CORPORATION OF THE TOWNSHIP OF WESTMEATH

BY-LAW 89-29

A By-Law to enter into an agreement with A.J.Robinson & Associates Incorporated for the performance of the Flood Risk Mapping Study on the Ottawa River near Westmeath - Phase III.

Whereas:

1) The Municipality has authority under section 104 of the Municipal Act R.S.O. 1980 to make provision for the welfare and Safety of the inhabitants of the Municipality.

2) The Council of the Township of Westmeath considers it desirable to have Flood Plain Mapping done, and intends to incorporate it into the Township of Westmeath Official Plan.

Now therefore the Municipal Council of the Corporation of the Township of Westmeath ENACTS as follows:

1 That the Corporation of the Township of Westmeath enters into an agreement, known as Schedule 'A' attached to, and forming part of this By-Law, with A.J.Robinson & Associates for the Flood Risk Mapping Study on the Ottawa River near Westmeath.

2 The total cost of the Project is $19,039.00 of which 10% will be paid by the Corporation of the Township of Westmeath. The balance is to be funded by Environment Canada and the Ministry of Natural Resources jointly.

3 The Clerk is hereby authorized to sign the agreement referred to in Section 1 on behalf of the Corporation.

Passed and ENACTED this 18th day of October, 1989.

Gordon White
Reeve

Pat Burns
Clerk

SCHEDULE 'A'

A. J. Robinson & Associates Inc.

CONSULTING ENGINEERS

# ENGINEERING AGREEMENT
# WESTMEATH FLOODPLAIN MAPPING
# PHASE III

# FORM OF AGREEMENT BETWEEN CLIENT AND CONSULTANT

AGREEMENT made in triplicate this 23 day of August 1989.

BETWEEN:

The Township of Westmeath
Westmeath, Ontario
K0J 2L0

hereinafter referred to as the "Client",

AND

A.J. Robinson & Associates Inc.
302 Legget Drive, P.O. Box 13130
Kanata, Ontario
K2K 1X3

hereinafter referred to as the "Consultant"

WHEREAS the Client has requested the Consultant to perform the services set out in Article II hereof in connection with the Project (as hereinafter defined) and the Consultant has agreed to perform such services on and subject to the terms and conditions of this Agreement;

NOW THEREFORE, in consideration of the mutual provisions hereinafter contained, the Client and the Consultant agree as follows:

## ARTICLE I - DEFINITION

The terms defined in this Article I shall for all purposes of this Agreement have the meanings herein specified unless the content otherwise specifies or requires:

1. **"Project" shall mean:**
   "Floodline Mapping Study - Westmeath Phase III"

2. **"Project Team" shall mean:**
   A committee composed of the Municipality, Ontario Ministry of Natural Resources and Environment Canada to provide quality control and streamline the approval process.

## ARTICLE II - CONSULTING SERVICES

1. The Terms of Reference for the entire project is as outlined in Schedule "A":

## ARTICLE III - FEES

1. The client shall pay to the Consultant the following fees in accordance with the following formula for the performance of the services set out in Article II hereof:

2. The above is inclusive of automobile mileage, reasonable travelling and living expenses, long distance telephone charges, teletype and telegraph charges, printing and reproductions, progress photography, special delivery and express charges, overtime premium payments, and computer charges.

## MILESTONE AND PAYMENT SCHEDULE

| No. | Item | Deliverable | Completion Date | Invoice |
|---|---|---|---|---|
| 1. | Prepare Tender Document and Select Mapping Contractor | Contract Awarded to Mapping Contractor | Oct. 20/89 | $2,200.00 |
| 2. | Hydraulics Report (Preliminary - no wave set up) | Preliminary Hydraulics Report | Nov. 20/89 | $3,403.00 |
| 3. | Mapping Co-ordination | Manuscripts | Mar. 5/90 | $1,422.00 |
| 4. | Hydraulics Report Final | Hydraulics Report | Mar. 12/90 | $1,100.00 |
| 5. | Map Checking and Reporting | Map Check Report | Mar. 30/90 | $4,762.00 |
| 6. | Completeness Check | Completeness Memo | July 23/90 | $1,120.00 |
| 7. | Floodline Map Preparation - Preliminary | Whiteprint Plots | June 6/90 | $1,588.00 |
| 8. | Floodline Map Preparation - Final | Cronaflex Plots | July 30/90 | $1,324.00 |
| 9. | General Report | General Report | July 30/90 | $1,128.00 |
| 10. | Meetings | Minutes | Mar. 26/90<br>July 4/90 | $ 496.00<br>$ 496.00 |
| 11. | Final Completion Date | | Nov. 30/90 | |
| | | | Total | $19,039.00 |

## ARTICLE IV - PAYMENT OF FEES AND EXPENSES

1. Invoices for payment of any matter under this Agreement should be sent in triplicate to:

   Clerk - Treasurer
   Township of Westmeath
   Westmeath, Ontario
   K0J 2L0

2. The Consultant will be paid on a net 30 day basis subject to Article III, Paragraph 2, and in accordance with the Project Payment Milestone in Article III, Paragraph 1.

3. Overdue accounts are subject to carrying charges at a rate of 1.25% per month for periods in excess of 30 days from date of receipt of invoice to the Client, subject to Article III, Paragraph 2.

## ARTICLE V - GENERAL TERMS AND CONDITIONS

1. **Co-operation**

   The Client shall give due consideration to all drawings, plans, specifications, reports, proposals, and other information provided by the Consultant, and shall make any decisions which he is required to make in connection therewith within a reasonable time so as not to delay the work of the Consultant.

2. **Staffing**

   Any personal changes that have to be made by the Consultant during the course of the Project must be approved by the Client. Such changes must not interfere with the continuity of the Project. If replacement to staff is necessary, the Consultant will provide a replacement who has at least the same level of skill and proficiency as the person being replaced.

3. **Confidential Information**

All documents, information and material belonging to the Client obtained by the Consultant for use in carrying out this Agreement will be treated as confidential and will not be used for any purpose other than for this Agreement.

4. **Ownership of Documents**

(a) All plans, drawings, specifications, designs and documents prepared by the Consultant shall be and remain the property of the Client.

(b) Except as expressly provided in this Agreement, regarding cancellation, termination or other expiration of this contract, each party shall forthwith return to the other all papers, materials and other properties of the other held by each for purposes of this Agreement, and, in addition, each party agrees to assist the other party in respect of the orderly termination of this Agreement and to complete the transfer of all aspects hereof, tangible and intangible, as may be necessary for the orderly, non-disrupted business continuation of each party.

5. **Progress Reports and Project Duration**

(a) The Consultant shall, during the duration of this Agreement, not less than ten (10) working days after the end of each calendar month, submit to the Client a monthly progress report, signed by an authorized officer of the Consultant. Each progress report shall describe the status of the Consultant's performance since the preceding report. Each report shall describe the Consultant's activities by reference to the consulting work set out in Article II.

(b) The duration of this contract is from start date to finish date.

6. **Changes to Project Requirements and Contingencies**

At any time during the term of Agreement, the Client may request changes to the Project requirements. Within ten (10) days of such written notification of such a request, the Consultant will advise the Client whether the changes are possible; the cost of the changes; and the effect on the project milestone and payment schedule. The Client will notify the Consultant in writing whether it accepts or rejects the changes within thirty (30) working days. Authorization to implement the changes will be receipt by Consultant of a Purchase Order.

7. **Breach of Completion Dates**

If the Consultant fails to deliver the deliverables by the final completion date stated in the project milestone and payment schedule for reasons not beyond the control of the Consultant, the Consultant agrees to pay to the Client, at the Client's request, the Client's estimated minimum damages $50.00 for each working day that the deliverable is delayed. The maximum damages, however, will be limited to the amount outstanding on the total contract, as shown in the example below.

Example:

| | | |
|---|---|---|
| Total contract value | $20,000.00 | |
| Progress payments made on deliverables before complete date | $18,000.00 | |
| Difference | | $2,000.00 |
| Liquidated damages for breach of completion at $50/day but not to exceed | | $2,000.00 |

8. **Client's Personnel**

The Consultant will be responsible for the project. However, where appropriate, Project Team will be available on a consultative basis. The Consultant will be allowed to visit the Client's office to consult with the Project Team's personnel.

9. **Liability**

(a) The Consultant shall indemnify and hold the Client harmless for any loss, claim or damage to persons or property caused by the fault or negligence of the Consultant, its employees or representatives.

24.1.1 The Contractor agrees to indemnify, keep indemnified and save harmless the Crown and Her officers, servants and agents from and against all claims, demands, costs, actions, causes of action, expenses, legal fees whatsoever which may be taken or made against them or any of them or incurred or become payable by them or any of them for any loss, damage or injury, including death, or any nature or kind whatsoever arising out of or in consequence of any act, neglect or omission of the Contractor his servants, agents or invitees.

24.1.2 The Consultant agrees to protect, indemnify, keep indemnified and save harmless the Crown and Her officers, servants and agents from and against all claims, demands, costs, actions, causes of action, expenses, legal fees whatsoever which may be taken for made against them or any of them incurred or become payable by them or any of them for any loss, damage or injury, including death, of any nature or whatsoever arising out of or in consequence of any act, neglect, or omission, of the Consultant or any employee or employees of the Consultant, in connection with the performance of this Agreement.

(b) In the event employees of the Consultant or its agents enter premises occupied by or under control of the Client in the performance of their responsibilities, the Consultant will indemnify and hold harmless the Client, its officers and employees from any loss, cost, damage, expense or liability by reason of property damage or personal injury of any nature or kind caused by the performance of act of the employees of the Consultant or its agents. Without limiting the foregoing, the Consultant will maintain public liability and property damage insurance covering the obligations contained herein, and provide proof of such insurance coverage upon request.

10. **Premature Termination**

(a) If the Consultant is found to be of serious misconduct in the opinion of the Client's representative, or neglects, fails or refuses to carry out the assignment in which this Agreement applies, or to observe this Agreement in other respects, the Client shall be entitled to dismiss the Consultant summarily without notice and without payment in lieu of notice.

(b) If the Client terminates this Agreement for any reason other than those specified in Clause (a) of Paragraph 10, and stated elsewhere in this Agreement the Consultant shall be entitled to payment of those expenses incurred by the Consultant to the date of termination.

11. **Successors and Assignment**

(a) This Agreement, Request for Proposal, Consultant's Proposal, and schedules attached hereto constitute the entire understanding between the parties with respect to the subject matter, and all prior agreements, representations, statements, negotiations and undertakings whether oral or in writing are superseded in their entirety by the provisions of this Agreement.

(b) Each party stipulates that it has full power and authority to enter into and perform this Agreement, and the person signing this Agreement on behalf of eh named party is property authorized and empowered to sign it, and each party further acknowledges that it has read this Agreement, understands it, and agrees to be bound by it.

(c) If the Consultant is an individual and dies before his services hereunder have been completed, this Agreement shall automatically terminate as of the date of his death and the Client shall pay for the services rendered and disbursements made to the date of such termination.

(d) If the Consultant is an individual and is unable to satisfactorily perform his services hereunder due to physical or mental incapacity for a period of 15 consecutive days, the Client may terminate this Agreement on 48 hours notice to the Consultant and shall pay for the services rendered and disbursements made to the date of such termination.

(e) If a party to this Agreement who is an individual shall desire to bring in a partner or partners, or if a party which is partnership should desire to bring in a new partner or partners to share the benefit and burden of this Agreement, it may do so but shall promptly notify the other party of such action, but it shall not in any way alter the provisions of this Agreement.

(f) The award of this contract to the Consultant will not preclude the Consultant from bidding and being awarded future contract assignments which are in conjunction with this Project.

(g) A Consultant shall not assign or subcontract any interest in this Agreement without the express consent in writing of the Client.

12. **Communications**

Any notices to be given or required under this Agreement must be in writing and shall be deemed to have been given when personally delivered, or mailed by registered or certified mail, postage prepared, to the following address:

To the Consultant:

Mr. Paul Frigon, P.Eng, Manager of Water Resources
A.J. Robinson & Associates Inc.
302 Legget Drive, P.O. Box 13130
Kanata, Ontario
K2K 1X3

To the Client:

Mrs. Pat Burn, Clerk - Treasurer
Township of Westmeath
Westmeath, Ontario
K0J 2L0

13. **Workers' Compensation Act**

(a) The Consultant agrees to comply fully with all the requirements of the Workers' Compensation Act, and without limiting the foregoing, agrees to pay all assessments made under the said Act against the Consultant.

