

RE: PROPOSED BYRNE CREEK RELOCATION

ACTING MUNICIPAL MANAGER'S RECOMMENDATION:

1. *THAT the recommendations of the Director Engineering be adopted.*

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TO: MUNICIPAL MANAGER 83 03 29
FROM: DIRECTOR ENGINEERING
SUBJECT: PROPOSED BYRNE CREEK RELOCATION

RECOMMENDATIONS:

1. THAT Council approve, in principle, the relocation of Byrne Creek as outlined in the following report.
2. THAT Council authorize the Director Engineering to proceed with arranging for the preparation of final engineering drawings for the creek relocation, including provision of an estimated cost of constructing the required works.
3. THAT Council authorize staff to pursue negotiations with Canadian National Railways on a land exchange involving lands which are required for the creek relocation shown on the attached Figure 4.
4. THAT Council authorize the Legal and Lands Department to negotiate the acquisition of the additional private lands required for the creek relocation as shown on Figure 4.

SUMMARY:

The following report examines the potential to relocate Byrne Creek out of the Byrne Road right-of-way to permit the upgrading of Byrne Road to an acceptable industrial standard and to relieve the potential for future flooding. The relocated creek would incorporate measures to provide a suitable habitat for fish enhancement as well as providing an opportunity for the future development of recreational areas. There are, however, even further benefits to be derived from creek relocation in such forms as considerable energy cost savings in the frequency of pumping required and in being able to get away from the inherent and incessant water flow obstructions caused by the myriad number of necessary access culverts in the existing ditch on Byrne Road. The relocation proposal is illustrated on the attached Figure 1.

Once having accepted the concept of removing the creek from the Byrne Road right-of-way, the primary focus of this report was directed towards the feasibility of the hydrological aspects of the Municipality's storm drainage requirements and measures to provide flood protection for the area.

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The shape of the relocated creek is proposed to consist of a main channel which would contain the 10-year flow but in order to facilitate fish passage, this channel would incorporate a "notch" in which the "normal" low flows would be concentrated. More severe flooding up to a 100-year flood would be contained within set-back dykes located close to the property lines of the creek right-of-way. A conceptual cross-section is shown on the attached Figure 2. The land between the set-back dykes, including the dykes themselves, would form the linear parkway which could be flooded occasionally without causing significant damage.

The detailed design of the creek relocation has not been done and, therefore, it is important to bear in mind that the estimate of cost, which is examined in more detail in the following report, is based on preliminary design information only. The important aspect of the entire creek relocation project, however, is that it appears to be completely feasible, which has not heretofore been established. Up to now, we had available to us only a very preliminary concept of the creek relocation project which did not adequately address the very crucial aspects of overall hydraulics, hydrology, and total estimated project costs. These aspects were very recently given the attention that was required for the presentation of this report in turning project concept into project feasibility; this work was done by the Engineering Department with utilization of the services of the independent consulting engineering firm of R.F. Binnie and Associates Ltd.

Creek relocation costs, projected to total approximately \$2.6 million, includes provision of approximately \$1.0 million for property acquisition. For reasons of sheer size of the project and the time required to conclude property acquisitions, the project readily lends itself to being accomplished over a period of two years. The sum of approximately \$1.6 million is currently available in monies already specifically appropriated for this project in the Capital Budget, Code 60-32, Storm Extensions, including \$1.1 million of funds carried forward from previous years and \$0.5 million being provided in the 1983 Capital Budget. The balance of the required total project funding of approximately \$1.0 million could be provided in the 1984 Capital Budget through General Revenue Fund financing or internal borrowing, or a combination of both sources.

REPORT:

1. Background

The primary objective of the proposed creek relocation is to provide a width of road allowance on Byrne Road capable of accommodating future upgrading of this very major and very important industrial collector road. The creek relocation project is also notably significant, however, in its provision of the capability of:

- (1) Properly handling major storm drainage flows and relieving the potential for future flooding.
- (2) Providing a suitable fish habitat.
- (3) Providing the basic facility to develop future recreation and open space proposals.

