



Public Works
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Canada

Western Region

Région de l'Ouest



0003062

MACKENZIE HIGHWAY, N.W.T.
MILE 902 TO MILE 802
PRELIMINARY SUBMISSION
DETAIL DESIGN DATA

August, 1974

MEMORANDUM

NOTE DE SERVICE

Mr. W. R. Binks
Program Manager (Civil)
Design & Construction
OTTAWA, Ontario

FROM
DE
F. E. Kimball
Project Manager NWT Roads
Western Region

SECURITY CLASSIFICATION DE SÉCURITÉ
000011
OUR FILE - N/RÉFÉRENCE
9305-52-300
YOUR FILE - V/RÉFÉRENCE
DATE
August 1, 1974

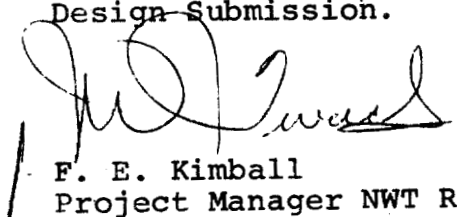
SUBJECT
OBJET

PRELIMINARY DESIGN SUBMISSION -- MILE 902 TO MILE
802 MACKENZIE HIGHWAY

Enclosed are 24 copies of the narrative portion of the above-noted Design Submission. Two sepia copies of the plans have been forwarded under separate cover.

Six copies of the narrative and a sepia of the plans have been forwarded to Mr. C. Amos of D.I.N.A. in Yellowknife. Single copies of the narrative and a single set of prints have been forwarded to D.O.E. in Edmonton and Winnipeg and E.M.R. in Calgary and to D.I.N.A. in Edmonton.

Every attempt has been made to provide all information required in a Preliminary Design Submission. It would be appreciated if you could obtain an early response identifying any omissions or additional information requirements relative to this Preliminary Design Submission.


F. E. Kimball
Project Manager NWT Roads
Western Region

Encl.

MACKENZIE HIGHWAY

PRELIMINARY DESIGN DATA

MILE 902 - MILE 802

Department of Public Works
of Canada
Western Region
EDMONTON, Alberta

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INTRODUCTION

The general design criteria used by the Department of Public Works design teams in preparing the preliminary and final designs of the Mackenzie Highway are outlined in the General Design Data Report, Section "D", Mile 715 to Mile 936 published on June 29, 1974 by the Public Works of Canada, Western Region. Narratives on specific concerns for this Design Submission are contained in this Report, Preliminary Design Data, Mile 902 to Mile 802.

In some cases orthophoto mapping was available in 1"=1,000' scale. Where available, these were included in this Submission.

In four areas, Mile 802 to 805.3, Mile 810.7 to 815.5, Mile 824.4 to 826.5 and Mile 883.3 to 890.5 it has been decided to revise the Highway alignment due to conflicts with the proposed pipeline right of way. Investigations are now under way for Highway alignment revisions in these sections and these revisions will be re-submitted at a later date. To provide continuity of gradeline and alignment on the plans this Submission contains complete design and drainage for the entire Submission, Mile 902 - Mile 802.

The Environmental Data sheets and the Landscape Evaluation sheets have not been included for the proposed revision areas pending approval of the new alignment.

Horizontal alignment improvements are being investigated at Miles 901.6, 899.6, 896.0, 894.1, 892.1, 883.6, 882.4, 881.6, 871.2 and 833.2. These sections of the present alignment which have small deflection angles and small intersection angles will be revised to provide a smoother and more continuous line.

CHAPTER 1

OVERLAND DRAINAGE

From Mile 902 to Mile 802 the Highway route crosses a variety of terrain conditions that vary from well-drained uplands to a poorly-drained drumlinized till plain. Surficial soils are predominantly silty sandy clays with a few sandy gravel areas while bedrock consisting primarily of shales, sandstones and limestones of paleozoic and cretaceous age may be found at shallow depths in many locations.