(b) When the Consultant personally performs labour under this Agreement, the Consultant agrees to apply to the Workers' Compensation Board for personal coverage.

(c) When the Consultant fails to pay any assessment made under the Said Act, the Consultant agrees that the Client may deduct the amount of said assessment from any monies payable or returnable to the Consultant under this Agreement, and may pay such amounts to the said Board.

(1) Upon the commencement of this Agreement, the Consultant agrees to provide the Client with satisfactory proof of compliance with paragraph (a), in the form of a certificate showing that the Consultant is presently in good standing with the Workers' Compensation Board of Ontario.

(2) In addition to the obligations imposed under sub-paragraph (1), upon the request of the Client at any time during the term of this contract, the consultant agrees to provide satisfactory proof of the Consultant's continued good standing with the Workers' Compensation Board in relation to the Consultant's obligations under paragraph (a).

14. **Occupational Health and Safety Act**

(a) The Consultant shall be knowledgeable of, and abide by, the provisions of all legislative enactments, by-laws and regulations in regard to health and safety in the Province of Ontario, as well as specific health and safety instructions which may be given to the Consultant by the Client. Without limiting the generality of the foregoing, the Consultant shall specifically ensure that he/she is knowledgeable of and performs all obligations imposed by the Occupational Health and Safety Act of Ontario.

(b) The Consultant shall at all times have available a competent supervisor who is authorized to act on his/her behalf, and who is to ensure that work is properly and safely carried out.

(c) (1) The Consultant agrees that performance of the work to be carried out under this Agreement will include but not necessarily be limited to those occupational hazards listed in Schedule "H" attached hereto.

(2) The Consultant hereby acknowledges that the Consultant has received notice of and is fully aware of the potentially hazardous nature of the activities outlined in sub-paragraph (1) and the Consultant hereby agrees that the Consultant will be responsible for initiating and implementing all necessary safety precautions and procedures to ensure safe completion of these potentially hazardous activities.

15. **Other**

(a) All charges stipulated in this Agreement shall be payable in Canadian currency.

(b) This Agreement is not binding on either party until signed by both parties.

(c) The Consultant is considered to be an independent contractor and not an agent, employee or servant of the Client, and the personnel employed by the Consultant shall be agents, employees or servants of the Consultant and not of the Client.

(d) This Agreement shall be deemed to be a contract made under the laws of the Province of Ontario and for all purposes be construed in accordance with the laws of the said Province.

(e) The Consultant shall comply with all applicable by-laws, rules, regulations, orders and statutes of governmental authorities, whether municipal, provincial or federal, relating to the performance of this Agreement.

(f) Headings used in this Agreement are for reference purpose only and they shall not be used in construction of this Agreement.

(g) The Schedules "A" and "B" attached hereto form part of this Agreement.

16. **Arbitrations Act**

(a) In the event of any dispute or claim arising between the Client and the Consultant as to their respective rights and obligations under this Agreement, either party hereto may give the other written notification of such dispute of claim within fourteen (14) days of the dispute or cause of action arising.

(b) If the dispute or claim cannot be resolved to the satisfaction of the Client and the Consultant and providing both parties consent, the dispute or claim may be referred to arbitration and in the absence of agreement as to the choice of an arbitrator, the Arbitrations Act, R.S.O., 1980, Chapter 25, as amended, shall apply.

(c) The parties agree that the award of an arbitrator shall be final and binding.

(d) If no agreement is made for arbitration, then either party may submit the dispute to such judicial tribunal as the circumstances may require.

IN WITNESS WHEREOF the parties hereto have executed this Agreement.
SIGNED, SEALED AND DELIVERED

)
)
)
)
)

Randi Keith
Witness as to execution )
Name of Executive of Municipality )
RANDI KEITH
DEPUTY CLERK-TREASURER

Pat Burn
Name PAT BURN )
Designation CLERK-TREASURER

P. Fraser
Witness/Secondary )
Signature of Consultant )

Primary Signature of the )
Consultant

SCHEDULE "A"

TO THE AGREEMENT BETWEEN

THE CLIENT AND THE CONSULTANT

Project Specifications

Terms of Reference

**Project Specifications - Overview**

This schedule provides specifications for the project to be conducted by the Consultant.

The specifications have been extracted from the Request for Proposal.

ON WHITE, Reeve
, Beachburg, Ont.
C0
182-3508

CORPORATION OF

# The Township of Westmeath

*A Perfect Blend, Agriculture, Tourism, Industry*

OFFICE OF THE CLERK-TREASURER
613 - 587-4464

PAT BURN, Clerk-Treasurer
Westmeath, Ontario
K0J 2L0
613 - 587-4464

Westmeath, June 19, 1989

A. J. Robinson & Associates Inc.
Consulting Engineers
P.O. Box 13130
Kanata, Ontario
K2K 1X3

Attention: P. Frigon

SUBJECT: Proposed Westmeath Phase III
Floodline Mapping Study, Ottawa River

Dear Sir,

We are pleased to inform you that the project team for the above noted mapping study has awarded this project to your firm based on your March 1989, proposal subject to the following changes:

1. Islands in the river will not be mapped, reducing the total engineering cost of the project to $ 19,038 as per your April 10, 1989 memorandum.

2. The project completion date is extended to August 31, 1990. Hydraulics should be completed this year as per the original schedule.

Enclosed is a new standard form of engineering agreement for Flood Damage Reduction Program (FDRP) projects. Please note in the agreement that there is now a penalty clause for breach of project completion date. This is a new requirement for all FDRP agreements and contracts. Please forward a draft of the completed agreement to the Ministry of the Natural Resources, Huntsville and Environment Canada, Burlington for review.

Please forward a table of flood elevations and a location map for those Phase III areas which were calculated in the Phase II hydrology and hydraulics study e.g. the area upstream of Rocher Fendu dam and the Lac Coulonge area. We are preparing a zoning by-law and this information is urgently needed.

Also please proceed with preparation of tender documents for the mapping component of Phase III to be let this spring. Mapping should be scheduled to have pencil manuscripts completed by April, 1990 to correspond with the Ministry's budget. Forward a draft for review to D. Anderson, Energy, Mines and Resources, Ottawa and MNR Huntsville.

We are looking forward to completing the remainder of the flood line mapping for the river frontage in the township.

Yours Truly

Pat Burn

Pat Burn (Mrs.)
Clerk-Treasurer

Encl.
c.c. D. Yarranton, MNR, Pembroke District
c.c. W. McMullen, MNR, Algonquin Region
c.c. D. Brown, Environment Canada
c.c. K. Abrahams, Conservation Authorities and Water Management Branch, MNR, Toronto

GORDON WHITE, Reeve
R.R. 1, Beachburg, Ont.
K0J 1C0
613 - 582-3508

CORPORATION OF

# The Township of Westmeath

*A Perfect Blend, Agriculture, Tourism, Industry*

OFFICE OF THE CLERK-TREASURER
613 - 587-4464

PAT BURN, Clerk-Treasurer
Westmeath, Ontario
K0J 2L0
613 - 587-4464

Westmeath, January 25, 1989



A. J. Robinson and Associates
Consulting Engineers
P.O. Box 13130
Kanata, Ont.
K2K 1X3

Attention: P. Frigon

SUBJECT: Request for Proposal
Proposed Floodline Mapping,
Ottawa River, Westmeath Twp. Phase III

Dear Sir,

A thir phase of floodline mapping is being initiated for the Ottawa River in Westmeath Township to complete the floodline mapping for the township.

We are requesting your firm's proposal for this work. The work will be carried out according to the attached Terms of Reference. The scope of the work is outlined at the beginning of these Terms of Reference and will cover the following:

Map administration
Map tendering
Map checking
Hydraulics for remaining section of river downstream of Rocher Fondu dam including field survey, split flow analysis, encroachment analysis, wave run-up analysis, hydraulics report
Floodline map preparation
Meetings

Please forward three copies of your proposal to this office by January 27, 1989.

Should there be technical questions on the work, please contact W. McMullen, Ministry of Natural Resources in Huntsville, or D. Brown, Environment Canada, Burlington.

Yours Truly

Randi Keith

Randi Keith (Mrs.)
Deputy Clerk-Treasurer

Environment Canada | Environnement Canada

Ministry of Natural Resources | Ministère des Richesses naturelles
Ontario

CANADA/ONTARIO FLOOD DAMAGE REDUCTION PROGRAM

# MUNICIPALITY OF
# THE TOWNSHIP OF WESTMEATH

## TERMS OF REFERENCE
## FOR A
## FLOODLINE MAPPING STUDY
## ON THE
## OTTAWA RIVER
## PHASE III

January, 1989

TECHNICAL SUBCOMMITTEE

PREPARED IN CO-OPERATION WITH THE

MINISTRY OF NATURAL RESOURCES

CENTRAL REGION

REVISED MAY, 1986

TERMS OF REFERENCE
FOR
FLOODLINE MAPPING STUDIES

CONTENTS



APPENDIX



Technical Guidelines

FLOOD PLAIN MANAGEMENT IN ONTARIO - TECHNICAL GUIDELINES, ONTARIO MINISTRY OF NATURAL RESOURCES

A. SCOPE OF THE WORK

LOCATION

Floodline mapping is required for a total of approximately 16 kilometres of the Ottawa River, 10 kilometres on Lac Coulonge and 6 kilometres in a section downstream of La Passe as shown on the attached map.

MAPS

A total of approximately 35 partial topographic map sheets aligned to the U.T.M. grid are required as shown on the attached map.

Map administration, tendering and checking will be carried out by the engineering consultant for this study.

HYDROLOGY

A hydrology is not required in this Phase of the Westmeath floodline mapping as it has been completed in Phase II.

HYDRAULICS

A hydraulics analysis and report will be required for the approximately three kilometre section of river between the Rocher Fendu (Sullivan Island) dam and the Township boundary. The hydraulics for the Lac Coulonge section was completed in Phase II.

At least three river and flood plain cross-sections will be needed.

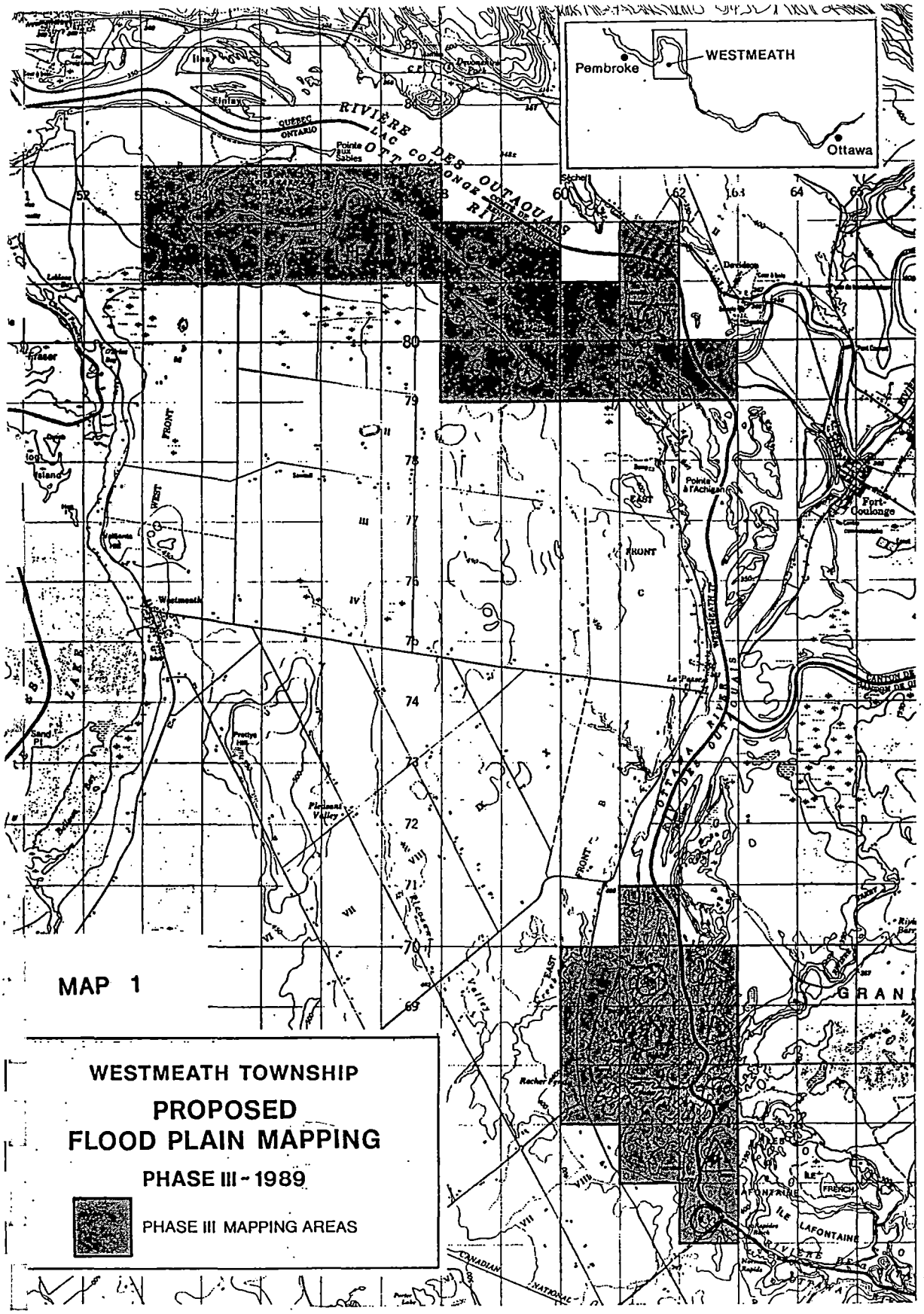
A split flow analysis around Green Island appears to be necessary.

