COMMUNAL SEWAGE WORKS SYSTEM
IN THE HAMLET OF ST-BERNARDIN
TOWNSHIP OF CALEDONIA
ENVIRONMENTAL STUDY REPORT

Report prepared for the
Ontario Ministry of the Environment
under the Provincial Direct Grant
Sewage Project No. 3-0630

Les ingénieurs
DESJARDINS/LASCELLES
engineering limited

August, 1992

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COMMUNAL SEWAGE WORKS SYSTEM
IN THE HAMLET OF ST-BERNARDIN
TOWNSHIP OF CALEDONIA
ENVIRONMENTAL STUDY REPORT

SECTION 1 - GENERAL

1.1 Terms of Reference

The Ministry of the Environment retained the firm of Desjardins/Lascelles Engineering Ltd to investigate the existing private sewage systems in the Hamlet of St-Bernardin and to prepare an engineering report recommending solutions with an estimate of cost.

A report titled "Report on Improvements to the Private Sewage Systems in the Hamlet of St-Bernardin, Township of Caledonia" and dated August, 1987 was prepared and presented to the Ministry of the Environment, to the Township of Caledonia and the residents of St-Bernardin.

Under clause 6.2 of this August 1987 report, a communal sewage works system was recommended to service 18 residences.

The Ministry of the Environment then retained the firm of Desjardins/Lascelles Engineering Ltd. to prepare an environmental study report for a communal sewage collection, treatment and disposal system for the Hamlet of St-Bernardin in the Township of Caledonia. The Terms of Reference outlining the requirements of the study are included in Appendix A.

1.2 Class EA Process

The Planning and Design Process Diagram for Class EA Type Municipal Sewage and Water Projects describes the Phases of such a study.

Section 2 of this report defines the problem.

Section 3 identifies alternative solutions.

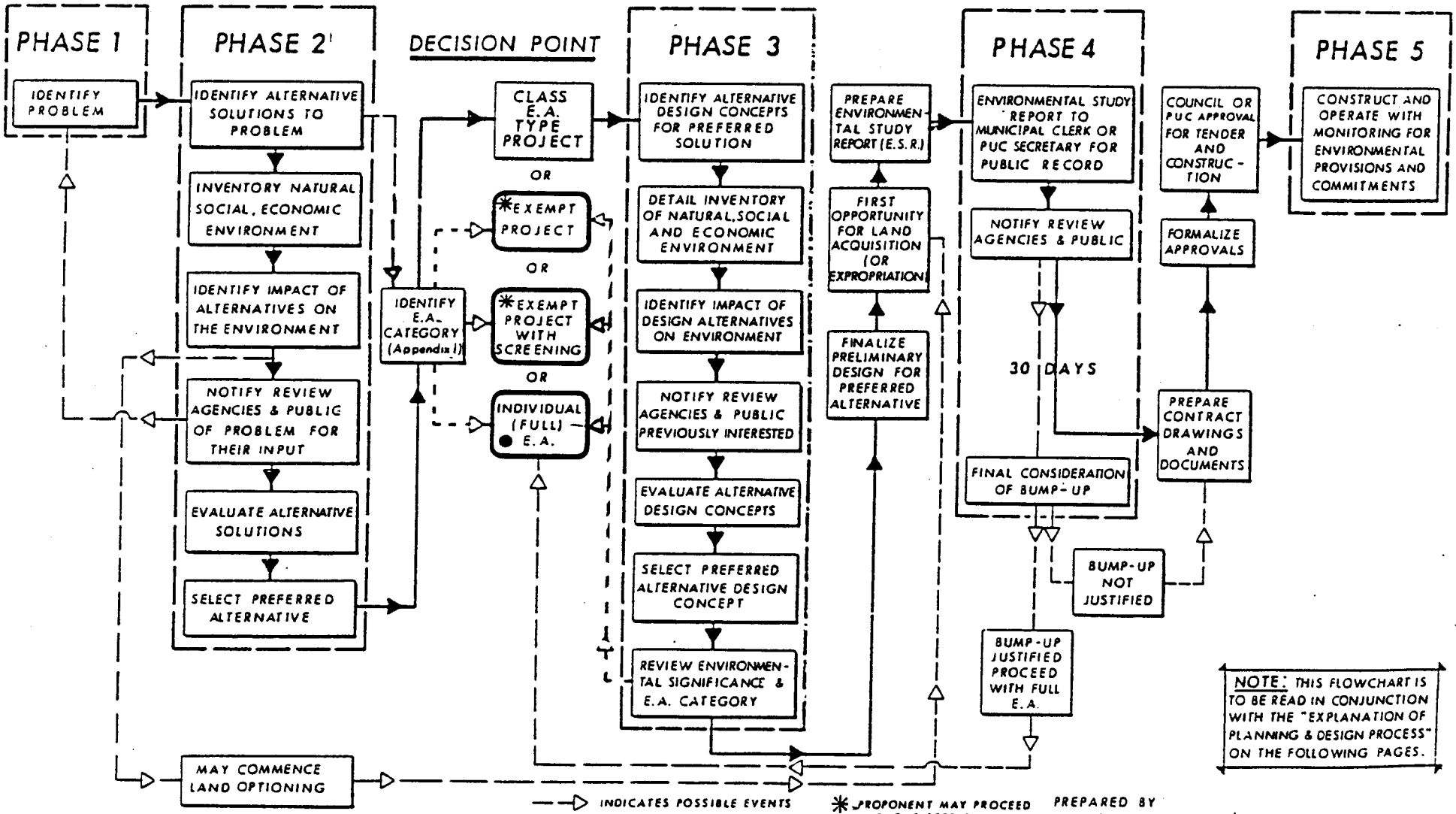
Section 4 provides an inventory of the natural, social and economic environment for the area, to be used as a measure for evaluation of alternatives.

Section 5 assesses the impact of alternatives on the environment.

Section 6 describes the agency and public contacts.

Section 7 evaluates the alternative solutions and design concepts leading to selection of the preferred alternative.

PLANNING & DESIGN PROCESS FOR CLASS E.A. TYPE MUNICIPAL SEWAGE AND WATER PROJECTS



PREPARED BY
MUNICIPAL ENGINEERS' ASSOCIATION
COMMITTEE ON CLASS ENVIRONMENTAL ASSESSMENTS

SECTION 2- PROBLEM IDENTIFICATION

2.1 General

A survey of the existing private sewage disposal systems in the Hamlet of St-Bernardin showed that the majority of residences in the Hamlet of St-Bernardin did not have an approved sewage disposal system and that sewage wastes were being discharged directly to the surface drainage ditches and the Caledonia Creek.

New sewage disposal systems have been constructed on individual properties where the space was available. On a number of lots, individual corrections could not be carried out and a communal system was recommended.

2.2 Location

The 14 residences and lots which form part of the proposed communal sewage disposal system are shown in Figure 1.

2.3 Purpose

This communal sewage disposal system is proposed to reduce public health problems, and to eliminate the contamination of ground water supply and surface water supply used for human consumption and livestock watering.

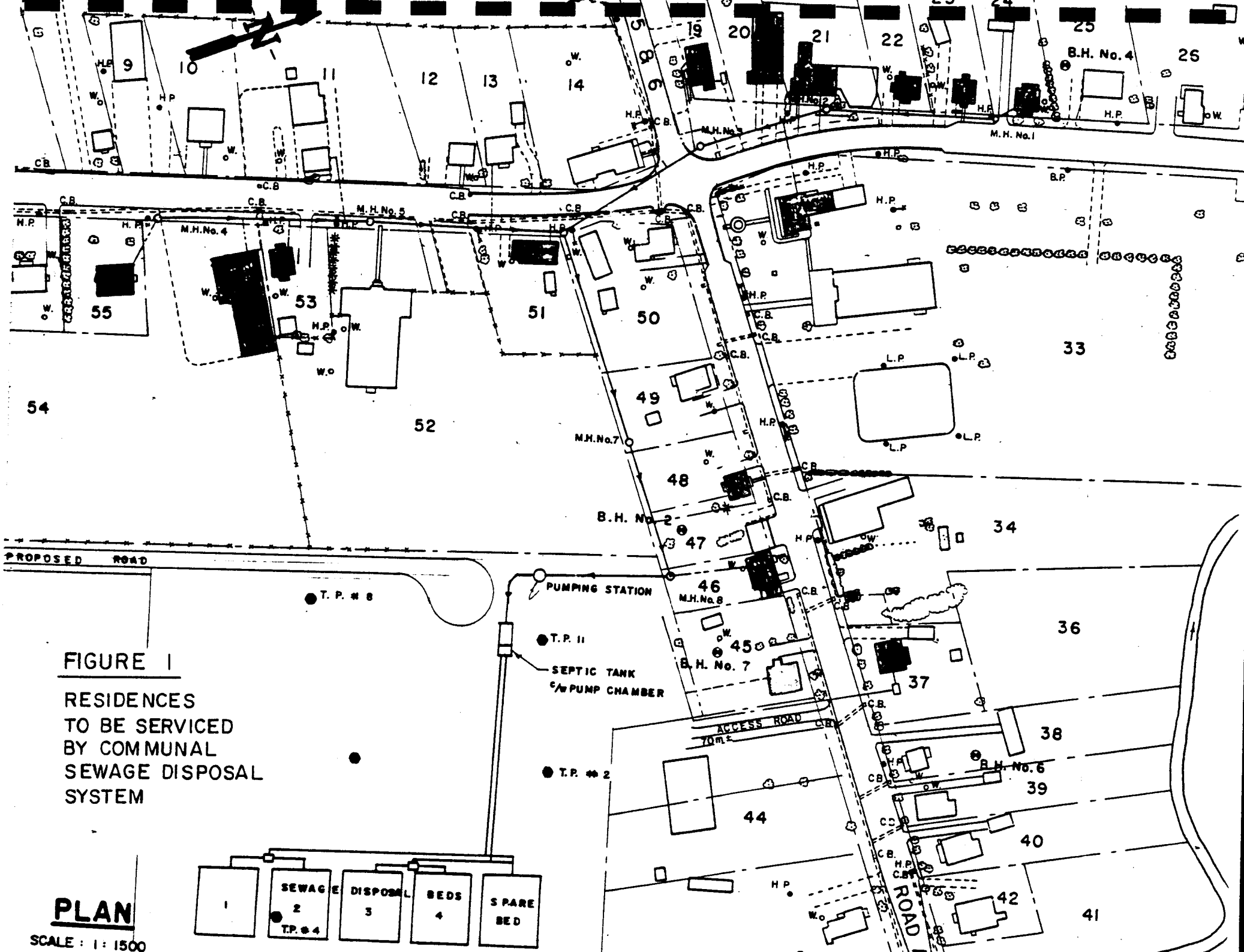


FIGURE 1

RESIDENCES
TO BE SERVICED
BY COMMUNAL
SEWAGE DISPOSAL
SYSTEM

PLAN

SCALE : 1 : 1500

SECTION 3- IDENTIFICATIONS OF ALTERNATIVE SOLUTIONS

3.1 General

The following alternatives have been identified as possible solutions which rate more detailed consideration:

1. Communal System

2. Sewers and sub-surface discharge sewage treatment facility

3. Sewers and lagoon discharge sewage treatment facility

4. Individual class 5 holding tank systems

5. "Do Nothing"

3.2 Communal System

A communal sewage disposal system is recommended for some 14 lots at and near the intersection of County Road No. 22 and the Concession Road between concessions 5 and 6 because it is impossible to accommodate conventional individual septic tank systems on these lots.

The individual system corrections are not feasible due to a lack of space, inadequate separation distances from existing wells, or due to severe terrain slope. Individual corrections are described in Appendix F.

3.2.1 Effluent requirements

The effluent requirements are dictated by MOE Policy 08-01 and its related guidelines.

In a communal septic tank and leaching beds system, the sewage is treated in the septic tank and the effluent discharged below the surface. The design should ensure that the underground water supply is not contaminated and that mounding is kept below the drainage tiles in the bed.

For a seasonal retention lagoon, the required effluent quality is:

BOD_5 less than 25 mg/L
Suspended Solids (SS) less than 30 mg/L
Total phosphorous (as P) less than 1.0 mg/L
with phosphorus removal.

3.2.2 Area to be Serviced

The area to be serviced includes the 14 lots shown in Figure 1. Six (6) additional lots shown as future connections may possibly request to be connected to the communal sewage system in the future.

The population for the 14 lots to be serviced is estimated at 42 persons.

If the 6 future connections are included in the serviced area then the projected connected population is estimated at 60 persons.

3.2.3 Sewage Collection System Alternatives

The alternatives available for the sewage collection are:

1. Gravity sewer
2. Vacuum sewer
3. Pressure sewer

3.2.3.1 Gravity Sewer

The great advantage of gravity systems is reliability and ease of operation and maintenance.

The size of pipe used will be 200 mm. and the material PVC.

Installation will be along existing roadways and acquired easements thus lessening the impact on the natural environment.

3.2.3.2 Vacuum Sewer

Advantages of a vacuum collection system are: Lower installation and material costs and minimal ground water infiltration.

Disadvantages include: Total dependence on hydro power and the pipe network must be fully sealed to maintain vacuum pressure in the system.

The impact on the environment would be similar to gravity sewer.

3.2.3.3 Pressure Sewer

With a pressure system, each household served by the system has a small pumping station located in its basement or on the property line. Because piped connections between the house and the collection line are normally 32mm (1 ¼") dia. pipe, grinder pumps must be used in each station to prevent clogging of lines.

The impact on the environment would also be similar to gravity sewer.

3.2.4 Sewage Pumping Station and Forcemain Alternatives

The alternatives available for the sewage pumping station and forcemain are:

1. Lift station
2. Individual pumping station
3. Vacuum collection station

3.2.4.1 Lift Station

A lift station is required with gravity sewers in order to pump the sewage to the septic tank or to the sewage retention lagoon via a PVC forcemain. High reliability is essential.

Some impact on the environment of pumping stations are: exposed to view, effect of operating noise, and change in property value. These can all be attenuated with proper construction techniques.

3.2.4.2 Individual Pumping Station

Individual pumping stations are required with a pressure sewer system. Each pumping station must be equipped with a grinder pump. The sump or holding tank normally holds 200 litres (60 gallons) of wastewater, but must be large enough to provide reserve capacity based on power outages. Provision to flush the system should be available.

The impact on the environment of these individual pumping stations are: changes in existing noise levels, and temporary disruption during construction.

3.2.4.3 Vacuum Collection Station

The vacuum collection station used with a vacuum sewer system

consists of vacuum collection tanks, vacuum pumps, sewage discharge pumps and an automatic controller. The vacuum pumps are completely automatic. Back-up or standby pumps are required.

The impact on the environment made by vacuum collection station are: effect of operating noises, temporary disruption during construction, and residents exposed to new view. As for the lift station, all these impact on the environment can be diminished with construction precautions.

3.2.5 Alternative Sewage Treatment Methods

The two alternatives considered for the treatment of the sewage are:

1. Septic tank and leaching beds
2. Seasonal retention lagoons

3.2.5.1 Septic Tank and Leaching Beds

The septic tank will remove solids from the sewage waste. The retained sludge undergoes partial digestion and must periodically be pumped out. A liquid effluent with low solids content is discharged to the receiving subsurface soil disposal system. Physical, chemical and biological reactions within the soil attenuates wastewater contaminants.

Pumps will be used to deliver an acceptable dose of treated effluent to the disposal beds.

A soils investigation at the site revealed that the soil at the proposed leaching beds location is suitable for absorption of the wastewater effluent. A replacement area equivalent to 100% of the initial field area has been provided.

The impact on the environment due to the installation of a septic tank and a tile field are: change in property value, erosion or compaction of the soils during construction, mixing of topsoil with subsoil, raising of water table, removal of productive farmland, overburden groundwater contamination at site and downgradient in the attenuation zone.

The first three impacts can be attenuated with good construction techniques. The purchase of groundwater rights off property in the direction of groundwater flow downgradient from the proposed leaching beds will permit attenuation by dispersion and dilution before the groundwater enters the creek.

3.2.5.2 Seasonal Retention Lagoon

Lagoons, or stabilization ponds, can be built to treat and retain the sewage waste before pond drawdown in the spring and fall. A large area is usually required for lagoons and lagoons should be fenced.