From Mile 902 to Mile 900 the Highway crosses a well-drained drumlinized till plain which degrades into a poorly-drained glaciolacustrine deposit around Mile 898. In this area additional culverts have been added to the design in order to accommodate the potential of upslope ponding. From Mile 898 to Mile 888 the right of way crosses an upland till plain, with a very diffuse drainage density and no drainage problems are anticipated. At Mile 885 the Highway begins a gradual descent to Travaillant River at Mile 869. This area is predominantly a flat till plain interspersed with moraine deposits and occasional bog areas. The density of drainage courses is rather light, but those courses present are well defined and tend to

dominate local drainage characteristics. No drainage problems are anticipated in this area.

Subdued hummocky moraine deposits interspersed with numerous knolls and lakes are the dominant topographic features from Mile 869 to Mile 844. From Mile 869 to 859 the terrain is rolling and there is sufficient good relief along the alignment to minimize the potential for upslope ponding. Most sags in the profile have culverts designed for them in order to maintain the present drainage pattern. The Highway then ascends gradually to Mile 859 and returns to a locally well-drained, rolling landscape. From here, a gradual descent takes the Highway to Mile 844 and the Thunder River. The rolling nature of the moraine features and the presence of definable drainage lines indicate that few drainage problems will be encountered in this section of the Highway.

Local drainage from Mile 845 to Mile 843 is dominated by the Thunder River valley. At Mile 843, the alignment ascends slightly and once again traverses an area of subdued hummocky terrain with numerous lakes in an area of upland glacial till deposits. This terrain continues from Mile 843 to Mile 834 and the naturally good relief of this section indicates few areas with potential for upslope

ponding. After crossing a drumlin at Mile 834, the alignment descends to a glaciolacustrine plain interspersed with thermo-karst features and occasional eskerine deposits. Local drainage varies from well-defined dendritic patterns to poorly-drained bogs and sedges. In these poorly-drained areas, culverts have been added to the design to accommodate the potential of upslope ponding. As in most situations where some drainage difficulties may be encountered, the drainage devices included in this design have been placed so as to minimize disruption of the existing drainage network.

In this Preliminary Design Submission the sizing for all culverts over sixty inches in diameter are those recommended by Fenco, the hydrology consultant for Section "D". Fenco's two publications, Hydrology Study, Mackenzie Highway, Fort Good Hope to Dempster Highway, March, 1974 and Bridge and Culvert Hydraulics, Mackenzie Highway, Fort Good Hope to Dempster Highway, March, 1974, contain analytical data to substantiate these recommended culvert sizes.

It is D.P.W.'s intent to carry out the complete design of the large culverts on Section "D" in-house in the Final Design Submission.

CHAPTER 2

SOURCES OF BORROW

The section of the Highway covered by this Preliminary Design Submission traverses an area of continuous permafrost with varying ice contents. From past experience on the Dempster Highway and on the Inuvik airport road it has been found that the overlay construction method using low moisture content rock material provides a superior road grade and offers the advantage of easier construction during the winter season. Therefore, the search for borrow material was concentrated toward areas of shales or other rock materials.

The haul limits for borrow areas selected are listed as follows:

Mile 902.0 - Mile 897.0

Shale overlain by eight feet of unusable overburden is available from the borrow area selected at Mile 899.5. Two other areas tested in this section contained unsuitable gravelly till and shale-rich till with low to moderate ice contents.

Mile 897.0 - Mile 891.9

Three areas were investigated in this section as potential borrow sources. Material in one area varied from ice-rich

clay and gravel adjacent to the Highway centreline to an extensive gravel source extending to three and one-half ($3\frac{1}{2}$) miles east of the Highway right of way. This area was not selected because of the high ice content. A second area contained clay till with low to moderate ice content. The area selected for a potential borrow source for the construction of the Highway grade for this section was the shale deposit at Mile 893.6. The shale in this area is overlain by eight feet (8) of unusable till.

Mile 891.9 - Mile 886.7

Investigation of five potential borrow areas resulted in one area being rejected because the material was a clay till. Four areas contained shale overlain by six and one-half ($6\frac{1}{2}$) feet of generally unusable overburden. The borrow area at Mile 889.9 was chosen from the four areas investigated because this area provided the combined factors of quantity and haul economics.