The following alternative floodway alignments will require investigation:

1. encroachment to a maximum flood depth of one metre or maximum flow velocity of one metre per second;

2. encroachment to within 30 metres of the river channel bank.

The effect of wind set up and wave run-up along the shore of Lac Coulonge is to be analysed and a freeboard recommended.


WESTMEATH
Pembroke
Ottawa
MAP 1
WESTMEATH TOWNSHIP
PROPOSED
FLOOD PLAIN MAPPING
PHASE III - 1989
PHASE III MAPPING AREAS

1. GENERAL

These Terms of Reference for floodline mapping outline the procedures to be used in the preparation and submission of proposals, the selection of an engineering consultant and mapping firm, the signing of an agreement, the topographic mapping and the engineering study.

The procedures for topographic mapping and the engineering study must be consistent with the "Flood Plain Management in Ontario-Technical Guidelines". These guidelines are available for reference purposes at MNR Regional and Conservation Authority offices. In addition, the Conservation Authorities and Water Management Branch, Ministry of Natural Resources has published Technical Memoranda and Reports as part of the Research and Development Work Plan. A list of the publications is presented in Exhibit 2. The consultant must utilize the findings presented in the publications where applicable during the engineering study.

2. PROJECT TEAM

The project will be undertaken by the Conservation Authority/ Municipality and assisted by a Project Team, comprised of representatives from Environment Canada, Ontario Ministry of Natural Resources and the Conservation Authority/Municipality. The purpose of the Project Team is to monitor and provide quality control on individual projects.

The Project Team will streamline the project administration and ensure technical specifications are met. It will act as the single contact body for the consultants and will avoid delays or multiple approvals. Recommendations of the Project Team represent acceptance by the MNR Region and the FDRP Technical Sub-Committee. In the event that the Conservation Authority/ Municipality disagrees with the recommendations the matter should be forwarded to the Regional Director and the FDRP Steering Committee for resolution.

The Project Team will report to and work under the direction of the Technical Sub-Committee based on the following:

Study's Progress

- ensure that the flood risk mapping meets the requirements of the FDRP Schedule B - Hydrologic and Hydraulic Procedures for Flood Plain Delineation and Schedule C - Surveys and Mapping Procedures for Flood Plain Delineation (revised 1984) included in "Flood Plain Management in Ontario - Technical Guidelines".

- plan the course of action for the study, define the approximate stream reaches to be studied, develop specific Terms of Reference and call for proposals

2. PROJECT TEAM (Cont'd)

- evaluate consultants' proposals and make recommendations to the Conservation Authority/Municipality and the Technical Sub-Committee for retaining the consultant. The Conservation Authority/Municipality will act as the client
- evaluate the tender document developed by the engineering consultant jointly with mapping experts from Energy, Mines and Resources and the Surveys and Mapping Branch of the Ontario Ministry of Natural Resources; make recommendations to the Conservation Authority/Municipality for retaining the mapping contractor. The Conservation Authority/Municipality will act as the client in the legal agreement
- ensure that aerotriangulation results conform to FDRP Schedule C (revised 1984)
- submit progress reports to the Technical Sub-Committee and Conservation Authority/Municipality
- refer any differences of opinion to the Technical Sub-Committee

Documentation and Approvals

- ensure approval of all technical reports (i.e. hydrology/hydraulics) and other administrative documents
- update and maintain the Schedule C Mapping Monitoring Form (Exhibit 7)
- resolve the disposition of resource materials generated by the study (i.e. storage of aerial photography, etc.)
- ensure compliance that the flood risk mapping meets the requirements of FDRP Schedules B and C

Financial Expenditures

- establish and recommend approval of lump-sum payment schedules based on the study components. Payment on a sub-component basis may be considered if deemed appropriate
- recommend approval of cost overruns or unforeseen expenditures to the Technical Sub-Committee and the Conservation Authority/Municipality
- advise of phasing-in costs into the next fiscal year for budgeting purposes, if required
- recommend payment of interim invoices to Technical Sub-Committee and Conservation Authority/Municipality

3. PROPOSAL

The Consultant shall provide the following information in the proposal: methodology to be used, relevant experience, staff committment, schedule, and costs.

A brief description of the hydrologic and hydraulic procedures and analyses to be used shall be presented. The procedures and analyses as outlined in the Technical Guidelines shall be the minimum standard. This standard may be exceeded by the consultant, subject to approval by the Project Team. The consultant should note any special advantages and/or limitations peculiar to the methodology selected. Specific areas where special modelling techniques are necessary should be identified. Experience on other similar or related studies should be listed. The proposal must outline the consultant's work program, providing names of the professional staff who will work on the job and their experience. The consultant should also provide an approximate breakdown of time to be spent by the senior managers, project engineers, technicians and support staff. Substitution of key personnel committed to the study in the proposal must not be made without approval of the Project Team. The estimated completion time of the the job and all major phases must be described on a critical path chart. The time allotted for approvals must be noted. Three to four weeks should be allowed for approval of each of the technical submissions.

The cost estimate must be broken down to identify the cost of the various components of the work. The following components must be identified:

1. background information review and documentation
2. preparation of tender document for topographic mapping
3. mapping coordination
4. map checking and report
5. hydrology
6. hydraulics
7. floodline map preparation
8. general report
9. meetings and presentations

Estimated engineering fees and disbursements must be identified for each component of the work. Special modelling techniques such as Dynamic Wave modelling, Dam break analysis, major spill analysis, ice jam investigations should be identified as separate components and costs for each of these components must be provided.

If the consultant feels it is advisable to do additional work, or to delete some work specified in the Terms of Reference, the cost for these additions or deletions should be separately identified.

4. SELECTION

For smaller projects under $20,000, a direct appointment is possible. For larger and complex projects, a consultant will be selected on the basis of an evaluation of the proposals submitted. Interviews may be held to carify items in the proposal prior to final selection.

Selection will be based on the following criteria: study methodology (35%), corporate experience (10%), staff committment (25%) schedule (10%), and appropriateness of costs (20%). The selection procedure may vary based on size and complexity of the project and the consultant will be apprised of such variation. All proposals will be ranked and the consultants advised of the selection procedure.

The Conservation Authority/Municipality is not necessarily required to commission a consultant resulting from this procedure. In such an event, consultants submitting proposals will be advised promptly.

5. AGREEMENTS

The selected consultant will be required to sign an engineering agreement with the Conservation Authority/Municipality. This agreement must be in a form acceptable to the Project Team. The Terms of Reference and the consultant's proposal will form part of this agreement. The fee for each component must be specified in the agreement.

After signing of the engineering agreement, only such works which are clearly beyond the scope of the Terms of Reference will be considered as additional. The consultant must provide a detailed cost estimate and must obtain written approval from the Project Team prior to commencement of additional work.

The mapping firm will be selected by the Project Team with the assistance of the engineering consultant. The selected mapping firm will be required to sign an agreement with the Conservation Authority/Municipality. This agreemtn must be in a form acceptable to the Project Team. The mapping specifications and Form of Tender of the selected mapping firm will form part of the agreement.

6. METHOD OF PAYMENT

The consultant will be paid on a lump sum basis for each of the nine components outlined in Section 3. Payment will only be made when all the requirements of the component are completely fulfilled to the satisfaction of the Project Team. The consultant therefore, must deliver all the information listed in Section 8.8 in final form to the Conservation Authority/Municipality and have received written approval prior to invoicing the component. During the pre-study discussions with the successful consultant, the Project Team may agree to establish a payment schedule on a subcomponent basis, if deemed appropriate. Subcomponents may include items of direct cost to the consultant and/or major achievements within a component.

## 7. TOPOGRAPHIC MAPPING COORDINATION AND CHECKING

The engineering consultant is required to coordinate all phases of map production with the engineering study. The engineering consultant is required to:

1) determine the extent of mapping based on available information

2) research all available records of ground control in the study area which are to be included as part of the tender document for topographic mapping

3) prepare a draft tender document and submit three copies for the approval of the Project Team

4) prepare the final tender document and distribute to selected mapping firms approved by the Conservation Authority/Municipality

5) assist the Project Team in the evaluation of tenders and selection of the mapping firm

6) monitor progress of mapping in accordance with Exhibit 7

7) review invoices by the mapping firm and recommend payment, if appropriate, by the Conservative Authority/Municipality

Topographic mapping shall be prepared by the mapping firm in accordance with Surveys and Mapping Procedures (1984). Each map shall bear the signature and stamp of the engineer/surveyor of the mapping firm. The signature of a senior officer of the mapping firm may be substituted. The format of the mapping sheet surround shall be in accordance with that presently employed under the Canada/Ontario Flood Damage Reduction Program. Prior to stereo compilation, the engineering consultant shall check the proposed mapping extent and recommend any adjustments deemed necessary to provide sufficient mapping coverage to delineate the Regulatory floodline. Also, prior to stereo compilation, the engineering consultant must obtain aerial triangulation results from the mapping firm and forward them to Energy, Mines and Resources (EMR) for approval and Project Team for information. The engineering consultant is required to supply the mapping firm the street name and landmarks necessary for final scribing.

The engineering consultant is required to check the various components of the topographic mapping as outlined in Section 8.04 of Surveys and Mapping Procedures (revised 1984), Technical Guidelines. The consultant must notify the Project Team in writing of the results of the checks of various components of the topographic mapping in the form of report prior to the commencement of the hydraulic calculations. The format and content for the map check report shall be as outlined in Exhibit 6.

7. TOPOGRAPHIC MAPPING COORDINATION AND CHECKING (Cont'd)

Following inspection of the horizontal and vertical ground control and aerial photography, the engineering consultant shall forward the materials listed in Sections 2.14 and 5.10 of Surveys and Mapping Procedures (revised 1984), Technical Guidelines to Geographical Referencing, Lands & Waters Group, Ministry of Natural Resources. Geographical Referencing will check the numbering system and computations. The engineering consultant shall forward the materials listed in Section 3.10 of Surveys and Mapping Procedures (revised 1984), Technical Guidelines to the National Airphoto Library. The specific annotation will be supplied to the engineering consultant for this purpose by Energy, Mines and Resources.

8. ENGINEERING STUDY

8.1 MEETINGS AND PRESENTATIONS

The consultant must allow for a minimum of four formal meetings with the Project Team. The meetings will consist of a pre-study discussion to confirm hydrologic, hydraulic, mapping and administration procedures; a review of hydrology; a review of hydraulics and mapping; and a final project review.