The desirable separation between lagoons and residential areas varies between 100 to 400 metres depending on the type of pond and characteristics of the waste.

The impact on the environment caused by the construction of a retention lagoon are: change in property value, erosion or compaction of the soils during construction, mixing of topsoil with subsoil, removal of productive farmland and possible nuisances due to odours, appearance and mosquitoes.

3.3 Individual Class 5 Holding Tank Systems

Under a Class 5 system, the holding tank is used to store sanitary sewage until a transport vehicle removes the wastewater to an authorized disposal site.

Controls are required to inform the owner when the holding tank should be emptied.

The major cost in operating a holding tank sewage haulage system is the cost for providing the pump-out and transfer device.

The rate charged for removing and hauling collected wastes will be approximately 2 cents per litre.

It is therefore necessary to keep the sewage flow per person as low as possible.

With sewage flow of 200 litres per person per day and 3 persons per residence, the daily sewage flow is estimated at 600 litres.

The haulage yearly rate will be approximately $4,380.00 and the holding tank will have to be pumped out on an average of once a week depending on the size of the tank.

The installation of a holding tank complete with controls is estimated at $4,500.00.

The impact on the environment caused by the construction of individual class 5 holding tank system are: loss of property space, temporary disruption during construction and possible contamination of surface watercourse caused by overflowing or spillage during pump out. These can be eliminated with good practices.

3.4 "Do Nothing"

The problems of sewage overflow to the watercourses and storm sewer drainage system and of wells contamination in the area have reached relatively serious levels. Some residences are discharging directly into the abutting stream and ditches.

To "do nothing" therefore does not represent a technical solution to existing problems and is not in conformity with Ontario Regulation 374/81 under Part VII of the Environmental Protection Act.

Financial and economic factors would offer the only basis on which to select this alternative as the preferred option.

SECTION 4 - INVENTORY OF THE NATURAL, SOCIAL AND ECONOMIC ENVIRONMENT

4.1 Natural Environment

4.1.1 General

General information on the natural environment of the study area was gathered through site survey and visits and through review of the soil survey for the County of Prescott under report no. 33 of the Ontario Soil Survey dated 1962.

4.1.2 Topography and Soils

The topography is level except where dissected by nearby watercourses.

The surface soils are mostly uplands fine sand which is a reddish brown, loose, fine sandy soils wiht sorted non-calcareous fine sand parent material and having good drainage characteristics.

The overburden is very thick being greater than 30 metres. The uppermost surficial deposit is deltaic sand and silt with reported thickness of 2 metres. Bedrock is found at depths greater than 30 metres.

4.1.3 Waterways and Drainage

The Caledonia Creek runs through the north end of the Hamlet across County Road no. 22 and flows to the South Nation River to the north-west.

A small watercourse runs parallel to County Road no.22 at approximately 50 metres west and empties into the Caledonia Creek.

A storm sewer system in the Hamlet drains County Road no.22 and the concession road allowance between concessions 5 and 6, and the abutting land. This storm sewer system outlets into the Caledonia Creek.

4.1.4 Conclusions

In general, the area is not one of high environmental sensitivity although the Caledonia Creek and connecting watercourse is considered significant and has local importance.

4.2 Social and Economic Environment

4.2.1 Regional Setting and Population

The Hamlet of St-Bernardin is located in the center of the Township of Caledonia.

The population of this community is about 200 and has not increased in the last 10 years.

There is no industry in this rural community but it has eight commercial and institutional establishments and approximately 50 residential dwellings.

4.2.2 Dwelling Characteristics

The Hamlet is characterized by single-detached houses and a corresponding high level of ownership. The average value of the dwellings is $85,000.00.

4.2.3 Current Economic Overview

The Hamlet of St-Bernardin is a small rural community. With a church, post-office and banking institution, this residential community is a gathering place for the surrounding farming residents.

SECTION 5 - POTENTIAL EFFECTS OF COMMUNAL SEWAGE WORKS SYSTEM

5.1 Natural Environment

The "do nothing" alternative requires no construction activities.

Construction of a large septic tank system would involve construction of sanitary sewer collection lines, a pumping station, a septic tank and leaching beds.

Construction of a seasonal retention lagoon would involve construction of sanitary sewer collection lines, a pumping station and a retention lagoon.

Sewage collection lines create local temporary disturbance to the natural environment but the effect is lessened since the lines are maintained within the existing road right-of-ways.

Construction of a septic tank and leaching beds or of a retention lagoon for treatment carries with it potential environmental concerns. Effects may include contamination of wells, altered natural drainage courses, disruption of vegetation, erosion, compaction and contamination of soils; which can all be mitigated by construction techniques.

An individual class 5 system also carries some minor potential environmental concerns. Effects may include disruption of vegetation, erosion, compaction and contamination of soils.

In conclusion, it is reasonable to suggest that a communal sewage disposal system may have a significant but acceptable environmental effect.

5.2 Human Environment

A communal sewage disposal system would satisfy human environmental objectives by ensuring that the domestic wastewater are collected, treated and disposed of in a safe and economical way.

An individual class 5 system entails dependence on a class 7 sewage system for waste disposal and this option may continue to have a negative effect on the human environment and could not be viewed as a long term solution.

The "do nothing" alternative entails that the sewage waste would continue to be discharged to the environment via the storm sewer and the watercourses and it would have a negative effect on the human environment since it does not deal with the existing pollution problem.

SECTION 6 - AGENCY AND PUBLIC CONTACTS

6.1 Agency Contacts

At the initiation stage of the study, a number of the provincial and local agencies were contacted by mail to inform them of the project, its location and of the alternative solutions being considered. In all cases, the opportunity for further involvement in the study was presented.

A copy of this preliminary environmental assement report will be submitted to the interested agencies for additional comments.

6.2 Public Open House Meetings

A meeting has been held with concerned property owners and the public on June 22, 1992.

Another public meeting was held on August 25, 1992.
Minutes of these two meetings are appended herewith under Appendix "D".

The opportunity for further involvement in the study was explained to the public.

SECTION 7 - PREFERRED SOLUTION

7.1 Evaluation of Alternatives

7.1.1 Sewage Collection System Alternatives

The alternatives considered for the sewage collection system are:

1. Gravity Sewer
2. Vacuum Sewer
3. Pressure Sewer

The gravity sewer collection is reliable and is easy to operate and to maintain. A low lift pumping station is required to pump the wastewater to the septic tank. The impact on the environment will be minimal.

The vacuum sewer system is totally dependent on hydro power and is fairly costly to maintain. The material and installation costs are similar to a gravity sewer collection system. The impact on the environment would also be minimal.

The pressure sewer system is fairly costly to maintain and the material and installation costs are slightly higher than for a gravity sewer collection system. The impact on the environment is also minimal.

7.1.2 Sewage Pumping Station and Forcemain Alternatives

The alternatives available with sewage collection systems considered above are:

1. Lift Station
2. Vacuum Collection Station
3. Individual Pumping Station

The low lift pumping station is required with the gravity collection sewer to raise the wastewater into the septic tank; otherwise the septic tank would be installed at too great a depth.

A vacuum collection station is required with the vacuum sewer system. Maintenance of the system is sophisticated and requires special servicing.

Individual pumping stations are required with the pressure sewer. Maintenance of these stations may have to be carried out by the individual owners. The system must also be flushed at regular intervals.

All of these alternatives have similar impact on the environment.

7.1.3 Alternative Sewage Treatment Methods

The septic tank and leaching beds sewage treatment is more economical than the seasonal retention lagoon.

The septic tank has to be emptied once a year. The seasonal retention lagoon has to be drawndown every fall and spring. Pond drawdown or discharge of lagoon contents would have to be to the Caledonia Creek.

Normally, the retention lagoon should be fenced to discourage trespassing.

The operation of a seasonal retention lagoon requires an estimated 400 man-hours per year.

The impact on the environment caused by the construction of a retention lagoon is much more pronounced than for a septic tank and leaching beds sewage treatment installation.

7.1.4 Individual Class 5 Holding Tank System

The haulage cost for a class 5 system are prohibitive and a holding tank system should only be used as a temporary measure.

Individual Class 5 holding tank system is not a viable alternative and should not be considered further.

7.1.5 "Do Nothing"

This alternative solution should not be considered since sewage will continue to be directed to the surface drainage system and wells will continue to be contaminated.

7.2 Selection of Preferred Alternative

The selected preferred alternative is a gravity collection sewer with a low lift pumping station and a septic tank and leaching beds treatment system.

This alternative has little impact on the environment, is the most economical and provides some flexibility and a margin of safety in case of overloading.

Drawings have been prepared and are attached herewith showing the preliminary collection system selected with respective sizes and slopes of the sewers and a preliminary layout of the sewage treatment facility.

A summary of the design parameters utilized in the sizing of the sewage collection system, pumping stations, forcemains, septic tank and leaching beds is enclosed under Appendix "C".

A proposed by-law governing the usage of the municipal sewage treatment facility and collection system within the service area (sewer use by-law) will be prepared.

7.3 Capital and Operating Cost Estimates.

The total estimate of cost for the construction of the preferred alternative is $225,385.00 including engineering supervision costs (8%) and contingencies (5%).

The total cost per residence will thus be approximately $15,562.00 and lot no. 19 will have to pay an additional estimated $7,517.00 for the restaurant.

With a direct grant of 85% from the MOE, the net capital cost per individual residence is estimated at $2,335.00.

The annual cost for operating and maintenance of the sewage disposal system is estimated at $2,380.00 and the cost per residence will thus be approximately $170.00 per year.

Respectfully submitted this 25th day of August, 1992.

Les ingénieurs
DESJARDINS/LASCELLES
engineering limited

per _____
Gaetan H. Lascelles, P. Eng.

Revised January 14, 1993
Revised October, 1993

Project No. 3-0630

A P P E N D I X "A"

TERMS OF REFERENCE
SEWAGE WORKS SYSTEM
TOWNSHIP OF CALEDONIA - HAMLET OF ST. BERNARDIN

GENERAL REQUIREMENTS

General compliance with task requirements of the MEA Class Environmental Assessment for Municipal Sewage and Water projects should be undertaken especially as it relates to the process of mandatory contacts and public participation resulting in the submission of an Environmental Study Report (ESR).

The ESR is to detail the planning and design process for a sewage works system to serve the eighteen (18) residences referred to in clause 7.5 of the August, 1987 "Report on Improvements to Private Sewage Systems in the Hamlet of St. Bernardin - Township of Caledonia" prepared by Desjardins/Lascelles Engineering Limited. It should also be sufficiently detailed to permit the Municipality to obtain a Conditional Certificate of Approval from the Ministry of the Environment for the required works after the 30-day public review period as well as to facilitate the arrangement of financing for the program.

The formation of a Liaison Committee should be initiated to consist of representatives from the Municipality, Ministry of the Environment and Consulting Engineer. The Liaison Committee would provide direction to the Consulting Engineer on the nature and scope of assigned tasks.

In carrying out the study the consultant should refer to the applicable section(s) of the Ministry's "Guidelines for the Design of Sanitary Sewage Works, Storm Sewers (Interim), Water Distribution Systems, Water Storage Facilities, Servicing of Areas Subject to Adverse Conditions, Water Supply for Small Residential Developments, Seasonally Operated Water Supplies and the associated Appendices" as well as the Ministry's "Guidelines for the Design of Water and Sewage Treatment Works".

WORK PROGRAM FOR PHASE 1 AND PHASE 2

Note: "Phase" Numbering corresponds with the planning and design process of the MEA Sewage/Water Class EA.

1.1.0 Meet with MOE Project Supervisor to review Terms of Reference and work program.

1.2.0 Based on the Report referred to in the second paragraph, page 1 of this Appendix A, state the problem to be addressed, namely:
- sewage being discharged to the storm sewer and drainage system.

2.1.0 State alternative solutions including but not limited to the following:

- Communal System
- Sewers and sub-surface discharge sewage treatment facility
- Sewers and lagoon discharge sewage treatment facility
- Do nothing.

2.1.1 State why individual system corrections are not feasible.

2.1.2 Establish the criteria for Sewage Treatment facility effluent quality and have these criteria

accepted by the Ministry of the Environment, Technical Support Southeast Region and Central/Southeast Approvals Supervisor. This shall be done by a combination of literature research, flow and water quality measurements upstream and downstream of proposed treatment facility locations.

The foregoing receiving water assessment procedures must be technically sound and acceptable to the Ministry. Technical Advice and guidance on procedures will be provided on request by the Ministry's Water Resources Branch, or Regional Offices' Technical Support Section, or from published procedures such as, "stream Water Quality Assessment Procedures Manual", March 1980, Ministry of the Environment, Water Resources Branch.

The effluent quality criteria should be consistent with the requirements outlined in the Ministry of the Environment publication "Water Management Goals, Policies, Objectives and Implementation Procedures", the "Canada - Ontario Agreement on Great Lakes Water Quality" and applicable Ontario polices.

2.2.0 Determine the mandatory contacts in accordance with the MEA Class EA.

2.2.1 Involve the mandatory contacts, other government agencies and the public in the discussion of the project in a manner acceptable to the Liaison Committee (e.g. questionnaires, newspaper advertisements, public meetings, etc.) The following information is to be provided upon initial contact:

- outline of the problem
- planning done to date
- alternative solutions being considered
- proceeding under MEA Class EA
- "bump-up" rights
- contact person of proponent

- how to stay further involved in planning process

2.3.0 Define problem area to be serviced, namely the eighteen (18) residences referred to in clause 7.5 of the report identified on page 1, paragraph 2.

2.3.1 Define population projections, flow and waste loading projections associated with the existing/ new works and identify constraints for the problem area.

2.3.2 Define sewage collection system alternatives for the problem area to be evaluated, extent of evaluation, and impact of the alternatives on the natural, social and economic environment.

2.3.3 Define sewage pumping station and forcemain alternatives for the problem area to be evaluated, extent of evaluation, and impact of the alternatives on the natural, social and economic environment.

2.3.4 Define alternative sewage treatment methods, based on effluent criteria developed in 2.1.2, to be evaluated including sludge management program, buffer zone requirements, etc. Define extent of the evaluation, and impact of the alternative on the natural, social and economic environment.

2.4.0 Detail the additional information and data required to identify the impact of the alternatives on the environment in order to adequately evaluate the alternatives identified in 2.3.2 to 2.3.4, complete with work schedule and costs for each component. Carry out a preliminary soils investigation to determine the relative merits of the sites selected as being possibly suitable for this project.

2.5.0 After acquiring all necessary information and data and input from the mandatory contacts, government agencies and the public, evaluate any additional identified alternative solutions including the impact of the alternatives on the environment.

2.6.0 Review 2.5.0 with MOE staff through Project Supervisor and with Liaison Committee.

2.7.0 With information from 2.5.0 consider the necessity of optioning land.

2.8.0 Present information concerning the following to the Municipal Council for the problem area:

- service area information
- sewage collection system alternatives
- sewage pumping station and forcemain alternatives
- sewage treatment alternatives based on effluent criteria
- need for property options, easements, etc.
- environmental impacts of alternative solutions

2.8.1 Hold public information meeting or open house to present the following for the problem area:

- service area information
- sewage collection system alternatives
- sewage pumping station and forcemain alternatives
- sewage treatment alternatives based on effluent criteria
- need for property option, easements, etc.
- environmental impact of alternative solutions

2.9.0 Select preferred solution and identify EA category.

END OF PHASE 2

WORK PROGRAM FOR PHASE 3 AND PHASE 4

3.1.0 Make preliminary selection of preferred alternative design concept.

3.1.1 Prepare a general/master plan showing the area to be serviced, the service area limits, land requirements, existing buildings and the layout of the existing collection system with respective sizes.

3.1.2 Prepare a summary of the design parameters utilized in sizing of the sewage collection system, pumping stations and forcemains. These parameters should include but not be limited to the existing and design population, the design sewage flow from domestic, commercial, institutional and other users, and allowance for inflow/infiltration.

3.1.3 Prepare a master plan showing the preliminary collection system with respective sizes and slopes of the sewers for the proposed alternative design concept.