Mile 886.7 - Mile 880.8

Two shale areas and one large gravel source were tested in this section. The area at Mile 883.5 was chosen on the basis of haul economics. Five feet (5) of unusable overburden are expected in this area.

Mile 880.8 - Mile 877.2

One of the two borrow areas tested in this section was rejected because of the excessive overburden. The borrow area at Mile 878.6 will provide shale overlain by approximately one to two feet of overburden.

Mile 877.2 - Mile 871.0

The only area tested in this section was at Mile 875.0. The shale in this area overlain by six and one-half ($6\frac{1}{2}$) feet of silty clay overburden will provide good construction material for this section of the Highway.

Mile 871.0 - Mile 866.0

From the three areas tested in this section two areas contained moderate to high ice content sandy silty clay. Shale and sandstone beneath an average depth of overburden of four and one-half ($4\frac{1}{2}$) feet in the borrow area at Mile 867.5 was selected for this section of the Highway.

Mile 866.0 - Mile 862.0

Four areas were tested in this section. Three areas contained silty clay with moderate to high ice content. The area selected for borrow is the small area of shale at Mile 864.6. The shale in this area is overlain by eight (8) feet of unusable overburden.

Mile 862.0 - Mile 844.0

Three usable borrow areas were identified in this section; a small area at Mile 851.0 and two large areas some distance from the right of way at Miles 859.3 and 857.7. Shale from the area at Mile 851.0, overlain by six (6) feet of unusable overburden, is intended to be hauled south toward the Thunder River. The remaining section of the Highway will be constructed with the shale and sandstone from the borrow area at Mile 857.7.

Mile 844.0 - Mile 837.2

Suitable construction material for this section of the Highway was not available along the right of way. Extensive investigations in the area resulted in finding a gravel deposit near the Thunder River airstrip. This gravel material has a low ice content. The location of this borrow area necessitates a three-mile access road to the south end of this section.

Mile 837.2 - Mile 827.1

From the sixteen areas investigated for potential borrow sources for this section of the Highway, three locations near Mile 830.0 were considered suitable for construction material. The area chosen was a sandstone and siltstone deposit approximately 8,000 feet from the right of way.

Mile 827.1 - Mile 820.3

A borrow area at Mile 823.0 was selected to provide construction material for this section of the Highway. The material in this area is shale, sandstone and siltstone. Five (5) feet of low ice content sandy silty clay overlies the usable material. The other area tested in this section consisted of high ice content silty clay.

Mile 820.3 - Mile 812.5

From the six areas tested in this section the area containing shale was chosen. The shale area is at Mile 817.5.

Mile 812.5 - Mile 802.0

From the seven areas tested in this section the area containing shale was chosen. The shale area is at Mile 807.0

CHAPTER 3

SPECIAL DITCH TREATMENT

The following special treatment for planned ditches has been identified in accordance with Section B-8 of the Mackenzie Highway General Design Data, Mile 715 - 936.

<u>Mile</u>	<u>Station</u>	<u>Average % Slope</u>	<u>Estimated Discharge in C.F.S.</u>	<u>Ditch Protection or Ditch Check Spacing</u>
843-844	5144-5140	7.6	.5	Coarse Gravel
851-852	4492-4485	3.5	1	40'
891-892	2363-2350	4.5	3	40'
892-893	2325-2320	3.5	1	50'
893-894	2269-2261	3.5	3	50'
896-897	2112-2108	3.5	1	50'

SUMMARY OF ENVIRONMENTAL DATA
MILES 902 TO 802

Prepared by: Schultz International Limited
Environmental Consultants

Data derived from field work during 1973 and air photo analysis are presented on the Environmental Data sheets. The portion of the Highway alignment under discussion is the section from just north of Kame Lake to Wounded Bear Lake. Within this section of the alignment, few conflicts of alignment versus environment exist. Areas of concern are identified and discussed.