8.2 MONTHLY PROGRESS REPORT

In addition to the formal meetings and presentations noted in Section 8.1, the consultant shall maintain close contact with the Project Team and must provide monthly progress reports on the status of the study. The monthly progress report is to be submitted to the Project Team before the end of the first week of each month. The consultant must closely adhere to the schedule. Delays during the study must be reported and justified in the monthly progress report along with a revised completion schedule. Significant unjustified delays may result in termination of the assignment.

8.3 BACKGROUND INFORMATION REVIEW

The consultant must review and document all existing studies, reports, plans, maps and hydrologic and hydraulic data related to the watershed.

The consultant must also investigate all proposed development in the watershed through the use of official plans, zoning bylaws, draft plans of subdivision, engineering drawings, and other pertinent documents or information, in order to determine the effect of such change in land use on floodlines.

The Conservation Authority/Municipality has prepared a list of pertinent reports and data that it is aware of and is appended to these Terms of Reference. The consultant's review should include, but not be limited to, the background information noted.

8.4 COMPUTER MODELS

The consultant must use the most current version of the computer models outlined in Exhibit 1 and those listed in the Technical Guidelines for hydrologic and hydraulic analyses. If the consultant proposes any modifications to the program or proposes to use an existing modified program, the consultant must submit to the Project Team input test data, output, complete listing of the modified computer program, user's manual and an explanation in detail as to the nature of and reasons for modifications for review and approval prior to its use.

8.5 HYDROLOGY

Unless otherwise specified, flood flows must be determined for the 100, 50, 20, 10, 5, and 2 year return period floods and the Regional flood where applicable, for both existing and future conditions.

The Regional Storm flood flow must be determined using a hydrologic model approved by the Project Team. The HYMO, HYMO-VUH, OTTHYMO, FLOOD 2, HEC-1, SWMM, and ILLUDAS are some of the approved hydrologic models. Other models may be acceptable, provided they comply with criteria established by the Conservation Authorities and Water Management Branch and receive written approval from the Project Team prior to the execution of the engineering agreement.

The hydrologic model must include a routing method to account for the effects of channel storage. Rating curves and travel times used in channel routing shall be determined by preliminary hydraulic calculations of the backwater profile or by procedures available in the approved hydrologic model. The length of the reaches and routing time increment shall be in accordance with criteria as outlined in the publication entitled 'Flood Routing Sensitivity Study' published by the Conservation Authorities and Water Management Branch. Cross-sections required for the hydrologic model routing procedure must be obtained from 1:5000 or 1:2000 topographic mapping or from field surveys. Cross-sections shall be extended sufficiently to ensure that the flows shall not exceed the range of the travel time table.

Dynamic wave routing shall be undertaken for channel reaches with mild slope where the diffusive wave model criterion cannot be satisfied. U.S. National Weather Service Dynamic Wave Operational Model (DWOPER) is acceptable to carry out this analysis.

Reservoir routing shall be undertaken for dams and embankments, such as railway embankments and road fills, that have significant storage effect. Future proposals for culvert replacement shall also be considered. For points downstream of such structures, the design flows shall not exhibit the retardation provided by the structures, i.e. only non-routed flows should be used. The Project Team shall be consulted where this storage, or

alternatively, failure of the dam or embankment, will have a significant effect on downstream flows and/or upstream flood levels. If failure may occur under flood conditions, consideration will be given to the effect on increasing the downstream peak flows. Reservoir routing shall also be undertaken for instream lakes and swamps that have a significant storage effect.

The consultant must determine the watershed contributing drainage area through field reconnaissance supplemented through the use of topographic maps and air photo interpretation. Ineffective areas such as large gravel pits which do not contribute to surface runoff shall be excluded in the evaluation of flood flows. The consultant shall carefully consider discretization of the watershed separating major tributary areas. The soils and land use data shall be reviewed to understand the influence on runoff.

The equivalent circular area method shall be used to compute the area rainfall reduction factors for Regional storm for all watersheds except those having an extremely elongated shape, for which the isohyetal method shall be used.

Calibration and validation of the hydrologic model shall be undertaken using all available streamflow records. At least three significant events (minimum runoff 25mm) shall be used at the calibration stage. The consultant must carefully examine the records and gauges in order to determine their accuracy and suitability for calibration and subsequent validation. If there are no suitable records, parameters used in the model must be supported by calibration and testing on a similar adjacent watershed. In either situation, the consultant must carry out sensitivity analyses to determine the impact of changing model parameters and degree of discretization of the watershed on calculated flows. The flows generated by the calibrated model must be substantiated through comparison with other analysis such as regional frequency analysis, MTC Modified Index Flood Method or other approved methods deemed suitable and approved by the Project Team. Calibrated watershed parameters shall not be adjusted beyond published ranges. The consultant shall report any calibration problems to the Project Team. In order to determine future flows, the calibrated model parameters must be adjusted accordingly. The proposed method for adjustment to account for future land use should be thoroughly discussed in the proposal.

The 100, 50, 20, 10, 5, and 2 year floods shall be determined by single station flood frequency analysis or by regional flood frequency analysis. Frequency analysis shall be undertaken where suitable streamflow records exist for the study watershed. A full inspection of the streamflow records and gauges must be undertaken. The suitability of the records for frequency analysis will be evaluated through discussion with the operating agency, field inspection and review of the records. A detailed inspection report on the station including equipment, site rating curve, vulnerability to backwater, ice influence or flanking with conclusions regarding its reliability shall be prepared as part of the hydrologic report.

Single station analysis shall be carried out when the length of record is equal to or greater than 20 years. For the length of record between 10 years and 19 years, single station analysis shall be substantiated through comparison with regional frequency analysis. If the length of record is less than 10 years, only regional frequency analysis shall be undertaken. Factors that must be considered in using existing streamflow records are the conversion and reconversion of regulated and natural flows; non-stationary records; the extension of the streamflow records; single site versus regional flood frequency analysis; and transfer of location of record. Frequency analysis should be carried out using the Consolidated Frequency analysis computer program (CFA1), developed by Environment Canada. Other models may be substituted only when prior written approval is received from Conservation Authorities and Water Management Branch and Environment Canada. The 95% confidence limits and expected probability adjustments must be provided.

An assessment of the impact of the future land use on the return period flows must be carried out using a calibrated hydrologic model and fully documented in the hydrology report. The calibrated hydrologic model or other acceptable procedure should be used to determine flows at ungauged locations and must be discussed in detail in the hydrology report.

Watersheds for which the required parameters of the regional frequency relationships fall outside the range of applicability of the regression equations, (i.e. for small or urban watersheds) the 100, 50, 25, 10, 5, and 2 year floods shall be determined using a calibrated hydrologic model. The model shall be based on precipitation frequency, or where snowmelt floods are significant, a combination of snowmelt and precipitation. As indicated previously, the flows generated by the model must be substantiated through comparison with other analyses. Further, where modelling is used to define return period flood magnitudes all relevant aforementioned criteria will apply.

The consultant must identify potential spill areas at the hydrologic phase of the study. Detailed analysis of spill quantities shall be undertaken during the hydraulic calculations and appropriate adjustments made to downstream flows based on discussion with and approval of the Project Team.

Prior to undertaking the hydraulic analysis, three copies of a draft technical report and documentation must be submitted for the hydrologic investigation. The draft report shall be prepared consistent with Section 5 of Hydrologic and Hydraulic Procedures, Technical Guidelines detailing all data, methodology, and assumptions. The format for the report shall be as outlined in Exhibit 3. A complete listing of the hydrologic model input data and output shall be submitted in original form. Photocopies of the computer printouts are not acceptable. Input data and the computer program shall also be submitted on diskettes suitable

8.5 HYDROLOGY (Cont'd)

for execution on an IBM PC or in a form acceptable to the Authority. The calculations and the draft technical report on the hydrologic analysis are to be reviewed and approved by the Project Team.

8.6 HYDRAULICS

Prior to undertaking hydraulic calculations, the consultant must forward a report on the check of the various components of the topographic mapping to the Project Team as indicated in Section 7. Water surface profiles shall be computed using the most current version of HEC-2, the backwater analysis program of the Hydrologic Engineering Center, Corps of Engineers, U.S. Army, Davis, California. Collection and processing of data, computational procedure and analysis of computed profiles must meet criteria and guidelines published by the Hydrologic Engineering Center in the User's Manual and Training Documents. The consultant should justify the use of "non-standard" model options. The HEC-2 EDIT program is to be run on the input data. Where the situation warrants, a hydraulic model other than HEC-2 may be used, provided the consultant is able to demonstrate its necessity and benefits to the Project Team.

Cross-sections shall be located and spaced in accordance with the criteria and guidelines published by the Hydrologic Engineering Center in the HEC-2 User's Manual and Training Documents. Maximum spacing between successive cross-sections shall be dictated by the analytical requirements of the model and in no case shall result in more than one-half metre difference in successive water surface elevations, unless approved by the Project Team.

Cross-sections of the channel above and below the waterline must be taken by field survey at all representative locations throughout the channel reach. This data will supplement the photogrammetrically generated cross-sections above the waterline. Cross-sections shall be extended across the entire floodplain, should be perpendicular to the anticipated flow lines (approximately perpendicular to contour lines) and only positive chainages are to be utilized. Computer generated vertically extended or interpolated cross-sections are not acceptable. Insufficient mapping must be reported immediately to the Project Team. Photographs of channel and floodplain are to be taken at several representative locations.

All existing structures, such as bridges, dams and embankments are to be photographed and those which will effect the floodline are to be surveyed. An explanation must be provided for other structures which are not surveyed. The top of road profile must be obtained by field survey and extend across the entire width of the floodplain.

Survey information of dimensions and elevations must be referenced to geodetic datum. A data sheet shall be prepared for each structure in accordance with Exhibit 4.

8.6 HYDRAULICS (Cont'd)

Plots of all cross-sections and road profiles with structures are to be drafted or produced using a drum or calcomp plotter. An appropriate scale must be selected for clear presentation of the cross-sections and road profiles with structures. Chainages shall be used to identify the cross-sections. The same numbering system for the cross-sections must be used in the HEC-2 model, as on the floodline maps and field survey notes and plots.

Water surface profiles must be determined for the Regional flood and the 100, 50, 20, 10, 5 and 2 year floods for future landuse conditions. The consultant must calibrate the hydraulic model where data such as high water marks are available. Starting water surface elevations must be established based on the guidelines published by the Hydrologic Engineering Center in the HEC-2 User's Manual and Training Documents. Where a lake is the control point, the starting water surface elevation shall be based on the long term mean lake level. The 1:100 year lake level is to be superimposed on the resultant water surface profile to establish the Regulatory level. Where a control starting elevation (such as a weir) is not possible, the starting section shall be located sufficiently downstream that the reach under consideration is not significantly affected by starting elevations.

The consultant must carry out sensitivity analysis in accordance with Section F8 of the Technical Guidelines to determine the effects of changing model parameters on the resulting flood levels. Floodlines upstream of structures with significant upstream storage will be based upon reservoir routing. An assessment of the sensitivity of culvert blockages on upstream flood levels must also be carried out for high embankments. A dam break analysis shall be undertaken to determine flood levels downstream of high embankments where failure under flood conditions may occur.

Spill areas may be identified as such only when the flow going out of the channel is not significant in terms of downstream flows. The consultant therefore must determine the volume of spill flow going out of the channel and its impact on downstream peak flows. The consultant must investigate whether the spill is natural or as a result of manmade structures and discuss with the Project Team. In case of a significant natural spill, downstream flood levels will be based upon reduced peak flows. If the spill is due to manmade structures, downstream flood levels are to be determined for both total flows and reduced flows. The consultant must determine the extent and depth of flooding due to the spill. Each spill area must be separately discussed in the technical report.

Prior to preparing the final floodline maps, three copies of a draft technical report, and one set of computer printouts containing input data, HEC-2 EDIT output, detailed and summary outputs, diskettes containing the input data suitable for execution on an IBM PC or in a form acceptable to the Conservation Authority/Municipality and output, cross-section

8.6 HYDRAULICS (Cont'd)

plots, survey notes and preliminary floodline maps must be submitted for the hydraulic investigation. The preliminary floodlines should be plotted in coloured pencil on white prints of the map sheets. The draft technical report shall be prepared consistent with Section 5 of Hydrologic and Hydraulic Procedures, Technical Guidelines detailing all data, methodology and assumptions. The format for the report shall be as outlined in Exhibit 3.