3.1.4 Prepare a proposed by-law governing the usage of the municipal sewage treatment facility and collection system within the service area (e.g. sewer use by-law).

3.1.5 Investigate in detail the selected sewage treatment facility and location including:

- hydrogeology/soils
- mapping
- site plan preparation
- site ecology
- site archaeology

3.1.6 Prepare a summary of the design parameters utilized in sizing the sewage treatment facility. These parameters should include by not be limited to the existing and design population, design sewage flows, sludge management program, buffer zone requirements, effluent discharge criteria and methods of discharge.

3.1.7 Prepare a preliminary layout of the sewage treatment facility of the proposed alternative design concept.

3.1.8 Provide detailed capital and operating cost estimates for the preferred alternative design concept.

3.1.9 Consider financial implication of project with respect to:

- available subsidies
- cost per connection based on gross and net capital costs

- proposed rates and average homeowner charges
- revenue and expenditure statement.

3.2.0 Identify any new mandatory contacts based on the preferred alternative design concept that have to be made, especially with the public.

3.2.1 Present the following information to the MOE staff through the Project Supervisor for review:

- servicing details
- details of sewage collection system including impacts on environment
- details of sewage pumping station(s) and forcemain(s), including impacts on environment
- details of sewage treatment facility, including impacts on environment
- financing of project

3.2.2 Present the preceeding information to Municipal Council.

3.2.3 Notify review agencies, new mandatory contacts and public previously involved of public information meeting or open house to discuss:

- servicing details
- details of sewage collection system including impacts on environment

- details of sewage pumping station(s) and forcemain(s) including impacts on environment
- details of sewage treatment facility including impacts on environment
- financing of projects

3.2.4 Evaluate feedback from 3.2.0 to 3.2.3 and discuss with MOE staff and Liaison Committee through Project Supervisor.

3.3.0 Finalize preliminary design for preferred alternative design concept.

3.4.0 Finalize Environmental Study Report (E.S.R.)

3.5.0 Submit ESR to Project Supervisor (15 copies) for comment and approval to release ESR for 30-day public review.

End of Phase 3

Phase 4 of MEA Class EA Planning and Design Process.

4.1.0 Place ESR in the "Public Record File".

4.2.0 Notify review agencies and public still involved in the project of the start of the 30-day public review period.

4.3.0 Discuss feedback from the 30-day public review with MOE staff through Project Supervisor and with the Liaison Committee.

4.4.0 In case of no "bump-up" forward ESR and Application for Works to MOE to obtain Conditional Certificate of Approval for preferred design solution(s).

End of Phase 4

APPENDIX "B"

HYDROGEOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED COMMUNAL SEWAGE DISPOSAL SYSTEM FOR THE HAMLET OF ST. BERNARDIN TOWNSHIP OF CALEDONIA

Prepared For:	Desjardins Lascelles Engineering Ltd.
Prepared By:	Geo-analysis Inc.
Dated:	February, 1992
Our File No.:	G9161
Your File No.:	89-103

GEO-ANALYSIS
P.O. Box 13010
Kanata, Ontario K2K 1X3
Telephone (613) 592-3900

21 February 1992

Desjardins Lascelles Engineering Ltd.
872 James Street
Hawkesbury, Ontario
K6A 2S2

Attention: Mr. Gaetan Lascelles, P.Eng.

Re: Proposed Communal Sewage Disposal System for the Hamlet of St. Bernardin; Our File No. G9161

Dear Sir:

Geo-analysis Inc. is pleased to submit 5 copies of the hydrogeological impact assessment of the above referenced project. Our project demonstrates that the soil at the proposed location is capable of accepting the proposed loading of 19500 L/day. A raised bed design will be required in order to provide 0.5 m of unsaturated soil over the groundwater mounding resulting from the loading.

Geo-analysis Inc. recommends:

1) that the leaching system be constructed as a fully raised bed with the tiles at a minimum of 0.9 m above the existing ground level over an area of 6000 m^2; or as raised bed with the tiles at a minimum of 1.6 m above the existing ground level over an area of 3000 m^2.
2) that the leaching system be located within the area depicted in Figure 2b;
3) that no overburden wells be constructed downgradient or within 60 metres from the proposed communal leaching system;
4) that the proposed leaching system be located at a minimum distance of 30 m from the creek
5) that a monitoring program be implemented.

If you have any questions regarding this report, please contact this office.

Yours very truly,

GEO-ANALYSIS INC.

Jacques J. Sauriol, M.Sc.
General Manager

JJS/pc

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1.0 INTRODUCTION

The purpose of this report is to analyze the hydrogeological impact of the proposed communal sewage disposal system for the Hamlet of St. Bernardin. The Hamlet of St. Bernardin is located on parts of Lots 12 and 13, Concessions V and VI, in the Township of Caledonia, County of Prescott (see Figure 1).

The proposed location of the sewage disposal system is on part of Lot 44 (see Figure 2 and 2b (back pocket)) at the southeast edge of the Hamlet. The proposed sewage disposal system will accomodate a maximum of 20 residences.

The report simulates the groundwater flow and calculates the groundwater mounding which represent the hydraulic capacity of the site for septic system effluent.
Geo-analysis Inc. also provides an opinion on the terrain suitability for large volume effluent disposal and its impact on the groundwater quality.

2.0 HYDROGEOLOGICAL SETTING

The hydrogeological setting for the site is as shown in Figure 3. The hydrogeological setting for the Village of St. Bernardin was previously described in Geo-analysis Inc. reports dated September 1986 and February 1987. The overburden aquifer consists of 3 units: a thin layer of fine orange-brown sand (typically 0.5-1.0 m thick), a layer of orange-brown sandy silt (typically 1.5-2.0 m thick) and a thick layer of grey clay (typically 30-40 m thick). According to the MOE waterwell logs, a confined aquifer consisting of approximately 3 m of gravel overlying shale can be found underlying the grey clay.

The hydrogeological setting was derived from test pits performed by Geo-analysis Inc. in December 1991 and MOE waterwell logs. The test pits are located as shown in Figure 2 and 2b. Appendix A includes the description of the test pits and the MOE waterwell logs.

The direction of the overburden groundwater flow is in an easterly direction towards Caledonia Creek (see Figure 2). The groundwater was found at 0.6 to 1.5 m below the ground level. Guelph permeameter tests performed in thin fine orange-brown sand layer resulted in hydraulic conductivity value of 2.9×10^{-4} cm/sec while a test performed in the orange-grey sandy silt resulted in a hydraulic conductivity of 1.3×10^{-5} cm/sec. Particle size determinations for these two layers are included in Appendix A.

3.0 GROUNDWATER MOUNDING

3.1 Model Selection

The MODFLOW (Modular Three-Dimensional Finite Difference Groundwater Flow Model) model developed, documented and validated by the United States Geological Survey (McDonald and Harbough) was used in the groundwater mounding analysis for the proposed septic system. Two scenarios were modelled: a) a proposed leaching area of 3000 m^2 and b) a leaching area of 6000 m^2.

3.2 Conceptual Model

The conceptual model consisted of 33 rows x 38 columns variably spaced grid (over a total area of 600 m x 600 m) (see Figure 4). The proposed septic system was discretized in 10 m x 10 m grid elements. The base of the aquifer was defined by the sloping impermeable thick grey clay layer ($K \approx 1x10^{-7}$ cm/sec). The slope of the clay plane is approximately 0.005.

The boundary conditions were set according to the observed groundwater flow. The westerly and easterly boundaries were chosen as constant head boundaries. Ground surface elevations were obtained from a plan by Desjardins/Lascelles Engineering Ltd..

3.3 Input Parameters

The initial heads were set according to spring elevations (0.6 m to 1.5 m below ground surface) as measured in previous studies. Areal recharge from precipitation was neglected due to the assumption of seasonally elevated groundwater as initial heads. No evapotranspiration was used in order to simulate worst case scenario.

The aquifer was assumed to be isotropic with regards to the permeability in the x and y directions. The storativity was set equal in all grid elements and was assumed to be 20% for the equivalent layer.

The loading of the septic system was specified by an inflow unit discharge for each grid elements located under the proposed septic system. The model was first calibrated through steady state runs using the seasonally elevated groundwater elevations and a weighted average hydraulic conductivity of 5.2×10^{-4} cm/sec for the equivalent layer. The equivalent layer consisted of an imported sand fill ($K = 1 \times 10^{-3}$ cm/sec), the orange-brown sand (3×10^{-4} cm/sec) and the orange-brown sandy silt (1.3×10^{-5} cm/sec). The model was then validated using the groundwater values observed for December 1991. The calibration and validation was optimized after 18 runs. The resulting heads from the steady state run for the calibrated seasonally elevated groundwater levels were then used as initial heads for the sewage disposal system loading simulations. The initial heads and model grid are shown in Figure 4 and 4a.

3.4 Results

The simulation was performed with one year transient runs. The simulation using 19,500 L/day over the originally proposed sewage disposal area of 3000 m^2 resulted in mounds of 2.2 m above the original groundwater elevations. The simulation of 19,500 L/day over a proposed sewage disposal system area of 6000 m^2 resulted in a maximum mound of 1.5 m. The resulting hydraulic head distributions for scenarios A and B are shown in Figure 5 and 5a respectively. The resulting groundwater mounds above original groundwater tables for scenarios A and B are shown in Figure 6 and 6a respectively.

3.5 Groundwater Mounding Discussion

The results of the modelling are sensitive to the selection of the aquifer hydraulic conductivity and specific yield. The value of storativity estimated for the equivalent layer is a reasonable selection (Fetter 1988). The proposed sewage disposal system with a leaching area of 3000 m^2 results in mounds of 2.2 m above existing groundwater levels, and the septic system leaching tiles should be built at a minimum of 1.6 m above existing ground levels. A leaching area of 6000 m^2 resulted in mounds of 1.5 m above original groundwater levels and the septic system leaching tiles for this option should be built at 0.9 m above existing ground levels. The imported sand fill used for the raised leaching bed should have an hydraulic conductivity of 1×10^{-3} cm/sec.

Geo-analysis Inc. believes that the large evapotranspiration that commonly occurs in the summer months will offset the effect of the gradual rise in the water table and that the system will effectively reach steady state within a one year period.

4.0 GROUNDWATER QUALITY

4.1 Nitrate Loading

4.1.1 Model Selection

The MOC (Computer Model of Two-Dimensional Solute Transport and Dispersion in Groundwater) developed, documented and validated by the United States Geological Survey (Konikow and Bredehoeft) was used in the nitrate loading analysis of the proposed septic system.

4.1.2 Conceptual Model

The conceptual model consisted of a 20 row x 20 column (600 m x 600 m) uniformally spaced grid. The proposed septic system was represented by a series of injection wells over four grid elements. The boundary conditions, base and slope of aquifer were all consistent with the input data used in MODFLOW.

4.1.3 Input Parameters

The aquifer parameters used in the MODFLOW model were duplicated for the MOC model. The longitudinal dispersivity was set to 10 m. The loading of the septic system was specified by effective injection rate of 6,500 L/day over the leaching area and an initial nitrate concentration of 40 mg/L. A background nitrate concentration of 3 mg/L was set equal in all grid elements as measured in test pits located nearby the proposed foot print of the bed.

4.1.4 Results

The results of the modelling are graphically shown in Figure 7. The plume reaches Caledonia Creek with maximum nitrate levels of 18 mg/L after 20 years (steady state). ,

4.1.5 Discussion

The results are sensitive to the selection of the aquifer hydraulic conductivities. A slower hydraulic conductivity produced wider plumes. The simulated nitrate levels reach 18 mg/L for both scenarios before discharging through the riverbed. Cherry et al (1991) demonstrated that nitrate travelling through riverbed sediments will undergo vigorous denitrification as a result of anaerobic conditions and elevated organic matter. The organic matter enriched riverbed environment at St. Bernardin seem to indicate that such denitrification is likely to occur. In such environments, nitrate levels have been reduced from 20 mg/L to less than 0.5 mg/L in the last meter before discharging into the river (Cherry 1991).

In addition, the organic carbon fraction (FOC) measured in the soils in the area of the proposed sewage disposal system location were 0.0018 for the fine orange-brown sand and 0.0039 for the orange-brown sandy silts. These concentrations are equivalent to one order of magnitude over the measured FOC in the Cambridge Aquifer (Cherry, 1991).

4.2 Overburden Drinking Groundwater

Samples were taken from the surface water at Caledonia Creek and yielded nitrate concentration of 0.71 mg/L. Sampling results for water quality are included in Appendix A. Nitrate levels were sampled at residences 1, 2 and 3 (see Figure 2 for sampling locations) and yielded concentrations of <0.10 mg/L for residences 1, 2 and 1.03 mg/L for residence 3. All were below the Ontario Drinking water guideline of 10 mg/L. Samples taken in the field yielded nitrate levels ranging from 0.6 mg/L for TP8 to 9.0 mg/L for TP1. The high values are still below the MOE guideline of 10 mg/L. The field is used agriculturally for the growth of corn and the nitrates are thought to originate from the use of fertilizers. The proposed leaching areas of 3000 or 6000 result in loading rates of less than the 5 $L/m^2/day$ suggested MOE criteria.

The model FLOWPATH was utilized to generate the pathlines for the overburden wells neighbouring the proposed sewage disposal area. The input parameters for this simulation were consistent with the ones used for the MODFLOW and MOC. The resulting pathlines are as shown in Figure 8. The effluent from the proposed septic system is not captured by the neighbouring overburden wells pumping at 3000 L/day.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The analysis provided in this report yielded the following information:

1. As predicted by the MODFLOW model, the mounded hydraulic surface caused by the effluent loading of 19,500 L/day over a proposed leaching area of 3000 m^2 is expected to reach 2.2 m above the original groundwater surface. The mound is expected to be raised 1.5 m above the original groundwater surface for the effluent loading of 19,500 L/day over a proposed leaching area of 6000 m^2.

2. The nitrate levels for either scenario as modelled by MOC are expected to reach levels of 18 mg/L before undergoing denitrification by the riverbed sediments.

3. The existing overburden shallow wells modelled in FLOWPATH are not expected to capture effluents from the proposed sewage disposal system.

The analysis yielded the following recommendations:

1. That the sewage disposal system be located within the area shown on Figure 2b. This location is recommended in order not to interfere with the existing overburden wells capture zones.

2. That the leaching tiles be built at a minimum of 1.6 m above ground elevation for the 3000 m^2 leaching area (scenario A) or 0.9 m above ground elevation for the 6000 m^2 leaching area (scenario B). The raised height is necessary to provide the vertical 0.5 m separation distance above the maximum height of the mound under the proposed bed area.

3. The proposed bed should be located at a minimum distance of 30 m from the creek.

4. It is recommended that no new overburden wells be located directly downgradient from the proposed sewage disposal system or 60 m of the proposed sewage disposal system.

5. It is recommended that a monitoring program be implemented to monitor hydraulic head in the overburden on the property and to monitor well water quality for nitrates.

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Cherry, J.A., Robertson, J.A. and Sudicky, E.A., 1991, "Groundwater Contamination from Two Small Septic Systems on Sand Aquifers", Groundwater, Volume 29, No. 1.

Fetter, C.W., 1988, "Applied Hydrogeology", 2nd Edition, Macmillan Publishing Company, New York, N.Y.

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Konikow L.F. and Bredehoeft J.D., 1984, "Computer Model of Two-Dimensional Solute Transport and Dispersion in Groundwater" Chapter C2, Book 7, USGS, Alexandria, Virginia

McDonald, M.G., and Harbough, A.W., 1988, "A Modular Three Dimensional Finite-Difference Groundwater Flow Model", Technique of Water Resources Investigations of the United States Geological, Survey, Book 6, Chapter A1, U.S.