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In many places on Byrne Road, the creek presently occupies very nearly 50% (about 33 feet) of the total width of the road allowance (66 feet). There is no feasible way to build the standard of roadway that is required on Byrne Road within the remaining available width of road allowance while keeping the creek open. Any type of creek allowance would be extremely expensive and completely contrary to the goals of habitat protection and enhancement. Council has previously authorized the installation of culverts under the new Marine Way on the proposed creek alignment in recognition of the fact that it would be almost impossible to install them after Marine Way is opened to traffic. Also, a new outfall structure with pump station has been constructed at the outlet to the Fraser River; for now, this station serves the creek in its present location in the road allowance.

Soil conditions along the proposed route are extremely varied and generally poor, consisting predominantly of peat and silt. Substantial areas have been covered with mineral fill, hog fuel and miscellaneous waste products.

2. Topography

The ground is generally flat, rising from approximately elevation 2.3 m at the Fraser River to elevation 4.0 m adjacent to the new Marine Way.

The land along the proposed creek alignment north of Marine Way towards Byrne Road and Marine Drive is lower and falls below elevation 3.0 m in places. Drainage in this area presently is particularly poor.

Although generally the terrain is flat, there are local variations of as much as 2 m. These location variations will be significant at the time of preparing the final design and cost estimates but it is considered that the representative profile which has been taken is sufficiently accurate for purposes of preparing a preliminary cost estimate.

As part of the recent new outlet structure and pump station for Byrne Creek at the Fraser River, a dyke has been constructed adjacent to the river to elevation 3.5 m.

3. Soils

There is some available soils information but further soils testing will be required before final design is carried out.

Some materials deposited in the vicinity of the future industrial loop road (Mandeville) will have to be removed completely from the creek right-of-way or, alternatively, the creek would have to be lined with an impermeable membrane. Any deposits of hog fuel will also have to be removed from areas adjacent to the creek.

Predominantly, the soils are peat, generally 1 m - 3 m in depth, underlain by silt.

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4. Set-Back Dykes

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For purposes of this preliminary report, it has been assumed that in-situ materials - in particular, peat and imported mineral fill - will suffice for the set-back dykes, providing the creek side of the dykes is protected by vegetation.

The rationale behind this is twofold:

- (a) The dykes, for the most part, will eventually be backed up by filling the adjacent properties as they are developed.
- (b) The purpose of the set-back dykes is only to retain water for short periods of time. As the tides become low during any one day, the capacity to discharge will be more than adequate to handle the high flows and lower the water contained by the dykes.

As a result, it appears that it will not be necessary to construct expensive dykes consisting of imported granular material, which could increase the overall costs by as much as \$500,000.

5. Drainage Areas/Storm Flows

The major storm flow (approximately 50%) is derived from the upper section of Byrne Creek, but there are three additional tributary flows from the west in the lower reaches below Marine Drive. It is assumed that a "local" storm sewer will be installed on Byrne Road to provide drainage for the roadway and adjacent industrial properties. This sewer could either extend along Byrne Road and discharge into the new creek at the existing pump station or, alternatively, it could discharge at several points along the new creek alignment.

Byrne Creek is a major watercourse in Burnaby's storm drainage plans and it will flow through a developing industrial area. It is considered, therefore, that the design of the creek should allow for the 100-year storm to be retained within the set-back dykes without causing any flooding and damage outside the creek right-of-way.

The Fraser River at the outlet is tidal and at high tides the creek will not drain by gravity into the Fraser River unless the creek builds up sufficient head to overcome the water level in the Fraser River. At the present time, during periods of heavier flow, the pumps operate to prevent a significant back-up of water during high tides. These pumps, however, are not designed to carry extreme flows and the final design of the Byrne Creek watercourse will have to ensure that flooding from the 100-year storm will not occur as a result of the restrictions on discharge caused by tides. In this connection, two alternatives will be examined as to the best means of discharging to the river, i.e. all flows through the pump house channel or utilization of a channel "straight out" to the river with only peak excess flows going to the pump house channel. There may be an impact in the choice of one or the other of the two alternatives on the Foreshore Park and this will be considered when making that decision.

