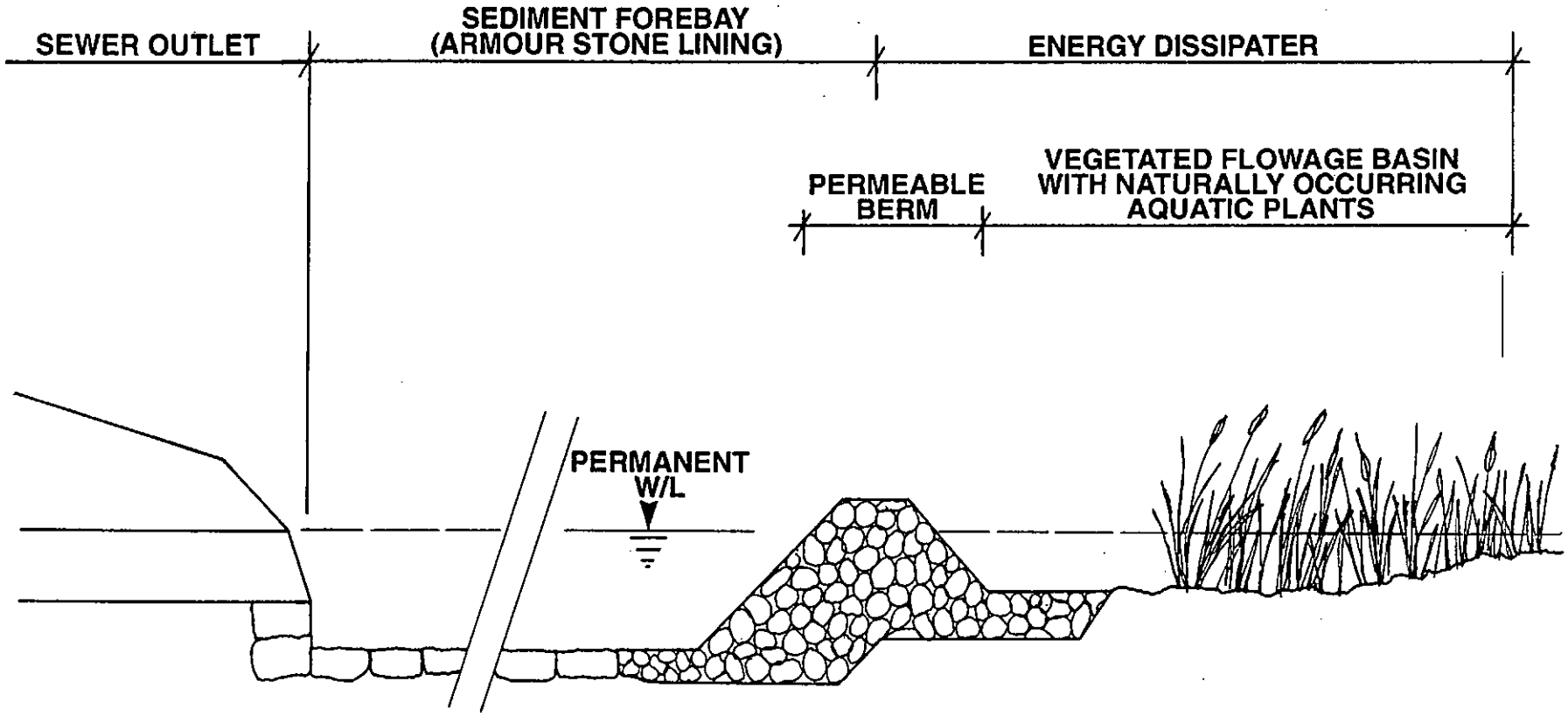
SECTION A-A



CONCEPTUAL DESIGN OF THE SEWER OUTLET - SECTION A-A
FIGURE 6

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