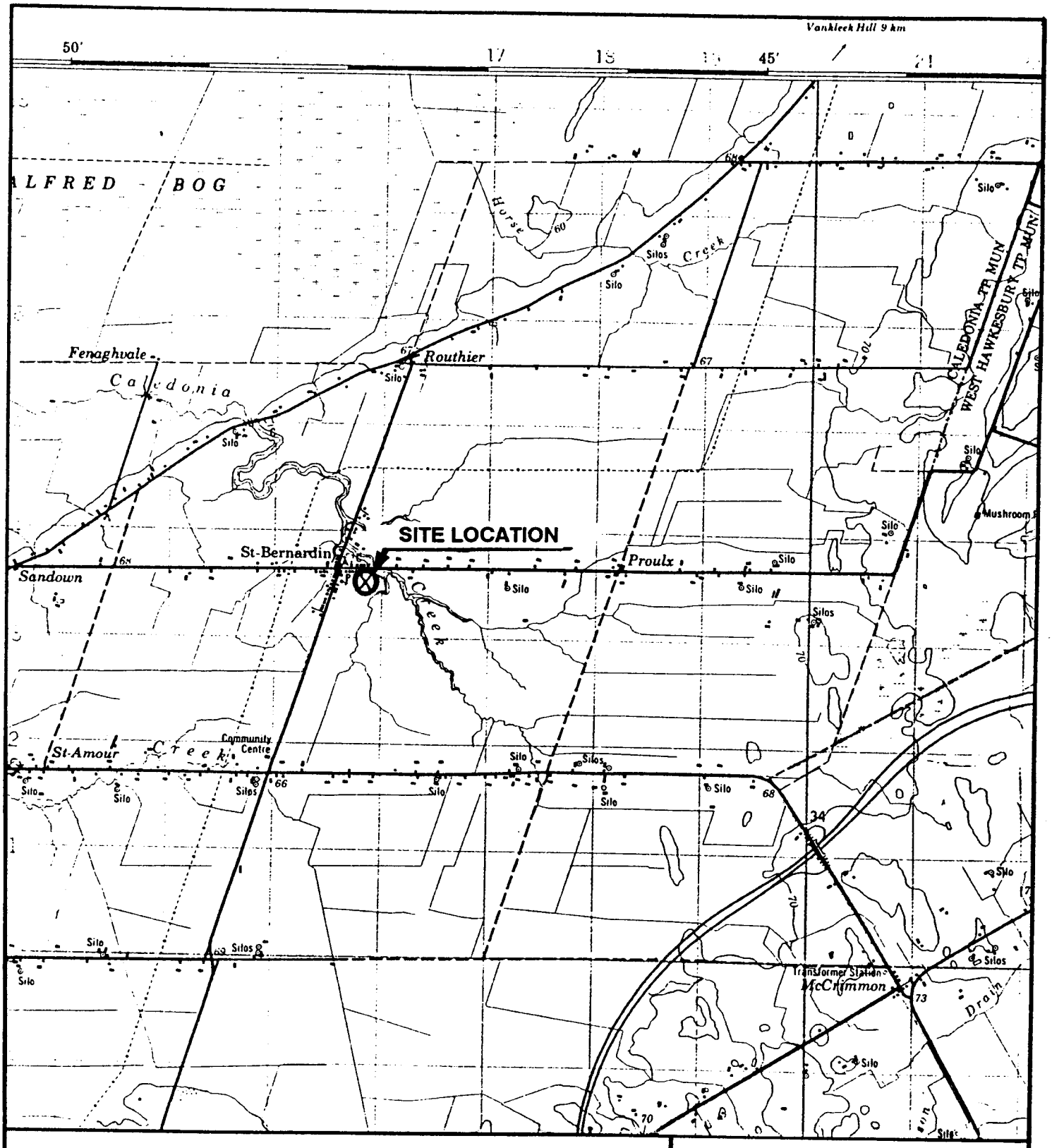

FIGURE 1: SITE LOCATION MAP

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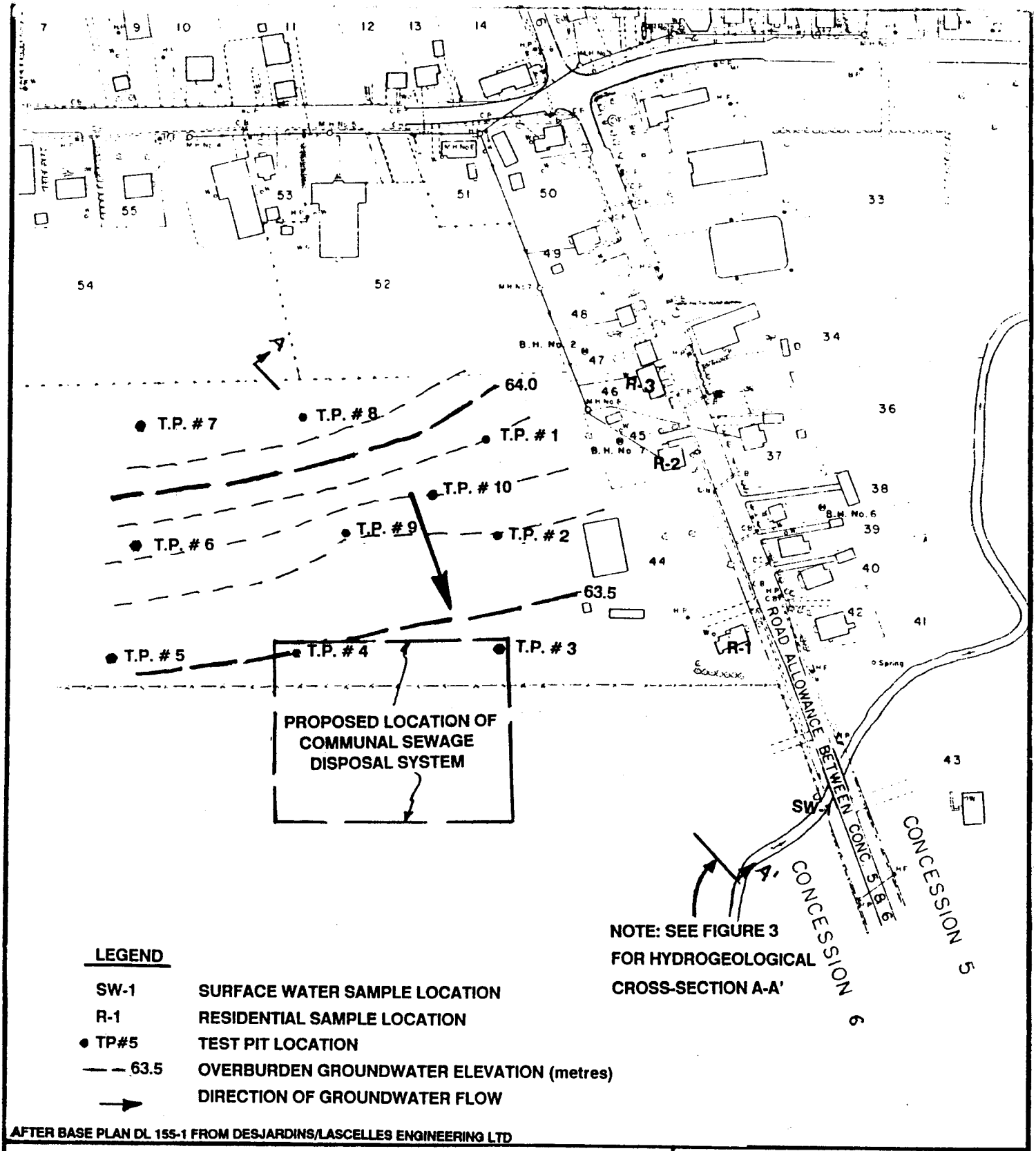

LEGEND

SW-1	SURFACE WATER SAMPLE LOCATION
R-1	RESIDENTIAL SAMPLE LOCATION
• TP#5	TEST PIT LOCATION
— — 63.5	OVERBURDEN GROUNDWATER ELEVATION (metres)
→	DIRECTION OF GROUNDWATER FLOW

AFTER BASE PLAN DL 155-1 FROM DESJARDINS/LASCELLES ENGINEERING LTD

FIGURE 2: -TEST PIT AND SAMPLING LOCATION MAP

-PROPOSED COMMUNAL SEWAGE DISPOSAL SYSTEM LOCATION MAP

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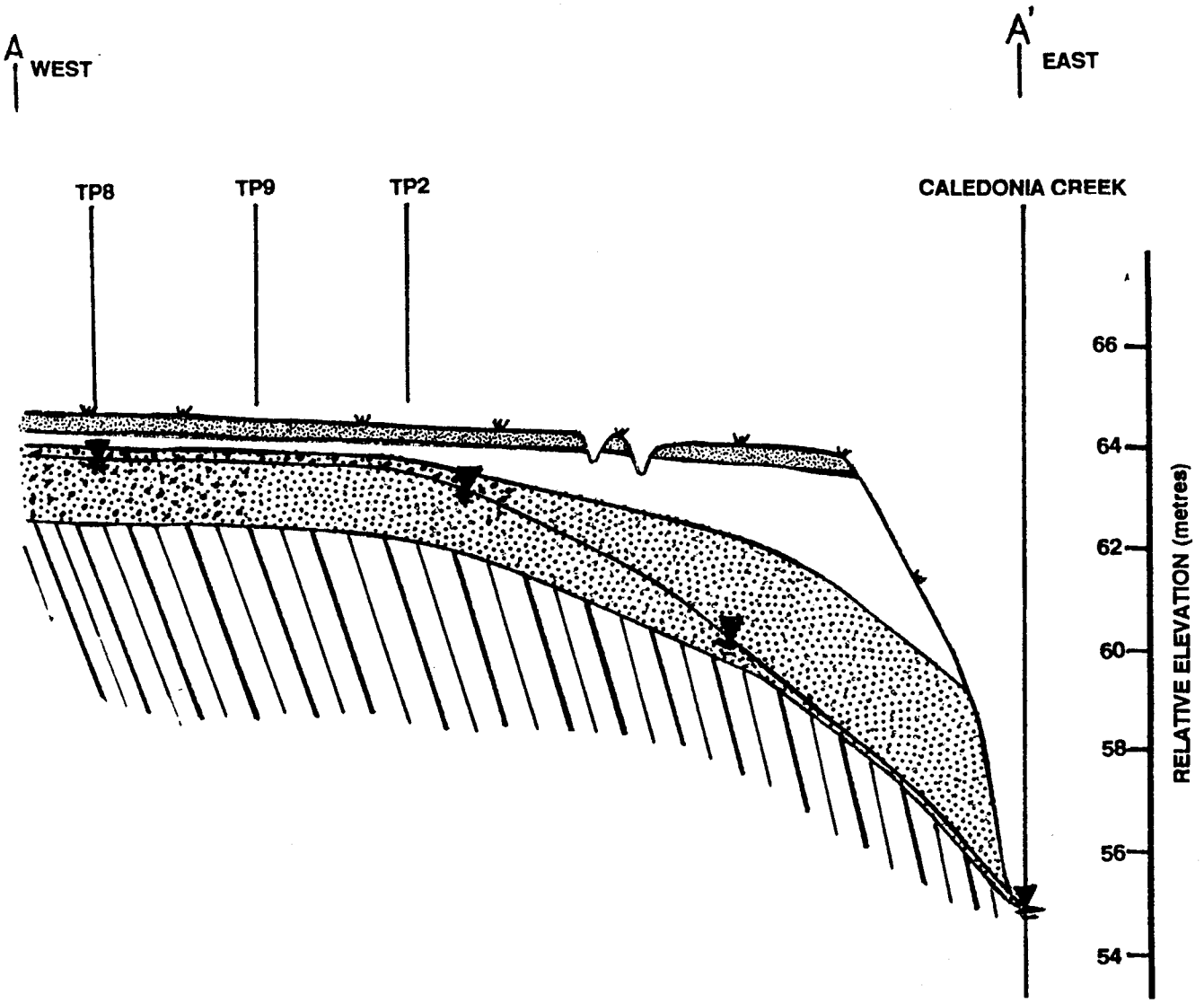
GEO-ANALYSIS



LEGEND

- GREY-BROWN FINE SANDY TOPSOIL
- ORANGE-BROWN MEDIUM SILTY SAND
- ORANGE-BROWN SANDY SILT
- FINE GRAINED WET GREY CLAY
- GROUNDWATER ELEVATION (DECEMBER 1991)

NOTE: SEE FIGURE 2 FOR LOCATION OF CROSS-SECTION A-A'

FIGURE 3: HYDROGEOLOGICAL CROSS-SECTION A-A'

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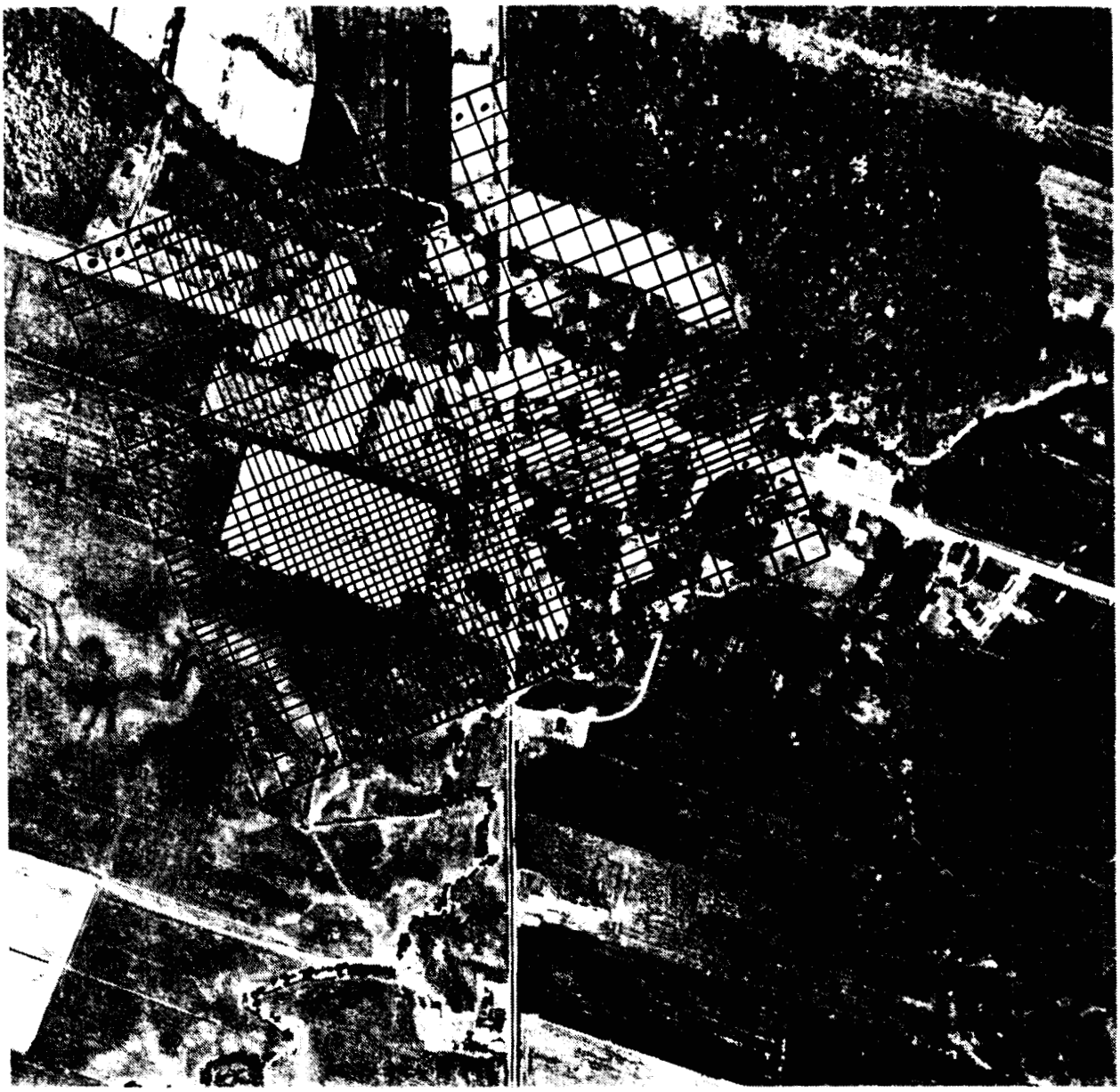
G9161
HORIZONTAL
1≃ 2 000

GEO-ANALYSIS



LEGEND:

- MODEL GRID CELL
- CONSTANT HEAD BOUNDARY
- INJECTION CELL (FOR SCENARIO B (6000 M))