The cost estimates in this report assume that the set-back dykes will be built to the elevation recommended for protection from the Fraser River 200-year flood as established by the Federal Government. This elevation is 0.6 m above the 200-year flood level of 2.9 m and increases at a grade of 1 m per 1000 m from the Fraser River.

The period of flooding for the Fraser River is most probably during May, June or July, while the most likely period of flooding from Byrne Creek is November, December, January. The probability of having a 100-year storm on Byrne Creek at the same time as a 200-year flood on the Fraser River is considered to be extremely remote and a possibility which can be effectively disregarded. Therefore, it can be considered that during the Byrne Creek 100-year storm the level of the water inside the dyke will be significantly above the level of the water in the Fraser River, even at the high tides that can be anticipated during the Winter months. As a result, it would be possible to achieve a gravity flow into the Fraser River without flooding occurring.

At those times when Byrne Creek has a high flow, the three tributaries from the west would also have high flows and flood protection measures would also be required along each tributary. The most acceptable methods of providing flood protection for each of these tributaries will need to be determined at the time of detailed design at which time suitable elevations for buildings would also be confirmed.

6.

Tides

Tides in the Fraser River estuary are extremely complex because of the effect of the estuary shape and the flood flows from the Fraser River.

The nearest tide gauges are at the Fraser Street bridge on the North Arm of the Fraser in Vancouver and at Port Mann on the main channel and it was necessary to interpolate information at these two locations to apply to the outlet of Byrne Creek. It is not claimed that this tidal information is typical or that it is strictly correct to interpolate between the stations. However, for preliminary purposes, the derived elevations provide a guide to the varying water levels of the Fraser River throughout the year. Further analysis would be required at the time of the detailed design but, for now, tidal information has been used to determine potential allowable discharges from Byrne Creek at high and low tide.

7.

Rights-of-Way

Between the Fraser River and Marine Way, the proposed right-of-way widths would be designed to satisfy the immediate requirements for storm drainage and for the future development of a linear parkway. It has been proposed that the right-of-way north from Marine Way to the point where Byrne Creek crosses Byrne Road would not provide all the park features of the section south of Marine Way. Bicycle and pedestrian access is not proposed in this section because of limited right-of-way widths and the potential hazards of having cyclists and pedestrians crossing Marine Way at the creek. Access for maintenance, however, would still be essential.

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The existing land is low in the section north of Marine Way and the land use west of the creek is agricultural; it has, therefore, been assumed that this land will not be filled. However, it has been assumed that the industrial area east of the creek will be filled to the elevations required for flood protection. It is believed that the creek, with gabion protection and access road, can be accommodated within a 20-metre right-of-way provided some fill to support the gabions can be placed on the adjacent industrial property.

In the section where the creek is immediately adjacent to Byrne Road a channel with near vertical walls constructed using gabions could probably be built alongside Byrne Road within a 5-metre right-of-way provided one wall could encroach somewhat into the Byrne Road right-of-way.

8. Fish Enhancement

An integral component of the concept involved in relocating the creek is to incorporate features which will promote the viability of Byrne Creek as a fish habitat in the long term. This is particularly relevant since Byrne Creek was once a cool, clean, fish stream.

It has been proposed that the realigned creek section below Marine Drive would be designed to act as a link which would allow the passage of fish between the Fraser River and Upper Byrne Creek. To meet this objective the outlet structures on the recently installed culverts incorporate flap gates which will not restrict fish passage. The creek relocation section would then function as a small rearing habitat with some limited potential as a spawning area. The area above Marine Drive would provide a spawning and rearing habitat.

The remaining major obstacle to fish enhancement is the water quality. Care would need to be taken during final design stage to prevent any possible leachates from contaminating the water.

Settlement ponds would be required where each tributary joins Byrne Creek. It has been proposed in earlier reports that water quality be monitored throughout the first few years to determine further measures necessary to maintain good water quality.