Following are brief discussions of Miles 902 to 802 of the proposed alignment under each of the assessment categories found on the Environmental Data sheets. These categories are:

TERRAIN	LANDSCAPE ARCHITECTURE
VEGETATION	RECREATION
WILDLIFE	CONSTRUCTION
FISH	ENVIRONMENTAL ASSESSMENT
ARCHAEOLOGY	

TERRAIN

The proposed alignment passes over a variety of terrain in the section from Miles 902 to 802. The changes in terrain are outlined below.

From Mile 902 at Wounded Bear Lake to Mile 900, the route traverses a till plain with drumlins parallel to the Highway. The Rengleng River is crossed at Mile 901.5. Glacio-lacustrine deposits with numerous lakes and bog areas are encountered in the next two miles. At Mile 898.0 the tributary of the Rengleng River draining Bathing



Lake is crossed. No major construction problems are anticipated in this section.

Within the next ten miles, the alignment rises and crosses an upland till plain with bedrock controlled topography. Very few drainage systems are encountered in this section. Drumlinized terrain is passed from Miles 892 to 891 and a bog area at Mile 892.5.

From Miles 888 to 885, the route drops rapidly approximately 300 feet and then continues to slope gently downward to Travaillant River at Mile 869. Again, few drainage systems are encountered in this section. Miles 885 to 877 is a flat upland plain with bedrock controlled topography. A large moraine deposit south of the Highway is passed at Miles 886 to 882. Extensive bog areas are encountered at Miles 887 and 878.5 north of the alignment. From Mile 877 to Travaillant River the terrain consists of subdued hummocky moraine deposits. No major construction problems are anticipated in this section of the Highway.

From Travaillant River to Thunder River (Mile 844) the Highway traverses subdued hummocky moraine deposits with numerous knolls and lakes; however, few streams and drainage channels are encountered. From Travaillant River to Mile 859 the route rises rapidly approximately 450 feet. A large rock outcropping lies north of the Highway from Miles 867 to 866, and a bog area is passed at Mile 865. The route drops rapidly from Miles 859 to 852 and then gradually until the edge of the Thunder River valley at Mile 845. Again, no major construction problems are anticipated in this section.

The Thunder River valley extends from Miles 845 to 843. The Highway drops and again rises approximately 300 feet. Long grades exceeding eight percent may result in road maintenance problems.



From Miles 843 to 834 the alignment traverses an area of subdued hummocky moraine and upland glacial till deposits with numerous lakes and hummocks. Few drainage systems are encountered. At the end of this section the route crosses a drumlin at Miles 835 to 834.

The Highway drops rapidly from the drumlin to a glacio-lacustrine plain which extends to the end of this section under discussion (Mile 802). This plain is characterized by many small lakes and a large number of varying size drainage systems necessitating numerous culverts. A prominent hill east of the route is passed at Mile 822. The Highway approaches to within a mile of the Mackenzie River at Mile 820. Numerous eskers and bog areas are encountered in the section from Miles 807 to 802.

The glacio-lacustrine plain presents a major construction and road maintenance hazard. The area has been repeatedly burned over and, as a result of the lack of forest cover, an escarpment lying immediately east of the Highway has become unstable. Numerous mudflows are present in the area from Miles 816 to 802. These mudflows may endanger the Highway.

VEGETATION

The forest cover on the terrain traversed between Miles 902 and 802 consists mainly of Black Spruce Associations. Generally trees are small and scattered, the largest ones being found on the higher, better drained hummocks and knolls. Here white spruce and paper birch are also commonly found. The best stands of trees in this section are found in the Thunder River valley. Good stands of trees are also found at Travaillant River and on the slopes between the Highway and



the Mackenzie River from Miles 830 to 820. The area from approximately Miles 816 to 802 has been repeatedly burned and has various stages of fire succession vegetation.

Impact of the Highway on the forest cover will be minimal. Removal of trees for the right-of-way, access roads, and borrow areas will have only a minor impact.