FIGURE 4 : MODFLOW MODEL

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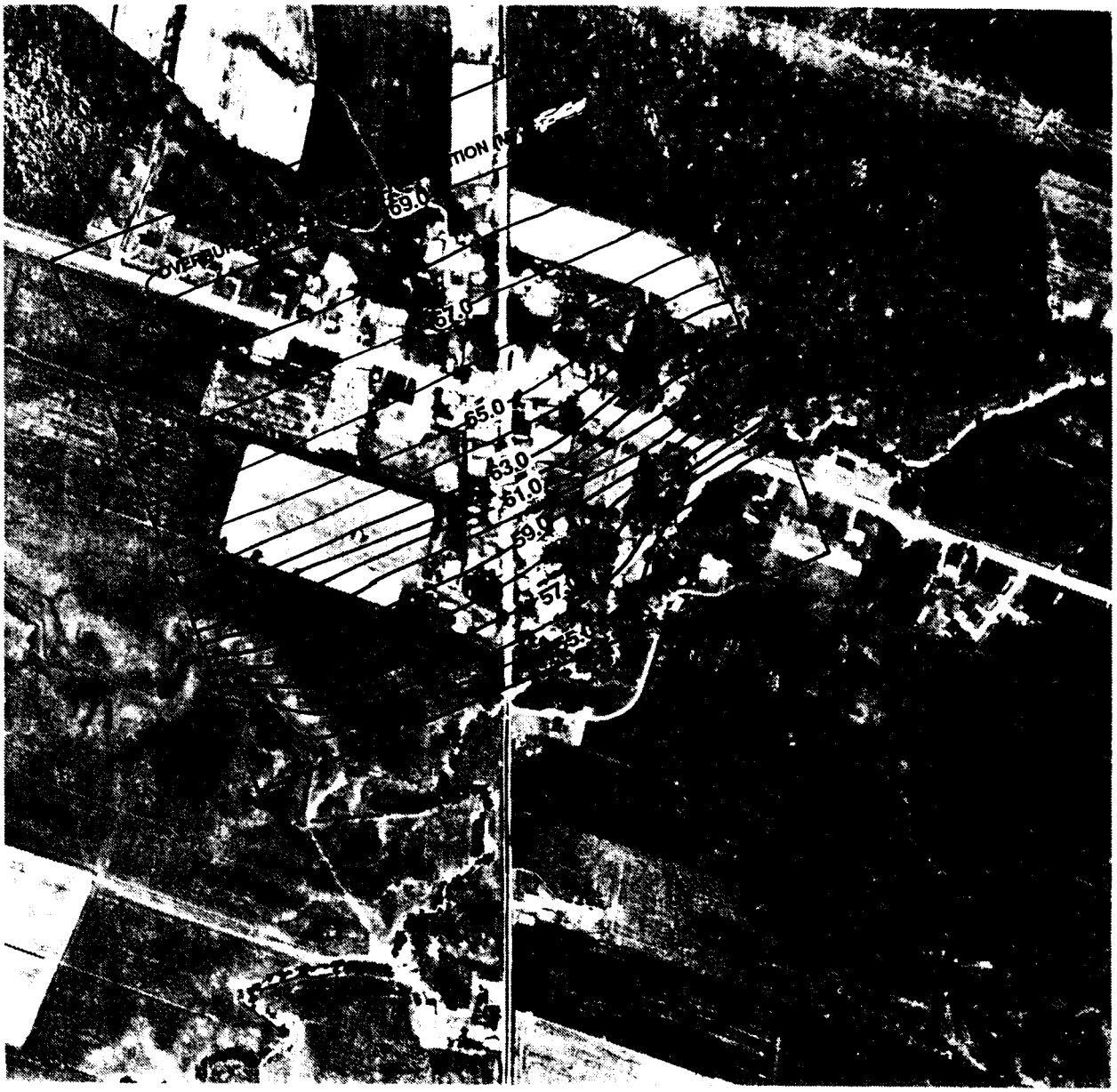

FIGURE 4A: EXISTING CONDITIONS: (MODFLOW)
OVERBURDEN GROUNDWATER ELEVATIONS

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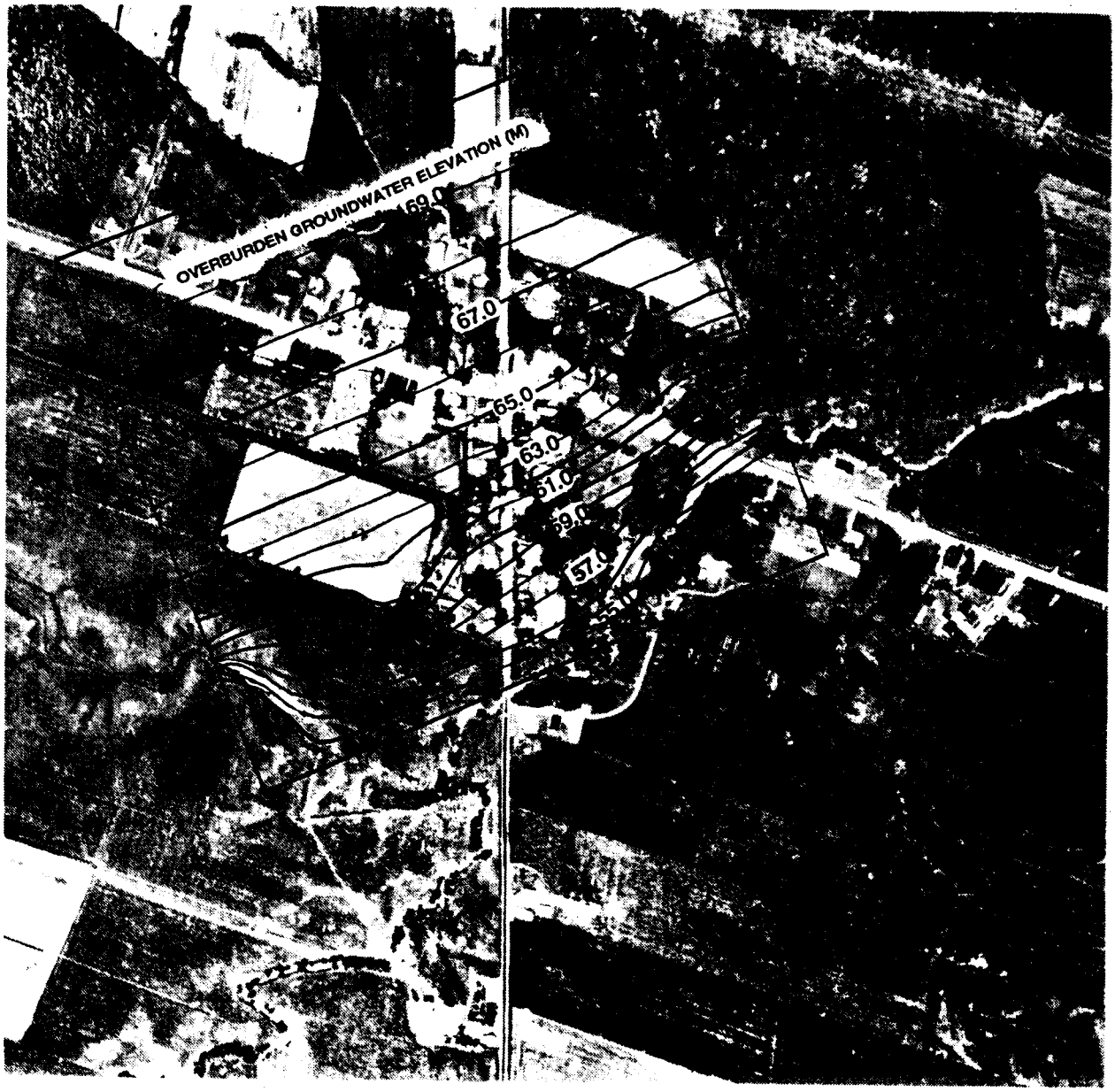

FIGURE 5: PROPOSED CONDITIONS: (MODFLOW)
OVERBURDEN GROUNDWATER ELEVATIONS
SCENARIO A (3000 M^2)

HAMLET OF ST-BERNARDIN

February 1992
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1:7500

GEO-ANALYSIS

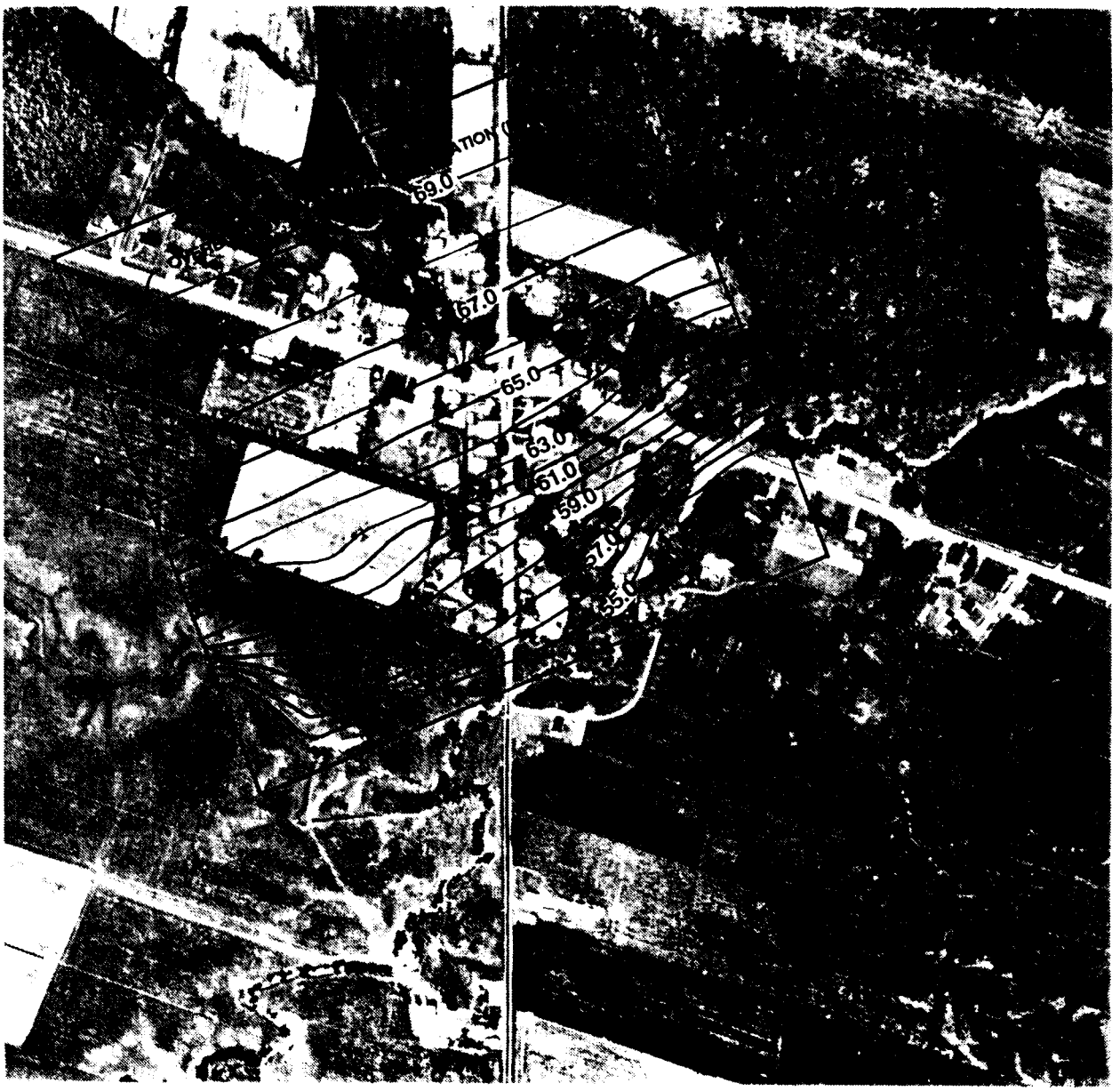

FIGURE 5A: PROPOSED CONDITIONS: (MODFLOW)
OVERBURDEN GROUNDWATER ELEVATIONS
SCENARIO B (6000 M^2)

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GEO-ANALYSIS

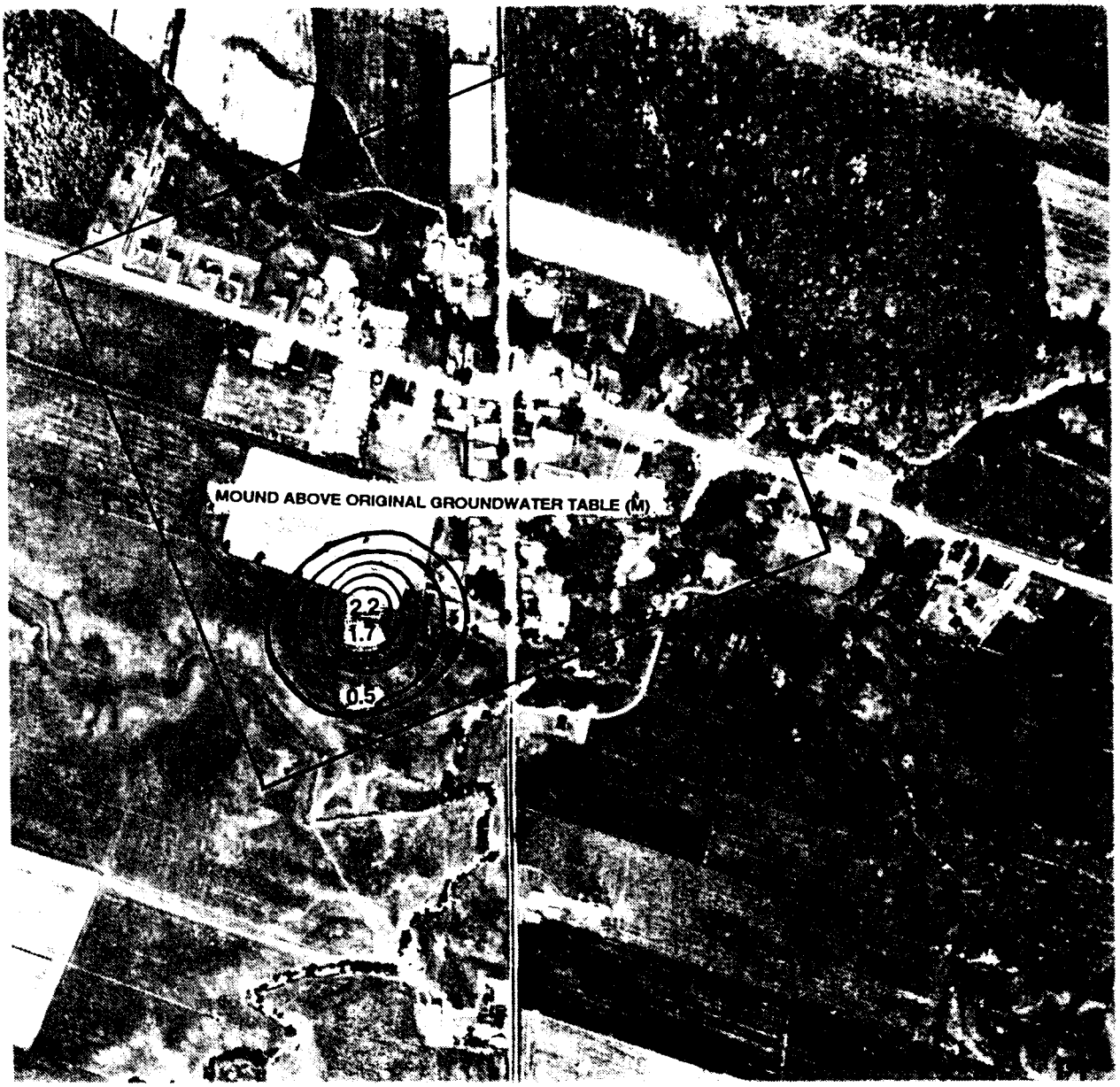

FIGURE 6: PROPOSED CONDITIONS: (MODFLOW) GROUNDWATER MOUNDING SCENARIO A (3000 M^2)