It is apparent that water quality is likely to be a significant problem in this area and it is not possible to estimate at this time measures which may be necessary to provide for fish rearing. It appears to be possible that, in the Big Bend Area, a policy of limiting the post-development storm run-off to the same levels that existed before development might help in improving water quality. This is known as "zero run-off" or "storm drainage retention". Such a policy would encourage some pollutants to settle before being discharged into Byrne Creek and would also help to reduce the size and cost of downstream drainage facilities.

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It is anticipated that culverts would be designed to encourage fish passage and that a low flow channel would be incorporated into the creek design. In addition, vegetation would be planted on the banks of the channel for fish protection. The ponds, which would form part of the park design, would also act as settlement ponds for removing silt.

Inasmuch as the lower reaches are not considered suitable for spawning it has been assumed that there is no need to line the creek with gravel except in some areas requiring scour protection.

9. Linear Parkway

The proposed Byrne Creek relocation corridor was originally designated as an open space link between the south slope residential areas and the Fraser River Foreshore Park. This linear park connection is embodied in the Council-adopted Big Bend Development Plan which is attached as Figure 3. If Byrne Creek is relocated to this area it will provide a significant visual asset and act as a focal point for park users.

It is considered imperative that a permanent service access road be provided at this time, not only for future park maintenance, but also for creek maintenance. It would be extremely costly and may be impossible to construct a watercourse which would be maintenance free in such a flat area of poor, unstable soils. Some of the adjacent properties would probably be preloaded during the early life of the creek and this could disturb the soils in the watercourse channel. For purposes of the preliminary estimate, a service access roadway, 4 metres wide, is proposed to be located adjacent to one of the creek banks south of Marine Way. This would facilitate construction of the channel, would serve as a bicycle path, and facilitate removal of excessive silt from settlement ponds.

As a part of total project costs, the portion of the trail corridor under the control of the Parks and Recreation Commission (Marine Way to the Fraser River) will be provided with restoration of vegetation which is natural to the area and typical of that which presently exists.

It is also intended to provide, in some seven or eight areas, a variation in dyke configuration to accommodate such future improvements as picnic tables, rest areas, and garbage cans.

Access across the proposed channel to the "Parks" area (future golf course) will be provided at or near the present access point at Royal Oak Avenue and the Railway line. It is most probable that the final design will provide for this by extending the required culvert under the Railway line a short distance to the north.

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10. Preliminary Cost Estimate - Creek Channel

I. South of Marine Way

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- (a) Channel and dyke construction, (complete), including permanent service road alongside proposed channel and restoration of natural vegetation in "Parks" portion south of Marine Way. \$ 453,000
 - (b) Excavation and dispose of hog fuel and other deleterious material in order to satisfy Fisheries' requirements. \$ 455,000
 - (c) Culverts \$ 230,000
 - (d) Tributary inlets \$ 30,000
 - (e) Fraser River dyke and culverts. \$ 110,000
- Sub-total south of Marine Way \$1,278,000

II. North of Marine Way

- (a) Channel, complete with gabion dykes. \$ 292,000
 - (b) Culverts under Byrne Road. \$ 110,000
- Sub-total north of Marine Way \$ 402,000
- GRAND TOTAL \$1,680,000

Certain assumptions and parameters have been used to derive the foregoing cost estimate as outlined in the attached Appendix 'A'.

11. Land Acquisitions

While much of the lands required for the creek relocation are currently owned by the Municipality, it will be necessary to acquire additional lands as shown on the attached Figure 4. The principal owner of these lands is The Canadian National Railways. It has been proposed that the Municipality enter into a land exchange involving properties which are in the immediate area and which could be consolidated with the C.N.R. lands. This proposal would negate the need to expend monies on the outright acquisition of these lands and, furthermore, would expedite the development of the C.N.R. lands.

The remaining privately-owned parcels of land would need to be acquired through funding provided in the overall estimated cost of the project, as discussed earlier in this report. The Legal and Lands Department has estimated the maximum cost of acquiring these lands, as referenced in Figure 4, to be approximately \$1.0 million.