WILDLIFE

Wolf and fox are common within the area of Miles 902 to 802. Based on winter track surveys, wolves and foxes are found in the following areas:

Miles 895 to 885

Miles 876 to 870

Miles 863 to 855

and Miles 817 to 805.

No wolf or fox den sites were located in this section, suggesting a minor impact on these species. However, increased hunting and trapping pressure will result with improved access to the area.

Winter and summer surveys indicate that moose are found in two areas in this section: Miles 890 to 880, and 850 to 835. In both areas, wolves are also found. Both will face greater hunting pressure once the Highway is completed.

No raptor nest sites immediate to the Highway were identified in the area from Miles 902 to 802.

Beaver and waterfowl are found on many of the lakes in this section. From Mile 902 to Travaillant River, waterfowl are found on most of



the larger lakes. Beaver are also present. However, the best waterfowl areas are generally removed from the alignment so little impact will result. From Travaillant River to Thunder River no good areas of waterfowl or beaver habitat are present immediate to the Highway. From Thunder River to Mile 802, most of the lakes have waterfowl and beaver. The area just west of approximately Miles 840 to 830 is one of the best beaver habitats in section D. This area will face increased trapping pressure once the Highway is built.

The Thunder River valley is a major bear denning area. Two bear dens are located within 2,000 feet of the proposed alignment. If construction and use of the Highway limits the use of presently active dens for which there may be no alternative sites, and if hunting pressure is excessive, then the impact of the Highway on the bears will be major.

FISH

Twenty streams crossed by the Highway were surveyed in the area from Miles 902 to 802. Fish were caught or observed in eight streams: Miles 898.0 (pike), 855.3 (pike), 837.9 (grayling fry), 832.3 (unidentified cyprinid), 821.3 (grayling), 806.5 (grayling fry), Travaillant River (longnose sucker, grayling, humpback whitefish, and pike), and Thunder River (grayling, pike, longnose sucker, pond smelt, lake chub, and slimy sculpin). In addition, four streams were classed as pike habitat although none were observed. These streams were Rengleng River and at Miles 899.9, 886.6, and 881.1. Bridges are to be constructed on Travaillant River and Thunder River. Fish passage culverts are recommended for the remaining ten streams identified above.



A sport fishery could be supported by Travaillant River and Thunder River although low summer flows in the latter stream may limit recreational use of it. Grayling would be the prime sport species in each river. Pike are also present in both rivers,

Movement of grayling in the stream at Mile 821.3 is hampered by a downstream log jam. This should be removed to improve the fishery capability of the stream.

ARCHAEOLOGY

Within the portion of the alignment under discussion, four archaeological sites were identified. All of the sites are prehistoric.

HILD 13 is located on the north shore of Wounded Bear Lake. Two flakes were found here. This site has a low salvage priority. HILD 12 is on a small lake at Mile 898. This site has a medium salvage priority and yielded a fragment of a worked flake and one other flake. The general area from Wounded Bear Lake to Loche Lake (Mile 890) is a sensitive archaeological area. All areas of construction activity, especially stream crossings, borrow sites, and excavations near lakes or streams, should be given some archaeological surveillance during Highway construction.

Two prehistoric sites were found in the Thunder River valley. HILD 24 yielded one worked flake. A complete biface and four flakes were found at HILD 23. This is also a sensitive archaeological area and should be treated as outlined above for the Wounded Bear Lake to Loche Lake area.



LANDSCAPE ARCHITECTURE

Opportunities exist for the enhancement of the visual potential along the Highway. Selective and variable clearing are the main means of relieving the monotony of the route. Variable clearing of the right-of-way will reduce the tunnel effect of a constant width clearing. Selective clearing is recommended to open up views of visual highlights. Areas where selective clearing can be used to advantage are at stream crossings, from Miles 845 to 843 for views of the Thunder River valley, from Miles 871 to 867 for views of Travaillant River, from Miles 835 to 834 for views from the drumlin of lakes east of the Highway, and from Miles 825 to 815 for views of the Mackenzie River and lakes west of the Highway.