The draft technical report, preliminary floodline maps and computer printouts are to be reviewed and approved by the Project Team.

8.7 FLOODLINE MAPS

The topographic maps for the floodline mapping shall be prepared by the mapping contractor in accordance with the Surveys and Mapping Procedures (revised 1984), Technical Guidelines.

The location of each cross-section used in the HEC-2 model will be shown with a light line . The chainage of each cross-section shall correspond to the HEC-2 model. There shall be a spot elevation on each section giving the water surface elevation to the nearest centimeter for each floodline to be plotted. Chainages shall be given where the watercourse enters and leaves each sheet, and at confluences.

The Regional storm and the 100 year floodlines are to be plotted on the final floodline maps. The floodlines are to be plotted in ink in a format specified by the Conservation Authority/Municipality.

Each map shall bear the A.P.E.O. stamp and signature of the consultant's engineer adjacent to the stamp/signature of a senior officer of the mapping firm.

8.8 REPORTS AND DOCUMENTATION

The final submission shall consist of the following reports and documentation after completion of each component of the work:

Background Information:
One copy of the documentation on background information

Tender Document for Topographic Mapping:
Number of copies will be specified by the Conservation Authority/ Municipality

Map Coordination and Monitoring Report:
Three copies

8.8 REPORTS AND DOCUMENTATION (Cont'd)

Hydrology

1) Five copies of a technical report on the hydrologic analysis

2) One complete listing of the computer program, input data and the detailed output for the hydrological model

3) Computer program source and executable modules, input data and the detailed output for the hydrological model on diskettes in IBM PC format (or in a form acceptable to the Conservation Authority/Municipality)

4) All field survey notes.

Topographic Mapping Inspection Report:

1) Three copies of a mapping inspection report

2) All field survey notes

Hydraulics:

1) Five copies of a technical report on hydraulic analysis

2) One complete listing of the HEC-2 and HEC-2 EDIT computer programs, input data, HEC-2 EDIT output and the detailed and summary output for the hydraulic model

3) HEC-2 and HEC-2 EDIT source and executable modules, input data, HEC-2 EDIT output and the detailed and summary output for the hydraulic model on diskettes in IBM PC format (or in a form acceptable to the Conservation Authority/Municipality)

4) All calculations for spill area analysis including computer printouts and input data and the output on diskettes in IBM PC format (or in a form acceptable to the Conservation Authority/ Municiplity)

5) All field survey notes

6) Cross-section plots

Floodline Maps:

1) One complete set of the final cronaflex maps

2) Two sets of mylars

3) Five complete white print sets

8.8 REPORTS AND DOCUMENTATION (Cont'd)

General Report:

Three copies of a draft general report shall be produced. The format for the general report shall be as outlined in Exhibit 5. The general report is meant to convey the scope of the work to the laymen. It should describe the nature of the mapping and briefly indicate how flows were calculated and elevations established. The report shall contain a section outlining all available information and highlights the previous findings relevant to the present study. Fifteen copies of the final general report shall be prepared upon receiving approval of the draft report from the Project Team.

8.9 APPROVALS

All reports, maps, and printouts must be reviewed and approved by the Project Team before final acceptance. Normally, only spot checking of approximately 10% of the maps and corresponding calculations will be undertaken by the Project Team. If errors or omissions are detected during review, then the submission will be rejected and returned to the consultant. The consultant is responsible for ensuring that technical materials conform to Technical Guidelines and for the accuracy of all information supplied to the Conservation Authority/Municipality. Approval by the Project Team does not relieve the consultant of responsibility for the accuracy of the study.

EXHIBIT 1
PROGRAMS CITED

1. Agricultural Research Service, U.S. Department of Agriculture, HYMO: Problem Oriented Computer Language for Hydrologic Modelling, Document ARS-S-9, USDAHL-74 Revised Model of Watershed Hydrology.

2. Conservation Authorities Branch, Ontario Ministry of Natural Resources, HYMO-VUH, FLOOD 2, HYDSTAT

3. U.S. Environmental Protection Agency, Stormwater Management Model SWMM, Hydrological Simulation Program - Fortran HSP-F.

4. Illinois State Water Survey, Urbana. Illinois Urban Drainage Area Simulator ILLUDAS, Bulletin 58.

5. Hydrologic Engineering Center, U.S. Army Corps of Engineers HEC-1, HEC-2, STORM

6. U.S. Army Corps of Engineers, North Pacific Division, Streamflow Synthesis and Reservoir Regulation Model SSARR.

7. University of Ottawa, OTTHYMO, QUALHYMO

8. United States National Weather Service, Dynamic Wave Routing Model DWOPER, Dam Break Analysis DAMBRK, National Weather Sevice River Forecast System NWSRFS models (Stanford and Sacramento Versions)

9. Environment Canada, Consolidated Frequency Analysis CFA1, Flood Damage Reduction Program Flood Frequency Analysis computer program FDRPFFA, Identification of High and Low Outliers Program OUTLIER

10. Ministry of Transportation and Communications, MTC Drainage Manual, Chapter B: Design Flood Estimation for Small Watersheds, Chapter H: Design Flood Estimation for Medium and Large Watersheds.

EXHIBIT 2

CONSERVATION AUTHORITIES AND
WATER MANAGEMENT BRANCH

Technical Memorandum Series

1985 02 13

| No. | SUBJECT | DATE | REMARKS |
|---|---|---|---|
| 1. | Hydrologic Modelling Practice - Floodplain Mapping Projects | 83 03 21 | |
| 2. | Use of Minimum Loss Rates in Storm Runoff Calculations | 83 04 22 | |
| 3. | Recognized Procedures for Streamflow Forecast Models | | being drafted |
| 4. | Technical Works - Conservation Authorities and Water Management Branch | 83 02 28 | |
| 5. | HYMO Compute Rating Curve Command | 83 07 12 | |
| 6. | Statistical Estimate of 100 year Flood Flows | 83 07 27 | draft |
| 7. | HYMO Flood Routing Procedure - Incorrect Use of the Storage Location Number | 85 01 28 | |
| 8. | Review of Dyke Design Practices | 85 01 21 | |
| 9. | Areal Rainfall Reduction Factors for Hurricane Hazel | 85 02 05 | draft |
| 10. | HYMO VSC Divergence Problem | 85 02 13 | draft |

LIST OF TECHNICAL REPORTS

1. Choice of Statistical Distributions for Flood Flow Frequency Analysis in Ontario, by Automated Business and Engineering Limited, August 1980.

2. Watershed Model Calibration Methodology Study, by Collins and Moon Limited, July 1981.

3. Southern Ontario Ice Jam Studies: Winter 1980/81, by D.M. Foulds, July 1981.

4. Statistical Hydrology: Regionalization of the Coefficient of Skew for the Province of Ontario, by MacLaren Plansearch Inc., October 1981.

5. Program FASTHEC2 User's Manual, by W. James and M. Robinson, McMaster University, January 1982.

6. HYDSTAT Computer Program for Univeriste and Multi-Variate Statistical Applications, In-house, October 1982.

7. Ice Management Manual, In-house, November 1982 (ISBN 0-7743-8101-9) (out of print).

8. Vulnerability of Natural Watercourses to Erosion Due to Different Flow Rates, by M.M. Dillon Limited, November 1982.

9. Flood Hydrology: VUH Model User's Manual, In-house, April 1983.

10. Northern Ontario Hydrology Study, Phase I: Inventory and Assessment of Data, by Cumming-Cockburn and Associates Ltd. and S.A. Kirchhefer Ltd., August 1983.

11. Proceedings of the Ice Jam Seminar, June 2, 1982, In-house, December 1983. (ISBN 0-7743-8917-6).

12. Snow Hydrology Study, Phases I and II: Study Methodology and Single Event Simulation, by MacLaren Plansearch Inc., January 1984.

13. An Investigation of Methods for Calculating Infiltration for Storm-Event Models in Ontario, by Collins and Moon Ltd., March 1984.

14. Flood Routing Sensitivity Study, by University of Waterloo Research Institute, March 1984.

15. Flood Damages: Volume 1 - A Review of Estimation Techniques; Volume 2 - Guidelines for Estimation, by Paragon Engineering Limited, March 1984.

16. An Investigation of the Runoff Component in the HYMO, OTTHYMO and VUH Models for Selected Ontario Watersheds, by University of Ottawa, pending.

17. Northern Ontario Hydrology Study, Phase II - Preliminary Assessment of Existing Models for Continuous Simulation, by S.A. Kirchhefer Ltd., pending.

18. Snow Hydrology Study, Phase III: Snowmelt and Regional Flood Frequency Analysis, by Cumming-Cockburn and Associates Ltd., pending.

EXHIBIT 3
FORMAT FOR TECHNICAL REPORT

The technical reports for hydrology and hydraulics and maps are to be prepared in such a manner that the entire work can be recreated by any qualified persons without the need to refer to any other material. Further, qualified persons are to be able to recognize and understand all the methods, approaches and basic data, and rationale used for these methods. All reports (Technical and General) shall bear the A.P.E.O. stamp and signature of the Project Manager/Project Engineer. All reports must acknowledge the Canada/Ontario Flood Damage Reduction Program and the report covers must bear the Federal and Provincial logos alongside the Conservation Authority/Municipality logo.

1) Report Format

The technical reports for hydrology and hydraulics are to be prepared separately in two parts using the following format:

. Acknowledgements
. Introduction:

- Objectives
- General description of watershed and study area
- History of flooding (Newspaper, Local People, Ontario Provincial Police, High Water Marks)
- General background information
- Criteria used for floodplain

PART A - HYDROLOGY

- Summary
- Background information
- Previous hydrologic studies
- Field survey
- Source, availability and location of hydrometric data
- Inspection of the stream flow and rainfall gauges and records
- Methodology used in determining watershed parameters
- Factors (lakes, reservoirs, landuse, etc.) influencing runoff
- River crossing (bridges, embankments) with significant storage effect
- Methodology used in determining design flows for existing and future conditions
- Hydrologic model(s) and computer program(s) used
- Observed hydrographs, precipitation (rainfall, snowmelt)

PART A - HYDROLOGY (Cont'd)

- Calibration and validation of the hydrologic model
  - data (observed hydrographs, rainfall amounts, spatial and temporal distributions of rainfall, antecedent moisture conditions, etc.) used in calibration
  - calibration of model parameters
  - justification of the values of the calibrated parameters
  - sensitivity analysis
  - validation of the model
- Comparison of flows generated by the calibrated model with other analysis (such as regional frequency analysis, MTC Modified Index Flood method, etc.)
- Flood frequency analysis
  - conversion of regulated flows to natural conditions
  - non-stationary record
  - extension of streamflow records
  - single site frequency analysis
  - regional flood frequency analysis
  - transfer of location
  - conversion to regulated conditions under probable reservoir operating procedures
- Comparison of results with previous estimates or recorded events
- Magnitude of design floods for existing and future conditions
- Conclusions and recommendations
- List of technical persons with qualifications that worked on the project
- A.P.E.O. stamp and signature of the Project Manager/Project Engineer
- References

Tables

- Available hydrologic and hydrometric data
- Hydrologic and hydrometric data used in the calibration and validation works
- Calibration and validation results
- Calculated and calibrated watershed parameters for existing and future conditions
- Hydrologic data used in the determination of Regional storm flood flows
- Precipitation and snowmelt data used in the determination of return period flows
- Streamflow data used in the frequency analysis
- Results of the frequency analysis
- Sensitivity analysis
- Comparison of flows by different methods for various return period flood events
- Magnitude of design floods for existing and future conditions at various points of interest along the watercourse

PART A - HYDROLOGY (Cont'd)

Maps & Diagrams

- A small scale topographic map showing the watershed and subwatersheds boundaries, hydrometric stations
- Schematic diagram of the watershed model
- Observed and simulated hydrographs in the calibration and validation analysis
- Flood frequency curves
    - single site analysis
    - regional analysis
    - confidence limits
    - expected probability adjustments
- Landuse plans (existing and future conditions) and soil maps
- Any relevant diagrams, maps, etc. used in the analysis