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12. Conclusions

Staff has reviewed the technical considerations involved in relocating Byrne Creek and concluded that it is feasible. There are several direct benefits to be derived from the proposed creek relocation in addition to providing additional right-of-way to permit the upgrading of Byrne Road to an acceptable standard. These include provision of flood protection for the area; the acquisition of lands to facilitate the future development of a linear park connection from the Fraser River Foreshore Park to Burnaby's south slope residential area and the Byrne Creek Ravine Park; and the enhancement of the creek as a viable fish habitat.

The total projected costs are approximately \$2.6 million, of which approximately \$1.6 million is currently available. The balance of required funding of approximately \$1.0 million could be provided in the 1984 Capital Budget through General Revenue Fund sources, from internal borrowing, or from a combination of both sources. It is proposed to carry out the work over a 2-year period (1983 and 1984), which is reasonable and logical from the aspects of the amount of existing funding in place and time required to acquire property and finalize design.

On 1983 April 06, the Parks and Recreation Commission approved the recommendations in this report, and thereby agreed to the relocation of the creek into the park trail corridor, on the condition that natural vegetation be replaced following creek construction. This will be done; in fact, details have already been worked out, and the estimated cost for the restoration in the amount of \$77,000 is included in the project budget.

E.E. Osborn
DIRECTOR ENGINEERING

EEO:PB:sp
Attachs.

- cc: () Director Planning & Building Inspection
- () Director Recreation & Cultural Services
- () Director Finance