RECREATION

Minimal opportunities for recreation exist throughout most of the section of the alignment under discussion. A campsite or rest stop could be established on the lake at Mile 894.5. Some waterfowl hunting and fishing may be possible on the lake. Both Travaillant River and Thunder River could support a limited sport fishery for grayling and pike. Trails could be constructed at Miles 822 to 820 to allow people to walk west to the banks of the Mackenzie River or to climb the prominent hill east of the Highway. This would give them a panoramic view of the surrounding area.



CONSTRUCTION

Construction difficulties should be minor in the section of the alignment from Mile 902 to Thunder River. Few streams are encountered in this area and bog areas are few. Fifteen cuts are proposed in this portion, the most extensive being at Mile 891.5. This cut is about 1,200 feet long and 15 feet maximum depth; however, it is found in a drumlinized area and should be stable. Other large cuts are at Miles 896.3 and 892.2, but again both are on relatively stable ground. Twenty-six culverts, 60 inches and larger, are proposed for this portion of the Highway from Mile 902 to Thunder River. Normal design culverts are adequate on these streams. Seven additional streams which will have culverts installed at the crossing site were evaluated for fisheries potential. Fish passage design culverts are recommended for the streams at Miles 901.5, 899.9, 898.0, 886.6, 881.1, and 855.3. Travaillant River and Thunder River will have bridge crossings.

Some construction difficulties exist in the portion of the alignment from Thunder River to Mile 802. Eight cuts are proposed, the only major one being at Mile 843.7. This cut will be 500 feet long and up to 30 feet thick. Such a cut on the steep slope of the Thunder River valley may lead to extensive ground icing and mudflow problems. Many streams are encountered in this section necessitating numerous culverts. Thirty-seven culverts, 60 inches and larger, are proposed. Normal design culverts are adequate on these streams. Eleven additional streams which will have culverts installed in them were evaluated for fisheries potential. Fish passage design culverts are recommended only for the streams at Miles 837.9, 832.3, 821.3, and 806.5.

The stream at Mile 832.3 had the most severe icing in section D. Of a total ice depth of 6.5 feet, 4 feet was estimated due to icing.



Culvert size must be adequate to handle this volume of ice.

As mentioned in the Terrain section, the unstable escarpment east of the Highway from Miles 816 to 802 poses a potential major construction problem. Mudflows from this unstable escarpment may endanger the Highway.

ENVIRONMENTAL ASSESSMENT

Throughout the majority of the section of the alignment under discussion, the impact of the Highway will be low. Only three areas will be subject to a high impact.

The general area from Wounded Bear Lake to Mile 895 will be a high impact area. The area has major lakes and streams containing fish and wildlife which will face increased pressure once the road is built. In addition, the area is a sensitive archaeological area.

The Travaillant River crossing is an area of high impact. This, again, will result mainly from increased pressures on the fishery resource with improved access to the area.

The greatest impact of the Highway will be in the Thunder River valley. This is a sensitive archaeological area where additional sites may be discovered. The fishery resource of the river will face increased pressure. In addition, the valley is the best bear denning area in section D. If bears are forced to find less suitable denning areas, then the impact on the bear population will be highly detrimental.

Finally, from Miles 840 to about 830 a moderate impact will result. This is mainly the result of the increased trapping pressure on the beaver in the lakes immediately west of the Highway.



CHAPTER 5

BORROW AREA DEVELOPMENT

Borrow pits are a necessity in highway construction, however, poorly planned, haphazard borrow areas will detract from the general appearance of the landscape. Even if borrow pits are hidden from the motorist's view, they will remain visible to those flying overhead. This may be a significant point since the Mackenzie Valley provides a rather narrow, well-used flight corridor.

It should be practical to design borrow areas which will provide necessary construction material, yet still blend into the landscape. Some borrow areas may be used for other purposes after highway construction. They may serve as parking areas for rest stops, as emergency pulloffs and recreation areas, as interpretive features depicting natural vegetation succession, and as wildlife viewing areas since various species of wildlife will undoubtedly invade these clearings. Such potential uses must be taken into account as the borrow pits are excavated.