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GEO-ANALYSIS

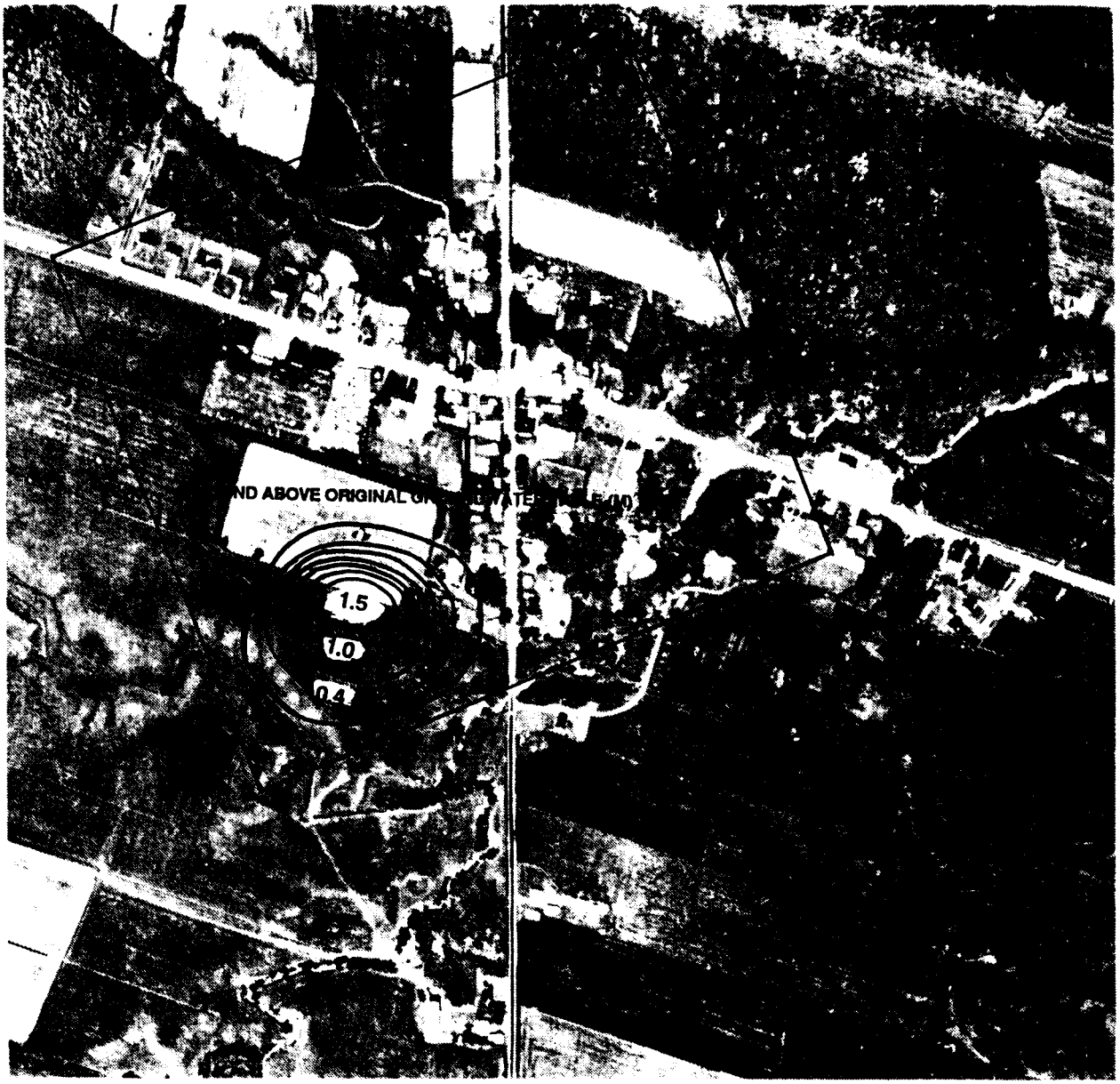

FIGURE 6A: PROPOSED CONDITIONS: (MODFLOW)
GROUNDWATER MOUNDING
SCENARIO B (6000 M^2)

HAMLET OF ST-BERNARDIN

February 1992
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GEO-ANALYSIS

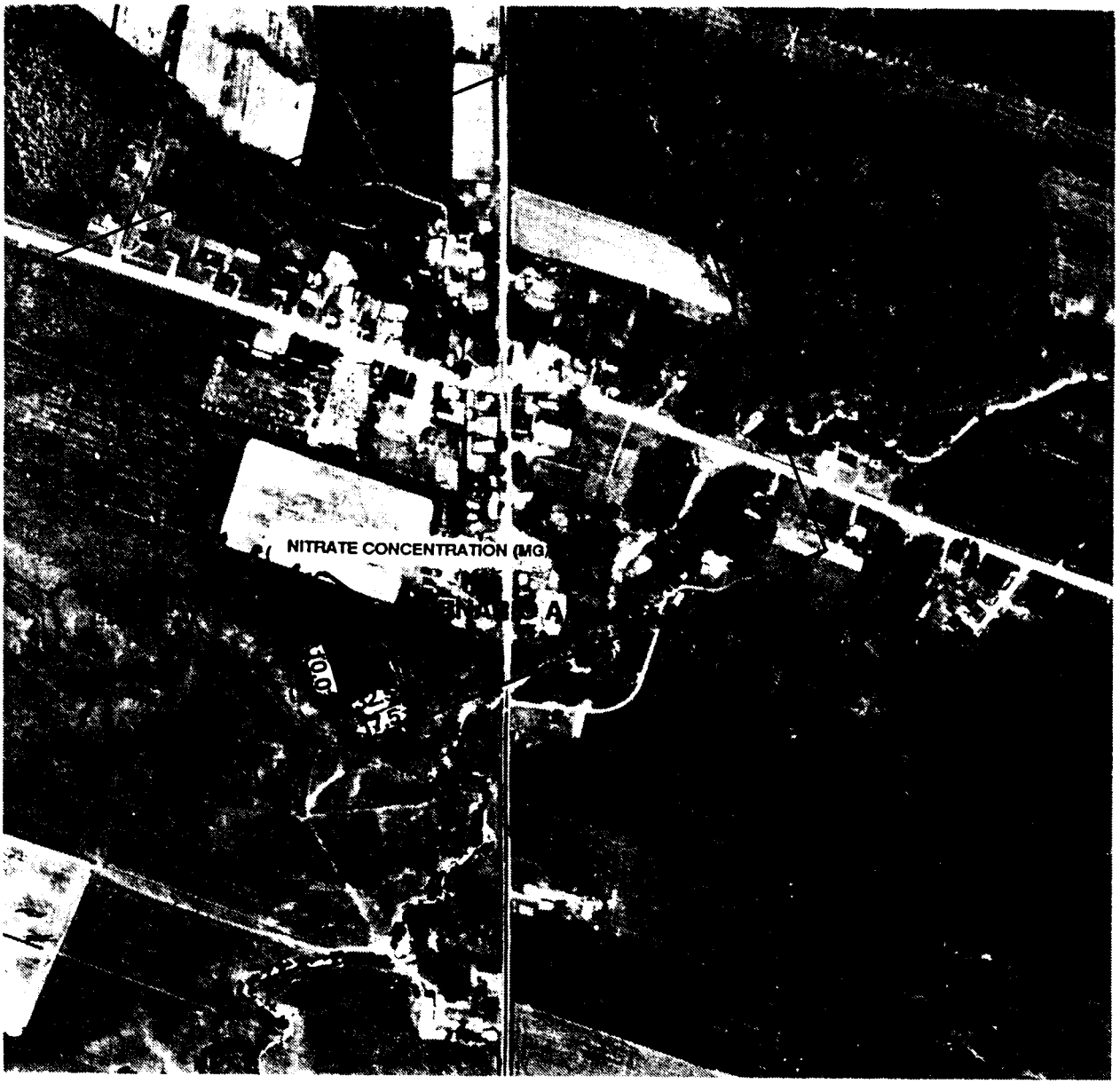

FIGURE 7: PROPOSED CONDITIONS: (MOC)
NITRATE LOADING CONCENTRATIONS

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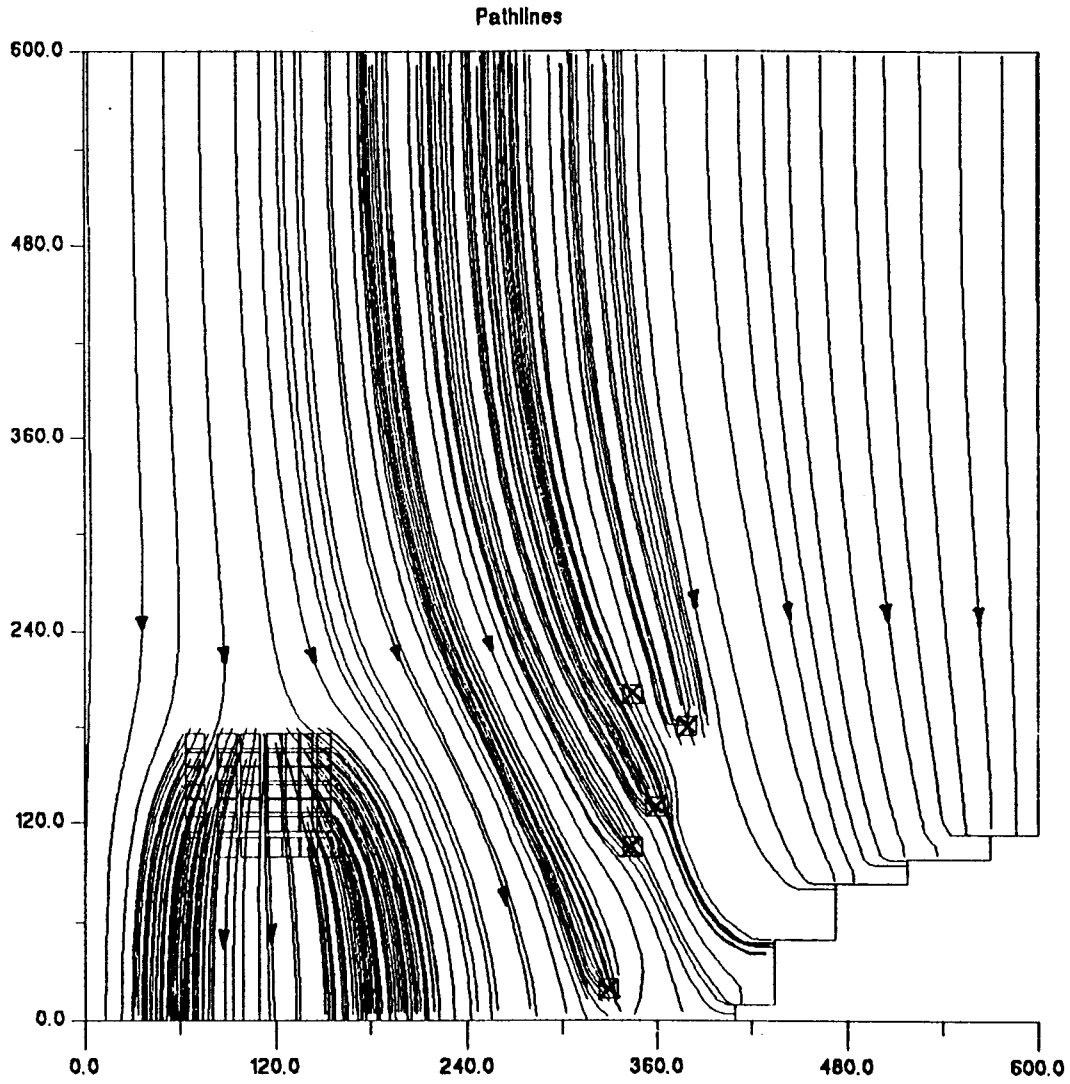

LEGEND:

DIRECTION OF OVERBURDEN GROUNDWATER FLOW

EXISTING OVERBURDEN WELL

PROPOSED SEWAGE DISPOSAL SYSTEM

FIGURE 8: PROPOSED CONDITIONS: (FLOWPATH) OVERBURDEN GROUNDWATER FLOW PATHLINES AND WELLS CAPTURE ZONES

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GEOANALYSIS

APPENDIX A

- TEST PITS STRATIGRAPHY
- WATER QUALITY DATA
- MOE WATERWELL LOGS

TEST PIT STRATIGRAPHY
LOT 44, ST. BERNARDIN, ONTARIO

Test pits TP1 to TP10 excavated December 6, 1991
Inspected by Geo-analysis Inc., File No. G9161

DEPTH (metres)	STRATIGRAPHY
TP1	
0-0.3	- grey-brown fine sandy topsoil
0.3-1.70	- orange-brown medium silty sand
1.70-4.50	- fine grained wet grey clay
	Dec. 6 water @ 1.3 m
	Dec. 11 water @ 0.7 m
TP2	
0-0.2	- topsoil*
0.2-1.0	- orange-brown sandy silt
1.0-2.20	-clay*
	Dec. 6 water @ 1.195 m
	Dec. 11 water @ 0.85 m
TP3	
0-0.4	- grey-brown silty sand
0.4-1.20	- sand*
1.2-2.9	- sandy silt**
2.9-4.50	- clay*

*** same as (TP1)**
**** same as (TP2)**

DEPTH (metres)	STRATIGRAPHY

TP4

0-0.25	- silty sand***
0.25-0.35	- sand*
0.35-2.65	- sandy silt**
2.65-3.2	- clay*
	Dec. 6 water @ 1.22 m
	Dec. 11 water @ 0.7 m

TP5

0-0.4	- topsoil*
0.4-0.6	- sand*
0.6-1.1	-sandy silt**
1.1-2.0	- brown sandy clay
2.0-3.5	- clay*

TP6

0-0.3	- topsoil*
0.3-0.6	- sand*
0.6-1.2	- sandy silt**
1.2-2.4	-brown sandy clay
2.4-3.7	- clay*

TP7

0-0.3	- topsoil*
0.3-0.6	- sand*
0.6-1.6	- sandy silt**
1.6-3.6	- clay*

. . . . . * same as (TP1)
. . . . . ** same as (TP2)
. . . . . * same as (TP3)**

DEPTH (metres)	STRATIGRAPHY
TP8	
0-0.25	- topsoil*
0.25-0.4	- sand*
0.4-2.0	- sandy silt**
2.0-4.3	- clay*
	Dec. 6 water @ 1.715 m
	Dec. 11 water @ 0.53 m
TP9	
0-0.2	- topsoil*
0.2-0.4	- sand*
0.4-2.2	- sandy silt**
2.2-4.4	- clay*
	Dec. 6 water @ 2.45 m
	Dec. 11 water @ 1.14 m
TP10	
0-0.4	- topsoil*
0.4-0.6	- sand*
0.6-1.25	- sandy silt**
1.25-1.6	- clay*

. . . . . * same as (TP1)
. . . . . ** same as (TP2)

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Geo Analysis

Attention: A. Buzza

LAB REPORT NO: A1-3078

DATE: Dec.24,1991
DATE RECEIVED: Dec.12,1991
PROJECT: G9161
St.Bernadin

SAMPLE TYPE:

PARAMETER	UNITS	Sample TP 1	Sample TP 2	Sample TP 4	Sample TP 8	Sample TP 9
Fe	mg/L					
Mn	mg/L					
Hardness	mg/L CaCO3					
Alkalinity	mg/L CaCO3					
pH						
Conductivity	umhos/cm					
F	mg/L					
Na	mg/L					
N-NO3	mg/L	9.00	7.00	3.40	0.60	6.00
N-NO2	mg/L					
N-NH3	mg/L					
SO4	mg/L					
Cl	mg/L					
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units					
Ca	mg/L					
Mg	mg/L					
Tann./Lig.	mg/L					
Total N	mg/L					
K	mg/L					

ANALYST: _____

ACCUTEST LABORATORIES LTD.
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REPORT OF ANALYSES

CLIENT: Geo Analysis

LAB REPORT NO: A1-3035

DATE: Dec.18,1991

DATE RECEIVED: Dec.9,1991

Attention: T. O'Brien

PROJECT: G9161

SAMPLE TYPE:

PARAMETER	UNITS	Sample R 1	Sample R 2	Sample R 3	Sample SW 1	Sample
Fe	mg/L					
Mn	mg/L					
Hardness	mg/L CaCO3					
Alkalinity	mg/L CaCO3					
pH						
Conductivity	umhos/cm					
F	mg/L					
Na	mg/L					
N-NO3	mg/L	<0.10	<0.10	1.03	0.71	
N-NO2	mg/L					
N-NH3	mg/L					
SO4	mg/L					
Cl	mg/L					
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units					
Ca	mg/L					
Mg	mg/L					
Tann./Lig.	mg/L					
Total N	mg/L					
K	mg/L					

ANALYST: _____

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSES

Client: Geo Analysis

Attn: Tim O'Brien

LAB REPORT NO: A1-3034
DATE: Jan. 21,1992
DATE SUBMITTED: Dec. 9,1992
PROJECT: G9161

SAMPLE MATRIX: SOIL

PARAMETER	UNITS	MDL	S-1	S-2			
Organic Matter	%		1.0	1.6			
TOC Fraction	%		0.18	0.39			

ND = Not Detected (<MDL)

MDL = Method Detection Limit

COMMENT:

ANALYST: _____

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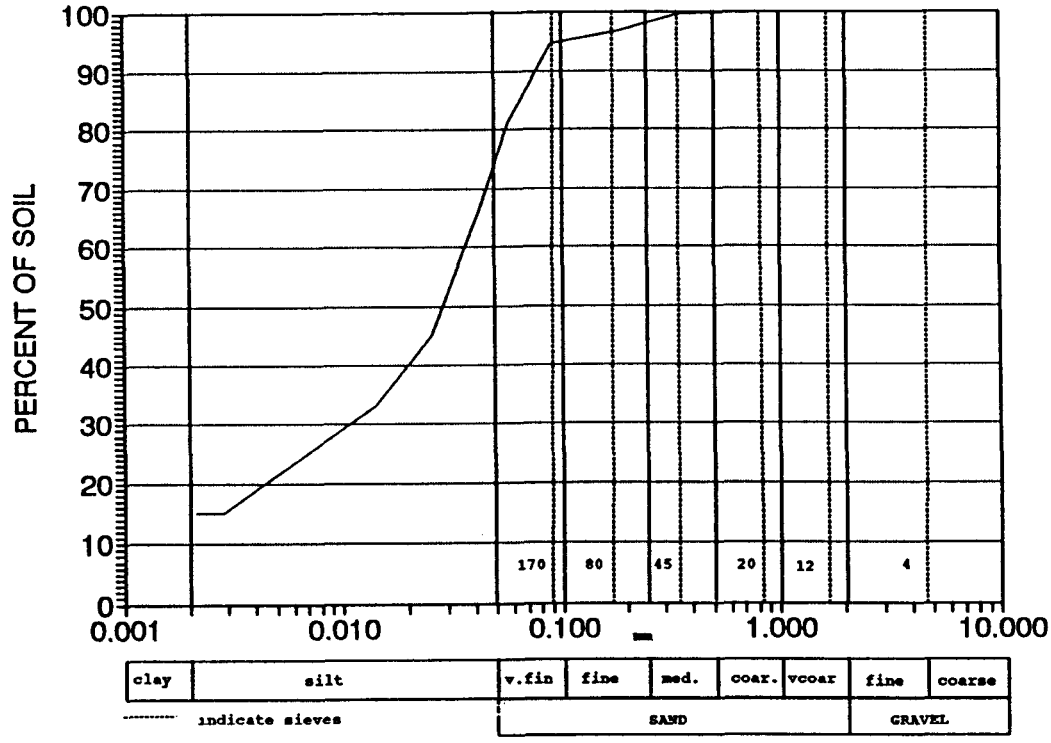
ACCUTEST LABS PARTICLE SIZE DETERMINATION

REPORT NUMBER: A1-3034
DATE: Dec. 23,1991
CLIENT: Geo-Analysis
PROJECT: G9161
SAMPLE NAME: TP#3 S-2

PARTICLE SIZE



PARTICLE TYPE	SIZE mm	% samp
COARSE GRAVEL	>4.750	0
FINE GRAVEL	>2.000-4.750	0
VERY COARSE SAND	>1.000-2.000	0
COARSE SAND	>0.500-1.000	0
MEDIUM SAND	>0.250-0.500	0.5
FINE SAND	>0.100-0.250	5.0
VERY FINE SAND	>0.050-0.100	22.5
SILT	>0.002-0.050	55.0
CLAY	<=0.002	17.0

COMMENTS: Organic Matter % 1.6

ANALYST: _____

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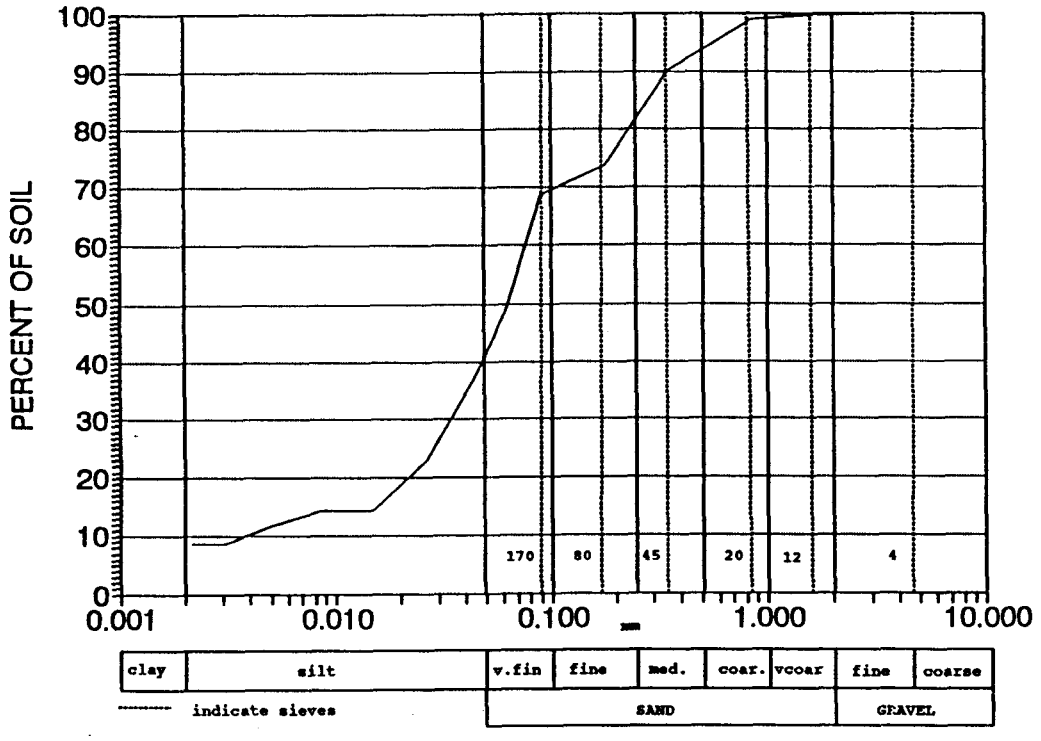
ACCUTEST LABORATORIES LTD.

ACCUTEST LABS PARTICLE SIZE DETERMINATION

REPORT NUMBER: A1-3034
DATE: Dec. 23,1991
CLIENT: Geo-Analysis
PROJECT: G9161
SAMPLE NAME: TP#1 S-1

PARTICLE SIZE



PARTICLE TYPE	SIZE mm	% samp
COARSE GRAVEL	>4.750	0
FINE GRAVEL	>2.000-4.750	0
VERY COARSE SAND	>1.000-2.000	1.0
COARSE SAND	>0.500-1.000	5.0
MEDIUM SAND	>0.250-0.500	13.0
FINE SAND	>0.100-0.250	12.0
VERY FINE SAND	>0.050-0.100	28.0
SILT	>0.002-0.050	32.5
CLAY	<=0.002	8.5

COMMENTS: Organic Matter % 1.0

ANALYST: _____

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 Tel.: (613) 727-5692 Fax: (613) 727-5222

PRESCOTT

WELL NO	GEO NUMBER	MUNICIPALITY CONCESSION ETC	LOT	UTM EASTING NORTHING	ELEV (m)	DATE	CSG DIA (cm)	KIND OF WATER	WATER FOUND (m)	STAT LVL (m)	PUMP LVL (m)	TEST RATE LPM	TEST TIME HR/MN	WATER USE	OWNER/LOG/SCREEN DEPTH IN (m) TO WHICH FORMATIONS EXTEND
CALEDONIA TOWNSHIP															
3		CON 05	13	515500 5033700	61.0	11/77	15.3 15.3	2	37.8	4.0	22.9	68.2	01/00	PU	CALEDONIA CNTR 4.6 RED CLAY SOFT 29.9 BLUE CLAY SOFT 37.5 GREY SND GRVL HARD 38.4 BLCK ROCK
1		CON 05	13	516740 5033560	61.0	12/54	12.8 12.8	1	38.1	1.2	1.8	27.3	00/00	ST	CHARLEBOIS V 10.7 BLUE CLAY 22.9 HPAN 39.3 SLTE
2		CON 06	10	515600 5033530	61.0	1/70	15.3	2	41.1	9.1	18.3	113.6	03/00	PU	COMM ECOLE CATHOLIQ 39.6 CLAY 42.1 GRVL
4		CON 06	12	515599 5033599	53.3	9/81	15.3	1	39.6	6.4	12.2	77.3	02/00	DO	WATHIER A 2.4 SND 39.3 CLAY 40.2 GRVL

APPENDIX "C"

HAMLET OF ST-BERNARDIN
TOWNSHIP OF CALEDONIA
M.O.E. PROJECT NO. 3-0630

COMMUNAL SEWAGE DISPOSAL SYSTEM

1. Lots to be serviced

Lots No.	Building Use	Number of Bedrooms	Comments
19	Single family & restaurant	4	
20	Single family	5	
21	Single family	3	
22	Single family	1	
23	Single family	3	
24	Single family	3	Optional
33	Single family	3	
37	Single family	3	
46	Single family	2	
48	Single family	3	
51	Single family	3	
53	Single family	3	
54	Commercial garage	2 equivalent	
55	Single family	3	

2. Sewage Flow Quantities

Residential houses: Max. 16 residences
Aver. no. of persons per residence: 3.2 persons
Sewage flow per person: 300 litres/day
Residential sewage flow = 16 res. x 3.2 pers. x 300L/pers/day
= 15,360 L/day
Restaurant - Lot No. 19
Number of seats (stools) = ± 5
Sewage flow per seat: 70 L/seat/day
Daily sewage flow = 5 seats x 70 L/seat/day = 350 L/day
Total Daily Sewage Flow = **15,710 L**
Daily Peak Flow = 15,710 x 2 = 31,420 L

3. Capacity of Septic Tank

Required capacity = 3/4 daily flow + 4,500 L
= (3/4 x 15,710) + 4,500
= 11,783 + 4,500 = **16,283** L

Use precast concrete septic tank having a useful capacity of 18,200 litres.

4. Soil Capacity

Percolation test at B.H. No. 7
Fine sandy soil
Water table at approx. 1.0 m. below top of ground
Percolation rate approx. 6 min./cm
Soil capacity = 52 L/m²/day

The raised beds will be constructed with imported soil having a percolation time of 4-10 min/cm.

5. Leaching Beds.

Length of distribution pipe required = QT/200
where Q= dailly sewage flow = 15,710 litres/day
T= percolation rate in min./cm.
= 10 min./cm. for imported sand.
L= QT/200 = 15,710 x 10/200 = **786** m.

Provide 4 beds having 12 rows of 18.3 m/row.

Length of distribution pipe provided
= 4 x 12 x 18.3 m = **878.4** m.

Slope per row = 40 mm/10m. x 18.6 m. = 74.4 mm
Use a slope of 75 mm/row (3"/row).

Provide a spare bed having 12 rows of 18.6 m/row in case of failure of one bed.

6. Pump Chamber

Pump chamber capacity shall be such that one drawdown will fill two tile beds (50% of beds) to 75% of pipe volumes.

Length of tile = 2 x 12 rows x 18.6 m./row = 446 m.

Required capacity = 446 m x 8.8 Lm. x 75%
= 2946 litres
say 3000 litres.

7. Pumps

Dosage required = 3,000 litres/pump, including header and forcemain.

Dosage should preferably be carried out wihtin 5 minutes or less to ensure that the disposal beds are flooded thoughout.

Minimum capacity required = 3,000 L/5 min.
= 600 L/min.

Provide two submersible pumps complete with level controls, alternator, high level alarm, and having a capacity of 600 litres per minute against a total head of 6 metres.

The pumps shall alternate with one pump connected to beds no. 1 and 2 and the other pump connected to beds no. 3 and 4.

APPENDIX "D"

MINUTES OF PUBLIC MEETING

SEWAGE WORKS PROJECT NO. 3-0630
COMMUNAL SEWAGE DISPOSAL SYSTEM
HAMLET OF ST-BERNARDIN
TOWNSHIP OF CALEDONIA

DATE: Monday, June 22, 1992 at 7:30 p.m.

LOCATION: Municipal Council Chamber
Township of Caledonia

ATTENDEES: Jean-Paul Charlebois, Reeve
Léonard Boucher, Deputy-Reeve
Roch Cadieux, Councillor
Yves Duval, Councillor
Johanne Bougie, Assistant Clerk-Treasurer
Grégoire Leroux, Road Superintendent

Gaëtan H. Lascelles, P. Eng. from the firm of Desjardins/Lascelles Eng. Ltd.

Concerned taxpayers (see the attached sign up list).

SUMMARY OF DISCUSSION

1. The status of the project with the revised estimate of cost (approx. $12,000.00/residence) was explained to the owners present.

2. The alternatives considered were reviewed and the preliminary environmental assessment report presented.

3. Comments from the publlic were received and are summarized herewith.

4. Mrs. Suzan Hopkins requested that further investigation be made with the Eastern Ontario Health Unit to verify the status of her sewage treatment system. She also would like to have the final cost of the proposed communal system in writing.

5. Mr. Gaston Duval mentioned that he prefers that a gravity system be used and would like to have a fixed cost.

6. Mr. Lucien Leroux and Mr. Jean-Pierre Duval are in agreement with the ES report.

...2/

7. Mr. André Cadieux is in agreement with the ES report and wants to connect to the communal system.

8. Mr. Bruno Dupont feels that the communal system is not required but has no opposition to it.

9. Mr. Reynald Marleau wants the maintenance cost to be kept at a reasonable level and approves of the proposed communal system.

10. Mr. Armand Wathier does not intend to connect to the communal system. The different options were explained to Mr. Wathier.

11. Mr. Romuald Séguin approves of the report and wants to connect to the proposed communal system.

12. Mr. James Heuvelmans wants to connect to the proposed communal system. Due to the distance from Mr. Heuvelmans' property to the proposed system, Mr. Heuvelmans was informed that his sewage may have to be pumped to the system.

13. Mr. Léon Lalonde wanted to know if the mature trees in front of his property will be affected. His trees shall be protected from damages. He is considering joining the communal system but does not want to make a commitment at this time.

14. Mr. Yves Duval is in agreement with the report and the proposed communal system.

15. Mr. André Leroux, a resident of the Hamlet of St-Bernardin and a licensed system installer, wanted to know when the project will be going to tender.

Prepared by:

Gaëtan H. Lascelles, P. Eng.

les ingénieurs
DESJARDINS/LASCELLES
engineering limited

File 89-103
June, 1992

Réunion publique le 22 juin 1992 à 19h30 concernant le système communautaire du Village de St. Bernardin avec Gaëlan Lacelles - Desjardins / Lacelles Eng. Ltd.

	Nom	Signature
(1)	Gaston Duval	Gaston Duval
(2)	Susan Hopkins	Susan Hopkins
(3)	Lucien Leroux	Lucien Leroux
(4)	James Heuvelman	James Heuvelman
(5)	Romuald Séguin	Romuald Séguin
(6)	Jean-Pierre Duval	Jean-Pierre Duval
(7)	Armand Wathier	Armand Wathier
(8)	André Cadieux	André Cadieux
(9)	Andre Leroux	Andre Leroux
(10)	Bruno Dupont	Bruno Dupont
(11)	Reynald Mailloux	Reynald Mailloux
(12)	Yves Duval	Yves Duval
(13)	Léon Lalonde	Léon Lalonde

Copie reçu le 22 juin 1992
Lacelles.