APPENDIX 'A' _ ASSUMPTIONS AND PARAMETERS

USED TO DERIVE COST ESTIMATES FOR

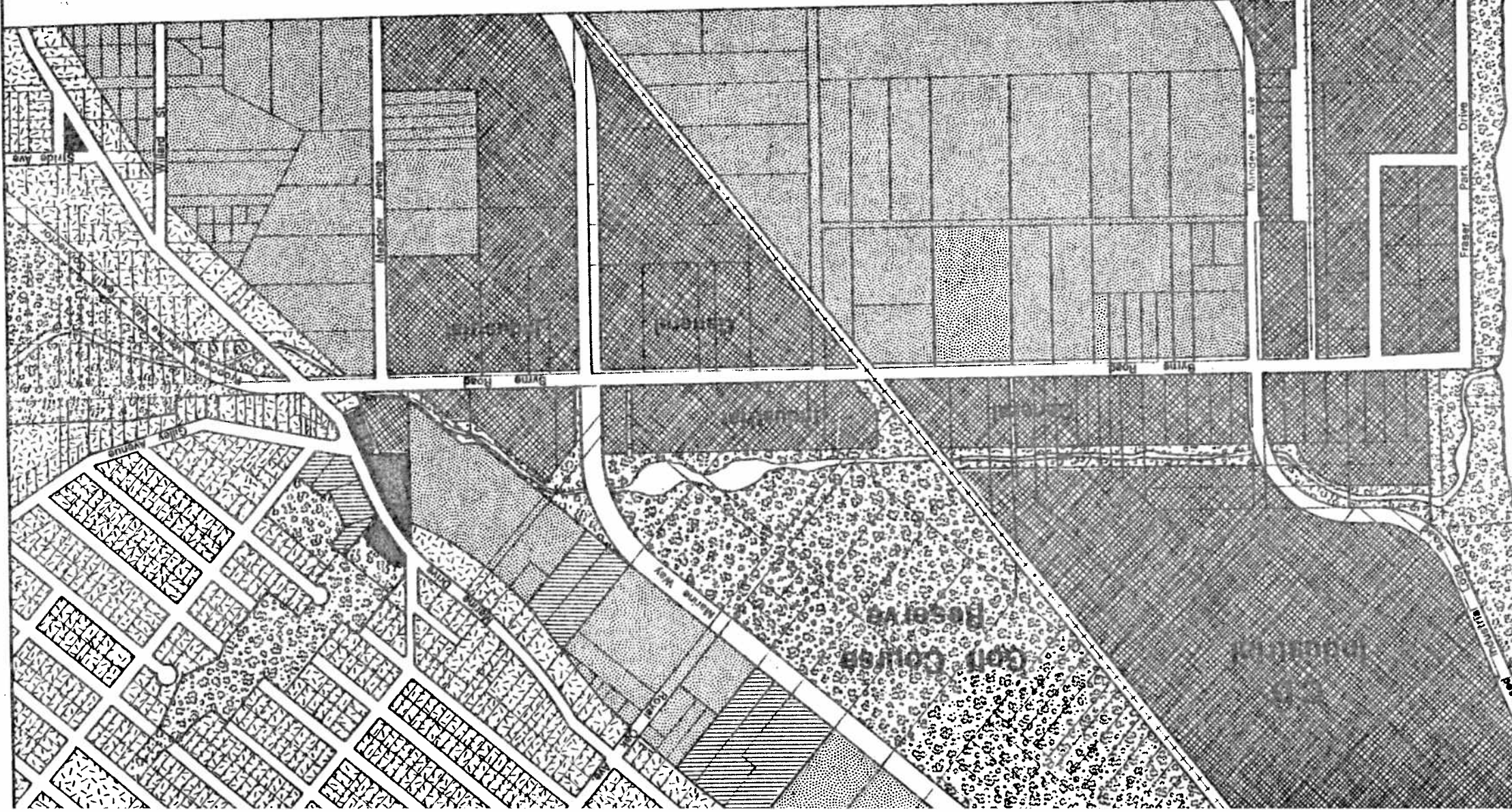
PROPOSED RELOCATION OF BYRNE CREEK

1. Costs exclude any landscaping, revegetation or "parks" treatment - e.g., pedestrian or bicycle paths, except for provision of restoration of natural vegetation in "Parks" portion south of Marine Way.
2. Costs exclude any work on Byrne Road or on the creek north of the Byrne Road culverts.
3. Costs exclude the future industrial loop road, Mountbatten Road and adjacent parking area, Royal Oak Avenue and adjacent parking area. The Royal Oak culverts are included.
4. Land acquisition costs are not included.
5. Existing soils information has been used to derive quantities of various types of material.
6. Any excess hog fuel or native materials can be disposed of on the proposed golf course site.
 - In this regard it will be necessary to obtain the approval of the Pollution Control Board to the deposition of these materials.
7. The existing deposits of waste products in the vicinity of the industrial loop road will have to be removed from the creek allowance - some of this may be disposed of at the golf course site, the remainder will have to be disposed off-site in a suitable sanitary landfill site.
8. The set-back dykes will be constructed at the edge of the right-of-way to the elevation required for protection from the 200-year Fraser River flood. This will permit gravity flow to the Fraser River even at high tide.
10. The existing new pump station will be adequate.
11. Additional culverts will be required at the outfall to the Fraser River.
12. The existing dyke adjacent to the Fraser River will be extended to provide protection for the Byrne Creek system from the Fraser River.
13. The Byrne Creek system is to be designed to carry the 100-year storm flows.
14. The 100-year storm flow on Byrne Creek will not occur at the same time as the 200-year Fraser River flood.
15. The golf course will not be flooded if it is filled entirely to the prescribed elevations presently being followed. If a portion of it is not so filled, an option will exist of either providing dykes on the watercourse(s) or permitting occasional flooding of the unfilled area only.

Appendix 'A' (cont'd)

16. It is not intended that lower Byrne Creek be developed as a fish spawning habitat.
17. Features would be developed in the creek to encourage the passage of fish to upper Byrne Creek and to provide an enhanced rearing habitat.
18. Flood protection measures on tributaries to Byrne Creek are not included.
19. Access to the creek will be essential for creek maintenance. Cost of access road included in estimate.
20. The C.N. rail tracks (unused rail line) will not be reinstated and culverts at this location are not included.
21. No allowance has been made for specialized water quality control devices such as oil interceptors.