At present, the general concensus appears to be that borrow areas should be hidden from the Highway alignment. It must be borne in mind that natural landscape variety and features of interest are not uniformly distributed along the Mackenzie

Highway route. Thus, it may be advantageous, in some instances, to develop borrow areas which are open to the alignment. These would provide open space and, with proper contouring and revegetation measures, would improve rather than detract from the visual properties of the landscape.

Methods of excavating borrow material may require that the original pit shape be rectangular. The original boundaries may then be expanded by excavating material, to a lesser depth, in tongues from the rectangle and by accessory dozing and contour grading. Principles of selective clearing applied along the right of way can apply equally to borrow areas. Clearing may be used to modulate the vegetation edge, to accentuate certain vegetation types by isolating them, and to accentuate landscape features such as lakes, bogs, and ridges by providing visual access to them.

Conceptual designs for borrow areas are convenient in that they can be easily identified and may be applied to level or otherwise uniform terrain. In most areas, including those designated as borrow sites along the Mackenzie Highway alignment, it would be difficult, if not impossible, to construct a borrow pit which would totally conform to a predetermined shape. The final shape, size and contours of a borrow area must be determined by the amount of material to be taken, location and shape of suitable deposits, local

topography and drainage and potential future use of the borrow area. Borrow areas will take one of two very general shapes: linear where the material lies in ridges, or amoeboid where the material is found in irregular deposits below flat or undulating terrain. Final decisions must be made, on site, by agreement between the environmental consultant and the construction engineer to insure an amenable balance between environmental and aesthetic factors and engineering suitability.

CHAPTER 6

REFERENCE: Letter of Direction d.d. June 27, 1974
Mackenzie Highway Alignment Review
Section "D".

In preparing the preliminary designs for Section D it is requested that the following be provided:

- (1) Where the proposed alignment is restricted between two lakes, and where a distance of 300 feet from the shoreline cannot be maintained, please document in the narrative portion of the preliminary design submission how the environmental impact on the waterbodies will be minimized.*

The numerous lakes and waterbodies throughout this section are characteristic of the hummocky terrain being traversed by the Highway route. In selecting a Highway route through this type of terrain the alignment will invariably come within 300 feet from the shorelines of some waterbodies.

Environmental Protection for these waterbodies will be provided for by the overlay construction method using rock material for the embankment which reduces the possibility of silt entering the streams and by installing culverts in

each identifiable drainage course, causing minimal disruption to the drainage pattern.

- (2) After consultation with the Canadian Wildlife Service please submit, with the preliminary design, recommendations concerning alignment locations and construction activities in 'sensitive' or 'critical' raptor nesting areas.

The results of consultations between C.W.S. and D.P.W. relative to alignment locations and construction activities in the area of raptor nesting sites are recorded in the report entitled "C.W.S. - D.P.W. Consultation, Highway - Raptor Interaction for the Mackenzie Highway, June, 1974."

- (3) Recommendations concerning possible crossing sites at the Hare Indian, Loon, Tieda and Thunder Rivers. E.M.R. and D.O.E. (Fisheries and Wildlife) should then be consulted concerning selection of the final crossing sites.

Consultation with E.M.R. and D.O.E. (Fisheries and Wildlife) are now in progress. A report listing their recommendations will be forthcoming.

CHAPTER 7

CONTENTS OF PRELIMINARY DESIGN SUBMISSION
MILE 902 - MILE 802

<u>TITLE</u>	<u>NUMBER OF SHEETS</u>
Cover Sheet	1
1 in. 250,000 Land Use Maps	4
1 in. 50,000 Topographic Maps	7
1 in. = 1,000' Mosaics	24
Environmental Consultant's Folio	
Environmental Data Sheets	
Mile 902 - Mile 802	22
Landscape Architectural Evaluation Sheets, Mile 902 - Mile 802	7
Legend Sheet	1
Typical Section Sheets	2
Plan Profile Mile Sheets	100
	<hr/>
Total	168