- Appendices
    - A large scale topographic map of the watershed showing the subwatersheds, overland flow and channel lengths used in time of concentration calculations, location of valley cross sections, structures with significant storage
    - Plots of the stream(s)/watershed/subwatersheds profiles and valley cross-sections
    - Calculations of various watershed parameters, (weighted slope, time of concentration, time to peak, recession constant, curve numbers etc.), rainfall reduction factors, storage-outflow relationships
    - Input data and output of the calibration and validation analysis
    - Input data and output for sensitivity analyses
    - Input data and summary output of hydrologic analysis
    - Input data and computer printouts of flood frequency analysis
    - Other relevant information

PART B - HYDRAULICS

- Summary
- Background information
- Previous backwater analysis
- Field survey
- Topography of floodplain
- Flood types
- Observed water level profiles
- Methodologies and assumptions
- Computer program(s) used for water surface profiles
- Calibration
    - data used in calibration
    - 'n' values for various recorded floods
    - 'n' values for design flood
- Selection of bridge routines (Normal/Special)
- Hydraulic control points
- Starting water surface elevation
- Sensitivity analysis
- Effects of river crossings

PART B - HYDRAULICS (Cont'd)

- Flood levels determined by reservoir routing analysis
- Flood levels determined by dam break analysis
- Flood levels based on dynamic modelling
- Water surface profiles of design floods
- Flood prone areas
  - Urban
  - Rural, agricultural
- Spill areas
  - natural/manmade
  - volume of spill flow
  - impact on downstream flows and flood levels
  - extent and depth of flooding due to the spill
- Conclusions and recommendations
- List of technical persons with qualifications that worked on the project
- A.P.E.O. stamp and signature of the Project Manager/ Project Engineer
- References

- Tables
  - Observed flow hydrographs and water level profiles
  - Results of calibration
  - Results of sensitivity analysis
  - Parameters, coefficients
  - Design flows and flood levels at critical locations

  Diagrams
  - A large scale topographic map showing the watershed and subwatersheds boundaries and floodline mapping study limits
  - Water surface profile(s) of design flood(s)
  - Bridge data sheets
  - Plots of cross-sections
  - Other diagrams related to hydraulic analysis

- Appendices
  - Flood level calculations based on reservoir routing analysis for structures with significant upstream storage
  - Input data and summary output of the backwater calculations
  - All calculations for spill area analysis
  - Input data and output of the dam break analysis
  - Input data and output of the dynamic modelling analysis
  - Input data and output of the final calibration run
  - Input data and output for the sensitivity analyses
  - Photographs of all structures
  - Photographs of floodplain at representative reaches
  - Other relevant information

2. Discussion

The technical reports shall be produced in a manner which is consistent with Section 5 of Hydrologic and Hydraulic Procedures, Technical Guidelines and the following shall be discussed in detail:

a) Data used in calibration work including the reasons for the choice of data used in the work.

b) Information, other than the most current, used in the calibration work.

c) The criteria used in the flood frequency analysis; reasons for choosing a particular distribution.

d) Justification for the selected watershed parameters used in the study.

e) Hydrologic routing procedure.

f) Method used and assumptions made in the calculation of the effects of lakes, reservoirs, embankments and landuse on flows.

g) The specific criteria used in determining the design flood flows.

h) Criteria, locations, field surveyed and photogrammetrically generated cross-sections on a reach by reach basis used in backwater analysis.

i) Method used and assumptions made in the determination of the starting water surface elevations for backwater computations

j) The specific criteria used to determine where the effective flow limits are located.

k) Reasons for using the selected Manning's roughness and other bridge coefficients in determining the design flood water surface profiles.

l) Method used and assumptions made in the calculation of the effects of the bridges, culverts crossings and embankments on water surface profiles; selection of bridge routine (Normal/Special) and reasons for each crossing.

m) Methods used and assumptions made in the determination of spill flows; effects on downstream flows and floodlines, areas affected due to the spill.

n) Assumptions made and methods used, with respect to parameter estimation at various stages of hydrologic and hydraulic analysis.

# BRIDGE DATA

WATERCOURSE _____ MAP SHEET NO. _____

LOCATION _____ U.T.M. GRID REFERENCE _____

STRUCTURE _____ _____

## A. SPECIFICATIONS

Span _____ m

Length of Structure _____ m

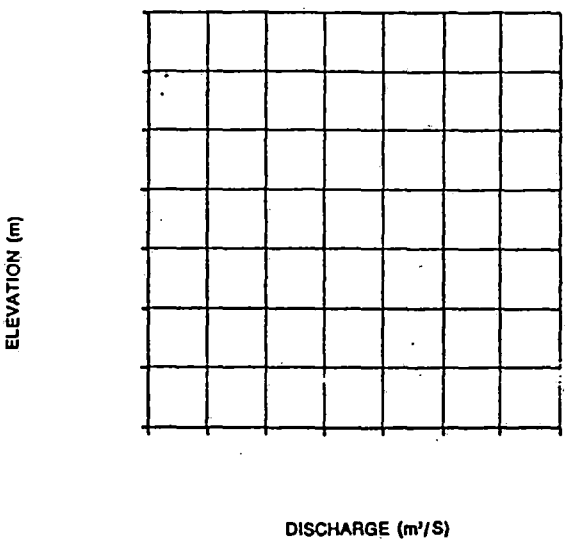
Top of Road Elevation _____ m

Low Chord (Soffit) Elevation _____ m

Upstream Invert Elevation _____ m

Effective Flow Area _____ $m^2$

## B. STAGE DISCHARGE CURVE




## C. PHOTOGRAPHIC PRESENTATION

EXHIBIT 5

FORMAT FOR GENERAL REPORT

Acknowledgements

Summary

1. Introduction:
   - purpose of the study
   - history of flooding problems
   - past flood plain mapping studies
   - criteria used for flood plain

2. Background Information

3. Study Area:
   - study scope and study limits
   - description of communities affected

4. Hydrology

5. Hydraulics

6. Flood Line Delineation:
   - description of mapping used, date of photo, scale, contour intervals, accuracy and checking
   - explanation of how the flood lines were identified
   -identify flooding problem areas and the causes

7. Conclusions and Recommendations

8. APEO stamp and signature of the Project Manager/ Project Engineer

9. References

10. Exhibits:
    - location maps to identify study area
    - landuse maps (existing and future conditions)
    - identification of historically flooded areas
    - historical photos, if available
    - tables and hydrographs to provide summary of discharges, elevations and mean velocities with a cross-section reference
    - flood frequency curves

EXHIBIT 6

FORMAT FOR TOPOGRAPHIC MAPPING INSPECTION REPORT

- Summary

- Introduction
  - Scope and Objectives
  - Flight date for aerial photography, name of the company prepared the aerial photography
  - Name of the mapping firm prepared the topographic mapping

- Random inspection and confirmation:
  - Horizontal and vertical ground control
  - Aerial photography

- Mapping Check
  - Inspection of each map sheet as per Section 8.04 (c) of the Surveys and Mapping Procedures (revised 1984), Technical Guidelines
  - Field check of map sheets
    - location of the checked map sheets on a sheet index plan
    - field survey:
      - methodology
      - date of the survey
      - types of equipment
      - names of crew members
    - source of information for ground controls (horizontal and vertical) used in the accuracy check
    - description and locations of the ground controls using maps
    - detailed discussion including methodology, listings, and data input of any computer program if used in the calculations of the horizontal and vertical accuracy check
    - detailed calculations for horizontal and vertical accuracy check using diagrams
    - all relevant calculations
    - discussion on the results of the map check
    - conclusions
  - Ensure each map bears the stamp and signature of the engineer/surveyor of the mapping firm. The signature of a senior officer of the mapping firm may be substituted
  - Prints of the checked map sheets showing the locations of spot elevations and identifiable contour crossings (for vertical accuracy) and identifiable features (for horizontal accuracy) as per Section 8.04 (c) of the Surveys and Mapping Procedures (revised 1984), Technical Guidelines

  - All field survey notes

  - Computer program in source and executable forms, input data and output on diskettes in IBM PC format (or in a form acceptable to the Conservation Authority/Municipality)

EXHIBIT 7

MONITORING MAPPING REQUIREMENTS
FOR COMPLETED FDRP PROJECTS

Fiscal Year _____ C.A./Mun._____

Project Name: _____

Engineering Consultant _____ Mapping Co. _____

I Tender Documents

i) Date tender documents were submitted by the Engineering Consultant to the Technical Sub-Committee/Project Team

_____

ii) Decision by Technical Sub-Committee.
Approved _____ Date _____

iii) Date Contract Awarded:

_____

II Aerial Photography for Line Mapping

(Aerial photography as a component of topographic mapping)

i) On what date did the Engineering Consultant receive the photography information and all materials from the mapping firm as set out in Section 3.10, Surveys and Mapping Procedures (revised 1984), Technical Guidelines

_____

ii) Do the photogrammetric checks confirm that photography is suitable for mapping?

_____

III Aerial Photography for Orthophoto Mapping

i) Photography taken to produce orthophoto maps was submitted to the Technical Sub-Committee/Project Team on:
Date _____

ii) Decision by Technical Sub-Committee:

Approved: _____ Date _____

Comments: _____
_____
_____
_____

EXHIBIT 7 (Cont'd)

IV Horizontal and Vertical Control

(Horizontal and vertical control as a component of topographic mapping)

All returns for horizontal and vertical control will be delivered, on completion of these phases or completion of the project to:

Surveys and Mapping Branch
Ministry of Natural Resources
Queen's Park
Toronto, Ontario
M7A 1W3

i) What date did the Engineering Consultant receive from the mapping firm all materials required for inspection, as outlined in Section 5.10, Surveys and Mapping Procedures (revised 1984), Technical Guidelines

_____

ii) Date report submitted to the Technical Sub-Committee/Project Team

_____

V Aerial Triangulation

i) Date results of the aerial triangulation were submitted by the mapping firm to the Technical Sub-Committee/Project Team

_____

ii) Decision by Technical Sub-Committee:

Approved: _____ Date: _____

VI Line Mapping

(Maps as a component of topographic mapping)

i) Identify the map sheets chosen to have both a vertical and horizontal accuracy inspection taken

_____

ii) Date the Engineering Consultant field-checked a selected number of map sheets

_____

Comments: _____
_____
_____
_____

EXHIBIT 7 (Cont'd)

III) Comments on Vertical and Horizontal accuracy:

Comments: _____
_____
_____
_____

iv) Written report to the Technical Sub-Committee/Project Team by the Engineering Consultant regarding results of the vertical and horizontal accuracy:

Date: _____

VII Orthophoto Mapping

I) Date that proofs of combined half-tone positives with contours were submitted to the Technical Sub-Committee/Project Team:

_____

II) Outcome of the Technical Sub-Committee's Inspection:

Approved: _____ Date: _____

Not Approved: _____ Date: _____

Comments: _____
_____
_____
_____

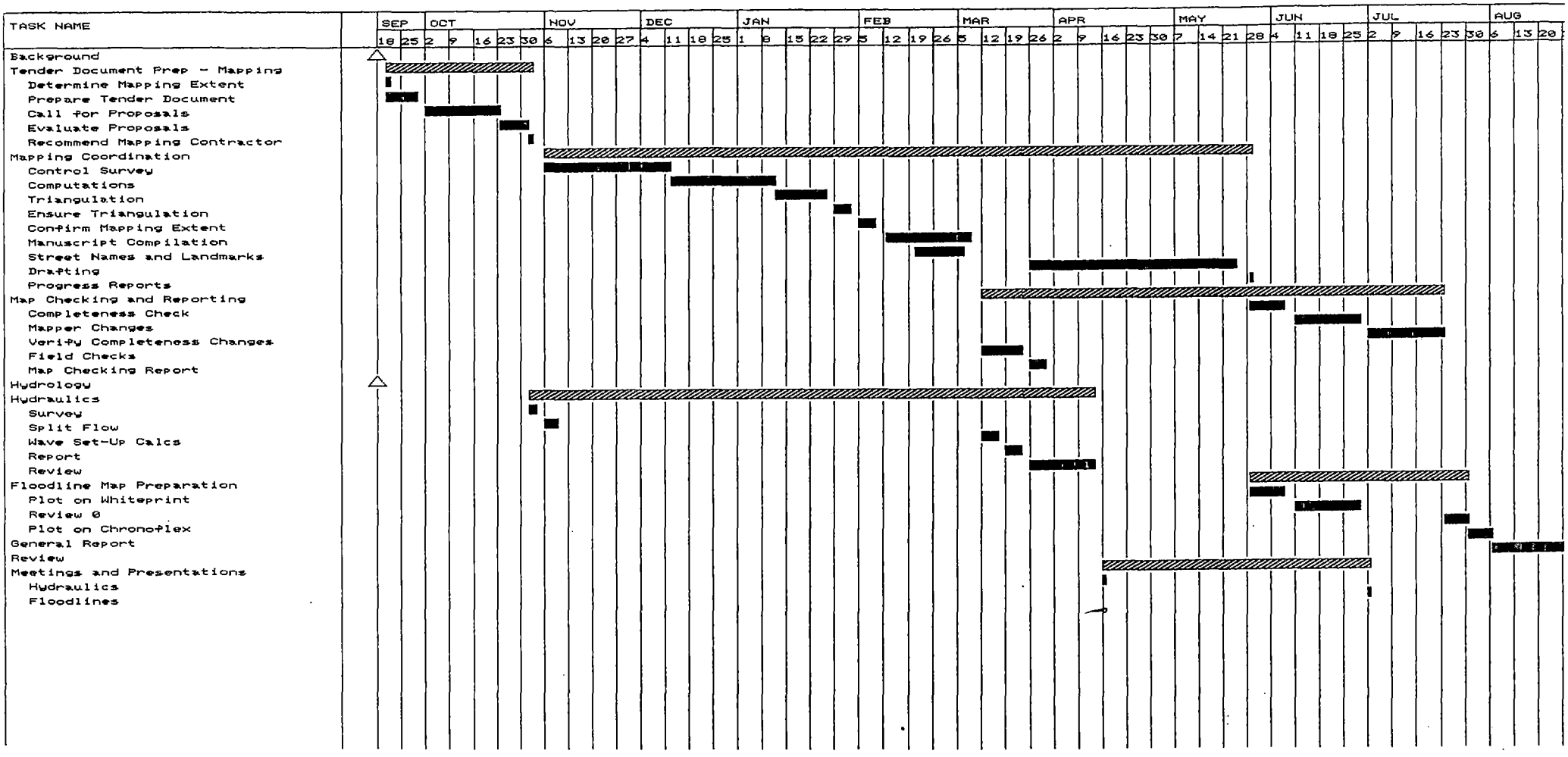
VIII) Final Completion

1) Final Cronaflexes from Mapping Company

Date: _____

2) Final Cronaflexes with floodline delineated to Conservation Authority/Municipality

Date: _____




**REVISED SCHEDULE**

# SCHEDULE "B"

## TO THE AGREEMENT BETWEEN

## THE CLIENT AND THE CONSULTANT

Project Specifications

Consultant's Proposal

**Project Specifications - Overview**

This schedule provides specifications for the project to be conducted by the Consultant.

The specifications have been extracted from the Consultant's proposal.

# PROPOSAL FOR FLOOD RISK MAPPING
# OTTAWA RIVER
# NEAR WESTMEATH - PHASE III

Prepared for

Municipality of the Township of Westmeath
County of Renfrew

Prepared by

A.J. ROBINSON & ASSOCIATES INC.
Consulting Engineers
Project No. 89004

March 1989

# A.J. Robinson & Associates Inc.

CONSULTING ENGINEERS
P.O. Box 13130 Kanata, Ontario K2K 1X3
Telephone (613) 592-6060
FAX (613) 592-5995


March 20, 1989

The Township of Westmeath
Westmeath, Ontario
K0J 2J0

Attention: Pat Burn, Clerk-Treasurer

Re: Flood Risk Mapping Study
Ottawa River near Westmeath - Phase III
Our Project No. 89004

Dear Madam:

Please find enclosed a copy of our engineering proposal, for your review and comments. We have forwarded an additional two copies to Bill McMullen, Ministry of Natural Resources, Huntsville.

We express our thanks to the Township for extending a request for proposal to us and should clarification be required, please feel free to contact the undersigned.

Yours truly,

A.J. ROBINSON & ASSOCIATES INC.

Paul R. Frigon, P.Eng.
Water Resources Manager

PRF/bm
encl.

TABLE OF CONTENTS



## LIST OF FIGURES



## LIST OF MAPS

## LIST OF TABLES

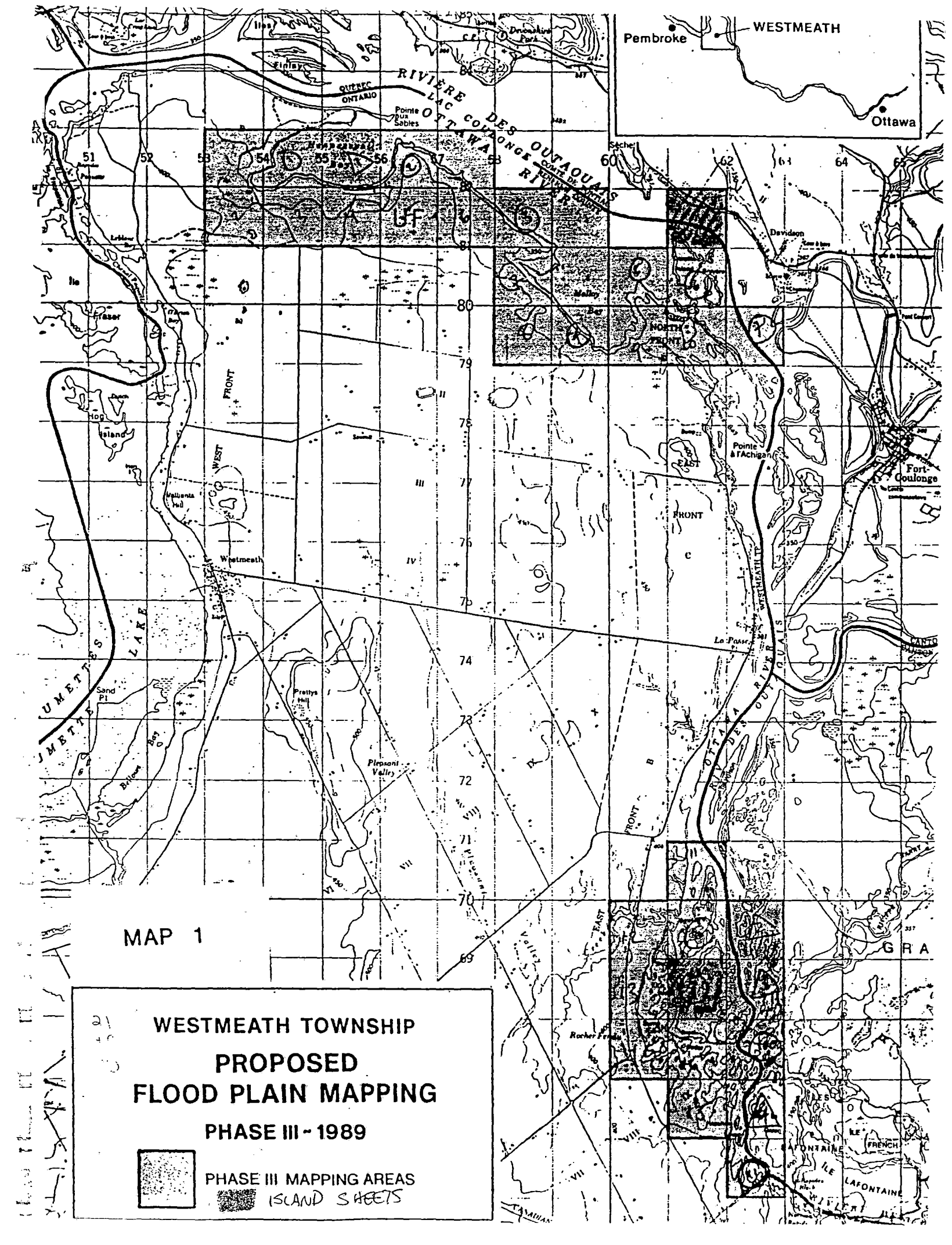


## LIST OF APPENDICES

## 1.0 INTRODUCTION

This proposal was prepared in response to a request by The Township of Westmeath dated January 25, 1989.

The Phase III study will complete the flooding mapping for that portion of the Ottawa River that is adjacent to the Township of Westmeath. It will include Lac Coulonge as well as a reach between LaPasse, Rocher Fendu Dam and the Township's southerly boundary. This study area is illustrated in Map 1.


Pembroke
WESTMEATH
Ottawa
RIVIERE DES OUTAOUAIS
LAC COUCHONG
OTTAWA RIVER
QUEBEC
ONTARIO
Pointe aux Sables
Finlay
Davidson
Pointe à l'Achigan
Fort Coulonge
Hog Island
Fraser
Westmeath
Pleasant Valley
Prettys Hill
Sand Pt
Rocher Fendu
La Passe
FRONT
WEST
EAST
UMETTE'S LAKE
ILE LAFONTAINE
ILE FRENCH
51
52
53
54
55
56
57
58
60
62
64
79
78
77
76
75
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72
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69
MAP 1
WESTMEATH TOWNSHIP
PROPOSED
FLOOD PLAIN MAPPING
PHASE III - 1989
PHASE III MAPPING AREAS
ISLAND SHEETS

## 2.0 PROPOSED METHODOLOGY

The methodology for an FDRP study is clearly established by the detailed Terms of Reference (May, 1986) and is well understood by A.J. Robinson & Associates Inc. This is reflected in our FDRP mapping experience outlined in Section 4.0 "Relevant Experience" and in the attached curricula vitae of our engineering team.

The following sub-sections highlight our approach to the Floodplain Mapping of the Ottawa River near Westmeath - Phase III. They should be read in conjunction with Table 1 and Figure 1 that outline specific task costs and task scheduling.

### 2.1 Map Co-ordination and Checking

A.J. Robinson and Associates Inc. will prepare the appropriate tender document for floodline/topographic mapping and will assist in the selection of a qualified mapping firm. Ground control, aerial triangulation and stereo compilation will be performed by the mapping firm using the existing 1:8000 aerial photography. There will be a requirement for additional air photography in order to accommodate some of the islands in Lac Coulonge and downstream of Rocher Fendu Dam.

Map checking will be performed by our survey crew in the Summer of 1989. We have allowed five days to complete this component of the study.

Thirty-five map sheets will be prepared, as illustrated on Map 1. This will represent floodline mapping of 16 kilometers of the Ottawa River; 10 kilometers on Lac Coulonge and 6 kilometers downstream of LaPasse.

Prior to the hydraulic calculations, a report will be submitted that details the mapping co-ordination and map checking process.