Byrne Road Industrial Area Land Use Plan



- Industrial
- Park
- Agriculture
- Commercial
- Residential
- Institutional
- Proposed Relocation of Byrne Creek

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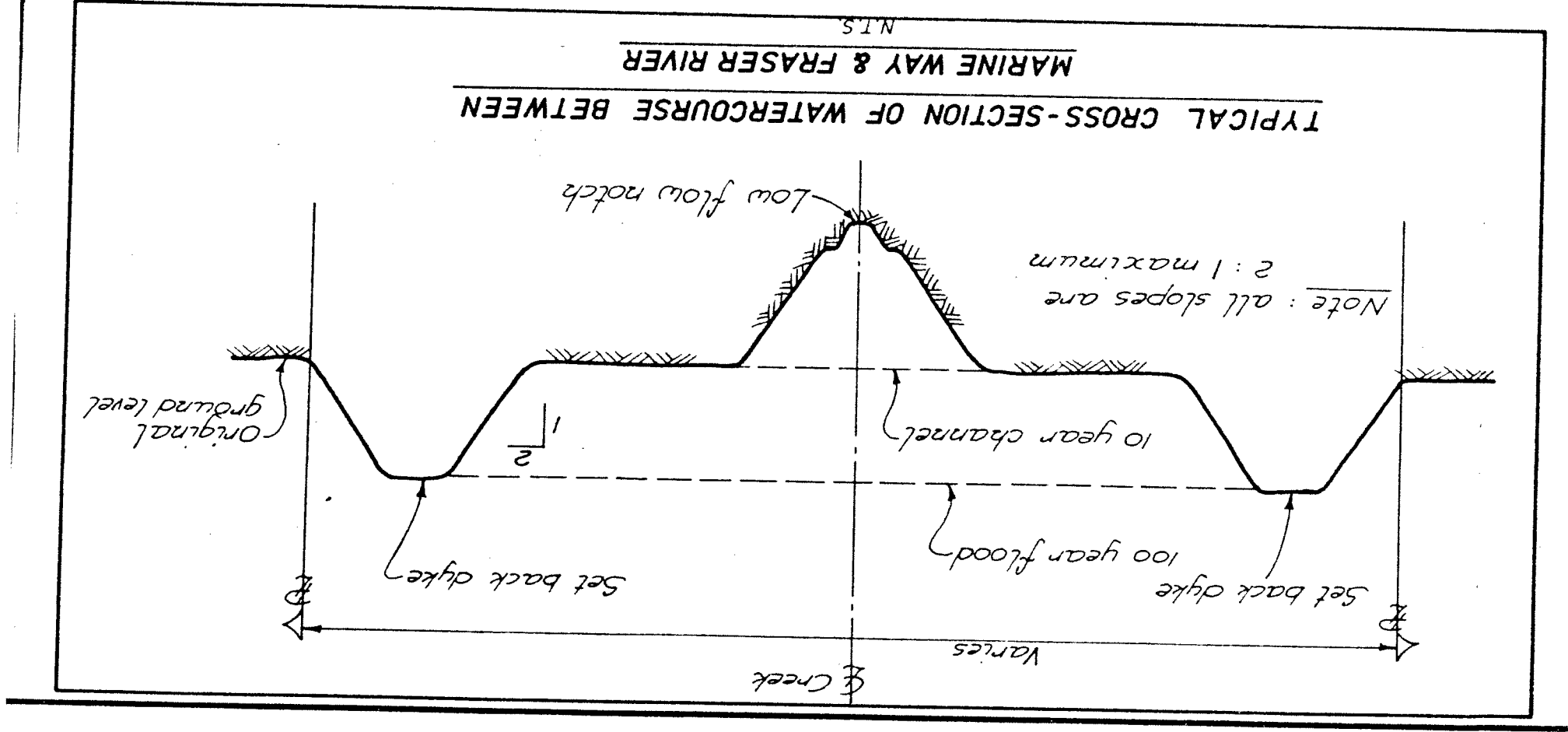
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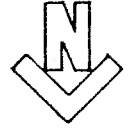
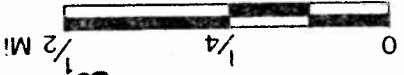