En faveur du projet

1) Lucien Lemieux — oui
2) Jean Pierre Duval — oui
3) André Cadieux — oui
4) Bruno Dupont — ?
5) Armand Wathier — NON
6) Romuald Séguin — oui
7) James Newelmans — oui
8) Léon Falonde — possiblement
9) Reynald Marleau (Gaspé) — oui
10) Ange-Mai Marleau — oui
11) Susan Hopkins — ~~oui~~ ?
12) Yves Duval — oui
13) Justin Duval — oui

Copie reçu le 22 juin, 1992
CH Darveau

CORPORATION DU CANTON DE CALEDONIA
OF THE TOWNSHIP OF

6950 Chemin de Comté No. 22, R.R. # 1
6950 County Road No. 22, R.R. # 1
ST-BERNARDIN, Ontario
K0B 1N0

(613) 678-2100

File 37-103

Notre dossier: 542(b)
Our file:

le 18 août, 1992

AVIS

Veuillez prendre avis qu'une réunion spéciale aura lieu à l'Hôtel de Ville à St-Bernardin le mardi soir, 25 août, 1992 à 20h00 pour discuter du système communautaire, Projet No. 3-0630 du Hameau de St-Bernardin avec Gaëtan Lascelles de la firme ingénieurs-conseils Desjardins/Lascelles Ltée.

August 18, 1992

NOTICE

Please be notified that a special meeting will be held on Tuesday night, August 25, 1992 at 8:00 p.m. to discuss the sewage works project No. 3-0630 of the Hamlet of St-Bernardin with Gaëtan Lascelles of Desjardins/Lascelles Engineering Ltd.

Canton Caledonia Township

GL/fl

Joanne Bougie-Normand
(for) Gertrude Levac, A.M.C.T.
Clerk-Treasurer
Greffier-trésorier

MINUTES OF PUBLIC MEETING

SEWAGE WORKS PROJECT NO. 3-0630
COMMUNAL SEWAGE DISPOSAL SYSTEM
HAMLET OF ST-BERNARDIN
TOWNSHIP OF CALEDONIA

DATE: Tuesday, August 25, 1992 at 8:00 p.m.

LOCATION: Municipal Council Chamber
Township of Caledonia

ATTENDEES: Jean-Paul Charlebois, Reeve
Léonard Boucher, Deputy-Reeve
Roch Cadieux, Councillor
Yves Duval, Councillor
Gertrude Levac, Clerk-Treasurer

Gaëtan H. Lascelles, P. Eng. from the firm of Desjardins/Lascelles Eng. Ltd.

Concerned taxpayers and local residents:

Larry Massia	Romuald Séguin
Susan Hopkins	Ange-Mai Marleau
Reynald Marleau	Léon Lalonde
Gaston Duval	Manon Daoust
James Heuvelmans	

SUMMARY OF DISCUSSION

1. The environmental assessment report was presented and explained by the project engineer Gaëtan H. Lascelles.

2. Mrs. Susan Hopkins asked the Engineer to check the overflow water or sewage coming from Mrs. Gauthier's property.

3. Mrs. Hopkins was advised that she has no Certificate of Approval for her sewage disposal system.

4. The drainage ditch abutting the school's property line was discussed at length. The Engineer was asked to approach the C.E.S.C.L.F.P.-R. director of properties to have this ditch cleaned and to have the outlet improved.

5. The Engineer mentioned that a sewer use by-law will have to be passed by the municipality to establish the use and the maintenance of the system and the charge to be levied.

...2/

6. In general, the persons present were in agreement with the project and the alternative selected.

Prepared by: _____
Gaëtan H. Lascelles, P. Eng.

les ingénieurs
DESJARDINS/LASCELLES
engineering limited

File 89-103
August, 1992

A P P E N D I X "E"

March 8, 1992

E.R. Freistadt
Project Engineer
Project Engineering Branch

B.D. Burns
Sr. Approvals Engineer
Southeast Region

RE: HAMLET OF ST BERNARDIN - CALEDONIA TOWNSHIP

I have attached a copy of the comments provided by Mr. Brian Kaye, following his review of the report submitted by Desjardins/Lascelles Engineering.

You will note that there are a number of concerns raised as a result of Mr. Kaye's review of the submitted documentation. From the Region's perspective, there are a number of deficiencies that need to be addressed before proceeding further. In particular, the consultant must deal with Policy 15-08 concerning reasonable use, and demonstrate that the preferred alternative will not have any impact on the groundwater resources of adjacent properties.

Mr. Kaye has also offered some suggestions on other alternatives that the consultant may wish to consider. If you require anything further, please feel free to contact me.

B.D. Burns

cc G.A. Murphy
B. Kaye
PF/BDB/EA 05-02

Ministry of the Environment
Ontario

Ministère de l'Environnement

Southeastern Region
Région du Sud-Est

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613 / 549-4000

133, avenue Dalton
Kingston (Ontario)
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613 / 549-4000

M E M O R A N D U M

February 24, 1993

TO: B.D. Burns
Sr. Approvals Engineer
Approvals and Planning Unit

FROM: B.G. Kaye
Sr. Hydrogeologist
Groundwater Unit

RE: Communal Sewage Works System in the
Hamlet of St. Bernardin, Township of Caledonia
Environmental Study Report, MOE Project 3-0630

Having reviewed the above noted report prepared by Desjardins/ Lascelles Engineering Limited, revised January 14, 1993, I offer the following comments. The hydrogeological aspects of the report are contained in Appendix B: Hydrogeological Impact Assessment for the Proposed Communal Sewage Disposal System for the Hamlet of St. Bernardin, by Geo-analysis Inc., February 1992.

In the cover report by Lascelles, a large septic tank and tile field system is selected as the preferred alternative for sewage disposal. I am not entirely comfortable with the manner in which this option was selected as the consultant does not seem to appreciate the potential for environmental impact from these systems. On page 8, the report states "Physical, chemical and biological reactions within the soil remove wastewater contaminants before the liquid reaches the water table". On page 9, where potential environmental impacts are listed, groundwater contamination is not even mentioned. It would appear that the engineering consultant does not appreciate the potential for groundwater impact. This potential was not given any weight during the selection process.

With in-ground septic disposal selected as the preferred alternative, Geo-analysis was retained to conduct the hydrogeological assessment. The assessment consists of two main components: a hydraulic modelling exercise and an impact modelling exercise.

Geo-analysis has defined approximately 2 to 3 m of fine sand and

sandy silt over 30 - 40 m grey clay. According to maps in our files, the underlying bedrock is most likely limestone of the Ottawa Formation. The upper unconfined sand and sandy silt will be the primary receiver of the septic effluent. The hydraulic modelling predicts that this unit will be able to accept the anticipated effluent volumes.

Neither the Lascelles report nor the Geo-analysis report define whether or not the upper unconfined aquifer is used as a drinking water supply. I expect that it is since Geo-analysis makes the recommendation for no "new overburden wells" located down-gradient of the septic system. Assuming that the unconfined aquifer is currently being used as a drinking water source, the proposed subsurface system must comply with the requirements of Policy 15-08: the "Reasonable Use Policy". Under this Policy, it is the proponent's responsibility to demonstrate that the system will not contaminate the groundwater below adjacent properties. For domestic septic systems this normally requires a prediction of nitrate impacts.

According to the site plan provided, it would appear that the tile beds are to be located within 10 m of the property boundary. The Geo-analysis impact modelling predicts that nitrate concentrations in the groundwater at the Caledonia Creek, roughly 130 m down-gradient of the property line, will be on the order of 18 mg/l. Clearly, the system cannot meet the Policy 15-08 requirements given the present property proposed for the system.

Policy 15-08 compliance problems aside, I have serious concerns regarding the proposed communal system. For instance, the report states that the system is required to "eliminate the contamination of groundwater supply" yet only 14 of 57 lots are to be hooked up to the system. I must assume that the remaining 43 lots will continue to use private Class 4 systems. The report suggests that individual corrections could not be carried out on those 14 lots but offers no details of why. Lot size certainly isn't the only constraining factor since several of the lots to be hooked up appear to have more than enough space for standard Class 4 systems (lots 33 and 54 for instance).

It is a gross misconception to assume that a communal in-ground septic disposal system will lead to less groundwater contamination than individual systems. In fact, the contrary may be the case. The use of individual systems will permit the disposal of septic effluent over a much broader area thus allowing for greater dispersion and dilution.

Considering the cost of the communal system (estimated at $14,500 per lot), and the associated groundwater contamination problem, serious consideration should be given to the use of:

- shared systems on those lots where space is limited;

- the possibility of land lease arrangements with adjacent farm owners;
- provision of water treatment units.

Even the construction of properly cased wells into the underlying limestone bedrock to replace existing dug wells coupled with any required water treatment devices would likely be significantly cheaper than the communal option.

Based on the available information, I cannot support the selection of a large communal subsurface sewage disposal system as the preferred alternative. Even if this option is pursued further, the present design will not be able to operate within the groundwater protection requirements of Policy 15-08.

B.G. Kaye

/BK

cc. C.K: Hammond/ GW-07-16 Caledonia Township

- TM22945

L'Ingénierie
LASCELLES
engineering limited
CONSULTANT ENGINEER INGENIEUR-CONSEIL

GAETAN H. LASCELLES P.Eng.

APPENDIX "F"

1089-1037
August 10, 1993

Ministry of the Environment
Project Engineering Branch
250 Davisville Avenue
Toronto, Ontario
M4S 1H2

Attention: Mr. E.R. Freistadt, P. Eng.
Project Engineer
NE/NW/SE Regions

Re: Township of Caledonia
Hamlet of St-Bernardin
Sewage Works Project No: 3-0630

Dear Sir:

As per the comments from the Regional Office; B.D: Burns; Sr: Approvals Engineer, Approval & Planning Unit, and Brian Kaye; Sr: Hydrologist, Groundwater Unit, we are providing the following amendments to the ESR:

The proposed sewage diposal system nitrate loading to the overburden has been analyzed by Geo-Analysis Inc. at a location 50m from the creek: This resulted in maximum concentration of nitrate of 18 mg/L reaching the creek bed:

The sewage disposal system as located in the ESR plan DL 155-1 revised July 1992 will now be located at a minimum distance of 120m from the creek bed. The nitrate loading from this location results in nitrate loading of less than 10 mg/L at the creek bed: As noted by Geo-Analysis Inc:; the organic matter enriched riverbed environment at the creek seems to indicate that denitrification as a result of anaerobic conditions and elevated organic matter will occur reducing the nitrate concentrations of less than 10 mg/L to less than 2.5 mg/l. Denitrification of an order of larger magnitude have been measured by Cherry et al.(1991) in similar conditions:

:::2/

870 JAMES ST., HAWKESBURY, ONTARIO K6A 2W8 bus. (613) 632-0241 res. (613) 632-3069 fax. (613) 632-166

L89-103
cont'd

In order that the nitrate loading be contained on the property, it is suggested that the water rights on the property downgradient from the proposed sewage disposal system be acquired. This would restrict the taking of contaminated groundwater. The land in question would consist of that strip of land from the adjacent property to the creek.

Individual corrections to private sewage diposal systems have previously been studied and were discussed at a public meeting held on June 22, 1992. These alternatives included the grouping of some lots connected to small common sewage disposal systems and correction by acquisition of land or replacement of a dug well with a drilled well. They are as follows:

Lots 19,20,21,22 & 23

Lots 19,20,21 & 23 are all equiped with holding tanks which discharge to the ditch. Lot 23 has a stone loading pit which also discharges to the ditch.
Lots 19 to 23 are all equiped with dug wells which restrict the separation distance to a septic system. At the rear of their lots is also a ravine which prevents the installation of a system in most of the rear lots. It is suggested that all five lots be connected to a septic tank to be located on lot 21 and that the effluent be pumped to a sewage disposal bed to be located on part of lot 18. This requires the location of the sewage pumping line under the creek bed and the acquisition of parcel of land from lot 18.

Lots 53,54 & 55

Lot 53's existing sewage disposal system consists of a holding tank which discharges directly to the drainage ditch and hence to the storm sewer. Lot 55 has a septic tank and sewage disposal bed. The bed is located partly on adjacent property and is being travelled upon by heavy machinery. Lot 54 has planned washroom facilities with the garage extension. Due to the lack of room on lots 53 & 55 and to the lack of untravelled area on lot 54 (heavy machinery garage with parking lot), it is suggested that the three lots be connected to one septic tank with the effluent flowing to a sewage disposal bed to be located on lot 44. This would require acquisition of parcel of land from lot 44.

.../3

L89-103
cont'd

Lots 46, 47 & 48
Lot 46 and 48 both have a holding tank system possibly discharging to the nearby ditch. The proximity of neighbouring dug well also restricts the available space for a sewage disposal bed. Lot 47 is presently vacant. Lots 46 and 48 both have dug wells. It is suggested that lots 46 and 48 replace their dug wells by drilled wells and construct a shared sewage disposal bed on lot 47. It may be more advantageous for lots 46,47 & 48 to acquire land on lot 44 and construct a sewage disposal system for the three lots: Requires acquisition of lot 47 or parcel of lot 44.

Lot 33
South west corner of lot 33 has been detached from Lot 33. It has a cesspool which is presently too close to the existing dug well. It is suggested that a class 4 septic system be constructed at the rear of the lot. If insufficient room, acquidition of land from the remainder of lot 33 could be contemplated.

Lot 37
Lot 37's sewage system consists of direct discharge to the creek. It is suggested that a parcel of land be purchased from lot 36 in order to construct a class 4 sewage disposal system.

Lot 51
Lot 51 seems to discharge directly to ditch. If a drilled well is installed, there may be sufficient room to install a class 4 system.

Lot 24
Septic system located 6m from creek. No discharge problems noticed yet. If found to be discharging to creek, may join lot 19 to 23 on shared sewage disposal bed.

...4/

L89-103
cont'd

All of the above possibilities have been discussed at the public meeting and it was established that the preference was for one communal sewage disposal system.

Considering all the above information, we still believe that the communal sewage disposal system would meet policy 15-08 if the water rights were purchased.

We trust you will find the enclosed to your entire satisfaction and we remain,

Yours truly,

L'ingénierie
LASCELLES
Engineering Ltd.

Per: _____
Manon C. Rodrigue, P.Eng
for Gaëtan H. Lascelles, P.Eng.

MCR:dl

cc.: Gerry Murphy, MOE, Cornwall
Barry Burns, MOE, Kingston
Brian Kaye, MOE, Kingston
Township of Caledonia
c/o Joanne Bougie-Normand Clerk-Treasurer

L'ingénierie
LASCELLES
engineering limited
CONSULTANT ENGINEER INGENIEUR-CONSEIL

GAËTAN H. LASCELLES P.Eng.

APPENDIX "G"

L89-103
September 1, 1993

Ministry of the Environment
Project Engineering Branch
250 Davisville Avenue
Toronto, Ontario
M5S 1H2

Attention: Mr. E.R. Freistadt, P. Eng.
Project Engineer
NE/NW/SE Regions

Re: Township of Caledonia
Hamelet of St-Bernardin
Sewage Works Project No. 3-0630

Dear Sir:

Further to your telephone request of August 19, 1993, we recommend that a communal system as presented in the ESR be implemented for the remaining lots.

Individual corrections were reviewed as requested by the MOE Regional Office. Problems with the acquisition of lands and crossing the creek bed are to be expected with the individual corrections available.

We trust you will find this information to your satisfaction and we remain,

Yours truly,

L'ingénierie
LASCELLES
engineering limited

per
Gaëtan H. Lascelles, P.Eng.

GHL:ml

cc: Township of Caledonia
c/o Joanne Bougie Normand, Clerk-Treasurer

870 JAMES ST., HAWKESBURY, ONTARIO K6A 2W8 bus. (613) 632-0241 res. (613) 632-3069 fax. (613) 632-166