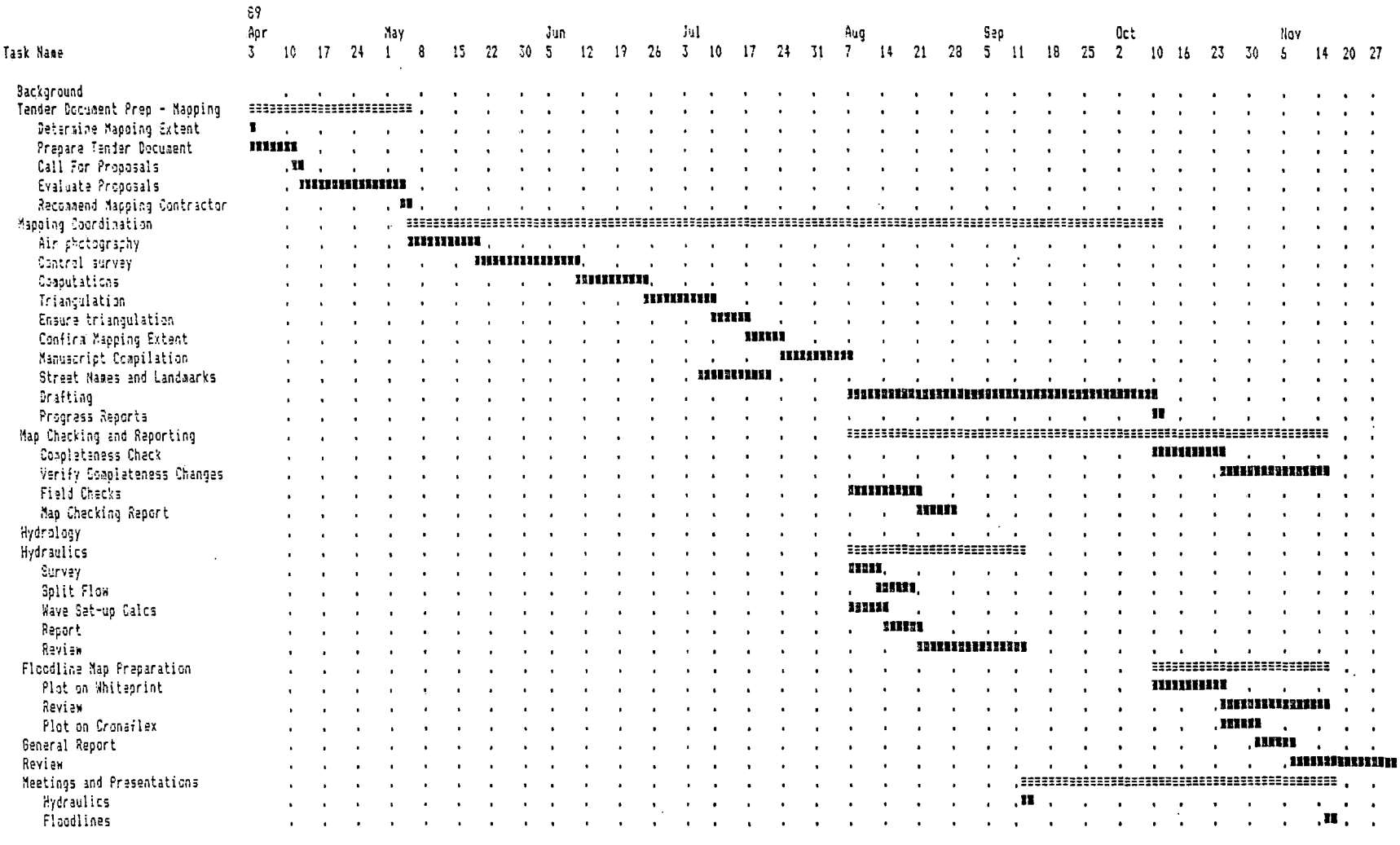
### 2.2 Hydrology

The flows required to define the 100 year floodline (Regulatory) have been determined in Phase II of the Westmeath Floodline Mapping Study and will be used in Phase III.

Table 1
DETAILED COST ASSESSMENT

| | disburse | drafting | manager | engineer | survey | clerical | technologist | Total | |
|---|---|---|---|---|---|---|---|---|---|
| Background | | | | | | | | | * |
| Tender Document Prep - Mapping | | | | | | | | | |
| Determine Mapping Extent | | | 132 | 82 | | | | 214 | |
| Prepare Tender Document | 50 | | 634 | | | 288 | | 972 | |
| Call For Proposals | 100 | | 132 | | | 60 | | 292 | |
| Evaluate Proposals | 50 | | 396 | | | 72 | | 518 | |
| Recommend Mapping Contractor | 50 | | 106 | | | 48 | | 204 | |
| Mapping Coordination | | | | | | | | | |
| Air photography | | | | | | | | | |
| Control survey | | | | | | | | | |
| Computations | | | | | | | | | |
| Triangulation | | | | | | | | | |
| Ensure triangulation | 50 | | 132 | | | 60 | | 242 | |
| Confirm Mapping Extent | | | 264 | | | | 160 | 424 | |
| Manuscript Compilation | | | | | | | | | |
| Street Names and Landmarks | | | 264 | | | | 160 | 424 | |
| Drafting | | | | | | | | | |
| Progress Reports | | | 132 | | | 120 | 60 | 332 | |
| Map Checking and Reporting | | | | | | | | | |
| Completeness Check | | | | | | | 640 | 640 | |
| Verify Completeness Changes | | | | | | | 480 | 480 | |
| Field Checks | 750 | | | | 3,200 | | | 3,950 | — #600 |
| Map Checking Report | | | 132 | | | 480 | 800 | 1,412 | |
| Hydrology | | | | | | | | | * |
| Hydraulics | | | | | | | | | |
| Survey | 150 | | 211 | | 640 | | | 1,001 | |
| Split Flow | 150 | | 264 | 328 | | | 400 | 1,142 | |
| Wave Set-up Calcs | | | 132 | 328 | | | 640 | 1,100 | |
| Report | 100 | | 264 | 656 | | 240 | | 1,260 | |
| Review | | | | | | | | | |
| Floodline Map Preparation | | | | | | | | | |
| Plot on Whiteprint | 100 | | 528 | | | | 960 | 1,588 | |
| Review | | | | | | | | | |
| Plot on Cronaflex | 100 | 960 | 264 | | | | | 1,324 | |
| General Report | 100 | | 132 | 656 | | 240 | | 1,128 | * |
| Review | | | | | | | | | * |
| Meetings and Presentations | | | | | | | | | |
| Hydraulics | 100 | | 396 | | | | | 496 | |
| Floodlines | 100 | | 396 | | | | | 496 | |
| | 1,850 | 960 | 4,910 | 2,050 | 3,840 | 1,608 | 4,320 | 19,638 | * |

Figure 1
STUDY SCHEDULE



## 2.3 Hydraulics

The Standard Step Backwater Method as implemented in HEC-2 was used to estimate regulatory flood levels for the Ottawa River from Rocher Fendu to Westmeath in the Phase II study. These levels will be used to define the Regulatory floodline on 30 of the map sheets with wind set-up calculations being determined for 9 map sheets in the Lac Coulonge area.

For the 5 map sheets downstream of Rocher Fendu, a small hydraulics study will be required to determine flood levels in this area. At least three channel cross sections will be surveyed in the Summer of 1989 to determine the control at Ile Lafontaine. It may be necessary to undertake split flow analysis around Green Island as well.

## 2.4 Floodline Mapping

Flood and Fill lines will be plotted on whiteprints of fairdrawn manuscripts for review by the Project Team. The lines will be transcribed to cronaflex once approval has been received. The required number of originals and copies are indicated in Table 2.

## 2.5 Reports and Meetings

The required reports and number of copies are presented in Table 2. Monthly Reports will submitted in those months when a major report is not due.

It is anticipated that two meetings of the Project Team and a final presentation to Westmeath Council will be required. The meetings are: Draft Hydraulics and Floodline Map Presentation.

## TABLE 2
## REQUIRED REPORT AND MAPPING SUBMISSIONS

| SUBMISSION | | QUANTITY |
|---|---|---|
| Background Report | | Not Required |
| Tender Document for Topographic Mapping | | |
| | DRAFT | 3 |
| | FINAL | 4 |
| Map Coordination and Monitoring Report | | 3 |
| Mapping Inspection Report | | 3 |
| Hydrology Report | | Not Required |
| Hydraulics Report | | |
| | DRAFT | 3 |
| | FINAL | 5 |
| General Report | | |
| | DRAFT | 3 |
| | FINAL | 15 |
| Floodline Maps (set) | | |
| | Cronaflex | 1 |
| | Mylar | 2 |
| | Whiteprints | 5 |
| | Air photo | 1 |

## 3.0 STUDY STAFF

The Water Resources Group within A.J. Robinson and Associates Inc. has highly qualified and experienced professional and technical staff to undertake the Phase III Floodline Mapping of the Ottawa River. The staff assigned to the study and their respective roles are outlined below. A detailed presentation of staff qualifications may be found in their curriculum vitae in Appendix A.

**Project Manager - Paul Frigon, P.Eng.**

As Manager of Water Resources within A.J. Robinson & Associates Inc. Mr. Frigon is responsible for all water resources projects. He has over ten years of experience in the field of water resources: seven with the Grand River Conservation Authority and over three years in consulting. His responsibilities within the study will include: day to day supervision of staff; report writing; liaison with the project team; attendance at meetings; and project administration.

**Project Engineer - Rob Pankratz, M.Eng., P.Eng.**

Mr. Pankratz will be responsible for all hydraulic modelling and will assist in the preparation of reports. His most recent experience with hydraulic modelling has been the Eastman Drain Master Drainage Plan currently being completed for the Raisin Region Conservation Authority. Previous FDRP experience includes the Ottawa River Floodplain Mapping Study (Westmeath) Phase II.

**Project Technologist - Tim O'Brien, C.E.T.**

Mr. O'Brien has over seven years experience in the water resources field. His experience includes computer models such as OTTHYMO and HEC-2. He will assist Mr. Pankratz in the hydraulics and Mr. Frigon in the mapping component. His recent contribution to the Map Coordination and Map Checking component of the Westmeath Phase III study resulted in a letter of commendation from Energy Mines and Resources.

Project Technologist - Marc Gagne

Mr. Gagne has over 10 years experience in surveying and is responsible for all field surveys undertaken by A.J. Robinson & Associates Inc. He will be present in the field to ensure accurate and efficient completion of the study's survey requirements.

## 4.0 RELEVANT EXPERIENCE

For the past 11 years, A.J. Robinson & Associates Inc. has been actively involved in water resources engineering including: FDRP, floodplain mapping, watershed management plans, master drainage plans, storm water management, and engineering and construction supervision of water related projects. Mr Frigon has recently joined the staff of A.J. Robinson & Associates Inc. Over a similar period, Mr. Frigon, both with the Grand River Conservation Authority and as a Project Engineer/Manager with Paragon Engineering in southern Ontario, has worked on similar projects.

The following list of studies suggest some of the more recent projects that both A.J. Robinson & Associates Inc. (AJR) and Mr. Frigon (PRF) have worked on that would relate to the Westmeath Phase III study.

A more detailed presentation of relevant experience for A.J. Robinson & Associates Inc. is presented in the Company Profile in Appendix B.

Floodplain Mapping (PRF)

- Baden Creek (FDRP) - 1986 - for the Grand River CA (GRCA)
- Speed and Eramosa River (FDRP) - 1987 - for the GRCA
- Muskoka River (FDRP)- 1987 - for the Town of Bracebridge

Floodplain Mapping (AJR)

- Ottawa River (FDRP) - 1988 - for the Township of Westmeath
- Green's Creek - 1987 - for the National Capital Commission
- Sawmill Creek - 1987 - for the Township of Rideau

Master Drainage/ Watershed Management Plans

- Dingman Creek (PRF) - 1987 - for the Upper Thames CA
- Moodie Drive (AJR) - 1988 - for the City of Nepean
- Shirley's Brook (AJR) - 1988 - for the Mississippi Valley CA
- Eastman Drain (AJR) - 1988 - for the Raisin Region CA

## 5.0 STUDY COSTS

The estimated engineering fees, disbursements and total costs to complete the study are outlined in Table 1. The staff per diem rates are listed in Table 3. The breakdown of costs by component is given in Table 4. It is estimated that the study will cost $19,638 to complete in accordance with the Terms of Reference.

TABLE 3
STAFF PER DIEM RATES

| Title | Staff Member | 1989 Per Diem Rate (8 Hour Day) |
|---|---|---|
| Project Manager | P. Frigon | 528 |
| Project Engineer | R. Pankratz | 312 |
| Technologist | T. O'Brien | 272 |
| Surveyor | M. Gagne | 320 |
| Surveyor | E. Ferguson | 140 |
| Draftsperson | I. McKinnon | 280 |
| Secretarial | S. Peters | 264 |

## TABLE 4
## COMPONENT COSTS

| COMPONENT | FEES | DISBURSEMENTS |
|---|---|---|
| Background | N/A | N/A |
| Tender Document | $1,949 | $250 |
| Mapping Coordination | $1,372 | $50 |
| Map Checking and Reporting | $5,732 | $750 |
| Hydrology | N/A | N/A |
| Hydraulics | $4,103 | $400 |
| Floodline Maps | $2,712 | $200 |
| General Report | $1,028 | $100 |
| Meetings and Presentation | $792 | $200 |
| Sub-Total | $17,688 | $1,950 |
| **GRAND TOTAL** | **$19,638** | |

N/A - not applicable

## 6.0 STUDY SCHEDULE

A schedule of study tasks is presented in Figure 1. It is estimated that the study will be completed by November 1989. This will require approval to proceed by early April, 1989 so that a mapping contractor could be selected by early May, 1989. Air photography for those areas not covered in Phase II, must be completed in May of 1989 to meet the November deadline.