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Figure 1

Fig. 2





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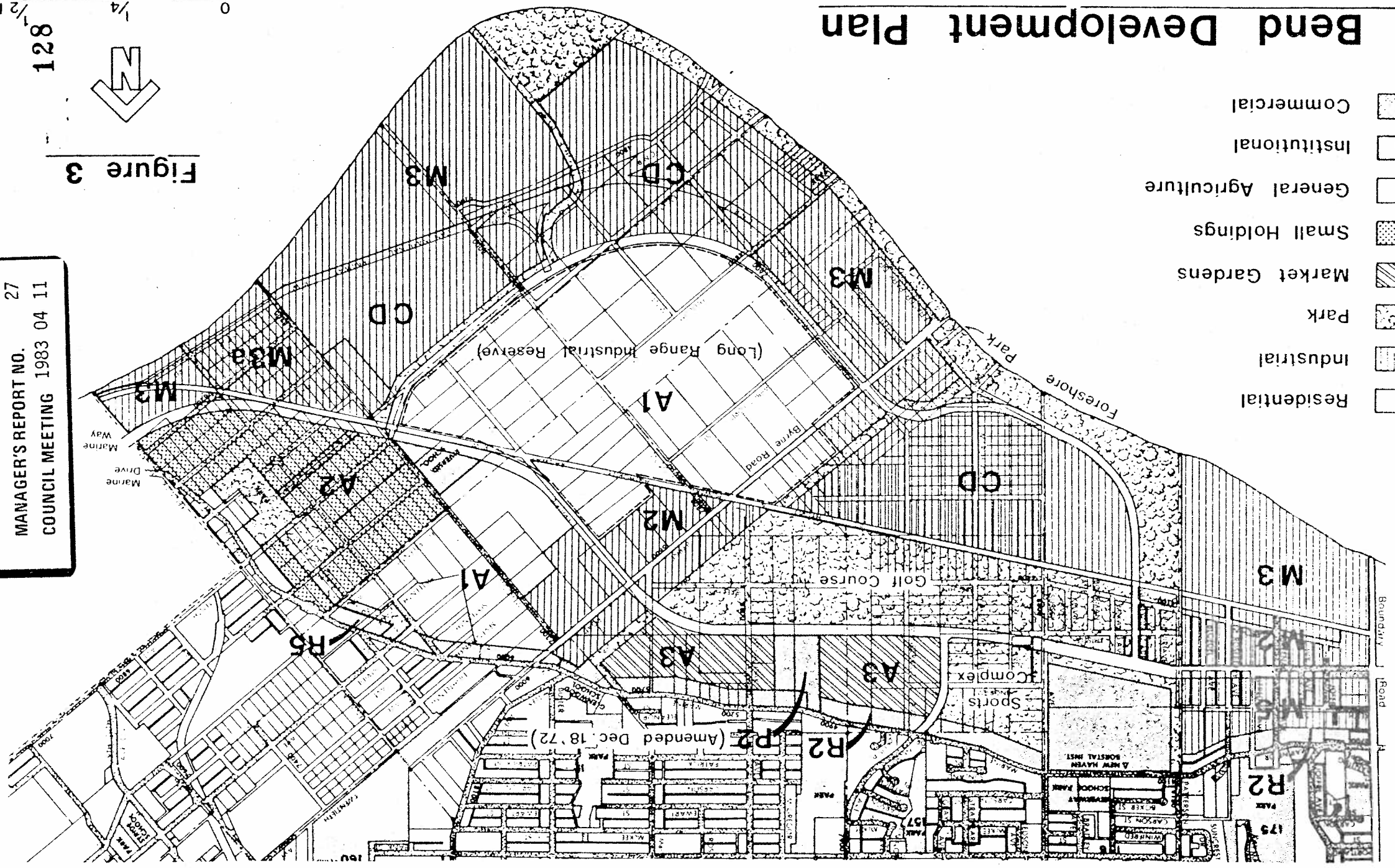
Figure 3

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Big Bend Development Plan

Adopted March 27, 1972



- Residential
- Industrial
- Park
- Market Gardens
- Small Holdings
- General Agriculture
- Institutional
- Commercial



P2 (Amended Dec. 18, 72)

Boundary Road

Relocation of Byrne Creek Proposed Land Acquisitions

 Lands to be acquired from C.N.R. via land exchange with no capital outlay
 Private lands to be acquired requiring expenditures now

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Figure 4

